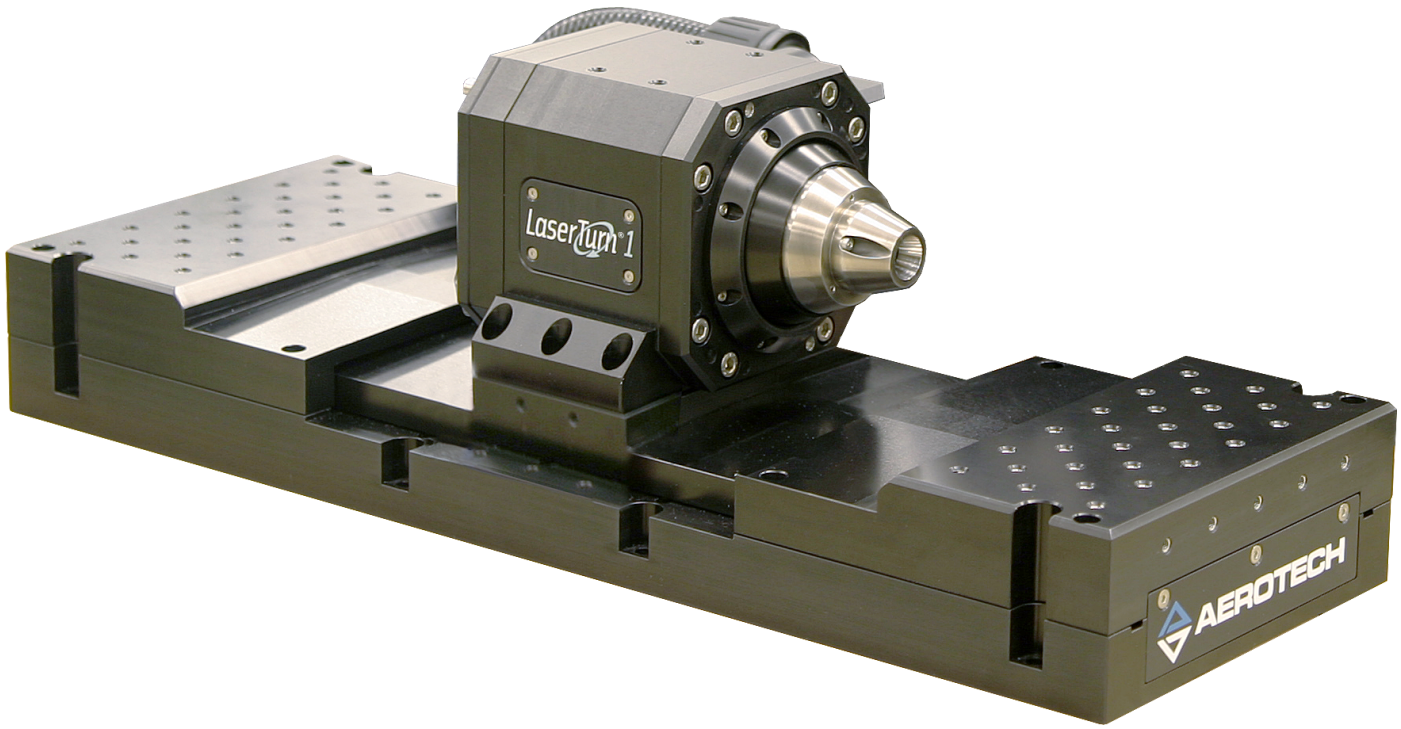
LaserTurn®1
Hardware Manual

Revision: 1.07.00



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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 LaserTurn®1 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 LaserTurn®1 stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.
5. Use care when moving the LaserTurn®1 stage. Lifting or transporting the LaserTurn®1 stage improperly can result in injury or damage to the LaserTurn®1.
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:
LaserTurn®1 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
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Date 11/8/2018

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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 Numbering System

LaserTurn®1 Linear / Rotary Platform	
Cutting Configuration (Required)	
-DCUT	Dry cutting configuration
-WCUT	Wet cutting configuration with fluid rotary union
Front Tooling (Required)	
-FT1	Front tooling platform
-FT2	Front tooling platform with gripper
-FT3	Front tooling platform with right-hand alignment gripper
-FT4	Front tooling platform with left-hand alignment gripper
Gripper Jaws (Optional)	
-J1	Gripper jaws for 0-8 mm tube diameters
Metrology - Linear (Required)	
-PL1	Metrology, uncalibrated with performance plots
-PL2	Metrology, calibrated (HALAR) with performance plots
Note: Metrology option applies to linear axis only.	
Accessories (To be Ordered as a Separate Line Item)	
Collet-D-CLTxx	Levin type D collet, 0.1 mm to 8 mm part diameter sizes available
RingSeal-D-RSxx	Ring seal for wet cutting (consult with Aerotech for available sizes)
CGF	Collet and gripper filtration kit

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: 40% to 60% RH The optimal operating humidity is 50% RH.
	Storage: 30% to 60% 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 you need to use your equipment in a location that is 2,000 m above 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 LaserTurn®1 stages have limited protection against dust, but not water. This equates to an ingress protection rating of IP50.
Use	Indoor use only

1.2. Accuracy and Temperature Effects

Extreme temperature changes could cause a decrease in performance or permanent damage to the stage. Aerotech stages are designed for and built in a 20°C (68°F) environment. Any deviation from standard operating temperature will affect stage accuracy. The severity of temperature effects on all stage specifications depends on many different environmental conditions, including how the stage is mounted. Contact the factory for more details.

1.3. Basic Specifications

Table 1-3: LaserTurn®1 Series Specifications

		Linear Axis	Rotary Axis
Travel		100 mm	±360° Continuous
Accuracy		±2 µm (standard) ±0.5 µm (calibrated)	±121 µrad (±25 arc sec)
Bidirectional Repeatability		±0.2 µm	±20 µrad (±4 arc sec)
Straightness		±1 µm	N/A
Flatness		±1 µm	N/A
Pitch		25 µrad (5 arc sec)	N/A
Yaw		15 µrad (3 arc sec)	N/A
Maximum Speed(1)		300 mm/s	1000 rpm
Tube Capacity		N/A	7.9 mm (Dry Cut) 3.0 mm (Wet Cut)(2)
Maximum Force (Continuous)		30.6	N/A
Maximum Torque (Continuous)		N/A	0.48 N·m
Load Capacity(3)	Axial	2 kg	
	Radial	0.5 kg	
	Moment	0.75 N·m	
Moving Mass (unloaded)		6 kg	N/A
Rotor Inertia (unloaded)		N/A	0.0005 kg·m^2
Stage Mass with Tooling Platforms		12 kg	N/A
Collet Type(4)		N/A	Type D (Levin)
Collet Runout(5)		N/A	<30 µm
Minimum System Air Pressure(6)		100 psig	
Material		Hardcoated Aluminum Stage Body; Stainless Steel Collet Chuck	
Mean Time Between Failure		10,000 Hours	

1. Maximum speed based on stage capability. Requires the selection of an appropriate amplifier with sufficient voltage and current.
2. Maximum tube diameter is reduced to 6.7 mm for dry cutting with the -WCUT option.
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. Collet chuck accepts type D collets (Levin Lathe and Son™).
5. Measured TIR of a precision gage pin with an ultra-precision Type D collet 3 mm away from the collet face at 80 psi applied air pressure and no load.
6. Collet chuck mechanism is normally-open. Collet mechanism requires air to close collet chuck. Air supply must be dry (0° F dew point) oil-less air OR 99.99% pure nitrogen. Air or nitrogen must be filtered to 1 micron particle size or better.

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Chapter 2: Installation

WARNING: LaserTurn®1 installation must be in accordance to instructions provided by this manual and any accompanying documentation. Failure to follow these instructions could result in injury or damage to the equipment.

2.1. Unpacking and Handling the Stage

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

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 LaserTurn®1. Unsecured moving parts may shift and cause bodily injury.
- Improper handling could adversely affect the performance of the LaserTurn®1. Use care when moving the LaserTurn®1.
- Lift only from the base of the linear axis.
- Do not use the rotary axis as a lifting point.
- Do not use the [QTY-4] tapped holes on top of the rotary axis as lifting points.

Carefully remove the LaserTurn®1 from its protective shipping container. Gently set the LaserTurn®1 on a smooth, flat, and clean surface.

Before operating the LaserTurn®1, 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 LaserTurn®1 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.

Red, anodized aluminum shipping brackets have been installed to prevent unwanted motion and potential damage from occurring during shipment. The brackets must be removed before the LaserTurn®1 can be operated. Retain the brackets and hardware for future use.

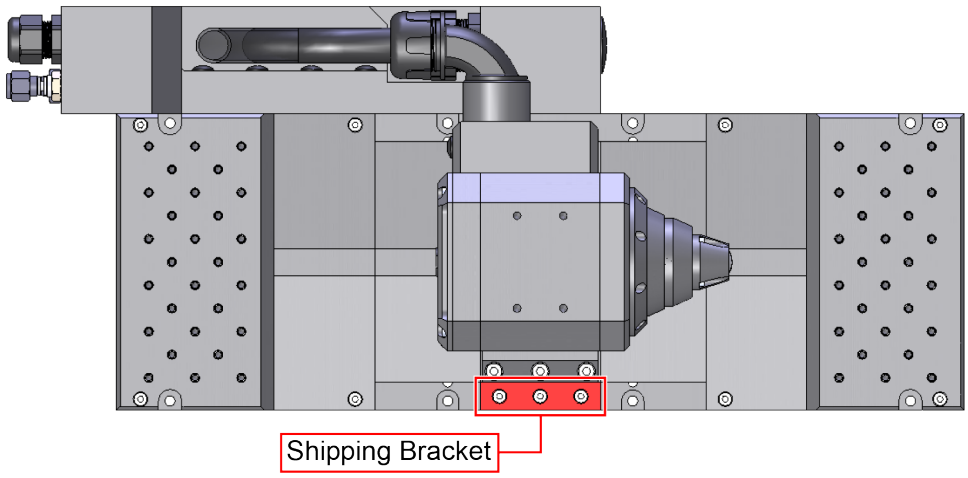


Figure 2-1: LaserTurn®1 Shipping Bracket (Top View)

2.2. Dimensions

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.

