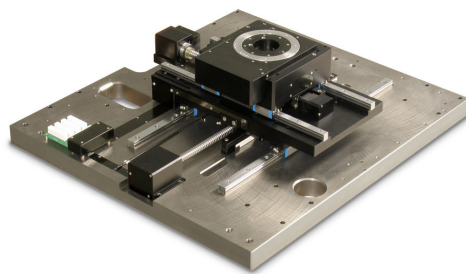
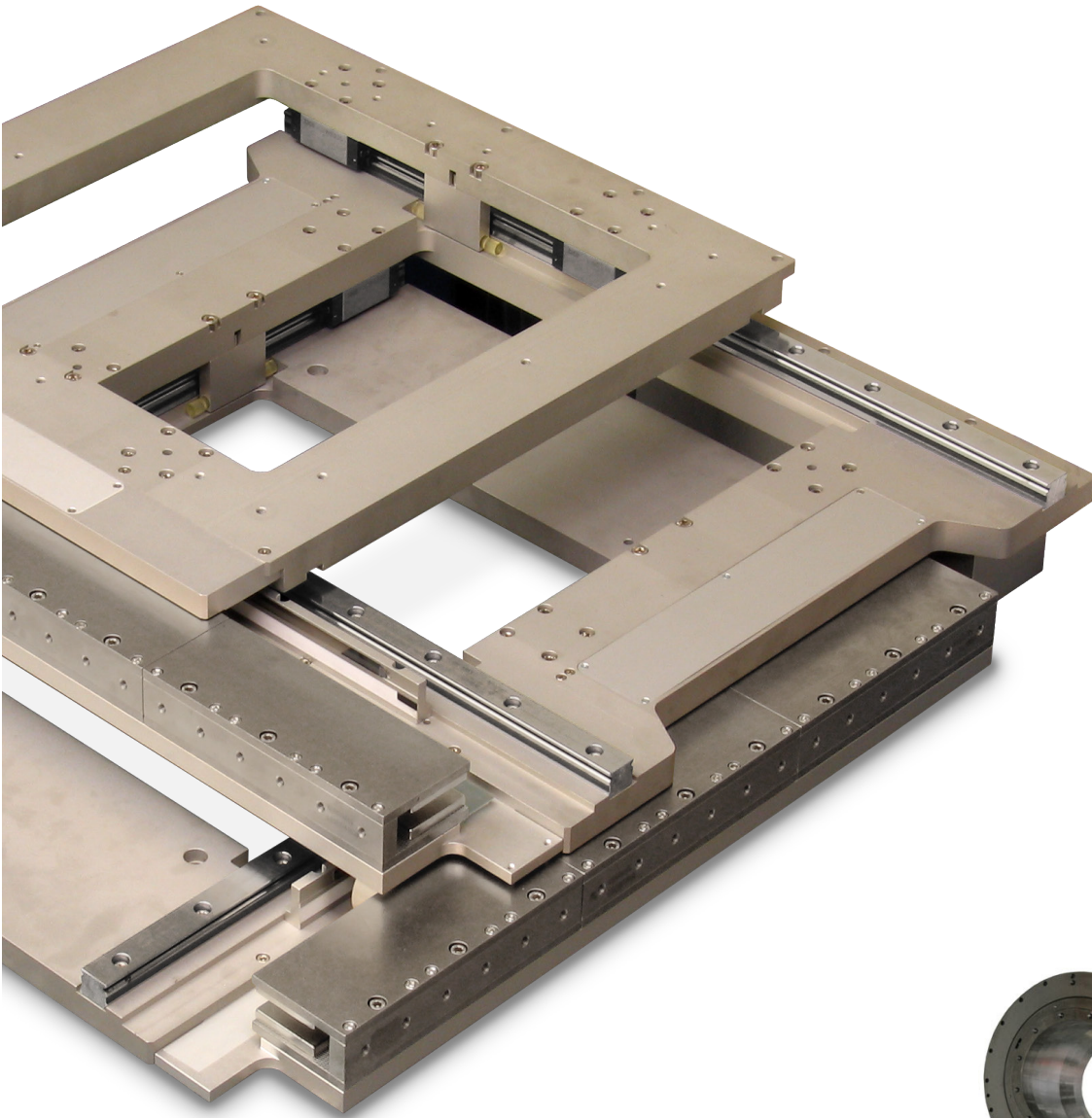




primatics

**Custom Design for High Performance  
Complex Machines**

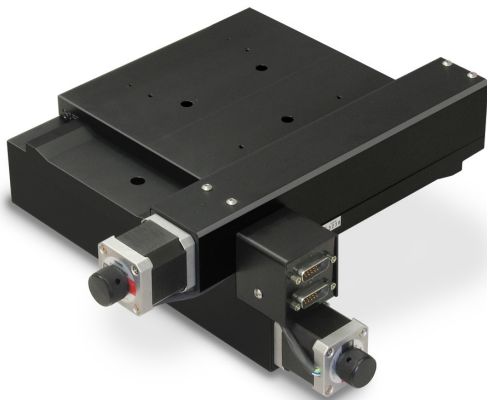


Custom Motion

## Custom Motion

Motion is used in a wide variety of commercial, industrial and academic tasks from inspection and assembly to material handling and dispensing. Many commercial and industrial projects require reduced time-to-market cycles while minimizing development and production costs. Even in the modern laboratory the demand to test more samples, increase the utilization of analytical equipment or commercialize a process benefits by incorporating automated motion into more tasks.

