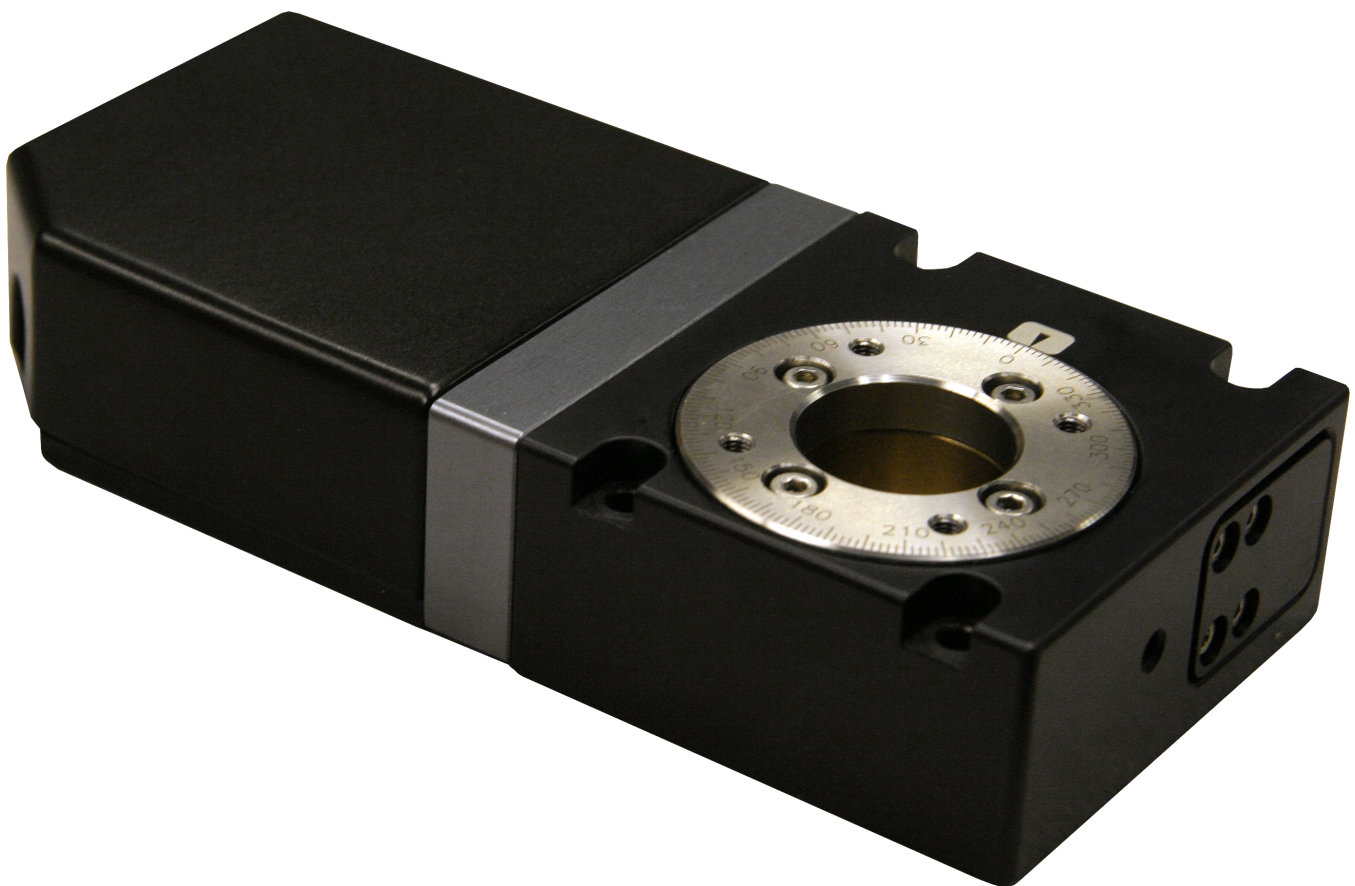




MPS50GR Hardware Manual

Revision: 1.02.00



Global Technical Support

Go to www.aerotech.com/global-technical-support for information and support about your Aerotech products. The website provides downloadable resources (such as up-to-date software, product manuals, and Help files), training schedules, and PC-to-PC remote technical support. You can also complete Product Return (RMA) forms and get information about repairs and spare or replacement parts. For immediate help, contact a service office or your sales representative. Have your customer order number available before you call or include it in your email.

| United States (World Headquarters) | |
|--|--|
| Phone: +1-412-967-6440 Fax: +1-412-967-6870 Email: service@aerotech.com | 101 Zeta Drive Pittsburgh, PA 15238-2811 www.aerotech.com |
| United Kingdom | Japan |
| Phone: +44 (0)1256 855055 Fax: +44 (0)1256 855649 Email: service@aerotech.co.uk | Phone: +81 (0)50 5830 6814 Fax: +81 (0)43 306 3773 Email: service@aerotechkk.co.jp |
| Germany | China |
| Phone: +49 (0)911 967 9370 Fax: +49 (0)911 967 93720 Email: service@aerotechgmbh.de | Phone: +86 (21) 5508 6731 Email: service@aerotech.com |
| France | Taiwan |
| Phone: +33 2 37 21 87 65 Email: service@aerotech.co.uk | Phone: +886 (0)2 8751 6690 Email: service@aerotech.tw |

This manual contains proprietary information and may not be reproduced, disclosed, or used in whole or in part without the express written permission of Aerotech, Inc. Product names mentioned herein are used for identification purposes only and may be trademarks of their respective companies.

Copyright © 2018, Aerotech, Inc., All rights reserved.

Aerotech Worldwide

United States ■ France ■ Germany ■ United Kingdom
China ■ Japan ■ Taiwan



Table of Contents

| | |
|--|-----------|
| MPS50GR Hardware Manual | 1 |
| Table of Contents | 3 |
| List of Figures | 4 |
| List of Tables | 5 |
| Safety Procedures and Warnings | 7 |
| EU Declaration of Incorporation | 9 |
| Chapter 1: Overview | 11 |
| 1.1. Environmental Specifications | 12 |
| 1.2. Basic Specifications | 13 |
| 1.3. Vacuum Operation | 14 |
| Chapter 2: Installation | 15 |
| 2.1. Unpacking and Handling the Stage | 15 |
| 2.2. Dimensions | 16 |
| 2.3. Securing the Stage to the Mounting Surface | 18 |
| 2.4. Attaching the Payload to the Stage | 20 |
| 2.5. Torque Capability | 22 |
| Chapter 3: Electrical Specifications and Installation | 23 |
| 3.1. Motor and Feedback Connectors | 24 |
| 3.2. Motor and Feedback Wiring | 29 |
| 3.3. Motor and Feedback Specifications | 31 |
| 3.4. Machine Direction and Homing Limit | 33 |
| 3.5. Motor and Feedback Phasing | 34 |
| Chapter 4: Maintenance | 35 |
| 4.1. Service and Inspection Schedule | 35 |
| 4.2. Cleaning and Lubrication | 36 |
| 4.3. Troubleshooting | 38 |
| Appendix A: Warranty and Field Service | 39 |
| Appendix B: Revision History | 41 |
| Index | 43 |

List of Figures

| | | |
|-------------|--|----|
| Figure 2-1: | MPS50GR Dimensions | 16 |
| Figure 2-2: | MPS50GR Mounting Plate Dimensions | 17 |
| Figure 2-3: | MPS50GR LMO Option Dimensions | 17 |
| Figure 2-4: | Mounting Hole Locations | 19 |
| Figure 2-5: | Side Mounting Holes | 19 |
| Figure 2-6: | Tabletop Mounting | 20 |
| Figure 2-7: | Load Capability of MPS50GR Series Stages | 21 |
| Figure 2-8: | Axial and Radial Loads | 21 |
| Figure 2-9: | Torque vs Speed | 22 |
| Figure 3-1: | Motor and Feedback Wiring (-M1 Option) | 29 |
| Figure 3-2: | Motor and Feedback Wiring (-M2 Option) | 30 |
| Figure 3-3: | Machine Direction | 33 |
| Figure 3-4: | Encoder Phasing Reference Diagram (Standard) | 34 |
| Figure 4-1: | Grease Access | 37 |

List of Tables

| | | |
|-------------|---|----|
| Table 1-1: | Model Numbers and Ordering Options | 11 |
| Table 1-2: | Environmental Specifications | 12 |
| Table 1-3: | MPS50GR Series Mechanical Specifications | 13 |
| Table 2-1: | Stage to Mounting Surface Hardware | 18 |
| Table 3-1: | 25-Pin D Motor and Feedback Connector Pinouts (-M1) | 25 |
| Table 3-2: | 25-Pin D Motor Mating Connector (-M1) | 25 |
| Table 3-3: | 25-Pin D Motor and Feedback Connector Pinouts (-M1 with -HV Option) | 26 |
| Table 3-4: | 25-Pin D Motor and Feedback Connector Pinouts (-M2) | 27 |
| Table 3-5: | 25-Pin D Motor Mating Connector (-M2) | 27 |
| Table 3-6: | 25-Pin D Motor and Feedback Connector Pinouts (-M2 with -HV Option) | 28 |
| Table 3-7: | Feedback Specifications | 31 |
| Table 3-8: | DC Motor Specifications | 32 |
| Table 3-9: | Stepper Motor Specifications | 32 |
| Table 3-10: | Encoder Specifications | 32 |
| Table 4-1: | Troubleshooting | 38 |

This page intentionally left blank.

