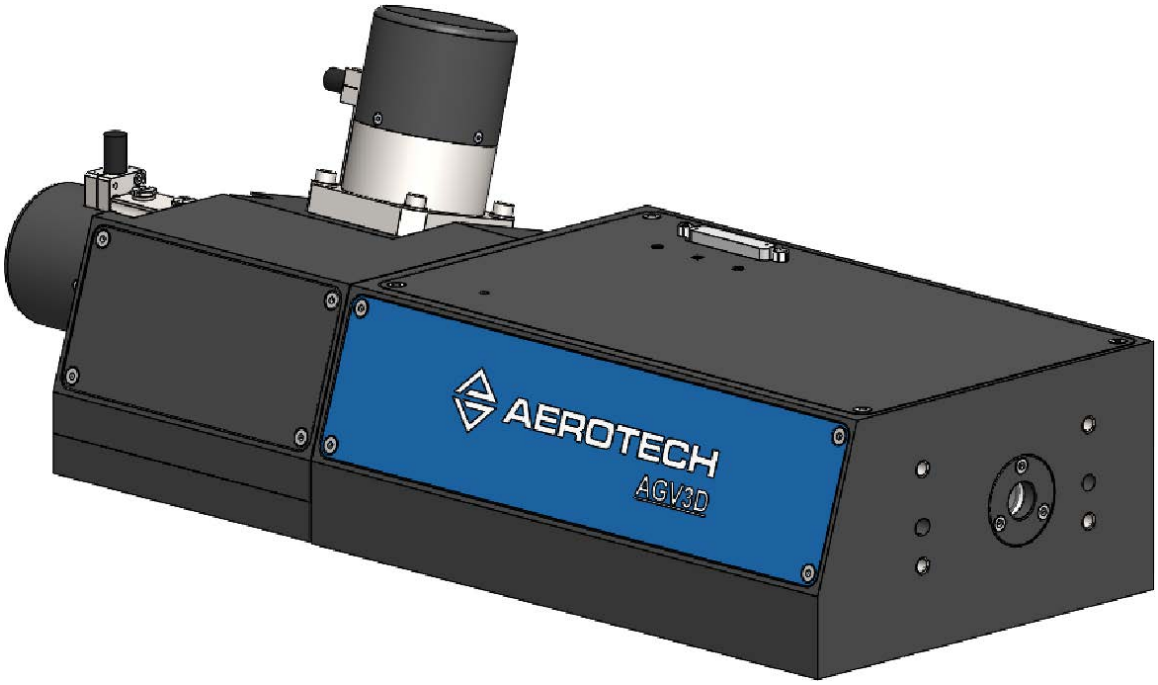
AGV3D Three-Axis Laser Scan Head Hardware Manual

Revision: 1.01.00



Global Technical Support

Go to www.aerotech.com/global-technical-support for information and support about your Aerotech products. To get help immediately, contact a service office or your sales representative (Support@aerotech.com). Include your customer order number in your email.

Software Support: Aerotech offers a range of software packages readily available for download. Free software is available for instant download. Chargeable software requires a current software key. Link: Software Downloads

Software Activation: The following link provides information and resources to activate your Aerotech software.
Link: Software Activation

Manuals, Help Files, and Cable Drawings: Browse a directory of manuals, help files, and cable drawings for Aerotech software and hardware products. Link: Browse Manuals, Help Files, and Cable Drawings

Frequently Asked Questions: The Frequently Asked Questions (FAQs) section provides answers to most common questions about Aerotech products. Link: Product FAQs

Product Training: View training information and schedule a training class. Link: Training Sessions

Request Product Repair or Return: We offer complete service and repair services for all of our products. Learn more about our pricing and warranties, plus access the forms required for many Global Technical Support port requests. Link: Repair & Return

Remote and Field Service Technical Support: Schedule a remote session now or a field service appointment. Link: Remote Technical Support

Table of Contents

List of Figures

List of Tables

Safety Procedures and Warnings

This manual tells you how to carefully and correctly use and operate the AGV3D.

- Read all parts of this manual before you install or operate the AGV3D or before you do maintenance to your system.
- To prevent injury to you and damage to the equipment, obey the precautions in this manual.
- Aerotech continually improves its product offerings; listed options may be superseded at any time.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.

If you do not understand the information in this manual, contact Aerotech Global Technical Support.

NOTE: This product is intended for light industrial manufacturing or laboratory use.

DANGER: Reduce the possibility of electrical shock, bodily injury, or death. This product contains potentially lethal voltages.

- Operators must be trained before operating this equipment.
- All service and maintenance must be performed by qualified personnel.
- Disconnect electrical power before servicing equipment.
- Do not connect or disconnect any electrical components or connecting cables while connected to a power source.
- Restrict access to the AGV3D and component parts while the AGV3D is connected to a power source.
- All components must be properly grounded in accordance with local electrical safety requirements.
- Operator safeguarding requirements must be addressed during final integration of the product.

DANGER: Lasers.

- Wear eye protection.
- Be aware of the possibility of visible and/or invisible laser radiation. Avoid eye or skin exposure to direct or scattered radiation.

DANGER: Compressed Air.

- Wear eye protection when in the proximity of compressed air components.
- The noise from some compressed air components could be loud enough to require ear protection.

WARNING: To prevent damage to the equipment:

- Operators must be trained before operating this equipment.
- All service and maintenance must be performed by qualified personnel.

- 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.
- Use care when moving the AGV3D. Lifting or transporting the AGV3D improperly can result in injury or damage to the AGV3D.
- The AGV3D must be mounted securely. Improper mounting can result in injury and damage to the equipment.

WARNING: Cables can pose a tripping hazard. Securely mount and position all system cables to avoid potential hazards.

WARNING: Wear clean, powder-free gloves when you handle optical components.

Laser Safety

It is the responsibility of the user to provide the necessary conditions for safe operation of a laser system and to safeguard the surrounding area against the hazards that can be caused by laser radiation. The user must ensure compliance with all local and national regulations.

Although the scan head by itself does not emit laser radiation, the user must undertake a thorough analysis of system safety before operating the AGV3D in conjunction with a laser source. Important information for performing this analysis is presented in this manual. Additional information may be found in the corresponding documentation supplied by the manufacturer of the laser source.

Classes of Lasers

The AGV3D series scan head can be used with a variety of lasers. Each laser is assigned a particular hazard level, which is indicated by the Laser Class label that is affixed to the device near the location where laser radiation is emitted. Brief descriptions of each of the various radiation classes are presented in the table below.

Note that in addition to the dangers of radiation, lasers may pose further dangers, such as the risk of electrical shock or the generation of poisonous fumes.

Classifications of Laser Devices

	Class	Danger
	Class I	Inherently safe; no possibility of eye damage during normal operation.
	Class IIa	Requires in excess of 1000 seconds of continuous viewing to cause eye damage.
	Class II	The blink reflex will prevent eye damage, unless the person deliberately stares into the beam for an extended period of time.
	Class IIIa	Mostly dangerous in combination with optical instruments which change the beam diameter or power density. However, even without optical enhancement, direct contact for over two minutes may cause eye damage.
	Class IIIb	Direct exposures of 0.01 second or less may cause eye and skin damage.
	Class IV	Direct or scattered radiation without optical enhancement may cause eye and skin damage.

Laser Area

The area in which the maximum permitted radiation value can be exceeded is defined as the laser area. In general, a laser area is applicable to Class IIIa, IIIb and IV laser systems. A laser area may also be produced by focusing the beam of a Class I, IIa, or II laser device.

The AGV3D has the capability of aiming the laser beam over an approximately pyramidal volume. When the scan head is used in conjunction with a laser device capable of generating a sufficiently intense beam, a laser area will be produced that includes the aiming volume as well as the reflections from all objects that can be exposed to the radiation. It is important to note that even apparently diffuse surfaces can reflect laser radiation and a laser beam that has been reflected several times can still be dangerous.

The laser area must be designated by suitable warning signs or lamps and protected by appropriate shading and interlock switches.

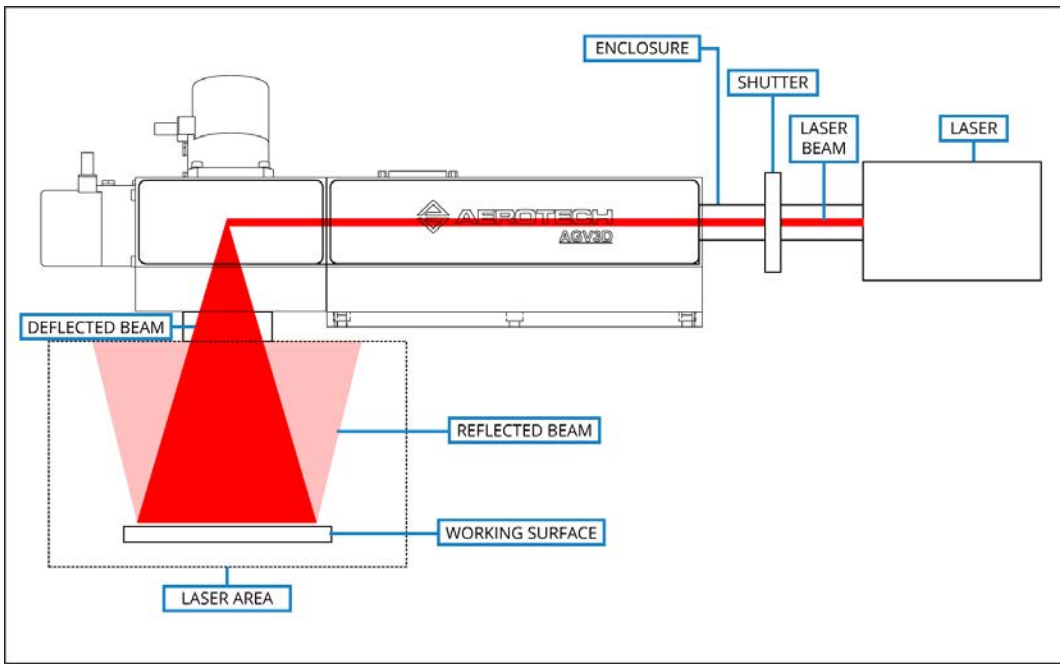


Figure 1: Laser Area of an AGV3D Scan Head

Laser Shutter

A laser attenuator (beam shutter) is a mechanical or electrical device that blocks the emission of laser radiation. It is a requirement for most classes of laser systems. The attenuator must be available for use at all times during operation of the laser system. Power switches and key controls do not satisfy the attenuator requirement.

The AGV3D scan head does not include a laser attenuator, and therefore it cannot block or weaken the laser beam. Due to the unique properties of each laser, it is the user's responsibility to incorporate an appropriate shutter as per any and all applicable regulations in order to prevent unwanted emission of the laser beam.

The beam shutter should be fitted between the laser source and the scan head (refer to Figure 1).

WARNING: Do no stare into the laser beam, place your body parts in the beam path, or expose yourself to reflections from powerful beams.

WARNING: Only a Class 1 HeNe laser is recommended for performing alignments. If this is not possible, use the lowest power setting on the available laser and employ remote beam sensing techniques.

WARNING: Wear eye protection. The danger to your eyes increases when optical instruments are used in conjunction with the scan head.

EU Declaration of Incorporation

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

herewith declares that the product:

AGV3D Scan Head

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 Directive, Restricted Substances (RoHS 3)

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

Name / Alex Weibel
Position Engineer Verifying Compliance
Location Pittsburgh, PA
Date 12/2/2020

CE

Chapter 1: Overview

Aerotech's AGV3D three-axis laser scan head manipulates a laser beam in three degrees of freedom: X, Y, and Z. The AGV3D uses two mirrors, each of which is actuated by a galvano motor, to deflect the beam in the X and Y directions. Before the X and Y deflections, the laser beam travels through the Dynamic Focusing Module (DFM). The DFM uses an expander lens that is mounted on a high-dynamic linear stage and stationary optics to adjust the focus the laser beam. Change the distance between the expander lens and the optics to adjust the focal height (Z-height of the focused spot). Use this in field-flattening applications to eliminate the need for expensive focusing optics such as an F-theta lens, or in applications that require different working heights in different stages of the process. The DFM in the AGV3D can also be used to collimate the incoming laser beam to function as a beam expander to increase the incoming beam diameter to 2.5X the original size.

The scan head enclosure is fully sealed, featuring cover glass and gaskets over both the input and exit apertures, to make sure that no dust or particles can infiltrate the enclosure and cause damage to the internal optical components. Only use a laser that meets the laser specifications that are listed in Section 1.3. Basic Specifications for details.

