
**THE ART50/ART100 PRECISION
ROTARY STAGE**

USER'S MANUAL

P/N: EDA145 (V1.0)



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CHAPTER 1: OVERVIEW

In This Section:

- Introduction 1-1
- Description 1-2
- ART50/ART100 Model Numbers 1-3
- Safety Procedures and Warnings..... 1-4

1.1. Introduction

This manual describes technical information needed for typical applications of the ART50/100 series translation tables. Included are instructions detailing the entire installation from unpacking to start-up. Also included are concise explanations concerning applications, and the maintenance of the mechanical and electrical components. In addition, there is a section defining the specifications pertinent to the ART50/100 series stage from the package.



Figure 1-1. ART50 / ART100 Rotary Stages

1.2. Description

ART50/100 Series rotary stages are extremely compact units providing precise positioning capability for lighter applications. The following is a list of some features:

- Maximum rotary speed of 40 deg/sec, and resolution of 1 arc second.
- Table mounted on precision, low friction ball bearings
- Anti-backlash gearing
- Base and table are machined from high strength aluminum plate
- Aluminum surfaces are either clear or black anodized
- A total of 12 and 44 table mounting holes (#8-32) for the ART50 and ART100 respectively
- Optional right angle bracket for orienting perpendicular to mounting surface
- Compatibility with a full line of Aerotech positioning and motion controls
- Standard stage and motor mounted optical home markers
- Stepping motor is included
- Optional preparation for vacuum operation (10E-6 torr.)

1.3. ART50/ART100 Model Numbers

The stage model number indicates the optional features on a particular stage. To determine the options on your stage, refer to Table 1-1. The example given is ART50-M-1, which designates a 50 mm stage, a metric mounting and grid pattern, and a stepping motor with a home marker indicator.

Table 1-1. ART50/ART100 Model Numbering System (ART50-M-1)

ART50		-M	-1
Series	Stage Construction Options	Mounting and Grid Pattern	Motor
ART50	/VAC3	-M	-1
ART100	/VAC6	-U	-1-W100
		-MA (ART100 Only)	-2
		-UA (ART100 Only)	-3
			-3-W100
			-4

Table 1-2. Model Options

ART50 & ART100 Series Rotary Stage	
ART50	50 mm (2 in) diameter rotary stage w/ stepping motor and 0.001 degree accurate home marker
ART100	100 mm (4 in) diameter rotary stage w/ stepping motor and 0.001 degree accurate home marker
Stage Construction Options	
/VAC3	Vacuum preparation of stage to 10^{-3} torr.
/VAC6	Vacuum preparation of stage to 10^{-6} torr.
Mounting and Grid Pattern	
-M	Tabletop with metric-dimension mounting pattern and holes
-U	Tabletop with English-dimension mounting pattern and holes
-MA	Tabletop with Aperture and metric-dimension mounting pattern and holes
-UA	Tabletop with Aperture and English-dimension mounting pattern and holes
Motor	
-1	Stepping motor with 4.6 m (15 ft) integral cable and home marker (wired unipolar – F0.85)
-1-W100	Stepping motor with 4.6 m (15 ft) integral cable and home marker (wired unipolar – F0.85) For use with U100 controller
-2	Stepping motor with 0.9 m (3 ft) integral cable and home marker (wired unipolar – F0.85) Requires motor-to-controller cable: SMS-O or SMC for U100M
-3	Stepping motor with 4.6 m (15 ft) integral cable and home marker (series wired – F0.50)
-3-W100	Stepping motor with 4.6 m (15 ft) integral cable and home marker (series wired – F0.50) For use with U100 controller
-4	Stepping motor with 0.9 m (3 ft) integral cable and home marker (wired unipolar – F0.50) Requires motor-to-controller cable: SMS-O or SMC for U100M
Accessories	
Alignment-NPA	Non-precision assembly
AG5	Adapter plate for ART50
Z5S	Right angle L-bracket for ART50
Z5R	Right angle L-bracket for ART100



Listed options may be superseded at any time. Refer to the most recent addition of the Aerotech Motion Control Product Guide for the most current product information.

1.4. Safety Procedures and Warnings

The following statements apply throughout this manual. Failure to observe these precautions could result in serious injury to those performing the procedures and/or damage to the equipment.



To minimize the possibility of electrical shock and bodily injury, make certain that all of the electrical power switches are in the off position prior to making any electrical connections.



To minimize the possibility of electrical shock and bodily injury when any electrical circuit is in use, ensure that no person comes in contact with the circuitry.



When this stage is connected to a mechanical system, mechanical motion will occur. Care must be exercised that all personnel remain clear of any moving parts.



To minimize the possibility of bodily injury, make certain that all electrical power switches are in the off position prior to making any mechanical adjustments.

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CHAPTER 2: SETUP

In This Section:

- Installation..... 2-1
- Stage Dimensions 2-2

2.1. Installation

This section covers the handling, mounting, and installation of the ART50/ART100 Series Stages. For added clarity, each step of the installation instructions has been broken down into component parts. The ART50/ART100 Series Stage should only be installed by those who read and thoroughly understand this manual. Each step appears below.

2.1.1. Read Instructions

When performing the installation instructions, do not continue to the next step until you have properly completed the previous step(s).

2.1.2. Unpack Stage

Carefully remove the stage from the protective shipping container. Place the stage on a smooth, flat, and clean surface. This is a simple, yet very important step in maintaining the integrity of the stage. You will notice a label that will include a system part number and serial number. Record these numbers for they contain all the information necessary to maintain or update system hardware and software. Also, find the enclosed customer service information and accuracy certification. If it is obvious that damage occurred during shipping, report it immediately. It is wise to save the shipping container for possible use in the future.

Improper handling of the stage could adversely affect the performance specifications. Therefore, use care when moving the stage. Do not allow the stage to drop onto the mounting surface. Set it down gently.



2.1.3. Prepare Mounting Surface

The mounting surface used with the ART50/ART100 Series Stage should be coplanar within 0.0001 in/in for valid accuracy. For example, if the longest distance between the base hole pattern is 8 inches, then the mounting surface should be coplanar within 0.0008 inches. This can be achieved by scraping or shimming the interface until no rocking occurs beneath the pads of the stage before tightening any of the mounting screws.

2.1.4. Bolt Down Stage

Install and tighten the mounting screws through the mounting holes. See Section 2.2. for outline drawings and dimensions.

