If you should have any questions about the ART and/or comments regarding the documentation, please refer to Aerotech online at:


For your convenience, a product registration form is available at our web site.

Our web site is continually updated with new product information, free downloadable software, and special pricing on selected products.

The ART300 Precision Rotary Stage User’s Manual Revision History:

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<td>2-3</td>
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<tr>
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<td>ART320 Series Stage Dimensions</td>
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<td>5-2</td>
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<td>5-2</td>
<td>Motor/Stage Wiring</td>
<td>5-3</td>
</tr>
<tr>
<td>5-3</td>
<td>Motor/Stage Wiring</td>
<td>5-4</td>
</tr>
<tr>
<td>5-4</td>
<td>Motor/Stage Wiring</td>
<td>5-5</td>
</tr>
<tr>
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<td>Limit / Home Wiring Options</td>
<td>5-6</td>
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</tr>
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<td>5-8</td>
</tr>
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CHAPTER 1: OVERVIEW

1.1. Introduction

This manual describes technical information needed for typical applications of the ART300 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 ART300 series stage from the package.

Figure 1-1. ART300 Rotary Stages

ART310
ART320
ART310
1.2. Description

ART300 Series rotary stages are compact units providing precise positioning capability for lighter applications. The following is a list of some features:

- Maximum rotary speed of 27 rpm, and resolution of 1.5 arc second.
- Table mounted on dual large diameter pre-loaded angular contact bearings
- Anti-backlash gearing
- Base and table are machined from high strength aluminum plate
- Aluminum surfaces are either clear or black anodized
- Large aperture versions available
- Optional right angle brackets 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
- DC brushless torque motor comes standard
- Optional preparation for vacuum operation (10E-6 torr.)
1.3. ART300 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 ART310-M-G54-BMS, which designates a 100 mm stage, a metric mounting and grid pattern, a 54:1 gear ratio, and a brushless servo motor.

Table 1-1. ART300 Model Numbering System (ART310-M-G54-BMS)

<table>
<thead>
<tr>
<th>ART3 Series</th>
<th>Table Diameter</th>
<th>Stage Construction Options</th>
<th>Mounting and Grid Pattern</th>
<th>Gear Ratio</th>
<th>Motor</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>10</td>
<td>/VAC3</td>
<td>-M</td>
<td>-G54</td>
<td>-BMS</td>
<td>-HC</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>/VAC3</td>
<td>-U</td>
<td>-G108</td>
<td>-BM</td>
<td>-RB310U</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>/VAC6</td>
<td>-MA</td>
<td>-G216</td>
<td>-DC</td>
<td>-RB310MA</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td></td>
<td>-UA</td>
<td></td>
<td>-SM</td>
<td>-RB315UA</td>
</tr>
</tbody>
</table>

Table 1-2. Model Options

<table>
<thead>
<tr>
<th>ART300 Series Rotary Stage</th>
<th>Diameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ART310</td>
<td>100 mm</td>
<td>100 mm (4 in) diameter rotary stage</td>
</tr>
<tr>
<td>ART315</td>
<td>150 mm</td>
<td>150 mm (6 in) diameter rotary stage</td>
</tr>
<tr>
<td>ART320</td>
<td>200 mm</td>
<td>200 mm (8 in) diameter rotary stage</td>
</tr>
<tr>
<td>ART330</td>
<td>300 mm</td>
<td>300 mm (12 in) diameter rotary stage</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage Construction Options</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>/VAC3</td>
<td>Vacuum preparation of stage to $10^{-3}$ torr.</td>
</tr>
<tr>
<td>/VAC6</td>
<td>Vacuum preparation of stage to $10^{-6}$ torr.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mounting and Grid Pattern</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>-M</td>
<td>Tabletop with metric-dimension mounting pattern and holes</td>
</tr>
<tr>
<td>-U</td>
<td>Tabletop with English-dimension mounting pattern and holes</td>
</tr>
<tr>
<td>-MA</td>
<td>Tabletop with aperture and metric-dimension mounting pattern and holes</td>
</tr>
<tr>
<td>-UA</td>
<td>Tabletop with aperture and English-dimension mounting pattern and holes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gear Ratio</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>-G54</td>
<td>54:1 gear ratio</td>
</tr>
<tr>
<td></td>
<td>ART310, ART315 – Standard</td>
</tr>
<tr>
<td></td>
<td>ART320 – Optional</td>
</tr>
<tr>
<td>-G108</td>
<td>108:1 gear ratio</td>
</tr>
<tr>
<td></td>
<td>ART310, ART315 – Optional</td>
</tr>
<tr>
<td></td>
<td>ART320, ART330 – Standard (only ratio available with ART330)</td>
</tr>
<tr>
<td>-G216</td>
<td>216:1 gear ratio</td>
</tr>
<tr>
<td></td>
<td>ART310, ART315 – Optional</td>
</tr>
</tbody>
</table>
### Table 1-2. Model Options – Continued