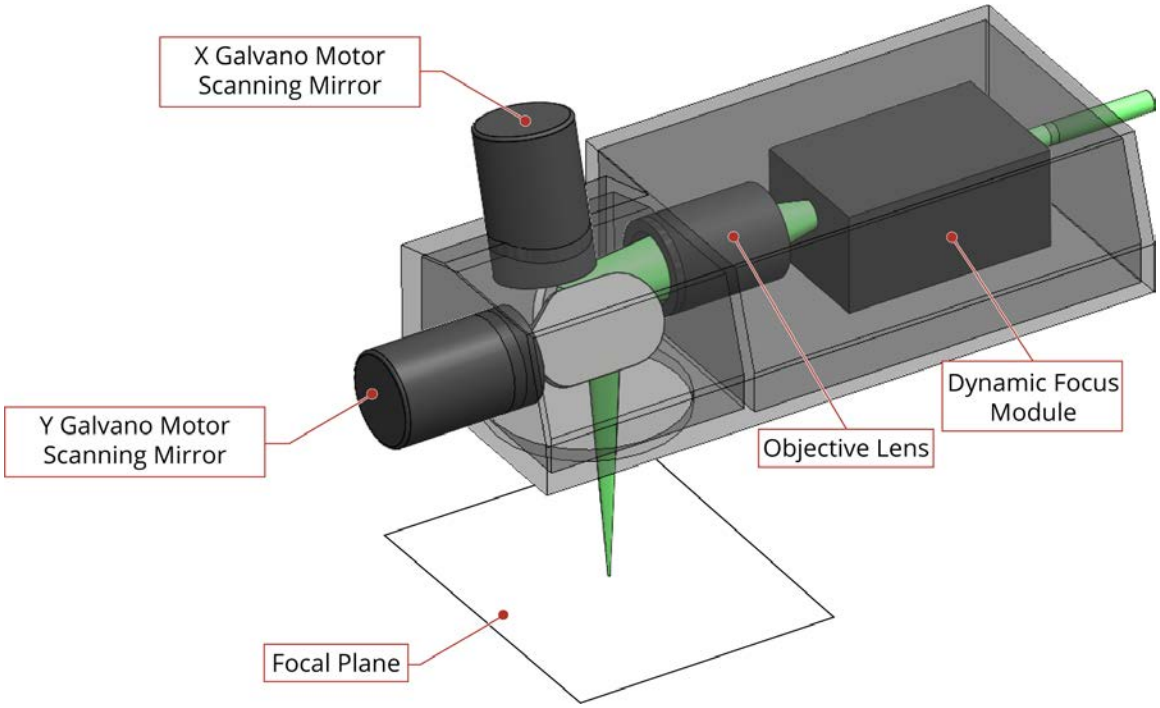


Figure 1-1: Functional Principle of a 3-Axis Galvanometer Scanner

Integration Flexibility

The AGV3D offers mounting flexibility, with mounting hole patterns on the side, rear, and bottom faces. The control connections consist of two 300 mm cables terminated in 25-pin D-style connectors for the X and Y axes, and an additional 25-pin D-style connector located on the top face of the enclosure for the Z axis. The cables can be oriented in any direction and terminated on the machine to make sure that there is no interference with beam delivery from the control cables.

A beam alignment fixture is included with the AGV3D. Bolt the fixture to the front face of the enclosure to help align the input laser beam to the system (refer to Section 2.5.).

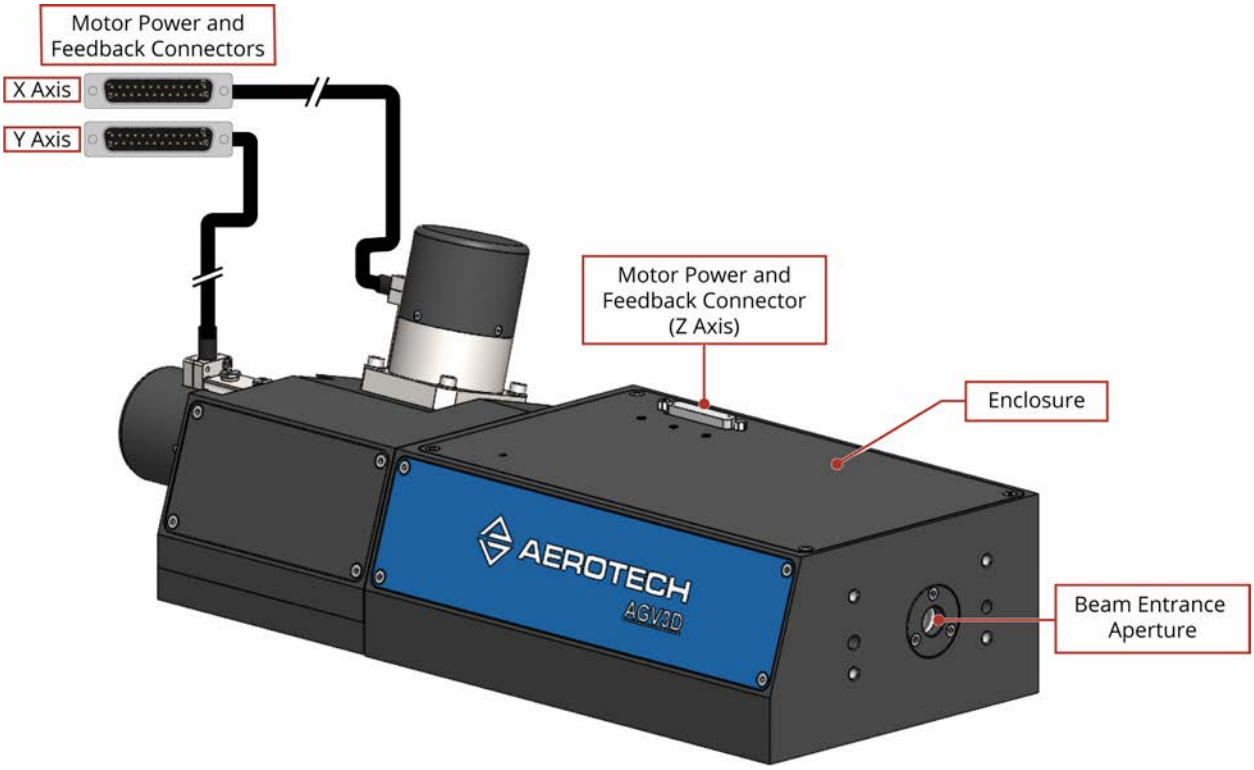


Figure 1-2: Standard AGV3D

Table 1-1: Ordering Options

AGV3D Series High Performance Galvanometer Scanner	
Wavelength (Required)	
-W001	10.6 µm
-W003	1552 nm
-W004	1064 nm
-W005	1030 nm
-W006	532 nm
-W007	515 nm
-W008	355 nm
-W009	343 nm
-W012	9.3 µm
NOTE: Custom wavelengths are available. Contact the factory for details.	
Scanner Aperture (Required)	
-20	20 mm Scanner Aperture
-30	30 mm Scanner Aperture
Field Configuration (Required)	
-F1	Near Field of View
-F2	Far Field of View
Air Cooling (Optional, refer to Section 2.6.)	
-AC	Air cooling
Water Cooling (Optional, refer to Section 2.7.)	
-WC	Water cooling
Plate (Optional)	
-MP1	Rear Mounting Plate
-MP2	Bottom Mounting Plate
Integration (Required)	
-TAS	Integration - Test as system Testing, integration, and documentation of a group of components as a complete system that will be used together (ex: drive, controller, and stage). This includes parameter file generation, system tuning, and documentation of the system configuration.
-TAC	Integration - Test as components Testing and integration of individual items as discrete components that ship together. This is typically used for spare parts, replacement parts, or items that will not be used together. These components may or may not be part of a larger system.

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	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 AGV3D is gasketed at critical interfaces to provide some protection from contamination due to laser marking and cutting. Dust and fumes generated by the laser machining process should be removed through exhaust or vacuum systems. Failure to control this debris could result in rapid contamination of the cover glass and damage to beam delivery optical components.
Use	Indoor use only

1.2. Accuracy and Temperature Effects

Aerotech products are designed for and built in a 20°C (68°F) environment. Extreme temperature changes could cause a decrease in performance or permanent damage to the AGV3D. At a minimum, the environmental temperature must be controlled to within 0.25ºC per 24 hours to ensure the AGV3D specifications are repeatable over an extended period of time. The severity of temperature effects on all specifications depends on many different environmental conditions, including how the AGV3D is mounted. Contact the factory for more details.

1.2.1. Power-On Thermal Drift

For the best possible accuracy and repeatability, it is recommended that the +5 V feedback power supply be connected to the galvano motors for a minimum of four hours prior to performing any critical operations with the AGV3D. Application of the feedback power supply can raise the temperature of the galvano motors, resulting in a transient period of "power-on" thermal drift. Allowance for this warm-up period provides the galvano motors sufficient time to achieve thermal equilibrium.

In applications where a mark-and-measure calibration is performed to improve accuracy, it is essential that the calibration procedure not be conducted prior to completion of the warm-up period. Otherwise, the calibration may not be effective due to the change in zero offset that can result from the "power-on" thermal drift.

To minimize delays in operating the AGV3D, it is recommended that the +5 V feedback power supply is continuously maintained to the galvano motors, even when they are not under servo control.

1.3. Basic Specifications

Table 1-3: AGV3D Series Specifications

		AGV3D-20	AGV3D-30
Optical Specifications			
Compatible Wavelength (1)		343 nm, 355 nm, 515 nm, 532 nm, 1030 nm, 1064 nm, 1550 nm, 9.3 µm, 10.6 µm	
Aperture		20 mm	30 mm
Input Beam Diameter ($1/e^2$)		8 mm	12 mm
Beam Displacement		23.2 mm	35.7 mm
Dynamic Performance			
Tracking Error		0 µsec	
Peak Acceleration	Galvo Scanners	500,000 rad/s^2	350,000 rad/s^2
	Z-Focus (2)	150 m/s^2	
Continuous Acceleration	Galvo Scanners	130,000 rad/s^2	120,000 rad/s^2
	Z-Focus (2)	50 m/s^2	
Maximum Positioning Speed	Galvo Scanners	300 rad/s 40 m/s at 100x100 mm FOV 400 m/s 1000x1000 mm FOV	125 rad/s 17 m/s at 100x100 mm FOV 170 m/s at 1000x1000 mm FOV
	Z-Focus	1000 mm/s (2) 3.8 m/s at 160 mm working distance 30 m/s at 500 mm working distance 100 m/s at 1000 mm working distance	
Processing Speed (3)	Galvo Scanners	50 rad/s at 100x100 mm FOV: 6.5 m/s at 1000x1000 mm FOV: 65 m/s	
	Z-Focus	500 mm/s (2) 1.9 m/s at 160 mm working distance 15 m/s at 500 mm working distance 50 m/s at 1000 mm working distance	
Stability			
Long-Term Drift (4)	Galvo Scanners	10 µrad / 12 h	
	Z-Focus	0.5 µm / 12 h	
Thermal Drift	Galvo Scanners	10 µrad / °C	
	Z-Focus	2.5 µm / °C	

All angles are optical unless otherwise specified. All specifications are per axis unless otherwise specified.
(1) Contact Aerotech to inquire about additional wavelengths.
(2) As measured at the focusing apparatus.
(3) Processing speed is dependent on allowable tracking error. Achievable with < 2% velocity error over continous velocity portion of the move.
(4) After initial 3-hour warm-up with ambient temperature variation < ±0.5°C.
(5) Without -AC option
(6) For -AC option, if nitrogen is used, it must be 99.99% pure and filtered to 0.25 µm. If compressed air is used, it must be filtered to 0.25 µm, dry to 0º F dew point and oil free.
(7) Working distance is measured from the bottom surface of the scan head.

Table 1-4: AGV3D Series Specifications (continued)

		AGV3D-20	AGV3D-30
Mechanical Specifications			
Axes		3 total: Spot positioning (X,Y); Focusing (Z)	
Accuracy	Galvo Scanners	50 µrad pk-pk	
	Z-Focus	0.5 µm	
Repeatability	Galvo Scanners	0.4 µrad rms	
	Z-Focus	0.15 µm	
Dither (Minimum Incremental Motion) (5)	Galvo Scanners	< 0.4 µrad rms	
	Z-Focus	0.003 µm (2) 0.05 µm at 160 mm working distance 0.25 µm at 500 mm working distance 0.8 µm at 1000 mm working distance	
Cooling (6)		Air cooling (-AC option); Water cooling (-WC option)	
Weight		10.5 kg	11.2 kg
Material		Anodized aluminum	
Mean Time Before Failure (MTBF)		20,000 hours	

All angles are optical unless otherwise specified. All specifications are per axis unless otherwise specified.
(1) Contact Aerotech to inquire about additional wavelengths.
(2) As measured at the focusing apparatus.
(3) Processing speed is dependent on allowable tracking error. Achievable with < 2% velocity error over continous velocity portion of the move.
(4) After initial 3-hour warm-up with ambient temperature variation < ±0.5°C.
(5) Without -AC option
(6) For -AC option, if nitrogen is used, it must be 99.99% pure and filtered to 0.25 µm. If compressed air is used, it must be filtered to 0.25 µm, dry to 0º F dew point and oil free.
(7) Working distance is measured from the bottom surface of the scan head.

Table 1-5: AGV3D-20 Spot Diameter Range (µm) within Field of View per Wavelength

Nominal Field of View	Nominal Working Distance	343 nm	355 nm	515 nm
100 mm x 100 mm	83 mm	7.0 - 7.5	7.2 - 7.8	10.3 - 11.1
200 mm x 200 mm	221 mm	11.7 - 12.7	12.1 - 13.2	17.3 - 18.9
300 mm x 300 mm	358 mm	16.2 - 17.9	16.8 - 18.5	24.3 - 26.8
400 mm x 400 mm	495 mm	20.8 - 23.0	21.5 - 23.8	31.2 - 34.6
500 mm x 500 mm	632 mm	25.3 - 28.1	26.3 - 29.2	38.1 - 42.4
600 mm x 600 mm	770 mm	29.9 - 33.3	31.0 - 34.5	45.1 - 50.2
700 mm x 700 mm	907 mm	34.5 - 38.4	35.8 - 39.9	52.1 - 58.1
800 mm x 800 mm	1045 mm	39.1 - 43.6	40.5 - 45.2	59.1 - 65.9
1000 mm x 1000 mm	1320 mm	48.2 - 53.9	50.1 - 55.9	73.1 - 81.7
		532 nm	1030 nm	1064 nm
100 mm x 100 mm	83 mm	10.6 - 11.4	20.4 - 22.0	21.1 - 22.7
200 mm x 200 mm	221 mm	17.8 - 19.6	34.1 - 37.3	35.2 - 38.5
300 mm x 300 mm	358 mm	25.0 - 27.6	47.8 - 52.7	49.3 - 54.4
400 mm x 400 mm	495 mm	32.2 - 35.7	61.5 - 68.1	63.5 - 70.4
500 mm x 500 mm	632 mm	39.4 - 43.8	75.2 - 83.6	77.6 - 86.3
600 mm x 600 mm	770 mm	46.6 - 51.9	88.9 - 99.0	91.8 - 102.3
700 mm x 700 mm	907 mm	53.8 - 60.0	102.7 - 114.5	106.0 - 118.3
800 mm x 800 mm	1045 mm	61.0 - 68.1	116.5 - 130.1	120.3 - 134.3
1000 mm x 1000 mm	1320 mm	75.4 - 84.4	144.1 - 161.2	148.8 - 166.4
		1550 nm	9.3 µm	10.6 µm
100 mm x 100 mm	83 mm	30.7 - 32.9	190.5 - 204.7	216.7 - 232.8
200 mm x 200 mm	221 mm	51.5 - 56.0	316.4 - 346.2	360.2 - 394.1
300 mm x 300 mm	358 mm	71.6 - 79.1	442.6 - 488.1	503.9 - 555.7
400 mm x 400 mm	495 mm	92.2 - 102.2	568.8 - 630.0	647.6 - 717.4
500 mm x 500 mm	632 mm	112.8 - 125.4	695.0 - 771.9	791.3 - 878.9
600 mm x 600 mm	770 mm	133.4 - 148.6	821.1 - 913.7	934.9 - 1040.2
700 mm x 700 mm	907 mm	154.1 - 171.8	947.2 - 1055.4	1078.3 - 1201.2
800 mm x 800 mm	1045 mm	174.7 - 195.1	1073.2 - 1196.9	1221.4 - 1361.9
1000 mm x 1000 m	1320 mm	216.2 - 241.8	1324.6 - 1479.1	1506.8 - 1682.0

NOTES:
Spot diameter is expressed as $1/e^2$ assuming a beam quality of $M^2 = 1$.
Nominal working distance is measured from the bottom surface of the scan head.
Refer to Table 1-7 to determine which field configuration option is required to achieve a specific nominal field of view for the desired wavelength.
Contact Aerotech for additional data.