2.2. Stage Dimensions

2.2.1. ART50 Series Stage Dimensions

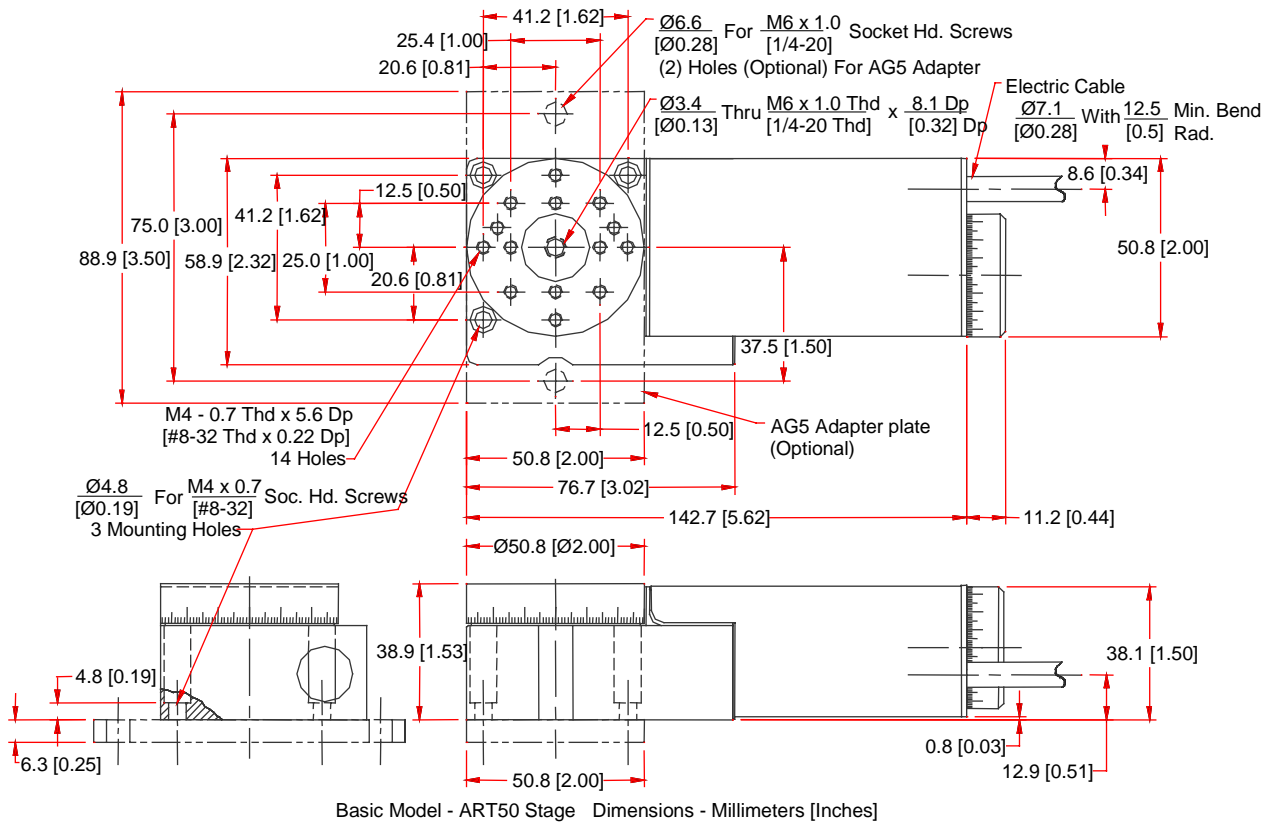


Figure 2-1. ART50 Series Stage Dimensions

2.2.2. ART100 Series Stage Dimensions

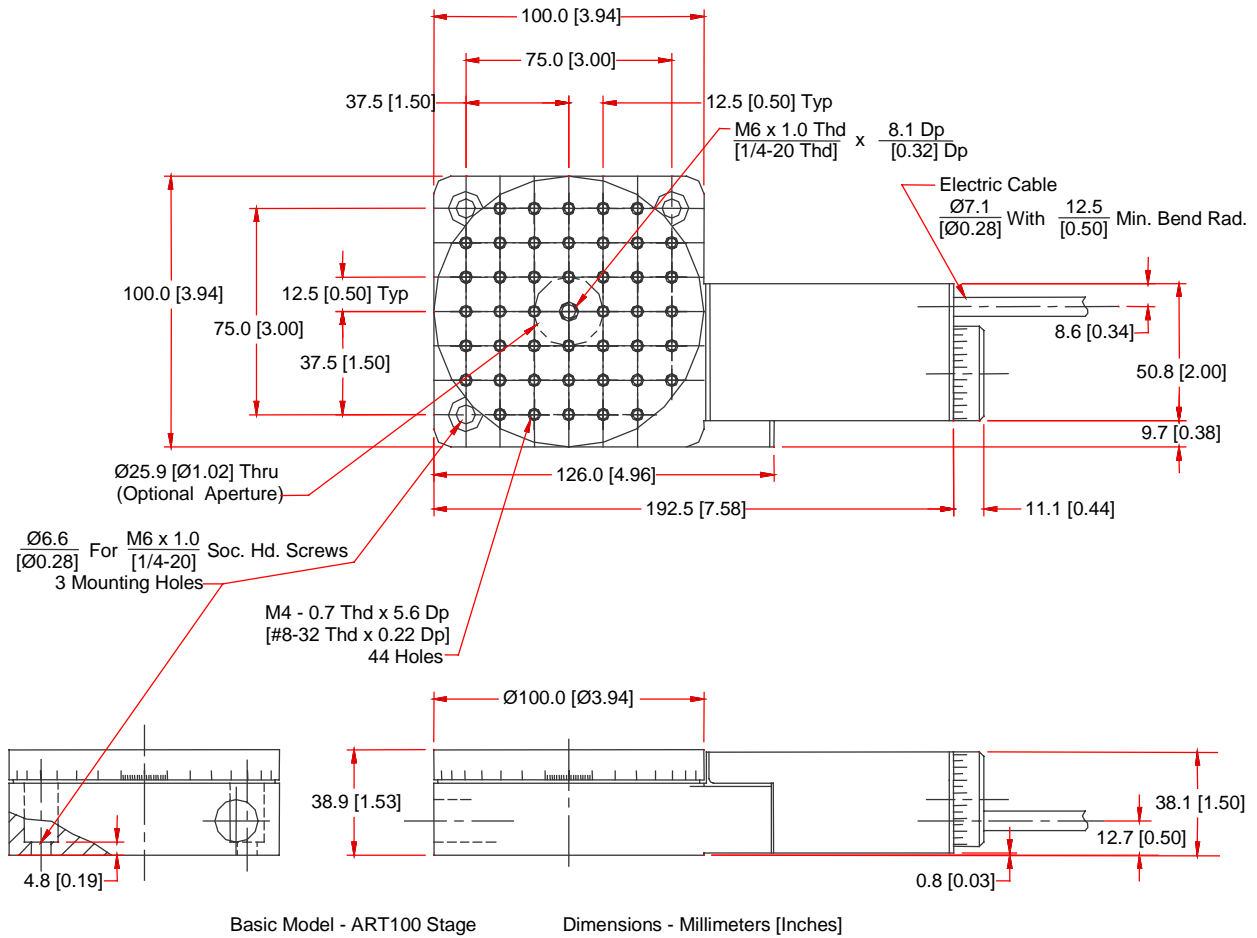


Figure 2-2. ART100 Series Stage Dimensions



CHAPTER 3: APPLICATION NOTES

In This Section:

- Introduction3-1
- Fastening the Application3-1
- Life Expectancy and Load Capability.....3-1

3.1. Introduction

When the stage is secure, the motor drive can be installed per the directions in Chapter 5.