Safety Procedures and Warnings

Read this manual in its entirety before installing, operating, or servicing this product. If you do not understand the information contained herein, contact an Aerotech representative before proceeding. Strictly adhere to the statements given in this section and other handling, use, and operational information given throughout the manual to avoid injury to you and damage to the equipment.

The following statements apply wherever the Warning or Danger symbol appears within this manual. Failure to observe these precautions could result in serious injury to those individuals performing the procedures and/or damage to the equipment.



WARNING: This product uses electrical supplies and signals. To minimize possible electrical damage to the stage or injury to the operator, obey the electrical precautions that follow.

1. Access to the MPS50GR and component parts must be restricted while connected to a power source.
2. Do not connect or disconnect any electrical components or connecting cables while connected to a power source.
3. Disconnect electrical power before servicing equipment.
4. All components must be properly grounded in accordance with local electrical safety requirements.
5. Operator safeguarding requirements must be addressed during final integration of the product.
6. Moving parts can cause crushing or shearing injuries. Access to all stage and motor parts must be restricted while connected to a power source.
7. Cables can pose a tripping hazard. Securely mount and position all system cables to avoid potential hazards.
8. Do not expose this product to environments or conditions outside of the listed specifications. Exceeding environmental or operating specifications can cause damage to the equipment.
9. The MPS50GR stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.
10. Use care when moving the MPS50GR stage. Lifting or transporting the MPS50GR stage improperly can result in injury or damage to the MPS50GR.
11. This product is intended for light industrial manufacturing or laboratory use. Use of this product for unintended applications can result in injury and damage to the equipment.
12. If the product is used in a manner not specified by the manufacturer, the protection provided by the product can be impaired and result in damage, shock, injury, or death.
13. The motor case temperature may exceed 75°C.
14. Operators must be trained before operating this equipment.
15. All service and maintenance must be performed by qualified personnel.

This page intentionally left blank.

EU Declaration of Incorporation

Manufacturer: Aerotech, Inc.
101 Zeta Drive
Pittsburgh, PA 15238-2811
USA

herewith declares that the product:

MPS50GR Stage

is intended to be incorporated into machinery to constitute machinery covered by the Directive 2006/42/EC as amended;

and that the following harmonized European standards have been applied:

EN ISO 12100:2010

Safety of machinery - Basic concepts, general principles for design

EN 60204-1:2010

Safety of machinery - Electrical equipment of machines - Part 1: General requirements

and further more declares that

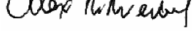
it is not allowed to put the equipment into service until the machinery into which it is to be incorporated or of which it is to be a component has been found and declared to be in conformity with the provisions of the Directive 2006/42/EC and with national implementing legislation, i.e., as a whole, including the equipment referred to in this Declaration.

This is to certify that the aforementioned product is in accordance with the applicable requirements of the following Directive(s):

2011/65/EU

RoHS 2 Directive

Authorized Representative: Simon Smith, European Director
Address: Aerotech Ltd
The Old Brick Kiln, Ramsdell, Tadley
Hampshire RG26 5PR
UK

Name  / Alex Weibel
Position Engineer Verifying Compliance
Location Pittsburgh, PA
Date 12/11/2018



This page intentionally left blank.

Chapter 1: Overview

NOTE: Aerotech continually improves its product offerings; listed options may be superseded at any time. All drawings and illustrations are for reference only and were complete and accurate as of this manual's release. Refer to www.aerotech.com for the most up-to-date information.

Table 1-1: Model Numbers and Ordering Options

| MPS50GR Miniature Gear-Driven Rotary Stage | |
|--|--|
| MPS50GR | 20 mm aperture |
| Vacuum Preparation (Optional) | |
| -HV | High-vacuum preparation 10^{-6} torr |
| Motor (Required) | |
| -M1 | DC servomotor |
| -M2 | Stepper motor |
| Mounting Plate (Optional) | |
| -MP | Optical table mounting plate |
| Lens Mount (Optional) | |
| -LMO | Aperture lens mount |
| Metrology (Required) | |
| -PL0 | No metrology performance plots |
| -PL1 | Metrology, uncalibrated with performance plots |
| -PL2 | Metrology, calibrated (HALAR) with performance plots |
| Accessories (To be Ordered as a Separate Line Item) | |
| AP1-MPS | Adapter plate; mounts MPS50GR to MPS50SL |
| HDZ-MPS50GR | Right-angle bracket |

1.1. Environmental Specifications



WARNING: Do not expose this product to environments or conditions outside of the listed specifications. Exceeding environmental or operating specifications can cause damage to the equipment.

Table 1-2: Environmental Specifications

| | |
|----------------------------|---|
| Ambient Temperature | Operating: The optimal operating temperature is 20° C \pm 2° C (68° F \pm 4° F). If at any time the operating temperature deviates from 20° C, degradation in performance could occur. |
| | Storage: 0° to 40° C (32° to 104° F) in original shipping packaging |
| Humidity | Operating: 20% to 60% RH |
| | Storage: 10% to 70% RH, non-condensing in original packaging. The stage should be packaged with desiccant if it is to be stored for an extended time. |
| Altitude | Operating: 0 m to 2,000 m (0 ft to 6,562 ft) above sea level Contact Aerotech if your specific application involves use above 2,000 m or below sea level. |
| Vibration | Use the system in a low vibration environment. Excessive floor or acoustical vibration can affect system performance. Contact Aerotech for information regarding your specific application. |
| Protection Rating | The MPS50GR is not suited for dusty or wet environments. This equates to an ingress protection rating of IP00. |
| Use | Indoor use only |

1.2. Basic Specifications

Table 1-3: MPS50GR Series Mechanical Specifications

| Mechanical Specifications ⁽¹⁾ | | MPS50GR |
|---|---------------------|----------------------------|
| Travel | | 360° Continuous |
| Accuracy ^(2,3) | Uncalibrated | 250 arc sec |
| | Calibrated | 80 arc sec |
| Resolution (Minimum Incremental Motion) | DC Servomotor (-M1) | 2 arc sec |
| | Stepper Motor (-M2) | 2 arc sec |
| Unidirectional Repeatability ⁽²⁾ | DC Servomotor (-M1) | 8 arc sec |
| | Stepper Motor (-M2) | 20 arc sec |
| Tilt Error Motion | | 40 arc sec |
| Worm Gear Ratio | | 80:1 |
| Maximum Speed | DC Servomotor (-M1) | 23 deg/s |
| | Stepper Motor (-M2) | 4.5 deg/s |
| Aperture | | 20 mm |
| Maximum Torque (Continuous) | | 0.4 N·m |
| Load Capacity ⁽⁴⁾ | Axial | 4 kg |
| | Radial | 1 kg |
| | Moment | 0.25 N·m |
| Rotor Inertia (Unloaded) | | 0.000031 kg·m ² |
| Stage Mass | | 0.8 kg |
| Material | | Anodized Aluminum Body |
| 1. Specifications are for single-axis systems measured 25 mm above the tabletop; performance of multi-axis system is payload and workpoint dependent. Consult the Aerotech factory for multi-axis or non-standard applications. 2. With Aerotech controllers. 3. Excessive duty cycle may impact stage accuracy. 4. Payload specifications are for a single-axis system. | | |

1.3. Vacuum Operation

MPS50GR stages ordered with the -HV option (high vacuum preparation) are designed for operation in high vacuum environments. Special preparations include:

- Stage parts are lubricated with vacuum-compatible lubricants.
- Materials, fasteners, and coatings with vacuum outgas performance are ensured to be compatible with the specified level of vacuum.
- For high vacuum stages, situations that may allow gases to become temporarily trapped during pump down are removed.
- Prior to assembly, stage parts are thoroughly cleaned in a clean environment.
- Stages are packaged in a special polyethylene bag.

Vacuum Guidelines

To ensure that the MPS50GR will continue to perform well in the vacuum environment, follow the guidelines listed below (in addition to standard handling, installation, and lubrication guidelines outlined in this manual).

1. Do not remove the MPS50GR from its sealed bag until it is ready for use.
2. Always handle the MPS50GR in a clean environment and use powder-free polyethylene gloves to prevent any contaminants from adhering to the surface of the MPS50GR.
3. During installation, use cleaned, vented, stainless steel fasteners when securing the MPS50GR.
4. Reduced air pressure eliminates significant convective heat transfer. This, coupled with the viscous vacuum-compatible lubricants, could result in excessive motor operating temperatures. Because of this, consider all continuous torque ratings to be 40 to 60% lower than the value specified for operation in normal atmospheric environment. Reduce motor usage accordingly.
5. For vacuum applications, the recommended lubricant is a small quantity of **Braycote® 602EF** grease or a compatible substitute of equal quality.
6. Baking vacuum components at 60 °C for 24 to 48 hours significantly reduces outgassing at initial pump-down to vacuum pressure and evaporates water vapor that impregnates porous surfaces on the aluminum and Teflon cables. Aerotech recommends that customers bake out vacuum systems when first installing them in the vacuum chamber.

