ACS Hardware Manual

Revision: 1.05.00

Global Technical Support

Go to www.aerotech.com/global-technical-support for information and support about your Aerotech products. The website supplies software, product manuals, Help files, training schedules, and PC-to-PC remote technical support. If necessary, you can complete Product Return (RMA) forms and get information about repairs and spare or replacement parts. To get help immediately, contact a service office or your sales representative. Include your customer order number in your email or have it available before you call.

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Safety Procedures and Warnings

This manual tells you how to carefully and correctly use and operate the ACS. Read all parts of this manual before you install or operate the ACS 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 ACS 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 ACS stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.
5. Use care when moving the ACS stage. Lifting or transporting the ACS stage improperly can result in injury or damage to the ACS.
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.

EU Declaration of Incorporation

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

herewith declares that the product:

ACS 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, 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
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Position Engineer Verifying Compliance
Location Pittsburgh, PA
Date 3/31/2020

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: ACS100 Model Numbering System

ACS Mechanical-Bearing Direct-Drive Rotary Collet Stage, 100 mm diameter	
Stage Size (Required)	
-85	85 mm stage height; 0.6 N·m continuous torque
-135	135 mm stage height; 1.6 N·m continuous torque
Chuck Style (Required)	
-ER8	ER8 ultra-precision collet
-ER8MB	ER8 microbore collet
Feedback (Required)	
-E1	Incremental encoder, 1 Vpp, sine wave output
-E2	Incremental encoder, Digital, RS422 line-driver, x5 interpolation
-E3	Incremental encoder, Digital, RS422 line-driver, x10 interpolation
-E4	Incremental encoder, Digital, RS422 line-driver, x25 interpolation
-E5	Incremental encoder, Digital, RS422 line-driver, x50 interpolation
NOTE: Digital output encoder signals are synthesized with a 16 MHz clock. Ensure that the encoder sample rate on the controller is at least 16 MHz or higher (slower clock rates are available on request).	
Rear Seal (Optional)	
-SL	Rear seal
Connector (Required)	
-CN1	4-pin high-powered D-style motor and 25-pin D-style feedback connectors
-CN2	25-pin D-style motor and 25-pin D-style feedback connectors
Wrench (Optional)	
-WR	Wrench for changing the collet Aerotech P/N: MFB25378-01 [Qty-2]
Air Purge (Optional)	
-PR	Air purge fitting to positive pressurize ACS stage to limit ingress of airborne particulates
Metrology (Required)	
-PL1	Uncalibrated with performance plots
-PL2	Calibrated (HALAR) with performance plots
Accessories (To be Ordered as a Separate Line Item)	
Collet-ER8-CLTxx	ER8 DIN6499AA electropolished collet, 0.5 mm to 5 mm part sizes diameter available
Collet-ER8MB-CLTxx	ER8 DIN6499AA electropolished mircro-bore collet, 0.2 mm to 0.9 mm part sizes diameter available
CGF	Collet and gripper filtration kit

Table 1-2: ACS150 Model Numbering System

ACS Mechanical-Bearing Direct-Drive Rotary Collet Stage, 150 mm diameter	
Stage Size (Required)	
-115	115 mm stage height; 2.9 N·m continuous torque
-135	135 mm stage height; 5.1 N·m continuous torque
-180	185 mm stage height; 9.3 N·m continuous torque
Chuck Style (Required)	
-ER25	ER25 ultra-precision collet
-ER40	ER40 ultra-precision collet
-3J1	3-Jaw gripper, 10 mm stroke, normally closed
-3J2	3-Jaw gripper, 10 mm stroke, normally open
-3J3	3-Jaw gripper, 16 mm stroke, normally closed
-3J4	3-Jaw gripper, 16 mm stroke, normally open
Feedback (Required)	
-E1	Incremental encoder, 1 Vpp, sine wave output
-E2	Incremental encoder, Digital, RS422 line-driver, x5 interpolation
-E3	Incremental encoder, Digital, RS422 line-driver, x10 interpolation
-E4	Incremental encoder, Digital, RS422 line-driver, x25 interpolation
-E5	Incremental encoder, Digital, RS422 line-driver, x50 interpolation
NOTE: Digital output encoder signals are synthesized with a 16 MHz clock. Ensure that the encoder sample rate on the controller is at least 16 MHz or higher (slower clock rates are available on request).	
Rear Seal (Optional)	
-SL	Rear seal
Wrench (Optional)	
-WR	Wrench for changing the collet Aerotech P/N: MCA01857 [Qty-1] Aerotech P/N: MCA02007 [Qty-1]
Metrology (Required)	
-PL1	Uncalibrated with performance plots
-PL2	Calibrated (HALAR) with performance plots
Accessories (To be Ordered as a Separate Line Item)	
Collet-ER25-CLTxx	ER25 DIN6499AA electropolished collet, 0.5 mm to 15 mm part holding sizes available
Collet-ER40-CLTxx	ER40 DIN6499AA electropolished collet, 15.5 mm to 25 mm part holding sizes available
CGF	Collet and gripper filtration kit
NOTE: ER40 collet sizes less than 15.5 mm diameter are not supported. Use the ER25 collect chuck if these sizes are required.	

Table 1-3: ACS200 Model Numbering System

ACS Mechanical-Bearing Direct-Drive Rotary Collet Stage, 200 mm diameter	
Stage Size (Required)	
-155	155 mm stage height; 11.1 N·m continuous torque
-185	185 mm stage height; 15.9 N·m continuous torque
Chuck Style (Required)	
-3J1	3-Jaw gripper with 12 mm clear aperture, 10 mm stroke, normally closed
-3J2	3-Jaw gripper with 12 mm clear aperture, 10 mm stroke, normally open
-3J3	3-Jaw gripper with 12 mm clear aperture, 16 mm stroke, normally closed
-3J4	3-Jaw gripper with 12 mm clear aperture, 16 mm stroke, normally open
-3J5	3-Jaw gripper with 25 mm clear aperture, 13 mm stroke, normally closed
-3J6	3-Jaw gripper with 25 mm clear aperture, 13 mm stroke, normally open
-3J7	3-Jaw gripper with 25 mm clear aperture, 20 mm stroke, normally closed
-3J8	3-Jaw gripper with 25 mm clear aperture, 20 mm stroke, normally open
Feedback (Required)	
-E1	Incremental encoder, 1 Vpp, sine wave output
-E2	Incremental encoder, Digital, RS422 line-driver, x5 interpolation
-E3	Incremental encoder, Digital, RS422 line-driver, x10 interpolation
-E4	Incremental encoder, Digital, RS422 line-driver, x25 interpolation
-E5	Incremental encoder, Digital, RS422 line-driver, x50 interpolation
NOTE: Digital output encoder signals are synthesized with a 16 MHz clock. Ensure that the encoder sample rate on the controller is at least 16 MHz or higher (slower clock rates are available on request).	
Metrology (Required)	
-PL1	Uncalibrated with performance plots
-PL2	Calibrated (HALAR) with performance plots
Accessories (To be Ordered as a Separate Line Item)	
CGF	Collet and gripper filtration kit

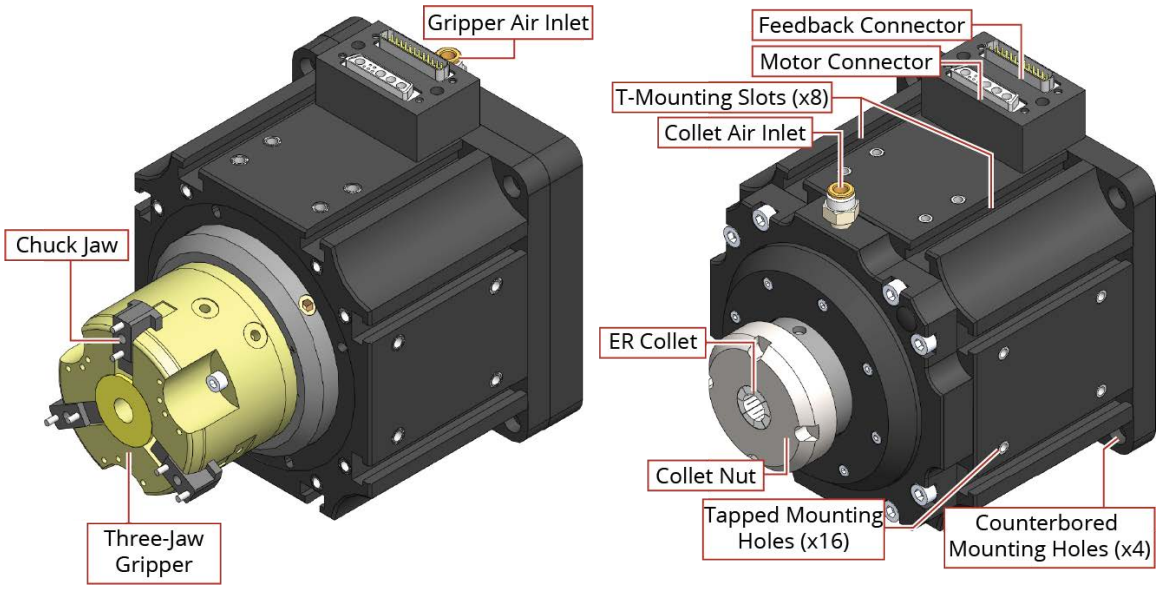

Figure 1-1: ACS Rotary Stage with Callouts

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 1-4: 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 ACS stages are not suited for dusty or wet environments. This equates to an ingress protection rating of IP40.
Use	Indoor use only

1.2. 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.

Table 1-5: ACS100 Series Specifications

ACS Series		ACS100-85	ACS100-135
Total Travel		±360° Continuous	
Collet Option(1)(6)		ER8	
Maximum Torque (Continuous)		0.48 N·m	1.6 N·m
Accuracy(2)	Calibrated	±73 µrad (±15 arc sec)	
	Uncalibrated	±146 µrad (±30 arc sec)	
Repeatability(2)		±29 µrad (±6 arc sec)	
Pin/Collet Runout (ER Collets)(3)		<25 µm	
Grip Repeatability / Max Jaw Length (3 Jaw)		± 20 µm / 50 mm	
Maximum Aperture	ER8	5 mm	5 mm
Maximum Load(4)	ER8	1.5 kg (Axial); 0.5 kg (Radial); 0.75 N·m (Moment)	
Rated Speed(5)		800 rpm	
Bus Voltage		Up to 340 VDC	
Total Mass		2.5 kg	4.5 kg
Finish	Table	Hardcoat	
	Stage	Black Anodize	

1. ACS collet chuck accepts Rego-Fix ER collets manufactured to DIN6499 specifications only.
2. Repeatability and accuracy are dependent on encoder resolution. To achieve the listed specifications, encoder resolution must be 1.2 arc sec or less.
3. Measured TIR of precision gage pin chucked with an ultra precision ER collet (DIN6499) 6 mm away from collet face with no load.
4. Maximum loads are mutually exclusive. Loading limits are due to the collet chuck mechanism. Contact Aerotech directly if part load requirement exceeds specifications.
5. Maximum speed based on stage capability. Maximum application velocity may be limited by system data rate and system resolution.
6. Collet chuck mechanism is normally-closed. Collet mechanism requires air to open collet chuck. Air supply must be dry (0ºF dew-point) oil-less air OR 99.99% pure Nitrogen. Air or nitrogen must be filtered to 1 micron particle size or better.

Table 1-6: ACS150 Series Specifications

ACS Series		ACS150-115	ACS150-135	ACS150-180
Total Travel		±360° Continuous		
Gripper/Collet Option(1)(6)		ER25, ER40, 3J-12		
Maximum Torque (Continuous)		2.85 N·m	5.06 N·m	9.29 N·m
Accuracy(2)	Calibrated	±73 µrad (±15 arc sec)		
	Uncalibrated	±146 µrad (±30 arc sec)		
Repeatability(2)		±29 µrad (±6 arc sec)		
Pin/Collet Runout (ER Collets)(3)		<25 µm		
Grip Repeatability/Max Jaw Length (3 Jaw)		±20 µm/50 mm		
Maximum Aperture	ER25	16 mm		
	ER40	30 mm		
	3J-12	12 mm		
Maximum Loads(4)	ER25	10 kg (Axial); 5 kg (Radial); 6 N·m (Moment)		
	ER40	15 kg (Axial); 10 kg (Radial); 12 N·m (Moment)		
	3J-12	20 kg (Axial); 11 kg (Radial); 6 N·m (Moment)		
Rated Speed(5)		600 rpm		
Bus Voltage		Up to 340 VDC		
Total Mass	ER25 / ER40	8.0 kg	10.0 kg	14.0 kg
	3J-12	7.8 kg	9.7 kg	13.7 kg
Finish	Table	Hardcoat		
	Stage	Black Anodize		

1. ACS collet chuck accepts Rego-Fix ER collets manufactured to DIN6499 specifications only.
2. Repeatability and accuracy are dependent on encoder resolution. To achieve the listed specifications, encoder resolution must be 1.2 arc sec or less.
3. Measured TIR of precision gage pin chucked with an ultra precision ER collet (DIN6499) 6 mm away from collet face with no load.
4. Maximum loads are mutually exclusive. Loading limits are due to the collet chuck mechanism. Contact Aerotech directly if part load requirement exceeds specifications.
5. Maximum speed based on stage capability. Maximum application velocity may be limited by system data rate and system resolution.
6. Collet chuck mechanism is normally-closed. Collet mechanism requires air to open collet chuck. Air supply must be dry (0ºF dew-point) oil-less air OR 99.99% pure Nitrogen. Air or nitrogen must be filtered to 1 micron particle size or better. With 3-jaw gripper, air or nitrogen should be filtered to 20 micron particle size or better.