<table>
<thead>
<tr>
<th>Motor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-BM</td>
<td>Brushless servo motor with connectors and 1000-line encoder. Requires motor-to-controller cable. ART330 (BM250-MS-E1000H/)</td>
</tr>
<tr>
<td>-DC</td>
<td>DC servo motor with connectors and 1000-line encoder. Requires motor-to-controller cable. ART310, ART315 (1035LT-MSOF-E1000LD/), ART320 (1050LT-MSOF-E1000LD/), ART330 (1135LT-MSOF-E1000LD/)</td>
</tr>
<tr>
<td>-SM</td>
<td>Stepping motor with 4.6 m (15 ft) integral cable and home marker pulse (one per rev). ART310, ART315 (50SMB2-HM/), ART320 (101SMB2-HM/), ART330 (310SMB3-HM/)</td>
</tr>
<tr>
<td>-NM</td>
<td>No motor or encoder</td>
</tr>
</tbody>
</table>

### Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-HC</td>
<td>Home cam assembly establishes home reference accurate to one count. Requires home marker or encoder option on motor.</td>
</tr>
<tr>
<td>-RB310U</td>
<td>Raised tabletop for ART310, English</td>
</tr>
<tr>
<td>-RB310M</td>
<td>Raised tabletop for ART310, metric</td>
</tr>
<tr>
<td>-RB315U</td>
<td>Raised tabletop for ART315, English</td>
</tr>
<tr>
<td>-RB315M</td>
<td>Raised tabletop for ART315, metric</td>
</tr>
<tr>
<td>-RB310UA</td>
<td>Raised tabletop for ART310, English with aperture</td>
</tr>
<tr>
<td>-RB310MA</td>
<td>Raised tabletop for ART310, metric with aperture</td>
</tr>
<tr>
<td>-RB315UA</td>
<td>Raised tabletop for ART315, English with aperture</td>
</tr>
<tr>
<td>-RB315MA</td>
<td>Raised tabletop for ART315, metric with aperture</td>
</tr>
</tbody>
</table>

### Accessories

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDZ3</td>
<td>English right angle L-bracket for ART310, ART315</td>
</tr>
<tr>
<td>HDZ3M</td>
<td>Metric right angle L-bracket for ART310, ART315</td>
</tr>
<tr>
<td>HDZ4</td>
<td>English right angle bracket for ART320, ART330</td>
</tr>
<tr>
<td>HDZ4M</td>
<td>Metric right angle bracket for ART320, ART330</td>
</tr>
</tbody>
</table>

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.
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 ART300 series stages. For added clarity, each step of the installation instructions has been broken down into component parts. The ART300 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 ART300 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. ART310 Series Stage Dimensions

![Figure 2-1. ART310 Series Stage Dimensions]

<table>
<thead>
<tr>
<th>Motor Options</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>50SMB2-HM</td>
<td>84.3 [3.32]</td>
</tr>
<tr>
<td>1038LT-MSOF</td>
<td>158.2 [6.23]</td>
</tr>
<tr>
<td>BMS60</td>
<td>132.3 [5.21]</td>
</tr>
</tbody>
</table>

* See motor section for alternate motors and more details

Dimensions - Millimeters [Inches]
2.2.2. ART315 Series Stage Dimensions

Figure 2-2. ART315 Series Stage Dimensions
2.2.3. ART320 Series Stage Dimensions

**Figure 2-3. ART320 Series Stage Dimensions**

<table>
<thead>
<tr>
<th>Motor Options</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM (101SMB2-HM)</td>
<td>135.1 [5.32]</td>
</tr>
<tr>
<td>DC (1050LT-MSOF)</td>
<td>178.6 [7.03]</td>
</tr>
<tr>
<td>BMS (BMS60)</td>
<td>132.3 [5.21]</td>
</tr>
</tbody>
</table>

* See motor section for alternate motors and more details

Dimensions - Millimeters [Inches]
2.2.4. ART330 Series Stage Dimensions

Figure 2-4. ART330 Series Stage Dimensions
CHAPTER 3: APPLICATION NOTES

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 ART300 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 to be applied, consult the factory for the load capability.