Chapter 2: Installation



WARNING: MPS50GR installation must be in accordance to instructions provided by this manual and any accompanying documentation. Failure to follow these instructions could result in injury or damage to the equipment.

2.1. Unpacking and Handling the Stage

NOTE: If any damage has occurred during shipping, report it immediately.

Carefully remove the MPS50GR from the protective shipping container. Before operating the MPS50GR, it is important to let the MPS50GR stabilize at room temperature for at least 12 hours. Allowing the MPS50GR to stabilize to room temperature will ensure that all of the alignments, preloads, and tolerances are the same as they were when tested at Aerotech. Use compressed nitrogen or clean, dry, oil-less air to remove any dust or debris that has collected during shipping. Set the MPS50GR on a smooth, flat, and clean surface.

Each MPS50GR has a label listing the system part number and serial number. These numbers contain information necessary for maintaining or updating system hardware and software. Locate this label and record the information for later reference. If any damage has occurred during shipping, report it immediately.



WARNING: Make sure that all moving parts are secure before moving the MPS50GR. Unsecured moving parts may shift and cause bodily injury.



WARNING: Improper handling could adversely affect the performance of the MPS50GR. Use care when moving the MPS50GR.



WARNING: An unsecured MPS50GR could be dragged off of a mounting surface by its unsupported cable.

2.2. Dimensions

NOTE: Aerotech continually improves its product offerings; listed options may be superseded at any time. Refer to the most recent edition of the Aerotech Motion Control Product Guide for the most current product information at www.aerotech.com.

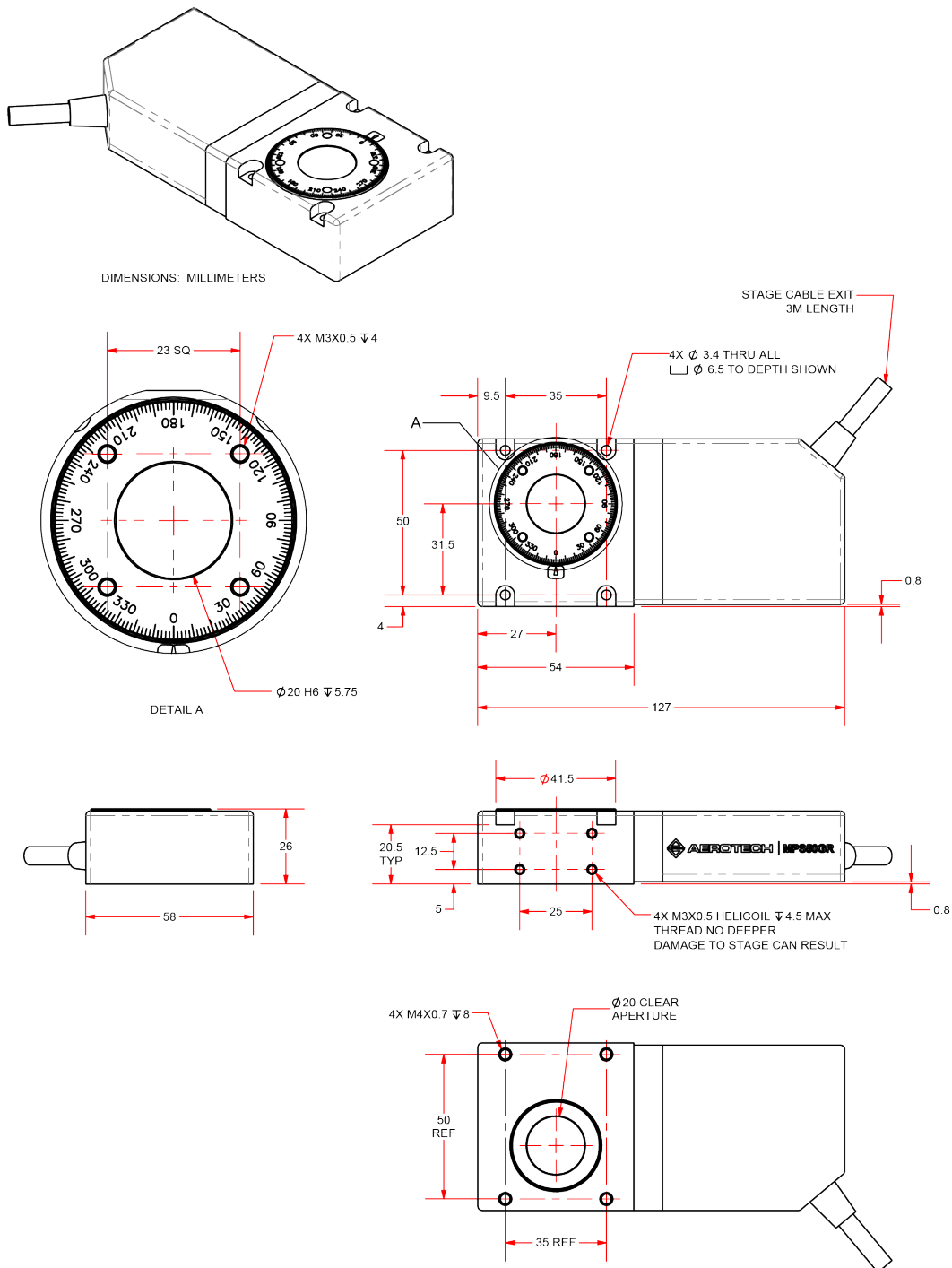
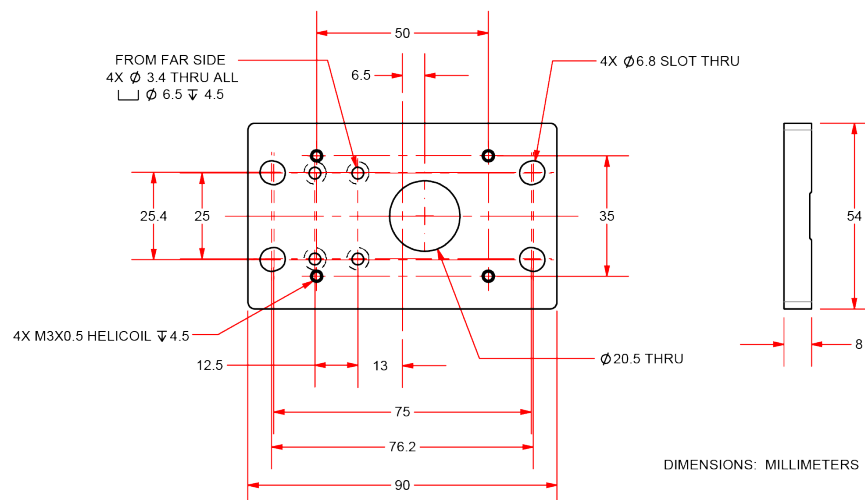
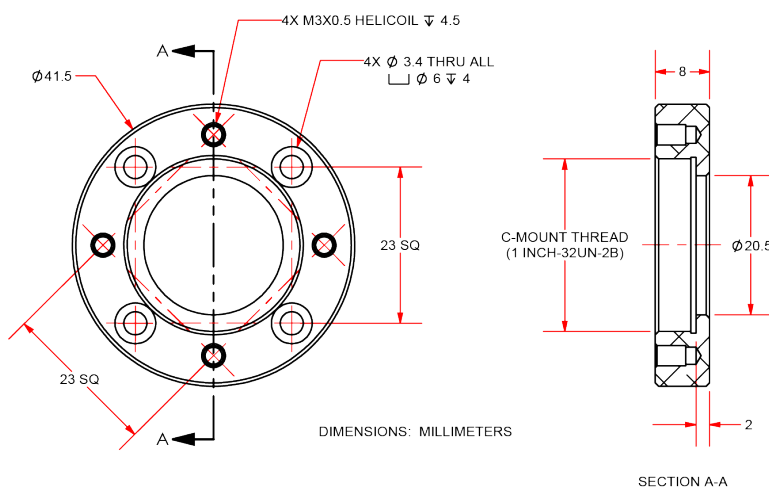


Figure 2-1: MPS50GR Dimensions

**Figure 2-2: MPS50GR Mounting Plate Dimensions****Figure 2-3: MPS50GR LMO Option Dimensions**

2.3. Securing the Stage to the Mounting Surface



WARNING: The MPS50GR must be mounted securely. Improper mounting can result in injury and damage to the equipment.

The mounting surface must be flat and have adequate stiffness in order to achieve the maximum performance from the MPS50GR stage. When it is mounted to a non-flat surface, the stage can be distorted as the mounting screws are tightened. This distortion will decrease overall accuracy. Adjustments to the mounting surface must be done before the stage is secured.

Inspect the mounting surface for dirt or unwanted residue and clean if necessary. Use precision flatstones on the mounting surface to remove any burrs or high spots. Clean the mounting surface with a lint-free cloth and acetone or isopropyl alcohol and allow the cleaning solvent to completely dry. Gently place the stage on the mounting surface.

NOTE: To maintain accuracy, the mounting surface must be flat to within 7.5 μm .

NOTE: The MPS50GR is precision machined and verified for flatness prior to product assembly at the factory. If machining is required to achieve the desired flatness, it should be performed on the mounting surface rather than the MPS50GR. Shimming should be avoided if possible. If shimming is required, it should be minimized to retain maximum rigidity of the system.

