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AGR Hardware Manual

Revision: 1.06.00



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Safety Procedures and Warnings

This manual tells you how to carefully and correctly use and operate the AGR. Read all parts of this manual before you install or operate the AGR or before you do maintenance to your system. To prevent injury to you and damage to the equipment, obey the precautions in this manual. The precautions that follow apply when you see a Danger or Warning symbol in this manual. If you do not obey these precautions, injury to you or damage to the equipment can occur. If you do not understand the information in this manual, contact Aerotech Global Technical Support.

This product has been designed for light industrial manufacturing or laboratory environments. The protection provided by the equipment could be impaired if the product is used in a manner not specified by the manufacturer.



DANGER: This product contains potentially lethal voltages. To reduce the possibility of electrical shock, bodily injury, or death the following precautions must be followed.

1. Access to the AGR 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.



WARNING: To minimize the possibility of electrical shock, bodily injury or death the following precautions must be followed.

1. Moving parts can cause crushing or shearing injuries. Access to all stage and motor parts must be restricted while connected to a power source.
2. Cables can pose a tripping hazard. Securely mount and position all system cables to avoid potential hazards.
3. 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.
4. The AGR stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.
5. Use care when moving the AGR stage. Lifting or transporting the AGR stage improperly can result in injury or damage to the AGR.
6. 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.
7. 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.
8. Operators must be trained before operating this equipment.
9. All service and maintenance must be performed by qualified personnel.

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EU Declaration of Incorporation

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

herewith declares that the product:
AGR

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, for example, 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):
EU 2015/863 RoHS 3 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 2/19/2020

CE

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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: AGR Model Options

AGR Series Gear-Driven Rotary Stages	
Model (Required)	
AGR50	Gear-driven rotary stage, 50 mm diameter clear aperture
AGR75	Gear-driven rotary stage, 75 mm diameter clear aperture
AGR100	Gear-driven rotary stage, 100 mm diameter clear aperture
AGR150	Gear-driven rotary stage, 150 mm diameter clear aperture
AGR200	Gear-driven rotary stage, 200 mm diameter clear aperture
Motor (Optional)	
-M1	BMS35 brushless motor and 2000-line digital RS422 line-driver encoder (AGR50, AGR75)
	BMS60 brushless motor and 2500-line digital RS422 line-driver encoder (AGR100, AGR150)
	BMS280 brushless motor and 2500-line digital RS422 line-driver encoder (AGR200)
-M2	BMS35 brushless motor and 2000-line digital RS422 line-driver encoder with brake (AGR50, AGR75)
	BMS60 brushless motor and 2500-line digital RS422 line-driver encoder with brake (AGR100, AGR150)
	BMS280 brushless motor and 2500-line digital RS422 line-driver encoder with brake (AGR200)
-M3	BMS35 brushless motor and 1000-line 1 Vp-p sine-wave encoder (AGR50, AGR75)
	BMS60 brushless motor and 1000-line 1 Vp-p sine-wave encoder (AGR100, AGR150)
	BMS280 brushless motor and 1000-line 1 Vp-p sine-wave encoder (AGR200)
-M4	BMS35 brushless motor and 1000-line 1 Vp-p sine-wave encoder with brake (AGR50, AGR75)
	BMS60 brushless motor and 1000-line 1 Vp-p sine-wave encoder with brake (AGR100, AGR150)
	BMS280 brushless motor and 1000-line 1 Vp-p sine-wave encoder with brake (AGR200)
-M5	BM22 brushless motor and 2000-line digital RS422 line-driver encoder (AGR50, AGR75)
	BM75 brushless motor and 2500-line digital RS422 line-driver encoder (AGR100, AGR150)
	BM250 brushless motor and 2500-line digital RS422 line-driver encoder (AGR200)
-M6	BM22 brushless motor and 2000-line digital RS422 line-driver encoder with brake (AGR50, AGR75)
	BM75 brushless motor and 2500-line digital RS422 line-driver encoder with brake (AGR100, AGR150)
	BM250 brushless motor and 2500-line digital RS422 line-driver encoder with brake (AGR200)
-M7	SM35 stepper motor (AGR50, AGR75)
	BM75 brushless motor and 1000-line 1 Vp-p sine-wave encoder (AGR100, AGR150)
	BM250 brushless motor and 1000-line 1 Vp-p sine-wave encoder (AGR200)
-M8	SM35 stepper motor with brake (AGR50, AGR75)
	BM75 brushless motor and 1000-line 1 Vp-p sine-wave encoder with brake (AGR100, AGR150)
	BM250 brushless motor and 1000-line 1 Vp-p sine-wave encoder with brake (AGR200)
-M9	SM60 high voltage stepper motor (AGR100, AGR150)
	SM280 high voltage stepper motor (AGR200)
-M10	SM60 high voltage stepper motor with brake (AGR100, AGR150)
	SM280 high voltage stepper motor with brake (AGR200)
Motor Location (Required) (refer to Figure 1-2)	
-ML1	Motor located on right side of stage housing, standard
-ML2	Motor located on left side of stage housing

Motor Orientation (Optional) (refer to Figure 1-3)	
-2	Motor orientation 2
-3	Motor orientation 3, standard
-4	Motor orientation 4
-5	Motor orientation 5
Travel (Required)	
	Continuous travel (Standard)
-TR015	Limited travel, ±7.5°
-TR030	Limited travel, ±15°
-TR045	Limited travel, ±22.5°
-TR060	Limited travel, ±30°
-TR075	Limited travel, ±37.5°
-TR090	Limited travel, ±45°
-TR105	Limited travel, ±52.5°
-TR120	Limited travel, ±60°
-TR135	Limited travel, ±67.5°
-TR150	Limited travel, ±75°
-TR165	Limited travel, ±82.5°
-TR180	Limited travel, ±90°
-TR195	Limited travel, ±97.5°
-TR210	Limited travel, ±105°
-TR225	Limited travel, ±112.5°
-TR240	Limited travel, ±120°
-TR255	Limited travel, ±127.5°
-TR270	Limited travel, ±135°
NOTE: -TRxxx limited travel options contain an extra 2° of overtravel between the nominal travel and the electrical limit on each side (Ex: -TR270 contains ±135° of nominal travel, with ±137° of travel between the electrical limits).	
Limits (Required with Limited Travel Configurations)	
-LI1	Normally-closed, end-of-travel limit switches with 9-pin connector
-LI2	Normally-open, end-of-travel limit switches with 9-pin connector
Direct Rotary Feedback (Optional)	
-E1	Direct, amplified-sine output encoder
-E2	Direct digital RS422 line-driver encoder, X5 multiplication
-E3	Direct digital RS422 line-driver encoder, X50 multiplication
Tabletop (Optional)	
-TT1	Metric tabletop
-TT2	English tabletop
Mounting Plate (Optional)	
-MP1	Universal English/metric mounting plate
Seals (Optional) (refer to Figure 1-5)	
-SL1	Labyrinth seal
Metrology (Required)	
-PL0	No metrology performance plots
-PL1	Metrology, uncalibrated with performance plots
-PL2	Metrology, calibrated (HALAR) with performance plots

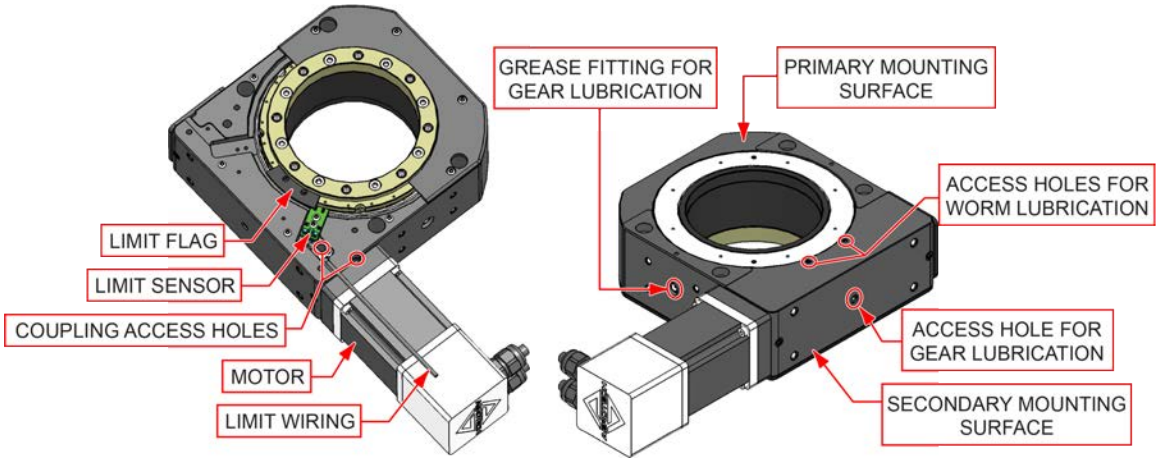


Figure 1-1: AGR Rotary Stage Showing Standard Features

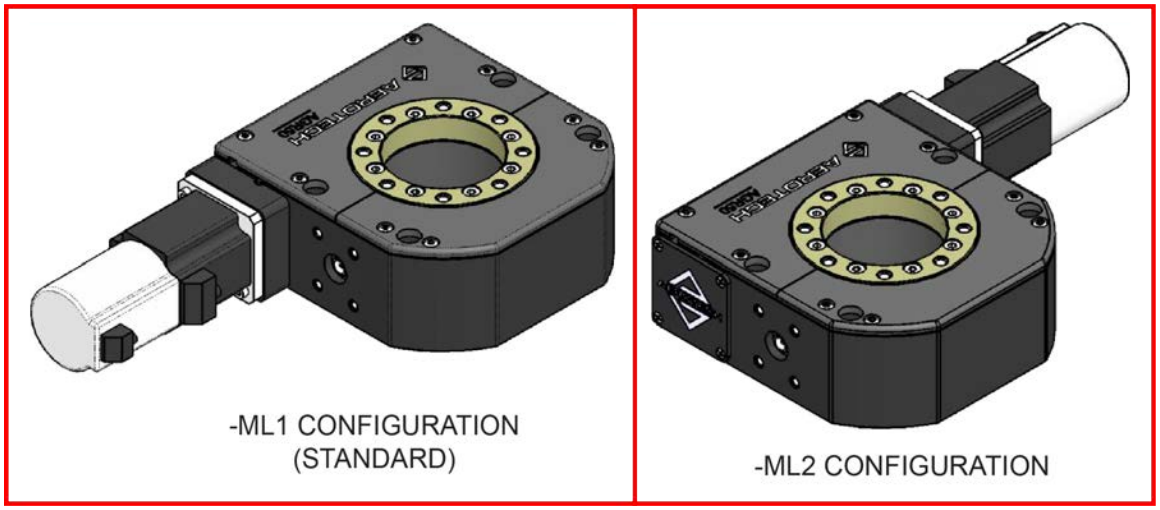


Figure 1-2: AGR Rotary Stage Motor Location

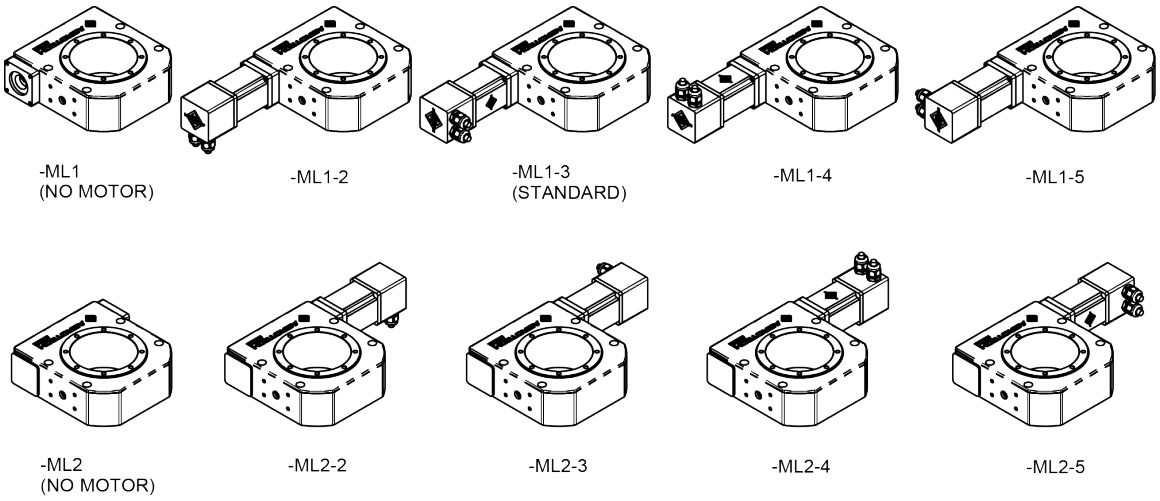


Figure 1-3: AGR Rotary Stage Motor Orientation

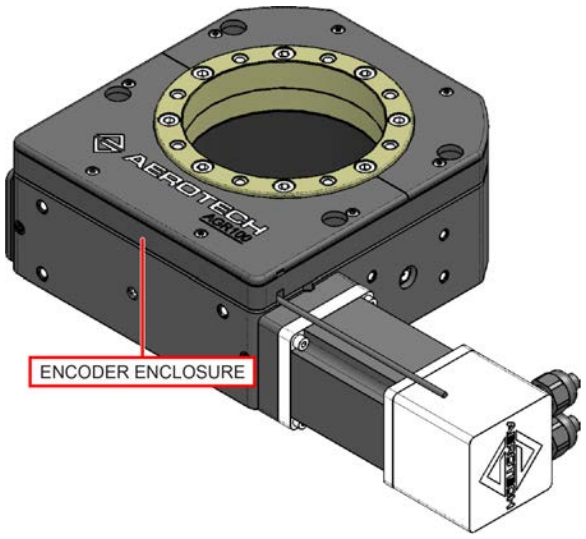


Figure 1-4: Encoder Option

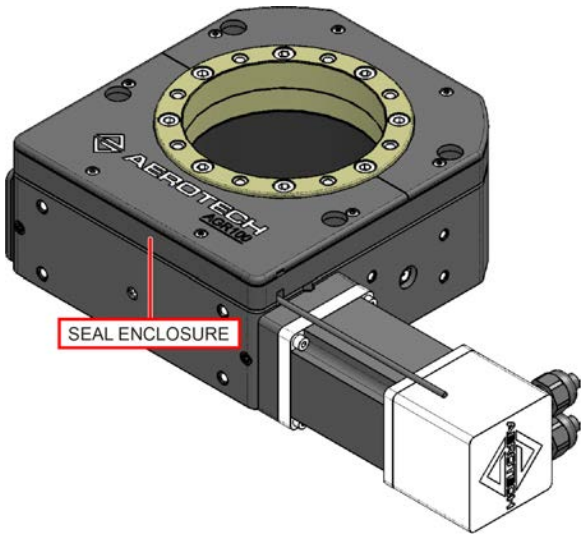


Figure 1-5: Seal Option

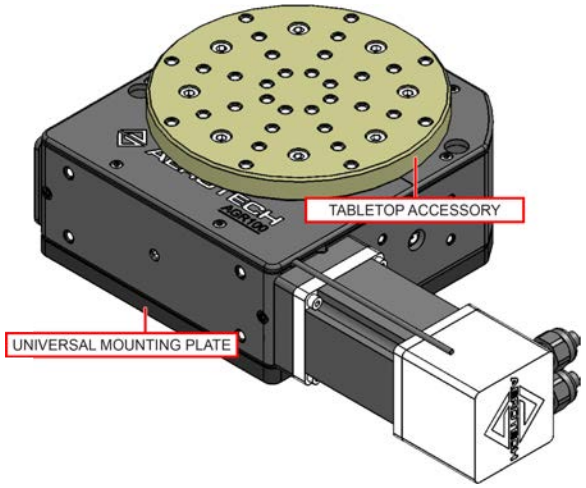


Figure 1-6: Stage Accessories

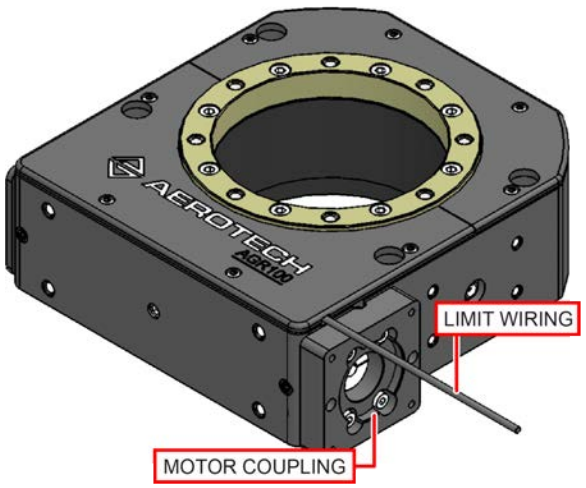


Figure 1-7: No Motor Option

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: 10° to 35° C (50° to 95° F) The optimal operating temperature is 20° C ±2° C (68° F ±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	In their standard configuration, the AGR stages have limited protection against airborne particles but not water. This equates to an ingress protection rating of IP40. With the Seal (-SL1) option, the AGR stages have limited protection against dust, but no protection against water. This equates to an ingress protection rating of IP50.
Use	Indoor use only.

