

## **General Installation Guidelines**

### **Environmental Considerations for Motion Control Systems**

The following environmental and safety considerations must be observed during all phases of operation, service and repair of a motion control system. Failure to comply with these precautions violates safety standards of design, manufacture and intended use of motion control components, such as electronics (controllers, drivers, and motors), as well as mechanical products. Please note that even a well-built products operated and installed improperly, can be hazardous. Precaution must be observed by the user with respect to the load and operating environment.

**NOTE:** *The customer is ultimately responsible for the proper selection, installation, and operation of motion control products purchased from Anaheim Automation, Inc.*

The atmosphere in which motion components are used must be conducive to good general practices of electrical/electronic/mechanical equipment. Do not operate the motion control products in the presence of flammable gases, dust, oil, vapor or moisture. For outdoor use, all motion control components must be protected from the elements by an adequate cover, while still providing adequate air flow and cooling. Moisture may cause an electrical shock hazard and/or induce system breakdown. Due consideration should be given to the avoidance of liquids and vapors of any kind. Contact the factory should your application require specific IP ratings. It is wise to install motion control components in an environment which is free from condensation, electrical noise, vibration and shock. Additionally, it is preferable to work with motion control components in a non-static protective environment. Exposed circuitry should always be properly guarded and/or enclosed to prevent unauthorized human contact with live circuitry.

**NOTE:** *No work should be performed while power is applied to a motion control system. Don't plug in or unplug the connectors when power is ON. Wait for at least 5 minutes before doing inspection work on the system after turning power OFF, because even after the power is turned off, there will still be some electrical energy remaining in the internal circuitry.*

Plan the installation of the motion control system design that is free from debris, such as metal debris from cutting, drilling, tapping, and welding, or any other foreign material that could come in contact with circuitry. Failure to prevent debris from entering the motion control system can result in damage and/or shock, and/or injury.

### **Wiring Considerations for Motion Control Systems**

The following information is intended as a general guideline for wiring of Anaheim Automation's motion control product lines. Be aware that when you route power and signal wiring on a machine or system, radiated noise from the nearby relays, transformers, and other electronic devices can be induced into the motor, drivers, controller, and encoder signals, input/output communications, and other sensitive low voltage signals. This can cause systems faults and communication errors.

**WARNING** - Dangerous voltages capable of causing injury or death, may be present in the motion control system. Use extreme caution when handling, wiring, testing, and adjusting during installation, set-up and operation. Don't make adjustments or changes to the system parameters, which can cause

mechanical vibration and result in failure and/or loss. Once the motion control systems components are wired, do not run the driver or controller by switching On/Off the power supply directly. Frequent power On/Off switching will cause fast aging of the internal components, which will reduce the lifetime of the driver and controller system.

***Strictly comply with the following rules:***

- Follow the Wiring Diagram packaged with motion control component.  
**NOTE:** Motor manufacturers vary in their color code wiring schemes
- Route high-voltage power cables separately from low-voltage power cables.
- Segregate input power wiring and controller, driver and motor power cables from control wiring and motor feedback cables as they leave the driver and motor. Maintain this separation throughout the wire run.
- Use shielded cable for power wiring and provide a grounded 360 degree clamp termination to the enclosure wall. Allow room on the sub-panel for wire bends.
- Make all cable routes as short as possible. In most cases, Anaheim Automation offers cables, which are purchased separately. Contact the factory, should you like a recommendation.

**NOTE:** Factory made cables are recommended for use in motion control systems that incorporate Anaheim Automation products. These cables are purchased separately, and are designed to minimize EMI. Anaheim automation cables are recommended over customer-built cables to optimize system performance, and to provide additional safety for the controller, driver and /or motor and the user.

**WARNING** - To avoid the possibility of electrical shock, perform all mounting and wiring of motion control products prior to applying power. Once power is applied, connection terminals may have voltage present.