Mount the stage to the mounting surface using M3 socket head cap screws (SHCS) [QTY 4] in the counter-bored mounting holes (refer to [Figure 2-4](#)). For a side-mount orientation, refer to [Figure 2-5](#).

Refer to [Section 2.2](#) for the dimension drawing for mounting hole locations and screw lengths.



DANGER: To minimize the possibility of bodily injury or death, disconnect all electrical power prior to performing any maintenance or making adjustments to the equipment.



WARNING: An unsecured MPS50GR could be dragged off of a mounting surface by its unsupported cable.

Tightening torque values for the mounting hardware are dependent on the properties of the surface to which the stage is being mounted. Values provided in [Table 2-1](#) are typical values and may not be accurate for your mounting surface. Refer to [Section 2.2](#) for specific model mounting locations and dimensions.

Table 2-1: Stage to Mounting Surface Hardware

| Mounting Hardware | | Typical Screw Torque |
|--------------------------------------|-----------------------|----------------------|
| Standard Mounting (Axis Vertical) | M3-0.5 x 25 SHCS | 0.9 N·m |
| Side Mounting (Axis Horizontal) | M3-0.5 Threaded Holes | 0.9 N·m |

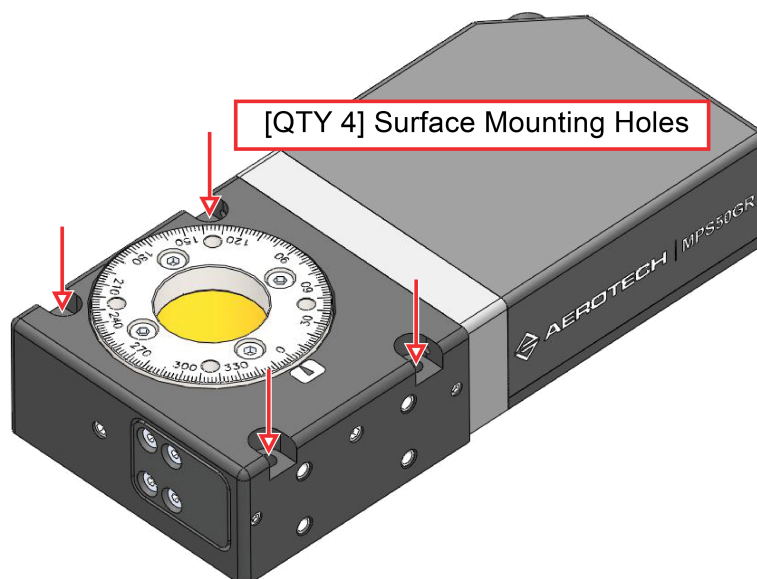


Figure 2-4: Mounting Hole Locations

NOTE: If the stage is not connected to a power source, the stage should move freely by hand. Do not attempt to manually move the stage if it is connected to a power source.

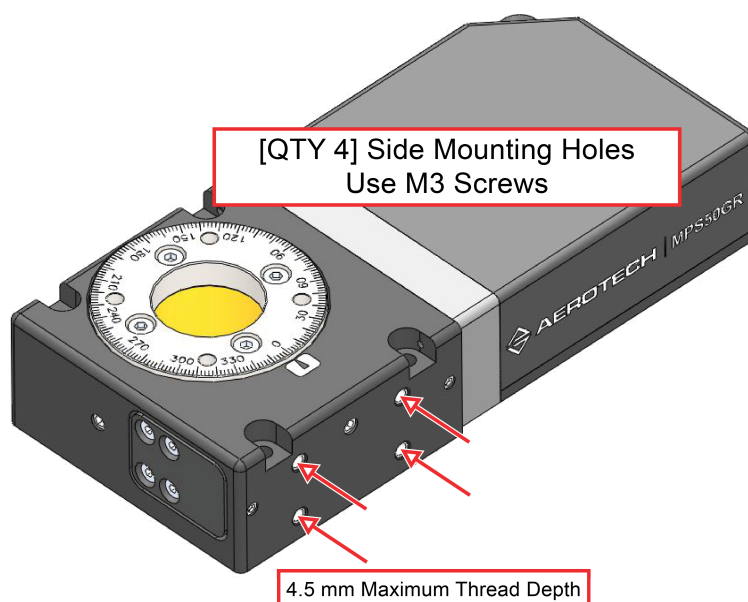


Figure 2-5: Side Mounting Holes

2.4. Attaching the Payload to the Stage

Aerotech recommends that customers use a representative payload during start-up to prevent accidental damage to the stage and the payload. Proceed with the electrical installation and test the motion control system in accordance with the system documentation. Document all results for future reference. For information on electrical installation refer to [Chapter 3](#) and the documentation delivered with the stage.

NOTE: If your MPS50GR was purchased with Aerotech controls, it might have been tuned with a representative payload based on the information provided at the time of order. If the MPS50GR is started up without a payload, the servo gains provided by Aerotech with the shipment may not be appropriate and servo instability can occur. Refer to the controller help file for tuning assistance.

The payload must be flat, rigid, and comparable to the stage in quality to maintain optimum performance.

NOTE: For valid system performance, the mounting interface should be flat within 7.5 μm .



WARNING: Refer to the dimensions in [Section 2.2](#) for maximum allowable thread engagement. A screw extending through the stage table can affect travel and damage the stage.

Refer to the dimension drawing in [Section 2.2](#) for mounting hole locations and screw lengths.

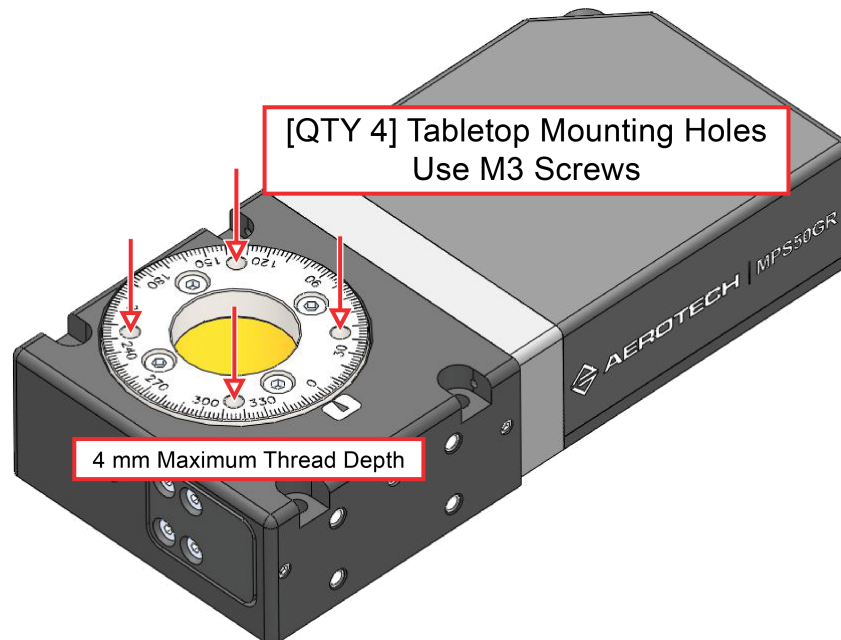


Figure 2-6: Tabletop Mounting

Application loads should be symmetrically distributed whenever possible (i.e., the payload should be centered on the stage table and the entire stage should be centered on the support structure). If cantilevered loads are applied, refer to [Figure 2-7](#) to find the maximum allowable load.

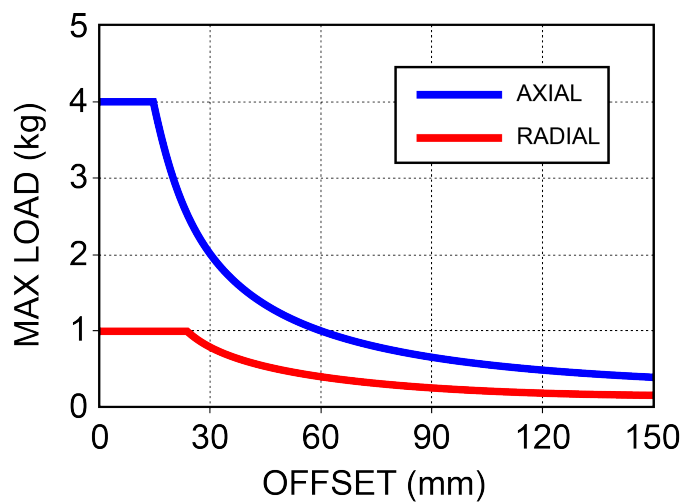


Figure 2-7: Load Capability of MPS50GR Series Stages

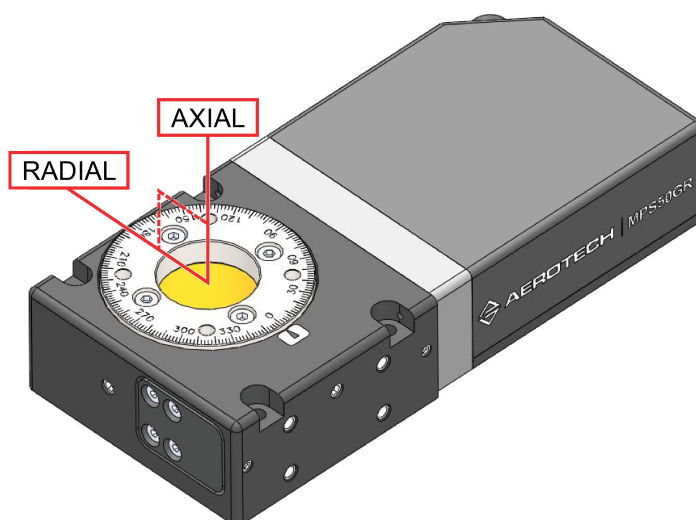


Figure 2-8: Axial and Radial Loads

2.5. Torque Capability

The worm-drive mechanism of the MPS50GR series of rotary stages provides a mechanical advantage that amplifies the input torque of the attached motor. The maximum torque that can be provided is 0.4 N·m. This is also the maximum torque that should be applied to the stage shaft.