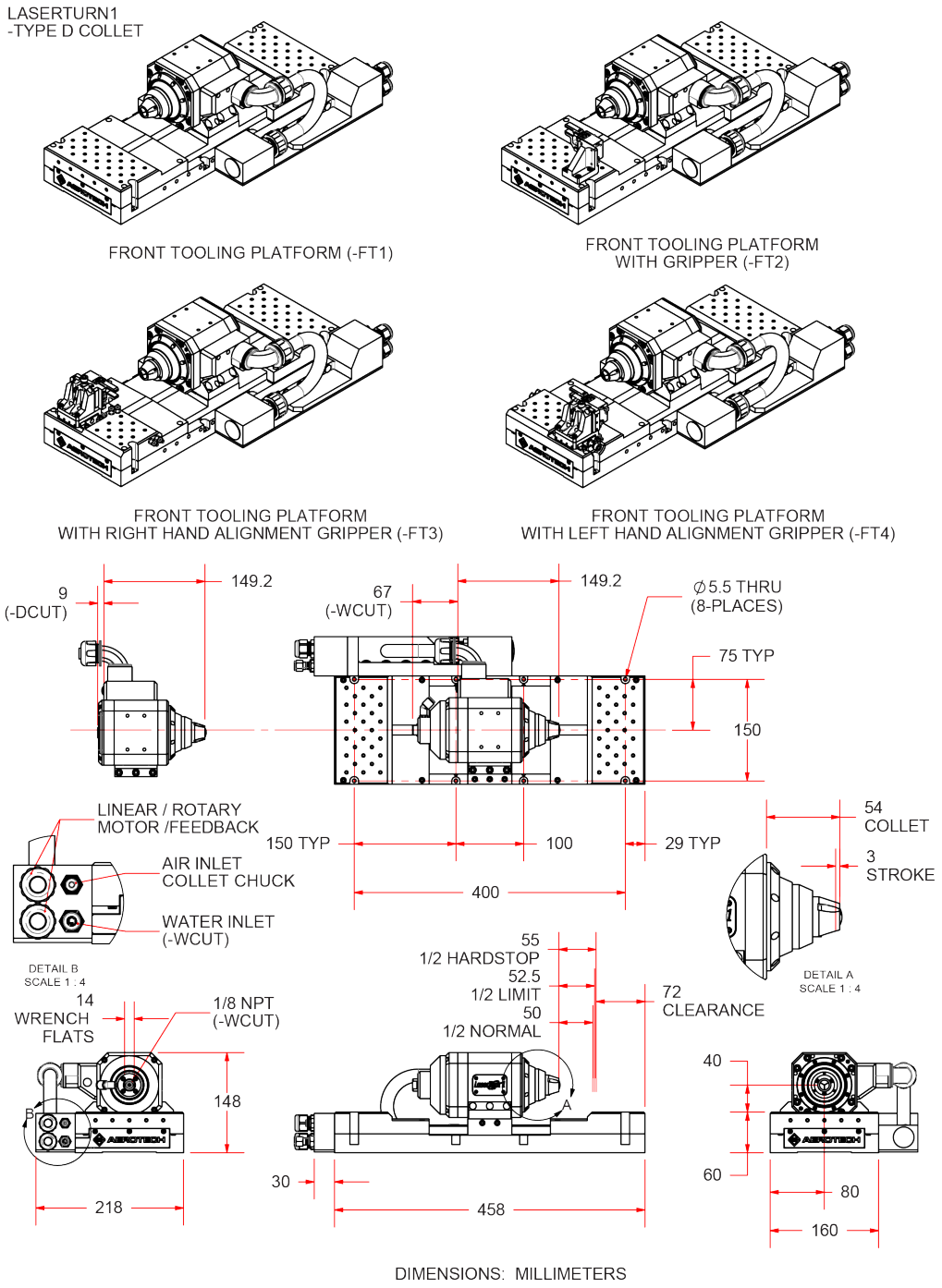


Figure 2-2: LaserTurn®1 Dimensions (part one)

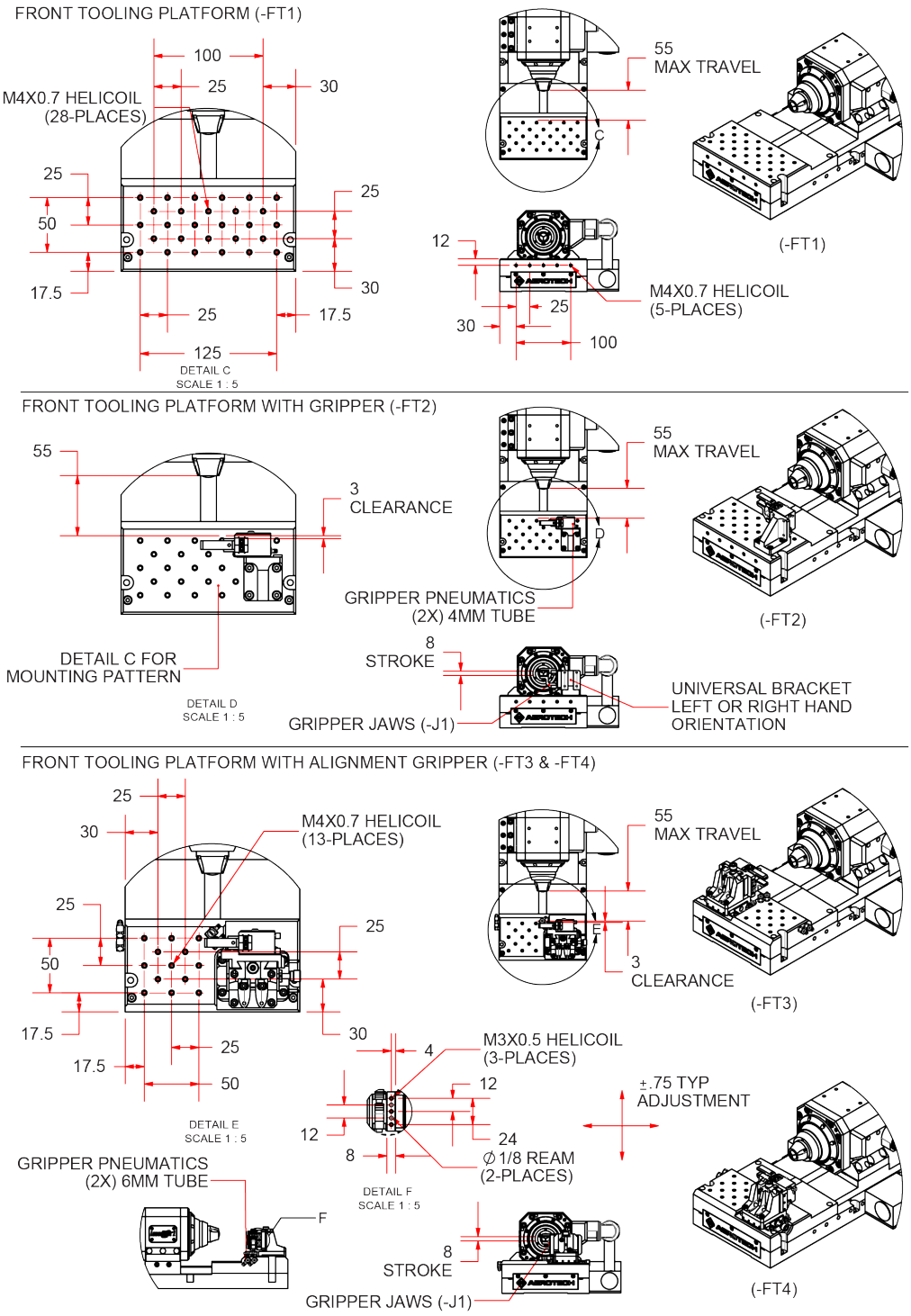


Figure 2-3: LaserTurn®1 Dimensions (part two)

2.3. Securing the Stage to the Mounting Surface

WARNING: Do not attempt to manually move the LaserTurn®1 if it is connected to a power source.

WARNING: Make sure that all moving parts are secure before moving the LaserTurn®1. Unsecured moving parts may shift and cause bodily injury.

WARNING: The LaserTurn®1 must be mounted securely. Improper mounting can result in injury and damage to the equipment.

DANGER: PINCH POINT! Keep Hands Clear while the stage is in motion.

The mounting surface must be flat and have adequate stiffness in order to achieve the maximum performance from the LaserTurn®1 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 LaserTurn®1 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 LaserTurn®1. Shimming should be avoided if possible. If shimming is required, it should be minimized to retain maximum rigidity of the system.

Use the [QTY. 8] M5 SHCS to secure the stage to the mounting surface. Typical screw torque is 4.1 N·m. Move the stage carriage to access the base plate mounting holes (refer to Figure 2-4).

WARNING: Do not attempt to move the carriage (or table top) of the LaserTurn®1 until the shipping brackets have been removed. Moving the carriage with the shipping brackets installed can cause permanent damage to the LaserTurn®1.

