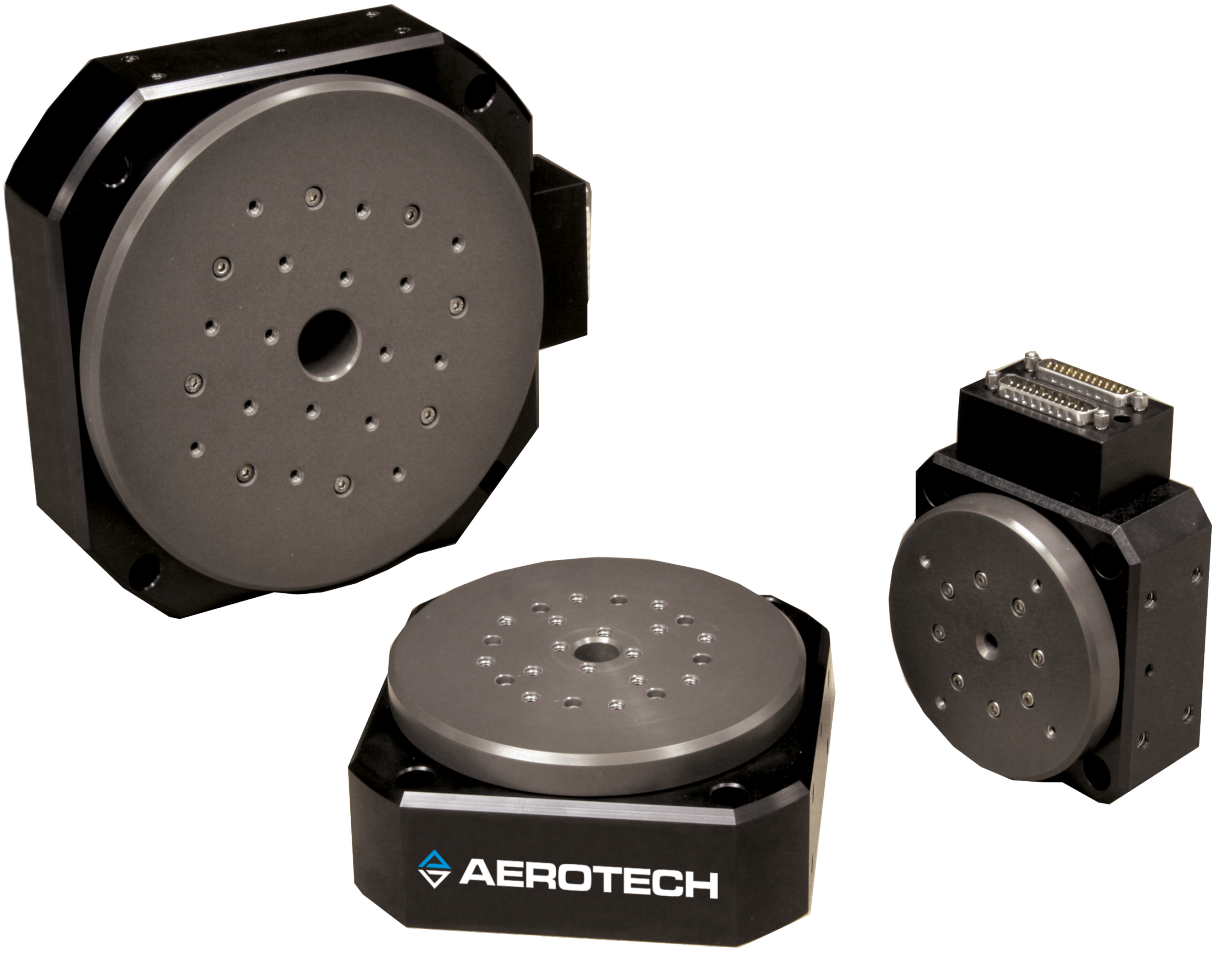
ADRS Hardware Manual

Revision: 1.04.00



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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.

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 ADRS 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 ADRS stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.
5. Use care when moving the ADRS stage. Lifting or transporting the ADRS stage improperly can result in injury or damage to the ADRS.
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:
ADRS 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

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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: Model Options

ADRS Series Direct-Drive Rotary Stage	
ADRS100	100 mm wide mechanical-bearing direct-drive rotary stage
ADRS150	150 mm wide mechanical-bearing direct-drive rotary stage
ADRS200	200 mm wide mechanical-bearing direct-drive rotary stage
Feedback (Required)	
-E1	Incremental encoder, 1 Vpp
-E2	Incremental encoder, TTL, x5 interpolation
-E3	Incremental encoder, TTL, x10 interpolation
-E4	Incremental encoder, TTL, x25 interpolation
-E5	Incremental encoder, TTL, x50 interpolation
Motor (Required)	
-M1	Low current, -A winding
-M2	Low voltage, -B winding
Tabletop (Required)	
-TT1	Metric tabletop
-TT2	English tabletop
Lower Seal (Optional)	
-SL	Lower Seal
Note: The Lower Seal is not available for the ADRS100.	
Metrology (Required)	
-PL1	Metrology, uncalibrated with performance plots
-PL2	Metrology, calibrated (HALAR) with performance plots

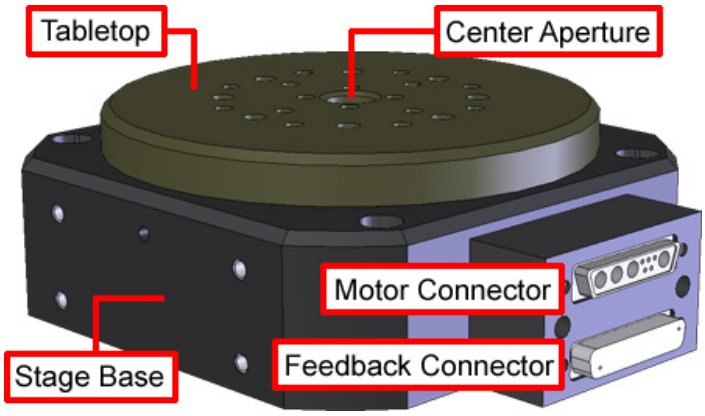

Figure 1-1: Typical ADRS Stage

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	The ADRS stages have limited protection against dust, but not water. This equates to an ingress protection rating of IP40.
Use	Indoor use only.

1.2. Accuracy and Temperature Effects

Aerotech products are designed for and built in a 20°C (68°F) environment. Extreme temperature changes could cause a decrease in performance or permanent damage to the ADRS. At a minimum, the environmental temperature must be controlled to within 0.25ºC per 24 hours to ensure the ADRS specifications are repeatable over an extended period of time. The severity of temperature effects on all specifications depends on many different environmental conditions, including how the ADRS is mounted. Contact the factory for more details.

1.3. Basic Specifications

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.

Resolution is dependent on encoder resolution and controller interpolation.