Table 1-7: ACS200 Series Specifications

ACS Series		ACS200-155	ACS200-185
Total Travel		±360° Continuous	
Gripper Option		3J1 through 3J8	
Maximum Torque (Continuous)		11.2 N·m	15.93 N·m
Accuracy(1)	Calibrated	±73 µrad (±15 arc sec)	
	Uncalibrated	±146 µrad (±30 arc sec)	
Repeatability(1)		±29 µrad (±6 arc sec)	
Grip Repeatability(2)		±20 µm	
Max Jaw Length from Chuck Face	3J-12	50 mm	
	3J-25	70 mm	
Aperture	3J-12	12 mm	
	3J-25	25 mm	
Maximum Loads(3)	3J-12	20 kg (Axial); 11 kg (Radial); 6 N·m (Moment)	
	3J-25	30 kg (Axial); 18 kg (Radial); 13 N·m (Moment)	
Rated Speed(4)		600 rpm	
Bus Voltage		340 VDC	
Total Mass		20.2 kg	24.3 kg
Finish	Table	Hardcoat	
	Stage	Black Anodize	

1. Repeatability and accuracy are dependent on encoder resolution. To achieve the listed specifications, encoder resolution must be 1.2 arc sec or less.
2. Measured TIR of precision gage pin 10 mm away from gripper face with no load.
3. Maximum loads are mutually exclusive. Loading limits are due to the collet chuck mechanism. Contact Aerotech directly if part load requirement exceeds specifications.
4. Maximum speed based on stage capability. Maximum application velocity may be limited by system data rate and system resolution.

1.3. Air Requirements

The air pressure supplied to the collet holder or gripper is important in ensuring that the material or tool is released properly, or for the optional gripper, that the material is held securely.

- If compressed air is used, it must be filtered to 1 micron, dry to 0º F dew point, and oil free.
- If nitrogen is used, it must be 99.99% pure and filtered to 1 microns.

For stages equipped with a three-jaw gripper, air must be regulated to between 3 and 7 bar (45 and 100 psig). Higher pressures could cause damage to the gripper assembly and should be avoided. The chuck becomes fully open at approximately 4-7 bar (60-100 psig) depending on the collet size. Higher pressures will not cause damage to the rotary union, but high flow rates will result. Because of the noncontact rotary union design on collet-equipped stages, a small amount of leakage will occur. Approximate leakage rates of between 10 Lpm (0.5 CFM) and 40 Lpm (1.4 CFM), depending on pressure, will be observed when the collet is open.

Chapter 2: Mechanical Specifications and Installation

WARNING: ACS 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 ACS. Unsecured moving parts may shift and cause bodily injury.
- Improper handling could adversely affect the performance of the ACS. Use care when moving the ACS.
- 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 ACS stage from its protective shipping container. Gently set the ACS stage on a smooth, flat, and clean surface.

Before operating the ACS stage, 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 ACS 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 ACS 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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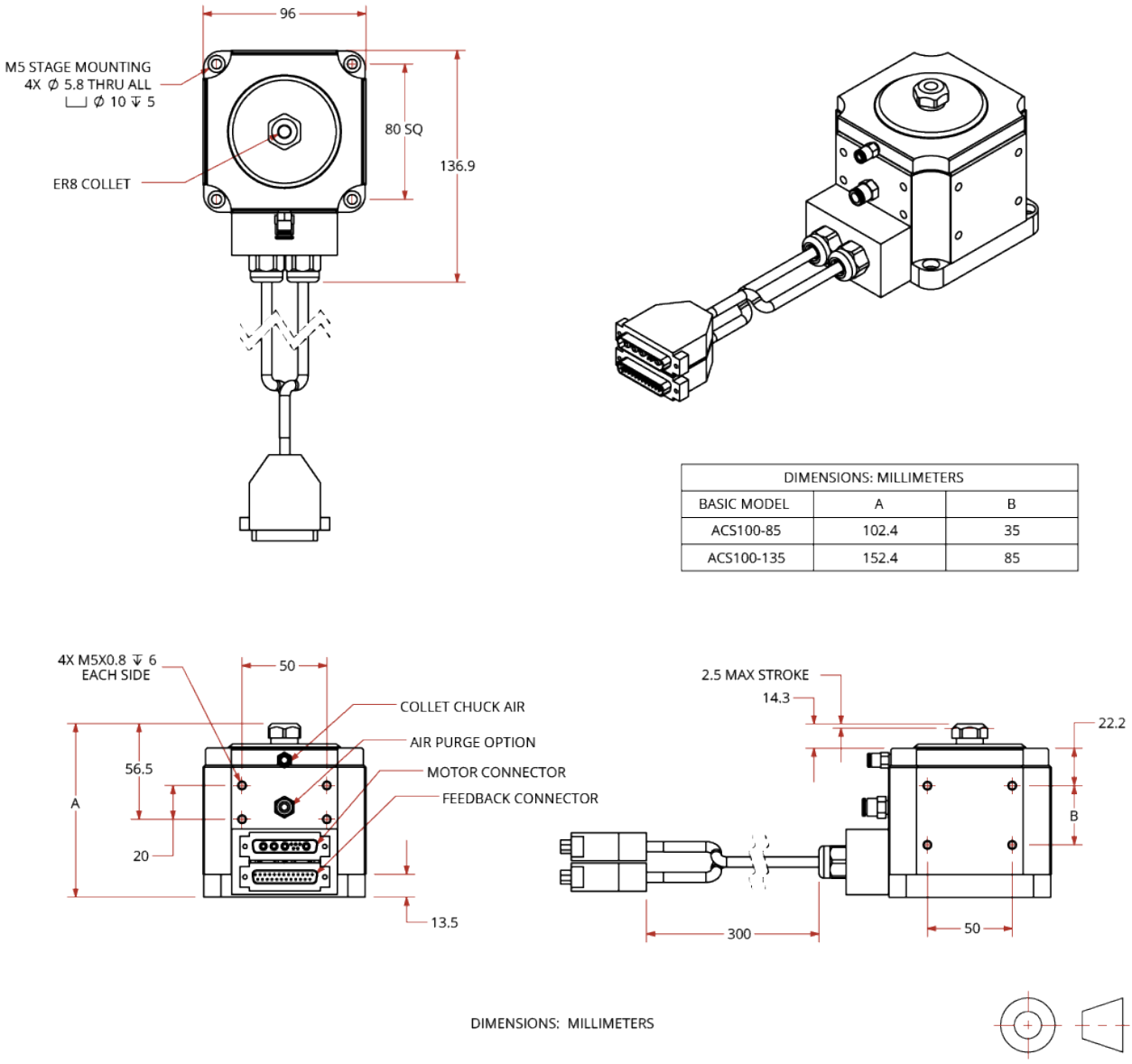
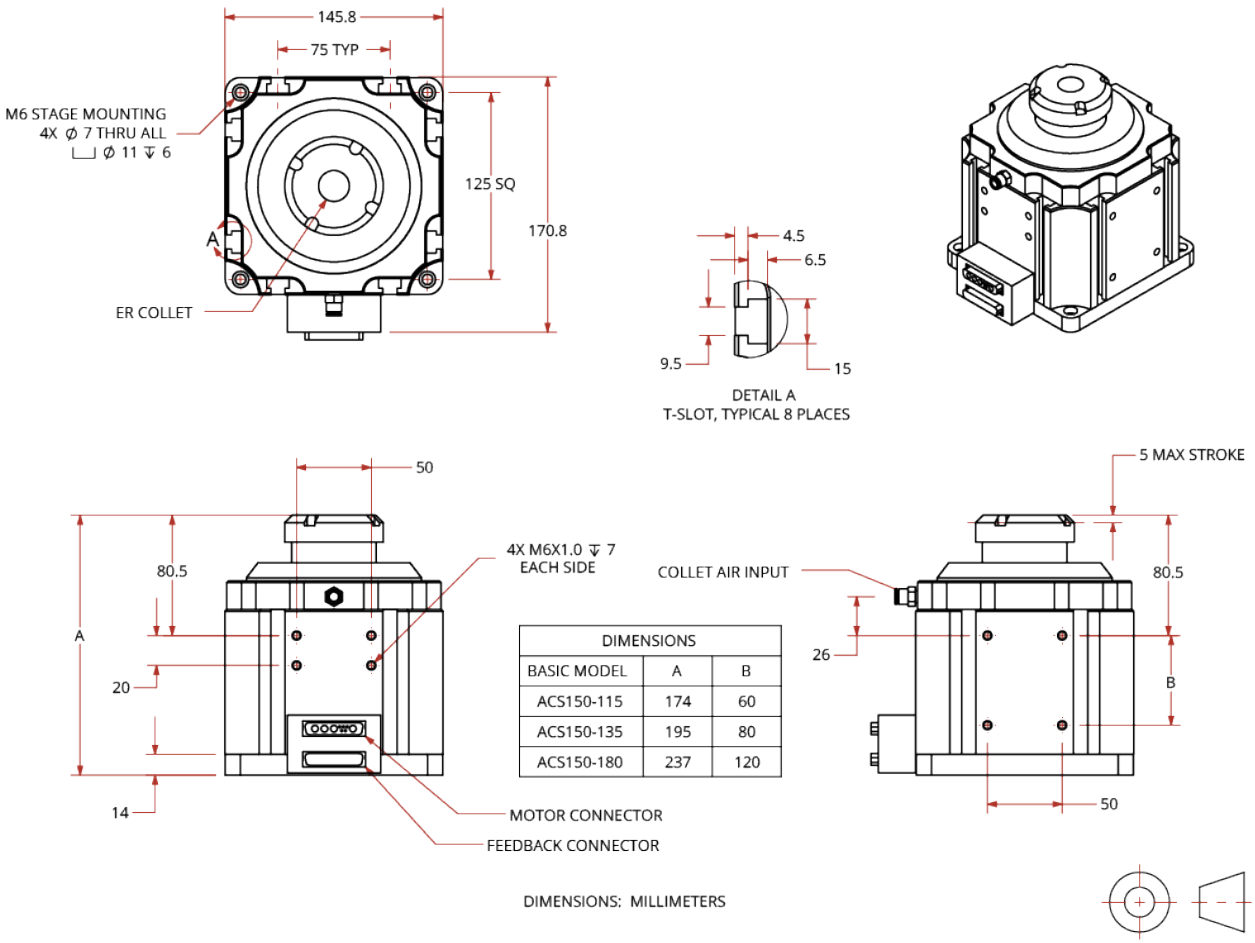
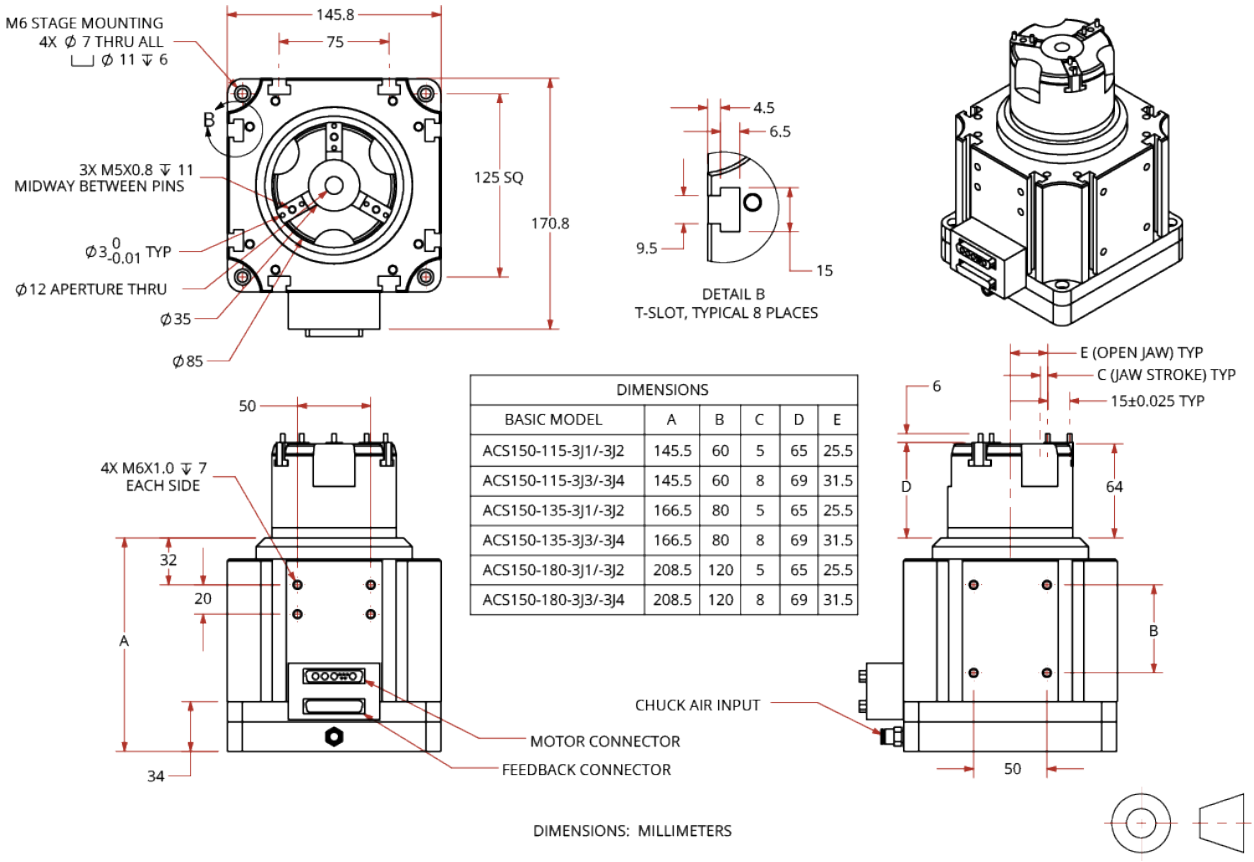