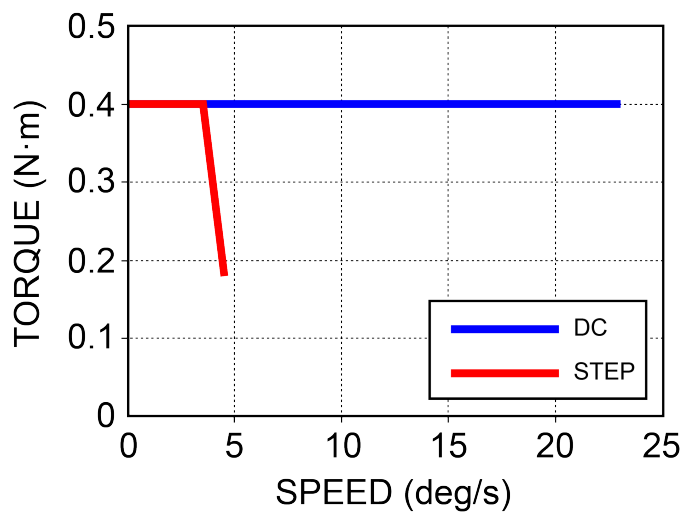


Figure 2-9: Torque vs Speed

Chapter 3: Electrical Specifications and Installation



WARNING: Electrical installation must be performed by properly qualified personnel.

Aerotech motion control systems are adjusted at the factory for optimum performance. When the MPS50GR is part of a complete Aerotech motion control system, setup usually involves connecting the MPS50GR to the appropriate drive chassis with the cables provided. Labels on the system components usually indicate the appropriate connections.

If system level integration was purchased, an electrical drawing showing system interconnects has been supplied with the system (separate from this documentation).

The electrical wiring from the motor and encoder are integrated at the factory. Refer to the sections that follow for standard motor wiring and connector pinouts.



WARNING: Applications requiring access to the stage while it is energized will require additional grounding and safeguards. The System Integrator or qualified installer is responsible for determining and meeting all safety and compliance requirements necessary for the integration of this stage into the final application.



DANGER: Remove power before connecting or disconnecting electrical components or cables. Failure to do so may cause electric shock or damage to the equipment.



WARNING: The DC Power supplies for controllers must be double insulated. All Aerotech-provided power supplies are double insulated.

3.1. Motor and Feedback Connectors

The MPS50GR comes from the factory completely wired and assembled. Each MPS50GR is shipped with documentation regarding the wiring, controller interface connectors, and specifications.

NOTE: Refer to the other documentation accompanying your Aerotech equipment. Call your Aerotech representative if there are any questions on system configuration.

The System Integrator or qualified installer is responsible for determining and meeting all safety and compliance requirements necessary for the integration of this stage into the final application.



DANGER: Remove power before connecting or disconnecting electrical components or cables. Failure to do so may cause electric shock or damage to the equipment.



CAUTION: The stage controller must provide over-current and over-speed protection. Failure to do so may result in permanent damage to the motor and stage components.

Table 3-1: 25-Pin D Motor and Feedback Connector Pinouts (-M1)

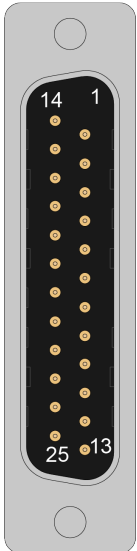
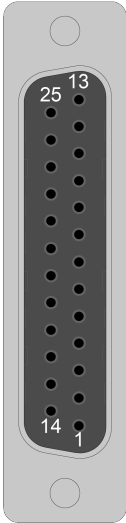
| Pin | Description | Connector |
|------|--|--|
| 1 | Connector key (to prevent improper connection) |  |
| 2 | Cosine-N | |
| 3 | Sine-N | |
| 4 | Marker-N | |
| 5 | Encoder Common | |
| 6 | Limit Common | |
| 7 | Reserved | |
| 8 | Reserved | |
| 9 | Reserved | |
| 10 | Motor - | |
| 11 | Motor + | |
| 12 | Reserved | |
| 13 | Reserved | |
| 14 | Cosine | |
| 15 | Sine | |
| 16 | Marker | |
| 17 | Encoder +5 V | |
| 18 | Stage ID | |
| 19 | Positive (CW) hardware limit | |
| 20 | Reserved | |
| 21 | Reserved | |
| 22 | Motor - | |
| 23 | Motor + | |
| 24 | Reserved | |
| 25 | Reserved | |
| Case | Signal shield connection (to case) | |

Table 3-2: 25-Pin D Motor Mating Connector (-M1)

| Mating Connector | Aerotech P/N | Third Party P/N |
|------------------|--------------|------------------------|
| Backshell | ECK01057 | TE #5745173-4 |
| Connector | ECK00300 | Amphenol #DB25S064 TLF |

Table 3-3: 25-Pin D Motor and Feedback Connector Pinouts (-M1 with -HV Option)

| Pin | Description | Connector |
|------|------------------------------------|--|
| 1 | Reserved |  |
| 2 | Reserved | |
| 3 | Motor + | |
| 4 | Motor - | |
| 5 | Reserved | |
| 6 | Reserved | |
| 7 | Reserved | |
| 8 | Limit Common | |
| 9 | Encoder Common | |
| 10 | Marker-N | |
| 11 | Sine-N | |
| 12 | Cosine-N | |
| 13 | Reserved | |
| 14 | Reserved | |
| 15 | Reserved | |
| 16 | Motor + | |
| 17 | Motor - | |
| 18 | Reserved | |
| 19 | Reserved | |
| 20 | Positive (CW) hardware limit | |
| 21 | Stage ID | |
| 22 | Encoder +5 V | |
| 23 | Marker | |
| 24 | Sine | |
| 25 | Cosine | |
| Case | Signal shield connection (to case) | |

1. Vacuum stages require a double-male bulkhead adapter (through the vacuum chamber wall) to mate to our standard cables.

Table 3-4: 25-Pin D Motor and Feedback Connector Pinouts (-M2)

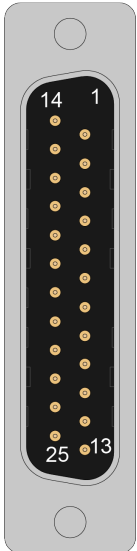
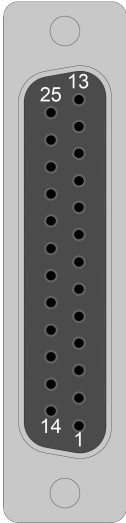
| Pin | Description | Connector |
|------|--|--|
| 1 | Connector key (to prevent improper connection) |  |
| 2 | Reserved | |
| 3 | Reserved | |
| 4 | Reserved | |
| 5 | Encoder Common | |
| 6 | Limit Common | |
| 7 | Reserved | |
| 8 | Reserved | |
| 9 | Reserved | |
| 10 | Motor Return | |
| 11 | Motor Phase A | |
| 12 | Motor Phase B | |
| 13 | Reserved | |
| 14 | Reserved | |
| 15 | Reserved | |
| 16 | Reserved | |
| 17 | Encoder +5 V | |
| 18 | Stage ID | |
| 19 | Positive (CW) hardware limit | |
| 20 | Reserved | |
| 21 | Reserved | |
| 22 | Motor Return | |
| 23 | Motor Phase A | |
| 24 | Motor Phase B | |
| 25 | Reserved | |
| Case | Signal shield connection (to case) | |

Table 3-5: 25-Pin D Motor Mating Connector (-M2)

| Mating Connector | Aerotech P/N | Third Party P/N |
|------------------|--------------|------------------------|
| Backshell | ECK01057 | TE #5745173-4 |
| Connector | ECK00300 | Amphenol #DB25S064 TLF |

Table 3-6: 25-Pin D Motor and Feedback Connector Pinouts (-M2 with -HV Option)

| Pin | Description | Connector |
|------|------------------------------------|--|
| 1 | Reserved |  |
| 2 | Motor Phase B | |
| 3 | Motor Phase A | |
| 4 | Motor Return | |
| 5 | Reserved | |
| 6 | Reserved | |
| 7 | Reserved | |
| 8 | Limit Common | |
| 9 | Encoder Common | |
| 10 | Reserved | |
| 11 | Reserved | |
| 12 | Reserved | |
| 13 | Reserved | |
| 14 | Reserved | |
| 15 | Motor Phase B | |
| 16 | Motor Phase A | |
| 17 | Motor Return | |
| 18 | Reserved | |
| 19 | Reserved | |
| 20 | Positive (CW) hardware limit | |
| 21 | Stage ID | |
| 22 | Encoder +5 V | |
| 23 | Reserved | |
| 24 | Reserved | |
| 25 | Reserved | |
| Case | Signal shield connection (to case) | |

1. Vacuum stages require a double-male bulkhead adapter (through the vacuum chamber wall) to mate to our standard cables.