Table 1-3: ADRS Series Specifications

		ADRS100	ADRS150	ADRS200
Tabletop Diameter		95 mm	140 mm	190 mm
Aperture		6 mm	15 mm	26 mm
Bus Voltage		340 VDC		
Maximum Torque (Continuous)		0.48 N·m	2.36 N·m	5.99 N·m
Maximum Speed(1)		1500 rpm	600 rpm	600 rpm
Accuracy(5)	Uncalibrated	388 µrad (80 arc sec)		
	Calibrated (2)	29.1 µrad (6 arc sec)		
Repeatability(5)		14.6 µrad (3 arc sec)		
Max Load (3)	Axial	7 kg	20 kg	40 kg
	Radial	3 kg	10 kg	20 kg
Axial Error Motion (4)		2 µm	5 µm	5 µm
Radial Error Motion (4)		3 µm	5 µm	5 µm
Tilt Error Motion		48.5 µrad (10 arc sec)		
Inertia (Unloaded)		0.00038 kg-m^2	0.00242 kg-m^2	0.00843 kg-m^2
Total Mass		2.0 kg	4.3 kg	7.6 kg
Finish	Tabletop	Hardcoat		
	Stage	Black Anodize		

1. Maximum speed is based on stage capability. Actual speed may depend on encoder resolution, load, amplifier bus voltage, and motor.
2. With -PL2 option.
3. Maximum loads are mutually exclusive.
4. Error motion specifications are below 700 rpm for the ADRS100. Above 700 rpm, the max radial error is 5 µm. Errors measured 25 mm above the tabletop.
5. Repeatability and accuracy are dependent on encoder resolution. To achieve the listed specifications, encoder resolution must be 0.36 arc sec or finer.

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Chapter 2: Mechanical Specifications and Installation

WARNING: ADRS 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 ADRS. Unsecured moving parts may shift and cause bodily injury.
- Improper handling could adversely affect the performance of the ADRS. Use care when moving the ADRS.
- Lift only by the base. Do not use the tabletop or cables as lifting points.

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

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

Before operating the ADRS, 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-less air to remove any dust or debris that has collected during shipping.

Each ADRS 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 ADRS 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

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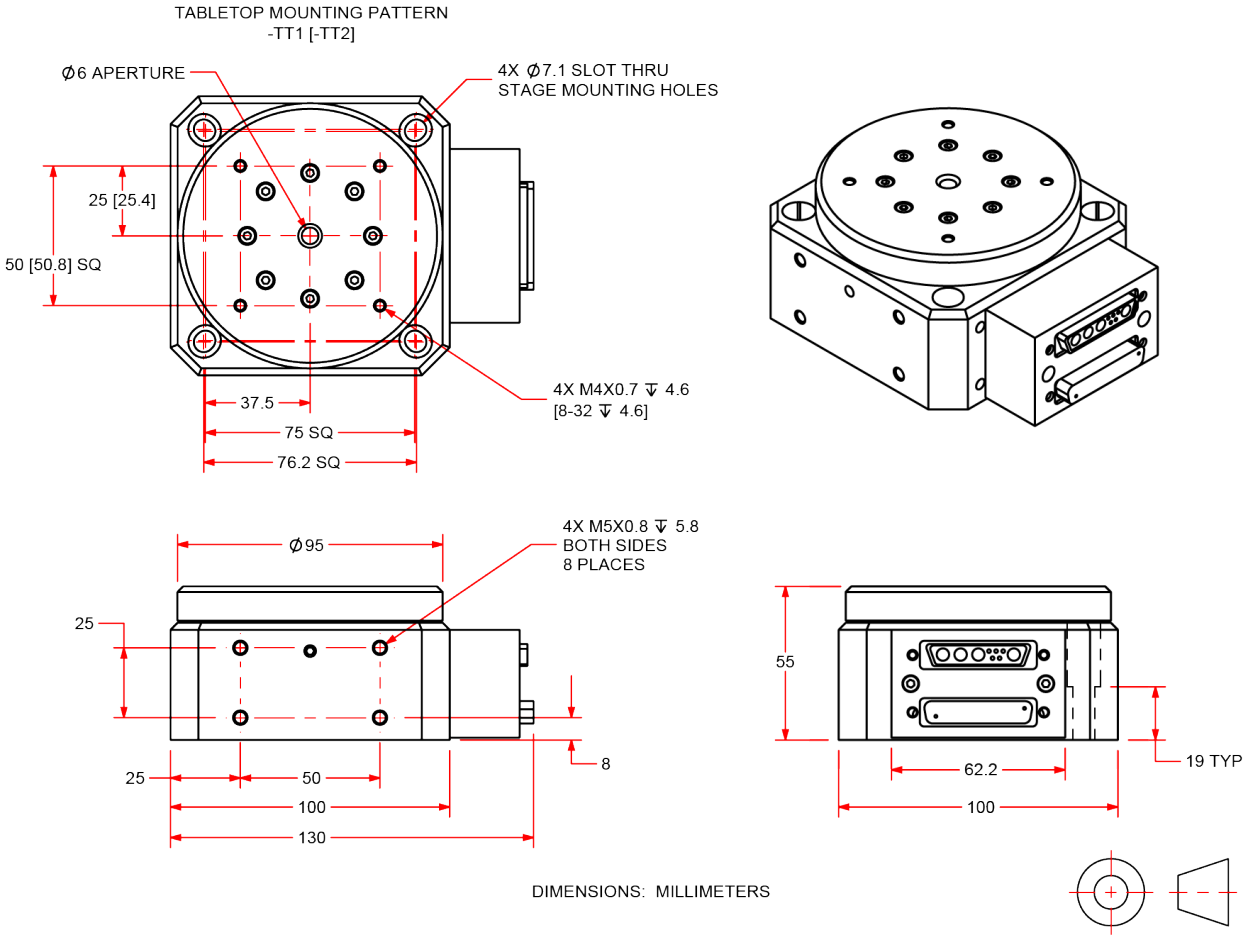