1.2. Basic Specifications

Table 1-3: AGR Series Mechanical Specifications (AGR50, AGR75, and AGR100)

		AGR50	AGR75	AGR100
Travel		360° (Limited Travel Versions Available)		
Frame Size		NEMA17	NEMA17	NEMA23
Accuracy (1)	Uncalibrated	0.87 mrad (180 arc sec)	0.58 mrad (120 arc sec)	0.58 mrad (120 arc sec)
	Calibrated	0.29 mrad (60 arc sec)	0.24 mrad (50 arc sec)	0.24 mrad (50 arc sec)
	Uncalibrated with Direct Encoder Option	97 µrad (20 arc sec)		
	Calibrated with Direct Encoder Option	58 µrad (12 arc sec)	49 µrad (10 arc sec)	49 µrad (10 arc sec)
Repeatability (Unidirectional) (1)	Standard	49 µrad (10 arc sec)		
	Direct Encoder (2)	24 µrad (5 arc sec)		
Repeatability (Bidirectional) (1)	Standard	0.22 mrad (45 arc sec)		
	Direct Encoder (2)	39 µrad (8 arc sec)	39 µrad (8 arc sec)	29 µrad (6 arc sec)
Tilt Error Motion		49 µrad (10 arc sec)		
Axial Error Motion		5 µm		
Radial Error Motion		10 µm		
Gear Ratio		51:1	67:1	85:1
Maximum Speed (3)	with Brushless Servomotor (BM and BMS models)	180°/s		
	with Stepper Motor	60°/s	60°/s	40°/s
Maximum Acceleration (4)		720°/s^2		
Aperture		50 mm	75 mm	100 mm
Load Capacity	Axial	40 kg	100 kg	200 kg
	Radial	20 kg	50 kg	100 kg
	Moment	See Moment Load Capacity: Section 2.4.		
Maximum Torque Load to Stage Shaft		2.5 N·m	3.5 N·m	12 N·m
Rotor Inertia (Unloaded)		0.00052 kg•m^2	0.0013 kg•m^2	0.0035 kg•m^2
Stage Mass (No Motor)	Standard	1.9 kg	2.4 kg	4.5 kg
	Direct Encoder	2.5 kg	3.1 kg	5.6 kg
Material		Aluminum		

1. Certified with each stage.
2. Direct encoder repeatability specifications are for systems that use the -E1 or -E3 direct encoder options only.
3. Maximum speed is load dependent. Contact an Aerotech Application Engineer if imbalanced loads are present.
4. Unloaded acceleration.
5. On-axis loading is listed.
6. 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.

Table 1-4: AGR Series Mechanical Specifications (AGR150 and AGR200)

		AGR150	AGR200
Travel		360° (Limited Travel Versions Available)	
Frame Size		NEMA23	NEMA34
Accuracy (1)	Uncalibrated	0.58 mrad (120 arc sec)	
	Calibrated	0.24 mrad (50 arc sec)	
	Uncalibrated with Direct Encoder Option	97 µrad (20 arc sec)	
	Calibrated with Direct Encoder Option	49 µrad (10 arc sec)	
Repeatability (Unidirectional) (1)	Standard	49 µrad (10 arc sec)	
	Direct Encoder (2)	24 µrad (5 arc sec)	
Repeatability (Bidirectional) (1)	Standard	0.22 mrad (45 arc sec)	
	Direct Encoder (2)	29 µrad (6 arc sec)	
Tilt Error Motion		49 µrad (10 arc sec)	
Axial Error Motion		5 µm	
Radial Error Motion		10 µm	
Gear Ratio		117:1	126:1
Maximum Speed (3)	with Brushless Servomotor (BM and BMS Models)	180°/s	120°/s
	with Stepper Motor	40°/s	
Maximum Acceleration (4)		720°/s^2	480°/s^2
Aperture		150 mm	200 mm
Load Capacity	Axial	300 kg	425 kg
	Radial	125 kg	200 kg
	Moment	See Moment Load Capacity: Section 2.4.	
Maximum Torque Load to Stage Shaft		20 N·m	80 N·m
Rotor Inertia (Unloaded)		0.011 kg·m^2	0.076 kg·m^2
Stage Mass (No Motor)	Standard	6.1 kg	18.6 kg
	Direct Encoder	7.6 kg	21.7 kg
Material		Aluminum	

1. Certified with each stage.
2. Direct encoder repeatability specifications are for systems that use the -E1 or -E3 direct encoder options only.
3. Maximum speed is load dependent. Contact an Aerotech Application Engineer if imbalanced loads are present.
4. Unloaded acceleration.
5. On-axis loading is listed.
6. 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.

1.3. Vacuum Operation

Contact the factory for information regarding operation in a vacuum environment.

Preparation and considerations for operation in a vacuum environment:

- Lubrication with vacuum-compatible lubricants
- Use of materials, fasteners, and coatings with vacuum outgas performance compatible with the level of vacuum specified
- For high vacuum stages, elimination of situations that may allow gases to become temporarily trapped during pump down
- Extensive cleaning prior to assembly in a clean environment and packaging in a special polyethylene bag
- Use of components able to withstand elevated temperatures (non-operating) for bake-out performances

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.

Chapter 2: Installation



WARNING: AGR 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



WARNING: It is the customer's responsibility to safely and carefully lift the stage.

- Make sure that all moving parts are secure before moving the AGR. Unsecured moving parts may shift and cause bodily injury.
- Lift only by the base.
- Do not use the tabletop, motor, or cables as a lifting points.
- Improper handling could adversely affect the AGR's performance. Use care when moving the AGR.



DANGER/HEAVY: The minimum weight of the AGR200 is 18.6 kg without a motor. Refer to Section 1.2. for stage mass specifications.

- Do not attempt to lift heavy loads single handed.

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

Carefully remove the AGR from its protective shipping container. Gently set the AGR on a smooth, flat, and clean surface.

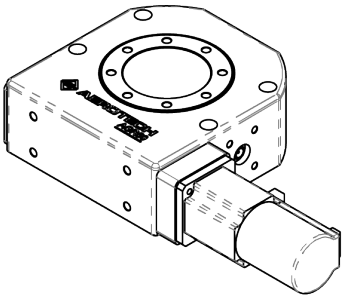
Before operating the AGR, it is important to let it stabilize at room temperature for at least 12 hours. Allowing it to stabilize to room temperature will ensure that all of the alignments, preloads, and tolerances are the same as they were when tested at Aerotech. Use compressed nitrogen or clean, dry, oil-free air to remove any dust or debris that has collected during shipping.

Each AGR 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.

Shipping Clamps

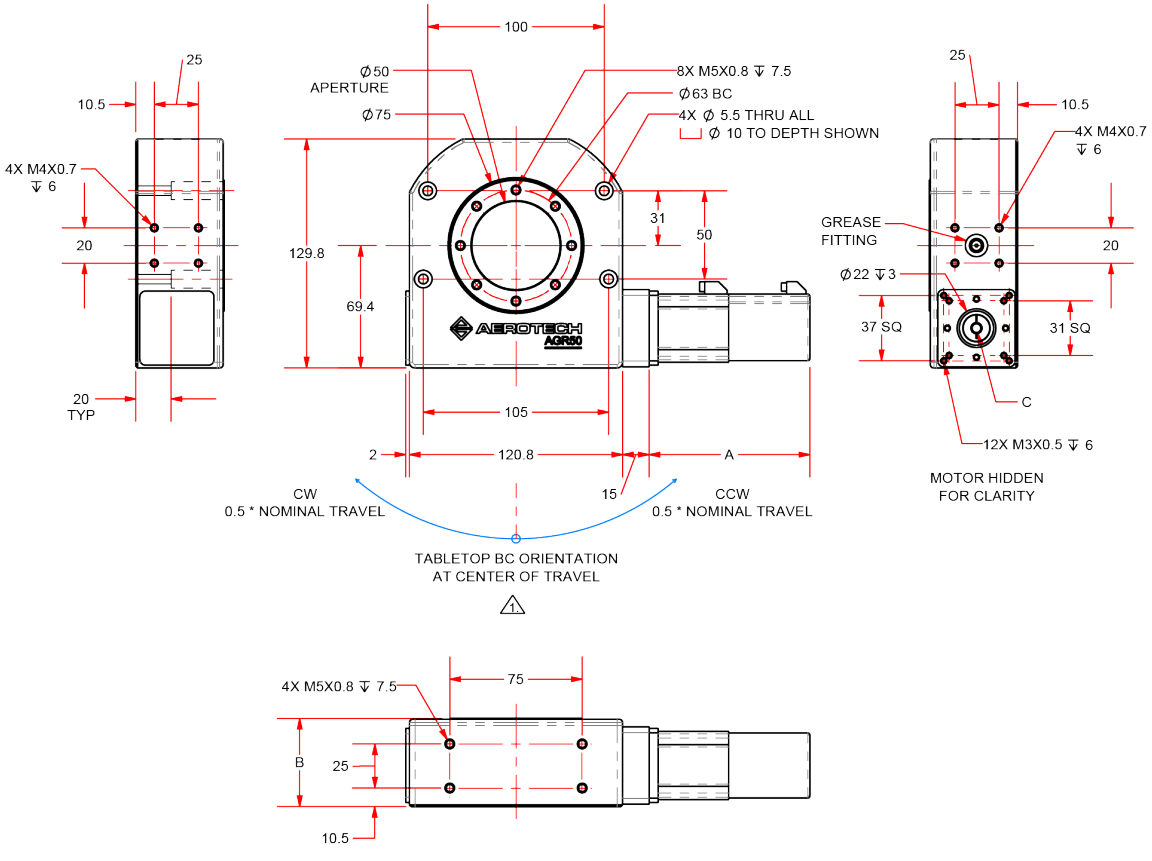
If the AGR has shipped as part of a system, shipping clamps (typically red, anodized aluminum) may have been installed to secure the system prior to shipment. The shipping clamps, if installed, will need to be removed prior to machine start up.

2.2. Dimensions



MOTOR	LENGTH "A"	SHAFT INPUT DIAMETER "C"
NO MOTOR	-	Ø6.35 [0.25]
-M1, -M3	125	Ø6.35 [0.25]
-M2, -M4	153	Ø6.35 [0.25]
-M5	91.1	Ø6.35 [0.25]
-M6	128	Ø6.35 [0.25]
-M7	127	Ø5.0
-M8	132	Ø5.0

OPTION	HEIGHT "B"
DEFAULT	50
-SL1	60
-E1, -E2, -E3	66.4
-SL1 + -E1, -E2, -E3	76.4



NOTES:

1. CW AND CCW TRAVEL LIMITATIONS APPLY TO -TRxxx LIMITED TRAVEL OPTION ONLY. ORIENTATION OF TABLETOP BC AT CENTER OF TRAVEL IS CONSISTENT FOR ALL CONFIGURATIONS.

DIMENSIONS: MILLIMETERS [INCHES]

Figure 2-1: AGR50 Dimensions

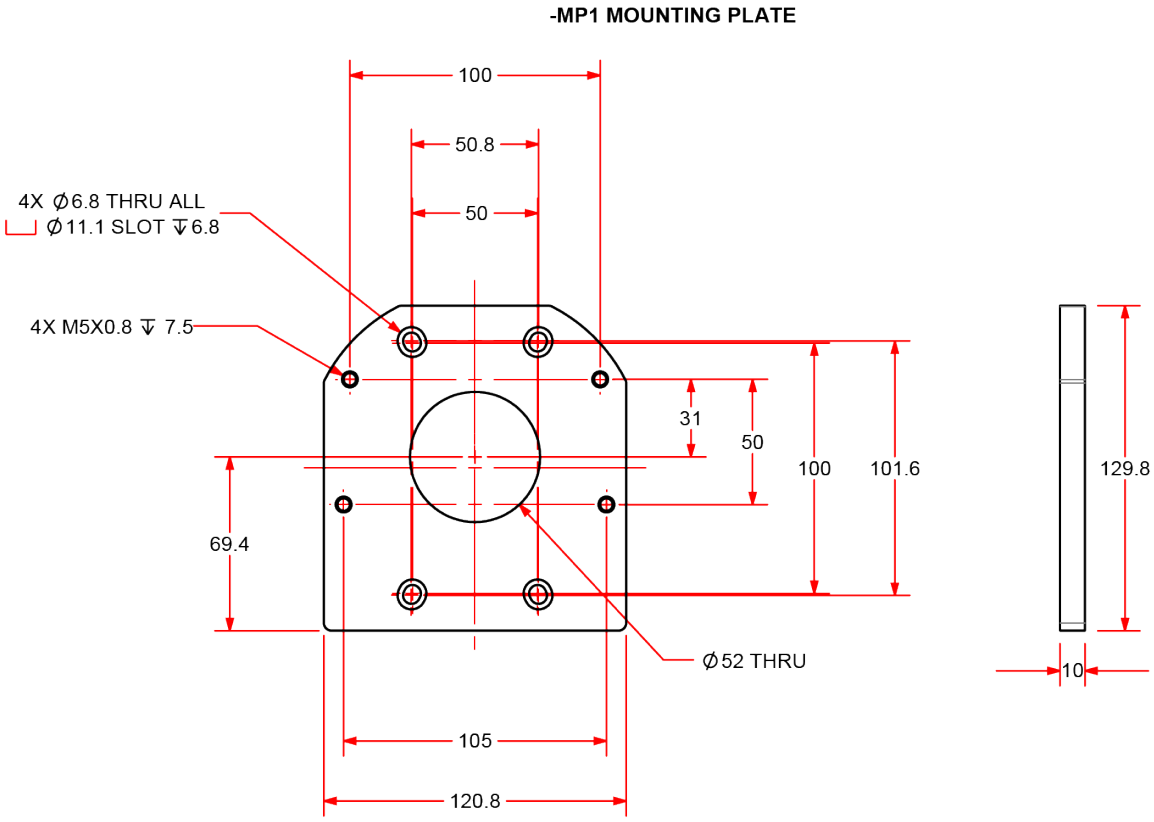


Figure 2-2: AGR50 -MP1 Mounting Plate Accessories

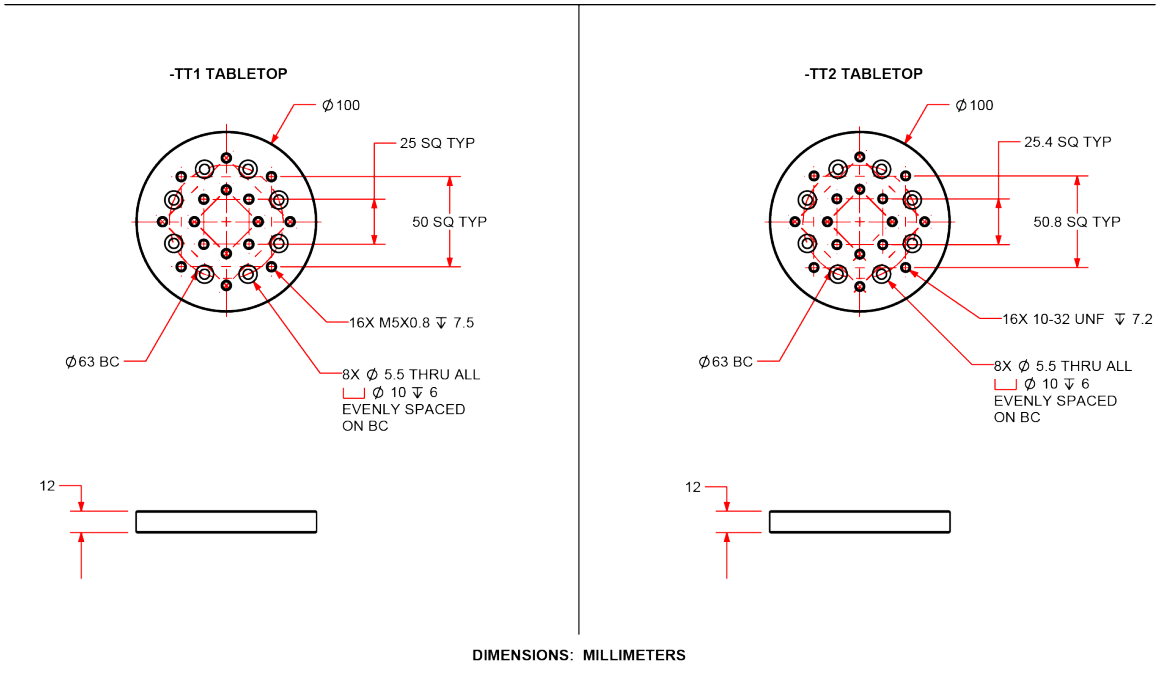
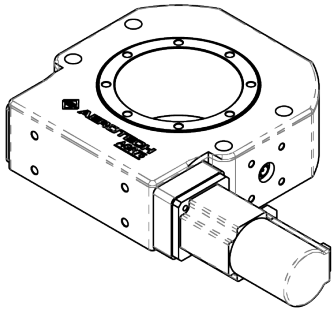
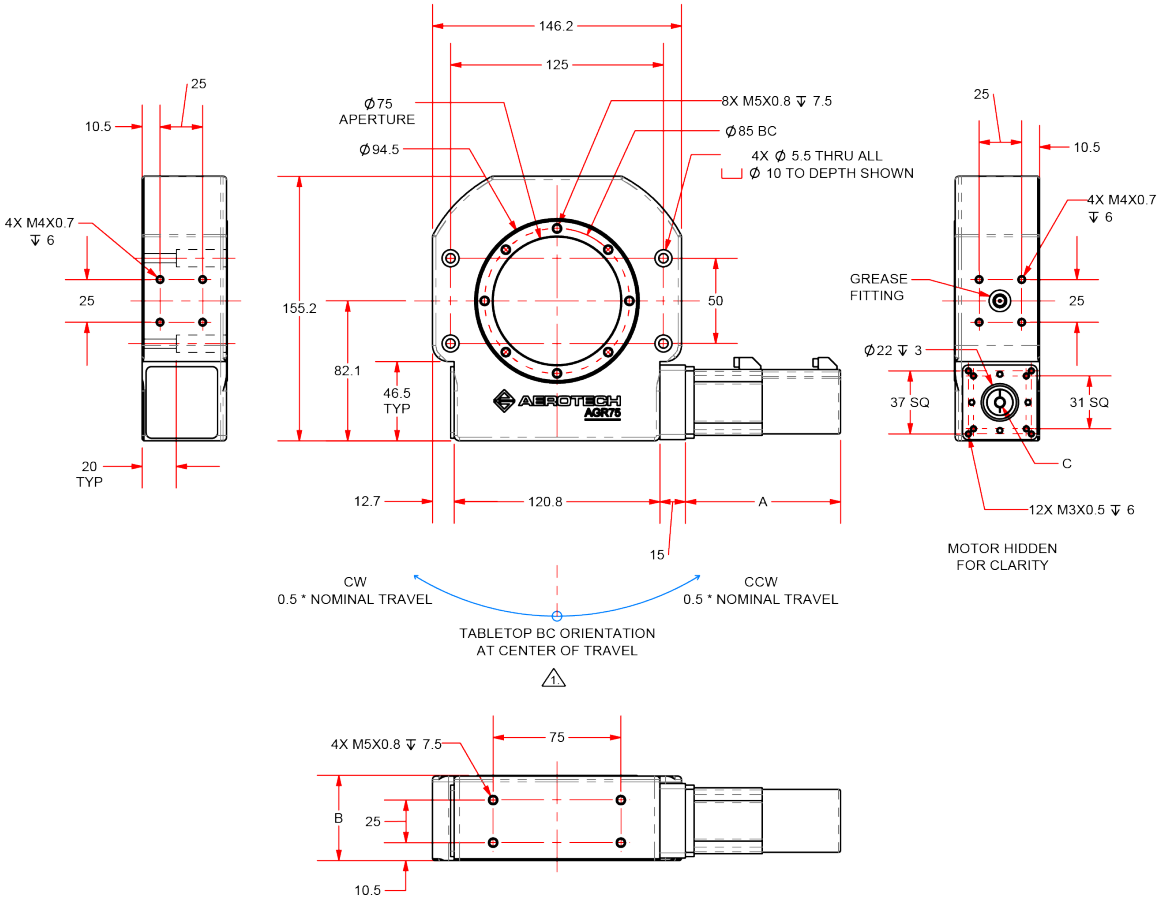