3.2. Motor and Feedback Wiring

Shielded cables are required for the motor and feedback connections.

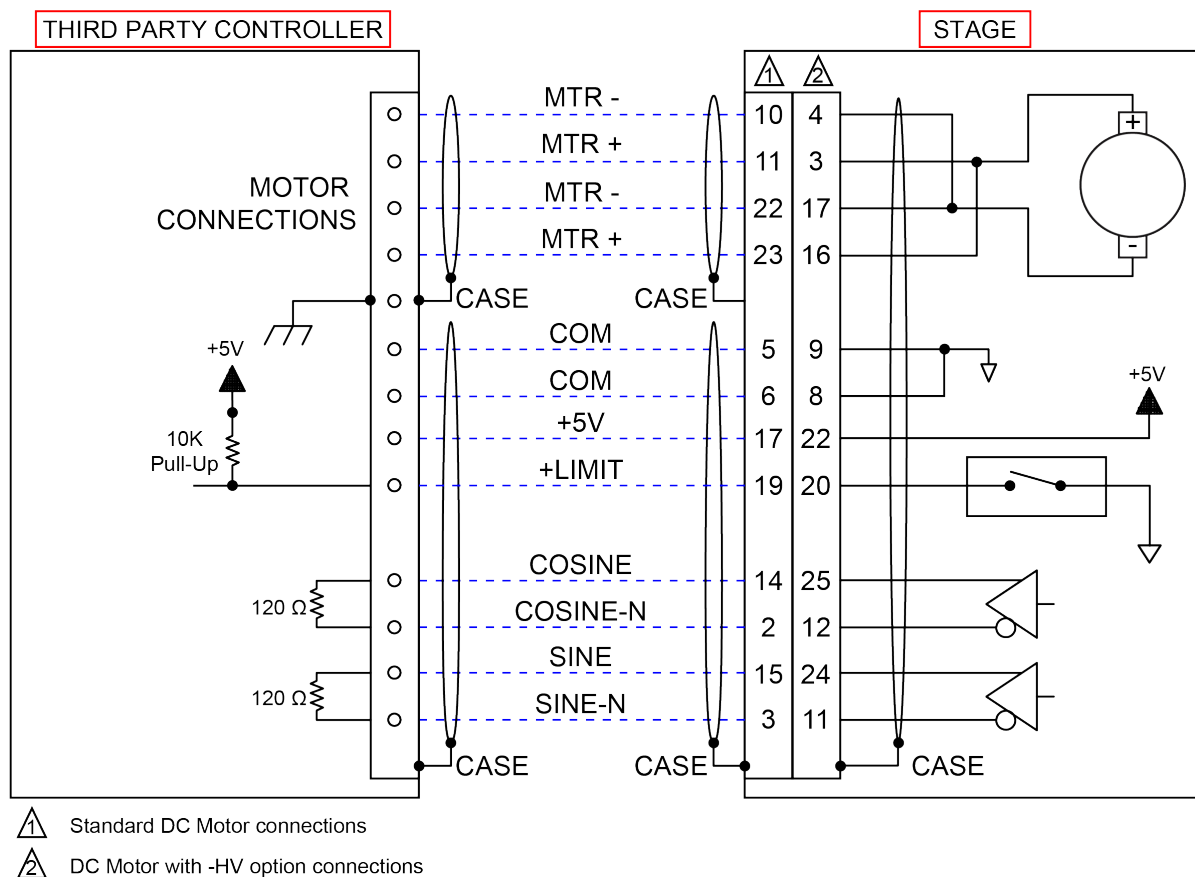


Figure 3-1: Motor and Feedback Wiring (-M1 Option)

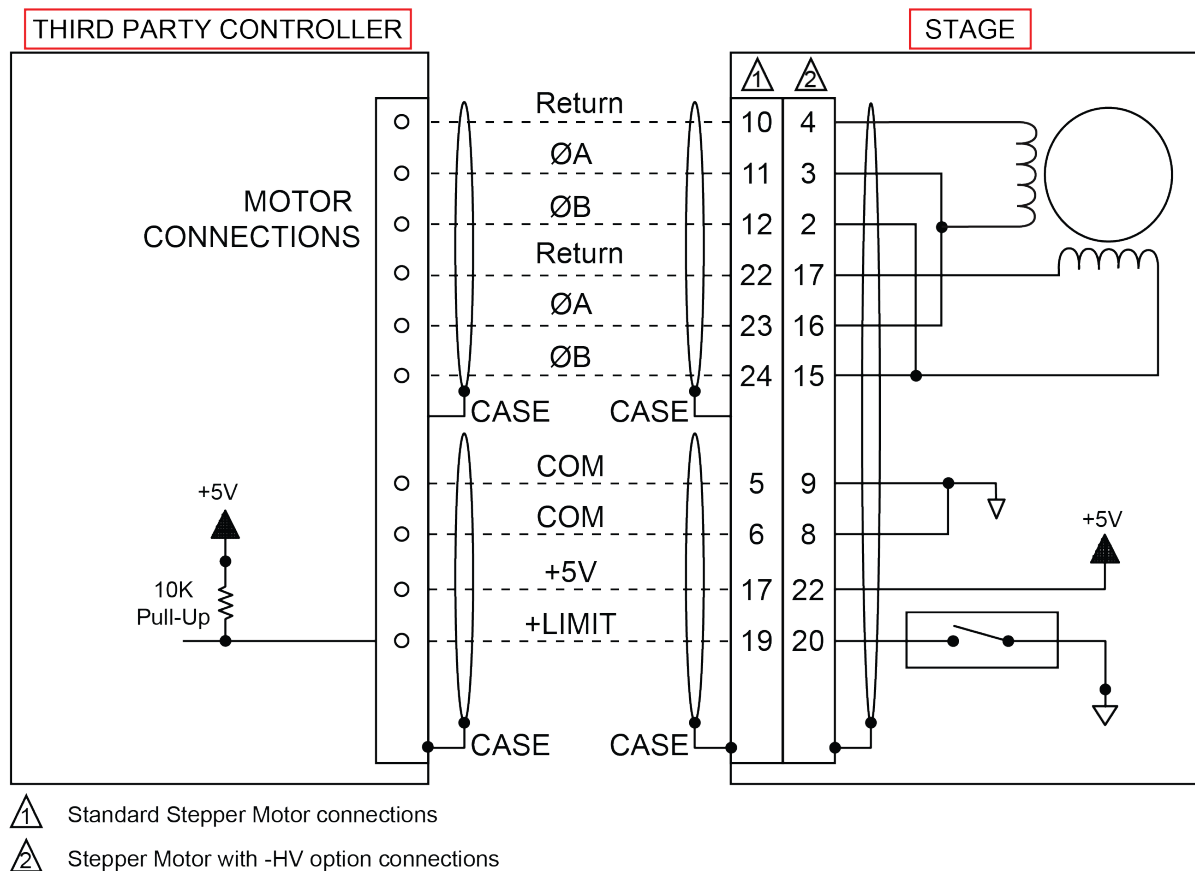


Figure 3-2: Motor and Feedback Wiring (-M2 Option)

3.3. Motor and Feedback Specifications

Table 3-7: Feedback Specifications

| Encoder Specifications | |
|------------------------|---|
| Supply Voltage | 5 V \pm 5% |
| Supply Current | 100 mA Typical |
| Output Signals | Digital Output (Incremental Encoder): RS422/485 compatible |

| Limit Switch Specifications | |
|-----------------------------|---|
| Supply Voltage | 5 V |
| Supply Current | 25 mA |
| Output Type | Open Collector |
| Output Voltage | 5 V |
| Output Current | 10 mA (sinking) |
| Output Polarity | Normally Closed (NC) <ul style="list-style-type: none">• Sinks current to ground (Logic "0") when not in limit• High impedance (Logic "1") when in limit• Requires external pull-up to +5 V (10 kΩ recommended) |

Table 3-8: DC Motor Specifications

| | DC Motor (-M1) |
|--------------------------|----------------------------|
| Stall Torque, Continuous | 0.0045 N·m |
| Peak Torque | 0.0095 N·m |
| Maximum Speed | 4200 rpm |
| Peak Current, Stall | 0.40 A |
| Continuous Stall Current | 0.19 A |
| Torque Constant | 0.0263 N·m/A |
| Terminal Resistance | 54.6 Ohm |
| BEMF Constant | 2.76 V/krpm |
| Inductance | 0.0012 H |
| Rotor Moment of Inertia | 1.00E-07 kg·m ² |
| Recommended Bus Voltage | 24 V |
| Maximum Terminal Voltage | 48 V |
| Motor Constant | 0.0036 N·m/ \sqrt{w} |
| Gear Ratio | 676:49 |

Table 3-9: Stepper Motor Specifications

| | Stepper Motor (-M2) |
|-------------------------|----------------------------|
| Stall Torque | 0.0036 N·m |
| Rated Phase Current | 0.15 A |
| Recommended Bus Voltage | 24 V |
| Rotor Inertia | 4.50E-08 kg·m ² |
| Full Step Angle | 15° |
| Phase Resistance | 35 Ohm |
| Phase Inductance | 0.0165 H |
| Maximum Speed | 2600 rpm |
| Gear Ratio | 2704:63 |



WARNING: The motor case temperature may exceed 75°C.