Figure 2-1: ACS100 Dimensions



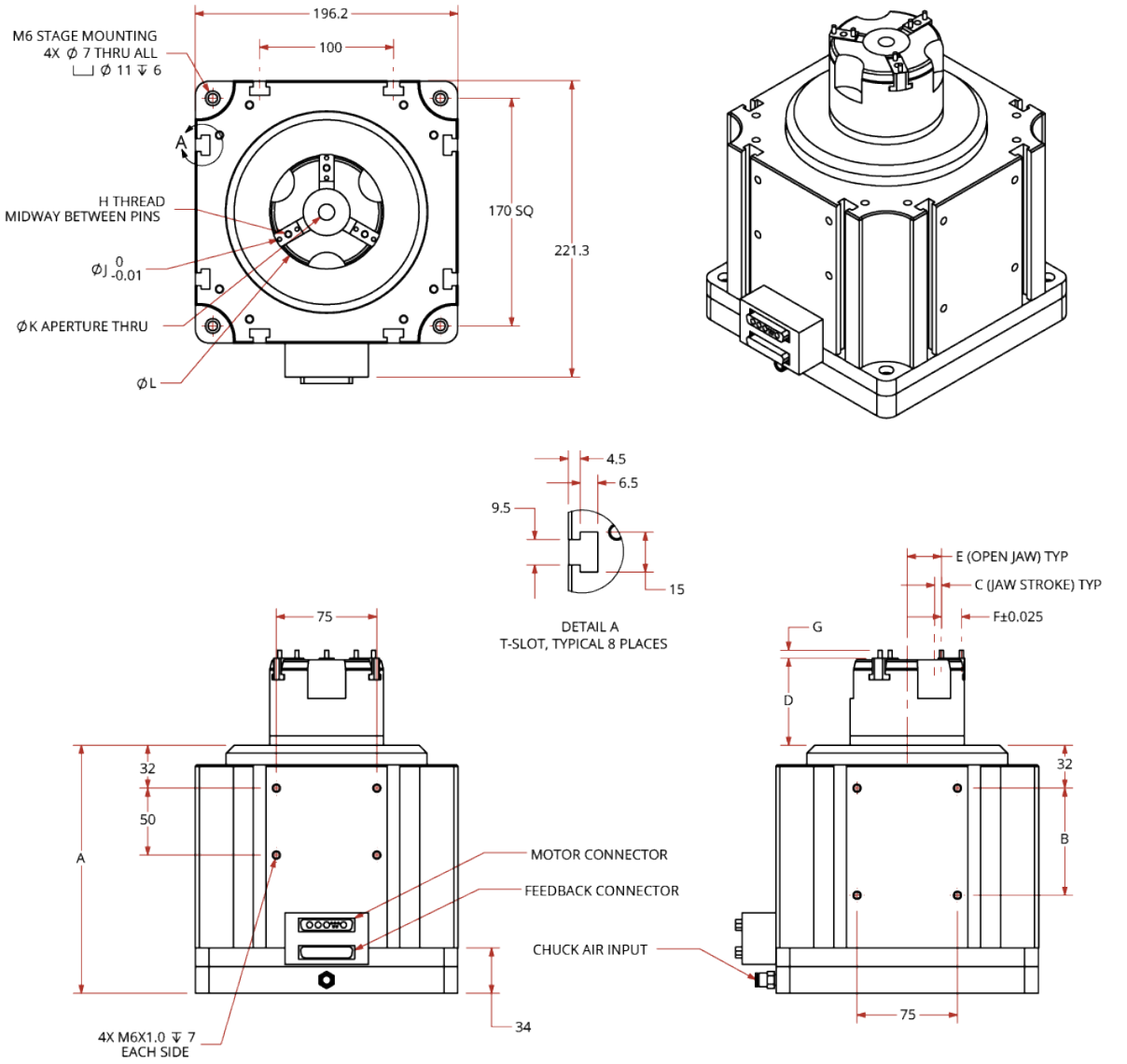
DIMENSIONS		
BASIC MODEL	A	B
ACS150-115	174	60
ACS150-135	195	80
ACS150-180	237	120

Figure 2-2: ACS150 (-ER Chuck Style) Dimensions



DIMENSIONS					
BASIC MODEL	A	B	C	D	E
ACS150-115-3J1/-3J2	145.5	60	5	65	25.5
ACS150-115-3J3/-3J4	145.5	60	8	69	31.5
ACS150-135-3J1/-3J2	166.5	80	5	65	25.5
ACS150-135-3J3/-3J4	166.5	80	8	69	31.5
ACS150-180-3J1/-3J2	208.5	120	5	65	25.5
ACS150-180-3J3/-3J4	208.5	120	8	69	31.5

Figure 2-3: ACS150 (-3J Chuck Style) Dimensions



DIMENSIONS											
BASIC MODEL	A	B	C	D	E	F	G	H	J	K	L
ACS200-155-3J1/-3J2	185.3	80	5	65	25.5	15	6	M5X0.8↧11	3	12	85
ACS200-155-3J3/-3J4	185.3	80	8	69	31.5	15	6	M5X0.8↧11	3	12	85
ACS200-155-3J5/-3J6	185.3	80	6.5	77	37.5	20	7	M6X1.0↧12	4	25	115
ACS200-155-3J7/-3J8	185.3	80	10	82	44.5	20	7	M6X1.0↧12	4	25	115
ACS200-185-3J1/-3J2	210.3	100	5	65	25.5	15	6	M5X0.8↧11	3	12	85
ACS200-185-3J3/-3J4	210.3	100	8	69	31.5	15	6	M5X0.8↧11	3	12	85
ACS200-185-3J5/-3J6	210.3	100	6.5	77	37.5	20	7	M6X1.0↧12	4	25	115
ACS200-185-3J7/-3J8	210.3	100	10	82	44.5	20	7	M6X1.0↧12	4	25	115

DIMENSIONS: MILLIMETERS

Figure 2-4: ACS200 (-3J Chuck Style) Dimensions

2.3. Securing the Stage to the Mounting Surface

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

WARNING: The ACS 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 to achieve the maximum performance from the ACS 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 5 µm over the entire stage footprint.

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

ACS series stages have a fixed mounting pattern (as shown in Figure 2-5).

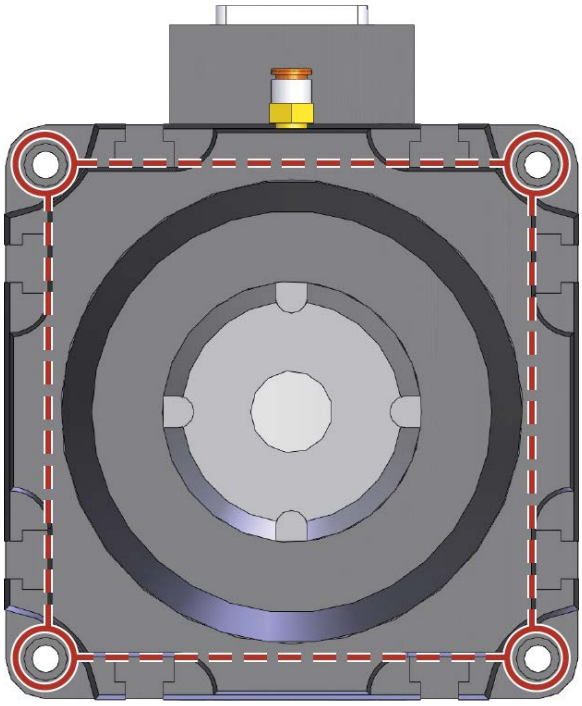
Eight T-slots are included as a standard feature on the ACS150 and ACS200 models. The dimensions of these T-slots are identical for the ACS150 and ACS200 (refer to Figure 2-6).

T-slots are not available on the ACS100 series stages.

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.

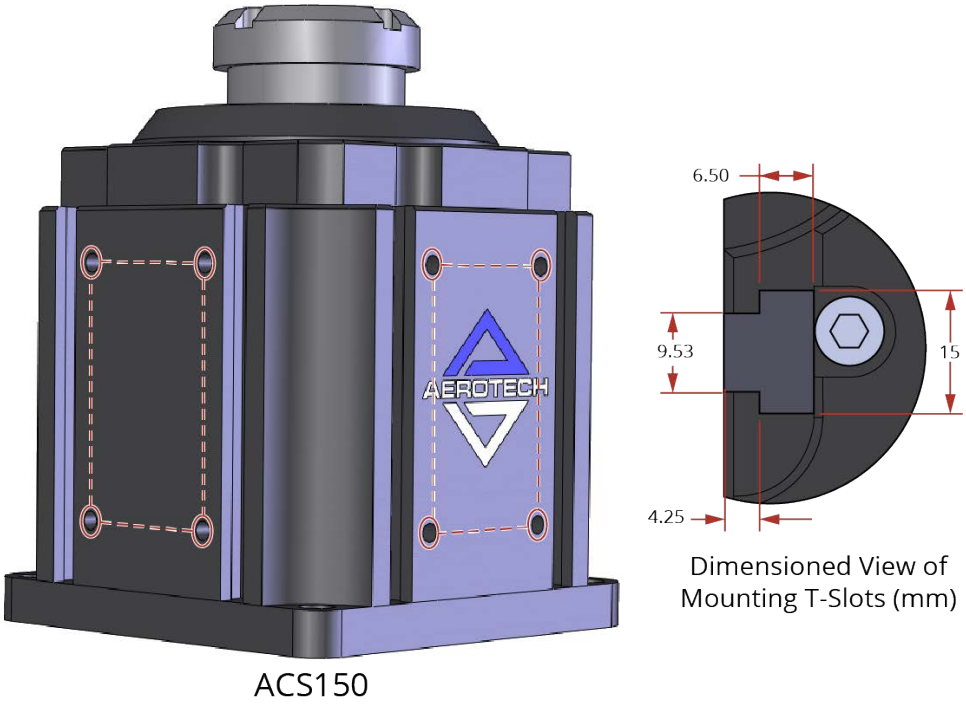
Table 2-1: Stage to Mounting Surface Hardware

Mounting Hardware			Typical Screw Torque
ACS100	Standard	5 mm [#10] SHCS	4 N·m
	Side	M5 x 0.8 THD x 6.4 [0.25] DP	4 N·m
ACS150, ACS200	Standard	6 mm [1/4”] SHCS	7 N·m
	Side	M5 x 0.8 THD x 7.6 [0.30] DP	4 N·m



ACS150

Figure 2-5: ACS Stage Mounting Holes



ACS150

Figure 2-6: Typical ACS150 Stage Showing Side Mounting Holes and T-Slot Detail

2.4. Clamping a Workpiece to the Collet

To prevent damage to the stage or parts, test the operation of the stage before any material is held in the collet or gripper. Proceed with the electrical installation and test the motion control system. Document all results for future reference. For information on electrical connections, refer to the documentation of the motion control system and Chapter 3.

To operate the collet, clean compressed air or nitrogen must be supplied to the stage (refer to Section 1.3.). The one-touch air inlet fitting accepts 1/4 inch OD plastic air line. Simply push the air line into the fitting and supply air to the stage. Depending on the pneumatics kit option chosen, Aerotech provides valves, fittings, and airlines in the kit to connect the collet system.

Once air is supplied, material of the appropriate size can be placed in the collet. All collets supplied by Aerotech are clearly labeled with their clamping size range and collet style. Be sure to use only the correct size material in the collet. If an incorrect material size is clamped, the accuracy of the collet could be compromised. Never clamp material or tools that are larger than the specified range. It is also important to have the material or tool inserted at least 2/3 the length of the collet bore. Any less than this could cause permanent deformation of the collet and reduce accuracy (refer to Section 2.5.1. for collet installation).

2.4.1. Load Capability

The ACS is designed for tubular manufacturing applications. With this in mind, the tubes loaded into the collet chuck of the rotary axis must fall within the maximum load parameters in Section 1.2.

NOTE: Maximum loads are mutually exclusive. Loading limits are due to the collet chuck mechanism. Contact Aerotech directly if part load requirement exceeds specifications.

NOTE: Moment loads on the collet assembly, even if within the allowable load range, may adversely affect collet runout. Avoid moment loads for optimal performance.

2.5. Changing the Workholding Devices

NOTE: Aerotech recommends using only electro-polished collets manufactured to DIN6499 specifications.

Various grip diameters are commonly available and can be interchanged following the collet removal and installation procedure detailed in Section 2.5.1.

ACS series stages are equipped with an ER style collet or a three-jaw gripper chuck. It may be necessary to change the style of collet or gripper. It is important that only collets designed for a particular collet holder are used. If necessary, check the part number on the stage to determine if the collet holder is designed for ER25 or ER40 collets.

ACS150 stages can be equipped with an ER25 collet, ER40 collet, or 3J-12 three-jaw gripper. Refer to Section 2.5.2. for directions on changing the collet chuck. For 3-Jaw gripper configurations (ACS150 and ACS200), refer to Section 2.5.3.

2.5.1. Collet Change Procedure

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.

Step 1: Remove power to the stage before installing or removing the collet.

Step 2: Apply air pressure to loosen the collet chuck.

Step 3: Remove the collet nut by turning it counterclockwise. If necessary, use a spanner wrench (available from Aerotech). Use caution when removing the collet nut as the collet may fall from its housing and be damaged.

Step 4: Clean the collet housing, collet nut threads, collet nut, and new collet. Acetone or isopropyl alcohol can be used to clean the metal components. Apply a small amount of any anti-seize lubricant to the collet taper to help reduce friction and decrease wear (refer to section Section 4.2.1.).

Step 5: Refer to the instructions in Figure 2-7 to install or remove a collet from the collet nut.

Step 6: Use the collet nut to guide the collet into the stage (Figure 2-8). Make sure that the collet is installed properly in its taper. Be sure that air pressure is still being supplied to the stage so the collet chuck is in the open position.

Step 7: Tighten the collet nut. Tightening by hand is sufficient as the clamping force is not determined by the torque of the nut, but by the force of internal springs. Spanner wrenches may be used if desired.

Step 8: Restore power to the stage.