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

Table 4-1. ART300 Series Rotary Stage Specifications

<table>
<thead>
<tr>
<th>Basic Model</th>
<th>ART310</th>
<th>ART315</th>
<th>ART320</th>
<th>ART300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table Diameter</td>
<td>100 mm (4 in)</td>
<td>150 mm (6 in)</td>
<td>200 mm (8 in)</td>
<td>300 mm (12 in)</td>
</tr>
<tr>
<td>Total Travel</td>
<td>360° continuous, both azimuth and elevation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drive System</td>
<td>Precision Worm Gear (54:1 motor-to-table ratio standard)</td>
<td>Precision Worm Gear in Oil Bath (108:1 motor-to-table ratio standard)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>54:1</td>
<td>108:1</td>
<td>216:1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 arc sec @ 4,000 steps/rev motor resolution</td>
<td>3 arc sec @ 4,000 steps/rev motor resolution</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.5 arc sec @ 4,000 steps/rev motor resolution</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Speed</td>
<td>54:1</td>
<td>108:1</td>
<td>216:1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11 rpm</td>
<td>27 rpm</td>
<td>27 rpm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.5 rpm</td>
<td>27 rpm</td>
<td>32 rpm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.75 rpm</td>
<td>13.5 rpm</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>54:1</td>
<td>108:1</td>
<td>216:1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 arc min</td>
<td>1.0 arc min</td>
<td>0.5 arc min</td>
<td></td>
</tr>
<tr>
<td>Repeatability (Unidirectional)</td>
<td>12 arc sec</td>
<td>6 arc sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axis Wobble</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radial</td>
<td>15.0 μm (600 μm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axial</td>
<td>3.0 μm (120 μm)</td>
<td>2.0 μm (80 μm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Load</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axial</td>
<td>25.0 kg (55.1 lb)</td>
<td>45.0 kg (99.2 lb)</td>
<td>115.0 kg (253.5 lb)</td>
<td></td>
</tr>
<tr>
<td>Radial</td>
<td>10.0 kg (22.0 lb)</td>
<td>25.0 kg (55.1 lb)</td>
<td>90.0 kg (198.4 lb)</td>
<td></td>
</tr>
<tr>
<td>Output Torque (static)</td>
<td>0.3 kg-m (25 lb-in)</td>
<td>0.7 kg-m (60 lb-in)</td>
<td>4.6 kg-m (400 lb-in)</td>
<td></td>
</tr>
<tr>
<td>Nominal Stage Weight</td>
<td>w/o Motor</td>
<td>2.0 kg (4.46 lb)</td>
<td>2.9 kg (6.4 lb)</td>
<td>6.4 kg (14.1 lb)</td>
</tr>
<tr>
<td></td>
<td>w/ Motor</td>
<td>3.1 kg (6.8 lb)</td>
<td>4.0 kg (8.8 lb)</td>
<td>7.5 kg (16.5 lb)</td>
</tr>
<tr>
<td>Material</td>
<td>Stage and Table</td>
<td>Aluminum</td>
<td>Stage: Cast aluminum; Table: Aluminum</td>
<td></td>
</tr>
<tr>
<td>Finish</td>
<td>Stage</td>
<td>Black Anodize</td>
<td>Paint: Textured Epoxy (Polane-T); Pebble Gray Color</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Table</td>
<td>Hard Coating (62 Rockwell Hardness Teflon Impregnated)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Measured 75 mm (3 in) above table; includes wobble and eccentricity components.
### 4.2. Motor Information