Figure 2-3: AGR50 Tabletop Accessories



MOTOR	LENGTH "A"	SHAFT INPUT DIAMETER "C"
NO MOTOR	-	Ø6.35 [0.25]
-M1, -M3	125	Ø6.35 [0.25]
-M2, -M4	153	Ø6.35 [0.25]
-M5	91.1	Ø6.35 [0.25]
-M6	128	Ø6.35 [0.25]
-M7	127	Ø5.0
-M8	132	Ø5.0

OPTION	HEIGHT "B"
DEFAULT	50
-SL1	60
-E1, -E2, -E3	66.4
-SL1 + -E1, -E2, -E3	76.4



NOTES:

1. CW AND CCW TRAVEL LIMITATIONS APPLY TO -TRxxx LIMITED TRAVEL OPTION ONLY. ORIENTATION OF TABLETOP BC AT CENTER OF TRAVEL IS CONSISTENT FOR ALL CONFIGURATIONS.

DIMENSIONS: MILLIMETERS [INCHES]

Figure 2-4: AGR75 Dimensions

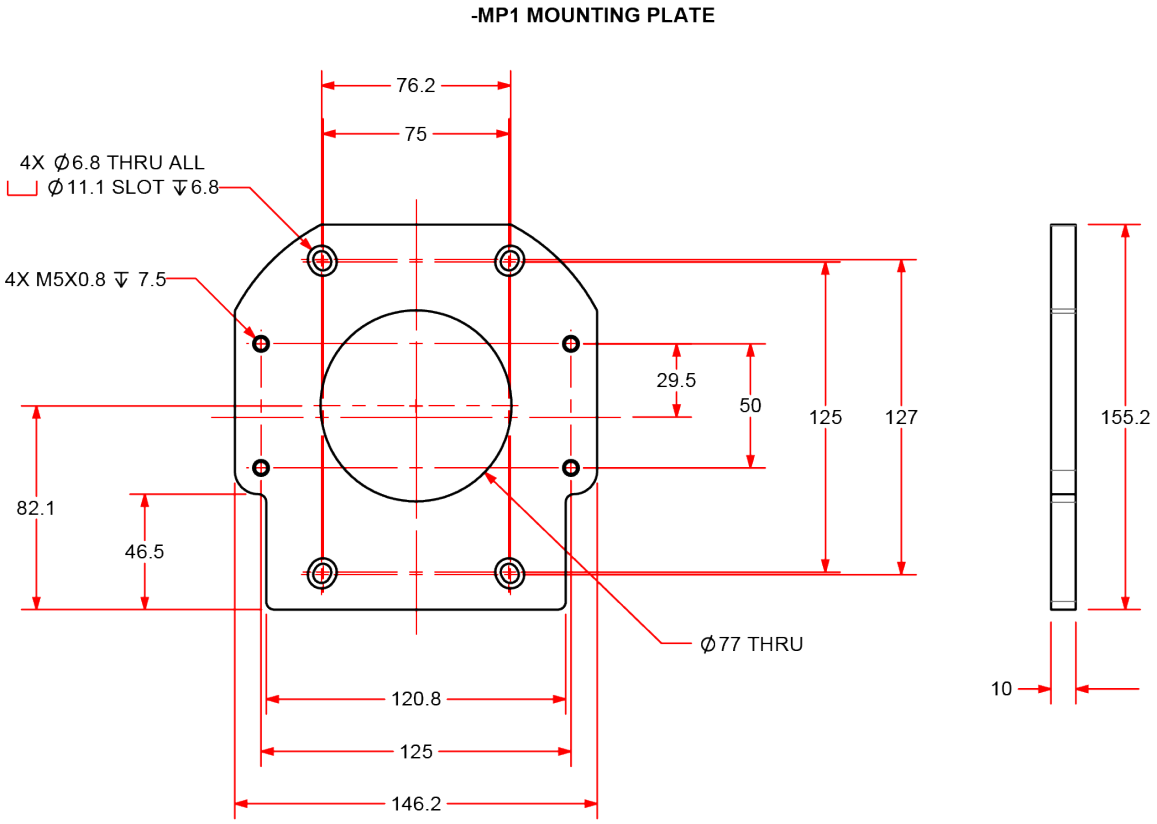


Figure 2-5: AGR75 -MP1 Mounting Plate Accessories

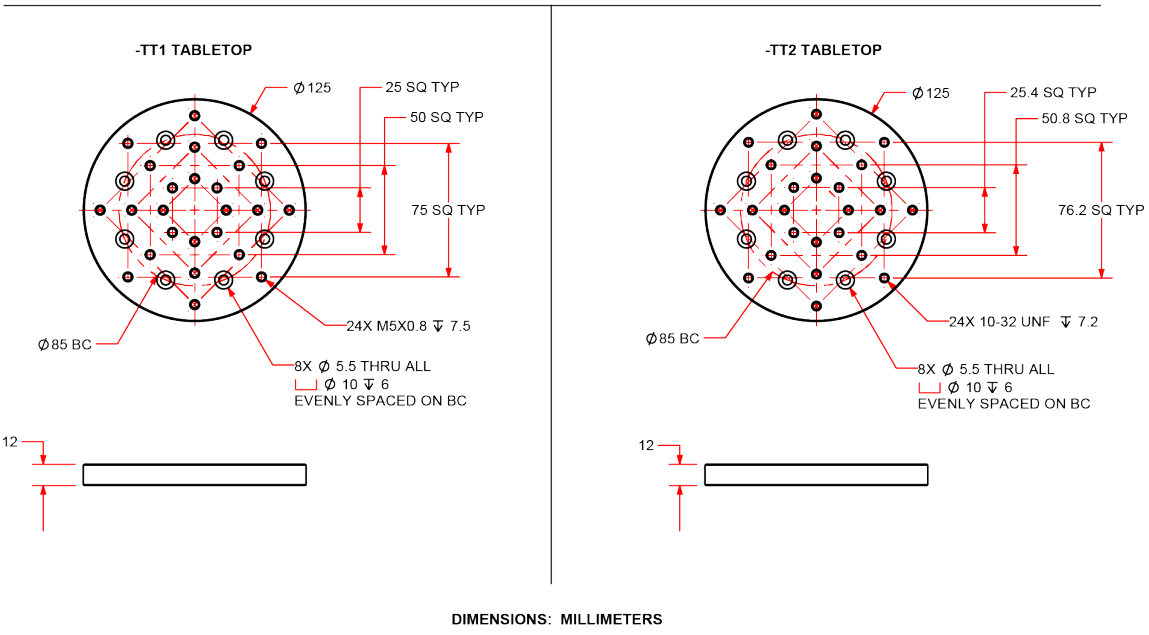
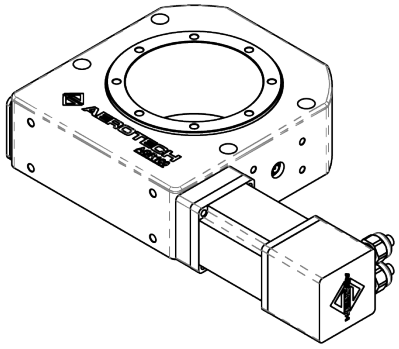
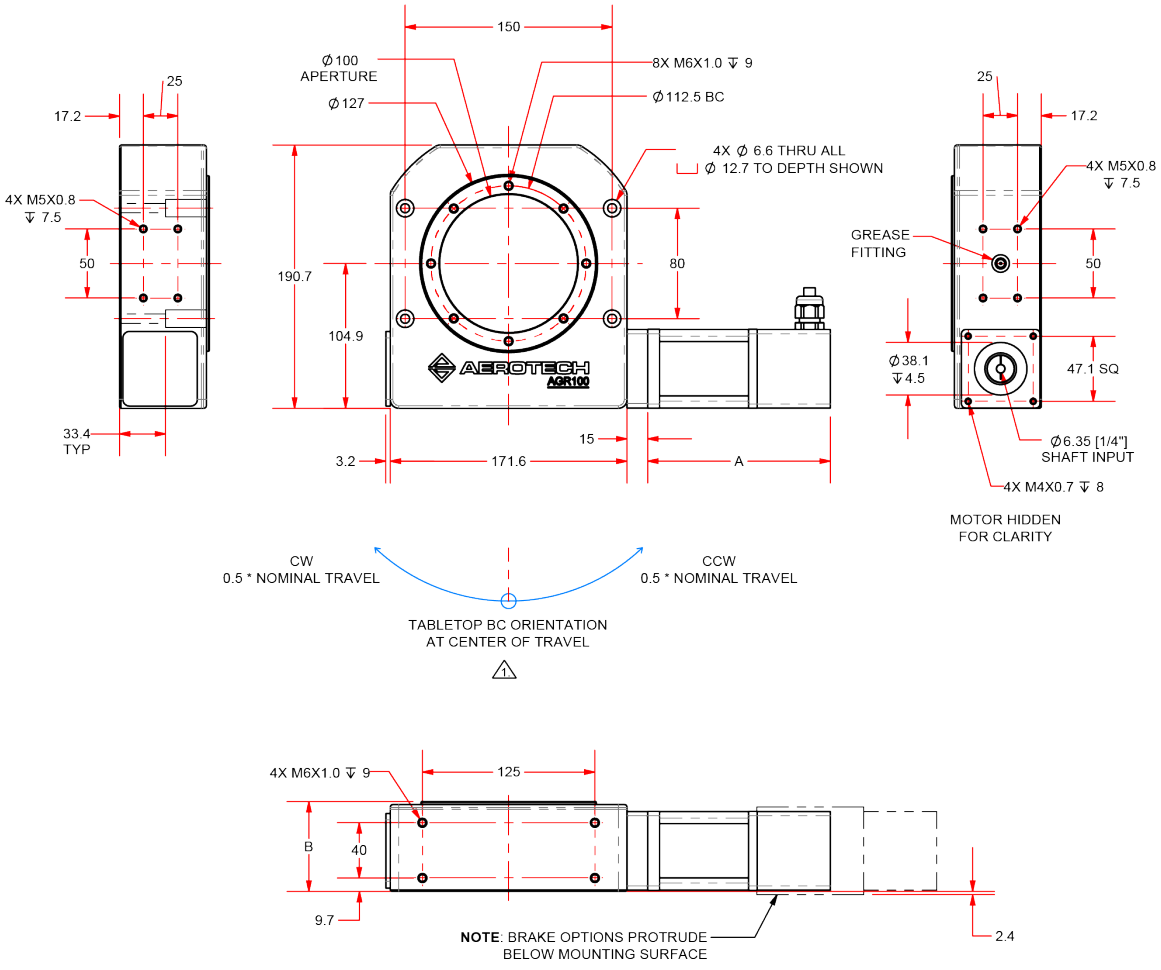


Figure 2-6: AGR75 Tabletop Accessories



MOTOR	LENGTH "A"
-M1, -M3, -M5, -M7	132.3
-M2, -M4, -M6, -M8	209.5
-M9	110.9
-M10	111.9

OPTION	HEIGHT "B"
DEFAULT	65
-SL1	78
-E1, -E2, -E3	81
-SL1 + -E1, -E2, -E3	94



NOTES:

1. CW AND CCW TRAVEL LIMITATIONS APPLY TO -TRxxx LIMITED TRAVEL OPTION ONLY. ORIENTATION OF TABLETOP BC AT CENTER OF TRAVEL IS CONSISTENT FOR ALL CONFIGURATIONS.

DIMENSIONS: MILLIMETERS

Figure 2-7: AGR100 Dimensions

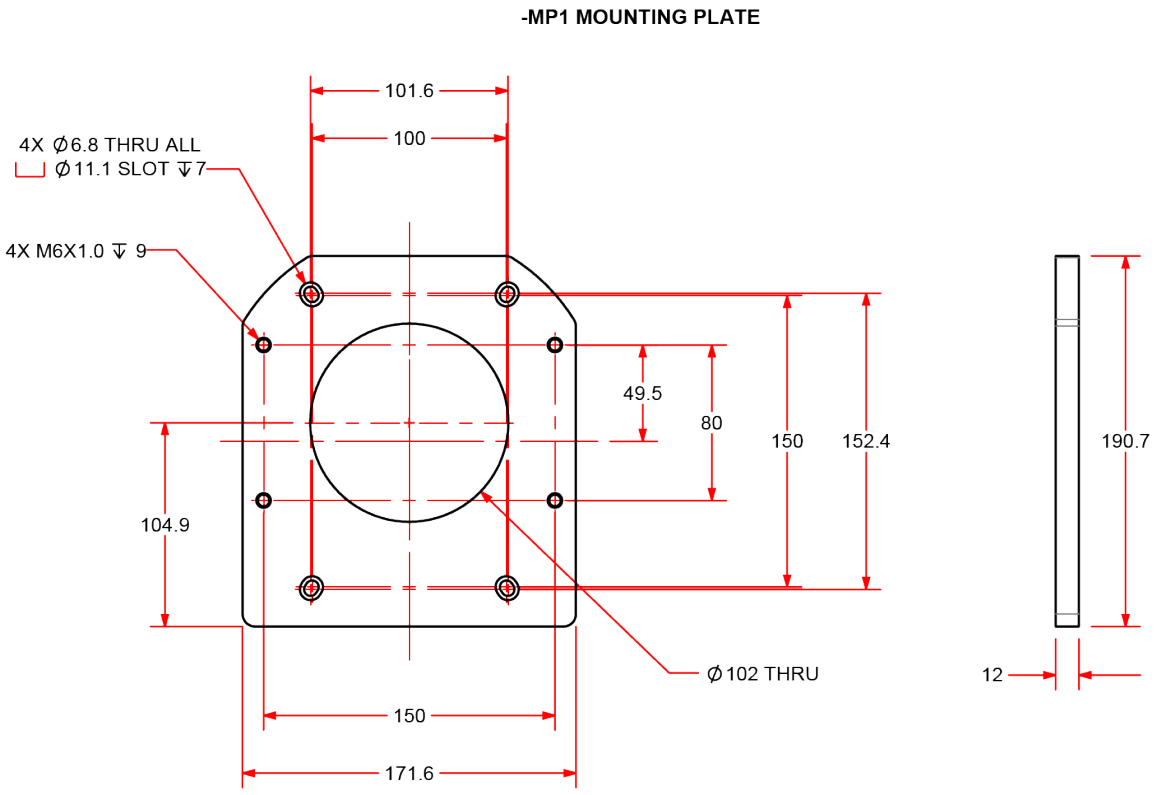


Figure 2-8: AGR100 -MP1 Mounting Plate Accessories

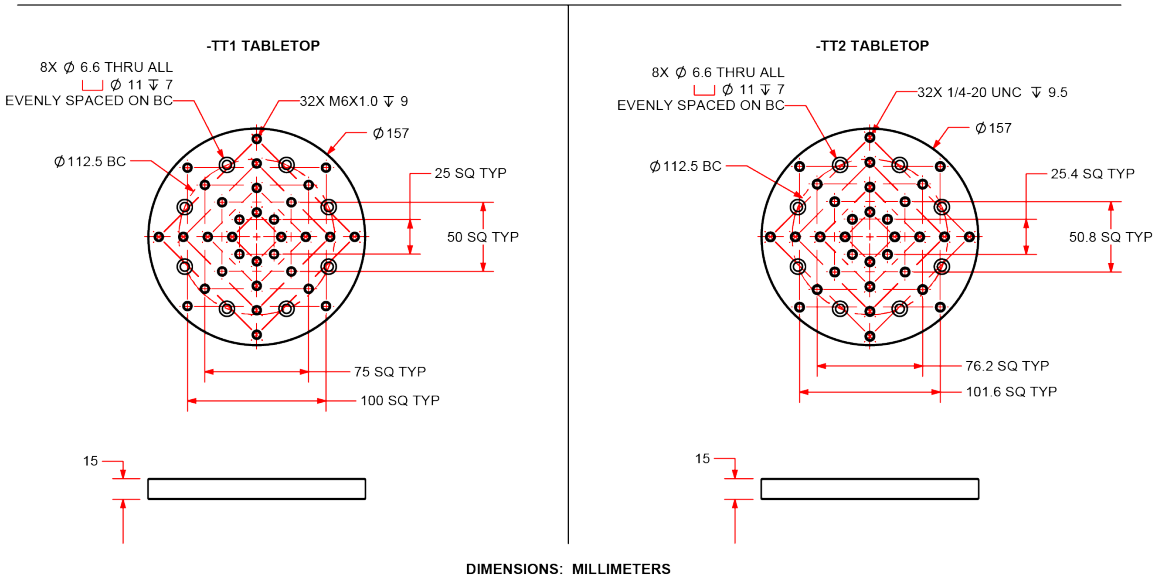
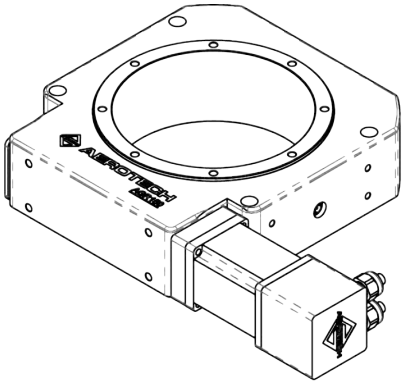