Table 3-10: Encoder Specifications

| | DC Motor | Stepper Motor |
|---|------------------------------|--|
| Feedback | 512 lines/rev Rotary Encoder | N/A |
| Electronic Resolution ⁽¹⁾ | 0.565 arc sec (0.000157°) | 0.785 arc sec (0.000218°) @ 480 steps/rev motor resolution |
| 1. The resolution includes the effects of both the motor and the stage gearing. | | |

3.4. Machine Direction and Homing Limit

Aerotech stages are configured to have positive and negative "machine" directions. The machine direction defines the phasing of the feedback and motor signals and is dictated by the stage wiring (refer to [Section 3.5](#) for Motor and Feedback phasing information). Programming direction of a stage is set by the controller that is used to move the stage. Programming direction is typically selectable in the controller, while machine direction is hardwired in the stage. [Figure 3-3](#) shows the machine direction of MPS50GR stages.

MPS50GR stages are equipped with one limit switch for use as a homing reference. Refer to [Section 3.1](#) and [Section 3.2](#) for specifications.

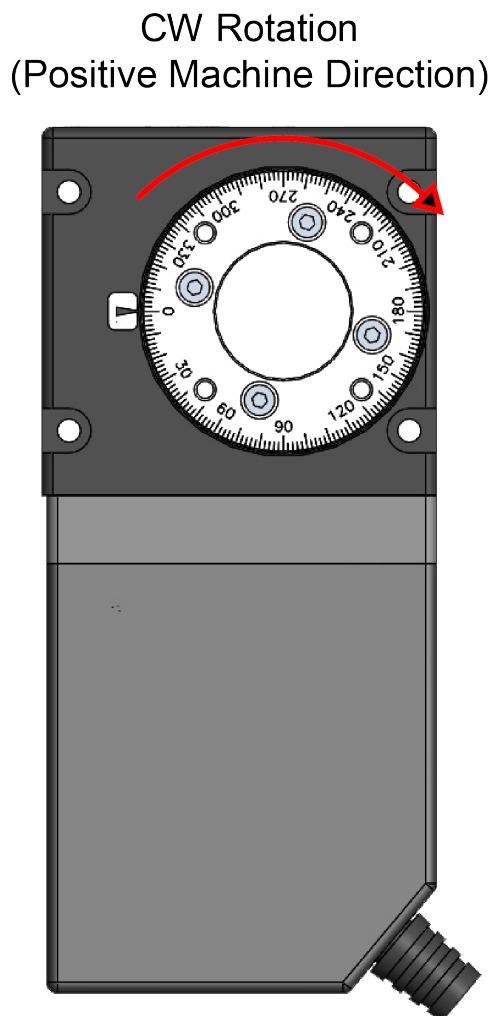


Figure 3-3: Machine Direction

3.5. Motor and Feedback Phasing

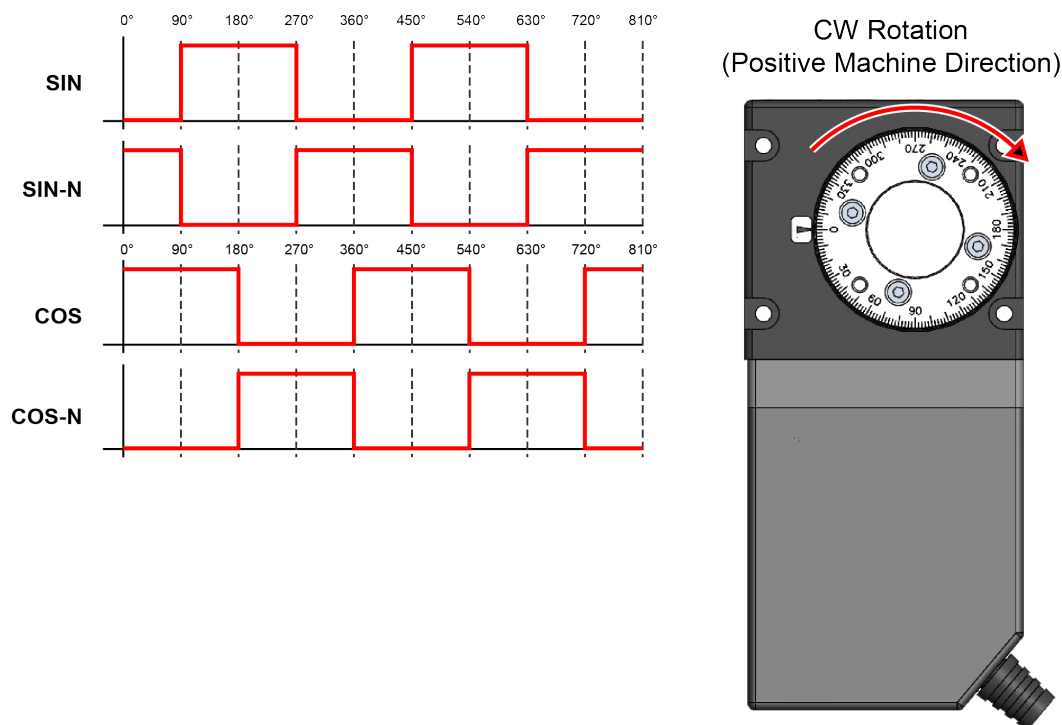


Figure 3-4: Encoder Phasing Reference Diagram (Standard)

Chapter 4: Maintenance

This chapter provides information about intervals between lubrications, details of the lubrication and inspection process, and recommendations of lubricants for use.



DANGER: Remove power before connecting or disconnecting electrical components or cables. Failure to do so may cause electric shock or damage to the equipment.

4.1. Service and Inspection Schedule

Lubricant inspection and replenishment in MPS50GR series stages depends on conditions such as duty cycle, speed, and the environment. An inspection interval of once per month is recommended until a trend develops for the application. Longer or shorter intervals may be required to maintain the film of lubricant on the gear surfaces.

In general, stages that operate in a clean environment at 50% duty cycle or less must be lubricated monthly or every revolutions (which ever comes first). For long-term reliability, we recommend that you return the stage to Aerotech after 300,000 rotation cycles for cleaning, relubrication, and gearing adjustments. For stages that operate at higher duty cycles, lubrication once every two weeks is recommended.

Monthly inspections should include but not be limited to:

- Visually inspect the stage and cables.
- Re-tighten loose connectors.
- Replace or repair damaged cables.
- Clean the MPS50GR and any components and cables as needed.
- Repair any damage before operating the MPS50GR.
- Inspect and perform an operational check on all safeguards and protective devices.

4.2. Cleaning and Lubrication



DANGER: Remove power before connecting or disconnecting electrical components or cables. Failure to do so may cause electric shock or damage to the equipment.



WARNING: In applications that have multiple stages bolted together to form multi-axis systems, the orthogonality may be lost if the stage tables of the support stages are loosened. Precision aligned stages should not be loosened or disassembled.



WARNING: Further disassembly of the stage is not recommended because proper assembly and calibration can only be done at the factory. In addition, a laser interferometer is required for post assembly verification to maintain warranties. Contact Aerotech for more information.

Cleaning

Before using a cleaning solvent on any part of the MPS50GR, blow away small particles and dust with nitrogen or, less preferably, clean, dry, compressed air.

Any external metal surface of the MPS50GR can be cleaned with isopropyl alcohol on a lint-free cloth.



WARNING: Make sure that all solvent has completely evaporated before attempting to move the stage.

Lubrication

The MPS50GR uses Mobilith SHC 100 grease.

NOTE: MPS50GR stages were previously assembled using Klubersynth BEM 44-461 US grease. Klubersynth BEM 44-461 US is compatible with the new Mobilith SHC 100 grease; however, MPS50GR stages that were assembled with Klubersynth can continue to use Klubersynth for regular maintenance lubrication.

Three grease access holes are provided – one for access to the worm gear, and two for access to the worm (refer to [Figure 4-1](#)). Two worm access screws are provided so the stage can be lubricated without removing the stage from its mounting surface, depending on whether the stage is base- or side-mounted. For standard stage assemblies, inject a small amount of Mobilith SCH 100 grease while the stage shaft slowly rotates (<5 rpm). A small grease syringe is recommended to apply the grease directly to the gear teeth.

Backlash adjustment is not recommended, proper assembly and calibration can only be done at the factory.