**Table 4-2. ART310 / ART315 Series Standard Motor Information**

<table>
<thead>
<tr>
<th>Code</th>
<th>Type</th>
<th>Model</th>
<th>Bus</th>
<th>Amps</th>
<th>Cable</th>
<th>Driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>-BMS</td>
<td>Brushless</td>
<td>BMS60-A-D25-E1000H</td>
<td>Up to 160 VDC</td>
<td>up to 1.8 A&lt;sub&gt;ms&lt;/sub&gt; Cont up to 7.3 A&lt;sub&gt;ms&lt;/sub&gt; Peak</td>
<td>BMCHPD/BFCD</td>
<td>U511/DR500/DR600</td>
</tr>
<tr>
<td></td>
<td>Servo</td>
<td></td>
<td></td>
<td></td>
<td>PMCHPD/BFCD</td>
<td>BB501 + BA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PMCHPD/BFCD</td>
<td>BAI</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BMP2HPD/BFCD</td>
<td>U100Z</td>
</tr>
<tr>
<td>-DC</td>
<td>DC Servo</td>
<td>1035LT-MSOF-E1000LD</td>
<td>40 VDC</td>
<td>up to 4.1 A Cont up to 8.2 A Peak</td>
<td>DC-MSO</td>
<td>U511/DR500/DR600</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BADC-MSO1</td>
<td>BB501 + BA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BADC-MSO1</td>
<td>BAI</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DCC</td>
<td>U100S</td>
</tr>
<tr>
<td>-SM</td>
<td>Microstepping</td>
<td>50SMB2-HM</td>
<td>40 VDC</td>
<td>up to 1 A</td>
<td>SMS-O</td>
<td>U511/DR500/D R600</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SMC</td>
<td>U100M</td>
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</tbody>
</table>

**Table 4-3. ART320 Series Standard Motor Information**

<table>
<thead>
<tr>
<th>Code</th>
<th>Type</th>
<th>Model</th>
<th>Bus</th>
<th>Amps</th>
<th>Cable</th>
<th>Driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>-BMS</td>
<td>Brushless</td>
<td>BMS60-A-D25-E1000H</td>
<td>Up to 160 VDC</td>
<td>up to 1.8 A&lt;sub&gt;ms&lt;/sub&gt; Cont up to 7.3 A&lt;sub&gt;ms&lt;/sub&gt; Peak</td>
<td>BMCHPD/BFCD</td>
<td>U511/DR500/DR600</td>
</tr>
<tr>
<td></td>
<td>Servo</td>
<td></td>
<td></td>
<td></td>
<td>PMCHPD/BFCD</td>
<td>BB501 + BA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PMCHPD/BFCD</td>
<td>BAI</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BMP2HPD/BFCD</td>
<td>U100Z</td>
</tr>
<tr>
<td>-DC</td>
<td>DC Servo</td>
<td>1050LT-MSOF-E1000LD</td>
<td>40 VDC</td>
<td>up to 5.4 A Cont up to 10.8 A Peak</td>
<td>DC-MSO</td>
<td>U511/DR500/DR600</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BADC-MSO1</td>
<td>BB501 + BA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BADC-MSO1</td>
<td>BAI</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>DCC</td>
<td>U100S</td>
</tr>
<tr>
<td>-SM</td>
<td>Microstepping</td>
<td>101SMB2-HM</td>
<td>40 VDC</td>
<td>up to 5 A</td>
<td>SMS-O</td>
<td>U511/DR500/D R600</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>SMC</td>
<td>U100M</td>
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</tbody>
</table>

**Table 4-4. ART330 Series Standard Motor Information**

<table>
<thead>
<tr>
<th>Code</th>
<th>Type</th>
<th>Model</th>
<th>Bus</th>
<th>Amps</th>
<th>Cable</th>
<th>Driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>-BM</td>
<td>Brushless</td>
<td>BM250E</td>
<td>Up to 320 VDC</td>
<td>up to 7.1 A&lt;sub&gt;ms&lt;/sub&gt; Cont up to 17.8 A&lt;sub&gt;ms&lt;/sub&gt; Peak</td>
<td>BMC2/BFC</td>
<td>U511/DR500/DR600</td>
</tr>
<tr>
<td></td>
<td>Servo</td>
<td></td>
<td></td>
<td></td>
<td>PMC/BFC</td>
<td>BB501 + BA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PMC/BFC</td>
<td>BAI</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BMP2/BFC</td>
<td>U100Z</td>
</tr>
<tr>
<td>-DC</td>
<td>DC Servo</td>
<td>1135LT-MSOF-E1000LD</td>
<td>80 VDC</td>
<td>up to 5.5 A Cont up to 11.0 A Peak</td>
<td>DC-MSO</td>
<td>U511/DR500/DR600</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BADC-MSO1</td>
<td>BB501 + BA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BADC-MSO1</td>
<td>BAI</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DCC</td>
<td>U100S</td>
</tr>
<tr>
<td>-SM</td>
<td>Microstepping</td>
<td>310SMB3-HM</td>
<td>80 VDC</td>
<td>up to 6 A</td>
<td>SMS-O</td>
<td>U511/DR500/D R600</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SMC</td>
<td>U100M</td>
</tr>
</tbody>
</table>
CHAPTER 5: ELECTRICAL

In This Section:
- Introduction ............................................................ 5-1
- Stepping Motor Wiring .............................................. 5-2

5.1. Introduction

Aerotech ART300 series rotary translation stages can be supplied with a full line of Aerotech positioning and motion controls.