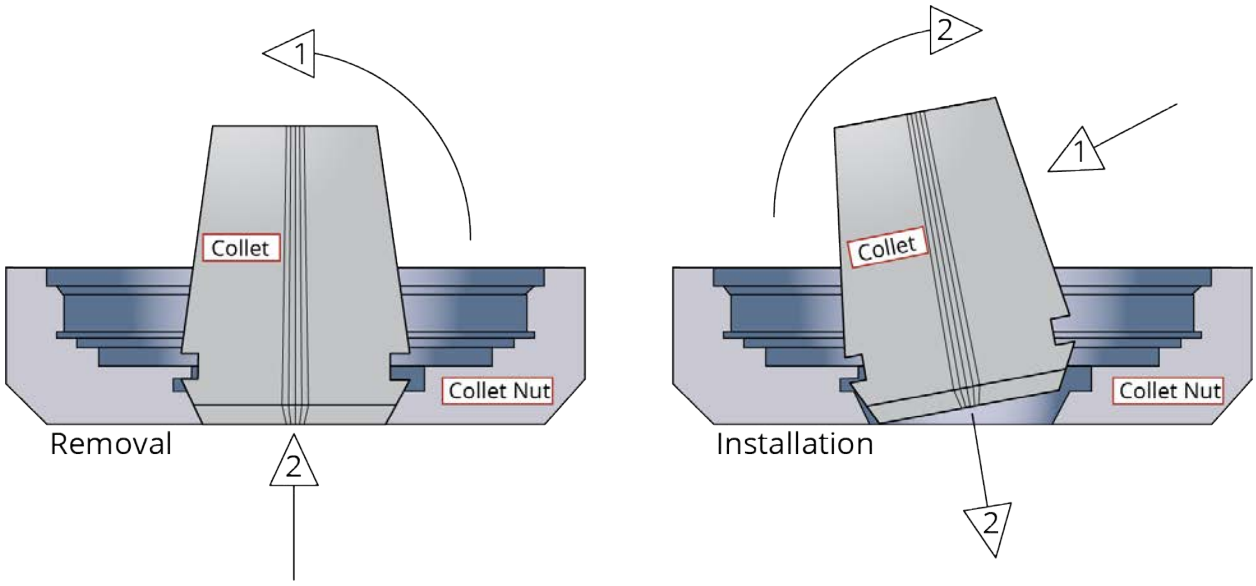


Figure 2-7: Schematic of Collet Insertion Into and Removal From Collet Nut

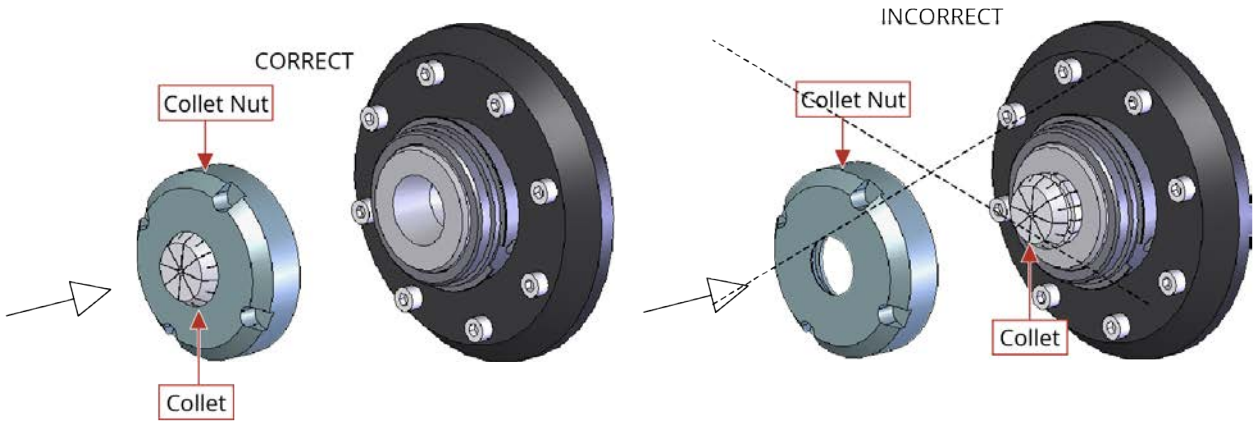


Figure 2-8: Installation Procedure for Collet

2.5.2. Changing Collet Chucks (ACS150)

ACS series stages are configurable with ER collet chucks for both ER25 and ER40 collets. In order to switch from the ER25 to the ER40 (or vice versa), some disassembly is required.

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.

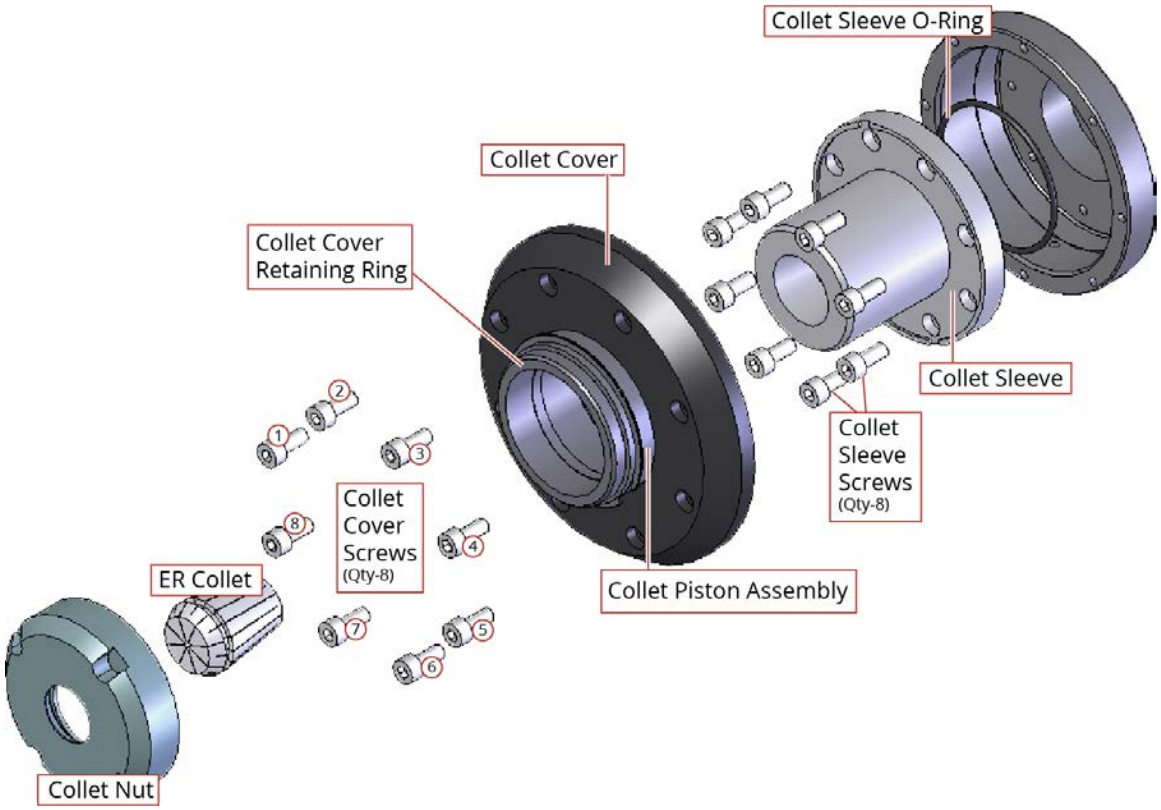


Figure 2-9: Collet Assembly Exploded View

Step 1: Remove power to the stage before installing or removing the collet.

Step 2: Apply air pressure to loosen the collet chuck.

Step 3: Remove the collet nut by turning it counterclockwise. If necessary, use a spanner wrench (available from Aerotech). Use caution when removing the collet nut as the collet may fall from its housing and be damaged.

DANGER: The collet cover is under tension from internal springs. Removing the collet cover screws incorrectly can result in personal harm and damage to the equipment.

Step 4: Remove air pressure from the stage. This will decrease the tension of the internal springs and make disassembling easier. Only continue to disassemble if the air pressure is completely removed.

Step 5: Remove every other collet cover screw (see Figure 2-9). DO NOT remove all of the screws at the same time. The cap is under tension from several springs and will be damaged or cause bodily harm if not removed carefully.

Step 6: Obtain [QTY. 4] M4 x 0.7 x 12 mm long socket head cap screws and thread them into the holes where the previous screws were removed in step 5. Tighten each one until it bottoms out in its hole.

Step 7: Loosen the four shorter (factory installed) screws, 1/4 turn at a time in a cross pattern. For example, loosen screw number 2, then screw number 6, then screw number 8, then screw number 4, then return to screw number 2. Repeat this process until the longer screws are supporting the tension of the springs entirely. It is then safe to remove the shorter screws completely.

Step 8: Using the same method as in step 7, remove the longer screws until the spring tension is completely relieved.

Step 9: Carefully slide the collet piston assembly out from its housing. Use caution to not tilt the piston assembly in its housing. This could cause damage to the housing, seals, or piston.

Step 10: It is now safe to remove the collet cover retaining ring. This can be done with a flat-head screwdriver or a pair of needle nosed pliers.

Step 11: Remove the collet cover and the springs from the collet piston.

Step 12: Remove the collet sleeve and collet sleeve O-ring.

Step 13: Thoroughly clean the new collet sleeve and nut as well as all old components. Inspect the seals and O-ring for damage or excessive wear. Replace if necessary.

Step 14: Insert the collet sleeve O-ring into its groove. Place the new collet sleeve into the shaft. Although the collet sleeve is designed for easy assembly, it may require some indicating of the taper to achieve the best possible runnout. Finger tighten all eight screws, then tighten in a cross pattern to a torque of 1.8-2.0 N·m (16-18 in-lbs).

Step 15: Reinstall the collet piston assembly into its housing. Use of O-ring lubricant is recommended during reassembly. There are chamfers to help guide the piston into place, but use caution not to twist or damage the seals.

Step 16: Replace the collet piston assembly.

Step 17: Installation of the collet cover is the reverse of removal. Begin with the four 12 mm long screws in every other hole and tighten until they bottom out in their respective holes. Then install the shorter original screws into the remaining holes and tighten in a cross pattern until the collet cover is seated against the shaft. Install the remaining four original screws. Torque all screws to a final torque of 1.8-2.0 N·m (16-18 in-lbs).

Step 18: Apply air pressure to the stage in order to install the collet.

Step 19: Install the new collet and collet nut as described in Section 2.5.1.

Step 20: Restore the air supply to the original settings and restore power to the stage.

2.5.3. Gripper Configurations (ACS150 and ACS200)

The grippers are configurable in both normally-closed and normally-open modes. The center shaft of the ACS stages has two sets of mounting holes for the three-jaw grippers, one for a normally-open configuration and one for a normally-closed configuration. See Figure 2-10 for locations of these holes. Figure 2-11 shows the mounting screw locations on the gripper itself. The following is the procedure to change configurations:

1. Remove power to the stage and disconnect air supply.
2. Remove the three gripper mounting screws.
3. Figure 2-12 shows the locations of the set screws in the gripper based on which configuration is desired. Move the set screws as necessary.
4. It will be necessary to move an O-Ring on the shaft. Figure 2-10 shows two O-Rings and the three O-Ring grooves. One O-Ring should always be around the air inlet hole, and the other must be moved to help seal the gripper. Move the O-Ring as necessary so that the set screw in the gripper will be surrounded by an O-Ring when it is bolted to the stage.
5. Bolt the gripper to the stage shaft using the holes labeled either “NC” (normally-closed), or “NO” (normally-open).
6. Restore power and air supply to the stage.