Figure 2-9: AGR100 Tabletop Accessories



MOTOR	LENGTH "A"
-M1, -M3, -M5, -M7	132.3
-M2, -M4, -M6, -M8	209.5
-M9	110.9
-M10	111.9

OPTION	HEIGHT "B"
DEFAULT	65
-SL1	78
-E1, -E2, -E3	81
-SL1 + -E1, -E2, -E3	94

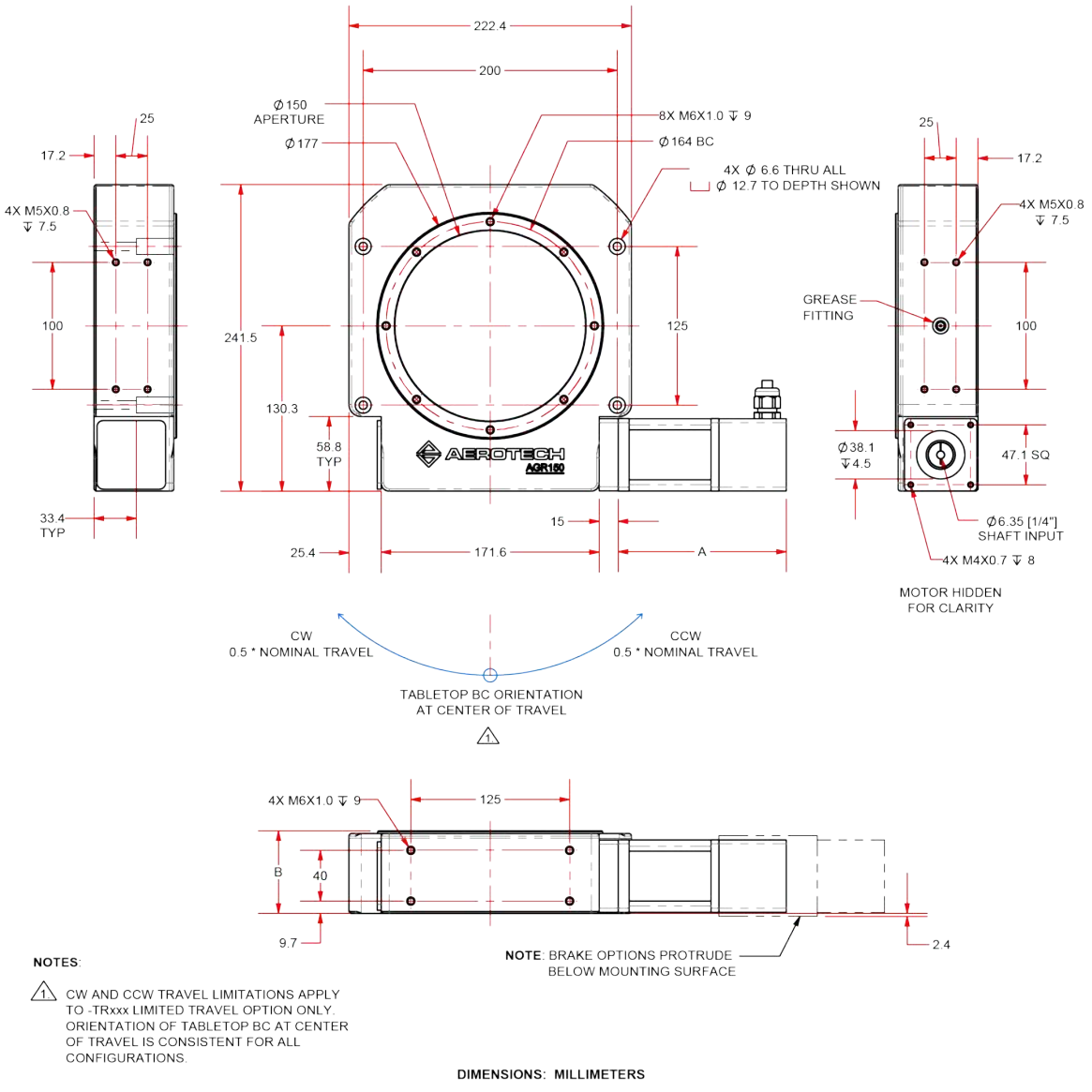


Figure 2-10: AGR150 Dimensions

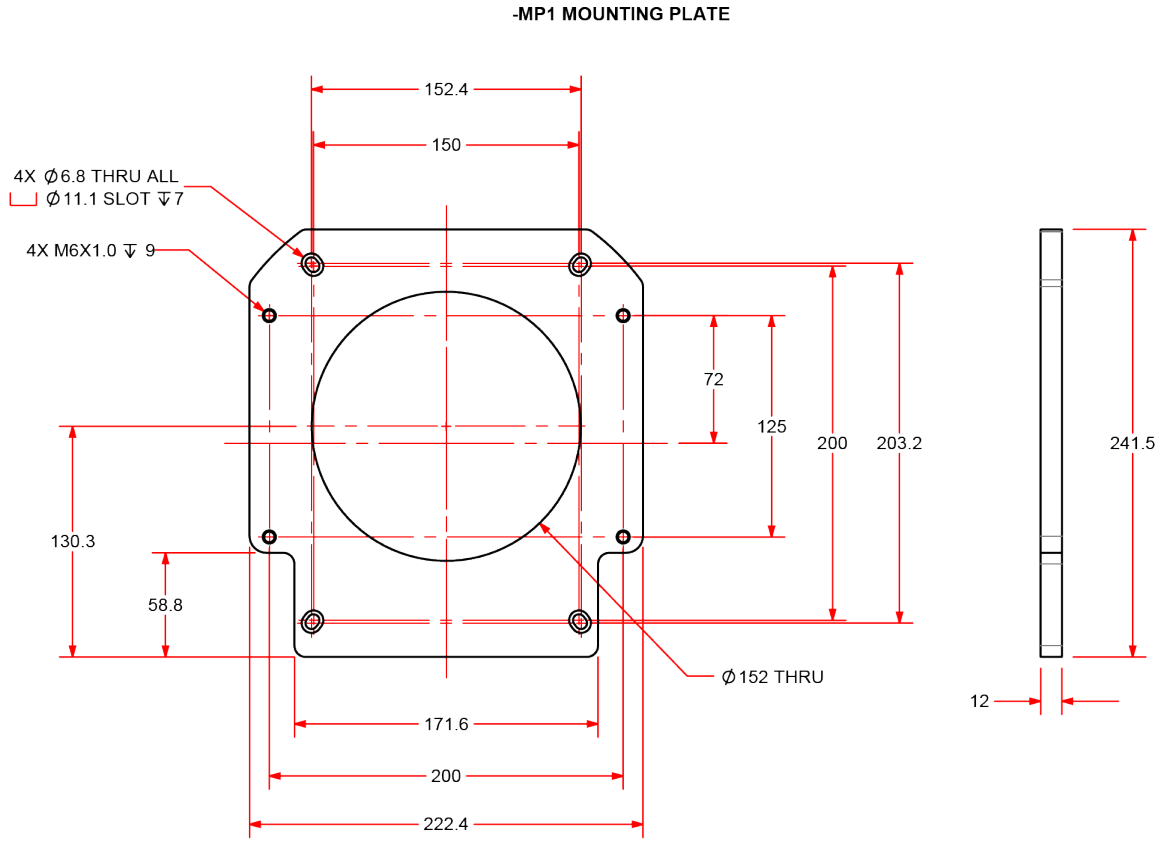


Figure 2-11: AGR150 Mounting Plate Accessories

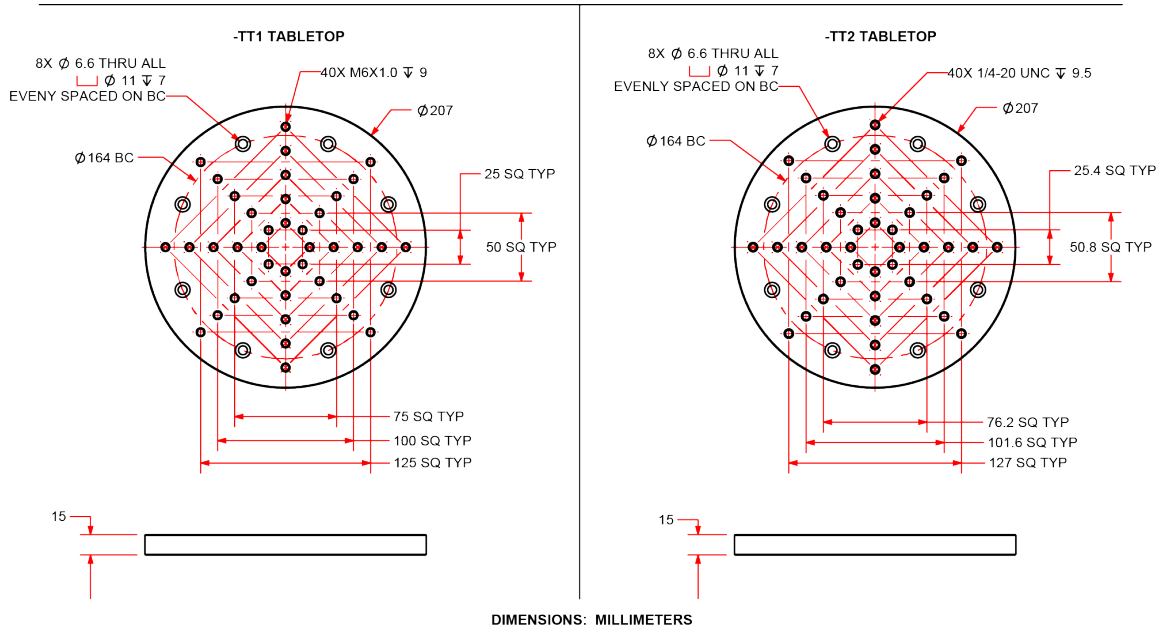
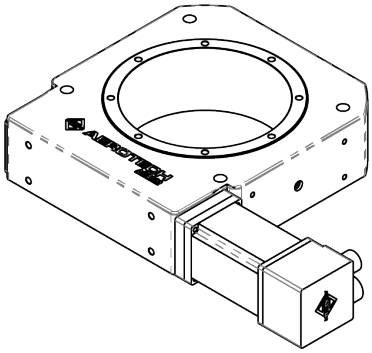
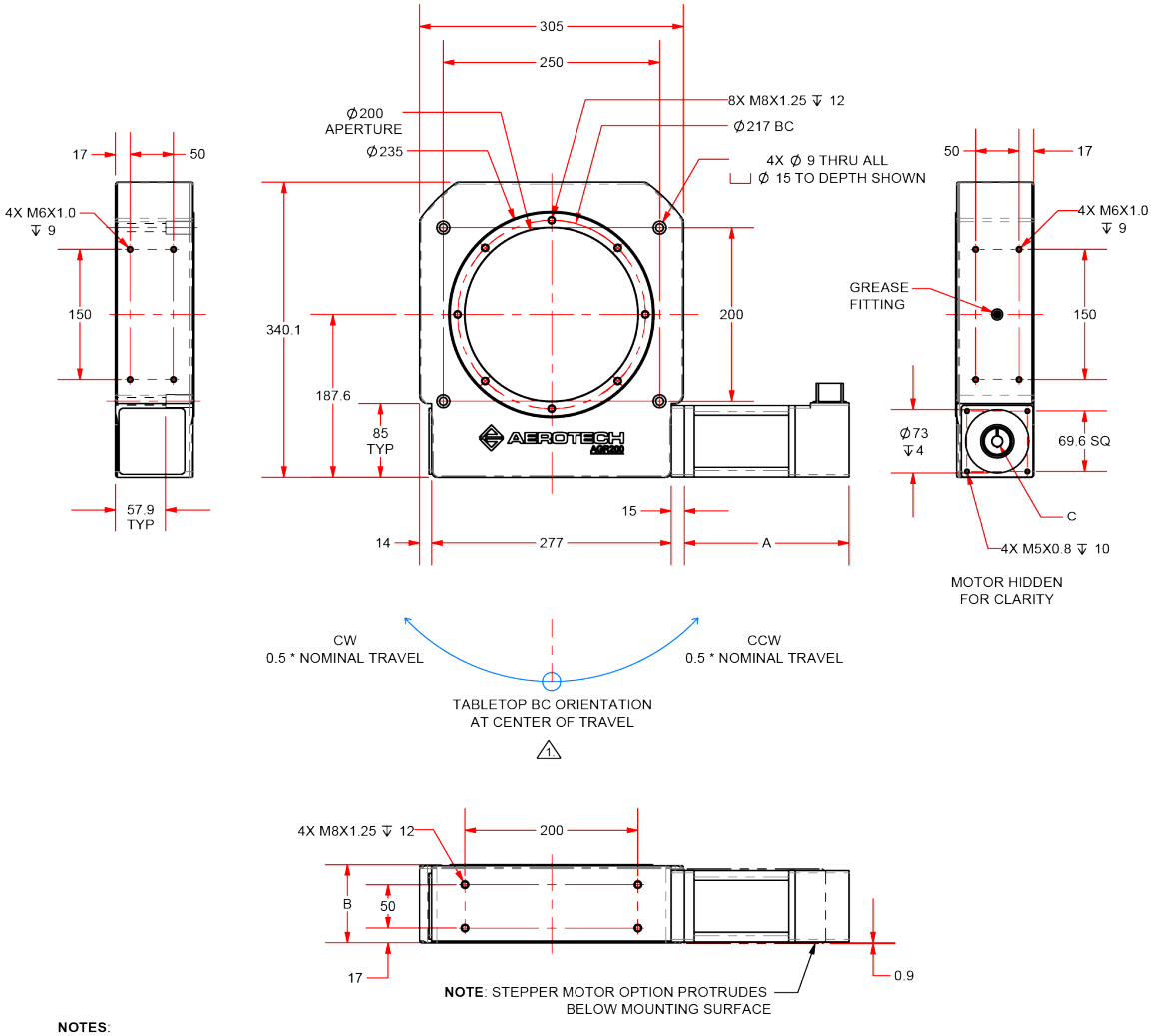


Figure 2-12: AGR150 Tabletop Accessories



MOTOR	LENGTH "A"	SHAFT INPUT DIAMETER "C"
-M1, -M3, -M5, -M7	190	Ø12.7 [0.5]
-M2, -M4, -M6, -M8	245.6	Ø12.7 [0.5]
-M9	177.1	Ø9.5 [0.375]
-M10	187.1	Ø9.5 [0.375]

OPTION	HEIGHT "B"
DEFAULT	90
-SL1	107
-E1, -E2, -E3	108.5
-SL1 + -E1, -E2, -E3	125.5



NOTES:

1. CW AND CCW TRAVEL LIMITATIONS APPLY TO -TRxxx LIMITED TRAVEL OPTION ONLY. ORIENTATION OF TABLETOP BC AT CENTER OF TRAVEL IS CONSISTENT FOR ALL CONFIGURATIONS.