Table 1-6: AGV3D-30 Spot Diameter Range (µm) within Field of View per Wavelength

Nominal Field of View	Nominal Working Distance	343 nm	355 nm	515 nm
100 mm x 100 mm	83 mm	4.8 - 5.0	5.0 - 5.2	7.4 - 7.7
200 mm x 200 mm	221 mm	7.9 - 8.6	8.2 - 8.9	11.9 - 13.2
300 mm x 300 mm	358 mm	11.0 - 12.2	11.3 - 12.5	17.3 - 19.2
400 mm x 400 mm	495 mm	14.2 - 15.8	14.6 - 16.2	22.7 - 25.3
500 mm x 500 mm	632 mm	17.5 - 19.4	17.8 - 19.8	28.2 - 31.6
600 mm x 600 mm	770 mm	20.7 - 23.0	21 - 23.4	33.8 - 38.1
700 mm x 700 mm	907 mm	23.9 - 26.6	24.3 - 27	39.7 - 44.8
800 mm x 800 mm	1045 mm	27.0 - 30.1	27.5 - 30.6	45.7 - 51.8
1000 mm x 1000 mm	1320 mm	33.3 - 37.1	33.9 - 37.8	58.4 - 66.7
		532 nm	1030 nm	1064 nm
100 mm x 100 mm	83 mm	7.7 - 7.9	14.6 - 14.7	15.0 - 15.2
200 mm x 200 mm	221 mm	12.2 - 13.6	22.4 - 24.7	23.3 - 25.7
300 mm x 300 mm	358 mm	17.8 - 19.8	32.3 - 35.9	33.4 - 37.0
400 mm x 400 mm	495 mm	23.3 - 26.0	42.2 - 47.1	43.5 - 48.5
500 mm x 500 mm	632 mm	28.9 - 32.4	52.2 - 58.4	53.8 - 60.1
600 mm x 600 mm	770 mm	34.6 - 38.9	62.3 - 69.8	64.1 - 71.7
700 mm x 700 mm	907 mm	40.5 - 45.6	72.6 - 81.4	74.5 - 83.5
800 mm x 800 mm	1045 mm	46.5 - 52.	82.8 - 93.0	84.9 - 95.3
1000 mm x 1000 mm	1320 mm	59.0 - 67.0	103.1 - 116.5	106.0 - 119.1
		1550 nm	9.3 µm	10.6 µm
100 mm x 100 mm	83 mm	21.1 - 21.8	128.5 - 137.1	145.8 - 155.8
200 mm x 200 mm	221 mm	33.2 - 36.5	211.1 - 231.2	240.3 - 263.1
300 mm x 300 mm	358 mm	47.3 - 52.4	296.1 - 326.8	337.0 - 371.9
400 mm x 400 mm	495 mm	61.5 - 68.4	381.3 - 422.	433.9 - 481.0
500 mm x 500 mm	632 mm	75.8 - 84.5	466.5 - 518.6	531.0 - 590.3
600 mm x 600 mm	770 mm	90.1 - 100.7	552.0 - 614.9	628.3 - 699.9
700 mm x 700 mm	907 mm	104.5 - 116.0	637.6 - 711.4	725.8 - 809.8
800 mm x 800 mm	1045 mm	119.0 - 133.2	723.5 - 808.2	823.6 - 920.0
1000 mm x 1000 mm	1320 mm	148.0 - 166.0	895.9 - 1002.6	1019.9 - 1141.4

NOTES:
Spot diameter is expressed as $1/e^2$ assuming a beam quality of $M^2 = 1$.
Nominal working distance (WD) is measured from the bottom surface of the scan head.
Refer to Table 1-7 to determine which field configuration option is required to achieve a specific nominal field of view for the desired wavelength.
Contact Aerotech for additional data.

Table 1-7: FOV Extents by Field Configuration Option and Wavelength

Field Configuration Option		343 nm	355 nm	515 nm
F1	Min	100 mm x 100 mm (83 mm Working Distance (WD))		
	Max	600 mm x 600 mm (770 mm WD)	550 mm x 550 mm (701 mm WD)	450 mm x 450 mm (564 mm WD)
F2	Min	150 mm x 150 mm (152 mm WD)	150 mm x 150 mm (152 mm WD)	175 mm x 175 mm (186 mm WD)
	Max	1000 mm x 1000 mm (1320 mm WD) (1)		
		532 nm	**1030 nm**	**1064 nm**
F1	Min	100 mm x 100 mm (83 mm WD)		
	Max	425 mm x 425 mm (530 mm WD)	375 mm x 375 mm (461 mm WD)	375 mm x 375 mm (461 mm WD)
F2	Min	175 mm x 175 mm (186 mm WD)		
	Max	1000 mm x 1000 mm (1320 mm WD) (1)		
		1550 nm	**9.3 µm**	**10.6 µm**
F1	Min	100 mm x 100 mm (83 mm WD)		
	Max	350 mm x 350 mm (427 mm WD)	325 mm x 325 mm (392 mm WD)	300 mm x 300 mm (358 mm WD)
F2	Min	175 mm x 175 mm (186 mm WD)	200 mm x 200 mm (221 mm WD)	200 mm x 200 mm (221 mm WD)
	Max	1000 mm x 1000 mm (1320 mm WD) (1)		

(1) For fields of view exceeding this value, or for applications using an F-theta lens in conjunction with AGV3D, contact Aerotech.
(2) The working distance (WD) is measured from the bottom surface of the scan head.

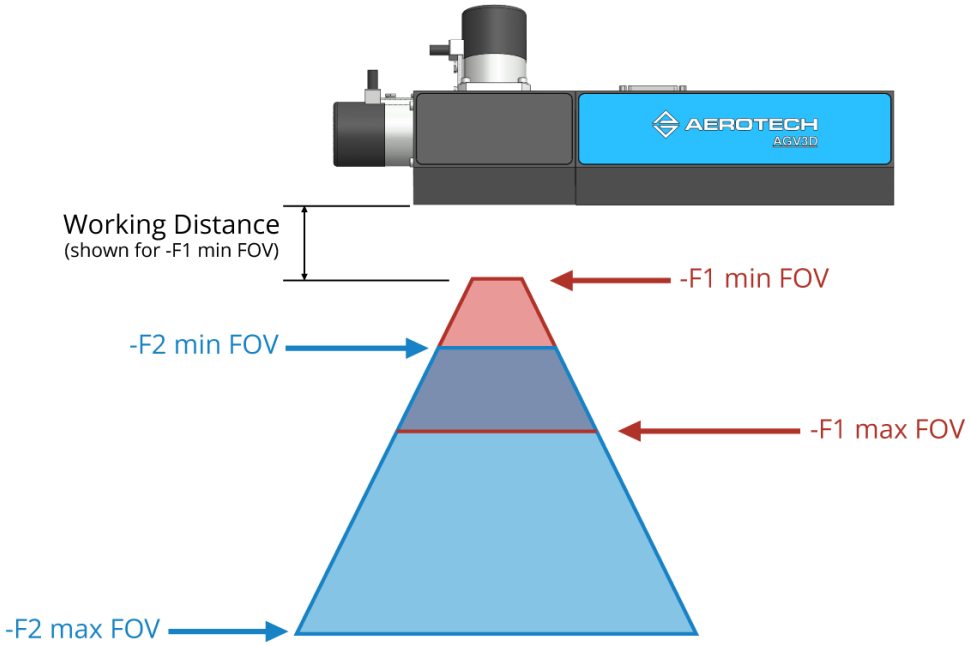


Figure 1-3: Working Distance Detail

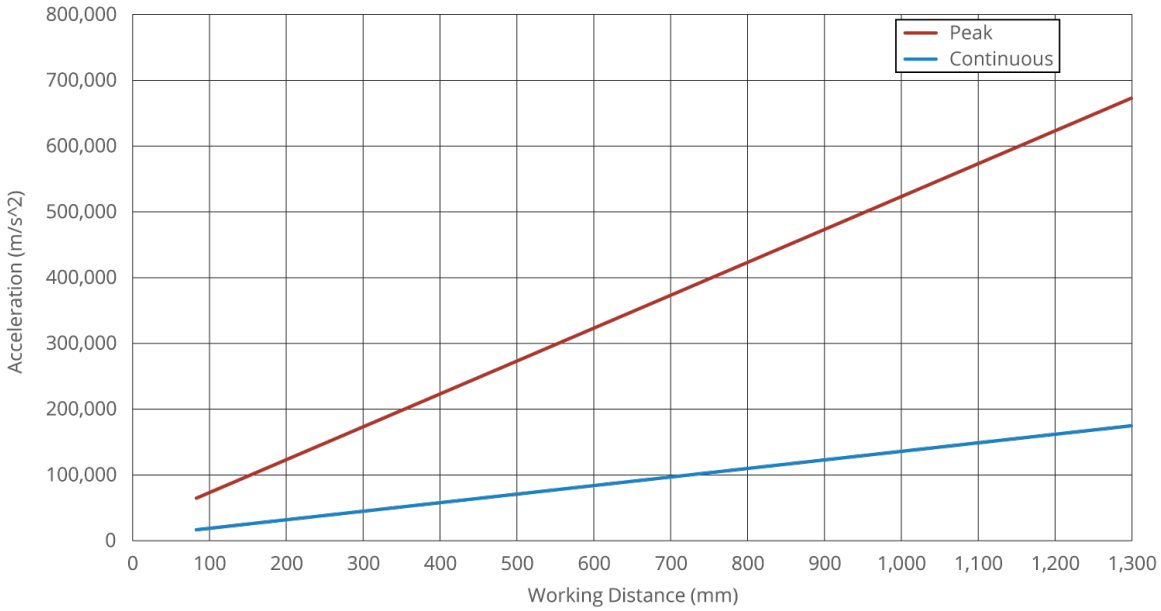


Figure 1-4: AGV3D-20 X/Y Axis Linear Acceleration vs Working Distance

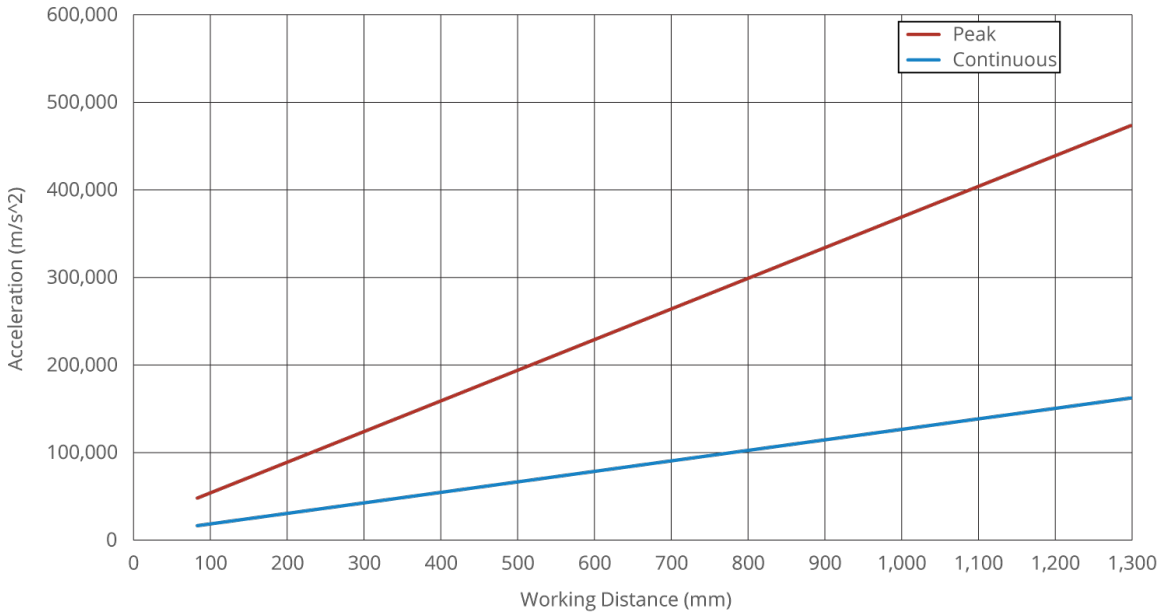


Figure 1-5: AGV3D-30 X/Y Axis Linear Acceleration vs Working Distance

Z-Axis linear acceleration values are shown for 1030 -1090 nm wavelength configuration. These values are generally representative of system performance for all wavelength options. If precise values for an alternate wavelength are required, contact the factory.