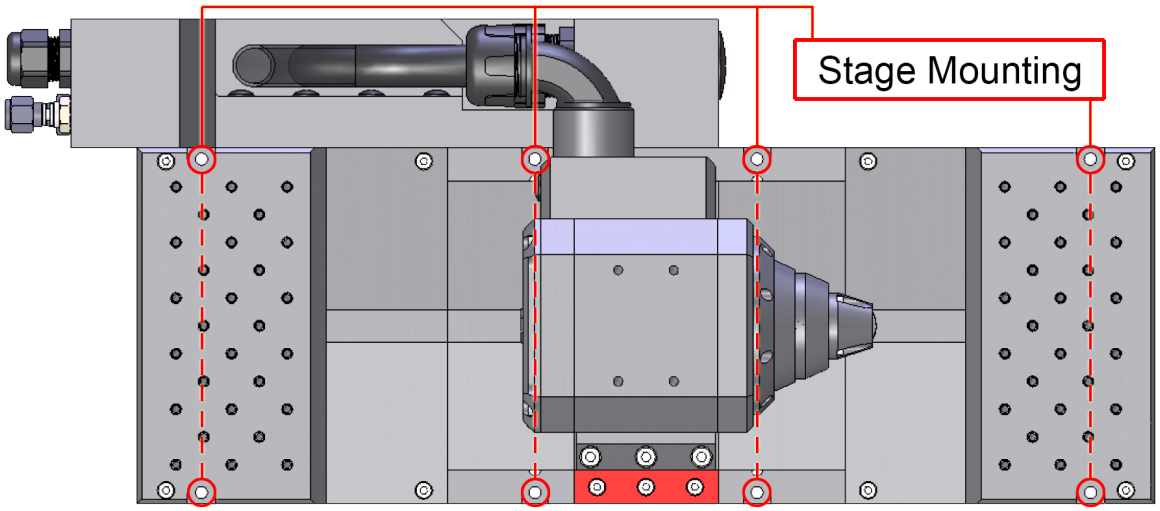


Figure 2-4: LaserTurn®1 Stage Showing Mounting Holes (Top View)

2.4. Air Requirements

The air pressure supplied to the collet holder 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 micron.

The chuck becomes fully closed at approximately 4-7 bar (60-100 psig) depending on the collet size. Higher pressures will not cause damage to the rotary union.

When the gripper options are ordered, the supply pressure will need to be regulated down (refer to Section 2.9. and Section 2.10. for more information). As with the collet chuck, the supply pressure can be regulated to control the grip force during stage indexing.

2.5. Wet Cut Fluid Requirements

Water or cutting fluid used during wet cut operations must be conditioned to meet certain requirements ensuring seal functionality and service life of the wet cut rotary union.

- Water or cutting fluid must be filtered to 5 microns or better.
- A fluid filter must be installed upstream of the rotary union between the pump outlet and the rotary union inlet.

2.6. Attaching the Payload to the Stage

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.

Linear

The LaserTurn®1 has optional front and rear tooling platforms. The surfaces of these platforms are precision surfaces that have been machined flat.

Rotary

To operate the collet, clean compressed air or nitrogen must be supplied to the stage (refer to Section 2.4.). The one-touch air inlet fitting accepts 4 mm OD plastic air line. Simply push the air line into the fitting and supply air to the stage. The CGF pneumatics kit option contains the required air supply components, such as valves, filters, and airlines.

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. Refer to Section 2.8.1. for collet installation.

WARNING: The size of material should match the collet size and be inserted into the collet at least 2/3 the length of the collet bore. Material that is larger or smaller than the collet or not inserted far enough into the collet will affect system performance, particularly material runout. In worst-case scenarios, the collet could be damaged and have to be replaced.

2.7. Load Capability

The LaserTurn®1 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 1.3.

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

If the LaserTurn®1 is configured for wet cut, it will have a rotary union attached to the end of the rotary shaft (Figure 2-5). A 1/8 in NPT tapped hole is provided on the end of the rotary union shaft to allow for connecting a pressure vessel or extension tube. To prevent damage or performance degradation of the stage, the unsupported length and weight of the attached pressure vessel is limited.

NOTE: Aerotech recommends the following limitations on the size and weight of an unsupported pressure vessel:

- Length past end of rotary union (L): <200 mm
- Moment about end of rotary union (M): <0.75 N-m

If these limits are exceeded, it is recommended that an external steady-rest or support be implemented.

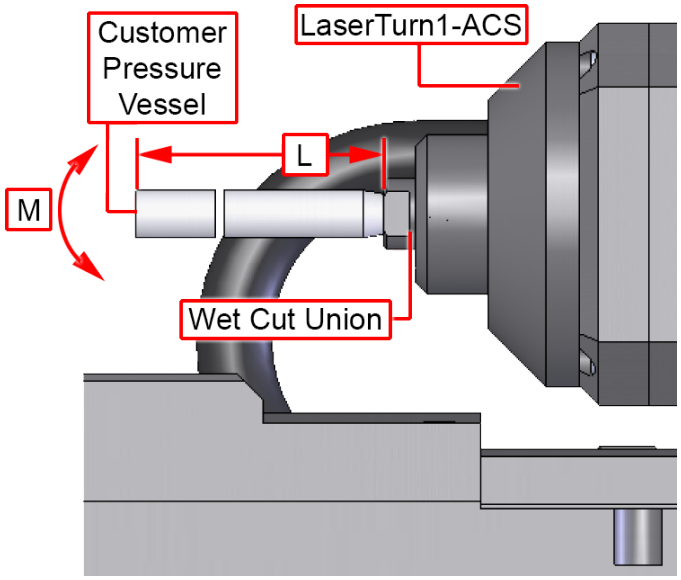


Figure 2-5: LaserTurn®1 Wet Cut Rotary Union Location

2.8. Changing the Workholding Devices

LaserTurn®1 stages may be equipped with Levin “Type-D” style collets. It is important that only the collets designed for a particular collet holder are used. Contact the factory for more details.

NOTE: Various grip diameters are commonly available and can be interchanged.

2.8.1. Collet Installation and Removal 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: Turn off air pressure to expose front of collet in chuck.

Step 3: Remove the collet from the chuck. While unthreading the collet, there will possibly be slight resistance and a clicking sound. The resistance and clicking is caused by [QTY-3] spring loaded ball end set screws that help prevent the collet from unthreading during stage operation. The ball end drops in and out of the collet’s detent as it is turned.

Step 4: For installation of a collet, first clean the chuck taper, and new collet including threads. Acetone or isopropyl alcohol may be used to clean the metal components. A small amount of any general-purpose, high viscosity grease can be applied to the collet taper to help reduce friction and decrease wear.

Step 5: Guide the collet into the stage (Figure 2-6) and thread into collet taper. Be sure that air pressure is still not being supplied to the stage so the collet chuck remains in the open position.

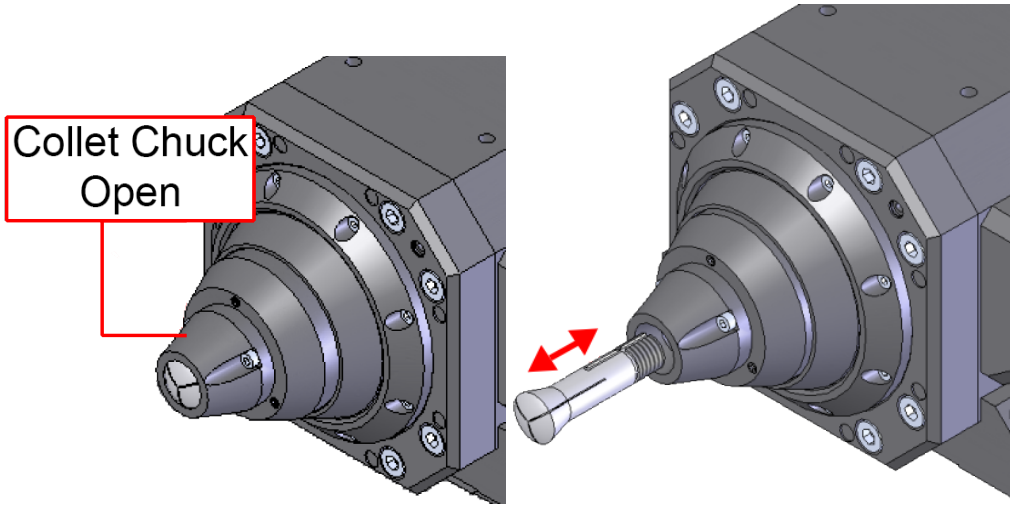


Figure 2-6: Installation Procedure for Collet

Step 6: Insert the desired part into the collet. Actuate the collet chuck by applying air pressure to verify that the collet is clamping the part. Adjust collet threaded depth as required.

Step 7: Restore power to the stage.

2.9. Gripper Installation (-FT2)

This option equips the system with a parallel gripper for automated tube advancement and material handling.

The standard metric tooling platform is used to mount the Gripper option. The Gripper option has universal mounting. It can be mounted on either the left or right-hand side of the tooling platform just by reversing the gripper on the bracket.

Add the gripper option to LaserTurn®1 systems with the procedure that follows.

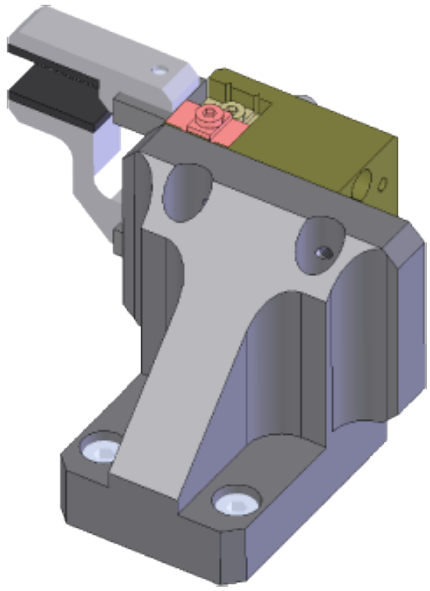


Figure 2-7: Gripper Detail

Step 1: Set up the gripper on the front tooling platform.