When the ART300 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**

- **Motor Rotational Reference:**
  - CW & CW-N indicate the direction in which the motor rotates.
  - CCW & CCW-N signal indicates overtravel in the counterclockwise direction.
  - CW & CW-N signal indicates overtravel in the clockwise direction.
  - Most Aerotech controls are standardly configured to accept active low limits with CCW & CCW-N signal.

- **Wire Colors:**
  - Standard color code shown in brackets, race colors may be changed to get proper phasing.

- **Standard Color Code Shown:**
  - Use to encoder variations, wire colors may be changed to get proper phasing.

- **Encoder Signal and Electrical Specs.:**
  - 5VDC ±5% Supply Voltage
  - 150mA Supply Current
  - 5VDC ±0.25V Supply Voltage
  - 5VDC ±0.5mA Max Source
  - ±2V Typ. Active High or "Form B" optional.
  - Frequency Response: Flat 0 to 25 kHz, 6dB octave roll-off above 25 kHz
  - Supply Current: 150mA
  - Supply Voltage: 5VDC ±5%
  - Min Load R = 500
  - MKR, MKR-N - LM393D, Open Collector
  - MSOF Using Sine Wave Output Encoders
  - Assay DC Encoded Drives – MO, MOF, MSOF, MSOI Using Sine Wave Output Encoders

- **Encoder Terminal Card:**
  - 69081207

- **Electrical ART300 Instruction Manual**
  - Insert MS24-28P
  - Insert MS24-28P
  - Mark AN3057016
  - Mark AN3057016
  - 34 Frame Size (1075, 1135)
  - Motor +
  - MOF, MSOF: 075D01-1800 (w/ Tach), 075D01-1500 (w/o Tach)
  - MOF, MSOF: 075D01-1800 (w/ Tach), 075D01-1500 (w/o Tach)
  - MO, MSOI: 041C01-1700 (w/ Tach), 041C01-1000 (w/o Tach)
  - COS-N
  - SIN-N
  - COS-N
  - SIN-N
  - COM
  - B
  - K
  - Limit Wiring
  - Home Limit
  - 14THOME LIMIT-N, HOME LIMIT
  - 28SCCW LIMIT-N, CCW LIMIT
  - 27RCW LIMIT-N, CW LIMIT

- **Encoder Signal and Electrical Specs.:**
  - 5VDC ±5% Supply Voltage
  - 150mA Supply Current
  - 5VDC ±0.25V Supply Voltage
  - 5VDC ±0.5mA Max Source
  - ±2V Typ. Active High or "Form B" optional.
  - Frequency Response: Flat 0 to 25 kHz, 6dB octave roll-off above 25 kHz
  - Supply Current: 150mA
  - Supply Voltage: 5VDC ±5%
  - Min Load R = 500
  - MKR, MKR-N - LM393D, Open Collector
  - MSOF Using Sine Wave Output Encoders

- **Optical Limit Switch Active LO Outputs:**
  - Standard
  - Optical LTD Switch
  - 690B1200, 690B1208, 690B1209, 690B1210, 690B1211
  - Form A
  - Form B
  - Form C
  - Form D

- **Optical Limit Switch Active HI Outputs:**
  - Standard
  - Optical LTD Switch
  - 690B1200, 690B1208, 690B1209, 690B1210, 690B1211
  - Form A
  - Form B
  - Form C
  - Form D

- **Optical Limit Switch Active HI Outputs:**
  - Standard
  - Optical LTD Switch
  - 690B1200, 690B1208, 690B1209, 690B1210, 690B1211
  - Form A
  - Form B
  - Form C
  - Form D
Figure 5-3. Motor/Stage Wiring
Figure 5-4. Motor/Stage Wiring
**Figure 5-5. Limit / Home Wiring Options**

- **Optical Limit Wiring (For stages using optical limit switch)**
  - OPTICAL LIMIT WIRING (For stages using optical limit switch)
  - J1
    - 31 #2 GRN COMMON
    - 14 #2 PINK Home LMT N.O.
    - 15 #2 YEL Home LMT N.C.