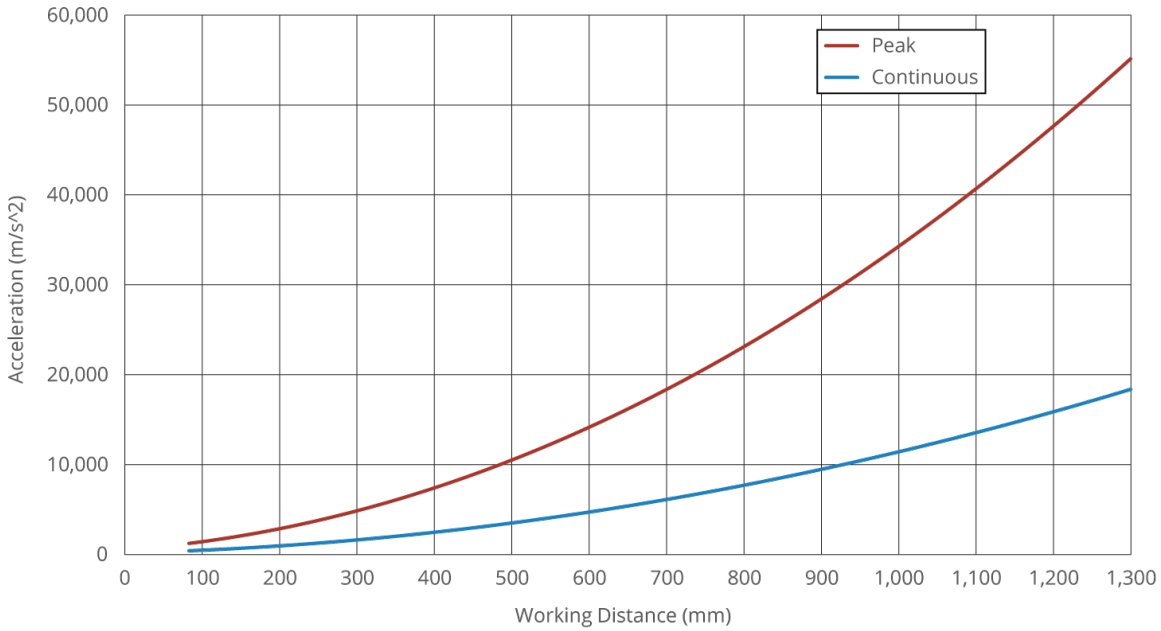


Figure 1-6: AGV3D Z-Axis Linear Acceleration vs Working Distance

1.4. Software Configuration

Refer to the AGV3D User Guide to configure the motion software. Any PC included with the system from the factory will already be configured.

This page intentionally left blank.

Chapter 2: Mechanical Specifications and Installation

WARNING: AGV3D 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.

WARNING: Do no stare into the laser beam, place your body parts in the beam path, or expose yourself to reflections from powerful beams.

WARNING: Only a Class 1 HeNe laser is recommended for performing alignments. If this is not possible, use the lowest power setting on the available laser and employ remote beam sensing techniques.

WARNING: Wear eye protection. The danger to your eyes increases when optical instruments are used in conjunction with the scan head.

WARNING: Failure to use the parameter file provided by the factory may result in permanent mechanical damage to the scan head.

2.1. Unpacking and Handling the Scan Head

WARNING: To prevent the accumulation of condensation on the optical surfaces, allow the shipping case to sit at room temperature before you open it.

WARNING: It is the customer's responsibility to safely and carefully lift and move the scan head. Improper handling could adversely affect the performance of the AGV3D

- Make sure that all moving parts are secure before moving the AGV3D. Unsecured moving parts may shift and cause bodily injury.
- Do not use the cables or tubing as a lift surface.
- Do not use the focal lens or exit aperture as a lift surface.
- Make certain that the lens cap is attached before moving the AGV3D.
- Only put the scan head on a soft surface when it is not attached to its mounting surface to protect the optics.

WARNING: Fingerprints contain aggressive substances that can damage optical surfaces. Always wear suitable gloves when you handle the optics.

Carefully remove the AGV3D from its protective shipping container. Gently set the AGV3D on a smooth, flat, and clean surface.

Before operating the AGV3D, it is important to let it stabilize outside of the shipping case 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 AGV3D 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.

2.2. Dimensions

NOTE: All drawings and illustrations are for reference only and were complete and accurate as of this manual's release. The most recent system drawings and schematics can be found on your Storage Device or at www.aerotech.com.

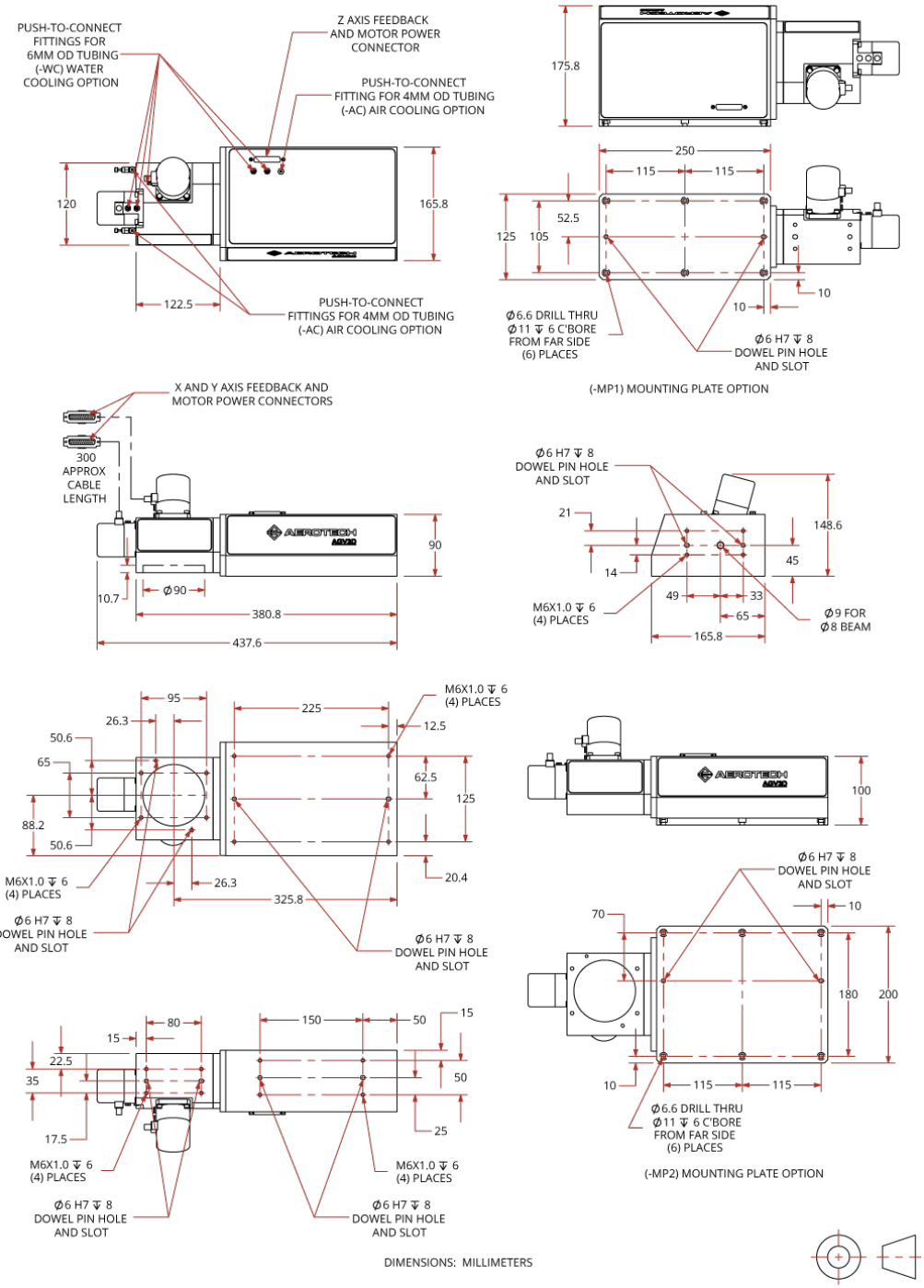


Figure 2-1: AGV3D-20 Scan Head Dimensions

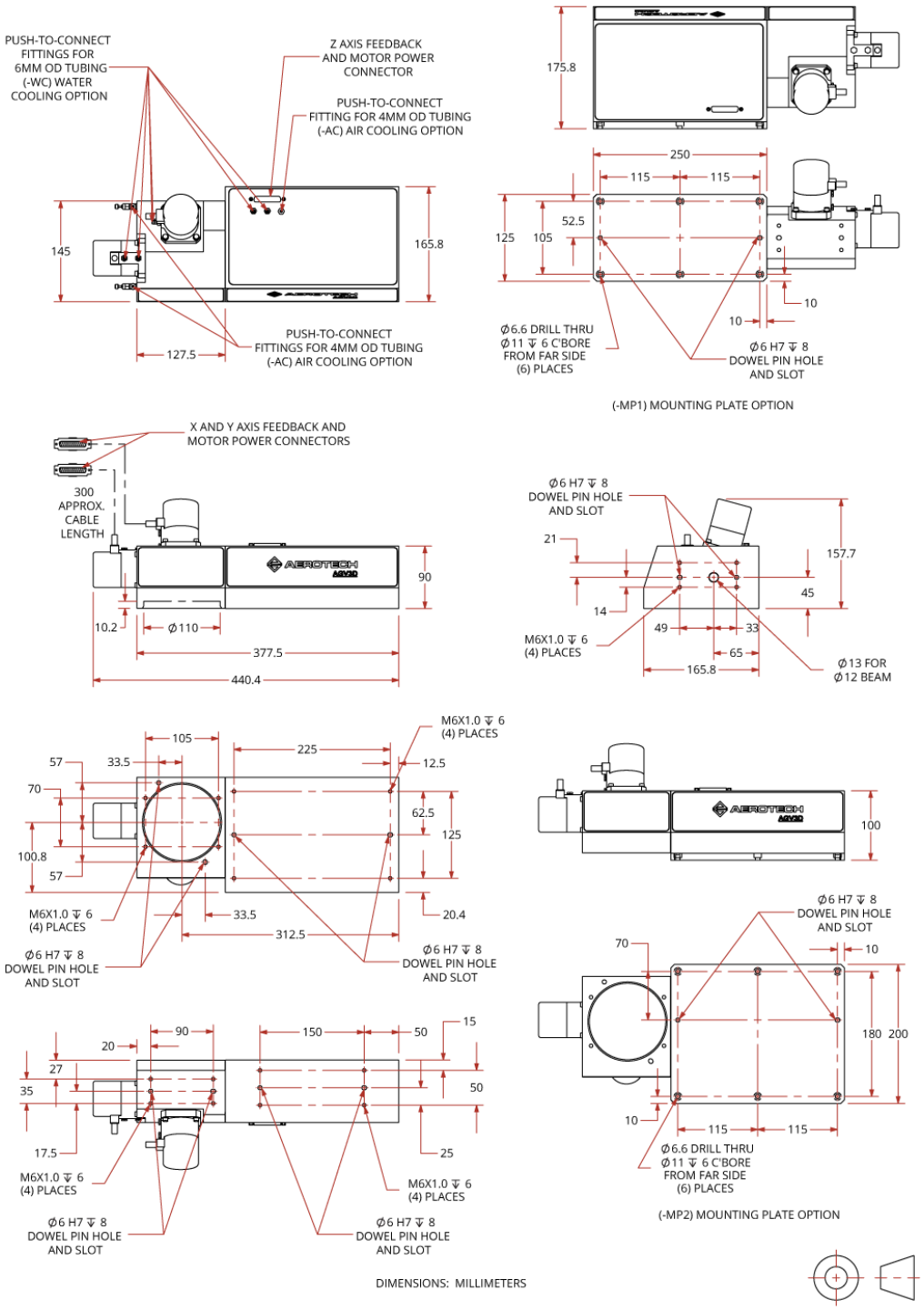


Figure 2-2: AGV3D-30 Scan Head Dimensions

2.3. Remove the Shipping Clamp

Remove the shipping clamp before you mount or operate the AGV3D. Put the AGV3D on a stable, flat surface for this procedure.

WARNING: You could cause permanent mechanical damage to the AGV3D if you do not remove the shipping clamp before your operate the AGV3D.

Removing the Shipping Clamp

1. Remove the four [QTY. 4] M3x0.5, 10 mm LG socket head cap screws that attach the top cover of the main AGV3D enclosure and set them aside.

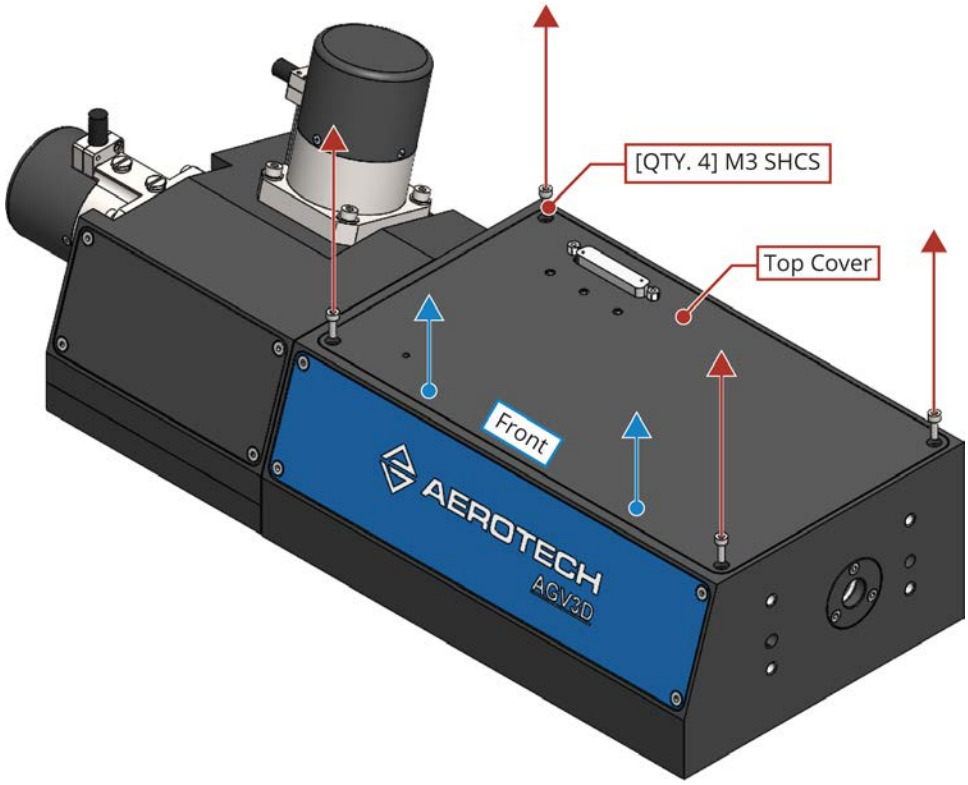


Figure 2-3: Top Cover Removal

NOTE: The top cover can not be completely removed because there are cables attached to the under-side of it.