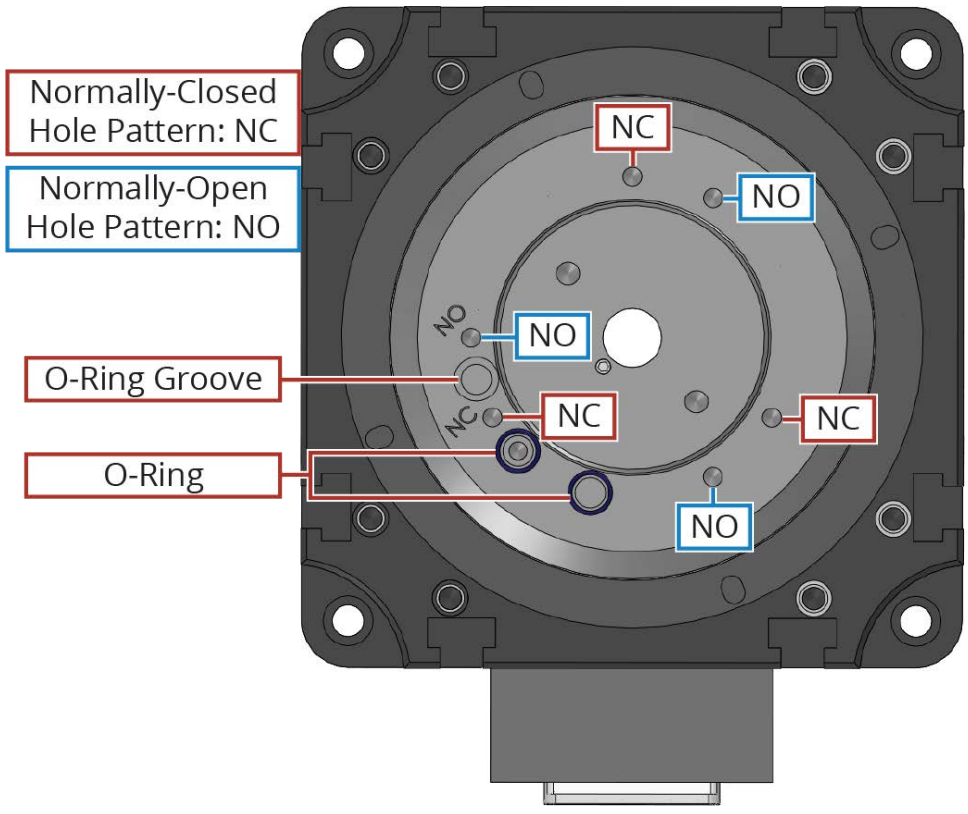


Figure 2-10: Gripper Mounting Hole Locations in ACS Shaft

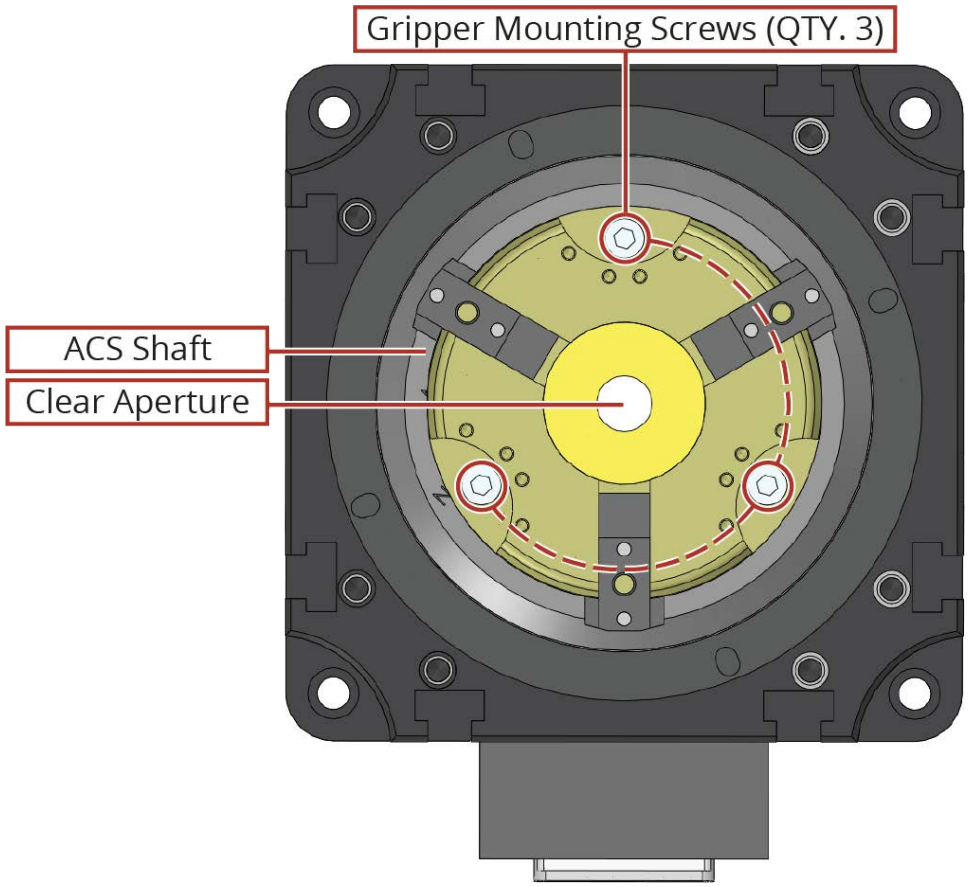


Figure 2-11: Mounting Holes for Three-Jaw Gripper

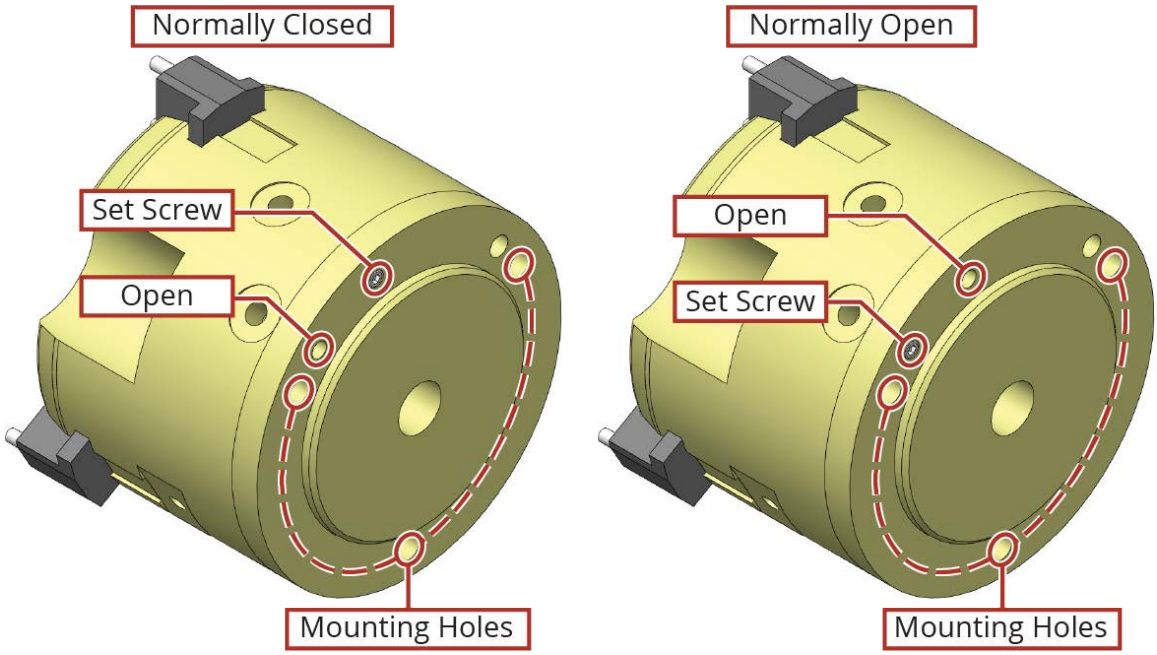


Figure 2-12: Air Inlets in Three-Jaw Grippers

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 ACS is part of a complete Aerotech motion control system, setup usually involves connecting the ACS 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.

NOTE: If using standard Aerotech motors and cables, motor and encoder connection adjustments are not required.

The protective ground connection of the ACS 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: Motor Pinouts (-CN1 option on the ACS100; standard on the ACS150 and ACS200)

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)	

NOTE: -CN1 is one of the connector options for the ACS100 (e.g., ACS100-CN1). The ACS150 and ACS200 do not have connector options and come standard with a -CN1 connector.

Table 3-2: Mating Connector Part Numbers for the Motor Connector (-CN1 option on the ACS100; standard on the ACS150 and ACS200)

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: Motor Pinouts (-CN2 option on the ACS100 only)

Pin	Description	Connector
11	Motor Phase A	
12		
13		
24		
25		
8	Motor Phase B	
9		
20		
21		
22		
4	Motor Phase C	
5		
6		
17		
18		
CASE	Frame Ground (motor protective ground)	
1		
2		
14		
15		
NOTE: -CN2 is one of the connector options available for the ACS100 (e.g., ACS100-CN2).		

Table 3-4: Mating Connector Part Numbers for the -CN2 Motor Option Connector

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

Table 3-5: Feedback Pinouts

Pin	Description	Connector
Case	Shield	
1	Reserved	
2	Over-Temperature Thermistor sensor	
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	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	Encoder Fault (Reserved on ACS100)	
24	Reserved	
25	Reserved	

Table 3-6: Mating Connector Part Numbers for the Feedback 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 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.

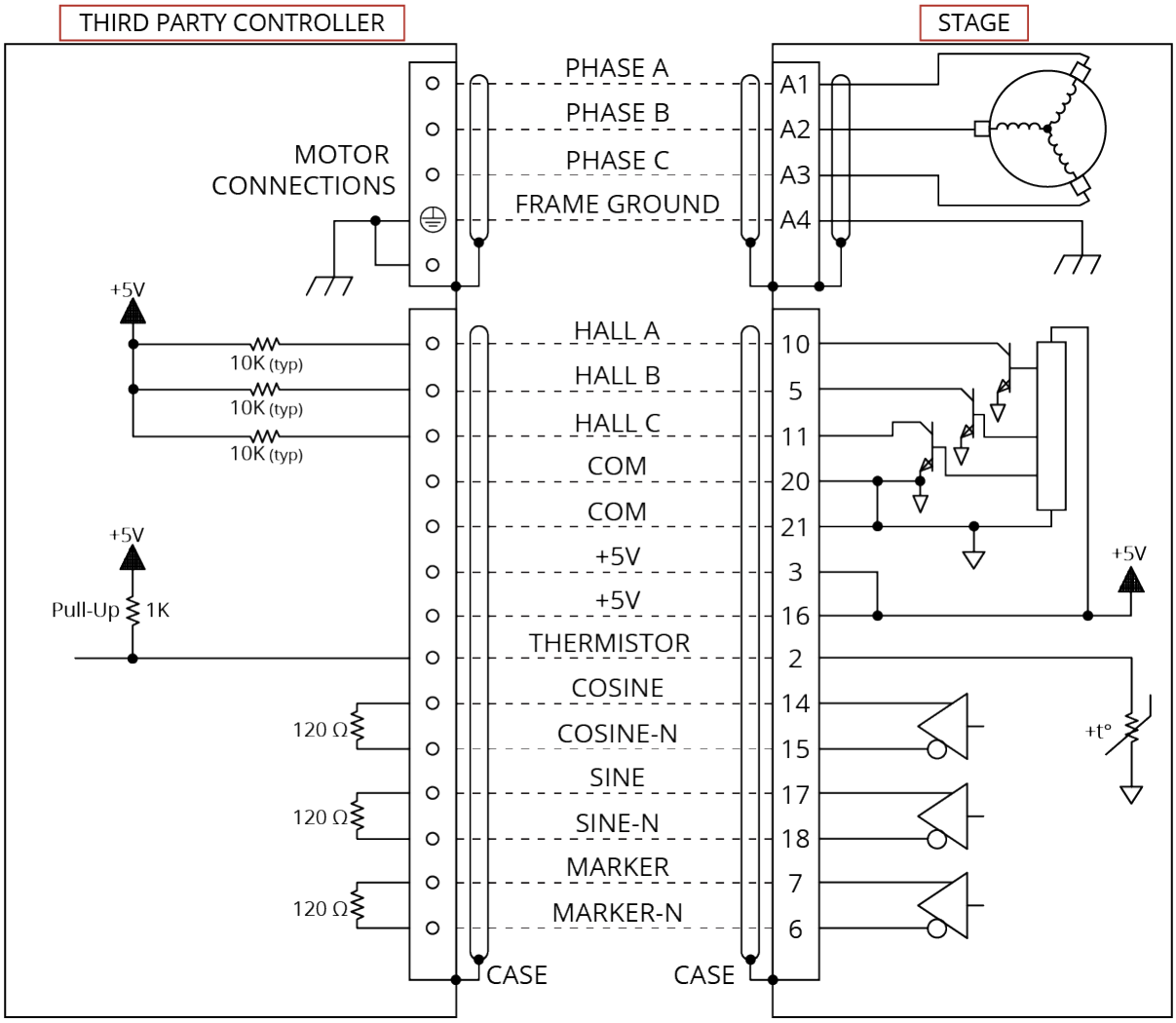


Figure 3-1: Motor and Feedback Wiring (ACS100 -CN1)

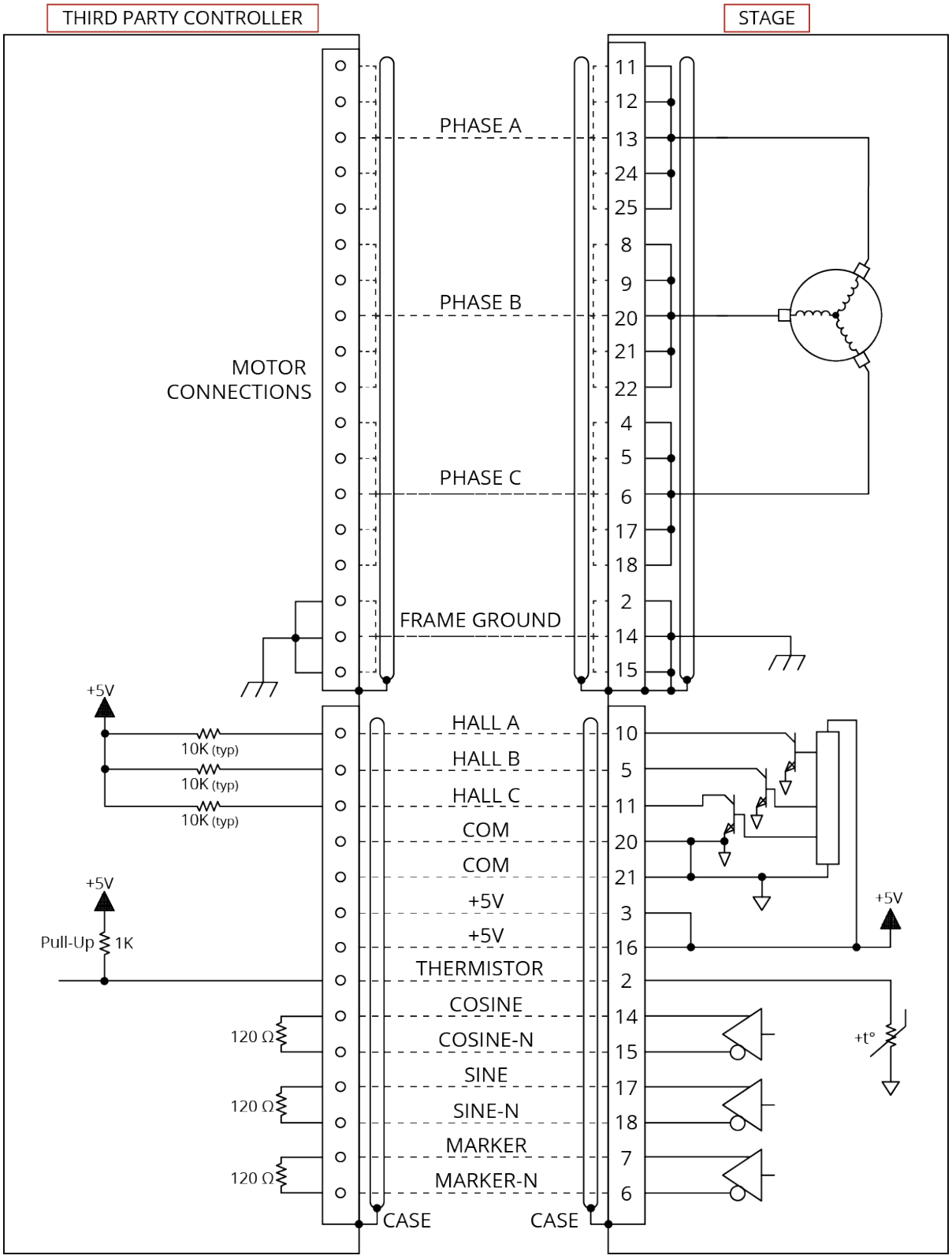


Figure 3-2: Motor and Feedback Wiring (ACS100 -CN2)