Step 2: Add [QTY-4] M4 socket head screws with washers.

Step 3: Manually index the LaserTurn®1 carriage toward the sub assembly and verify that there is no interference.

Step 4: Connect the pneumatics kit (optional accessory with the CGF option or customer supplied) to the gripper and adjust the operating pressure for desired grip force.

NOTE: Do not exceed 87 psi to the gripper on the open or closing cycle.

NOTE: Refer to the pneumatics layout drawing included with the documentation for assembly instructions.

2.10. Alignment Gripper Installation (-FT3)

This option equips a parallel gripper for automated tube advancement with a Y/Z adjustment stage. The adjustment stage has a travel range of ±0.75 mm to help align the material support bushings (refer to Figure 2-8).

NOTE: A special tooling plate is required to mount the Alignment / Gripper option.

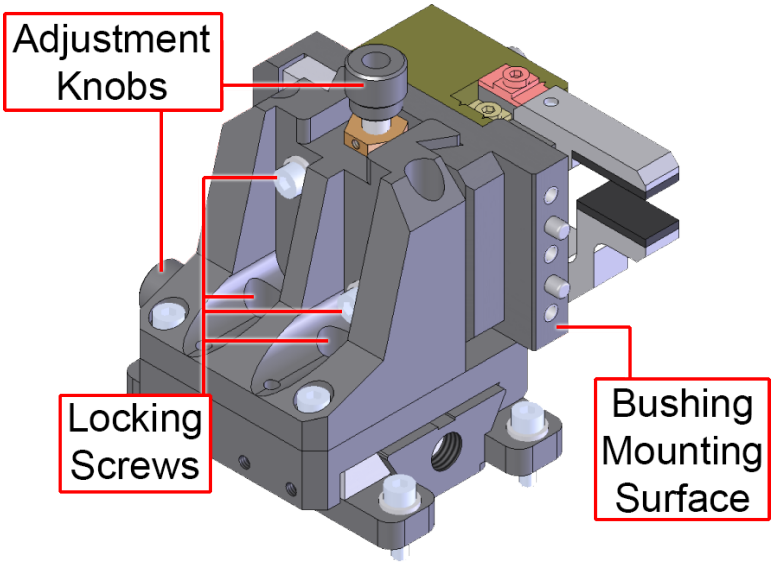


Figure 2-8: Alignment Gripper (Right-Handed)

Use the steps that follow to attach the optional front tooling platform with alignment gripper to the LaserTurn®1.

Step 1: Set the alignment gripper into the tooling plate pocket and reference it up against [QTY-2] 1/8” alignment pins.

Step 2: Add [QTY-4] M3 socket head screws with washers.

Step 3: Manually index the carriage toward the subassembly and make sure that there is not interference.

NOTE: Make sure that the assembly is still referenced against 1/8" pins as described in Step 1.

Step 4: Attach the customer-supplied bushing to the mounting surface.

Step 5: Loosen the [QTY-4] M3 socket head locking screws shown in Figure 2-8 so that the alignment mechanism can be adjusted.

Step 6: Feed the part into the collet and through the tube support bushing.

Step 7: Align the vertical and horizontal position of the bushing with the provided adjustment knobs.

Step 8: Secure the [QTY-4] M3 socket head locking screws that were loosened in Step 5.

Step 9: Connect the pneumatics kit (optional accessory with the CGF option or customer supplied) to the gripper and adjust the operating pressure for the desired grip force.

NOTE: Do not exceed 87 psi to the gripper on the open or closing cycle.

NOTE: Refer to the pneumatics layout drawing included with the documentation for assembly instructions.

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 LaserTurn®1 is part of a complete Aerotech motion control system, setup usually involves connecting the LaserTurn®1 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 cause electric shock.

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 LaserTurn®1 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.

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 HPD Motor Connector Pinouts (for Rotary and Linear Axes)

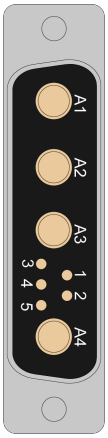
Pin	Description	Connector
A1	Motor Phase A	
A2	Motor Phase B	
A3	Motor Phase C	
1	Reserved	
2	Reserved	
3	Reserved	
4	Reserved	
5	Reserved	
A4	Frame ground (motor protective ground)	

Table 3-2: 4-Pin D Motor 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 #DBM9W4SA197

Table 3-3: 25-Pin D Feedback Connector Pinouts (Rotary Axis)

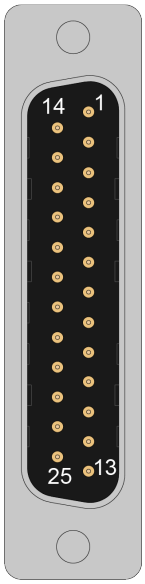
Pin	Description	Connector
1	Reserved	
2	Over-Temperature Thermistor sensor	
3	+5 V power supply (internally connected to Pin 16)	
4	Reserved	
5	Hall Effect sensor, phase B	
6	Marker-N	
7	Marker	
8	Reserved	
9	Reserved	
10	Hall Effect sensor, phase A	
11	Hall Effect sensor, phase C	
12	Reserved	
13	Reserved	
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	Reserved	
24	Reserved	
25	Reserved	
Case	Signal shield connection (to case)	

Table 3-4: 25-Pin D Feedback Mating Connector

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

Table 3-5: 25-Pin Feedback Connector Pinouts (Linear Axis)

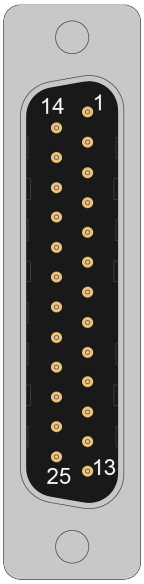
Pin	Description	Connector
1	Reserved	
2	Over-Temperature Thermistor sensor	
3	+5 V power supply (internally connected to Pin 16)	
4	Reserved	
5	Hall Effect sensor, phase B	
6	Marker-N	
7	Marker	
8	Reserved	
9	Reserved	
10	Hall Effect sensor, phase A	
11	Hall Effect sensor, phase C	
12	Signal indicating maximum travel produced by positive/CW stage direction.	
13	Reserved	
14	Sine	
15	Sine-N	
16	+5 V power supply (internally connected to Pin 3)	
17	Cosine	
18	Cosine-N	
19	Reserved	
20	Common ground (internally connected to Pin 21)	
21	Common ground (internally connected to Pin 20)	
22	Reserved	
23	Reserved	
24	Signal indicating maximum travel produced by negative/CCW stage direction	
25	Reserved	
Case	Signal shield connection (to case)	

Table 3-6: 25-Pin D Feedback 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 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.