- **Optical Home Wiring**
  - OPTICAL HOME WIRING
  - CAM SWITCH or MICRO SWITCH WIRING
  - J1
    - 31 #2 GRN COMMON
    - 22 #2 WBRN MARKER-N
    - 21 #2 GRN/YEL MARKER

- **Optical Limit Wiring (For stages using optical limit switch)**
  - J1
    - 31 #2 VIO +5V
    - 22 #2 GRN COMMON
    - 23 #2 ORN CW LMT
    - 24 #2 GRY CCW LMT
    - 28 #2 BLU CCW LMT N.O./N.C.
    - 15 H. LMT N.O.
    - 14 H. LMT N.C.

- **Small Stage Limit Wiring (Optional)**
  - SMALL STAGE LIMIT WIRING (Optional)
  - J1
    - 31 #22 GRN COMMON
    - 27 #22 WHIT CW LMT N.O.
    - 28 #22 GRY CCW LMT N.O.
    - 14 #22 PINK

- **Small Stage Limit Wiring (Standard)**
  - SMALL STAGE LIMIT WIRING (Standard)
  - J1
    - 31 #22 GRN COMMON
    - 23 #22 ORN CW LMT N.C.
    - 27 #22 WHIT CW LMT N.C.
    - 28 #22 GRY CCW LMT N.C.
    - 14 #22 PINK

- **Optical Home Wiring**
  - OPTICAL HOME WIRING
  - CAM SWITCH or MICRO SWITCH WIRING
  - J1
    - 31 #2 GRN COMMON
    - 22 #2 WBRN MARKER-N
    - 21 #2 GRN/YEL MARKER

- **Optical Limit Switch**
  - OPTICAL LIMIT SWITCH
  - If applicable: Jump 4-5, 6-7
  - Remove 3-4, 7-8
  - Wires 2 & 5 are switched with 4 & 6 with open frame 300 Series stages or 200 Series stages with foldback motors (FM).

- **Stepping Motor Limit Wiring (No Stage) (Optional)**
  - STEPPING MOTOR LIMIT WIRING (No Stage) (Optional)
  - J1
    - 31 #22 GRN COMMON
    - 27 #22 WHIT CW LMT N.O./N.C.
    - 23 #22 ORN CW LMT N.O.
    - 28 #22 GRY CCW LMT N.O./N.C.
    - 14 #22 PINK

- **Standard Motor Limit Wiring (No Stage) (Standard)**
  - STANDARD MOTOR LIMIT WIRING (No Stage) (Standard)
  - J1
    - 37 #2 VIO +5V
    - 36 #2 GRN COMMON
    - 31 27 23 31 #22 GRN COMMON
    - 27 23 31 27 #22 WHIT CW LMT N.C.
    - 23 27 31 23 #22 ORN CW LMT N.O./N.C.
    - 28 24 31 28 #22 GRY CCW LMT N.O./N.C.
    - 14 15 28 14 #22 BLU CCW LMT N.O./N.C.
    - 14 15 #22 PINK

- **Molex Connector Definition**
  - MOLEX CONNECTOR DEFINITION:
    - 03-06-1032 03-06-1061
    - 02-06-1132 02-06-1130
    - 03-06-2032 03-06-2062
    - 02-06-2132 02-06-2130

- **Standard Arrangement for Home Limit Wiring**
  - STANDARD ARRANGEMENT FOR HOME LIMIT WIRING IS TO PARALLEL THE CW LIMITS. IF CW HOME IS REQUIRED, THE CW LIMITS SHOULD BE WIRE IN PARALLEL INSTEAD.

- **Rotational Reference**
  - ROTATIONAL REFERENCE IS LOOKING INTO THE FLANGE OF THE MOTOR. CW LIMIT STOPS CW ROTATION OF THE MOTOR. CCW LIMIT STOPS CCW ROTATION OF THE MOTOR.