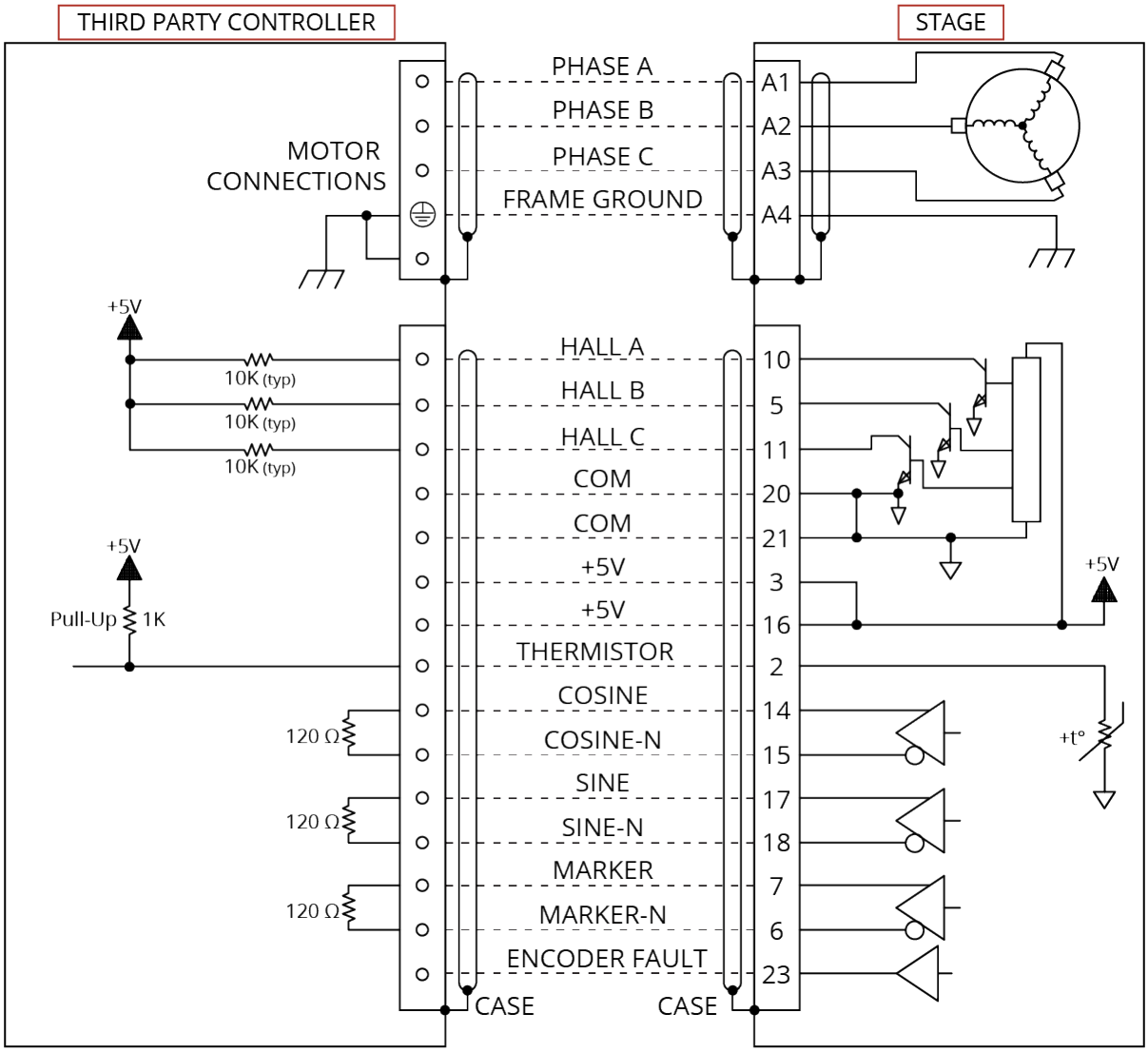


Figure 3-3: Motor and Feedback Wiring (ACS150 and ACS200)

3.3. Motor and Feedback Specifications

Table 3-7: 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

Table 3-8: Encoder Specifications

Model	ACS100, ACS150	ACS200
Fundamental Resolution	3600 lines/rev	5400 lines/rev
-E1(1)	0.09/0.0225 arc sec/line	0.06/0.015 arc sec/line
-E2	18 arc sec/line	12 arc sec/line
-E3	9 arc sec/line	6 arc sec/line
-E4	3.6 arc sec/line	2.4 arc sec/line
-E5	1.8 arc sec/line	1.2 arc sec/line
1. -E1 shows x4000/x16000 total interpolation		

Table 3-9: Maximum Speed (rpm) Per Encoder Option

Encoder Option	ACS100	ACS150	ACS200
-E1, -E2, -E3, -E4	800 rpm	600 rpm	600 rpm
-E5	800 rpm	600 rpm	500 rpm

NOTE: The encoders used on all ACS 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 3-10: Motor Specifications (ACS100)

		S-76-35 (ACS100-85)	S-76-85 (ACS100-135)
Performance Specifications (1,5)			
Winding Designation		-A	-A
Stall Torque, Cont. (2)	N·m	0.48	1.60
Peak Torque (3)	N·m	1.92	6.41
Electrical Specifications (5)			
Winding Designation		-A	-A
BEMF Const., line-line, Max	V_{pk}/krpm	29.1	57.0
Continuous Current, Stall (2)	A_{pk}	2.0	3.8
	A_{rms}	1.4	2.7
Peak Current, Stall (2)	A_{pk}	8.0	15.2
	A_{rms}	5.7	10.7
Torque Constant (4, 9)	$N·m/A_{pk}$	0.24	0.42
	$N·m/A_{rms}$	0.34	0.60
Motor Constant (2, 4)	$N·m/\sqrt{W}$	0.075	0.179
Resistance, 25°C, line-line	Ω	10.5	5.7
Inductance, line-line	mH	1.40	1.10
Maximum Bus Voltage	V_{DC}	340	340
Thermal Resistance	°C/W	1.83	0.93
Number of Poles	--	14	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 3-11: Motor Specifications (ACS150)

		S-130-39 (ACS150-115)	S-130-60 (ACS150-135)	S-130-81 (ACS150-180)
Performance Specifications (1,5)				
Winding Designation		-A	-A	-A
Stall Torque, Cont. (2)	N·m	2.36	4.18	5.89
Peak Torque (3)	N·m	9.42	16.73	23.55
Electrical Specifications (5)				
Winding Designation		-A	-A	-A
BEMF Const., line-line, Max	V_{pk}/krpm	75.1	148.9	222.7
Continuous Current, Stall (2)	A_{pk}	3.8	3.4	3.2
	A_{rms}	2.7	2.4	2.3
Peak Current, Stall (2)	A_{pk}	15.2	13.6	12.8
	A_{rms}	10.7	9.6	9.1
Torque Constant (4, 9)	N·m/A_{pk}	0.62	1.23	1.84
	N·m/A_{rms}	0.88	1.74	2.60
Motor Constant (2, 4)	N·m/√W	0.265	0.446	0.586
Resistance, 25°C, line-line	Ω	5.6	7.8	10.1
Inductance, line-line	mH	1.70	1.80	2.80
Maximum Bus Voltage	V_{DC}	340	340	340
Thermal Resistance	°C/W	0.95	0.85	0.74
Number of Poles	--	18	18	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 3-12: Motor Specifications (ACS200)

		S-180-69 (ACS200-155)	S-180-94 (ACS200-185)
Performance Specifications (1,5)			
Winding Designation		-A	-A
Stall Torque, Cont. (2)	N·m	11.12	15.93
Peak Torque (3)	N·m	44.47	63.70
Electrical Specifications (5)			
Winding Designation		-A	-A
BEMF Const., line-line, Max	V_{pk}/krpm	263.9	393.4
Continuous Current, Stall (2)	A_{pk}	5.1	4.9
	A_{rms}	3.6	3.5
Peak Current, Stall (2)	A_{pk}	20.4	19.6
	A_{rms}	14.4	13.9
Torque Constant (4, 9)	N·m/A_{pk}	2.18	3.25
	N·m/A_{rms}	3.08	4.60
Motor Constant (2, 4)	N·m/√W	1.053	1.391
Resistance, 25°C, line-line	Ω	4.4	5.6
Inductance, line-line	mH	1.70	2.60
Maximum Bus Voltage	V_{DC}	340	340
Thermal Resistance	°C/W	0.67	0.57
Number of Poles	--	18	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 3-4 shows the machine direction of ACS stages.