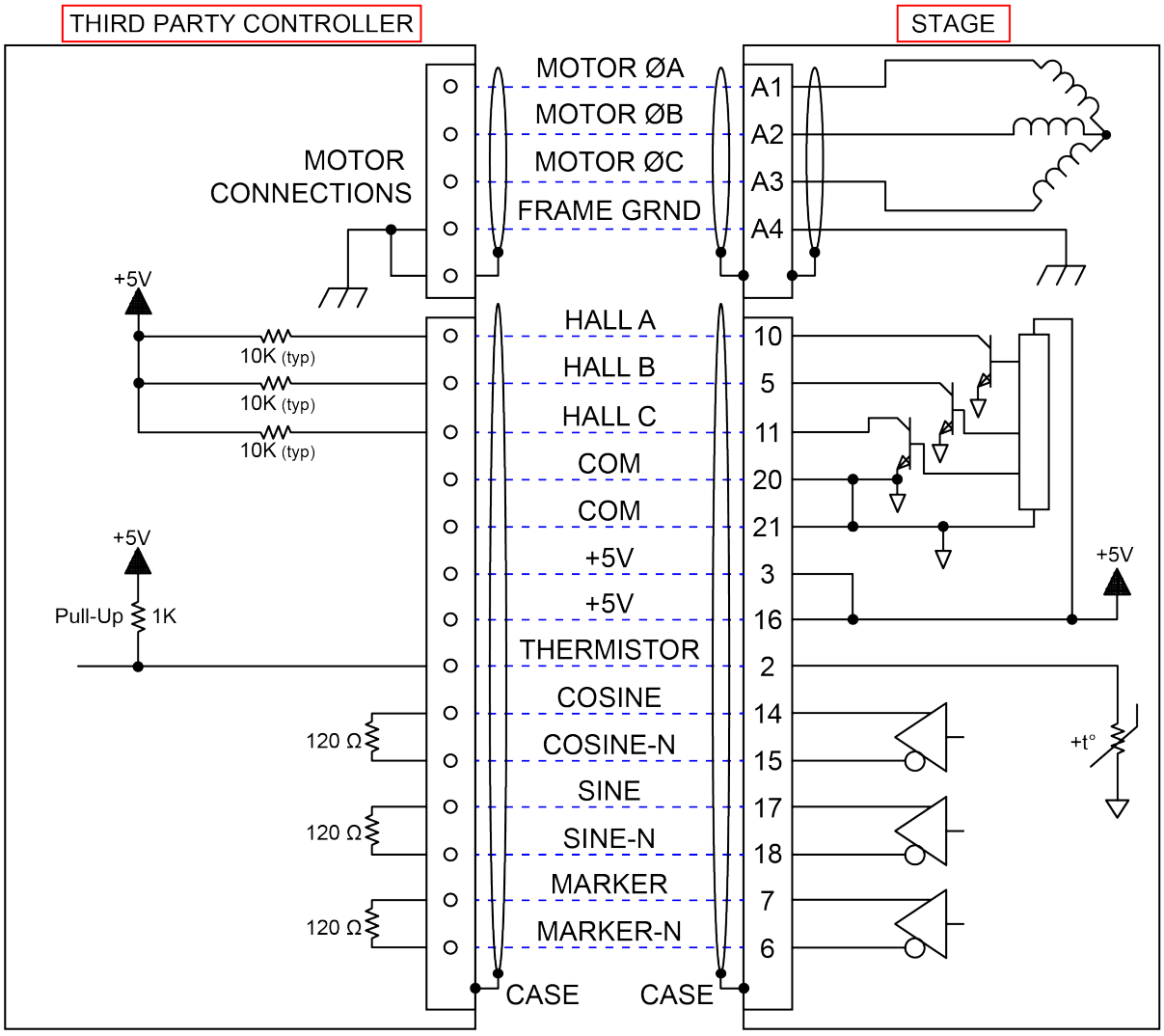
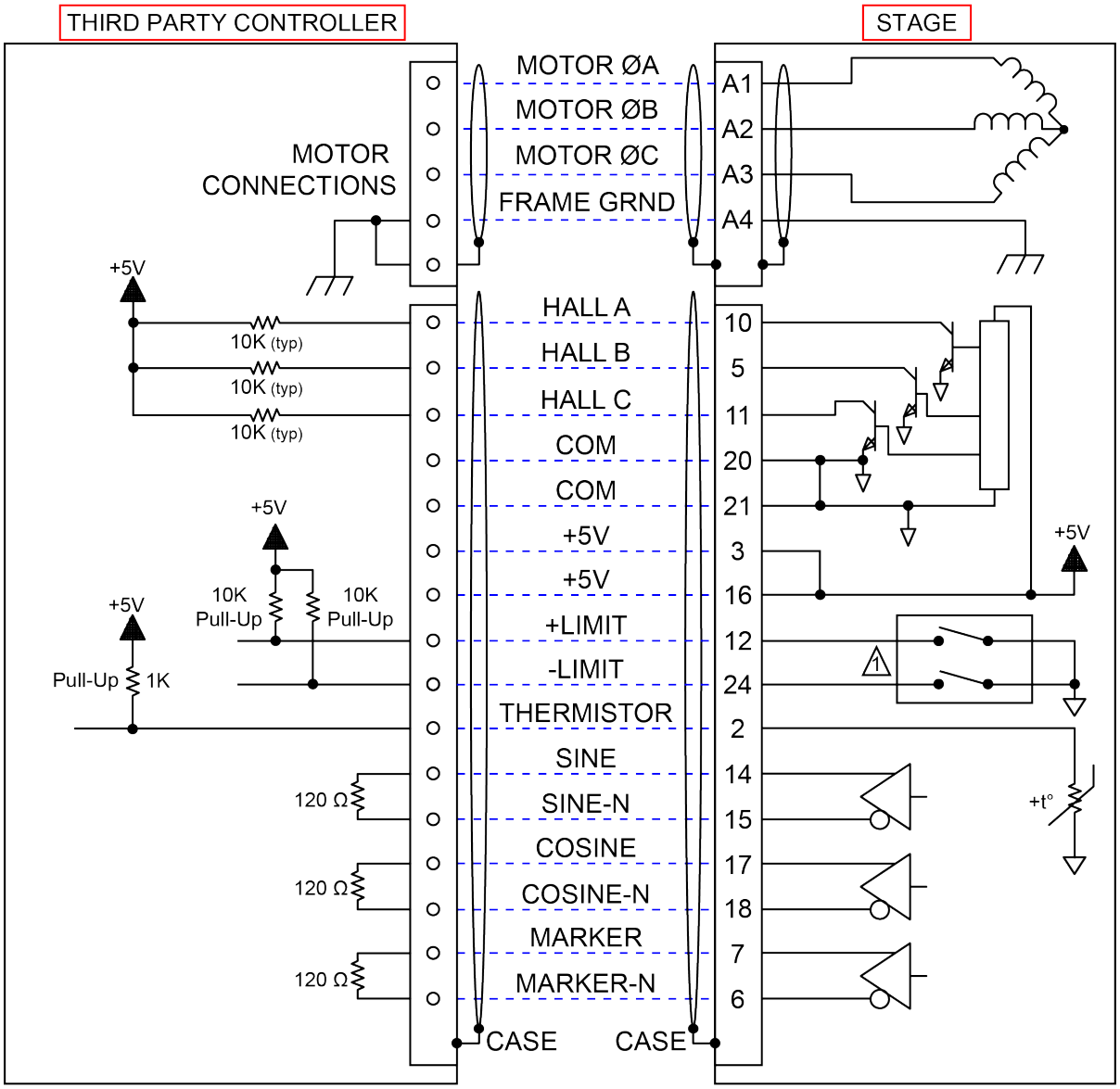


Figure 3-1: Motor and Feedback Wiring (Rotary Axis)



⚠1 Over-travel limit switches are configured at the factory N.C. (normally closed)

Figure 3-2: Motor and Feedback Wiring (Linear Axis)

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.)
Rotary Axis	Incremental Sine - 3600 lines per revolution (Fundamental)
Linear Axis	Incremental Sine - 20 µm resolution (Fundamental)

Limit Switch Specifications	
Supply Voltage	5 V ±5%
Supply Current	25 mA
Output Type	Open Collector
Output Voltage	5 V
Output Current	10 mA (sinking)
Output Polarity	Normally Closed (NC) • Sinks current to ground (Logic "0") when not in limit • High impedance (Logic "1") when in limit • Requires external pull-up to +5 V (10 kΩ recommended)
Notes: 1. If the LaserTurn®1 is driven beyond the electrical limit, it will encounter a mechanical stop. Impacting the mechanical stop could cause damage to the stage even at low speeds.	

Table 3-8: Rotary Axis Motor Specifications (S-76-35-A)

		S-76-35
Performance Specifications (1,5)		
Winding Designation		-A
Stall Torque, Cont. (2)	N·m	0.48
Peak Torque (3)	N·m	1.92
Electrical Specifications (5)		
Winding Designation		-A
BEMF Const., line-line, Max	V_{pk}/krpm	29.1
Continuous Current, Stall (2)	A_{pk}	2.0
	A_{rms}	1.4
Peak Current, Stall (2)	A_{pk}	8.0
	A_{rms}	5.7
Torque Constant (4, 9)	N·m/A_{pk}	0.24
	N·m/A_{rms}	0.34
Motor Constant (2, 4)	N·m/√W	0.075
Resistance, 25°C, line-line	Ω	10.5
Inductance, line-line	mH	1.40
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: Linear Axis Motor Specifications (BLMUC-111-A)

		BLMUC-111
Performance Specifications (1) (5)		
Continuous Force, 1.4 bar (20 psi) (2)	N (lb)	46.9 (10.5)
Continuous Force, No Forced Cooling (2)	N (lb)	30.6 (6.9)
Electrical Specifications(5)		
Winding Designation		-A
BEMF Constant (line-line, max)	V/(m/s) (V/(in/s))	11.35 (0.29)
Continuous Current 1.4 bar (20 psi) (2)	A_{pk} (A_{rms})	4.75 (3.36)
Continuous Current, No Forced Cooling (2)	A_{pk} (A_{rms})	3.10 (2.19)
Peak Current, Stall (3)	A_{pk} (A_{rms})	19.00 (13.44)
Force Constant, Sine Drive (4) (8)	N/A_{pk} (lb/A_{pk})	9.87(2.22)
	N/A_{rms} (lb/A_{rms})	13.96 (3.14)
Motor Constant (2) (4)	$N/\sqrt{W}$ ($lb/\sqrt{W}$)	3.78 (0.85)
Resistance, 25°C (line-line)	Ω	6.5
Inductance (line-line)	mH	0.87
Thermal Resistance, 1.4 bar (20 psi)	°C/W	0.65
Thermal Resistance, No Forced Cooling	°C/W	1.52
Maximum Bus Voltage	V_{DC}	340

1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature
2. Values shown @ 100°C rise above a 25°C ambient temperature, with motor mounted to the specified aluminum heat sink.
3. Peak force assumes correct rms current; consult Aerotech.
4. Force constant and motor constant specified at stall
5. All performance and electrical specifications ±10%
6. Maximum winding temperature is 125°C.
7. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures
8. All Aerotech amplifiers are rated Apk; use force constant in N·m/Apk when sizing.

3.4. Limits, Marker, and Machine Direction

Aerotech stages are configured to have positive and negative "machine" directions. The machine direction defines the phasing of the feedback and motor signals and is dictated by the stage wiring (refer to Section 3.5. for Motor and Feedback phasing information). Programming direction of a stage is set by the controller that is used to move the stage. Programming direction is typically selectable in the controller, while machine direction is hardwired in the stage. Figure 3-3 shows the machine direction of LaserTurn®1 stages.