DIMENSIONS: MILLIMETERS [INCHES]

Figure 2-13: AGR200 Dimensions

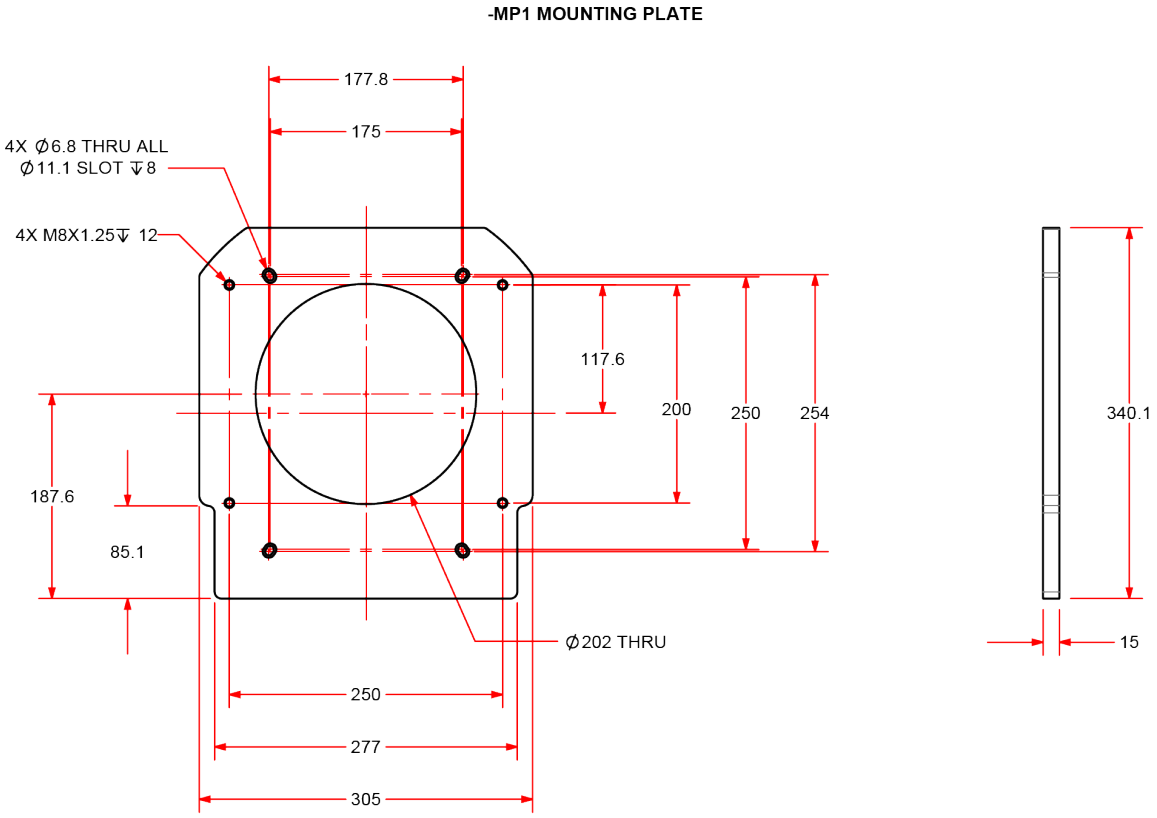


Figure 2-14: AGR200 Mounting Plate Accessories

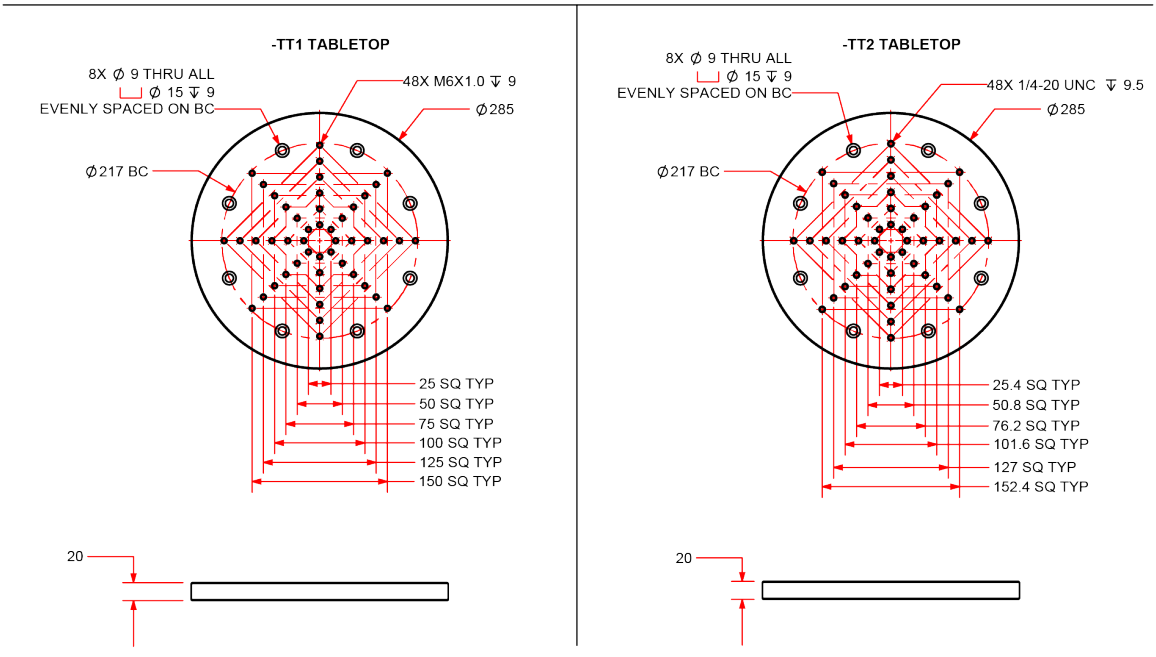


Figure 2-15: AGR200 Tabletop Accessories

2.3. Securing the Stage to the Mounting Surface



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



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

The mounting surface must be flat and have adequate stiffness to achieve the maximum performance from the AGR stage. When it is mounted to a non-flat surface, the stage can be distorted while 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 10 µm over the entire stage footprint.

NOTE: The AGR 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 AGR. Shimming should be avoided if possible. If shimming is required, it should be minimized to retain maximum rigidity of the system.

AGR series stages have a fixed mounting pattern available to secure the stage to a mounting surface. The counter-bored mounting holes are designed for 5 mm socket head cap screws (SHCS) for the AGR50 and AGR75, 6 mm SHCS for the AGR100 and AGR150, and 8 mm SHCS for the AGR200.

AGR series stages also have a fixed mounting pattern on the side of the stage. The size of the side mounting holes are M5 for the AGR50 and AGR75; M6 for the AGR100 and AGR150; and M8 for the AGR200.

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
M5 Socket Head Cap Screw (SHCS)	4.1 N·m
M6 SHCS	7.0 N·m
M8 SHCS	17.0 N·m

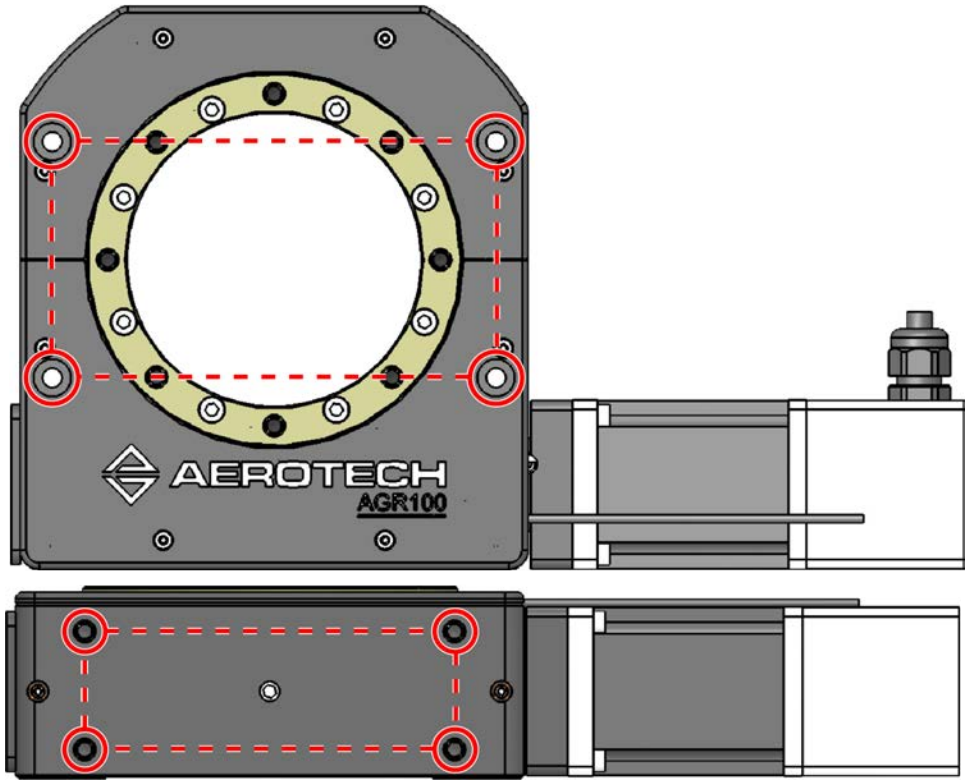


Figure 2-16: View of an AGR Stage Showing Mounting Holes

2.4. Attaching the Payload to the Stage

Inspect the mounting surface for dirt or unwanted residue and clean if necessary. Clean the mounting surface with a lint-free cloth and acetone or isopropyl alcohol and allow the cleaning solvent to completely dry.

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 AGR 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 AGR 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 10 µm.

Applied 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 2-17 through Figure 2-21 to find the maximum allowable load.

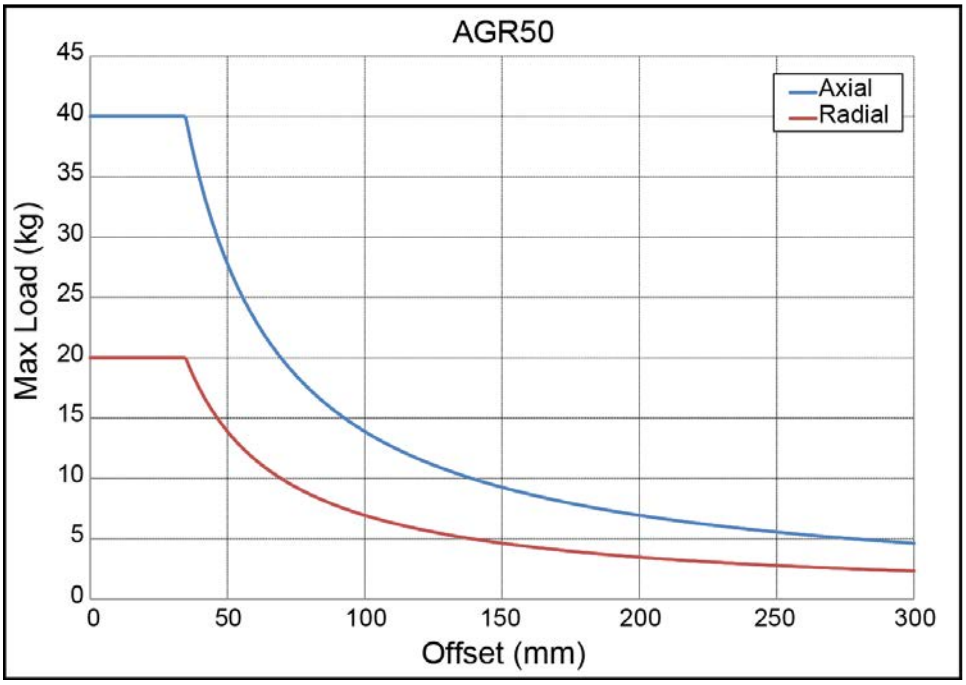


Figure 2-17: AGR50 Axial and Radial Cantilevered Load Capability

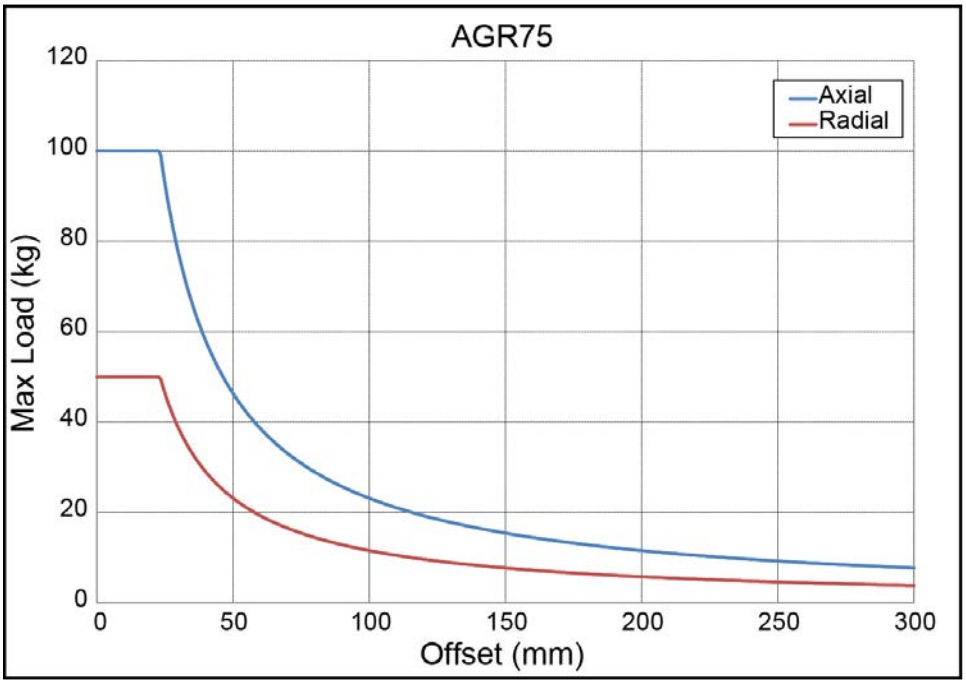


Figure 2-18: AGR75 Axial and Radial Cantilevered Load Capability

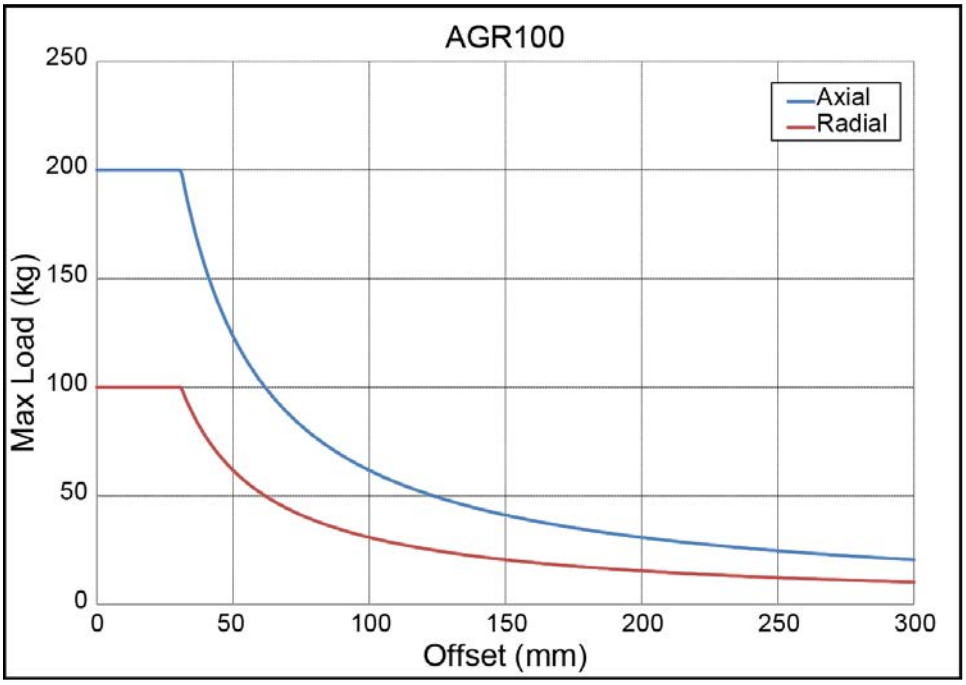


Figure 2-19: AGR100 Axial and Radial Cantilevered Load Capability

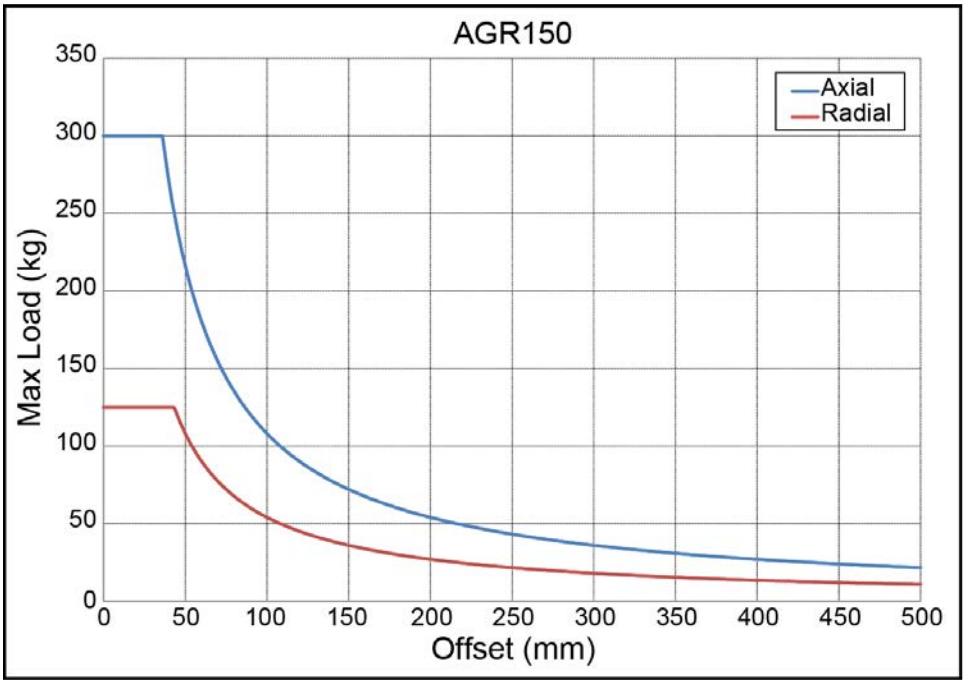


Figure 2-20: AGR150 Axial and Radial Cantilevered Load Capability

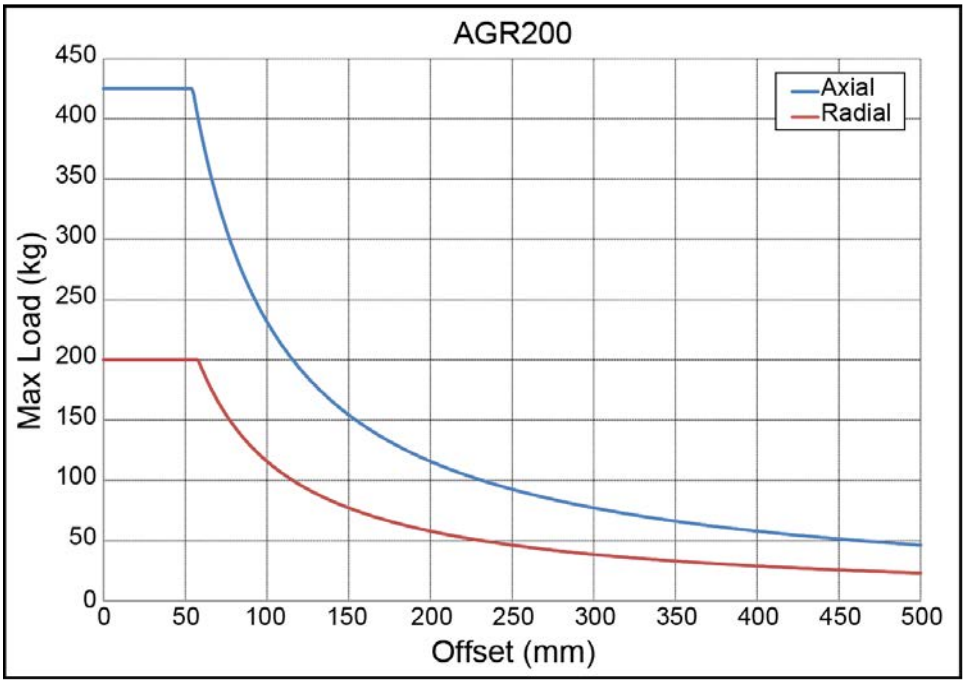


Figure 2-21: AGR200 Axial and Radial Cantilevered Load Capability

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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 AGR is part of a complete Aerotech motion control system, setup usually involves connecting the AGR 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: Operator access to the base and tabletop must be restricted while connected to a power source. Failure to do so may expose the operator to Electrical Shock or Mechanical hazards.