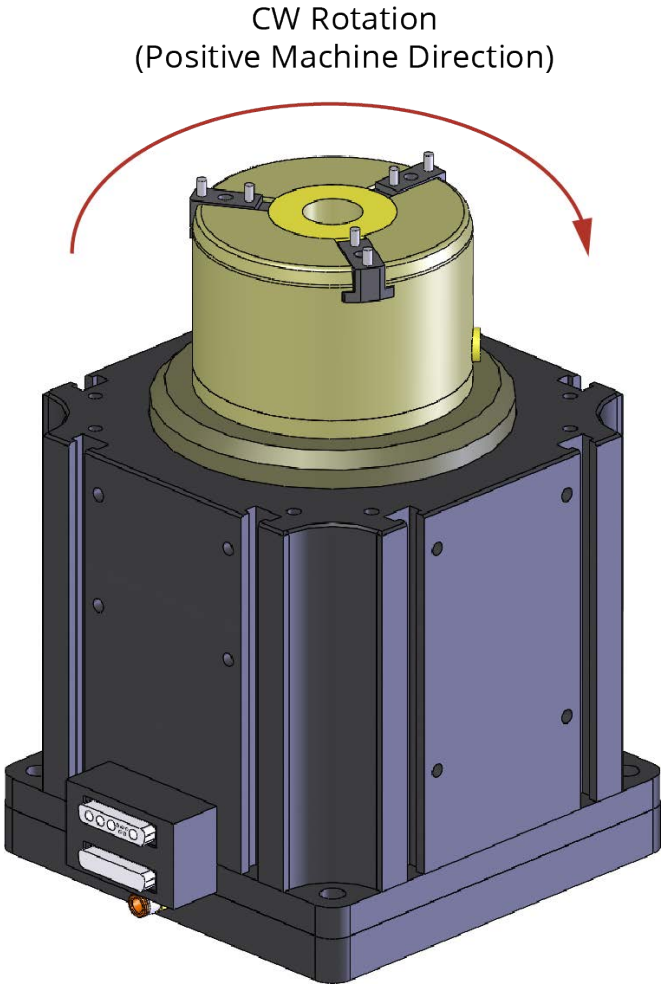


Figure 3-4: Machine Direction

3.5. Motor and Feedback Phasing

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

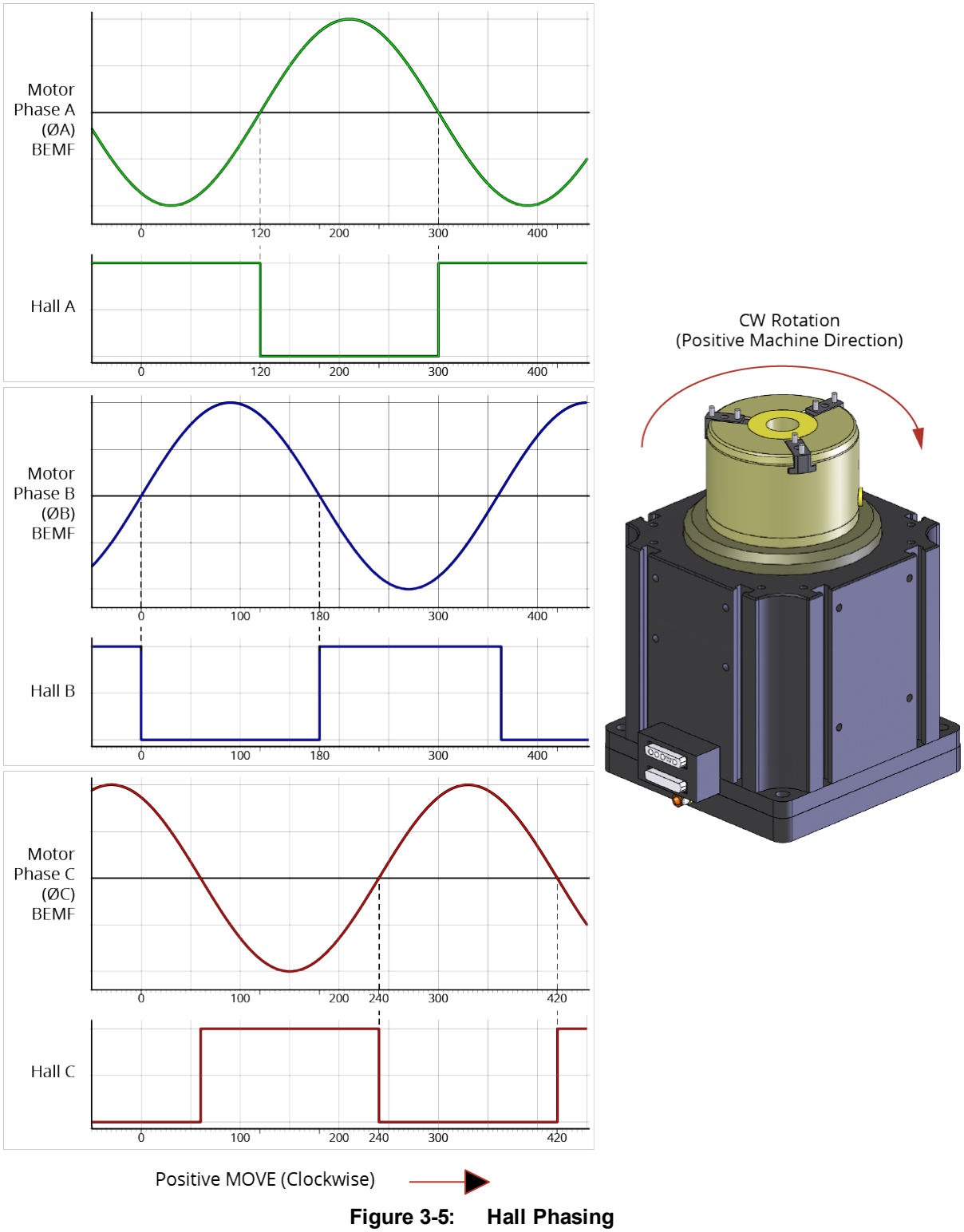


Figure 3-5: Hall Phasing

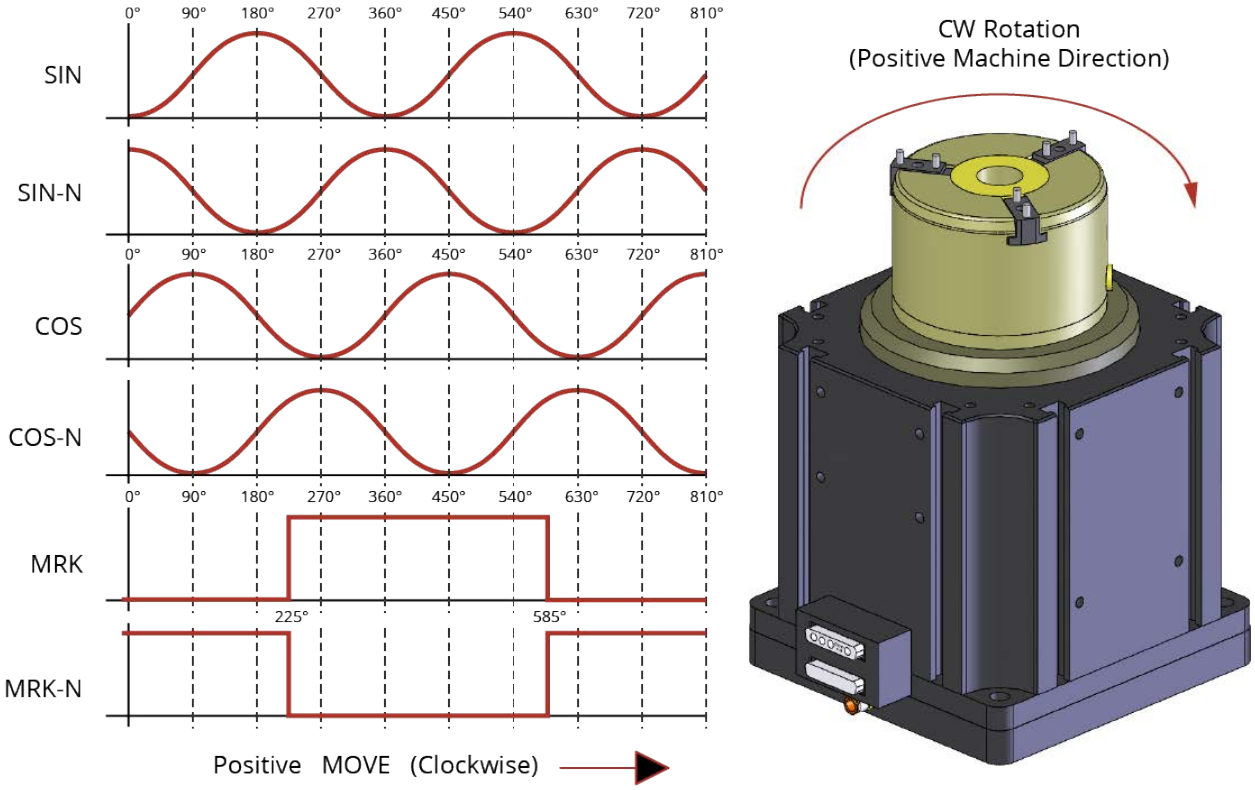


Figure 3-6: Analog Encoder Phasing Reference Diagram

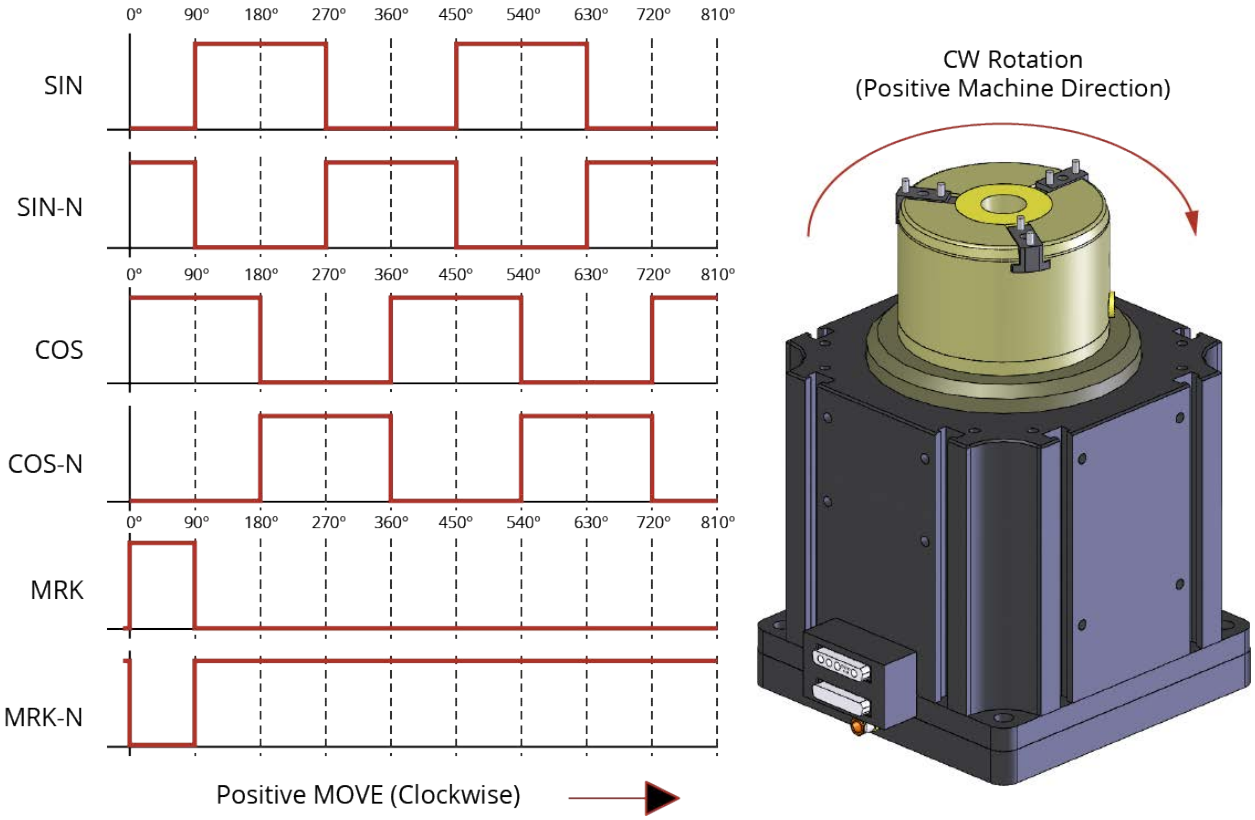


Figure 3-7: Encoder Phasing Reference Diagram (Standard)

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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.

WARNING: Failure to follow the maintenance procedures outlined in this section will result in voiding stage warranty.

4.1. Stage Service and Inspection Schedule

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

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

4.2. Stage Cleaning and Lubrication

Cleaning

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

Any external metal surface of the ACS 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.

WARNING: Acetone should never be used to clean the o-rings or seals.

Lubrication (Bearings)

The bearings should not require relubrication under normal operating conditions in a clean environment. 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.

4.2.1. Collet and Collet Chuck Lubrication and Cleaning

WARNING: Failure to lubricate and clean the collet interface surfaces will cause premature failure and wear that may void the warranty.

For the collet chuck and collet to operate properly, preventative maintenance and regular cleaning is required.

Before inserting any collet into the chuck, clean the chuck taper and the collet with acetone or isopropyl alcohol and a lint-free cloth. If required, nitrogen or clean, dry, oil-less compressed air can be used to clean out the collet grooves. Inspect the collet and the chuck interface surfaces to be sure no wear marks are present. If wear or fret marks (copper colored oxide marks) are present, the taper can be lightly polished with a fine-grit crocus cloth. The goal is to clean the surface of the taper and not to remove an excessive amount of material. If the wear marks are large, or excessive polishing is required to remove these marks, the collet chuck and collet may need to be replaced. Contact Aerotech Technical Support for more information. Wear and fretting can be prevented with proper lubrication and maintenance intervals.

After inspection and cleaning, grease the collet chuck taper and collet taper with a small amount of lubricant. Then, install the collet into the collet chuck. Aerotech recommends using the lubricants listed in Table 4-1.

Table 4-1: Recommended Lubricants

Vender	Product	Item #	Description
Henkel Technologies	Loctite	80209	Silver Grade Anti-Seize
Henkel Technologies	Loctite	51168	Food Grade Anti-Seize
Jet Lube	White Knight	16404	Food Grade Anti-Seize

Lubricant inspection and replenishment depend on application conditions such as collet chuck duty cycle, clamping force (air pressure), and the machining environment. An inspection interval of once every 8 operational hours is recommended until a trend develops for the application. Longer or shorter intervals may be required to maintain a film of lubricant on the collet taper. The collet and chuck should also be cleaned and relubricated after sitting for an extended period of time without operation. If the lubrication sits for long periods of time, it can become dry and lose its lubrication properties. Insufficient lubrication will lead to wear, fretting corrosion, and sticking or lock-up of the collet closer. If this occurs, the machine should be immediately stopped and the collet and collet chuck cleaned and relubricated. It is also recommended that the collet and chuck interface surfaces be cleaned, inspected, and relubricated every time the collet is removed.

4.3. Seal Replacement

4.3.1. Piston Seal Change Procedure

The seals on the collet piston should be replaced if a leak or excess wear becomes apparent. Figure 4-1 shows an exploded view of the assembly and includes all parts involved in the process.

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.

Table 4-2: Piston Seal Replacement Part Numbers

	ACS100	ACS150
Outer Piston Seal (QTY. 1)	MCA02051	MCA01985
Inner Piston Seal (QTY. 1)	MCA02052	MCA01986
NOTE: The steel labyrinth style rear seal should not need replacement.		

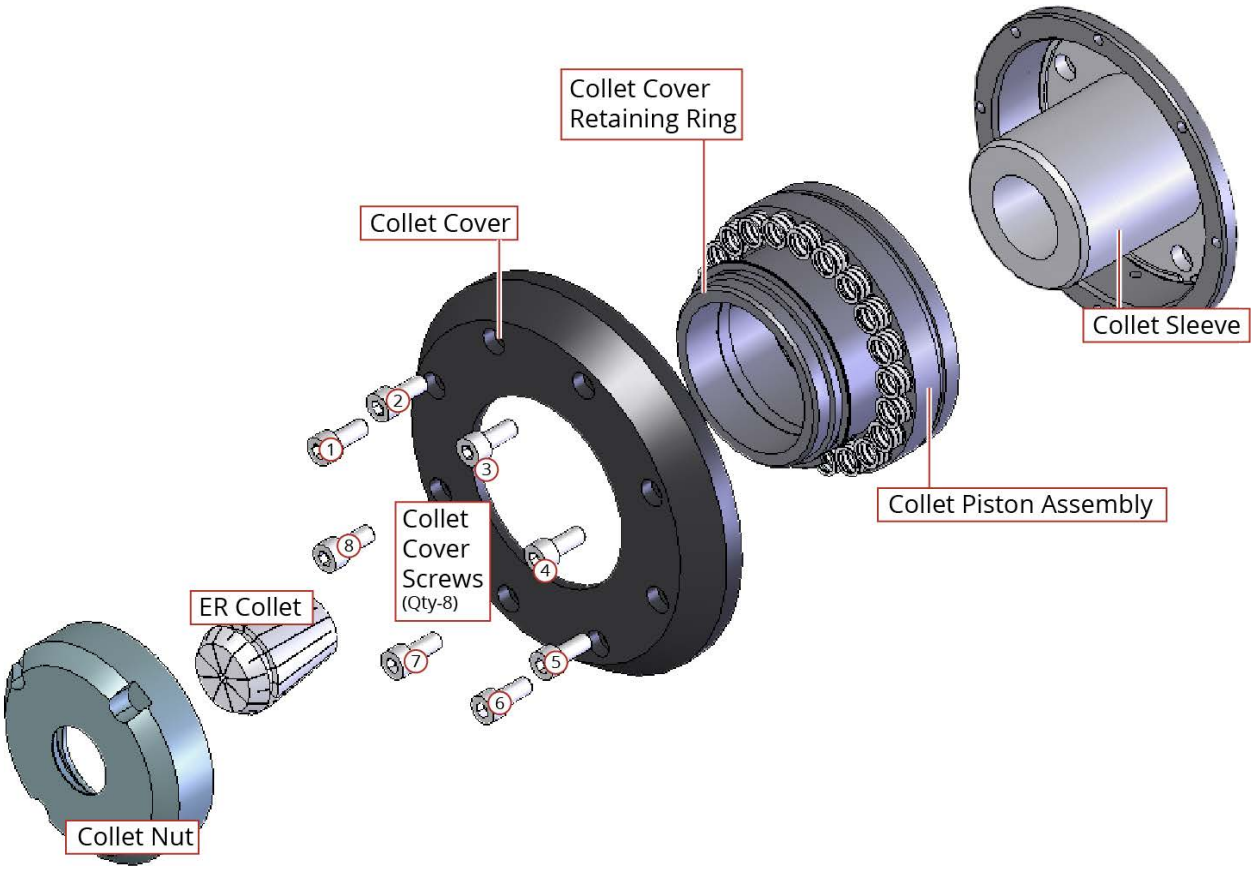

Figure 4-1: Piston Seal Change Exploded View

Step 1: Remove power to the stage.

Step 2: Supply air to the stage in order to release the collet.

Step 3: Remove the collet nut by turning it counterclockwise. Spanner wrenches may be necessary for removal and are available from Aerotech.

Step 4: Remove air pressure from the stage. This will allow the internal springs to relax slightly and ease further disassembly.

DANGER: The collet cover is under tension from internal springs. Removing the collet cover screws incorrectly can result in personal harm and damage to the equipment.

Step 5: Refer to Figure 4-1. Remove every other collet cover screw (i.e., screws 1, 3, 5, and 7). All screws cannot be removed at once, as the cap is under tension from several springs and will be damaged or cause bodily harm if removed without caution.

Step 6: Obtain four M4 x 0.7 x 12 mm long socket head cap screws and thread them into the holes where the previous screws were removed. Tighten each one until it bottoms out in its hole.

Step 7: Loosen the four remaining collet cover screws, 1/4 turn at a time. Loosen the screws in a cross pattern (i.e., loosen screw number 2, then screw number 6, then screw number 8, then screw number 4, then return to screw number 2). Repeat this process until the longer screws are supporting the tension of the springs entirely. It is then safe to remove the remaining collet cover screws completely.