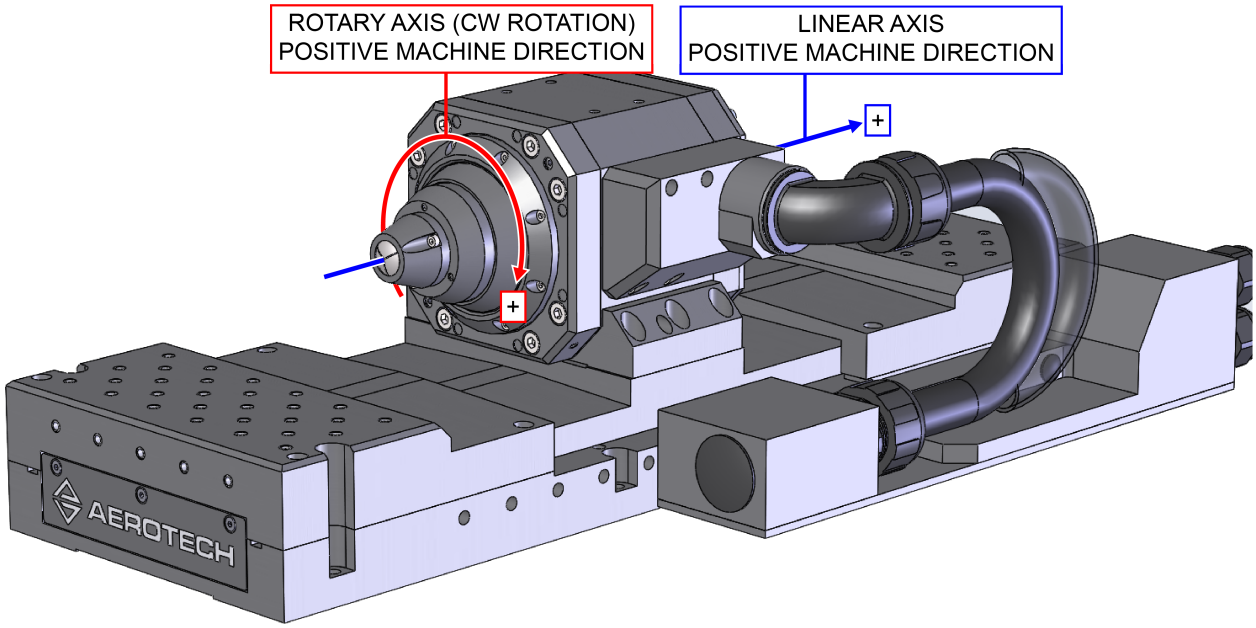
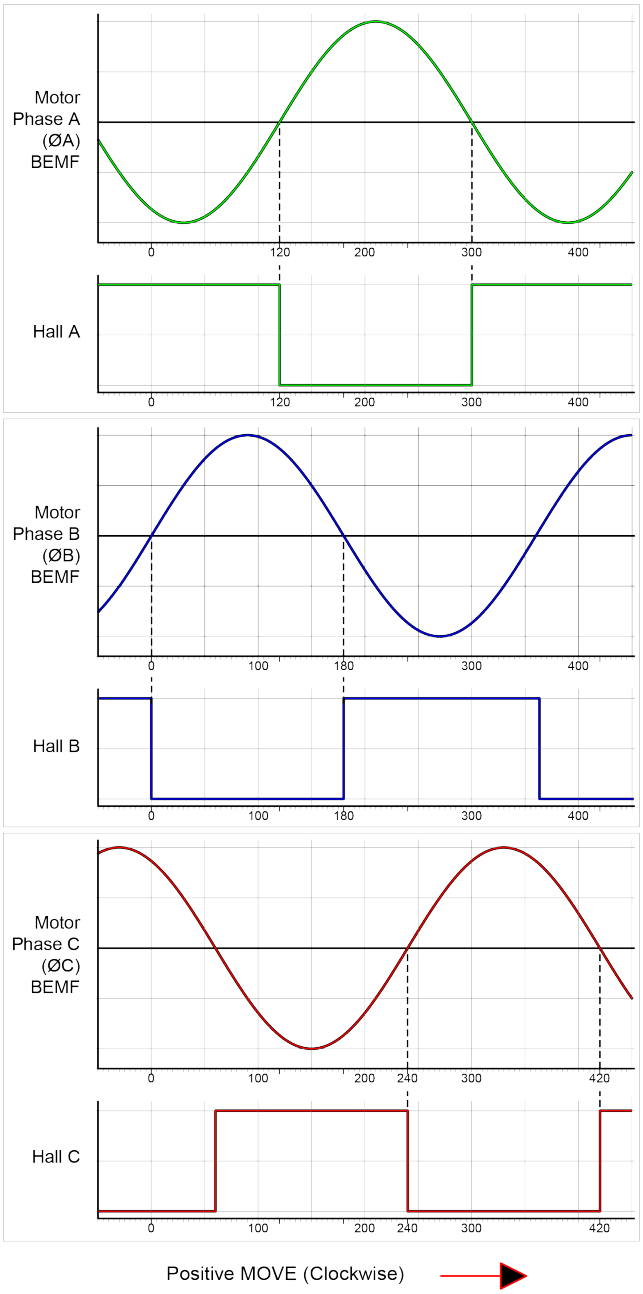


Figure 3-3: Machine Direction

3.5. Motor and Feedback Phasing

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



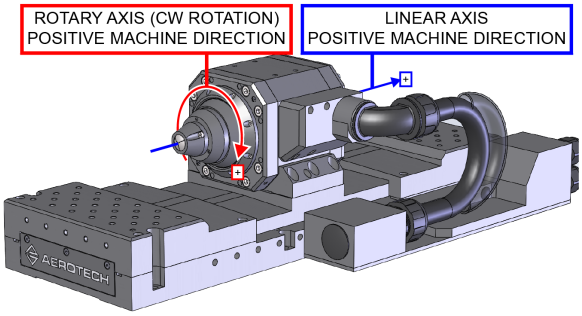


Figure 3-4: Hall Phasing

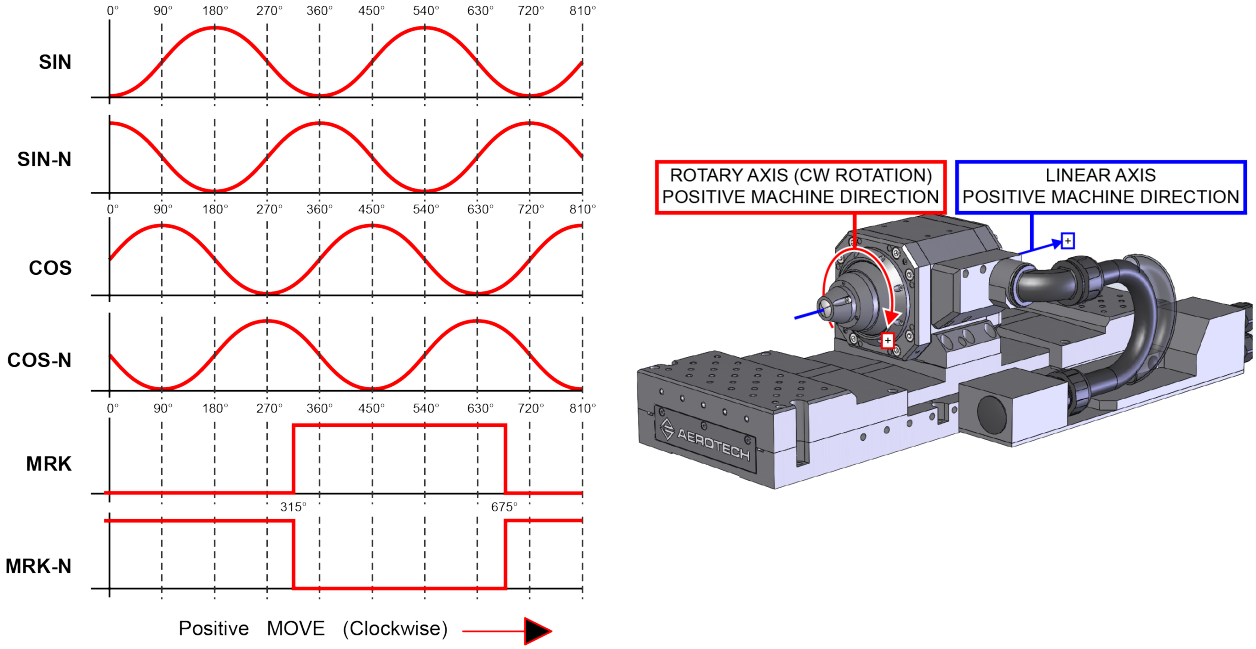


Figure 3-5: Analog Encoder Phasing Reference Diagram

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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. Service and Inspection Schedule

Inspect the LaserTurn®1 at least 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.

Rotary stage seals should be examined for excessive wear as part of this inspection interval. The application will determine the required replacement interval for the seals. The rotary stage bearings, motor, and encoder should 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 LaserTurn®1 and any components and cables as needed.
- Repair any damage before operating the LaserTurn®1.
- Inspect and perform an operational check on all safeguards and protective devices.

NOTE: For the wet cut option, replace the rotary seal before 1000 hours of service. Failure to follow the maintenance procedures outlined in Section 4.3.3. will result in voiding of warranty.

NOTE: The bearing area must be kept free of foreign matter and moisture; otherwise, the performance and life expectancy of the stage will be reduced. Always operate the stage with the hard cover and side seals in place to help keep dirt out.

In general, stages operating in a clean environment should be cleaned and lubricated annually or every 500 km (whichever comes first). For stages operating under conditions involving excessive debris, the stage should be cleaned every six months. For high-speed applications (those near max speed at a duty cycle of 50%), frequent maintenance with standard lubricants is required.

4.2. Cleaning and Lubrication

Cleaning

Before using a cleaning solvent on any part of the LaserTurn®1, blow away small particles and dust with nitrogen or, less preferably, clean, dry, compressed air.