Figure 2-1: ADRS100 Dimensions

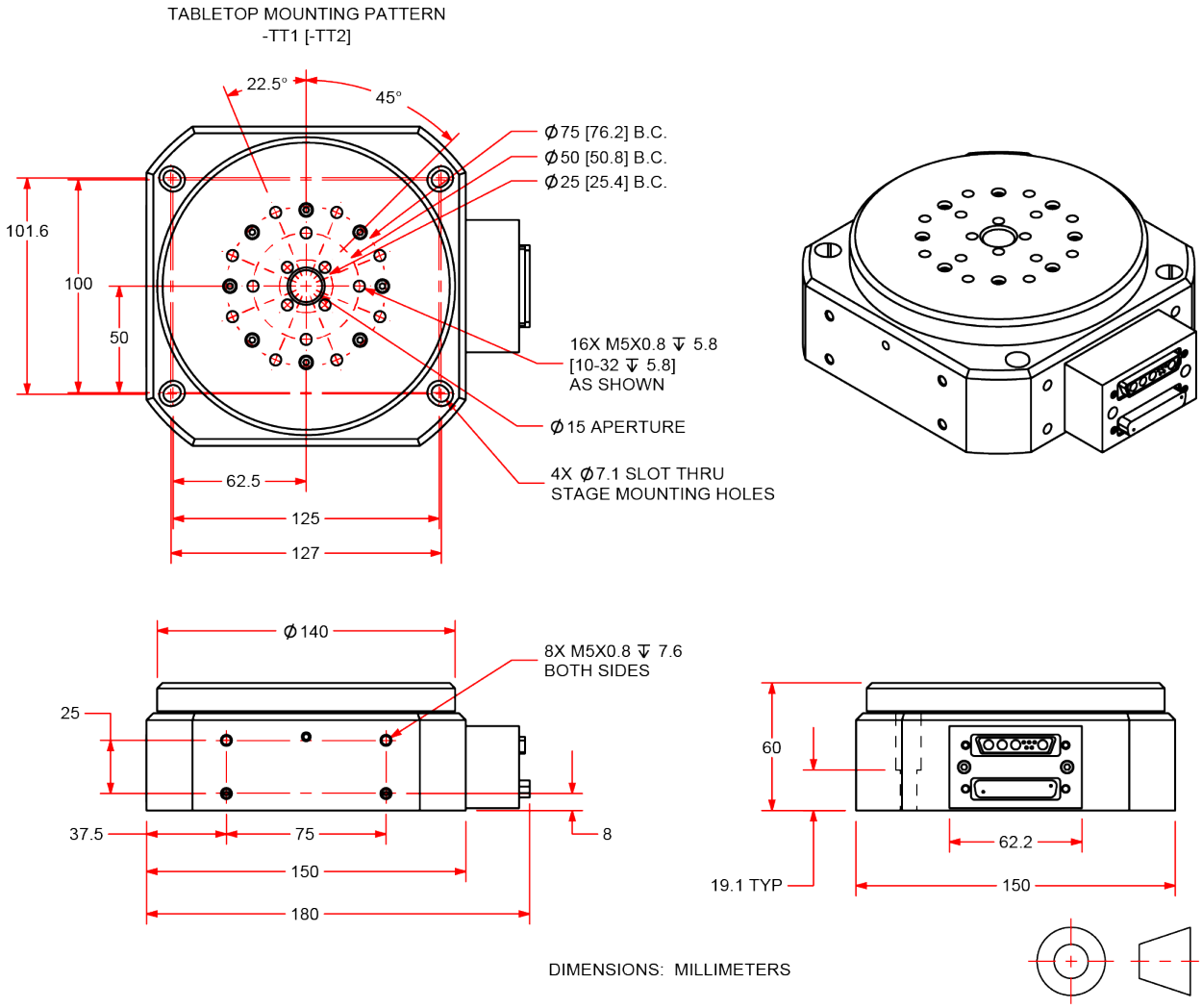


Figure 2-2: ADRS150 Dimensions

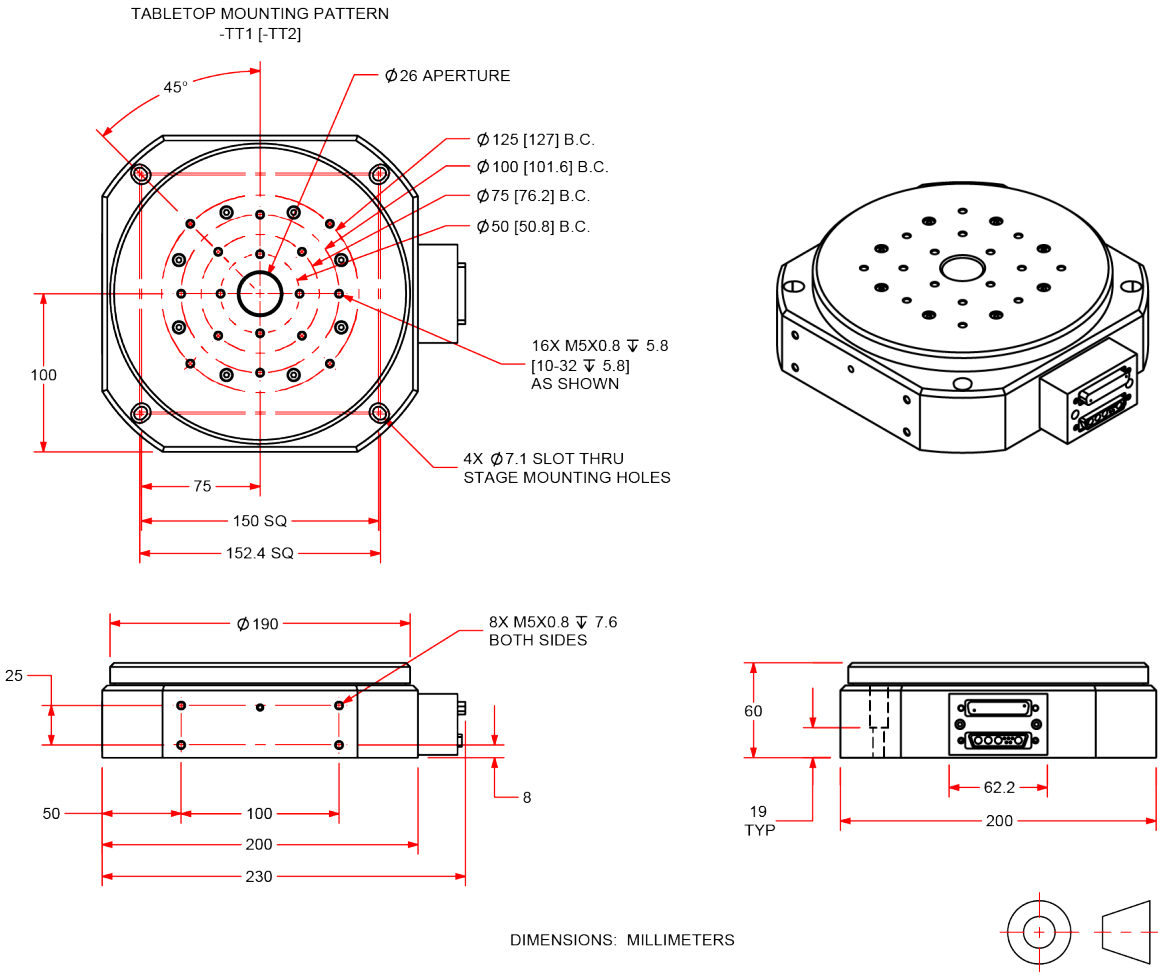


Figure 2-3: ADRS200 Dimensions

2.3. Securing the Stage to the Mounting Surface

WARNING: Do not attempt to manually move the ADRS if it is connected to a power source.

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

WARNING: The ADRS 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 ADRS 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 1 µm per 50 mm.

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

ADRS series stages have a fixed mounting pattern (as shown in Figure 2-4).