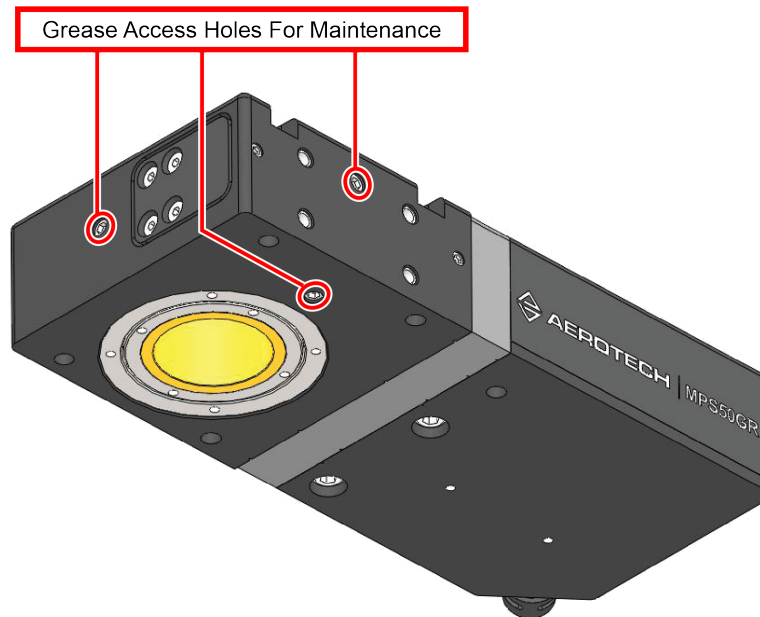


Figure 4-1: Grease Access

4.3. Troubleshooting

Table 4-1: Troubleshooting

| Symptom | Possible Cause and Solution |
|-----------------------------|--|
| Stage will not move | Brake not released (if equipped with brake; refer to stage documentation). In Limit condition. Check limits (refer to Chapter 3) and refer to the Controller documentation for polarity and compatibility requirements (Example: voltage requirements). Controller trap or fault (refer to the Controller documentation). |
| Stage moves uncontrollably | Encoder (sine and cosine) signal connections (refer to Chapter 3 and Controller documentation). Motor Connections (refer to Chapter 3 and the Controller documentation). |
| Stage oscillates or squeals | Gains misadjusted (refer to the Controller documentation). Encoder signals (refer to the Controller documentation). Gears need lubrication (Refer to Section 4.1. and Section 4.2.). |

Appendix A: Warranty and Field Service

Aerotech, Inc. warrants its products to be free from harmful defects caused by faulty materials or poor workmanship for a minimum period of one year from date of shipment from Aerotech. Aerotech's liability is limited to replacing, repairing or issuing credit, at its option, for any products that are returned by the original purchaser during the warranty period. Aerotech makes no warranty that its products are fit for the use or purpose to which they may be put by the buyer, whether or not such use or purpose has been disclosed to Aerotech in specifications or drawings previously or subsequently provided, or whether or not Aerotech's products are specifically designed and/or manufactured for buyer's use or purpose. Aerotech's liability on any claim for loss or damage arising out of the sale, resale, or use of any of its products shall in no event exceed the selling price of the unit.

THE EXPRESS WARRANTY SET FORTH HEREIN IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, BY OPERATION OF LAW OR OTHERWISE. IN NO EVENT SHALL AEROTECH BE LIABLE FOR CONSEQUENTIAL OR SPECIAL DAMAGES.

Return Products Procedure

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. Aerotech must be notified within thirty (30) days of shipment of incorrect material. No product may be returned, whether in warranty or out of warranty, without first obtaining approval from Aerotech. No credit will be given nor repairs made for products returned without such approval. A "Return Materials Authorization (RMA)" number must accompany any returned product(s). The RMA number may be obtained by calling an Aerotech service center or by submitting the appropriate request available on our website (www.aerotech.com). Products must be returned, prepaid, to an Aerotech service center (no C.O.D. or Collect Freight accepted). The status of any product returned later than thirty (30) days after the issuance of a return authorization number will be subject to review.

Visit <https://www.aerotech.com/global-technical-support.aspx> for the location of your nearest Aerotech Service center.

Returned Product Warranty Determination

After Aerotech's examination, warranty or out-of-warranty status will be determined. If upon Aerotech's examination a warranted defect exists, then the product(s) will be repaired at no charge and shipped, prepaid, back to the buyer. If the buyer desires an expedited method of return, the product(s) will be shipped collect. Warranty repairs do not extend the original warranty period.

Fixed Fee Repairs - Products having fixed-fee pricing will require a valid purchase order or credit card particulars before any service work can begin.

All Other Repairs - After Aerotech's evaluation, the buyer shall be notified of the repair cost. At such time the buyer must issue a valid purchase order to cover the cost of the repair and freight, or authorize the product(s) to be shipped back as is, at the buyer's expense. Failure to obtain a purchase order number or approval within thirty (30) days of notification will result in the product(s) being returned as is, at the buyer's expense.

Repair work is warranted for ninety (90) days from date of shipment. Replacement components are warranted for one year from date of shipment.

Rush Service

At times, the buyer may desire to expedite a repair. Regardless of warranty or out-of-warranty status, the buyer must issue a valid purchase order to cover the added rush service cost. Rush service is subject to Aerotech's approval.

On-site Warranty Repair

If an Aerotech product cannot be made functional by telephone assistance or by sending and having the customer install replacement parts, and cannot be returned to the Aerotech service center for repair, and if Aerotech determines the problem could be warranty-related, then the following policy applies:

Aerotech will provide an on-site Field Service Representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs. For warranty field repairs, the customer will not be charged for the cost of labor and material. If service is rendered at times other than normal work periods, then special rates apply.

If during the on-site repair it is determined the problem is not warranty related, then the terms and conditions stated in the following "On-Site Non-Warranty Repair" section apply.

On-site Non-Warranty Repair

If any Aerotech product cannot be made functional by telephone assistance or purchased replacement parts, and cannot be returned to the Aerotech service center for repair, then the following field service policy applies:

Aerotech will provide an on-site Field Service Representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs and the prevailing labor cost, including travel time, necessary to complete the repair.

Service Locations

<http://www.aerotech.com/contact-sales.aspx?mapState=showMap>

| USA, CANADA, MEXICO | CHINA | GERMANY |
|--|--|--|
| Aerotech, Inc. Global Headquarters Phone: +1-412-967-6440 Fax: +1-412-967-6870 | Aerotech China Full-Service Subsidiary Phone: +86 (21) 5508 6731 | Aerotech Germany Full-Service Subsidiary Phone: +49 (0)911 967 9370 Fax: +49 (0)911 967 93720 |
| JAPAN | TAIWAN | UNITED KINGDOM |
| Aerotech Japan Full-Service Subsidiary Phone: +81 (0)50 5830 6814 Fax: +81 (0)43 306 3773 | Aerotech Taiwan Full-Service Subsidiary Phone: +886 (0)2 8751 6690 | Aerotech United Kingdom Full-Service Subsidiary Phone: +44 (0)1256 855055 Fax: +44 (0)1256 855649 |

Have your customer order number ready before calling.

Appendix B: Revision History

| Revision | General Information |
|----------|--|
| 1.02.00 | Updated vacuum baking temperature: Section 1.3 . |
| 1.01.00 | <ul style="list-style-type: none">• Product update• Updates to motor and feedback connector tables: Section 3.1.• Updates to motor and feedback wiring figures: Section 3.2.• Updates to motor and feedback specifications tables: Section 3.3. |
| 1.00.00 | New Manual |

This page intentionally left blank.

Index

| | | | |
|------------------------------------|----------|--|----|
| | | Lubrication | 36 |
| | 2 | | |
| 2010 | | 9 | |
| | A | | |
| Altitude | | 12 | |
| Ambient Temperature | | 12 | |
| Attaching the Payload to the Stage | | 20 | |
| | B | | |
| Braycote® 602EF | | 14 | |
| | C | | |
| cleaning | | | |
| mounting surface | | 18 | |
| solvents | | 36 | |
| Cleaning | | 36 | |
| | D | | |
| Dimensions | | 16 | |
| | E | | |
| EN 60204-1 | | 9 | |
| EN ISO 12100 | | 9 | |
| Encoder Specifications | | 31 | |
| | G | | |
| Global Technical Support | | 2 | |
| grease | | 14 | |
| | H | | |
| Humidity | | 12 | |
| | I | | |
| Inspection Schedule | | 35 | |
| isopropyl alcohol | | 36 | |
| | L | | |
| Limit Switch Specifications | | 31 | |
| lubricants | | | |
| vacuum operation | | 14 | |
| | | M | |
| | | Mechanical Specifications | 13 |
| | | model numbers | 15 |
| | | mounting surface | |
| | | cleaning | 18 |
| | | securing stage | 18 |
| | | multiaxis combinations | 36 |
| | | O | |
| | | orthogonality | 36 |
| | | P | |
| | | Payload | 20 |
| | | Protection Rating | 12 |
| | | S | |
| | | Securing the Stage to the Mounting Surface | 18 |
| | | Service Schedule | 35 |
| | | shimming | 18 |
| | | solvents | 36 |
| | | Specifications | 13 |
| | | stage | |
| | | distortion | 18 |
| | | Support | 2 |
| | | T | |
| | | Technical Support | 2 |
| | | V | |
| | | Vacuum | 14 |
| | | vacuum guidelines | 14 |
| | | Vibration | 12 |
| | | W | |
| | | Warranty and Field Service | 39 |

This page intentionally left blank.