Any external metal surface of the LaserTurn®1 can be cleaned with isopropyl alcohol on a lint-free cloth. Harsher solvents, such as acetone, may damage the plastic and rubber seals on the linear bearing trucks.

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

NOTE: During the lubrication procedure, inspect the linear motion guides for any damage or signs of wear.

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

For more information about how to clean and lubricate the collet and collet chuck, refer to Section 4.2.1. Collet & Collet Chuck Lubrication and Cleaning.

For more information about how to clean and lubricate the linear bearings, refer to Section 4.2.2. Linear Lubrication and Cleaning Process.

For more information about how to lubricate the wet cut rotary union seals, refer to Section 4.3.3. Wet Cut Rotary Union Seal Replacement.

4.2.1. Collet & 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.

4.2.2. Linear Lubrication and Cleaning Process

The lubrication and cleaning process is outlined in the steps that follow. The linear bearings are greased with Kluber Isoflex. Do not mix lubricants due to potential incompatibilities.

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.

Step 2: Remove the tooling plate (refer to Section 4.5.).

Step 3: Clean any accumulated dust or debris from inside of the assembly.

Step 4: Use a lint-free cloth to remove any dirty or dried lubricant from the linear bearing guides. A swab soaked in isopropyl alcohol can be used to remove stubborn debris.

Step 5: Apply a thin, continuous film of lubricant to the linear bearing guides (refer to Figure 4-1). A good quality, natural bristle artist's brush is an excellent applicator.

Step 6: Manually move the stage to the opposite end of travel to work the grease into the linear bearing guides.

Step 7: Refasten the tooling plate.

Step 8: Restore power to the stage and drive the stage table back to its original position to redistribute lubricants.

Figure 4-1: Linear Bearing Location

4.3. Seal Replacement

4.3.1. Piston Seal Change Procedure

The collet chuck on the LaserTurn®1 is equipped with o-ring piston seals that are designed to last many collet chuck (open/close) cycles. However, due to regular wear, the seals may require replacement during the lifetime of the product. If trouble with the piston seals is suspected, it is recommended that you contact Aerotech Technical Support. The seals should only be replaced by a qualified Aerotech technician.

4.3.2. Ringseal O-Ring Replacement

During the lifetime of the stage, it may be necessary to change the ringseal o-rings. Contact Aerotech to obtain proper replacement seals. The ringseal screws into the center of the shaft from the front of the stage. Use the steps that follow to replace the o-ring.

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.

Step 2: Remove collet (See Section 2.8.1.).

Step 3: With the collet removed, the ringseal will now be exposed. Using a 4 mm allen key or [WIHA Tool #54040] unscrew the ringseal from the shaft.

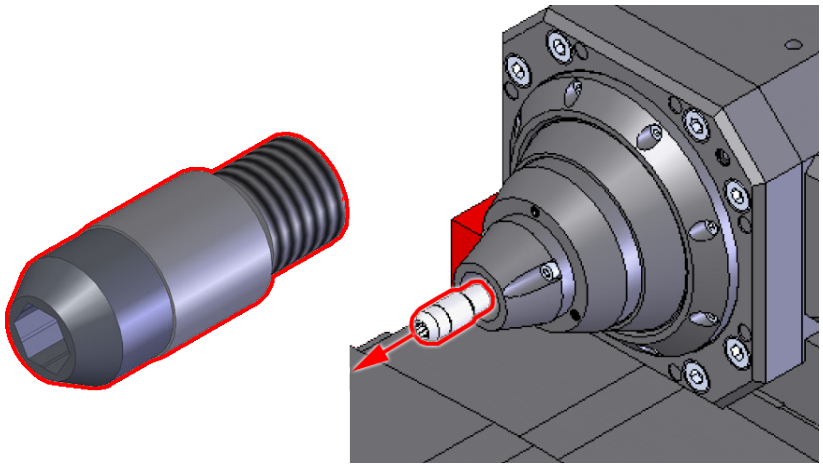

Figure 4-2: Typical Ringseal Removal

Step 4: Remove the o-ring ringseal (shown in Figure 4-3) and replace it with a properly lubricated new item. The shaft o-ring is a static seal and provides secondary protection against leaks. This seal does not need to be replaced unless required. Use a long pick or thin screwdriver to remove the shaft o-ring.

Step 5: Wrap the ringseal threads with Teflon thread seal tape [PTFE tape] in preparation for installation.

Step 6: Re-insert the ringseal into the inner collet housing and tighten into position.

Step 7: Re-insert the collet.

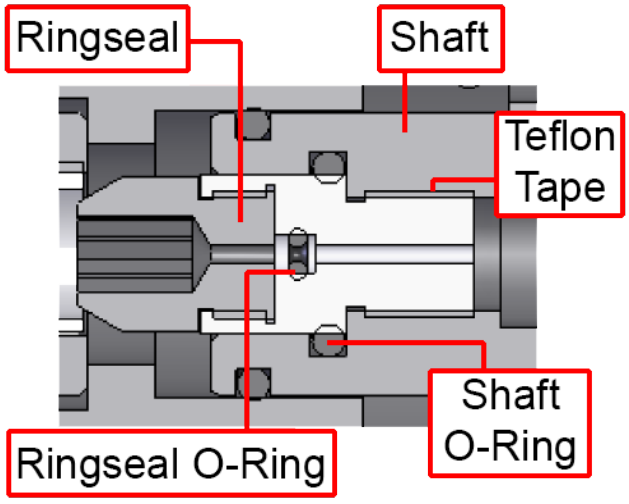

Figure 4-3: Cross-section View of Ringseal Showing O-Rings

4.3.3. Wet Cut Rotary Union Seal Replacement

The rotary seal in the wet cut rotary union requires periodic replacement. Contact Aerotech for obtaining appropriate replacement seals. Figure 4-4 shows a cross section of the rotary union assembly.

DANGER: The wet cut rotary union seal should be replaced and relubricated at a minimum of every 1000 hours of stage operation.
For heavy use or three shift operation: this corresponds to replacement every month.
For lighter use or single shift operation: this corresponds to replacement every three months.

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

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.

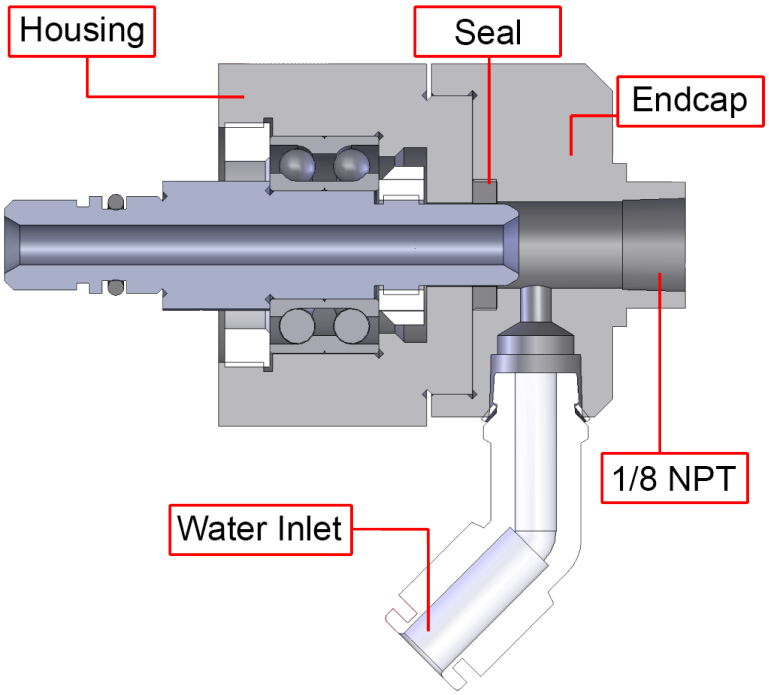

Figure 4-4: Cross-Section View of Wet Cut Rotary Union

Step 1: Remove power to the stage.

Step 2: Purge water from inside stage. Be careful to not get large quantities of water on the stage.

Step 3: To access the rotary union seal, remove [QTY-4] M3 end cap mounting screws from the rear of the assembly and carefully pull the end cap off of the housing (refer to Figure 4-5).

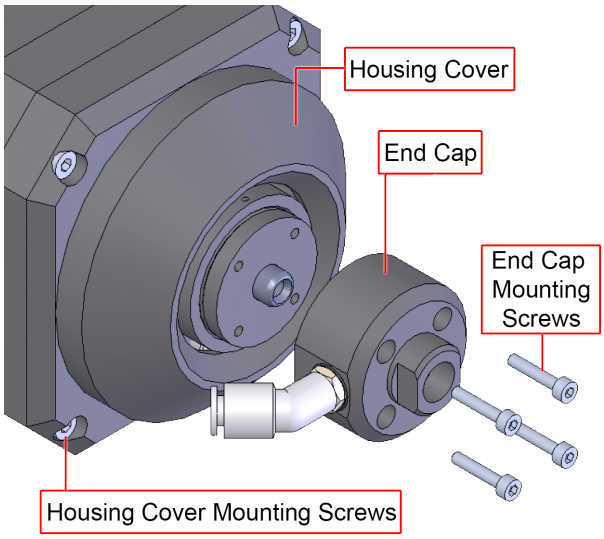

Figure 4-5: Rear Carriage Cover with Wet Cut Rotary Union

Step 4: The rotary seal and rotary union shaft will now be exposed. Pry the rotary seal from the end cap. Be careful to not cause damage to the sealing surfaces (see Figure 4-6).