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
[Top Mounting] 6 mm or 1/4" SHCS	7 N·m
[Side Mounting] M5 x 0.8 tapped holes	4 N·m

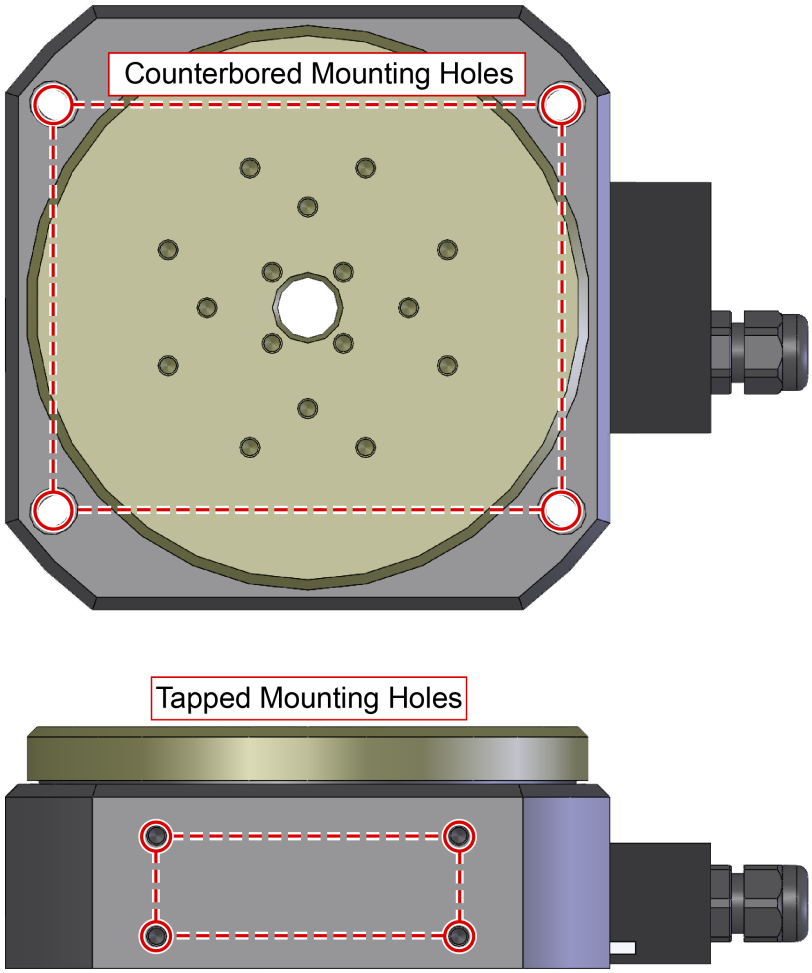


Figure 2-4: ADRS Stage Standard Mounting Hole Locations

2.4. Attaching the Payload to the Stage

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.

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.

To prevent damage to the payload or stage, test the operation of the stage before the payload is attached. 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 ADRS 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 ADRS 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 5 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 2-5 to find the loading condition. Refer to Figure 2-6 to find the maximum allowable load.