After becoming comfortable with the drive electronics, verify that the maximum speed is obtainable without encountering any fault conditions (i.e., loss of steps with the stepper motor assembly). Do this before any delicate payloads are attached. Document all results.

3.2. Fastening the Application

When fastening the payload to the upper mounting surface, the mounting interface should be coplanar within 0.00001 in/in for valid accuracies. It is recommended that feet or pads be used on the mounting surface to minimize the amount of surface needed to be coplanar.

3.3. Temperature Effects

The permissible ambient temperature operating range of the stage assembly is 32°F to 140°F (in a non-condensing atmosphere). Due to thermal expansion or contraction, the geometry of the stage will vary slightly with temperature.

3.4. Life Expectancy and Load Capability

The accuracy specification of ART50/ART100 series stages is measured at the center of travel 1.75 inches above the table with the stage in a horizontal position.

It is recommended that application loads be symmetrically distributed (i.e., the payload should be centered on the stage table and the entire stage should be centered on the support structure). If cantilevered loads are applied, refer to Figure 3-1 to find the maximum allowable load.

Be sure to consider dynamic loading when using the stage for high-speed applications (especially with cantilever loading).



The diagram in Figure 3-1 shows load on the y axis and moment arm on the x axis. The L_{sc} or “side cantilever” curve assumes a horizontal stage orientation for situations where the stage is mounted on edge with the payload mounted to the tabletop or the stage is mounted flat with the payload offset from the center of the table. To use the diagram, find the length of the moment arm, enter the x axis at the given length, move up to the proper curve and read the maximum value from the y axis.

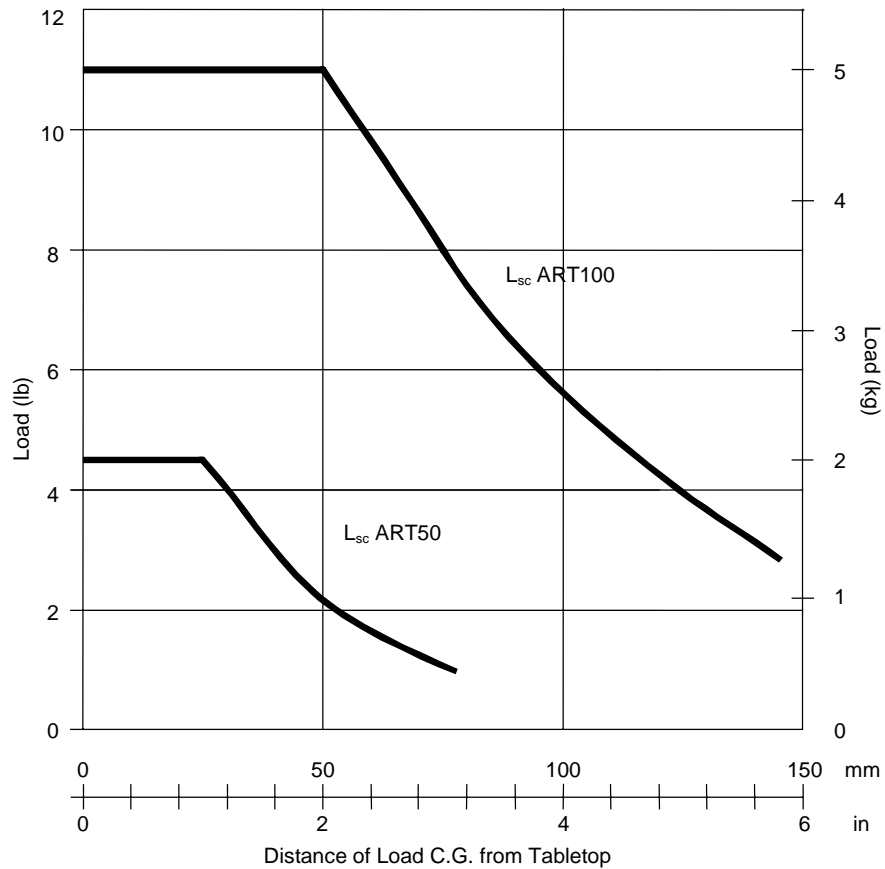


Figure 3-1. Load Capability of ART50 / ART100 Series Stages



CHAPTER 4: SPECIFICATIONS

In This Section:	
• Specifications	4-1
• Motor Information.....	4-2

4.1. Specifications

Table 4-1. ART50 and ART100 Series Rotary Stage Specifications

Basic Model		ART50	ART100
Total Travel		360° continuous, both azimuth and elevation	
Mechanical Drive System		Precision Worm Gear	
Resolution	180:1 motor to table ratio	0.005° (1.8 arc sec) @ 4000 steps/rev motor resolution	
		0.00028° (1 arc sec) @ 7200 steps/rev motor resolution	
Accuracy		0.06°	0.05°
Repeatability (Unidirectional)		0.0035° (12.6 arc sec)	0.0021° (7.6 arc sec)
Home Precision Repeatability		0.001° (3.6 arc sec)	
Wobble		50 arc sec	
Axis Runout ⁽¹⁾	Radial	7.6 µm (304 µin)	12.0 µm (480 µin)
	Axial	0.5 µm (20 µin)	2.0 µm (80 µin)
Load Capability	Axial	5.0 kg (11 lb)	10.0 kg (22 lb)
	Radial	2.3 kg (5 lb)	5.0 kg (11 lb)
	Output Torque (static)	0.0360 kg-m (50 oz-in)	0.072 kg-m (100 oz-in)
Maximum Speed		30°/s (5 rpm)	
Weight (including motor)		0.7 kg (1.6 lb)	1.4 kg (3.0 lb)
Material		Aluminum (Base and Tabletop)	
Finish		Clear Anodize (Black Anodize Motor Cover)	

1. Measured 75 mm (3 in) above tabletop, wobble, and eccentricity included.

4.2. Motor Information

Table 4-2. ART50 and ART100 Series Standard Motor Information

Code	Type	Bus	Amps	Cable	Driver
-1	Unipolar Microstepping	40 VDC	0.85 A	Integral	U511 / DR500
				Integral (-W-100)	U100M
-2	Unipolar Microstepping	40 VDC	0.85 A	SMS-O	U511 / DR500
				SMC	U100M
-3	Series Microstepping	40 VDC	0.5 A	Integral	U511 / DR500
				Integral (-W-100)	U100M
-4	Series Microstepping	40 VDC	0.5 A	SMS-O	U511 / DR500
				SMC	U100M



CHAPTER 5: ELECTRICAL

In This Section:

- Introduction 5-1
- Stepping Motor Wiring 5-1

5.1. Introduction

Aerotech ART50 / ART100 series rotary translation stages can be supplied with a full line of Aerotech positioning and motion controls.