NOTE: Refer to the controller documentation to adjust servo gains for optimum velocity and position stability.

3.1. Motor and Feedback Connectors

Stages equipped with standard motors and encoders come from the factory completely wired and assembled.

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

The protective ground connection of the AGR provides motor frame ground protection only. Additional grounding and safety precautions are required for applications requiring access to the stage while it is energized. 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 protective ground connection must be properly installed to minimize the possibility of electric shock.



WARNING: Operator access to the base and tabletop must be restricted while connected to a power source. Failure to do so may expose the operator to Electrical Shock or Mechanical hazards.



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: Brushless Motor Connector Pinout (AGR50, AGR75, AGR100, AGR150)

Pin	Description	Connector
Case	Shield Connection	
A1	Motor Phase A	
A2	Motor Phase B	
A3	Motor Phase C	
1	Reserved	
2	Reserved	
3	Reserved	
4	Reserved	
5	Reserved	
A4	Frame Ground (motor protective ground)	

Table 3-2: Mating Connector Part Numbers for the D-Style Motor Connector

Mating Connector	Aerotech P/N	Third Party P/N
Backshell	ECK00656	Amphenol #17E-1726-2
Sockets [QTY. 4]	ECK00659	ITT Cannon #DM53744-6
Connector	ECK00657	ITT Cannon #DBM9W4SA197

Table 3-3: Brushless Motor Power Connector Pinout (AGR200)

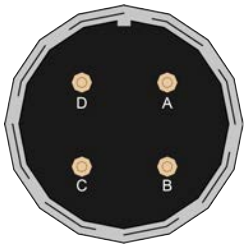
Pin	Function	Connector
A	Motor Phase A	
B	Motor Phase B	
C	Motor Phase C	
D	Frame Ground (motor protective ground)	
Backshell	Motor Cable Shield	P/N: MS3101A18-10P

Table 3-4: Stepper Motor Connector Pinout

Pin	Description	Connector
Case	Shield Connection	
A1	Motor Phase A	
A2	Motor Phase B	
A3	Motor Phase A Return	
A4	Motor Phase B Return	
1	Brake -	
2	Brake +	
3	Reserved	
4	Frame	
5	Frame	

Table 3-5: Mating Connector Part Numbers for the D-Style Motor Connector

Mating Connector	Aerotech P/N	Third Party P/N
Backshell	ECK00656	Amphenol #17E-1726-2
Sockets [QTY. 4]	ECK00659	ITT Cannon #DM53744-6
Connector	ECK00657	ITT Cannon #DBM9W4SA197

Table 3-6: Brushless Motor Feedback Connector Pinout (AGR50, AGR75, AGR100, AGR150)

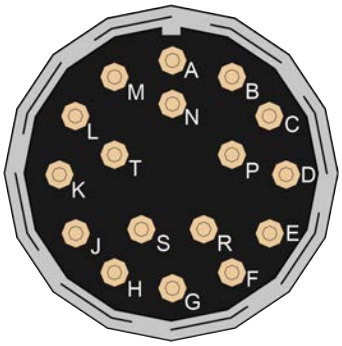
Pin	Description	Connector
Case	Shield Connection	
1	Reserved	
2	Over-Temperature Thermistor sensor (1)	
3	+5 V power supply	
4	Reserved	
5	Hall Effect sensor, phase B	
6	Marker-N	
7	Marker	
8	Reserved	
9	Reserved	
10	Hall Effect sensor, phase A	
11	Hall Effect sensor, phase C	
12	Reserved	
13	Brake - (2)	
14	Cosine	
15	Cosine-N	
16	Reserved	
17	Sine	
18	Sine-N	
19	Reserved	
20	Common ground	
21	Common ground	
22	Reserved	
23	Reserved	
24	Reserved	
25	Brake + (2)	

1. BMS motors only (otherwise Reserved)
2. with brake option only

Table 3-7: Mating Connector Part Numbers for the 25-Pin D-Style Feedback Connector

Mating Connector	Aerotech P/N	Third Party P/N
Backshell	ECK00656	Amphenol 17E-1726-2
Connector	ECK00300	FCI DB25S064TLF

Table 3-8: Brushless Motor Feedback Connector Pinout (AGR200)

Pin	Function	Connector
Case	Shield Connection	 P/N: MS3102R20-29P
A	Cosine	
B	Cosine-N	
C	Sine	
D	Sine-N	
E	Marker	
F	Marker-N	
G	Common ground	
H	+5 V power supply	
J	Reserved	
K	Hall Effect sensor, phase A	
L	Over-Temperature Thermistor sensor(1)	
M	Hall Effect sensor, phase B	
N	Reserved	
P	Hall Effect sensor, phase C	
R	Reserved	
S	Brake + (2)	
T	Brake - (2)	

(1) BMS motors only; reserved on all other motors
(2) With Brake option only

Table 3-9: Stepper Motor Feedback Connector Pinout

Pin	Description	Connector
1	Reserved	
2	Reserved	
3	+5 V power supply	
4	Reserved	
5	Reserved	
6	Marker-N	
7	Marker	
8	Reserved	
9	Reserved	
10	Reserved	
11	Reserved	
12	Reserved	
13	Reserved	
14	Cosine	
15	Cosine-N	
16	+5 V power supply	
17	Sine	
18	Sine-N	
19	Reserved	
20	Common ground	
21	Common ground	
22	Reserved	
23	Reserved	
24	Reserved	
25	Reserved	

Table 3-10: Mating Connector Part Numbers for the 25-Pin D-Style Feedback Connector

Mating Connector	Aerotech P/N	Third Party P/N
Backshell	ECK00656	Amphenol 17E-1726-2
Connector	ECK00300	FCI DB25S064TLF

Table 3-11: 9-Pin Limit Connector Pinout [-LI1 and -LI2 Option]

Pin #	Description	Connector
Case	Shield Connection	
1	+5V supply input for optical limit switch boards	
2	Common ground to limit switch	
3	Signal indicating maximum travel limit produced by positive/CW stage direction	
4	Reserved	
5	Signal indicating stage maximum travel produced by negative/CCW stage direction	
6	Reserved	
7	Reserved	
8	Reserved	
9	Reserved	

Table 3-12: Mating Connector Part Numbers for the 9-Pin Limit Connector

Mating Connector	Aerotech P/N	3rd Party P/N
Backshell	ECK01021	Amphenol #17E-1724-2
Connector	ECK00340	FCI #DE09S064TLF

Table 3-13: 15-Pin Direct Encoder Connector Pinout [-E1, -E2, or -E3 Option]

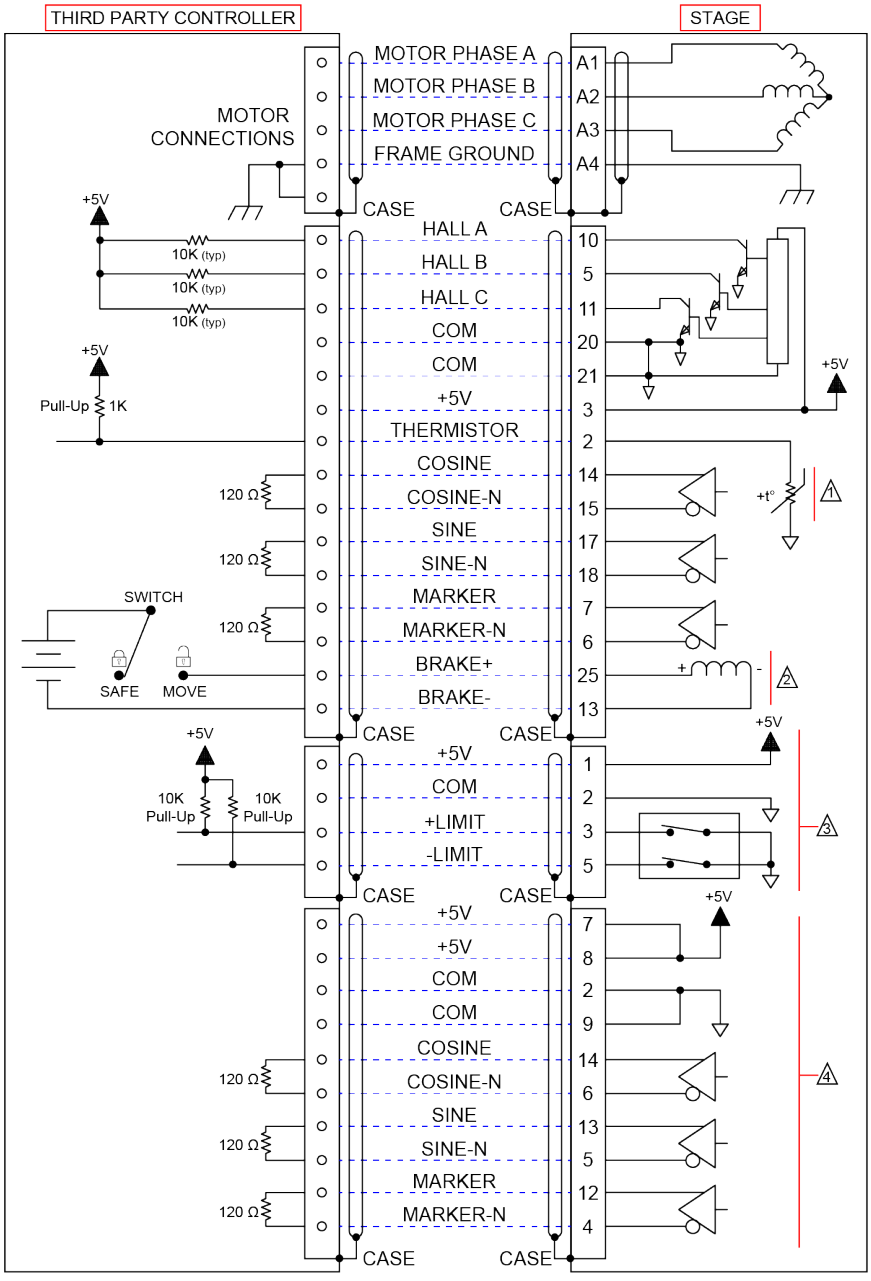
Pin	Description	Connector
Case	Shield Connection	
1	Reserved	
2	Common ground to encoder power	
3	Reserved	
4	Marker-N	
5	Sine-N	
6	Cosine-N	
7	+5 V supply input for optical encoders	
8	+5 V supply input for optical encoders	
9	Common ground to encoder power	
10	Reserved	
11	Reserved	
12	Marker	
13	Sine	
14	Cosine	
15	Reserved	

Table 3-14: Mating Connector Part Numbers for the 15-Pin Direct Encoder Connector

Mating Connector	Aerotech P/N	3rd Party P/N
Backshell	ECK01022	Amphenol 17E-1725-2
Connector	ECK00326	Amphenol DA15S064TLF

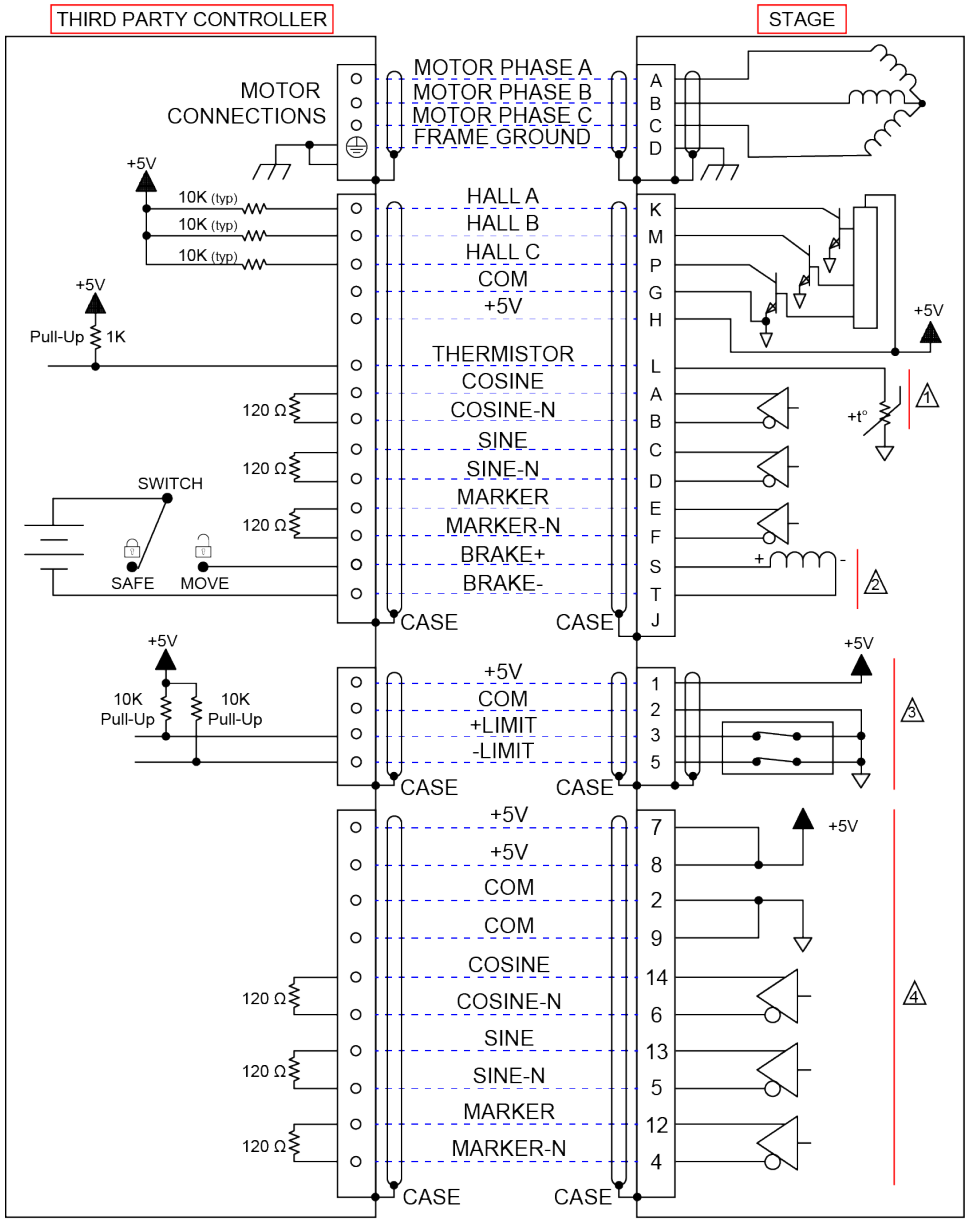
3.2. Motor and Feedback Wiring

All motor and controller manufacturers have their own designations for motor phases A/B/C and Hall signals A/B/C (refer to Section 3.5. for motor phasing). Shielded cables are required for the motor and feedback connections.