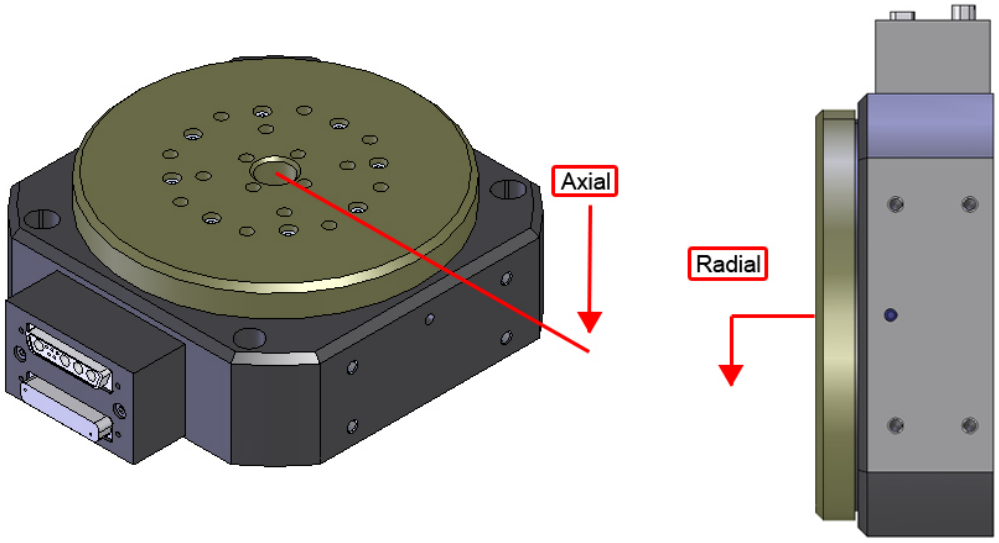


Figure 2-5: Load Orientations

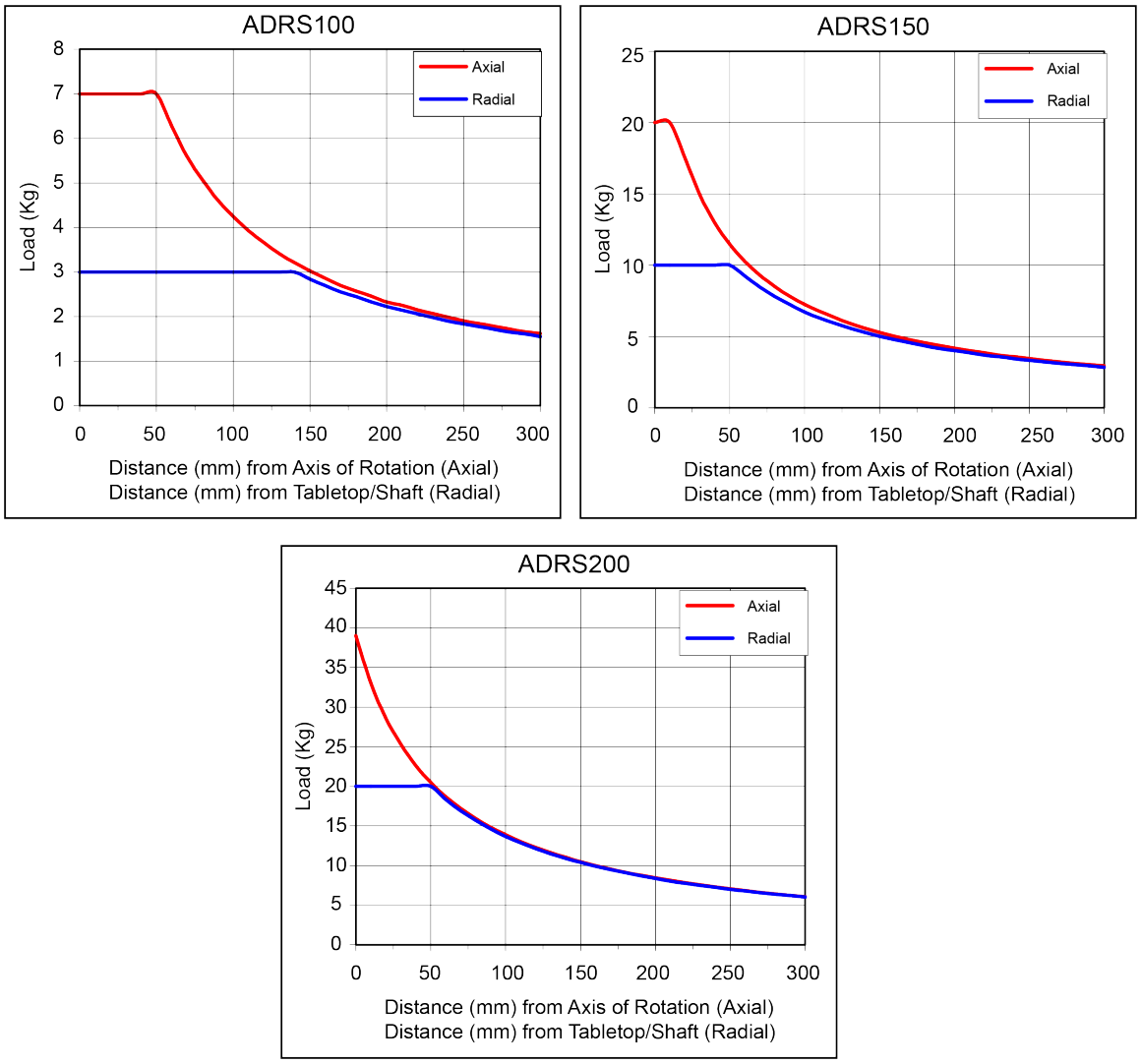


Figure 2-6: ADRS Cantilevered Load Capabilities

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 ADRS is part of a complete Aerotech motion control system, setup usually involves connecting the ADRS 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 following sections for standard motor wiring and connector pin assignments.

WARNING: Operator access to the base and tabletop must be restricted while connected to a power source. Failure to do so may cause electric shock.

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

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.

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 ADRS provides motor frame ground protection only. Additional grounding and safety safeguards 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.

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 cause electric shock.

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: 4-Pin Motor Connector Pinout

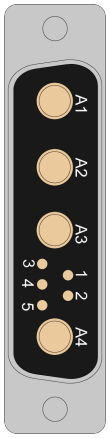
Pin	Description	Connector
A1	Motor Phase A	
A2	Motor Phase B	
A3	Motor Phase C	
1	Motor Shield (EMI shield)	
2	Reserved	
3	Reserved	
4	Reserved	
5	Reserved	
A4	Frame ground (motor protective ground)	

Table 3-2: 4-Pin Motor Connector Mating 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 #DBMM9W4SA197

Table 3-3: 25-Pin Feedback Connector Pinout

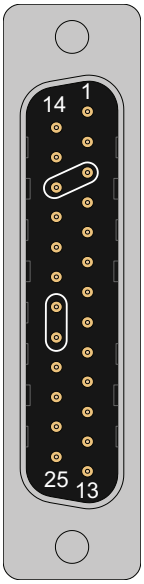
Pin	Description	Connector
1	Signal shield connection	
2	Over-Temperature Thermistor sensor	
3	+5 V power supply (internally connected to Pin 16)	
4	Reserved	
5	Hall Effect sensor, phase B	
6	Marker-N	
7	Marker	
8	Reserved	
9	Reserved	
10	Hall Effect sensor, phase A	
11	Hall Effect sensor, phase C	
12	Reserved	
13	Reserved	
14	Cosine	
15	Cosine-N	
16	+5 V power supply (internally connected to Pin 3)	
17	Sine	
18	Sine-N	
19	Reserved	
20	Common ground (internally connected to Pin 21)	
21	Common ground (internally connected to Pin 20)	
22	Reserved	
23	Fault output from encoder	
24	Reserved	
25	Reserved	
Case	Signal shield connection (to case)	

Table 3-4: Feedback Connector Mating Connector

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

3.2. Motor and Feedback Wiring

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

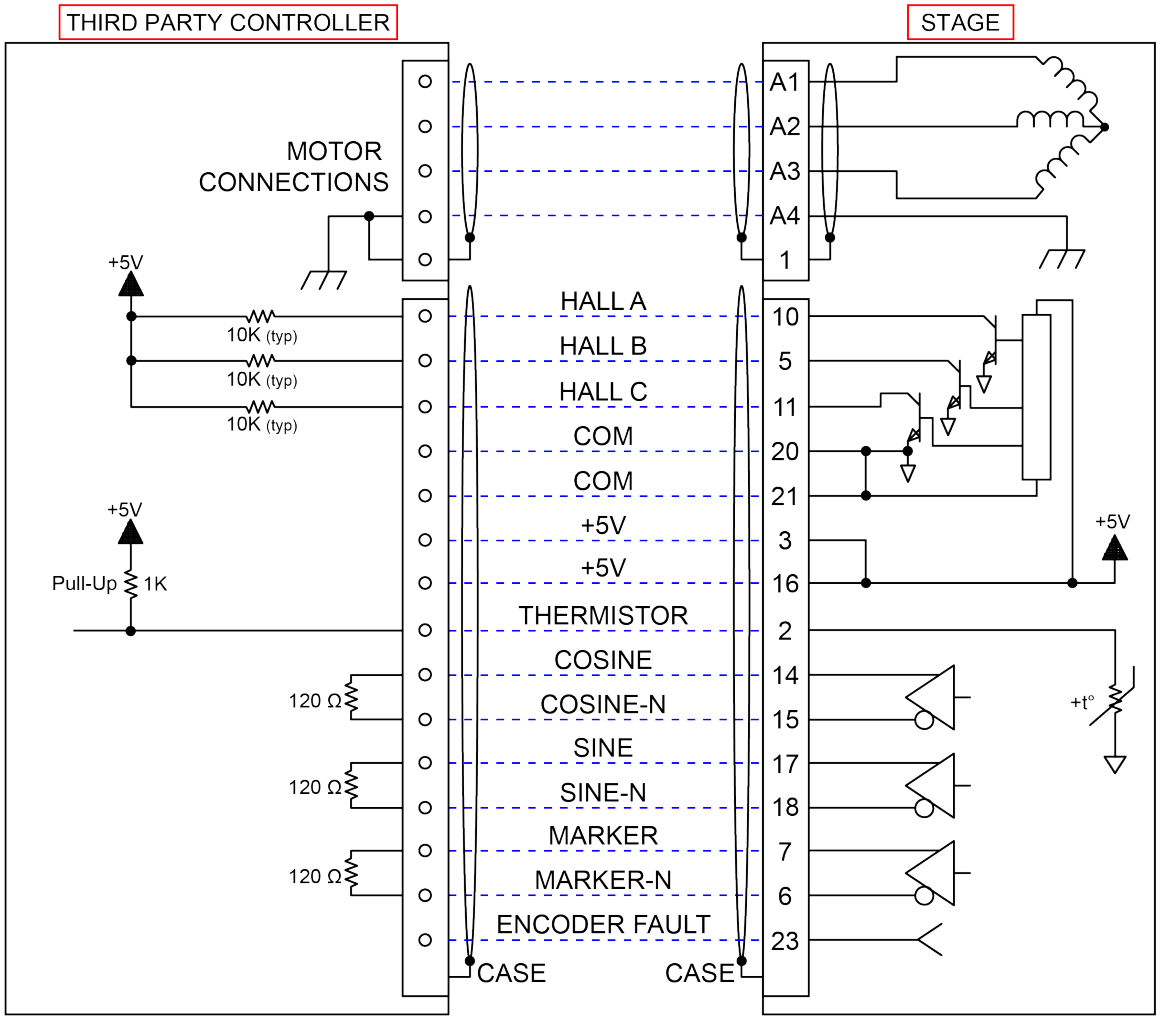


Figure 3-1: Motor and Feedback Wiring

3.3. Motor and Feedback Specifications

Table 3-5: Feedback Specifications

Hall-Effect Sensors Specifications	
Supply Voltage	5 V
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 ±10%
Supply Current	250 mA
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