When the ART50 / ART100 series stage is part of an Aerotech system refer to the system manuals and documentation for additional installation and operation information. All systems are adjusted for optimum performance. The end user need only connect the interconnecting cable from the drive chassis to the stage, and apply power.

Never connect or disconnect any electrical component or interconnecting cable while power is applied. Serious damage will result.



WARNING

5.2. Stepping Motor Wiring

For stages equipped with standard Aerotech stepping motor configurations, please refer to the following Figures.

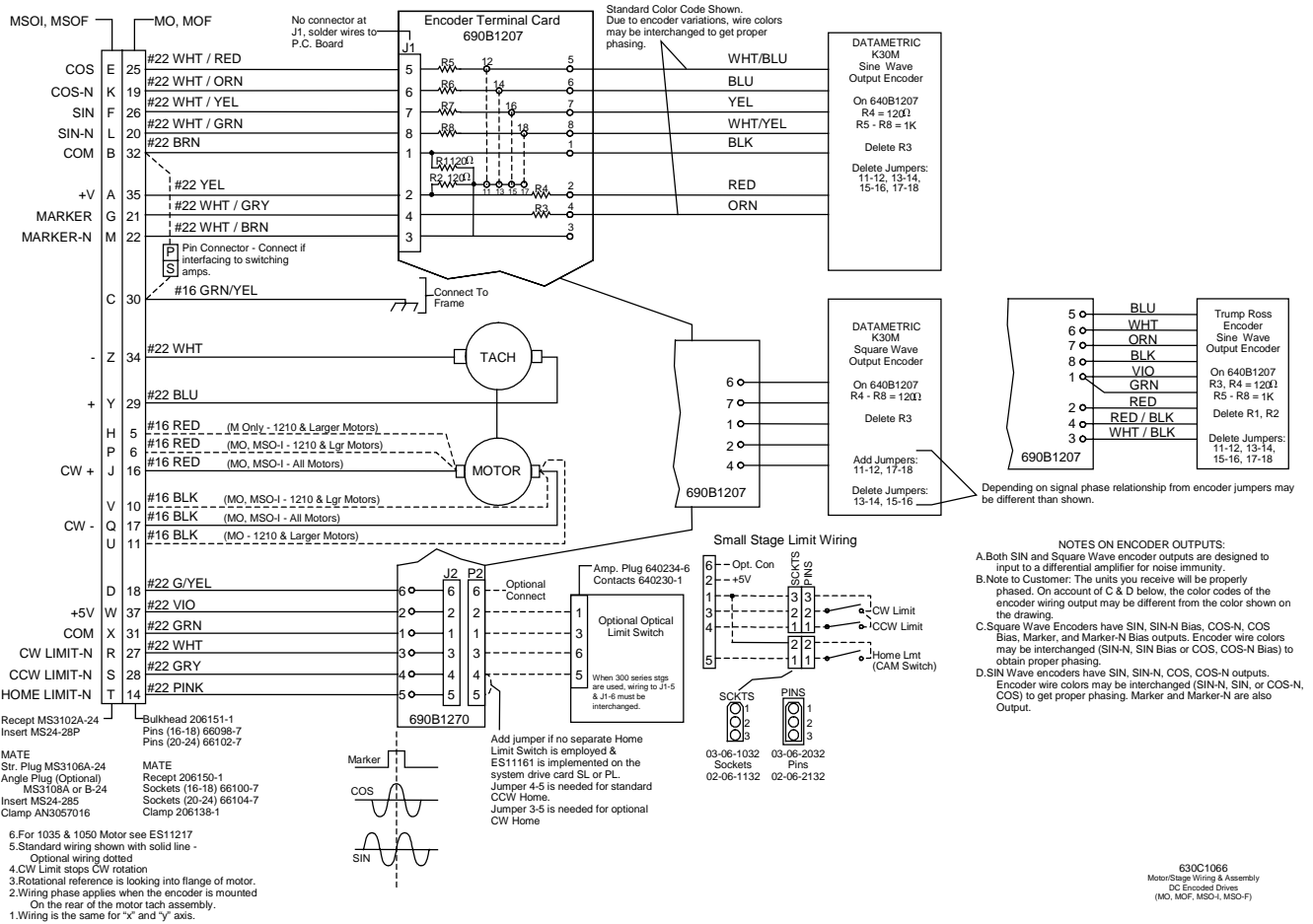


Figure 5-1. Motor/Stage Wiring

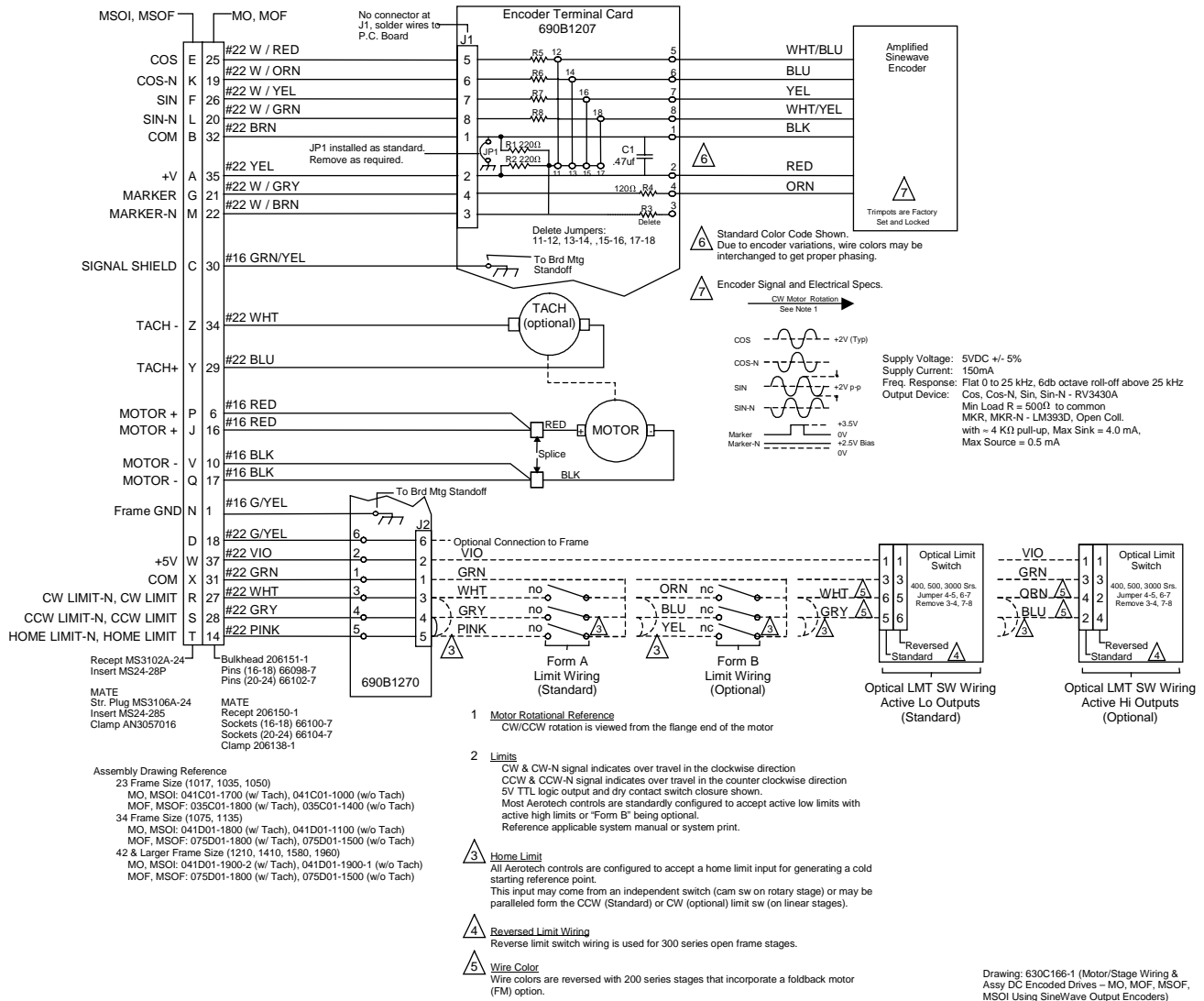


Figure 5-2. Motor/Stage Wiring

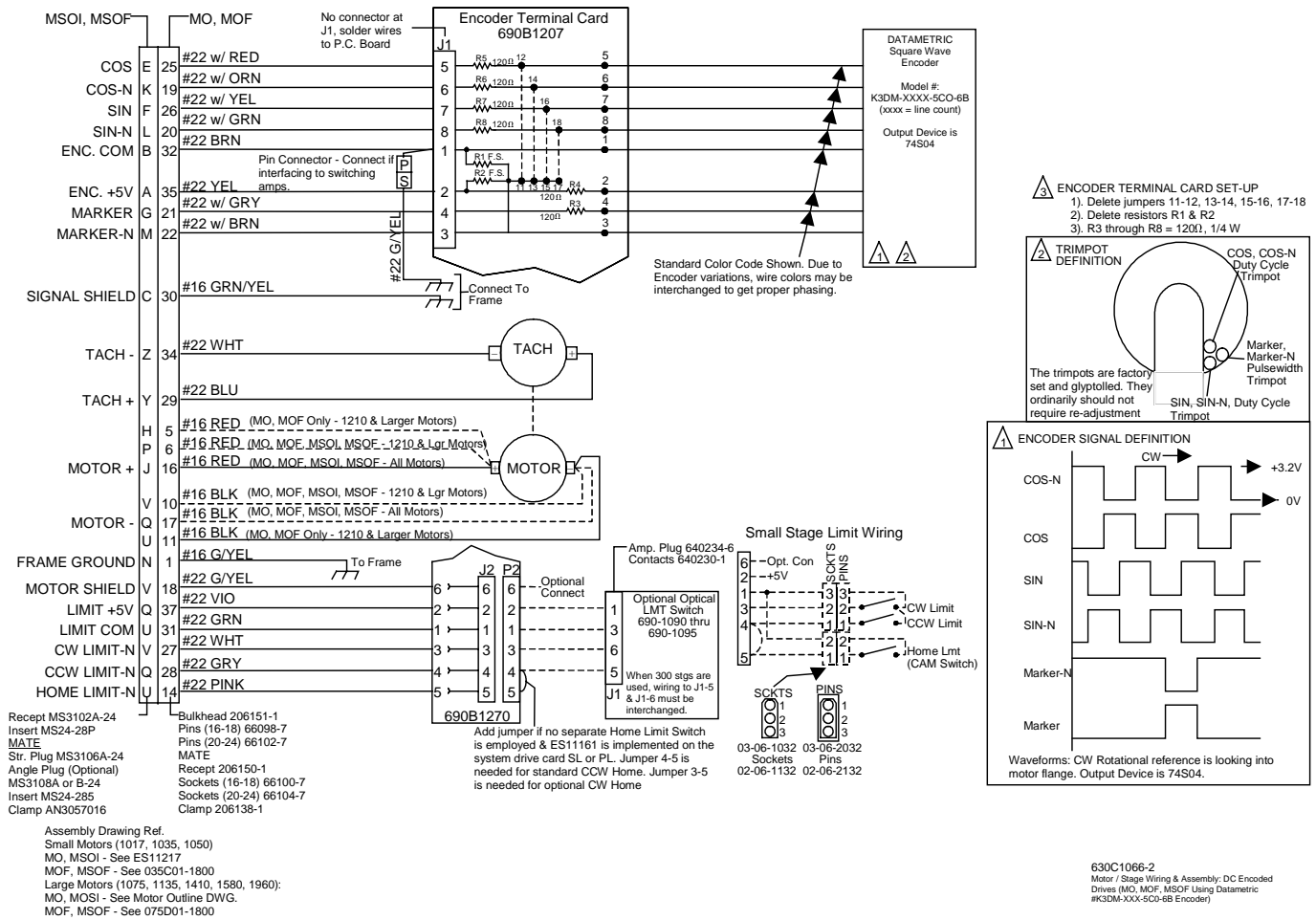