1. Thermistor is only available on BMS motors (options -M1, -M2, -M3, and -M4).
2. Brake is optional (options -M2, -M4, -M6, -M8).
3. Limited travel models only. Limit options are factory-configured as Normally Closed [-LI1] or Normally Open [-LI2]
4. Only with direct rotary feedback (options -E1, -E2, and -E3)

Figure 3-1: Brushless Motor and Feedback Wiring (AGR50, AGR75, AGR100, AGR150)



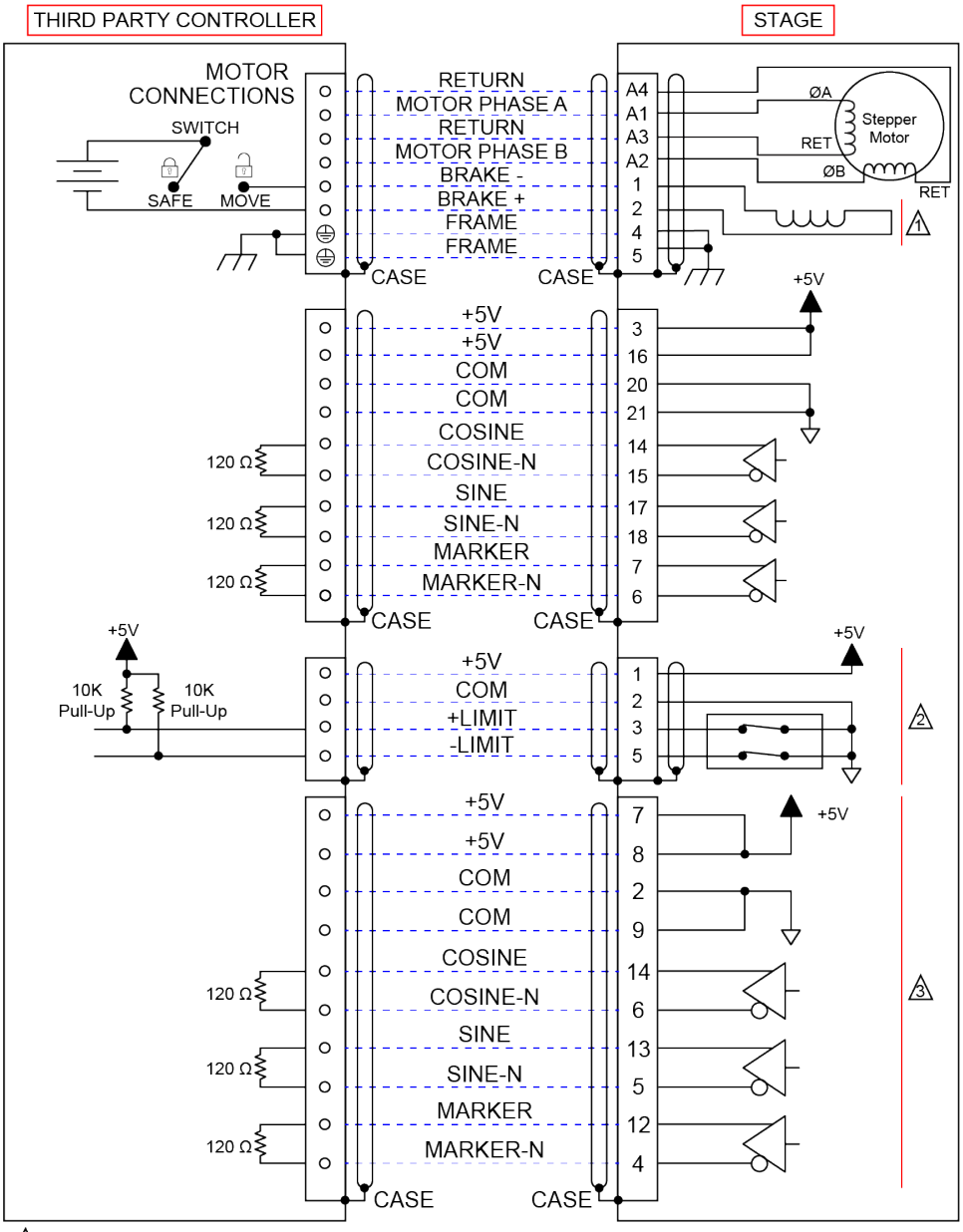
1 Thermistor is only available on BMS motors (options -M1, -M2, -M3, and -M4).

2 Brake is optional (options -M2, -M4, -M6, -M8).

3 Limited travel models only. Limit options are factory-configured as Normally Closed [-LI1] or Normally Open [-LI2]

4 Only with direct rotary feedback (options -E1, -E2, and -E3)

Figure 3-2: Brushless Motor and Feedback Wiring (AGR200)



1 Brake is optional (options -M8 and -M10).

2 Limited travel models only. Limit options are factory-configured as Normally Closed [-LI1] or Normally Open [-LI2]

3 Only with direct rotary feedback (options -E1, -E2, and -E3)

Figure 3-3: Stepper Motor and Feedback Wiring

3.3. Motor and Feedback Specifications

Table 3-15: Feedback Specifications

Hall-Effect Sensors Specifications	
Supply Voltage	5 V ±5%
Supply Current	50 mA
Output Type	Open Collector
Output Voltage	24 V max (pull up)
Output Current	5 mA (sinking)

Thermistor Specifications	
Polarity	Logic "0" (no fault)
	Logic "1" (over-temperature fault)
Cold Resistance	~100 Ω
Hot Resistance	~10 K
Note: 1K pull-up to +5V recommended.	

Encoder Specifications	
Supply Voltage	5 V ±5%
Supply Current	250 mA (typical)
Output Signals	**Sinusoidal Type (Incremental Encoder)**: 1 V_{pk-pk} into 120 Ω Load (differential signals SIN+, SIN-, COS+, COS- are .5 V_{pk-pk} relative to ground.)
	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) • 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)
	Normally Open (NO) • Sinks current to ground (Logic "0") when in limit • High impedance (Logic "1") when not in limit • Requires external pull-up to +5 V (10 kΩ recommended)

Brake Specifications	
Supply Voltage	24 VDC
Supply Current (1)	**AGR50, AGR75, AGR100, AGR150**: 250 mA Typical **AGR200**: 500 mA Typical
(1) Current required to release the brake and allow motion	

Table 3-16: Encoder Specifications (AGR50 and AGR75)

Model	AGR50	AGR75
SM(1)	6.353 arc sec/line	4.836 arc sec/line
BM/BMS (TTL)	3.176 arc sec/line	2.418 arc sec/line
BMS (Amplified Sine)(2)	6.353/3.176 arc sec/line	4.836/2.418 arc sec/line
Direct Rotary Encoder	15744 lines/rev	18000 lines/rev
-E1(2)	0.021/0.010 arc sec/line	0.018/0.009 arc sec/line
-E2	4.116 arc sec/line	3.600 arc sec/line
-E3	0.412 arc sec/line	0.360 arc sec/line
1. 1.8° step angle, 20 microsteps 2. BMS (Amplified Sine) and -E1 show x4000 / x8000 total interpolation		

Table 3-17: Encoder Specifications (AGR100 and AGR150)

Model	AGR100	AGR150
SM(1)	3.812 arc sec/line	2.769 arc sec/line
BM/BMS (TTL)	1.525 arc sec/line	1.108 arc sec/line
BMS (Amplified Sine)(2)	3.812/1.906 arc sec/line	2.769/1.385 arc sec/line
Direct Rotary Encoder	23600 lines/rev	31488 lines/rev
-E1(2)	0.014/0.007 arc sec/line	0.010/0.005 arc sec/line
-E2	2.746 arc sec/line	2.058 arc sec/line
-E3	0.275 arc sec/line	0.206 arc sec/line
1. 1.8° step angle, 20 microsteps 2. BMS (Amplified Sine) and -E1 show x4000 / x8000 total interpolation		

Table 3-18: Encoder Specifications (AGR200)

Model	AGR200
SM(1)	2.571 arc sec/line
BM/BMS (TTL)	1.029 arc sec/line
BMS (Amplified Sine)(2)	2.571/1.286 arc sec/line
Direct Rotary Encoder	40000 lines/rev
-E1(2)	0.008/0.004 arc sec/line
-E2	1.62 arc sec/line
-E3	0.162 arc sec/line
1. 1.8° step angle, 20 microsteps 2. BMS (Amplified Sine) and -E1 show x4000 / x8000 total interpolation	

Table 3-19: BMS35 and BMS60 Motor Specifications

		BMS35 (AGR50, AGR75)	BMS60 (AGR100, AGR150)
Performance Specifications (1, 5)			
Stall Torque, Continuous (2)	N·m (oz·in)	0.27 (38.0)	0.33 (46.2)
Peak Torque (3)	N·m (oz·in)	1.07 (152.0)	1.31 (184.9)
Rated Power Output, Continuous	W	96	116
Electrical Specifications (5)			
Winding Designation		-A	-A
BEMF Constant (Line-Line, Max)	V_{pk}/k_{rpm}	12.9	19.0
Continuous Current, Stall (2)	A_{pk} (A_{rms})	2.5 (1.7)	2.3 (1.6)
Peak Current, Stall (3)	A_{pk} (A_{rms})	9.8 (6.9)	9.2 (6.5)
Torque Constant (4, 8)	N·m/A_{pk} (oz·in/A_{pk})	0.110 (15.50)	0.140 (20.10)
	N·m/A_{rms} (oz·in/A_{rms})	0.150 (21.90)	0.200 (28.40)
Motor Constant (2, 4)	N·m/√W (oz·in/√W)	0.046 (6.52)	0.050 (7.02)
Resistance, 25°C (Line-Line)	Ω	5.80	8.40
Inductance (Line-Line)	mH	1.70	1.30
Maximum Bus Voltage	V_{DC}	340	340
Thermal Resistance	°C/W	2.21	1.73
Number of Poles	--	8	8

1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature
2. Values shown @ 75°C rise above a 25 °C ambient temperature, with housed motor mounted to a 250 mm x 250 mm x 6 mm aluminum heat sink
3. Peak torque assumes correct rms current; consult Aerotech
4. Force constant and motor constant specified at stall
5. All performance and electrical specifications ±10%
6. Maximum winding temperature is 100 °C (thermistor trips at 100 °C)
7. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures
8. All Aerotech amplifiers are rated A_{pk}; use torque constant in N·m/A_{pk} when sizing



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

Table 3-20: BMS280 Motor Specifications

		BMS280 (AGR200)
Performance Specifications (1, 5)		
Stall Torque, Continuous (2)	N·m (oz·in)	1.60 (227.0)
Peak Torque (3)	N·m (oz·in)	6.41 (908.0)
Rated Power Output, Continuous	W	381
Electrical Specifications (5)		
Winding Designation		-A
BEMF Constant (Line-Line, Max)	V_{pk}/k_{rpm}	57.0
Continuous Current, Stall (2)	A_{pk} (A_{rms})	3.8 (2.7)
Peak Current, Stall (3)	A_{pk} (A_{rms})	15.2 (10.7)
Torque Constant (4, 8)	N·m/A_{pk} (oz·in/A_{pk})	0.420 (59.70)
	N·m/A_{rms} (oz·in/A_{rms})	0.600 (84.50)
Motor Constant (2, 4)	N·m/√W (oz·in/√W)	0.179 (25.34)
Resistance, 25°C (Line-Line)	Ω	5.70
Inductance (Line-Line)	mH	1.10
Maximum Bus Voltage	V_{DC}	340
Thermal Resistance	°C/W	0.93
Number of Poles	--	14

1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature
2. Values shown @ 75°C rise above a 25 °C ambient temperature, with housed motor mounted to a 250 mm x 250 mm x 6 mm aluminum heat sink
3. Peak torque assumes correct rms current; consult Aerotech
4. Force constant and motor constant specified at stall
5. All performance and electrical specifications ±10%
6. Maximum winding temperature is 100 °C (thermistor trips at 100 °C)
7. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures
8. All Aerotech amplifiers are rated A_{pk}; use torque constant in N·m/A_{pk} when sizing



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

Table 3-21: BM22 and BM75 Motor Specifications

		BM22 (AGR50, AGR75)	BM75 (AGR100, AGR150)
Performance Specifications (1,2)			
Stall Torque, Continuous (3)	N·m (oz·in)	0.16 (22.5)	0.51 (72.0)
Peak Torque(4)	N·m (oz·in)	0.5 (70.80)	1.30 (181.0)
Rated Power Output, Continuous	W	50	192
Electrical Specifications (2)			
BEMF Constant (Line-Line, Max)	V_{pk}/k_{rpm}	3.9	9.0
Continuous Current, Stall (3)	A_{pk} (A_{rms})	4.9 (3.5)	9.0 (6.4)
Peak Current, Stall (4)	A_{pk} (A_{rms})	14.7 (10.4)	22.5 (15.9)
Torque Constant (5)	$N·m/A_{pk}$ ($oz·in/A_{pk}$)	0.03 (4.25)	0.060 (8.00)
	$N·m/A_{rms}$ ($oz·in/A_{rms}$)	0.042 (5.95)	0.080 (11.40)
Motor Constant (3,5)	$N·m/\sqrt{W}$ ($oz·in/\sqrt{W}$)	0.038 (5.41)	0.055 (7.84)
Resistance, 25°C (Line-Line)	Ω	0.7	1.00
Inductance (Line-Line)	mH	0.73	1.42
Maximum Bus Voltage	V_{DC}	80	340
Thermal Resistance	°C/W	4.56	1.41
Number of Poles	--	8	8

1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature
2. All performance and electrical specifications ±10%
3. Values shown @ 105°C rise above a 25 °C ambient temperature, with housed motor mounted to a 250 mm x 250 mm x 6 mm aluminum heat sink
4. Peak torque assumes correct rms current; consult Aerotech
5. Torque constant and motor constant specified at stall
6. Maximum winding temperature is 130 °C
7. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures
8. All Aerotech amplifiers are rated A_{pk}; use torque constant in $N·m/A_{pk}$ when sizing



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

Table 3-22: BM250 Motor Specifications

		BM250 (AGR200)
Performance Specifications (1,2)		
Stall Torque, Continuous (3)	N·m (oz·in)	2.30 (322.0)
Peak Torque (4)	N·m (oz·in)	5.70 (805.0)
Rated Power Output, Continuous	W	739
Electrical Specifications (2)		
BEMF Constant (Line-Line, Max)	V_{pk}/k_{rpm}	28.0
Continuous Current, Stall (3)	A_{pk} (A_{rms})	10.3 (7.3)
Peak Current, Stall (4)	A_{pk} (A_{rms})	25.6 (18.1)
Torque Constant (5)	$N·m/A_{pk}$ ($oz·in/A_{pk}$)	0.220 (31.40)
	$N·m/A_{rms}$ ($oz·in/A_{rms}$)	0.310 (44.40)
Motor Constant (3,5)	$N·m/\sqrt{W}$ ($oz·in/\sqrt{W}$)	0.206 (29.22)
Resistance, 25°C (Line-Line)	Ω	1.10
Inductance (Line-Line)	mH	2.74
Maximum Bus Voltage	V_{DC}	340
Thermal Resistance	°C/W	0.82
Number of Poles	--	8

1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature
2. All performance and electrical specifications ±10%
3. Values shown @ 105°C rise above a 25 °C ambient temperature, with housed motor mounted to a 250 mm x 250 mm x 6 mm aluminum heat sink
4. Peak torque assumes correct rms current; consult Aerotech
5. Torque constant and motor constant specified at stall
6. Maximum winding temperature is 130 °C
7. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures
8. All Aerotech amplifiers are rated A_{pk}; use torque constant in $N·m/A_{pk}$ when sizing



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

Table 3-23: Stepper Motor Specifications

		SM35 (AGR50, AGR75)	SM60-VT2 (AGR100, AGR150)	SM280-VT2 (AGR200)
NEMA Motor Frame Size		17	23	34
Stall Torque	N·m (oz·in)	0.78 (111)	1.41 (200)	8.75 (1238)
Rated Phase Current	A	3	0.84	7.1
Recommended Driver Bus Voltage	V	35	160	160
Rotor Inertia	$kg \cdot m^2$ ($oz \cdot in \cdot s^2$)	1.02×10^{-5} (0.0014)	3×10^{-5} (0.0042)	2.7×10^{-4} (0.038)
Full Step Angle	°	1.8	1.8	1.8
Accuracy	°	±0.09	±0.09	±0.09
Maximum Radial Load	N (lb)	28.4 (6.3)	75.4 (17)	22.5 (50)
Maximum Thrust Load	N (lb)	28.4 (2.2)	14.7 (3.4)	6.1 (14)
Weight	kg (lb)	0.50 (1.1)	0.70 (1.6)	3.8 (8.4)



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

3.4. Limits, Marker, and Machine Direction

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 3-4 shows the machine direction of AGR stages.

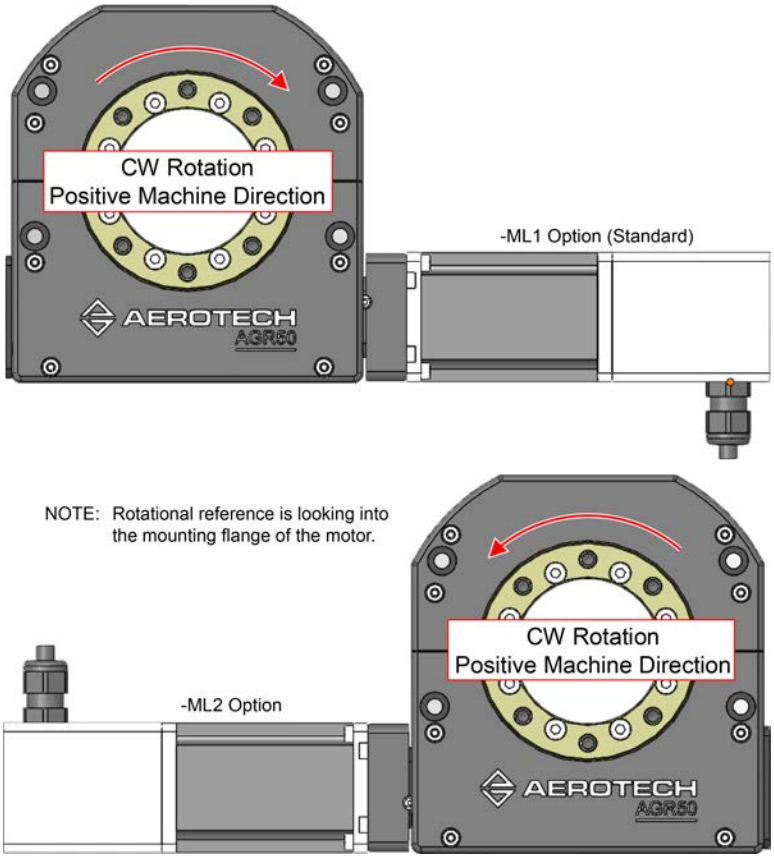


Figure 3-4: Machine Direction

Limited travel stages (-TRxxx option) have limit flags that can be adjusted to change the travel range of the stage unless the AGR is equipped with either the seal or encoder options. If the AGR is equipped with a seal or encoder, the AGR would need to be sent back to the factory for adjustments.