Table 3-6: ADRS Series Resolution Information

	ADRS100	ADRS150	ADRS200
Fundamental Resolution	3600 Lines/Rev	10000 Lines/Rev	10000 Lines/Rev
-E1 (1)	0.09/0.0225 arc sec/line	0.0324/0.0081 arc sec/line	0.0324/0.0081 arc sec/line
-E2	18 arc sec/line	6.48 arc sec/line	6.48 arc sec/line
-E3	9 arc sec/line	3.24 arc sec/line	3.24 arc sec/line
-E4	3.6 arc sec/line	1.296 arc sec/line	1.296 arc sec/line
-E5	1.8 arc sec/line	0.648 arc sec/line	0.648 arc sec/line
1. -E1 shows x4000/x16000 total interpolation. 2. Quadrature decoding included in interpolated resolution calculations.			

Table 3-7: ADRS Series Maximum Encoder Frequency

Resolution-Speed	ADRS100	ADRS150	ADRS200
-E1/-E2/-E3/-E4	1500 rpm	600 rpm	600 rpm
-E5	800 rpm	300 rpm	300 rpm

NOTE: The encoders used on all ADRS series stages come standard with a 16 MHz clock rate. Aerotech can provide slower or faster clock rates to match the controller being used. Consult Aerotech for more information.

Table 3-8: ADRS100 Motor Specifications [Aerotech Motor Model: S-76-35]

		S-76-35 (ADRS100)	
Performance Specifications (1,5)			
Winding Designation		-A (-M1)	-B (-M2)
Stall Torque, Cont. (2)	N·m	.48	
Peak Torque (3)	N·m	1.92	
Electrical Specifications (5)			
Winding Designation		-A (-M1)	-B (-M2)
BEMF Const., line-line, Max	V_{pk}/krpm	29.1	14.5
Continuous Current, Stall (2)	A_{pk}	2.0	4.0
	A_{rms}	1.4	2.8
Peak Current, Stall (2)	A_{pk}	8.0	16.0
	A_{rms}	5.7	11.3
Torque Constant (4, 9)	N·m/A_{pk}	0.24	0.12
	N·m/A_{rms}	0.34	0.17
Motor Constant (2, 4)	N·m/√W	0.075	
Resistance, 25°C, line-line	Ω	10.5	2.6
Inductance, line-line	mH	1.40	0.35
Maximum Bus Voltage	V_{DC}	340	
Thermal Resistance	°C/W	1.83	
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 force assumes correct rms current; consult Aerotech.
4. Torque constant and motor constant specified at stall
5. All performance and electrical specifications ±10%
6. Specifications given are for the motor only. When integrated into a housing with bearings additional losses should be considered.
7. Maximum winding temperature is 100 °C (thermistor trips at 100 °C)
8. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures
9. All Aerotech amplifiers are rated A_{pk}; use torque constant in N·m/A_{pk} when sizing

Table 3-9: ADRS150 Motor Specifications [Aerotech Motor Model: S-130-39]

		S-130-39 (ADRS150)	
Performance Specifications (1,5)			
Winding Designation		-A (-M1)	-B (-M2)
Stall Torque, Cont. (2)	N·m	2.36	
Peak Torque (3)	N·m	9.42	
Electrical Specifications (5)			
Winding Designation		-A (-M1)	-B (-M2)
BEMF Const., line-line, Max	V_{pk}/krpm	75.1	37.5
Continuous Current, Stall (2)	A_{pk}	3.8	7.6
	A_{rms}	2.7	5.4
Peak Current, Stall (2)	A_{pk}	15.2	30.4
	A_{rms}	10.7	21.5
Torque Constant (4, 9)	N·m/A_{pk}	0.62	0.31
	N·m/A_{rms}	0.88	0.44
Motor Constant (2, 4)	N·m/√W	0.265	
Resistance, 25°C, line-line	Ω	5.6	1.4
Inductance, line-line	mH	1.70	0.43
Maximum Bus Voltage	V_{DC}	340	
Thermal Resistance	°C/W	0.95	
Number of Poles	--	18	

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 330 mm x 330 mm x 13 mm aluminum heat sink
3. Peak force assumes correct rms current; consult Aerotech.
4. Torque constant and motor constant specified at stall
5. All performance and electrical specifications ±10%
6. Specifications given are for the motor only. When integrated into a housing with bearings additional losses should be considered.
7. Maximum winding temperature is 100 °C (thermistor trips at 100 °C)
8. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures
9. All Aerotech amplifiers are rated A_{pk}; use torque constant in N·m/A_{pk} when sizing

Table 3-10: ADRS200 Motor Specifications [Aerotech Motor Model: S-180-44]

		S-180-44 (ADRS200)	
Performance Specifications (1,5)			
Winding Designation		-A (-M1)	-B (-M2)
Stall Torque, Cont. (2)	N·m	5.99	
Peak Torque (3)	N·m	23.98	
Electrical Specifications (5)			
Winding Designation		-A (-M1)	-B (-M2)
BEMF Const., line-line, Max	V_{pk}/krpm	268.7	134.4
Continuous Current, Stall (2)	A_{pk}	2.7	5.4
	A_{rms}	1.9	3.8
Peak Current, Stall (2)	A_{pk}	10.8	21.6
	A_{rms}	7.6	15.3
Torque Constant (4, 9)	N·m/A_{pk}	2.22	1.11
	N·m/A_{rms}	3.14	1.57
Motor Constant (2, 4)	N·m/√W	0.628	0.628
Resistance, 25°C, line-line	Ω	12.8	3.2
Inductance, line-line	mH	3.40	0.85
Maximum Bus Voltage	V_{DC}	340	
Thermal Resistance	°C/W	0.82	
Number of Poles	--	18	

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 330 mm x 330 mm x 13 mm aluminum heat sink
3. Peak force assumes correct rms current; consult Aerotech.
4. Torque constant and motor constant specified at stall
5. All performance and electrical specifications ±10%
6. Specifications given are for the motor only. When integrated into a housing with bearings additional losses should be considered.
7. Maximum winding temperature is 100 °C (thermistor trips at 100 °C)
8. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures
9. All Aerotech amplifiers are rated A_{pk}; use torque constant in N·m/A_{pk} when sizing

3.4. 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 3-2 shows the machine direction of ADRS stages.