2. Carefully lift up the top cover from the front to access the shipping clamp.

WARNING: If a cable is damaged or detached in this step, it could cause severe damage to the AGV3D when it is operated.

3. Loosen the two [QTY. 2] M3 socket head cap screws that hold the shipping clamp in place. Carefully remove the shipping clamp, the two [QTY. 2] M3 shcs, and the two [QTY. 2] M3 washers as a group to make sure that you do not drop a screw or washer in the open AGV3D enclosure.

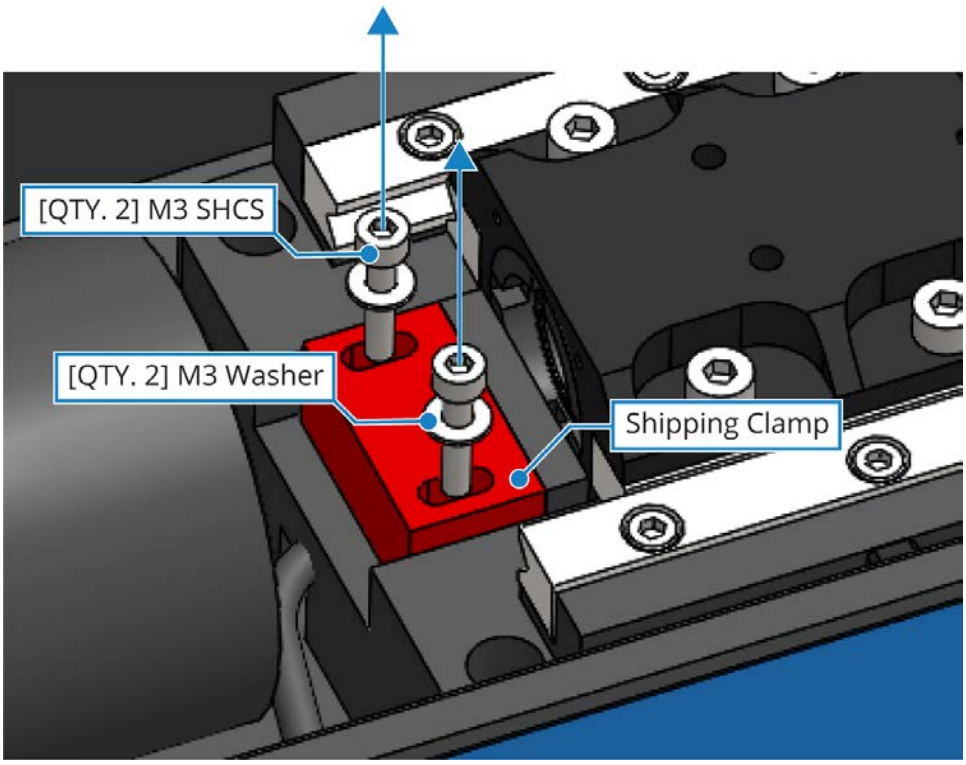


Figure 2-4: Shipping Clamp Detail

4. Replace the top cover onto the AGV3D enclosure. Be careful not to pinch any cables when you reattach the cover.

NOTE: The top cover should be flush with the enclosure. Carefully move any cables that interfere with the position of the top cover.

5. Attach the top cover with the four [QTY. 4] M3 socket head cap screws that were removed in Step 1.

2.4. Securing the Scan Head to the Mounting Surface

WARNING: It is the customer's responsibility to safely and carefully move and mount the scan head. Improper handling could adversely affect the performance of the AGV3D

- Make sure that all moving parts are secure before moving the AGV3D. Unsecured moving parts may shift and cause bodily injury.
- Make certain that the beam exit and the beam input aperture are covered before moving the AGV3D in order to prevent contamination.
- Put the scan head on a soft surface when it is not attached to its mounting surface to protect the optics.

The mounting surface should be flat and have adequate stiffness in order to achieve the maximum performance from the AGV3D scan head (Table 2-2). When an AGV3D is mounted to a non-flat surface, the scan head can be distorted as the mounting screws are tightened. This distortion will affect the alignment between the galvano motors and decrease the overall accuracy of the scan head. Adjustments to the mounting surface must be made before the scan head 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: The AGV3D 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 AGV3D. Shimming should be avoided if possible. If shimming is required, it should be minimized to retain maximum rigidity of the system.

The AGV3D has three options for you to mount your AGV3D to the mounting surface (Figure 2-5). The system should be mounted so that it is parallel to the workpiece (refer to Table 2-2 for the parallel mounting specification). Use the bottom of the exit cover glass bracket as a reference, if possible. If this surface is inaccessible, use the unused mounting points for reference. For example, if the rear mounting points are used to mount the AGV3D to the mounting surface, use the bottom mounting points as a reference. Either the exit cover glass bracket or the bottom mounting surface must be accessible to verify mounting parallelism.

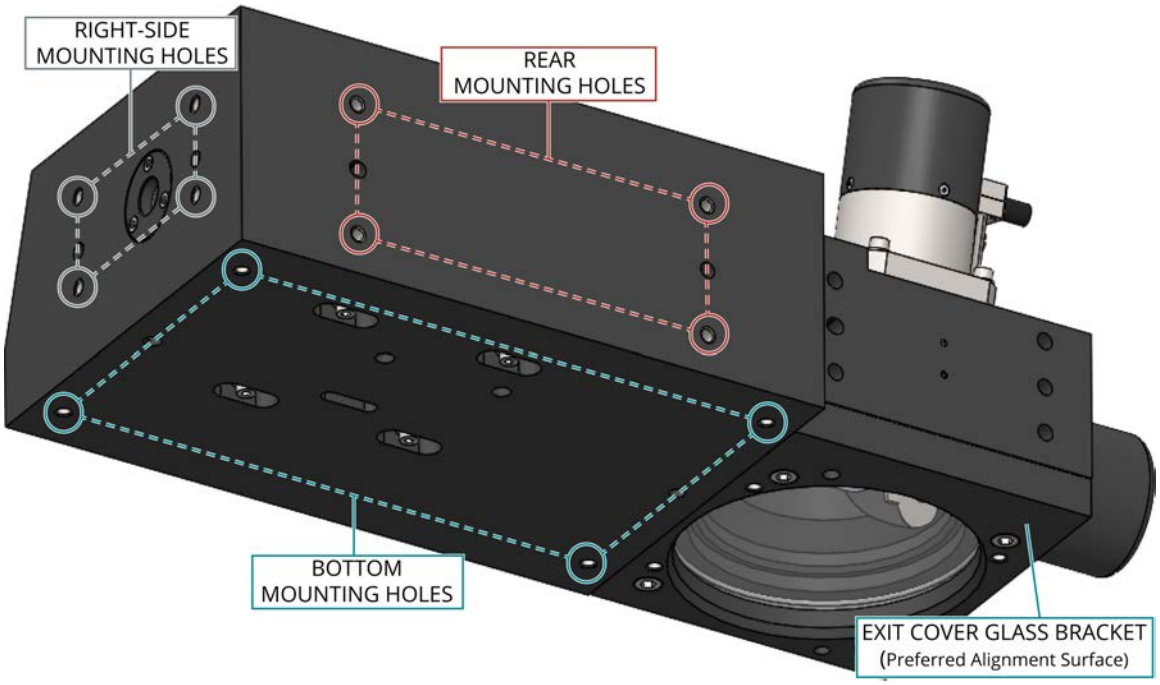


Figure 2-5: Mounting Point Locations

Table 2-1: Mounting Hardware Specifications

Location	Quantity	Screw Size
Right Side	4	M6x1, 9 mm LG
Rear Side	4	M6x1, 9 mm LG
Bottom	4	M6x1, 9 mm LG

Table 2-2: Mounting Specifications

	Specification
Parallelism to Workpiece	50 µm over 100 mm
Mounting Surface Flatness	25 µm over 305 mm

2.5. Laser Beam Alignment

For optimal performance, you must align the input laser beam to the AGV3D enclosure. Use the alignment fixture that is provided with the AGV3D to simplify the laser alignment procedure. The alignment fixture is designed to work with the working laser beam, so a visible alignment beam is not necessary for UV and IR wavelengths. The alignment targets will fluoresce under laser power, even for UV and IR wavelength lasers.

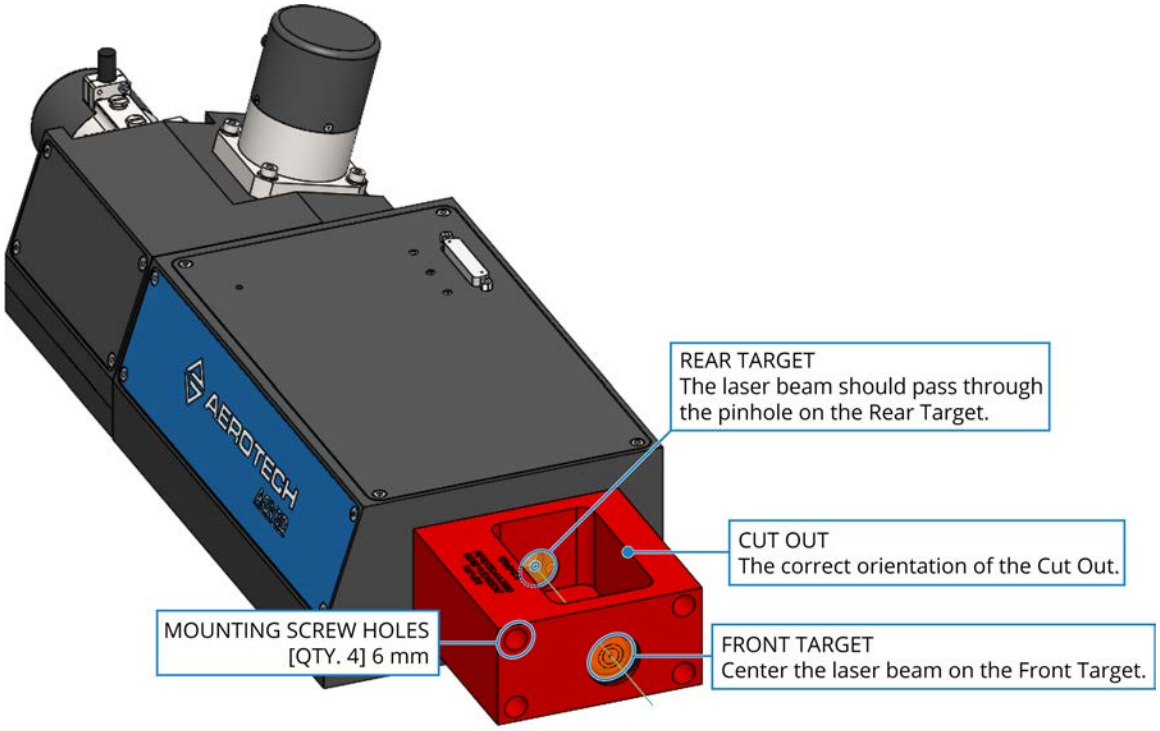


Figure 2-6: Alignment Fixture

DANGER: The laser will be turned on during the alignment procedure. Follow all laser safety precautions.

1. Do no stare into the laser beam, place your body parts in the beam path, or expose yourself to reflections from powerful beams.
2. Wear eye protection. The danger to your eyes increases when optical instruments are used in conjunction with the scan head.

WARNING: The laser could burn the fluorescing target disks.

- During laser alignment, it is critical that you only use sufficiently low power settings to avoid burning the target disks.
- In general, use as little power as necessary to see the laser spot on the fluorescing disks.
- The values in Table 2-3 are the recommended laser settings for alignment.
- Small deviations in power are acceptable, if necessary.

Alignment Procedure for UV, Visible, and NIR Wavelengths

1. Turn the laser off.
2. Bolt the laser alignment fixture to the front face of the AGV3D (refer to Figure 2-6).
   - Use the 6x12 mm LG dowel pins and M6x1.0 70 mm LG socket head cap screws provided with the alignment fixture.
   - The large cut out should point up.
3. Turn on the laser beam and align it so that the beam is roughly centered on the front target of the alignment fixture.

Table 2-3: Recommended Beam Power Settings

Average Power	Repetition Rate	Pulse Duration
1 W	<1 kHz	>600 fs

NOTE: The laser must warm-up and stabilize before you can perform a precision alignment. Refer to the documentation that was supplied with the laser.

4. Adjust the position of the laser source until the beam is concentric with the marked circles on the front target of the alignment fixture.
5. If the beam hits the rear target but does not go through the pinhole, adjust the angular position of the laser source until the beam is aligned with the rear pinhole.
6. If angular adjustments were required in Step 5: Verify that the beam is still centered on the front target. Make positional adjustments to the laser source if it is necessary to recenter the beam on the front target.
7. Repeat steps 5 and 6 until the beam is aligned with the rear target pinhole and centered on the front target.
8. Turn off the laser.
9. Remove the laser beam alignment fixture, M6 SHCS, and 6 mm dowels from the front face of the AGV3D.