Figure 5-3. Motor/Stage Wiring

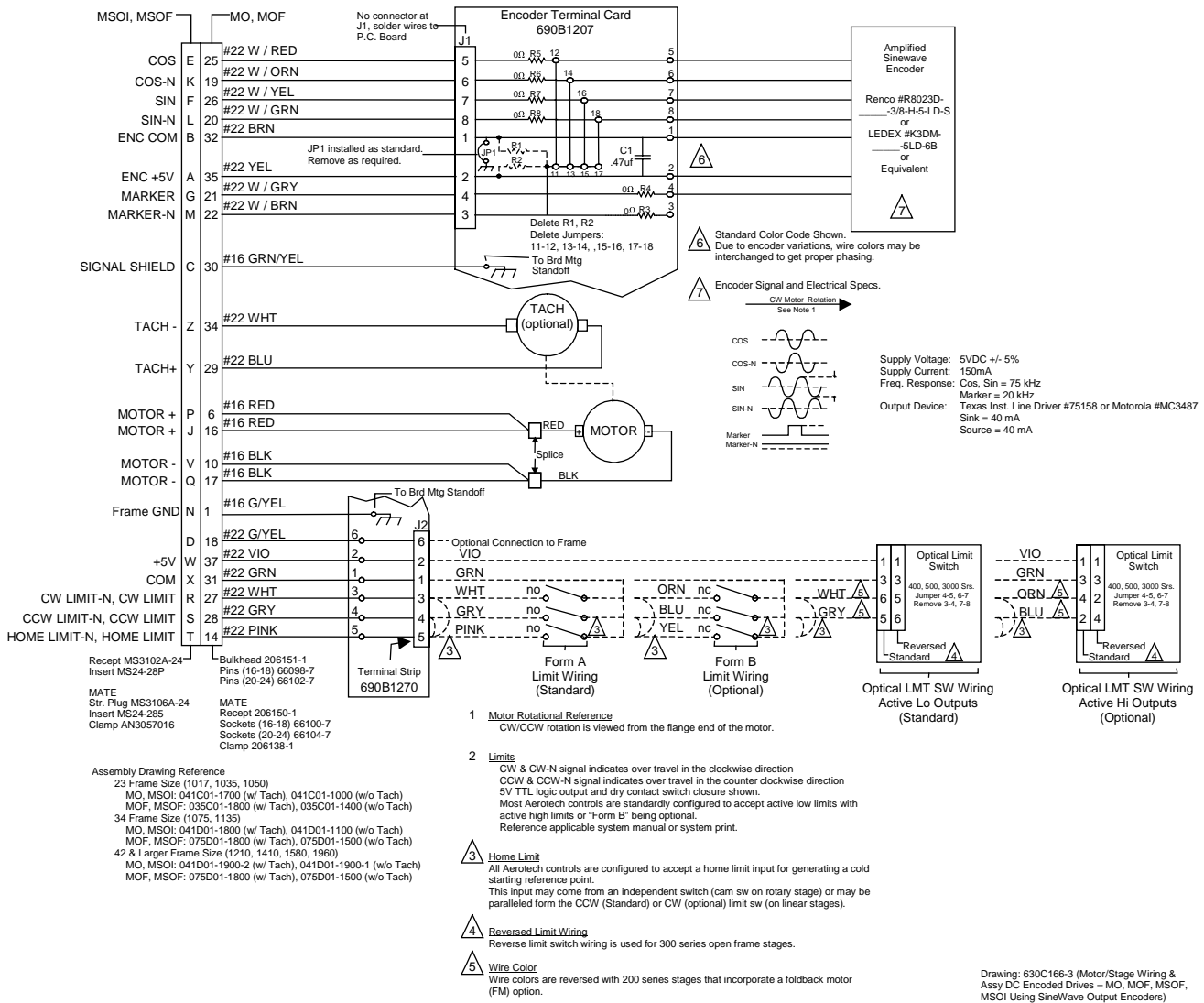


Figure 5-4. Motor/Stage Wiring

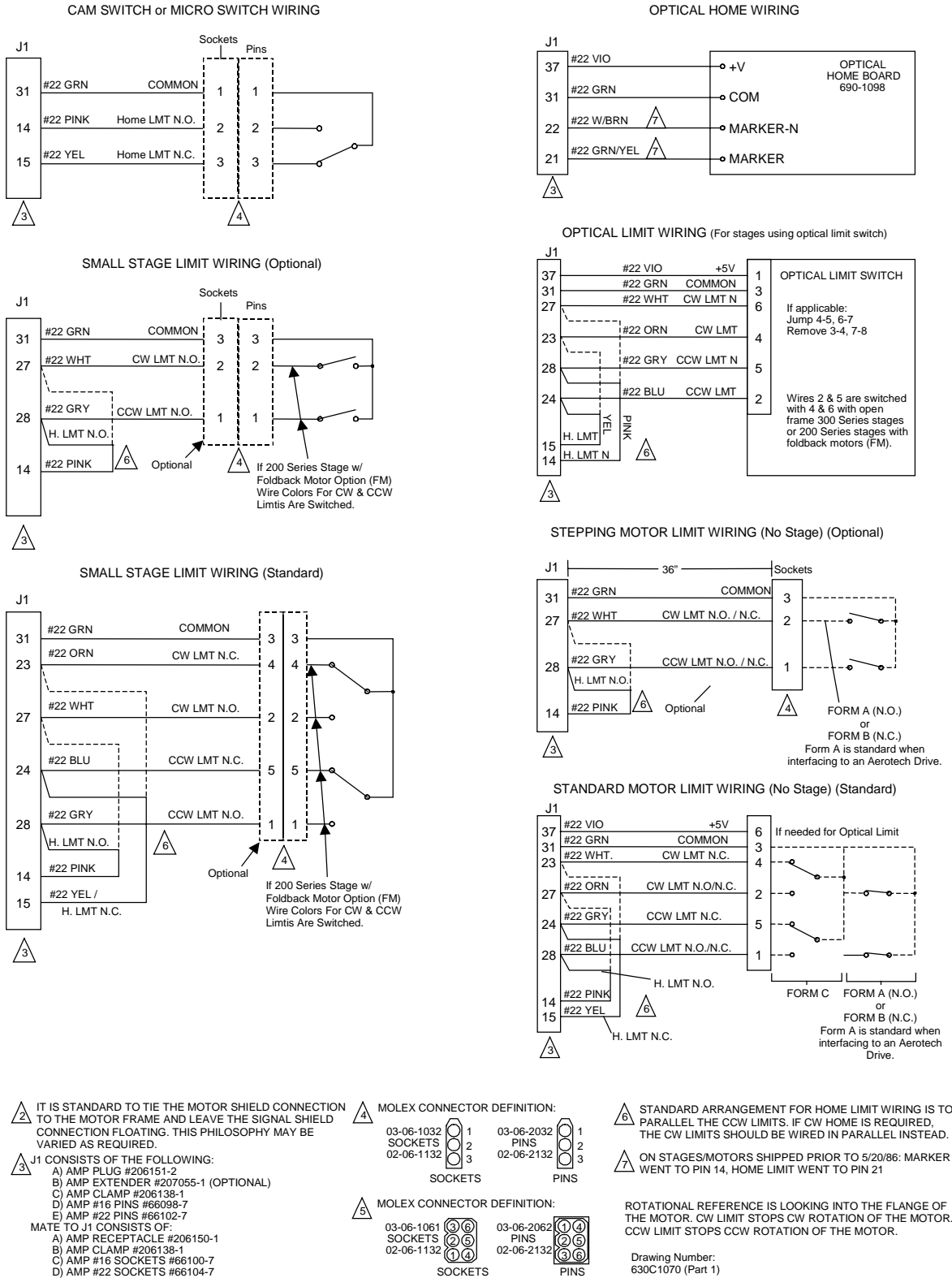


Figure 5-5. Limit / Home Wiring Options

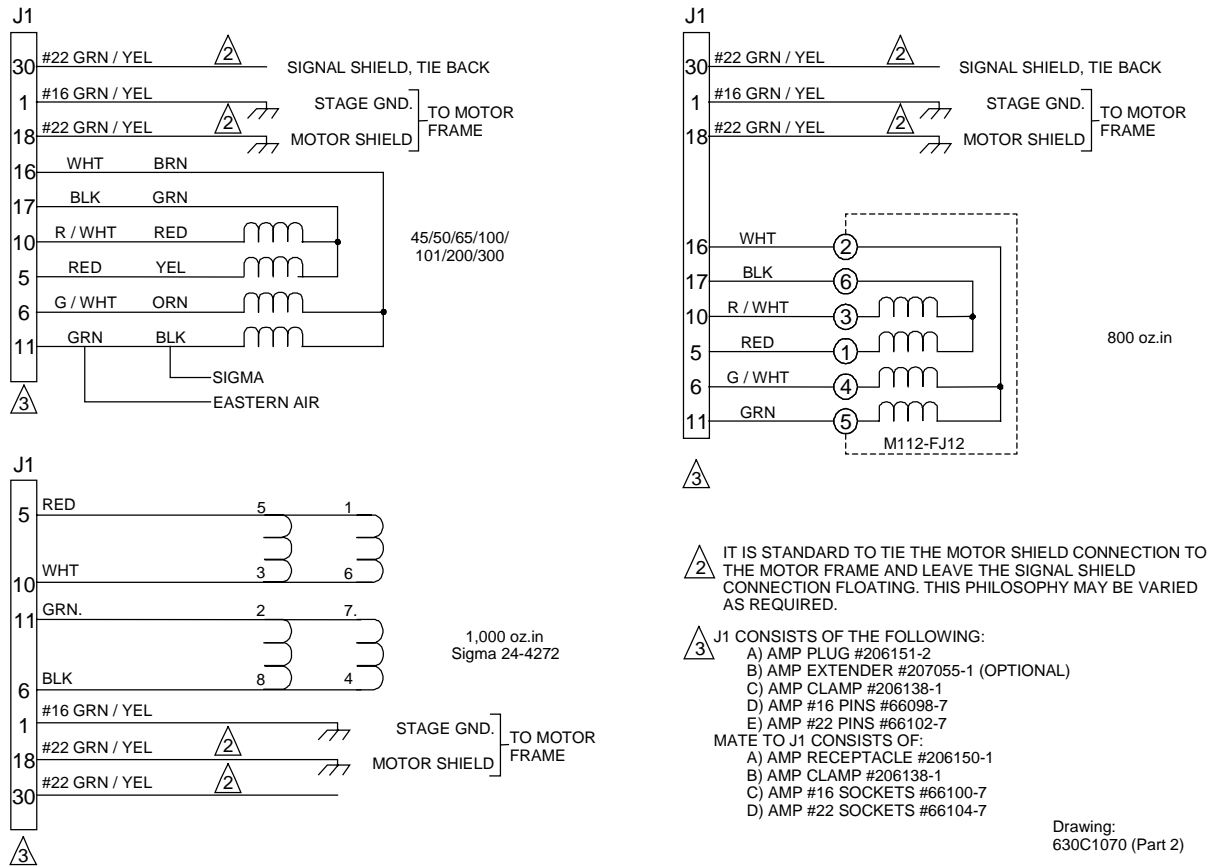
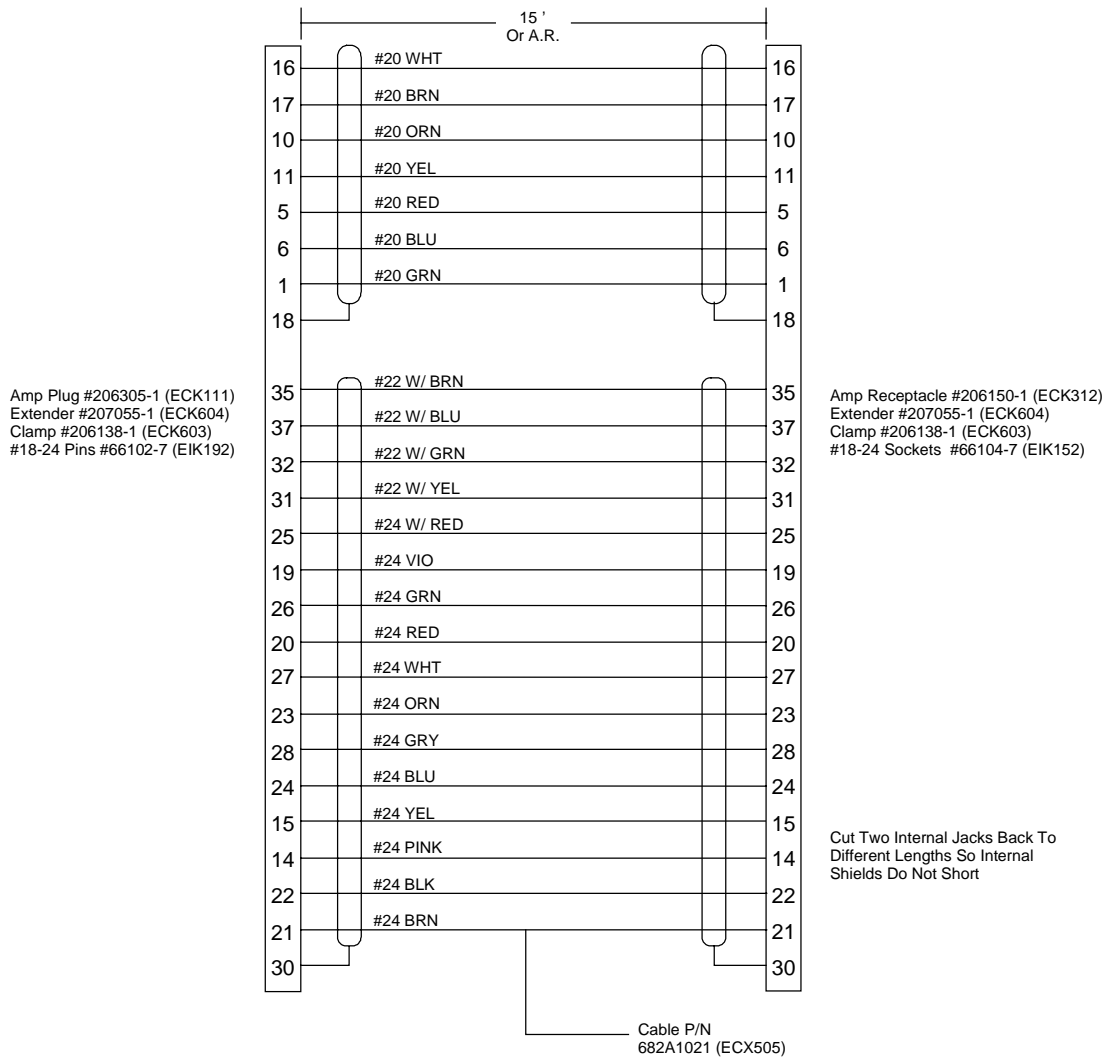