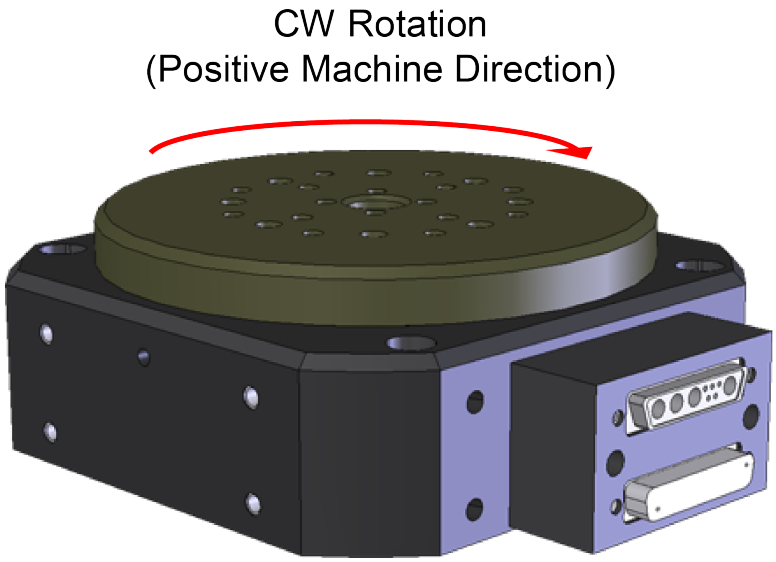
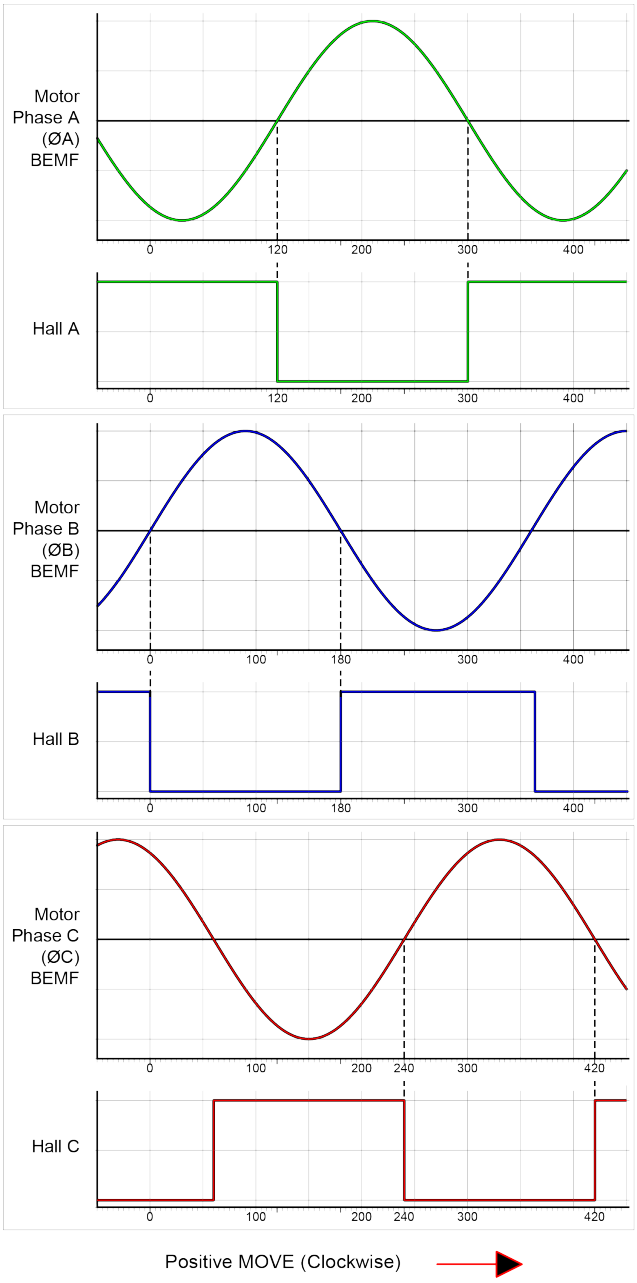