Figure 4-6: Seal Location

Step 5: Inspect the shaft and seal surface for scratches or nicks. Small wear marks are normal. If the shaft is undamaged, clean both the shaft and seal end cap surfaces with a lint-free rag and isopropyl alcohol. If the shaft is scratched (you can feel it with your fingernail), contact Aerotech customer service. (see Figure 4-7).

If advised to remove the rotary union, see Section 4.4. for instructions.

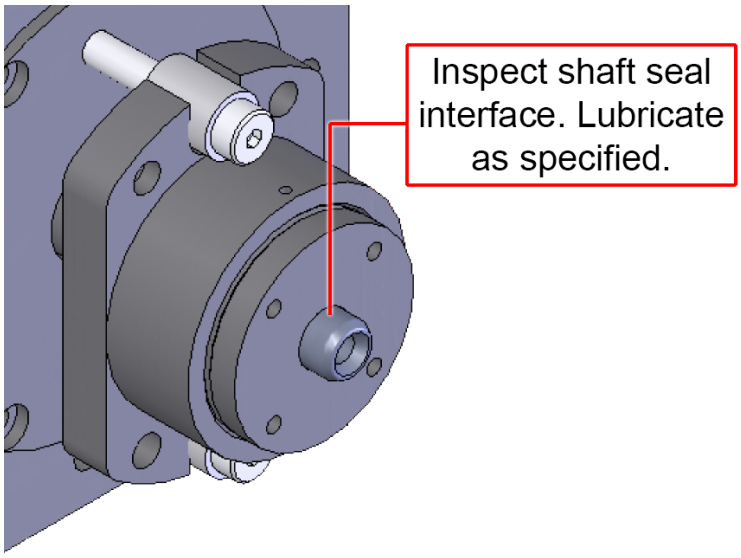

Figure 4-7: Wet Cut Rotary Union Shaft Inspection

Step 6: Lubricate the new seal with a generous amount of Parker O-Lube and press it uniformly into its housing in the end cap.

Step 7: Apply Parker O-Lube to the exposed end of the rotary union shaft as shown in Figure 4-7.

Step 8: Pilot the end cap back onto housing sub-assembly by using the rotary union shaft and housing. Use care when aligning the end cap so that damage does not occur to the newly installed seal.

Step 9: Tighten the end cap screws and reconnect water supply.

Step 10: Leak test stage prior to restoring stage power.

4.4. Wet Cut Rotary Union Removal

If the rotary union shaft becomes scratched or damaged, the rotary union must be replaced in order to properly seal the system (refer to Figure 4-8 for a view of the rotary union assembly).

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.

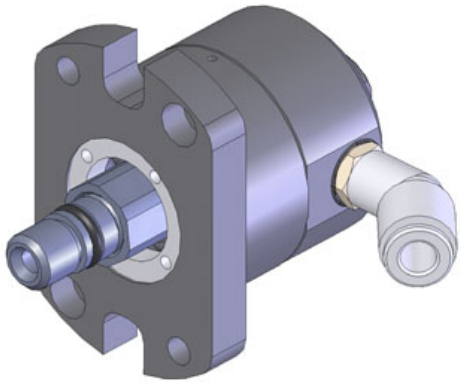

Figure 4-8: Wet Cut Rotary Union

Step 1: Remove power to the stage.

Step 2: Purge water from inside stage. Care should be taken when doing this to prevent large amounts of water from being deposited on stage.

Step 3: Remove [QTY-4] M3 end cap mounting screws from the rear of the assembly and carefully pull the end cap off of the housing. Also remove [QTY-4] M5 rear housing cover screws along with cover (see Figure 4-5).

Step 4: Remove the shoulder bolts and bushings (see Figure 4-10).

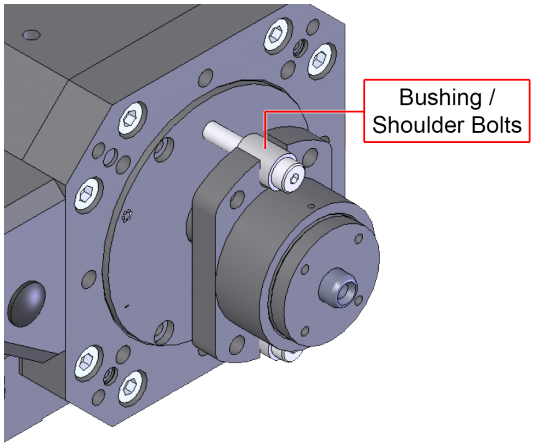

Figure 4-9: Housing Assembly Showing Rotary Union

Step 5: Use two 14 mm wrenches (one on the rotary union shaft nut, the other on the LaserTurn®1 shaft flats to unscrew the rotary union from the LaserTurn®1 shaft (see Figure 4-10).

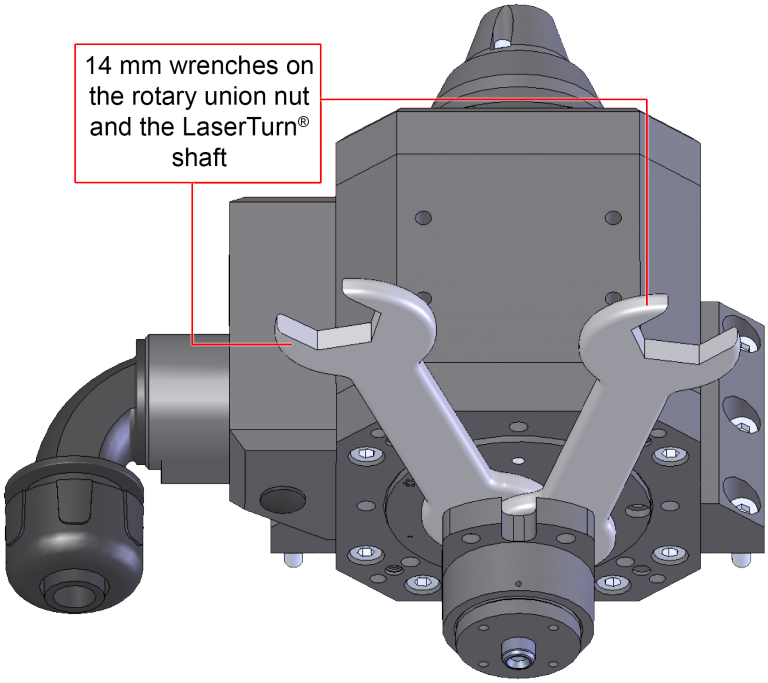

Figure 4-10: Wet Cut Rotary Union Removal

Step 6: Install a new rotary union assembly by attaching it to the rear of the LaserTurn®1 shaft. Tighten to 13.5 N·m [10 ft-lbs]. Add the shoulder bolts and bushings.

Step 7: Reattach the cover and end cap.

Step 8: Leak test the stage.

Step 9: Restore power to the stage.

4.5. Tooling Plate Removal

The procedure outlined below describes how to remove the tooling plates.

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.

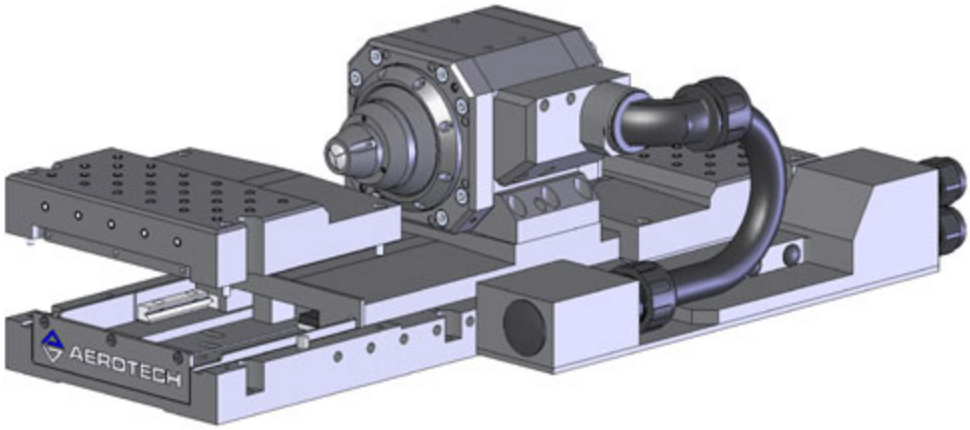

Figure 4-11: Tooling Plate Removal

Step 1: Remove power to stage.

Step 2: Remove [QTY-4] M4 flat head socket screws from the toolplate.

Step 3: Lift the toolplate straight up to remove it.

Step 4: Repeat these steps to remove the rear toolplate.

4.6. Troubleshooting

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	• 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 2.4.). • Collet not threaded in all the way. Follow procedures in Section 2.8. to ensure collet is installed properly
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 2.4.). • The collet has not been lubricated properly or the lubrication needs to be replenished (refer to Section 4.2.1.).

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Appendix A: Warranty and Field Service

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

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

Return Products Procedure

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

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

Returned Product Warranty Determination

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

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

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

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

Rush Service

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

On-site Warranty Repair

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

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

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

On-site Non-Warranty Repair

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

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

Service Locations

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

USA, CANADA, MEXICO	CHINA	GERMANY
Aerotech, Inc. Global Headquarters Phone: +1-412-967-6440 Fax: +1-412-967-6870	Aerotech China Full-Service Subsidiary Phone: +86 (21) 5508 6731	Aerotech Germany Full-Service Subsidiary Phone: +49 (0)911 967 9370 Fax: +49 (0)911 967 93720

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
1.07.00	General revision / product update
1.06.00	Revision changes have been archived. If you need a copy of this revision, contact Aerotech Global Technical Support.
1.05.00	
1.04.00	
1.03.00	
1.02.00	
1.01.00	
1.00.00	

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