**Motion Control Applications**

Anaheim Automation's cost-effective motion control product lines are the wise choice for both OEM and user accounts. Anaheim Automation's customers for these product lines are diverse: industrial companies operating or designing automated machinery or processes that involve food, cosmetics or medical packaging, labeling or tamper-evident requirements, cut-to-length applications, assembly, conveyor, material handling, robotics, special filming and projection effects, medical diagnostics, inspection and security devices, pump flow control, metal fabrication (CNC machinery), and equipment upgrades. Controller, driver and motor systems are most often found in motion systems that require speed and/or position control. Often times there are multiple possibilities for the same design requirement (different motor and drive technologies). Therefore, ***it is wise to consider the following attributes of an application before finalizing a motion control system design:***

- Cost for the entire system – feasibility
- Performance of the system, such as throughput, heat, etc.
- Life cycle/longevity - operating hours
- Environment to be used, such as IP ratings required
- Knowledge and/or experience of the designer and the final user-the more complex, the more knowledge a designer and user should have to design/operate efficiently and safely

- Customization and/or standard off-the-shelf products – smaller volume users are usually better off to try to design in standard products for cost and ease-of-use

Load characteristics, system performance requirements, and mechanical design, including coupling techniques must be thoroughly considered before the designer can effectively select the most suitable motion control components for a given application. **General motion control design**

**parameters include:**

- Distance to be traversed
- Maximum time allowed for the traverse
- Desired accuracy
- System friction
- System inertia
- Speed/Torque characteristics of the motors
- Torque-to-inertia ratio
- Torque margin
- Open or closed-loop system (feedback requirements)

**Helpful Design Tips:**

1. All mechanical systems exhibit some frictional force. When sizing a motor, remember that the motor must provide enough torque to overcome any system friction. When selecting a motor/driver/controller combination, remember that the capacity of the motor must exceed the overall requirements of the load. The torque that any motor can provide varies with its speed. Individual speed/torque performance curves should be consulted by the designer for each application. The torque-to-inertia ratio (measurement) determines how quickly a motor can accelerate and decelerate its own mass. Motors with similar torque ratings will have different torque-to-inertia ratios as a result of varying construction. Certainly, there will be different ratios between manufacturers with the same torque ratings.
2. Whenever possible, a motor driver/controller that is capable of providing more torque than what is absolutely necessary should be specified. This torque margin allows for mechanical wear, lubricant hardening, and other unexpected friction in a motion control system.
3. Resonance effects can cause a motor's torque to be slightly lower at some speeds. Therefore, selecting a motor driver that provides at least a 50% margin above the minimum required torque is ideal. More than 100% margin will likely prove too costly and is not necessary for good system performance.
4. It is very important to understand that to obtain the best cost-performance in a system design, one should expect to spend time in experimentation; tailor all the motion control system components in the design for the desired outcome. Experimentation for motor sizing is almost always necessary because of dynamic changes in system friction and inertia (load anomalies), that are difficult to calculate. Motor resonance effects can also change once the motor is coupled to its load.

Anaheim Automation offers some product lines that integrates a motor and driver/controller in one unit. This design concept makes selection easy, thus reducing errors and wiring time. With friendly customer service and professional application assistance, Anaheim Automation often surpasses the customer's expectations for fulfilling specific motion control requirements..

**NOTE:** Technical assistance regarding Anaheim Automation's product lines are available at no charge. This assistance is offered to help the customer in choosing Anaheim Automation products for a specific application. However, any selection, quotation, or application suggestion offered from Anaheim Automation's staff, its' representatives or distributors, are only to assist the customer. In all cases, determination of fitness of Anaheim Automation's products in a specific system application is solely the customers' responsibility. While every effort is made to offer solid advice and to produce technical data and illustrations accurately, such advice and documents are for reference only, and subject to change without notice. *Anaheim Automation is in no event responsible or liable for indirect or consequential damages resulting from the use or application of its product lines. Improper use of motion control components in an application can result in personal injury or death, property damage, and/or economic loss.*

### **Mounting of Motion Control Products**

The following information is intended as a general guideline for the installation and mounting of motion control components.

**WARNING** - Dangerous voltages capable of causing injury or death may be present in motor, driver and controller systems. Use extreme caution when handling, testing, and adjusting during installation, set-up, and operation. It is very important that the wiring of motion control products be taken into consideration upon installation and mounting.