- **Drawing Number**
  - Drawing Number: 630C1070 (Part 1)
Figure 5-6. Stepping Motor Wiring Options
Figure 5-7. Output Interconnecting Cable (SM-O)

Amp Plug #206305-1 (ECK111)
Extender #207055-1 (ECK604)
Clamp #206138-1 (ECK603)
#18-24 Pins #66102-7 (EIK192)

Amp Receptacle #206150-1 (ECK312)
Extender #207055-1 (ECK604)
Clamp #206138-1 (ECK603)
#18-24 Sockets #66104-7 (EIK152)

Cut Two Internal Jacks Back To Different Lengths So Internal Shields Do Not Short

Cable P/N 682A1021 (ECX505)

Drawing: 630C1070-3 (Output Interconnecting Cable SM-O, using 682A1021 Cable)
CHAPTER 6:  VACUUM OPERATION

In This Section:
- Introduction .............................................. 6-1
- Prep for Vacuum Operation ...................... 6-2

6.1. Introduction

As an option, Aerotech will prepare the ART300 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.............................................. 7-2
- Lubrication and Cleaning Process ......................... 7-3
- Important Notes on Lubrication.............................. 7-4

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. This will seriously affect gear set, bearing performance, and the life of the bearings.
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 to be 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 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 ART 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.
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.

Laser Products

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.

Return Procedure

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.

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.
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.

<table>
<thead>
<tr>
<th>Returned Product Non-warranty Determination</th>
</tr>
</thead>
<tbody>
<tr>
<td>After Aerotech’s examination, the buyer</td>
</tr>
<tr>
<td>shall be notified of the repair cost.</td>
</tr>
<tr>
<td>At such time the buyer must issue a valid</td>
</tr>
<tr>
<td>purchase order to cover the cost of the</td>
</tr>
<tr>
<td>repair and freight, or authorize the</td>
</tr>
<tr>
<td>product(s) to be shipped back as is, at</td>
</tr>
<tr>
<td>the buyer’s expense. Failure to obtain a</td>
</tr>
<tr>
<td>purchase order number or approval within</td>
</tr>
<tr>
<td>(30) days of notification will result in</td>
</tr>
<tr>
<td>the product(s) being returned as is, at</td>
</tr>
<tr>
<td>the buyer’s expense. Repair work is</td>
</tr>
<tr>
<td>warranted for (90) days from date of</td>
</tr>
<tr>
<td>shipment.</td>
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<table>
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<th>Rush Service</th>
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</thead>
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<tr>
<td>At times, the buyer may desire to expedite</td>
</tr>
<tr>
<td>a repair. Regardless of warranty or out-of-</td>
</tr>
<tr>
<td>warranty status, the buyer must issue a</td>
</tr>
<tr>
<td>valid purchase order to cover the added</td>
</tr>
<tr>
<td>rush service cost. Rush service is subject</td>
</tr>
<tr>
<td>to Aerotech’s approval.</td>
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<thead>
<tr>
<th>On-site Warranty Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>If an Aerotech product</td>
</tr>
<tr>
<td>cannot be made functional</td>
</tr>
<tr>
<td>by telephone assistance</td>
</tr>
<tr>
<td>or by sending and having</td>
</tr>
<tr>
<td>the customer install</td>
</tr>
<tr>
<td>replacement parts, and</td>
</tr>
<tr>
<td>cannot be returned to</td>
</tr>
<tr>
<td>the Aerotech service</td>
</tr>
<tr>
<td>center for repair, and</td>
</tr>
<tr>
<td>if Aerotech determines</td>
</tr>
<tr>
<td>the problem could be</td>
</tr>
<tr>
<td>warranty-related, then</td>
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<tr>
<td>the following policy</td>
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<td>applies:</td>
</tr>
<tr>
<td>Aerotech will provide an</td>
</tr>
<tr>
<td>on-site field service</td>
</tr>
<tr>
<td>representative in a</td>
</tr>
<tr>
<td>reasonable amount of</td>
</tr>
<tr>
<td>time, provided that the</td>
</tr>
<tr>
<td>customer issues a valid</td>
</tr>
<tr>
<td>purchase order to Aerotech</td>
</tr>
<tr>
<td>covering all transportation</td>
</tr>
<tr>
<td>and subsistence costs.</td>
</tr>
</tbody>
</table>
| 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.      |

<table>
<thead>
<tr>
<th>On-site Non-warranty Repair</th>
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<td>If during the on-site repair</td>
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<td>it is determined the problem</td>
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<td>Site Non-Warranty Repair”</td>
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<td>Aerotech, Inc.</td>
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<tr>
<td>101 Zeta Drive</td>
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<tr>
<td>Pittsburgh, PA 15238-2897</td>
</tr>
<tr>
<td>USA</td>
</tr>
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<td>Fax: (412) 963-7459</td>
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<td>TWX: (710) 795-3125</td>
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