Alignment Procedure for CO_2 Wavelengths (9.3 um and 10.6 um)

1. Bolt the laser alignment fixture to the front face of the AGV3D.
   - Use the 6x12 mm LG dowel pins and M6x1.0 70 mm LG socket head cap screws provided with the alignment fixture.
   - The large cut out should point up.
2. Tape fax paper (or other heat-sensitive paper) to the front alignment target. Poke a pinhole in the paper that is aligned with the pinhole in the front alignment target.
3. Fire one or two pulses of the laser and then inspect the mark on the fax paper to see if the mark is concentric with the pinhole. Use a ruler to measure the mark for large beams.
4. If the mark is concentric with the pinhole, proceed to Step 5. If not, adjust the position of the laser and repeat Steps 2 and 3 with a new piece of heat-sensitive paper. Use a new sheet of paper for each test until the laser beam is correctly centered on the target.
5. Remove the front target from the alignment fixture.
6. Determine if the beam is aligned with the pinhole on the rear target. Follow the procedure in Steps 2 and 3 with the rear target.
7. If the beam is not centered on the rear target, adjust the angular position of the laser source until the beam is aligned with the rear pinhole. Follow the same procedure in Steps 2 and 3 to check the beam position.
8. If angular adjustments were required in Step 7: Replace the front target in the alignment fixture and verify if the beam is still centered on the front target. Make positional adjustments to the laser source to recenter the beam.
9. Repeat Steps 2 through 8 until the beam is aligned with the rear target pinhole and the front target pinhole.
10. Remove the laser beam alignment fixture, M6 SHCS, and 6 mm dowels from the front face of the AGV3D.

2.6. Air Requirements

If the -AC (air-cooling) option was purchased, use this option to cool the turning mirrors and dynamic focusing module.

A gas supply pressure of 517 kPa to 586 kPa (75 psi to 85 psi) is required. Gas must be delivered via a polyurethane air hose with an outer diameter of 4 mm. Unless otherwise specified, a gas flow rate of 20 SLPM (standard liters per minute) at 550 kPa (80 psi) should be observed.

- If compressed air is used, it must be filtered to 0.25 microns, dry to 0º F dew point, and oil free.
- If nitrogen is used, it must be 99.99% pure and filtered to 0.25 microns.

The filtration requirement is necessary to prevent particles from damaging the optical surfaces of the turning mirrors.

WARNING: To prevent damage to the AGV3D, do not attach a water hose to an air fitting or an air hose to a water fitting.

WARNING: Wear eye protection when you are close to compressed air components.

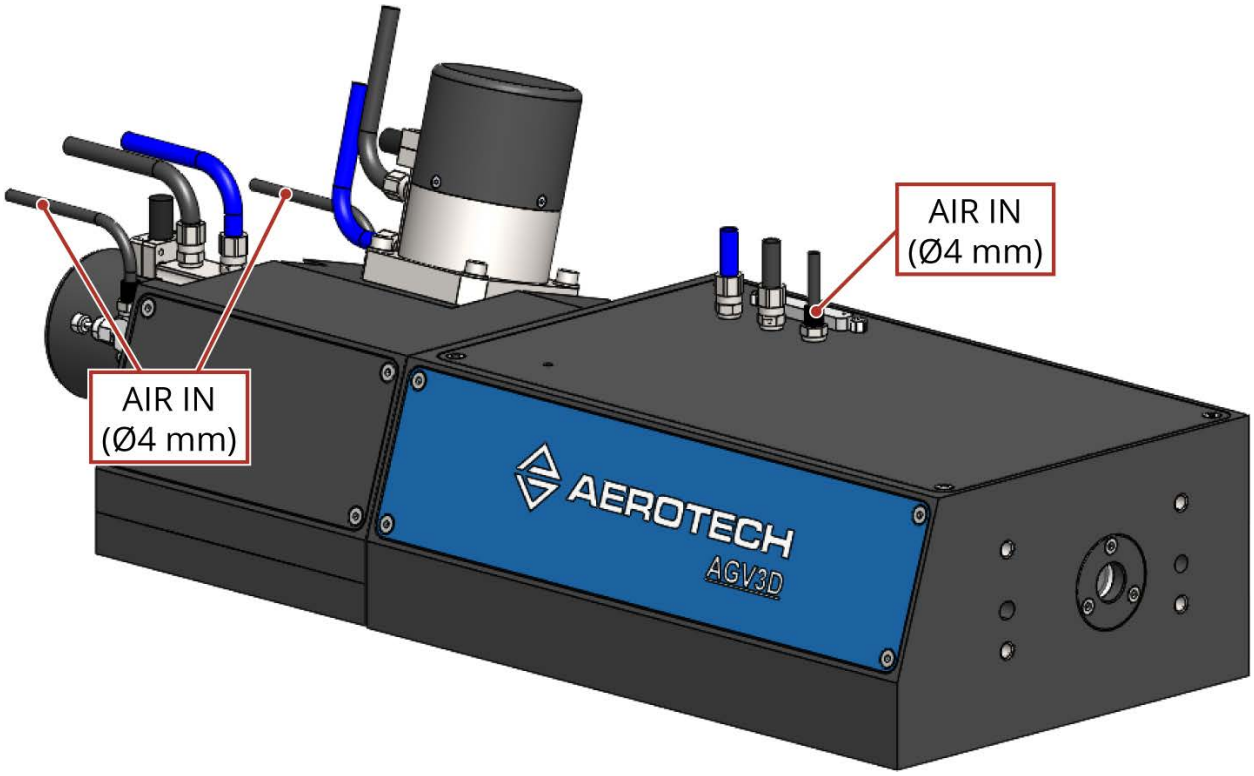


Figure 2-7: Air-Cooling Locations

2.7. Water Requirements

If the -WC (water-cooling) option was purchased, use this option to cool the galvo motors and the AGV3D enclosure.

Use distilled water and a chiller that is sized to deliver 0.35 GPM (gallons per minute) at 60 psid. Use nylon tubes with an outer diameter of 6 mm to deliver and retrieve the coolant from the scan head. You could use a corrosion inhibitor additive meant for multi-metal cooling channels to help increase the life of components in the water cooling circuit.

WARNING: Do not use cooling additives that are corrosive or damaging to common cooling-circuit materials. These materials include brass, stainless steel, aluminum (plain or anodized), nickel plating, polyurethane, nylon, and nitrile rubber. Contact the factory to discuss the specifics of your application before you use a coolant other than distilled water.

WARNING: To prevent damage to the AGV3D, do not attach a water hose to an air fitting or an air hose to a water fitting.

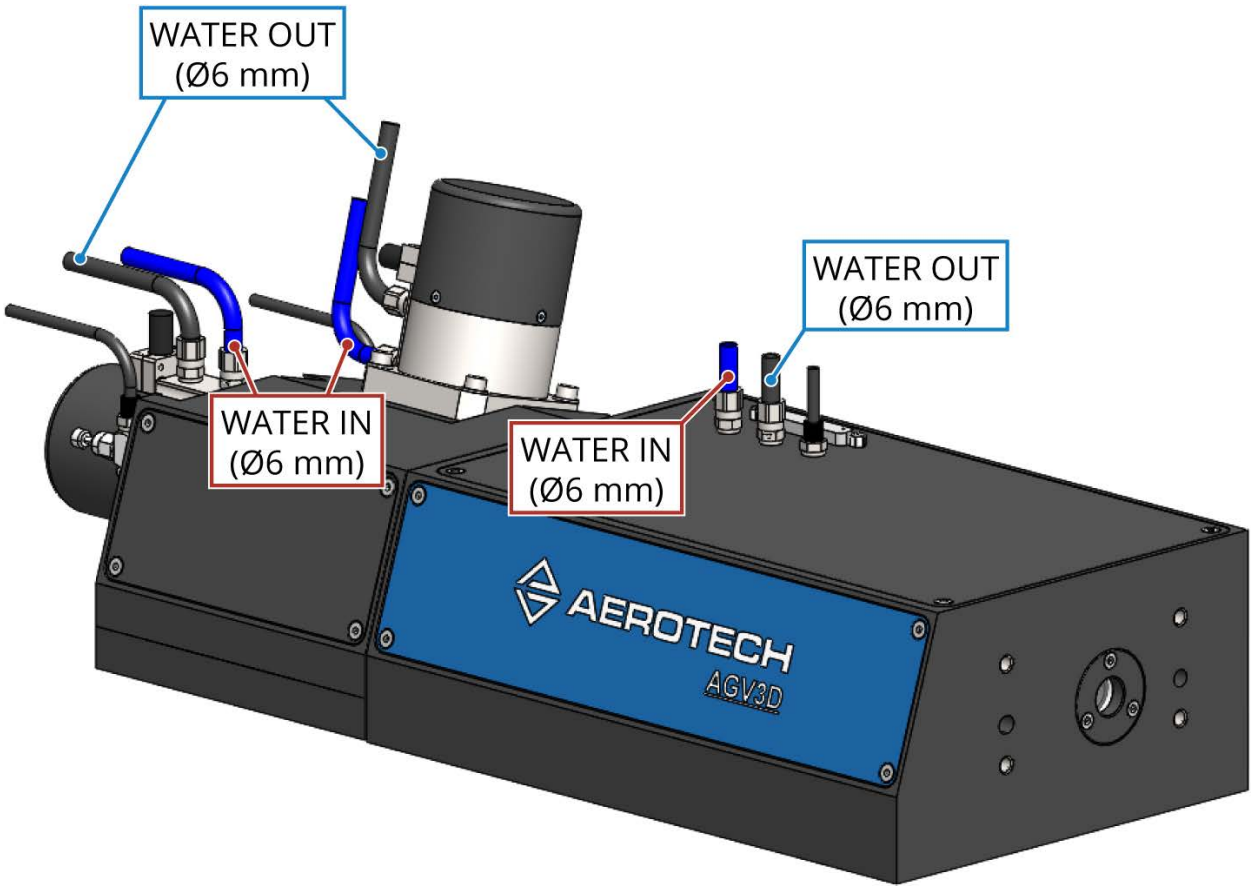


Figure 2-8: Water Cooling Locations

2.8. Changing the Dynamic Focusing Field-of-View Setting

The AGV3D has two field of view options for the Z-axis: -F1 and -F2 (refer to Table 1-7). The procedure that follows explains how to change the field of view setting.

NOTE: The AGV3D must be set to either the -F1 **or** the -F2 option. The AGV3D cannot be set to a field of view between these two settings.

Make sure that the AGV3D is securely mounted and in an upright position. You will need to access the bottom of the enclosure. The procedure cannot be done with the bottom mounting plate (-M2 option) attached.

How to Change the Field of View Setting

WARNING: Turn off the laser and disconnect the AGV3D from power before you begin this procedure.

1. Loosen, but do not remove, the four [QTY. 4] M4x0.7, 14 mm LG socket head cap screws that are located in the slots on the bottom side of the AGV3D enclosure.

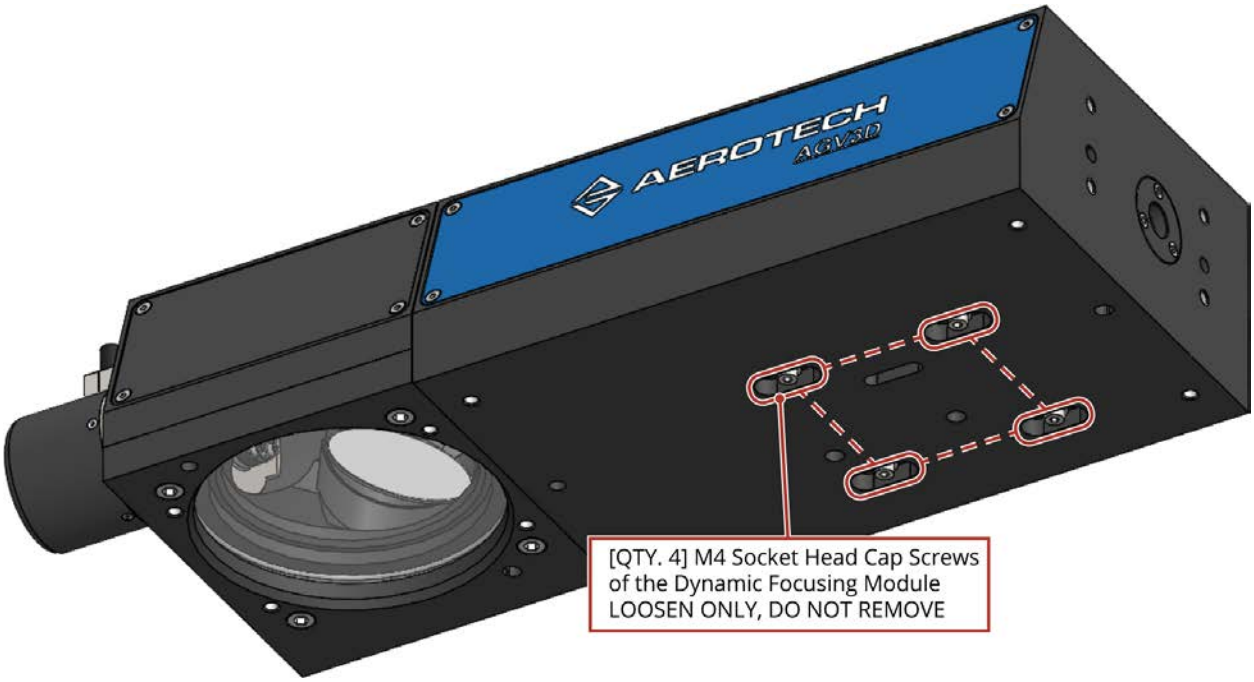


Figure 2-9: Dynamic Focusing Module Mounting Screws

2. Insert a 6 mm allen key, or similar tool, through the slot in the bottom of the enclosure and into the hole in the bottom of the Dynamic Focusing Module (DFM).
3. Use the tool to slide the DFM to the new field of view setting. The DFM is in the correct position when a reference edge is encountered and the DFM cannot be moved any further in the correct direction.
   - -F1 Option: Slide the DFM to the right
   - -F2 Option: Slide the DFM to the left

NOTE: The M4 screws do not need to reach the ends of their slots for the DFM to be in the correct position.