Figure 3-2: Machine Direction

3.5. Motor and Feedback Phasing

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



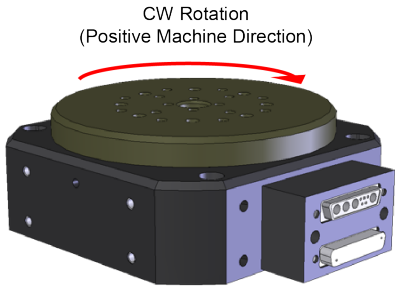


Figure 3-3: Hall Phasing

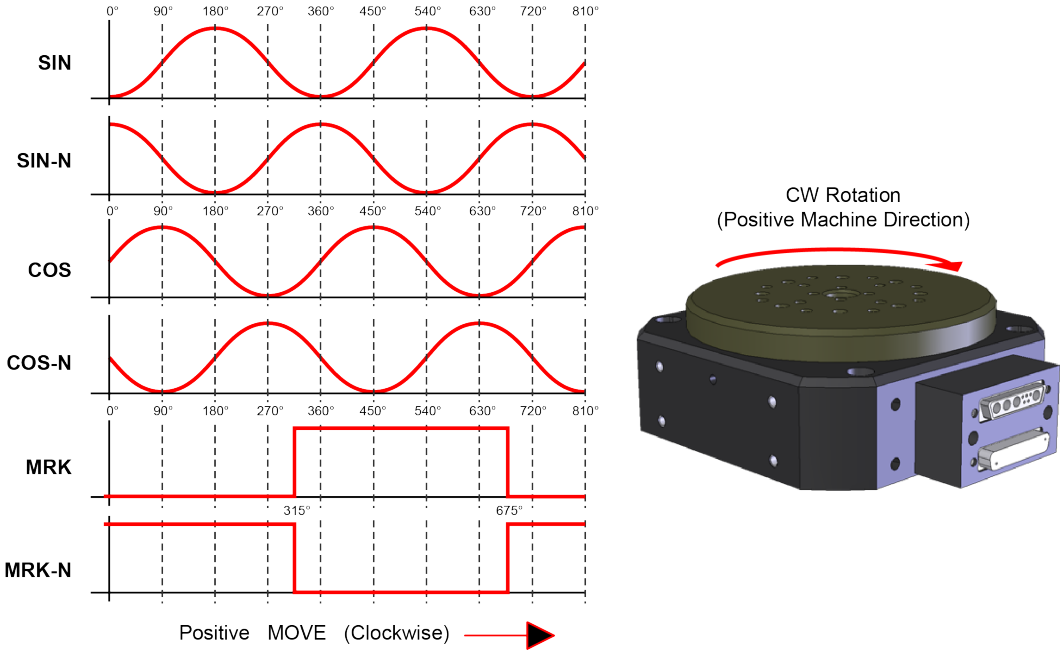


Figure 3-4: Analog Encoder Phasing Reference Diagram

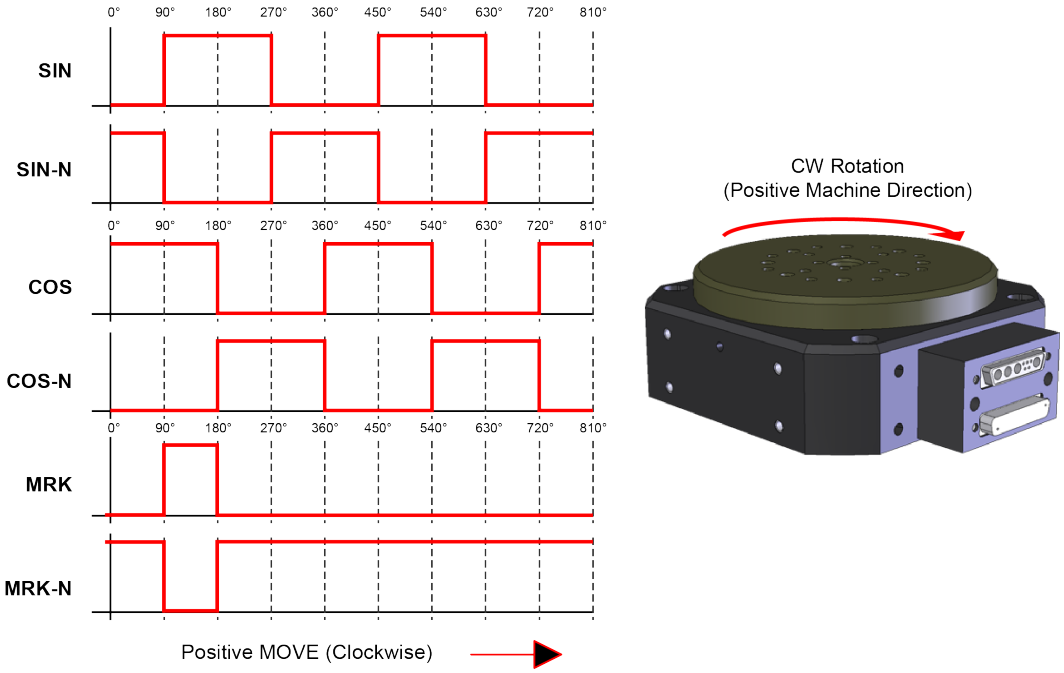


Figure 3-5: Encoder Phasing Reference Diagram (Standard)

Chapter 4: Maintenance

The ADRS series stages are designed to require minimum maintenance. Stages equipped with rear seals may require seal replacement (detailed in this chapter). Stages without rear seals do not require any maintenance other than periodic cleaning.

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

Inspect the ADRS once per month. A longer or shorter inspection interval may be required depending on the specific application, and conditions such as the duty cycle, speed, and environment.

If the stage is equipped with a rear seal (ADRS150 and ADRS200 only), the seal should be examined for excessive wear as part of this inspection interval. The application will determine the required replacement interval for the seal. The bearings, motor, and encoder for the ADRS series require no lubrication or maintenance.

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

4.2. Cleaning and Lubrication

Lubricate seals with Dow Corning Molykote 55 O-ring Lubricant or an equivalent O-ring lubricant.

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

Any metal surface on the stage can be cleaned with either acetone or isopropyl alcohol.

The seals should only be cleaned with a small amount of isopropyl alcohol if necessary. *Acetone should never be used on seals.*

4.3. Rear Seal Change Procedure

The seals on ADRS150 and ADRS200 stages may need to be replaced because of excess wear. Figure 4-1 shows an exploded view of the assembly and includes all parts involved in the process.

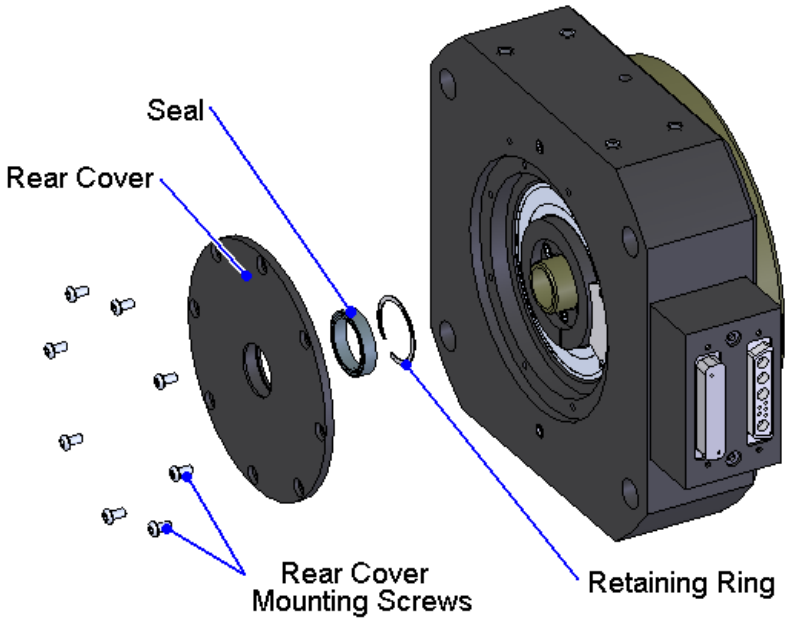


Figure 4-1: Exploded View of Seal Assembly

1. Remove power from the stage.
2. Remove the rear cover mounting screws (refer to Figure 4-1).
3. Slide the rear cover out of the stage. This may require a pick or small screwdriver due to the friction of the seal on.
4. Remove the retaining ring from the rear cover.
5. Carefully pry the seal out of its housing. Use caution not to scratch the sealing surfaces. Note the orientation of the seal.
6. Lubricate the new seal O-ring lubricant (see Section 4.2.) and carefully slide it into the rear cover. Be sure to replace the seal in the correct orientation. The open end of the seal should face away from the stage tabletop.
7. Replace the retaining ring.
8. Slide the rear cover back onto the stage, using caution not to twist or damage the seal. Replace the rear cover mounting screws.
9. Restore power to the stage.

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.

4.4. Troubleshooting

Symptom	Possible Cause and Solution
Stage will not move	• Refer to controller documentation for polarity and compatibility requirements (Example: voltage requirements). • Controller trap or fault (refer to 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 Controller documentation).
Stage oscillates or squeals	• Gains misadjusted (refer to the controller documentation). • Encoder signals (refer to the controller documentation).

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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) 3319 7715	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
1.04.00	• Product updates. • Updated the EU Declaration of Incorporation. • Updated the Maximum Torque (Continuous) specification for ADRS100 in Table 1-3. • Updated the motor specifications in Table 3-8. • Updated the drawing and specifications for ADRS100 in Figure 2-1. • Updated the drawing and specifications for ADRS150 in Figure 2-2. • Updated the drawing and specifications for ADRS200 in Figure 2-3.
1.03.00	• Full revision. • Updated the safety and warning information. • Updated Tilt Error spec for ADRS150 and ADRS200 (from 20 arc sec to 10 arc sec).
1.02.00	Revision changes have been archived. If you need a copy of this revision, contact Aerotech Global Technical Support.
1.01.00	
1.00.00	

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