Figure 5-6. Stepping Motor Wiring Options



Drawing: 630C1070-3 (Output Interconnecting Cable SM-O, using 682A1021 Cable)

Figure 5-7. Output Interconnecting Cable (SM-O)



CHAPTER 6: VACUUM OPERATION

In This Section:

- Introduction 6-1
- Prep for Vacuum Operation 6-1

6.1. Introduction

As an option, Aerotech will prepare the ART50/ART100 Series stage for operation in a vacuum environment.

6.2. Prep for Vacuum Operation

Meticulous attention to detail during modification, cleaning, and assembly has resulted in a stage with optimal performance in high vacuum applications (10^{-6} torr). Some of the features of this preparation are:

1. Lubrication with vacuum compatible lubricants.
2. Use of only materials with negligible outgassing under vacuum.
3. Elimination of situations that may allow gases to become temporarily trapped during pump-down.
4. Extensively cleaned and baked-out before being specially assembled in a clean environment and packed in a nitrogen filled bag.

To insure that the stage will continue to perform well in vacuum, follow the additional guidelines below:

1. **Handling** - Do not remove the stage from the sealed bag until ready for use. When handling, use teflon gloves in a clean environment to prevent any contaminants from adhering to the stage. When the stage is not in use for an extended duration, place it in a sealed container.
2. **Installation** - Use cleaned, vented, stainless steel fasteners when securing the stage.
3. **Applications** - In a vacuum environment, the lack of conductive heat transfer could result in excessive motor operating temperatures. This coupled with the viscous nature of vacuum compatible greases will make it necessary to derate performance specifications.

To reduce the amount of heat generated for low duty cycle applications, we offer special controllers that reduce the current supplied to the motor when idle. For applications that require additional performance, contact our applications engineers about implementing a cooling system.

4. **Lubrication** - Use only small quantities of Apiezon L grease or a substitute of equivalent quality.



CHAPTER 7: MAINTENANCE

In This Section:

- Introduction 7-1
- Lubrication Schedule 7-1
- Lubrication and Cleaning Process 7-2
- Important Notes on Lubrication..... 7-2

7.1. Introduction

It is necessary to keep the bearing surfaces properly lubricated, otherwise, friction failure and deformation will occur at the contact areas. This will seriously affect the performance and life of the bearings.

Foreign matter or moisture entering the bearing is unacceptable, and will seriously affect gear set and bearing performance and life.

7.2. Lubrication Schedule

The interval for inspection and replenishment of lubricant is dependent on duty cycle, speed, and environment. An interval of one week is recommended for inspection until a trend develops for the application. Longer or shorter intervals of inspection may be required to maintain the film of lubricant on the gear teeth.

The worm end bearings and motor bearings are shielded and should not need to be relubricated. The table support ball bearings are unshielded, although they operate at a low speed, in a protected location and should not need relubricated under normal applications.

7.3. Lubrication and Cleaning Process

The lubrication and cleaning process is outlined in the steps that follow.

1. Turn the power off.
2. Remove the socket head screws securing the black anodized motor cover and withdraw the motor.
3. Remove any accumulated dust or debris from the inside of the assembly.
4. Apply a thin continuous film of lubricant to the motor gear set through the access hole in the top of the housing. Rotate the assembly with the indexing knob to cover all of the teeth. A good quality, natural bristle artist's brush makes a good applicator.
5. Apply lubricant in the same manner to worm and worm gear through the access hole in the bottom of the stage with a hypodermic needle.
6. Replace the motor cover.



To minimize the possibility of bodily injury, make certain that all electrical power switches are in the off position prior to making any mechanical adjustments.

7.4. Important Notes on Lubrication

When cleaning and/or lubricating components of the ATS100 series stages:

1. Be sure to use a clean, dry, soft, lint-free cloth for cleaning.
2. Take the opportunity during the lubrication procedure to inspect the linear motion guides for any damage or signs of wear.
3. Dow Corning – BR2 is recommended as a lubricant
4. Further disassembly of the stage is not recommended because proper assembly and calibration can only be done at the factory. In addition, a laser interferometer is required for post assembly verification to maintain warranties.

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APPENDIX A: WARRANTY AND FIELD SERVICE**In This Section:**

- Laser Product Warranty
- Return Products Procedure
- Returned Product Warranty Determination
- Returned Product Non-warranty Determination
- Rush Service
- On-site Warranty Repair
- On-site Non-warranty Repair

Aerotech, Inc. warrants its products to be free from 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 which 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, where 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 or 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.

Aerotech, Inc. warrants its laser products to the original purchaser for a minimum period of one year from date of shipment. This warranty covers defects in workmanship and material and is voided for all laser power supplies, plasma tubes and laser systems subject to electrical or physical abuse, tampering (such as opening the housing or removal of the serial tag) or improper operation as determined by Aerotech. This warranty is also voided for failure to comply with Aerotech's return procedures.

Laser Products

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. Aerotech must be notified within (30) days of shipment of incorrect materials. 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. Any returned product(s) must be accompanied by a return authorization number. The return authorization number may be obtained by calling an Aerotech service center. 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 (30) days after the issuance of a return authorization number will be subject to review.

Return Procedure

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 air freight return, the product(s) will be shipped collect. Warranty repairs do not extend the original warranty period.

***Returned Product
Warranty Determination***

Returned Product Non-warranty Determination

After Aerotech's examination, 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 (30) days of notification will result in the product(s) being returned as is, at the buyer's expense. Repair work is warranted for (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 service 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.

Company Address

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TWX: (710) 795-3125

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