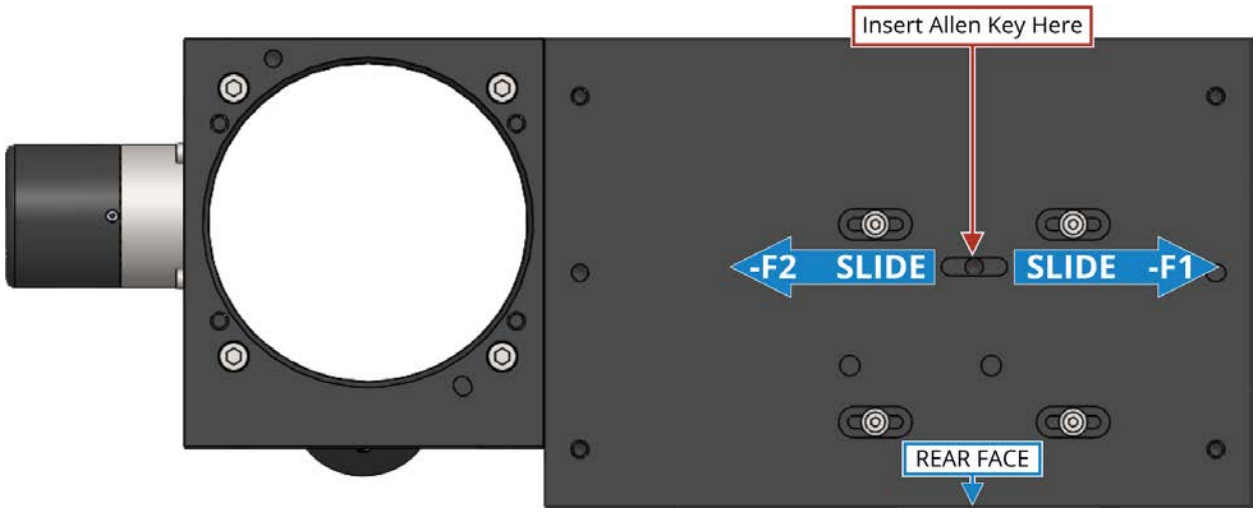


Figure 2-10: Dynamic Focusing Module Reference

4. To keep the DFM referenced after the Field of View adjustment, use the allen key to gently push the DFM towards the rear face.
5. Slowly tighten the M4 socket head cap screws that were loosened in Step 2.
   - Alternate between the screws.
   - Tighten the screws to a torque of 30 in·lb.
6. Use the AGV3D setup programs to update the parameter settings to make sure that the AGV3D functions correctly. Refer to the AGV3D User Guide.

2.9. Using an F-Theta Lens

The user is responsible for supplying both the F-Theta lens and a lens adapter. Contact the factory for assistance.

WARNING: Fingerprints contain aggressive substances that can damage optical surfaces. Always wear suitable gloves when you handle the optics.

Chapter 3: Electrical Specifications and Installation

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

Electrical installation requirements will vary depending on product options. Installation instructions in this section are for AGV3D stages equipped with standard Aerotech motors intended for use with an Aerotech motion control system. Contact Aerotech for further information regarding products that are otherwise configured.

Aerotech motion control systems are adjusted at the factory for optimum performance. When the AGV3D is part of a complete Aerotech motion control system, setup usually involves connecting the AGV3D 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 that require access to the AGV3D must be restricted to qualified and trained personnel. The system integrator or qualified installer is responsible for determining and meeting all safety and compliance requirements when they integrate the AGV3D into a completed system.

DANGER: Remove power before connecting or disconnecting electrical components or cables. Failure to do so could 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 could expose the operator to electrical shock or mechanical dangers.

3.1. Motor and Feedback Connectors

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

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

The X- and Y-axis galvo motors produce dual analog encoder feedback signals. The Z-axis motor produces single analog encoder feedback signals. The Primary (X, Y, and Z) and Secondary (X and Y) position feedback signals must be tuned for optimal performance. Use the Feedback Tuning Tab of the Digital Scope utility to adjust the gain, offset, and phase balance of each channel. Refer to the Nmark GCL or GL4 Controller Hardware Manual and the Help for more information.

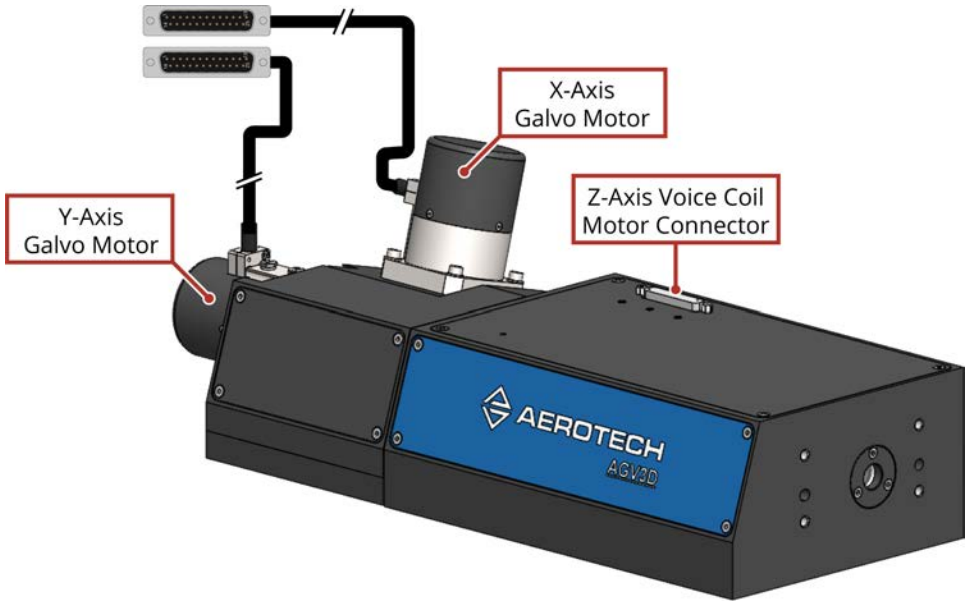


Figure 3-1: Connectors

The protective ground connection of the AGV3D 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.

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 could expose the operator to electrical shock or mechanical dangers.

CAUTION: The stage controller must provide over-current and over-speed protection. Failure to do so could cause electric shock or damage to the equipment.

Table 3-1: Motor and Feedback Connecter Pinouts (X and Y Axis)

Pin	Description	Connector
Case	Cable Shield	
1	Sine 1+	
2	Cosine 1+	
3	5V Common Ground	
4	Sine 2+	
5	Cosine 2+	
6	Signal indicating maximum travel produced by positive/CW mirror direction (CW/+LIMIT).	
7	Marker +	
8	Encoder 5V Supply Input	
9	Reserved	
10	Reserved	
11	Frame Ground	
12	Motor +	
13	Motor +	
14	Sine 1-	
15	Cosine 1-	
16	5V Common Ground	
17	Sine 2-	
18	Cosine 2-	
19	Signal indicating maximum travel produced by negative/CCW mirror direction (CCW/-LIMIT).	
20	Marker -	
21	5V Common Ground	
22	5V Common Ground	
23	Frame Ground	
24	Motor -	
25	Motor -	

Table 3-2: Mating Connector Part Numbers for the Motor and Feedback Connectors (X and Y Axis)

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

Table 3-3: Motor and Feedback Connecter Pinout (Z Axis)

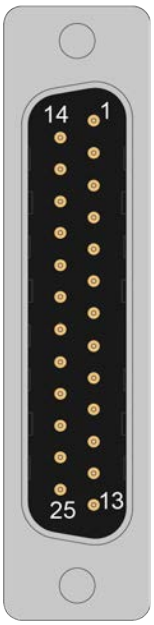
Pin	Description	Connector
Case	Cable Shield	
1	Sine+	
2	Cosine+	
3	Common ground	
4	Reserved	
5	Reserved	
6	Reserved	
7	Marker+	
8	Encoder +5 V	
9	Reserved	
10	Reserved	
11	Frame Ground	
12	Motor +	
13	Motor +	
14	Sine-	
15	Cosine-	
16	Common ground	
17	Reserved	
18	Reserved	
19	Reserved	
20	Marker -	
21	Common ground	
22	Common ground	
23	Signal Shield	
24	Motor -	
25	Motor -	

Table 3-4: Mating Connector Part Numbers for the Motor and Feedback Connector (Z Axis)

Mating Connector	Aerotech P/N	Third Party P/N
Connector	ECK00101	Amphenol DB25P064TXLF

3.2. Motor and Feedback Wiring

AGV3D scan heads come from the factory fully 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.

For cable drawings, refer to the documentation that shipped with your system.

Table 3-5: Aerotech Motor and Feedback Cable Part Numbers

Aerotech Controller	Nmark GCL or GL4	
Cable Application	Standard	Hi-Flex
Interface Cable Part Number	C23680-xxx	C23690-xxx

NOTES:
- -xxx = Cable Length in Decimeters (1 Decimeter = 3.937 inches)
- Contact factory for standard & custom cable lengths

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

WARNING: The protective ground connection must be properly installed to minimize the possibility of electric shock.