Subpanels installed inside the enclosure for mounting controller, driver, motor and system components, must be a flat, rigid surface that will be free from shock, vibration, moisture, oil, vapors, or dust. Remember that motors, drivers and controllers will produce heat during work, therefore, heat dissipation should be considered in designing the motion control system layout. Size the enclosure so as not to exceed the maximum ambient temperature rating. It is recommended that the controller and driver be mounted in position as to provide adequate airflow, as well as be mounted in a stable fashion, secured tightly.

**NOTE:** There should be a minimum of 10mm between the controller, driver and motor, and any other devices mounted in the system/electric panel or cabinet.

**NOTE:** In order to comply with UL and CE requirements, the motion control system must be grounded in a grounded conducive enclosure offering protection as defined in standard EN 60529 (IEC 529) to IP55 such that they are not accessible to the operator or unskilled person. As with any moving part in a system, the motor should be kept out of the reach of the operator. A NEMA 4X enclosure exceeds those requirements providing protection to IP66. To improve the bond between the power rail and the subpanel, construct your subpanel out of a zinc-plated (paint-free) steel. Additionally, it is strongly recommended that the drive and/or controller (as well as other motion components) be protected against electrical noise interferences. Noise from signal wires can cause mechanical vibration and malfunctions.

### **Customizing a Motion Control System**

Anaheim Automation was established in 1966 as a manufacturer of "turnkey" motion control systems. Its emphasis on R&D has insured the continued introduction of advanced stepper controller, driver and motor products. Today, Anaheim Automation ranks among the leading manufacturers and distributor of many motion control products, a position enhanced by its excellent reputation for quality products at competitive prices. Anaheim Automation offers a wide variety of standard motion control products. Occasionally, OEM customers with mid to large quantity requirements prefer to have a product that is custom or modified to meet their exact design or packaging requirements. Sometimes the customization is as simple as mounting dimensions, sheet metal, colors, or a label with their name and part number. Other times, a customer might require that a product meet an ideal specification. Engineers appreciate that Anaheim Automation's product lines can answer their desire for creativity, flexibility and system efficiency. Buyers appreciate the simplicity of the "one-stop shop," and the cost savings of a custom designs, while engineers are pleased with Anaheim Automation's dedicated involvement in their specific motion control system.

Anaheim Automation's standard product line is a cost-effective solution, in that they are known for their rugged construction and excellent performance. A considerable size of its sales growth has resulted from dedicated engineering, friendly customer service and professional application assistance, often surpassing the customer's expectations for fulfilling their custom requirements. While a good portion of Anaheim Automation's sales involves special, custom, or private-labeling requirements, the company takes pride in its standard stock base located in Anaheim, California, USA. To make customization affordable, a minimum quantity and/or a Non-Recurring Engineering (NRE) fee is required. Contact the factory for details, should you require a custom product in your design. All Sales for a customized or modified product are Non-Cancelable-Non-Returnable, and a NCNR Agreement must be signed by the customer, per each request. All Sales, including a customized product, are made pursuant to Anaheim Automation's standard Terms and Conditions, and are in lieu of any other expressed or implied terms, including but not limited to any implied warranties.

Anaheim Automation's customers are diverse: companies operating or designing automated machinery or processes that involve food, cosmetics or medical packaging, labeling or tamper-evident requirements, cut-to-length applications, assembly, conveyor, material handling, robotics, special filming and projection effects, medical diagnostics, inspection and security devices, pump flow control, metal fabrication (CNC machinery), and equipment upgrades. Many OEM customers request that Anaheim Automation "private-label" the motor, controller and/or driver, so that their customers stay loyal to them for servicing, replacements and repairs.

**PLEASE NOTE:** Technical assistance regarding all the products manufactured or distributed by Anaheim Automation, is available at no charge. This assistance is offered to help the customer in choosing Anaheim Automation products for a specific application. However, any selection, quotation, or application suggestion offered from Anaheim Automation's staff, its representatives or distributors, are only to assist the customer. *In all cases, determination of fitness of the product in a specific system design, is solely the customers' responsibility.* While every effort is made to offer solid advice and to produce technical data and illustrations accurately, such advice and documents are for reference only, and subject to change without notice.