DANGER: Disconnect electrical power before making any mechanical adjustments or performing maintenance.

If you need to make limited travel adjustments, access the limit flags by removing the two covers and if applicable, the tabletop (-TTx option). When reinstalling the covers, make sure that there is no contact between the covers and the stage shaft.

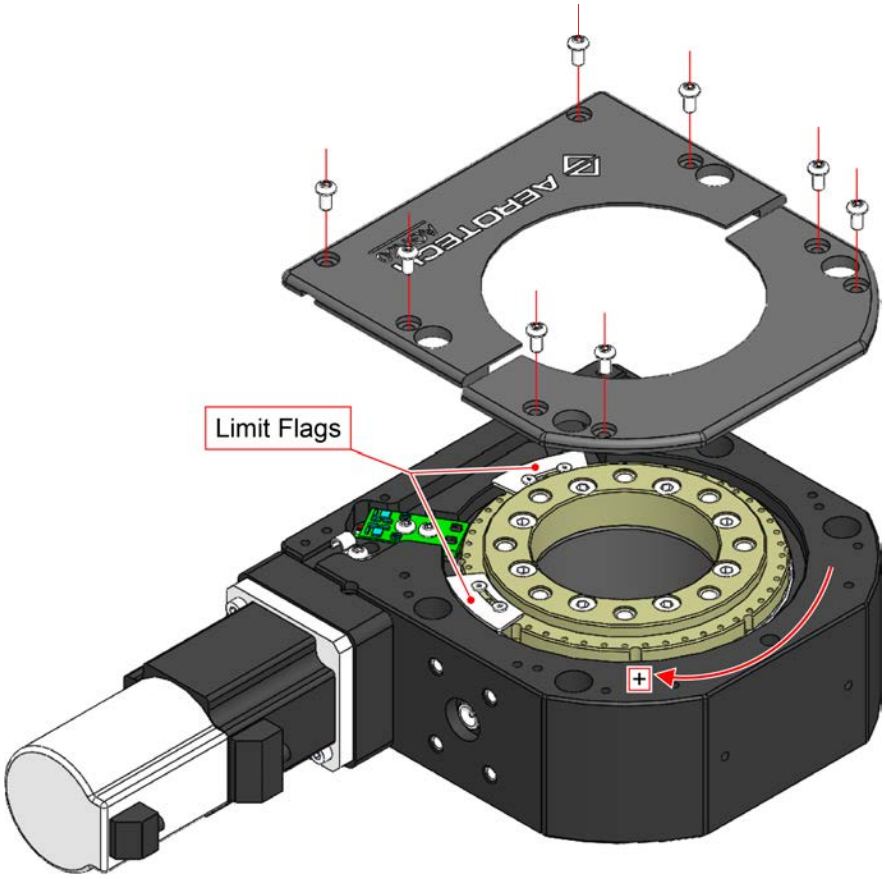


Figure 3-5: Limit Flag Locations

3.5. Motor and Feedback Phasing

Motor phase voltage is measured relative to the virtual wye common point.

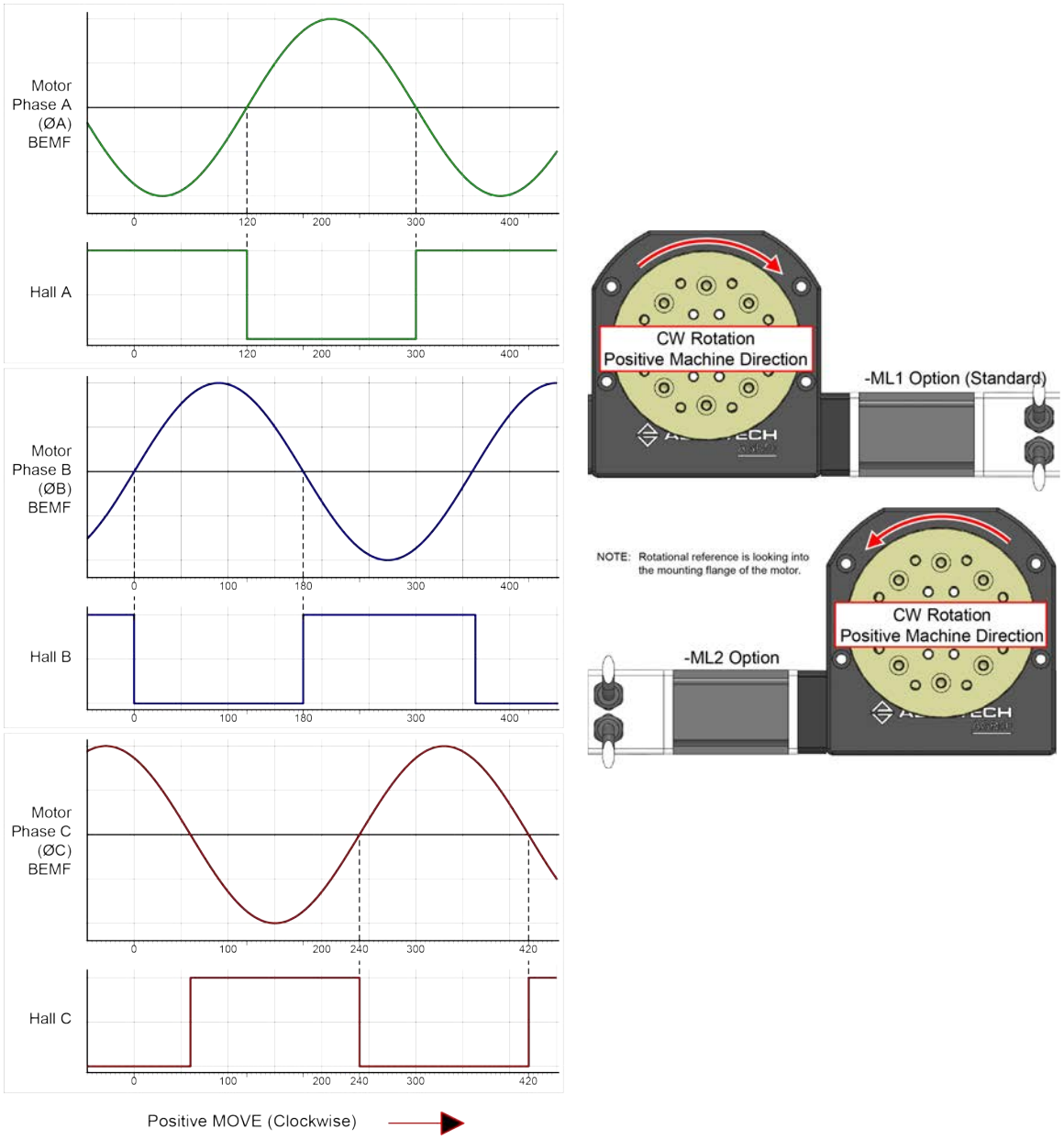


Figure 3-6: Hall Phasing

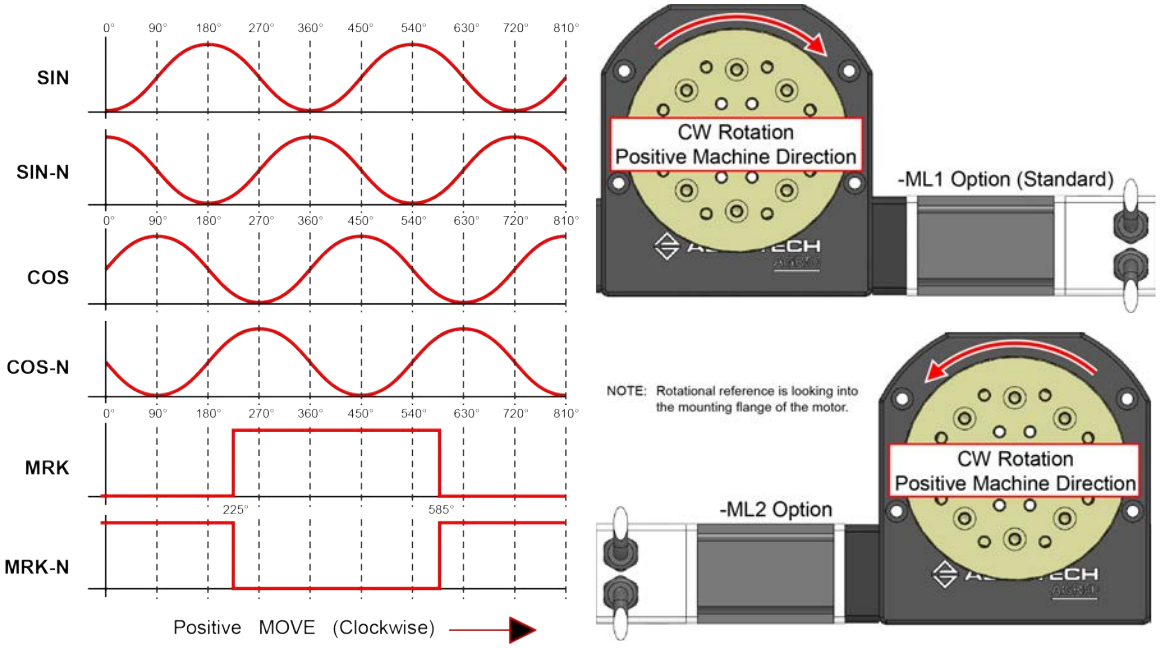


Figure 3-7: Analog Encoder Phasing Reference Diagram

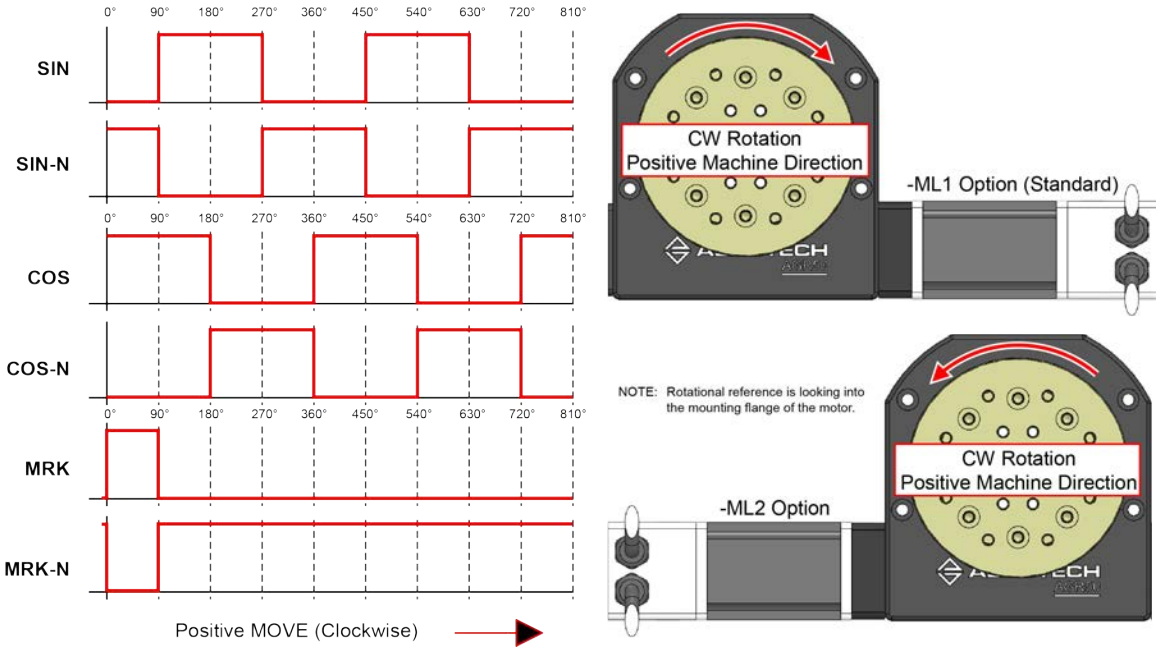


Figure 3-8: Encoder Phasing Reference Diagram (Standard)

Chapter 4: Maintenance



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.

4.1. Service and Inspection Schedule

Lubricant inspection and replenishment in AGR series stages depends on conditions such as duty cycle, speed, and the environment. An inspection interval of once every two weeks is recommended until a trend develops for the application. Longer or shorter intervals may be required to maintain the film of lubricant on the worm threads.

In general, stages that operate in a clean environment at 50% duty cycle or less must be lubricated monthly or every 75,000 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.

If the application process uses only a small portion of travel for most of the duty cycle, periodically drive the stage through full travel to redistribute the lubrication in the bearingsand worm drive.

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 AGR and any components and cables as needed.
- Repair any damage before operating the AGR.
- Inspect and perform an operational check on all safeguards and protective devices.

4.2. Cleaning and Lubrication

Cleaning

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

Any external metal surface of the AGR 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

For the worm gear drive mechanism, use Mobilith SHC 100 grease.

NOTE: AGR 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, AGR stages that were assembled with Klubersynth can continue to use Klubersynth for regular maintenance lubrication.

AGR rotary stages are designed for easy maintenance of the worm drive system. The drive mechanism can be lubricated while the stage is under power and integrated in upper level systems providing access to the lubrication ports are maintained. Access to the lubrication ports are provided by removing the port cover screws shown in Figure 1-1. Prior to removing the screw, make sure the surrounding surface is clean.

While the stage rotates (<5 rpm), slowly inject approximately 6 cc's of lubricant into the ports. Wipe clean any excess lubricant and reinstall the port cover screws.

Figure 4-1 shows the effect of the addition of lubricant to the current draw of a typical AGR stage. With the added lubricant the resulting current pull is much smoother, leading to much better mechanical performance and maximum life of the product.

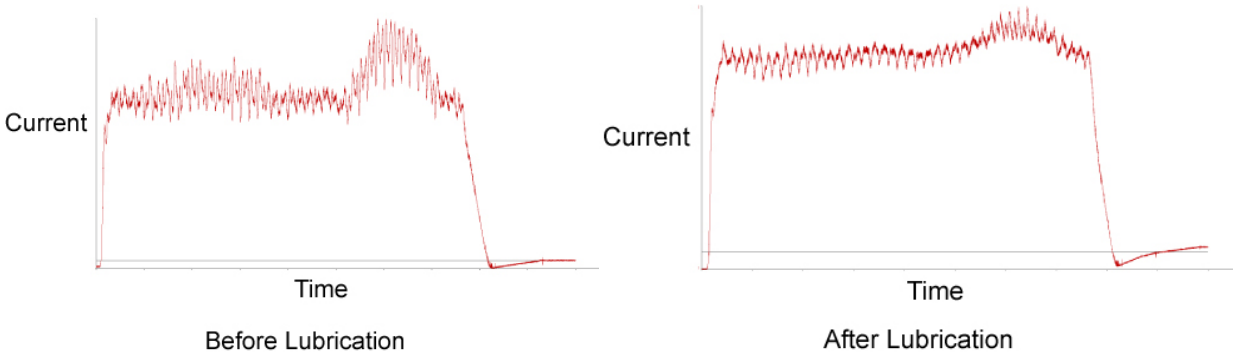


Figure 4-1: View of the Current Draw of a Typical AGR Stage Before and After Lubrication

4.3. 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).
The “no motor” option has been selected or for motor service	Access to the motor coupling is provided by removing half of the split top cover that is directly above the rotary motor (refer to Figure 1-1 for locations of the coupling access holes).

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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

TAIWAN	UNITED KINGDOM
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
1.06.00	The sections that follow have been updated: • EU Declaration of Incorporation • The limit options: Table 1-1 • AGR200 MS Feedback Connector Pinout: Table 3-8 • Direct Encoder Pinout: Table 3-13 • Motor and Feedback Wiring diagrams: Figure 3-1, Figure 3-2, and Figure 3-3 • BM22 and BM75 Motor Specifications: Table 3-21 • BM250 Motor Specifications: Table 3-22 • Stepper Motor Specifications: Table 3-23
1.05.00	• Updated the EU Declaration of Incorporation • Product updates • Updated the specifications in AGR Model Options table, which is Table 1-1 • Added the drawing for AGR Rotary Stage Motor Orientation, which is Figure 1-3 • Updated the specifications in AGR Series Mechanical Specifications (AGR50, AGR75, and AGR100) table, which is Table 1-3 • Updated the specifications in AGR Series Mechanical Specifications (AGR150 and AGR200) table, which is Table 1-4 • Updated the drawing for AGR50 Dimensions, which is Figure 2-1 • Added the drawing for AGR50 Mounting Plate Accessories as Figure 2-2 • Added the drawing for AGR50 Tabletop Accessories as Figure 2-3 • Updated the drawing for AGR75 Dimensions, which is Figure 2-4 • Added the drawing for AGR75 Mounting Plate Accessories as Figure 2-5 • Added the drawing for AGR75 Tabletop Accessories as Figure 2-6 • Updated the drawing for AGR100 Dimensions, which is Figure 2-7 • Added the drawing for AGR100 Mounting Plate Accessories as Figure 2-8 • Added the drawing for AGR100 Tabletop Accessories as Figure 2-9 • Updated the drawing for AGR150 Dimensions, which is Figure 2-10 • Added the drawing for AGR150 Mounting Plate Accessories as Figure 2-11 • Added the drawing for AGR150 Tabletop Accessories as Figure 2-12 • Updated the drawing for AGR200 Dimensions, which is Figure 2-13 • Added the drawing for AGR200 Mounting Plate Accessories as Figure 2-14 • Added the drawing for AGR200 Tabletop Accessories as Figure 2-15 • Removed Figure 2-16: View of an AGR Stage Showing Mounting Holes • Removed Table 3-6: Limits with Flying Leads • Removed section - Appendix A: Stepper Motor Removal
1.04.00	Revision changes have been archived. If you need a copy of this revision, contact Aerotech Global Technical Support.
1.03.00	
1.02.00	
1.01.00	
1.00.00	

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