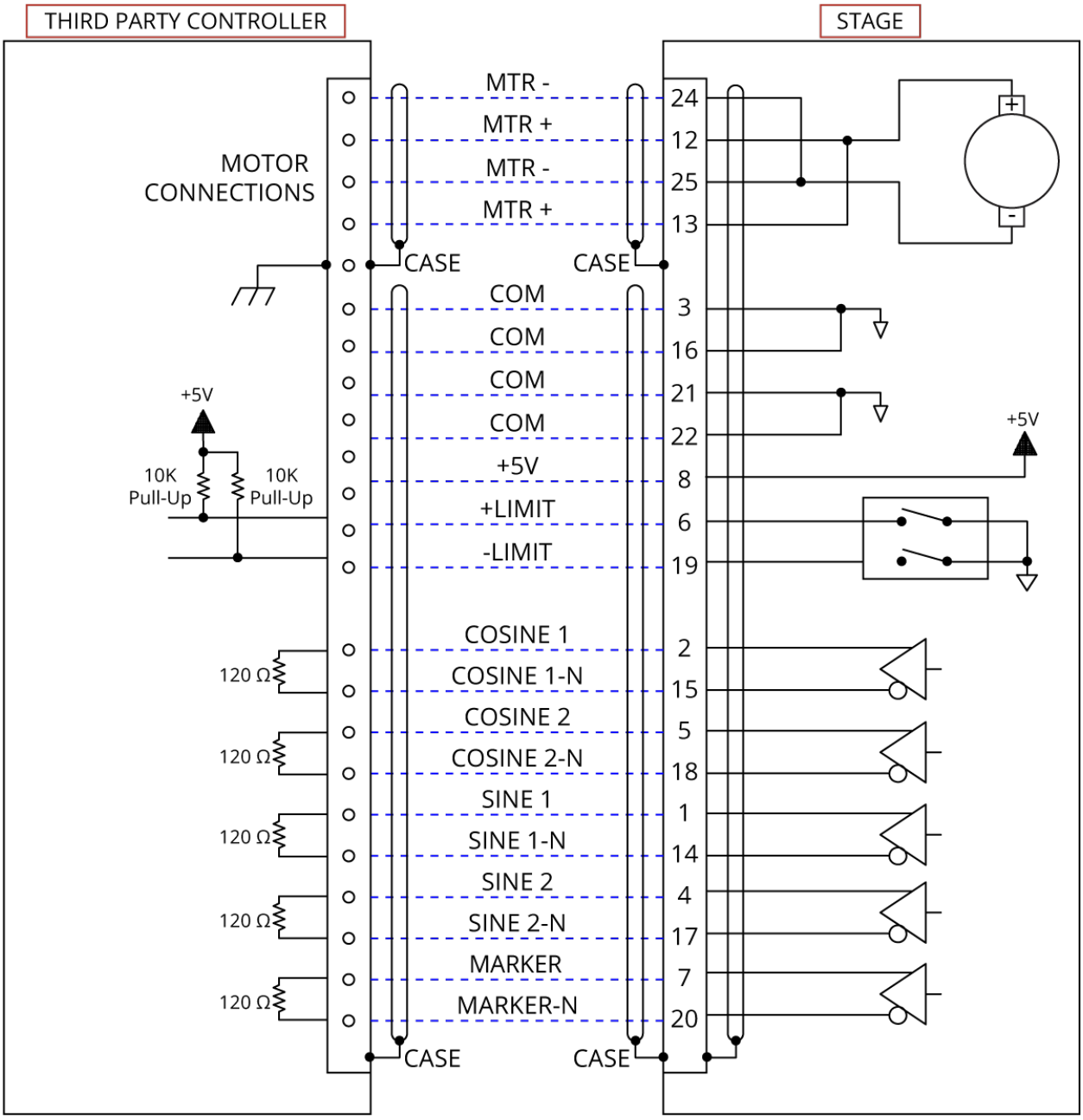


Figure 3-2: X- and Y-Axis Motor and Feedback Wiring

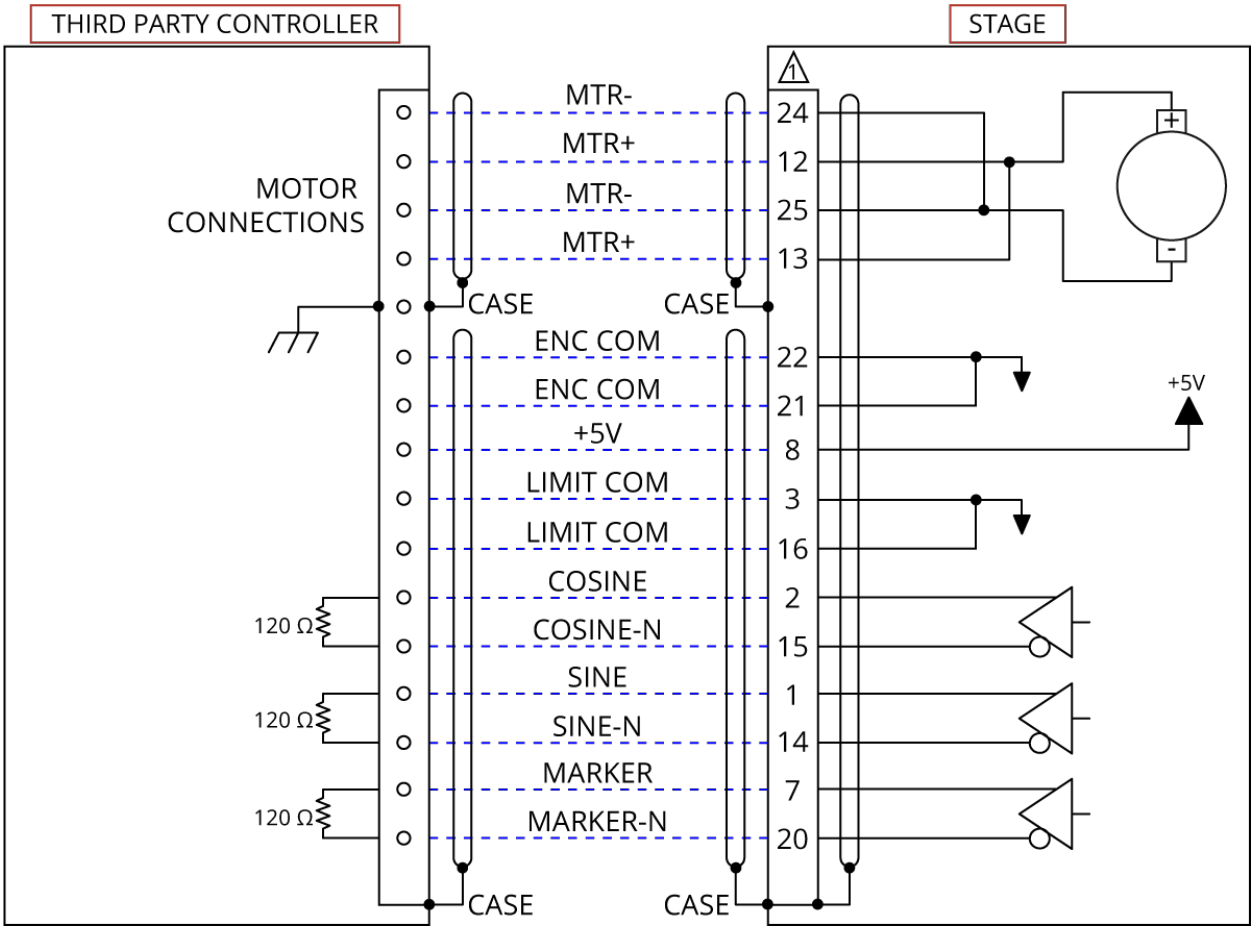


Figure 3-3: Z-Axis Motor and Feedback Wiring

3.3. Motor and Feedback Specifications

Table 3-6: AGV3D-20 Motor and Feedback Specifications

Feedback Specifications		
	X and Y Motors	Z Motor
Supply Voltage	5 V	
Supply Current	250 mA	
Output Signals	**Sinusoidal Type (Incremental Encoder)**: 1 V_{pk-pk} into 120 Ω Load (differential signals SIN+, SIN-, COS+, COS- are .5 V_{pk-pk} relative to ground.)	
Encoder Resolution	4096 lines/revolution	0.0076 nm
Limit Switches	Optical limit switches and software limits	Current limits and software limits
Home Switch	At Center	
Motor Specifications		
	X and Y Motors	Z Motor
BEMF Constant	1.4 V/krpm	6.64 V/(m/s)
Max Current	5 A	9 A
Resistance	1.5 Ω	1.84 Ω
Inductance	170 µH	1.12 mH
Maximum Bus Voltage	80 V	80 V
Number of Poles	2	N/A

Table 3-7: AGV3D-30 Motor and Feedback Specifications

Feedback Specifications		
	X and Y Motors	Z Motor
Supply Voltage	5 V	
Supply Current	250 mA	
Output Signals	**Sinusoidal Type (Incremental Encoder)**: 1 V_{pk-pk} into 120 Ω Load (differential signals SIN+, SIN-, COS+, COS- are .5 V_{pk-pk} relative to ground.)	
Encoder Resolution	4096 lines/revolution	0.0076 nm
Limit Switches	Optical limit switches and software limits	Current limits and software limits
Home Switch	At Center	
Motor Specifications		
	X and Y Motors	Z Motor
BEMF Constant	4.3 V/krpm	6.64 V/(m/s)
Max Current	5 A	9 A
Resistance	3.1 Ω	1.84 Ω
Inductance	675 µH	1.12 mH
Maximum Bus Voltage	80 V	80 V
Number of Poles	2	N/A

Chapter 4: Maintenance

The AGV3D scan head is designed to be completely resistant to dust. The scan head does not require any maintenance other than that it should be cleaned periodicly.

For operation in a dirty or dusty environments, you could have to periodically replace the entrance and exit aperture protective windows. Contact the factory for replacement parts.

WARNING: Do not remove any components from the system other than those specified in the Maintenance section of the manual. The internal optical components are precisely aligned at the factory in a clean environment to achieve high performance. Removal of any components will significantly compromise performance and can require that you send the scan head back to the factory for calibration.

NOTE: The scan head must be kept free of foreign matter and moisture; otherwise, the performance and life expectancy of the scan head will be reduced.

4.1. Service and Inspection Schedule

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.

Inspect the AGV3D 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 AGV3D and any components and cables as needed.
- Repair any damage before operating the AGV3D.
- Inspect and perform an operational check on all safeguards and protective devices.

In general, repair and/or replacement of damaged or malfunctioning components by Aerotech field service personnel is not possible. Repair typically requires that the unit be returned to the factory. Please contact Aerotech Global Technical Support for more information.

4.2. Cleaning and Inspection

There are no elements on AGV3D stages that require lubrication.

Before using a cleaning solvent on any part of the AGV3D, blow away small particles and dust with nitrogen or, less preferably, clean, dry, compressed air.

Any external metal surface of the AGV3D can be cleaned with isopropyl alcohol on a lint-free cloth.

4.2.1. Protective Windows

Optical surfaces that are contaminated with dirt and debris result in increased absorption of laser radiation. Over time, this contamination can cause the optical surfaces to absorb enough heat to cause permanent burn damage. There are several different kinds of optical surface contamination:

- Airborne particles in the ambient atmosphere – dust, grease, etc.
- Products from the laser process – vapors, back spatter, burned-in particles, etc.
- Organic contamination – particles produced by talking, coughing, or sneezing near the optical surfaces.

Wherever possible, protect the exposed optics to avoid contamination. However, since contamination cannot be completely avoided, you will have to periodically clean the optical system. Regularly inspect and clean the optical surfaces to help prevent permanent damage.

WARNING: Contamination from the laser process can cause irreversible damage to the optical surfaces. To help minimize contamination, use an exhaust or vacuum system.

Optical materials and coatings are relatively soft substances and incorrect cleaning techniques will result in surface damage and drastically reduced component lifetime. The cleaning procedure for the AGV3D is intended to help prolong the component lifetime.

WARNING: Fingerprints contain aggressive substances that can damage optical surfaces. Always wear suitable gloves when you handle the optics.

WARNING: Before performing any inspections of the focal lens, verify that the laser is switched off and secured against accidentally being switched on.

WARNING: Take extra care when cleaning a focal lens that does not have a protective glass window.

Cleaning Procedure

1. Use compressed nitrogen or clean, dry, oil-less air to remove any loose particles from the surface.
2. Moisten an appropriate lint-free lens cleaning cloth with isopropyl alcohol.
3. Fold the cloth over such that one folded (straight) edge will serve as the leading edge during the wiping motion.
4. Place the folded (straight) edge of the cloth onto one end of the optical surface. Applying very minimal pressure, slowly move the cloth over the optical component to the opposite end. Never bear down hard, scrub, or wipe in a circular motion when cleaning an optical surface.
5. Remove any liquid residue with a dry lint-free lens cleaning cloth or by blow it off in one direction with compressed nitrogen or clean, dry, oil-less air.
6. Repeat this procedure, using a new lint-free lens cleaning cloth for each repetition, until the surface is completely clean.

NOTE: Contact Aerotech if you need a replacement Protective Window.

4.2.2. Turning Mirrors

WARNING: Never touch the reflective surface of a turning mirror. Turning mirror surfaces are extremely delicate and can be easily damaged.

WARNING: Fingerprints contain aggressive substances that can damage optical surfaces. Always wear suitable gloves when you handle the optics.

The reflective surfaces of the turning mirrors are extremely sensitive and should only be cleaned when it is absolutely necessary and only by experienced personnel. In many cases, minor imperfections in the surface of the mirror can be less harmful than the surface damage caused by repeated cleaning.

To access the Turning Mirrors, the Exit Aperture Protective Window must first be removed.

Turning Mirror Cleaning Procedure

1. Remove the four [QTY. 4] M6x1.0, 16 mm LG socket head cap screws that secure the exit aperture protective window mounting bracket.
2. Remove the mounting bracket, protective window, and o-ring from the scan head.

   WARNING: The protective window is not secured in the mounting bracket. Make sure that it does not fall out of the bracket.
3. Clean the Turning Mirrors. Follow the same cleaning procedure from Section 4.2.1.
4. Replace the mounting bracket. Use the dowel pins to precisely locate the mounting bracket.
   NOTE: Make sure that the protective window and o-ring are in their correct positions.
5. Use the four [QTY. 4] M6 socket head cap screws that were removed in Step 1 to secure the mounting bracket to the scan head.

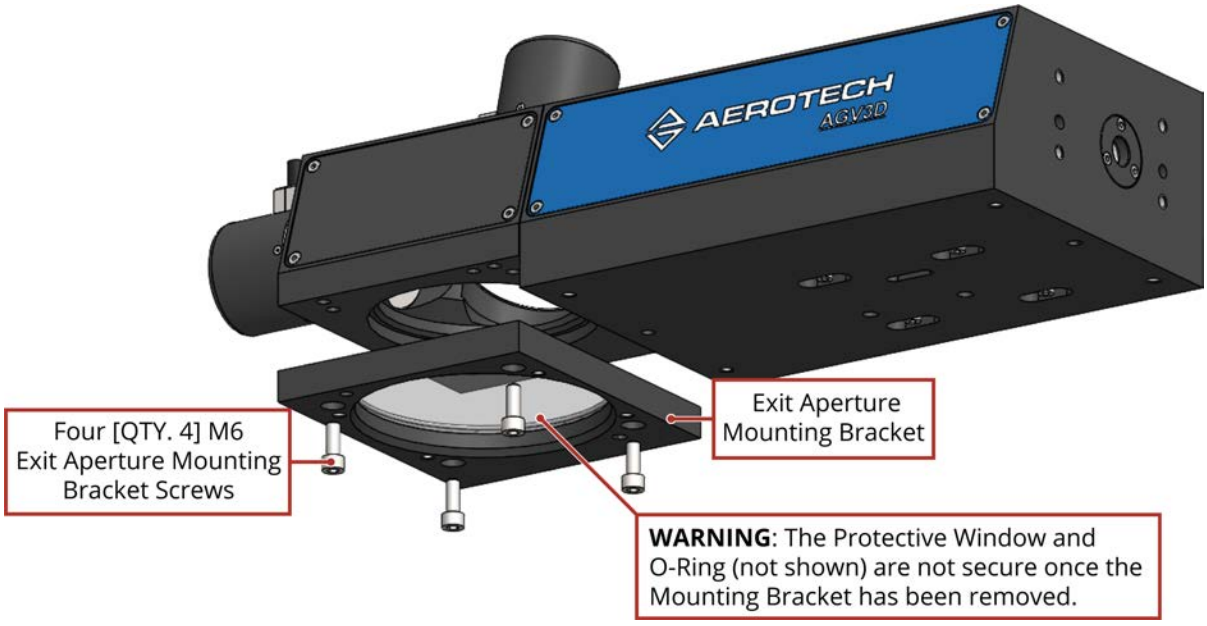


Figure 4-1: Exit Aperture Protective Window Mounting Bracket

4.3. Troubleshooting

This section provides some information regarding typical problems.

Table 4-1: Troubleshooting

Symptom	Possible Cause	Possible Solution
Scanners will not move.	Controller trap or fault.	See Controller documentation to clear fault.
	Motor and Feedback connections	See Section 3.1., Section 3.2., and Controller documentation
Scanners move uncontrollably	Gains not optimized	See Controller documentation for tuning instructions
	Encoder signals not optimized	See Section . and Controller documentation for encoder tuning instructions
	Motor and Feedback connections	See Section 3.1., Section 3.2., and Controller documentation
Scanners oscillate or squeal	Gains not optimized	See Controller documentation for tuning instructions
	Encoder signals not optimized	See Section . and Controller documentation for encoder tuning instructions
Reduction in power as the laser beam passes through the scan head	Optical surfaces contaminated with dirt and debris	See Section 4.2. for cleaning instructions
	Optical surfaces damaged	Contact Aerotech service and/or a lens supplier
AGV3D scanner does not find marker during homing cycle.	Motor and Feedback connections	See Section 3.1., Section 3.2., and Controller documentation
	Mechanical stops have shifted	Contact Aerotech service
AGV3D is out of focus	The working distance is incorrect	Follow the instructions in the software manual to set the correct working distance
	The lens spacing correction is incorrect	Follow the instructions in the software manual to set the lens spacing correction

This page intentionally left blank.

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

Appendix B: Revision History

Revision	Description
1.01.00	Updated Section 1.3. Basic Specifications • Figure 1-4 • Figure 1-5 • Figure 1-6
1.00.00	New Manual

This page intentionally left blank.

Index