Step 8: Using the same method as in Step 7, remove the longer screws until the spring tension is completely relieved.

Step 9: Carefully slide the collet piston assembly out from its housing. Use caution not to tilt the piston assembly in its housing as this could cause damage to the housing, seals, or piston.

Step 10: It is now safe to remove the collet cover retaining ring. This can be done with a flat-head screwdriver or a pair of needle nosed pliers.

Step 11: Remove the collet cover and the springs from the collet piston.

Step 12: There are two seals on the piston itself. One is an external seal that seals the piston against its housing; the other is an internal seal that seals the piston against the collet sleeve. To remove the seals, carefully pry them out of their housings with a small screwdriver or pick. Use caution not to scratch the surface of the piston.

Step 13: Thoroughly clean seal mounting surfaces, the chamfers, and all surfaces that the new seals may come in contact with. Even small particles or debris can damage the seals during installation.

Step 14: Lubricate the new seals with o-ring lubricant as specified in Section 4.2.

Step 15: Press the new seals over the chamfer and into their respective grooves. Be sure to align the seals such that the open end (when looking at a cross section) is facing away from the collet, as shown in Figure 4-3. The direction of the seal is extremely important in sealing the piston. Make sure that the seals sit into their mounting grooves by running a fingernail around the edge. If the seal is tilted or twisted slightly its function will be severely compromised.

Step 16: Reinstall the springs.

Step 17: Place the collet cover over the piston and reinstall the collet cover retaining ring.

Step 18: Reinstall the collet piston assembly into its housing. There are chamfers to help guide the piston into place, but use caution not to twist or damage the seals. It is recommended that a small amount of o-ring lubricant be used.

Step 19: Installation of the collet cover is the reverse of removal. Begin by inserting the four 12 mm long screws in every other hole and tightening until they bottom out in their respective holes. Then install the shorter original screws into the remaining holes and tighten in a cross pattern until the collet cover is seated against the shaft. Install the remaining four original screws. Torque all screws to a final torque of 1.8 to 2.0 N·m (16 to 18 in·lbs).

Step 20: Apply air pressure to the stage in order to install the collet.

Step 21: Install the new collet as described in Section 2.5.1.

Step 22: Restore the air supply to the original settings and restore power to the stage.

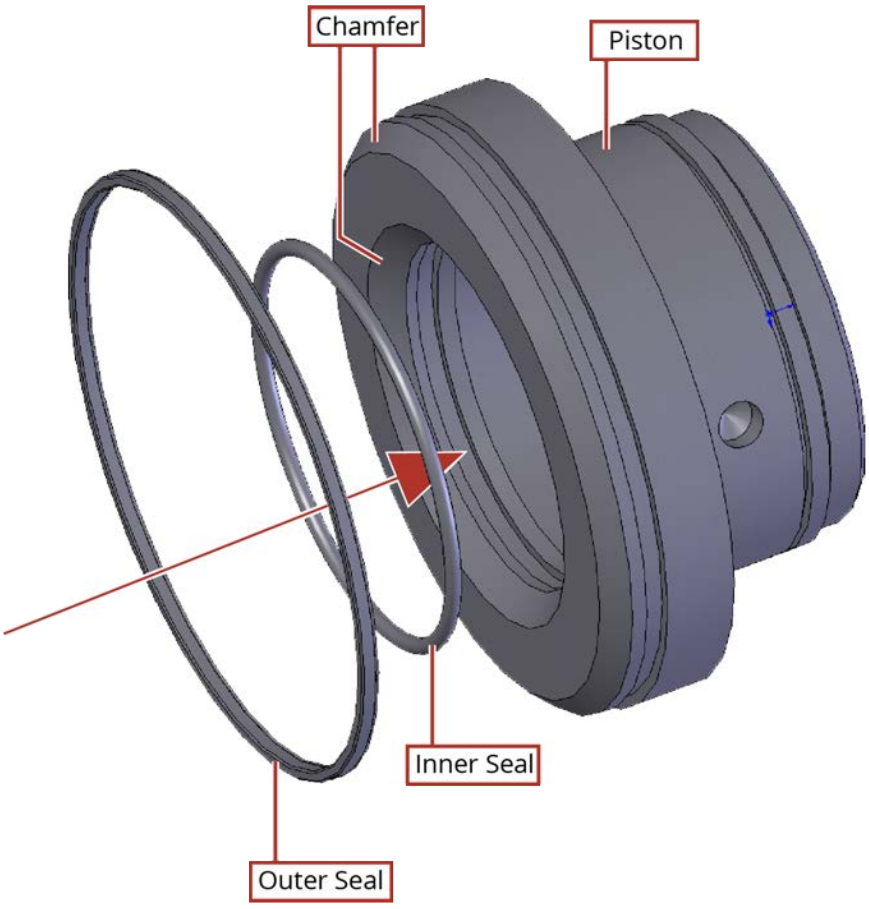

Figure 4-2: Piston Seal Installation Procedure

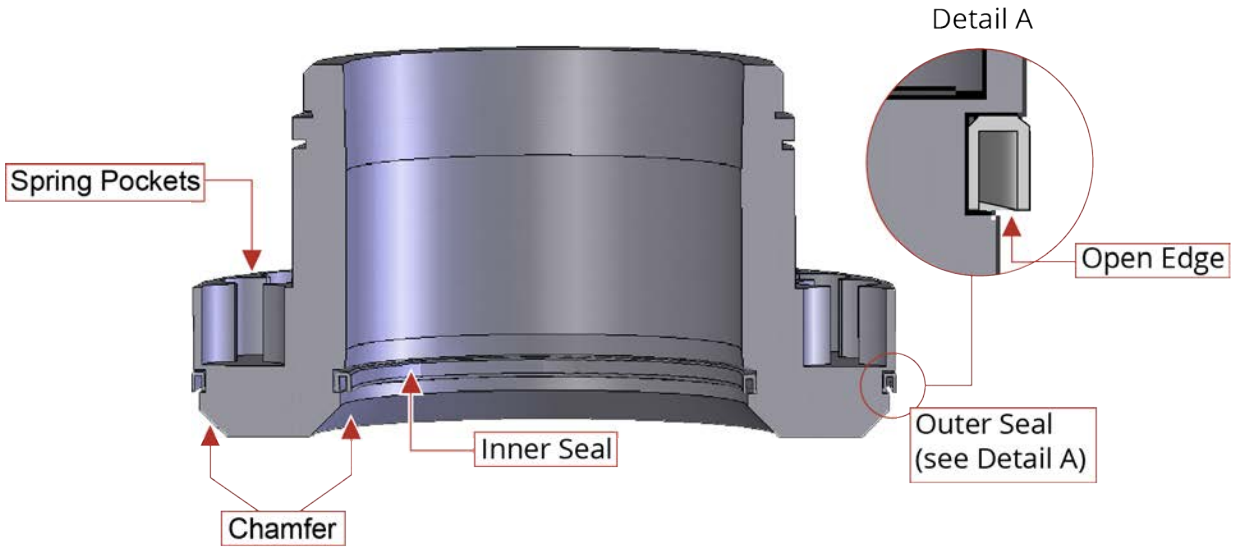

Figure 4-3: Cross-Section View of Piston Showing Seal Orientation

4.3.2. Rotary Union Seals for Three-Jaw Gripper Stages

This section applies only to ACS150 and ACS200 stages equipped with the three-jaw gripper chuck option.

Unlike ACS stages with ER collet holders, stages equipped with three-jaw grippers include a sealed rotary union. Due to friction of the seals on the shaft, wear can occur over a period of time and the seals may require replacement. Figure 4-4. shows an exploded view of the rotary union assembly. The following is the procedure for replacing the rotary union seals.

Table 4-3: Rotary Union Seal Replacement Part Numbers

	ACS150	ACS200
Rotary Union Seal (QTY. 2)	MCA12519	MCA02037

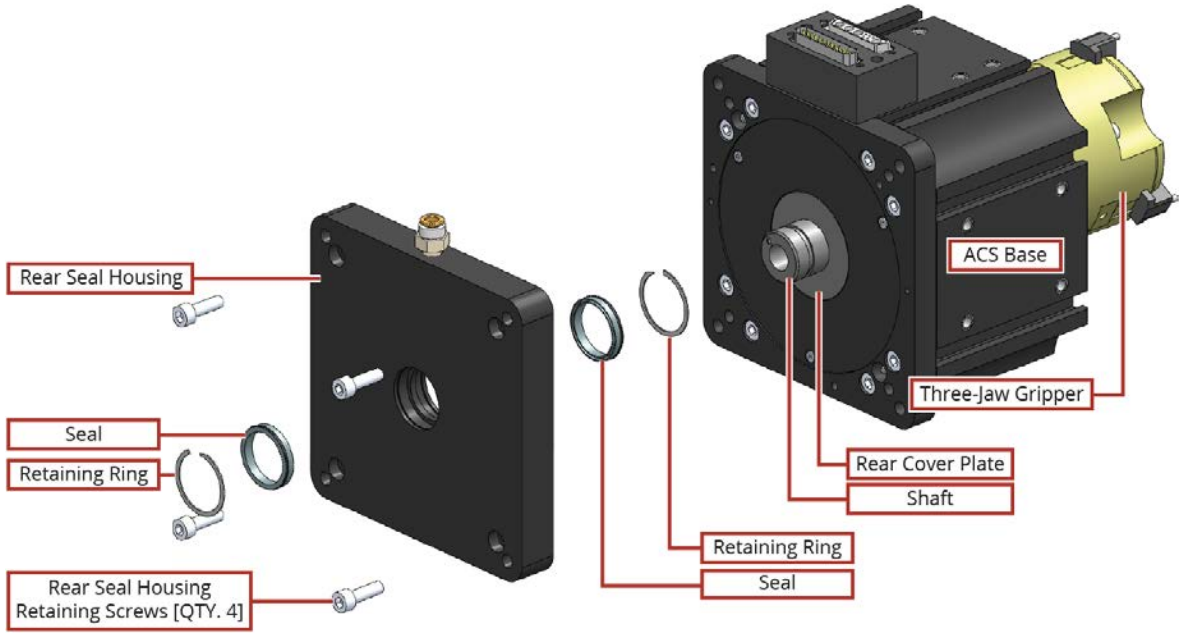

Figure 4-4: Exploded Drawing of Rear Seal Components

1. Disconnect power and air pressure to the stage.
2. Remove the air line from the air input.
3. Remove the four rear seal housing retaining screws and carefully pull the rear seal housing straight off of the main shaft of the stage.
4. Remove the two retaining rings using a small screwdriver or needle-nosed pliers. Be careful not to damage the rear seal housing.
5. Pry the air seals from their housings. This may require a small screwdriver or pick. Use caution not to damage the seal housings.
6. Clean all surfaces before reassembly. See Section 4.2. for recommended cleaning solvents.
7. Lubricate the new seals with o-ring lubricant (see Section 4.2.) and press them into the rear seal housing. Note the orientation of the seals in Figure 4-5. Check to make sure that the seals are seated completely by running a fingernail along the edge. If the seal is seated improperly a leak may result.
8. Replace the retaining rings.

9. Lubricate the sealing surfaces and carefully press the rear seal housing back onto the stage base. Use care when replacing the rear seal housing as the seals can be easily damaged.
10. Replace the rear seal housing retaining screws to a torque of 1.8 to 2.0 N·m (16 to 18 in-lbs).
11. Replace the airline and reconnect power.

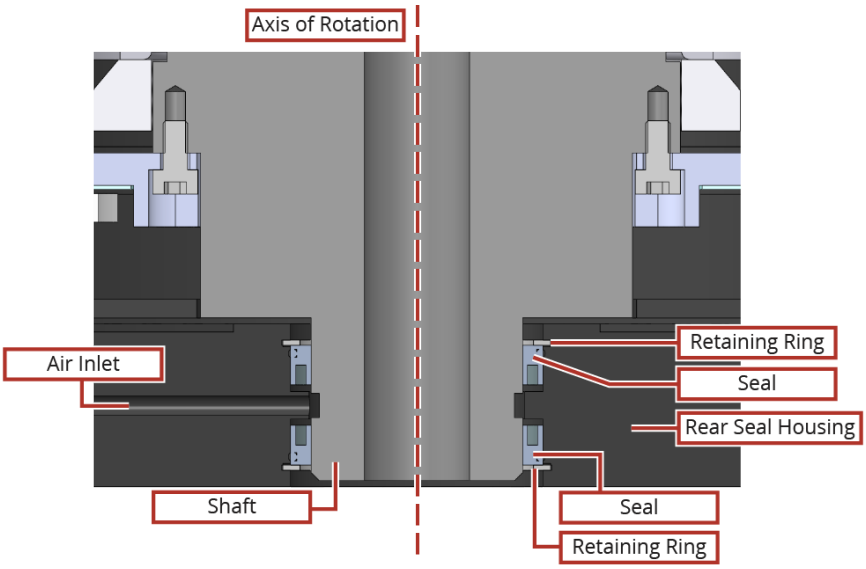

Figure 4-5: Cross-section View of Rear Seal Showing Seal Orientations

4.4. Troubleshooting

This section provides some information regarding typical problems.

Symptom	Possible Cause and Solution
Stage will not move	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).
Collet Chuck will not close	The collet is jammed due to debris, fretting, etc. Clean and lubricate the the collet assembly (refer to Section 4.2.1.)
Collet Chuck will not open	• Insufficient air pressure supplied to the stage. Make sure there are no blockages in the supply line and the pressure is high enough (refer to Section 1.3.). • The collet is jammed due to debris, fretting, etc. Clean and lubricate the the collet assembly (refer to Section 4.2.1.)

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
1.05.00	• Added -WR (wrench) part numbers: Table 1-1 and Table 1-2 • Added piston seal replacement part numbers: Table 4-2 and Table 4-3
1.04.00	• Product update • General revision • Updated safety/warning information • Created separate manual for ACS LP
1.03.00	Changed pin 8 to reserved
1.02.00	• Added information on ACS LP stages • Added stage dimensions • Added Declaration of Incorporation • Added Environmental Specifications section • Added safety information and warnings • Added motor specifications • Added note about current and voltage requirements of wires
1.01.00	Section added: Section 4.2.1.
1.00.00	New manual

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