Motion products include linear and rotary positioning stages, motor drives and controls. While many standard products are versatile and can satisfy a variety of needs, sometimes the motion task is not efficiently solved with common catalog products. In these cases a Custom Motion solution is a viable alternative.



Low profile XY stage with stepper motors for microscope

Custom motion can provide the best solution for matching features and performance to price.

### Specific Features

- Reduced size for specified travel
- Operation in specialized environments such as vacuum or clean rooms
- Specific mounting and attachment details
- Compatibility with other equipment or components
- Multi-axis configurations

### Improved Performance

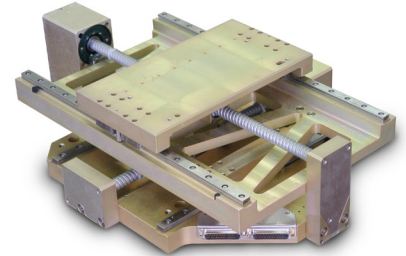
- Reduced settling times
- Reduced heating
- Improved precision
- Optimization for specified payloads

### Reduced Price

- Optimizing the design to meet specific requirements rather than a one-size-fits-all solution that may have features not required for a specific application

### Competitive Advantage

- A unique solution is not readily replicated by competitors

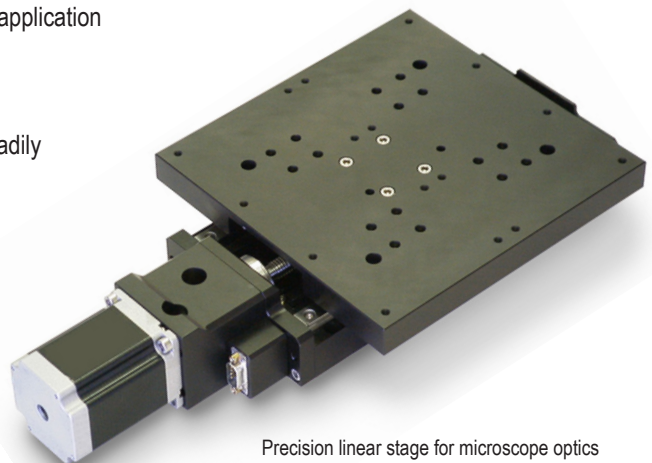


Custom XY for high vacuum environment. Unique configuration has stationary motors for improved heat conduction

## Expertise

Primatics, Inc. was established in 1997 by engineers with over 20 years of experience designing standard and custom motion systems. Their market reputation and longevity in the industry can be attributed to product reliability, performance, repeat business, and unsurpassed customer service.

Primatics' expertise extends beyond technologies and component selection to include best practices for manufacturing, assembly and verification processes.



Precision linear stage for microscope optics





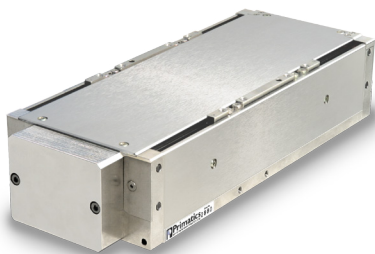
## Custom Solutions

Primatics offers three types of Custom Motion solutions: modified standard products, Custom Motion products, and Custom Motion platforms. Matching a solution to a project depends on several factors including project complexity, development schedule, quantity, and budget.

### Modified Standard Products

The modification of a standard product is cost effective when a standard product lacks one or two features to meet application requirements. Modified standard products involve minimal development costs. Examples include:

- Special hole patterns
- Custom finishes or markings
- Multi-axis configurations
- Alternative materials
- Cable management
- Preparation for special environment



PLG110 with custom electroless nickel finish

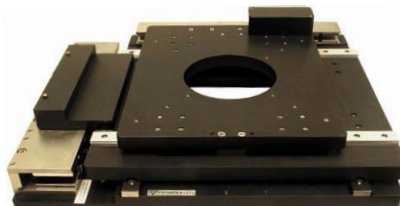


Ten custom linear motor stages ready for packaging and shipping

### Custom Positioning Stages & Controls

Custom Motion products designed to meet all customer requirements have moderate to higher development costs but yield lower production costs when compared with standard product solutions. Examples include:

- Low-profile X,Y,Z stage with internal cable management
- Large aperture dual-drive open frame X,Y stage on granite
- Very flat X,Y stage for vacuum operation
- Eight axis programmable motion controller with integrated linear servo amplifiers

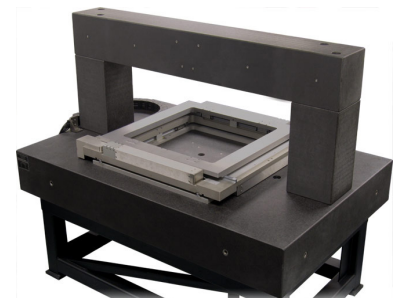


POF65 open frame, low profile XY stage

### Custom Motion Platform

A Custom Motion platform goes a step beyond positioning stages or controls. It is the integration of key motion tasks with material handling and/or process control and monitoring. Custom motion platforms are assembled and tested as a unit. Examples include:

- X,Y,Z, $\Theta$  stage on welded base with motion control panel
- X,Y axes in vacuum chamber with integrated material load and un-load mechanism
- X,Y,Z inspection mechanism with sample handler



Large format XY with center aperture on granite structure

## The Process

The flowchart (right) shows the basic four step process Primatics has developed for Custom Motion.

## Getting Started

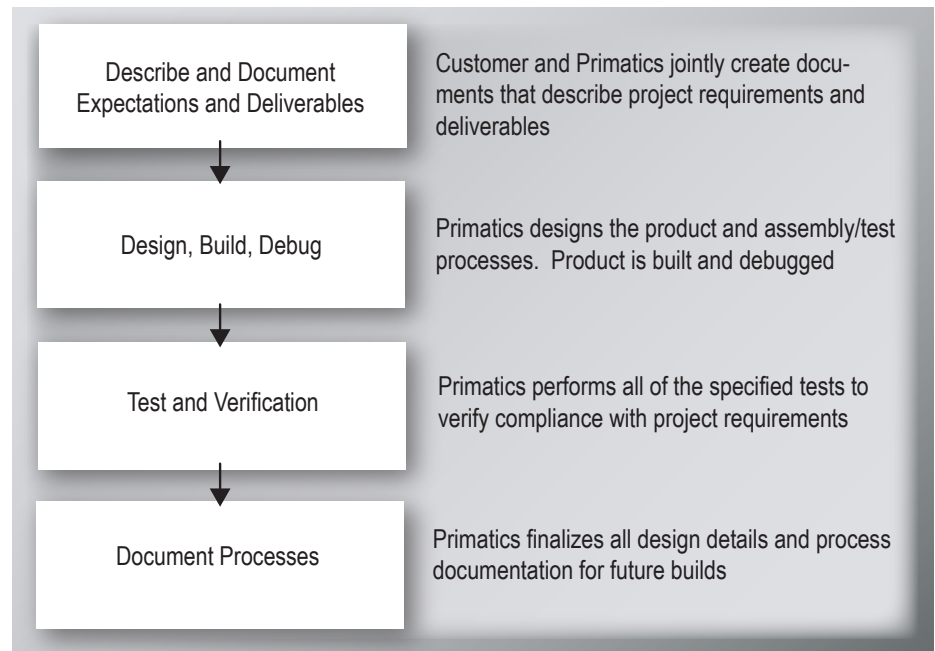
The success of a custom project is dependent on the ability to accurately describe project requirements. Start by listing the technical requirements of the product and include business issues such as regulatory compliance, product life cycle management, service and support strategies and IP ownership. Contact us and we will work with you to develop a document to represent the project and deliverables.

## Project Success

For a successful project, we highly recommend organizing information into four topics:

### Detailed Description

A description of the general operation or use of the machine or product, and concept sketches or drawings should be provided. It should show the operation of the product, and how it works with other components and systems. Describe how the motion interacts with and interfaces with other equipment. Describe how new generations of the product need to improve on performance or features. Describe what you want to accomplish rather than how it will be accomplished.



### Technical Specifications

Over-specifying a project can increase its cost. Recognize that many applications are actually a series of smaller tasks. Describe and specify each of the tasks individually. For example: many short high speed moves may be required in one part of an application, and long moves at slower speed may be adequate in another part. If only one higher speed specification is offered it may result in a more complex and costly solution that is actually necessary.

### Compliance and Assurance

Have an idea as to how to test compliance for every specification. Recognize that some specifications are 'tested'

through analysis rather than measurement. Assurance testing occurs on production units and is a sub-set of the compliance tests. Be aggressive in paring down the assurance tests as more tests have higher costs.

### Business Requirements

A custom solution that is too expensive is not a solution. Determine your target development, prototype and production costs up front to give us a guideline with which to make trade-offs. These must be determined in the context of quantities: monthly, yearly and/or lifetime. Also describe your service strategy, product life cycle, packaging and documentation requirements.





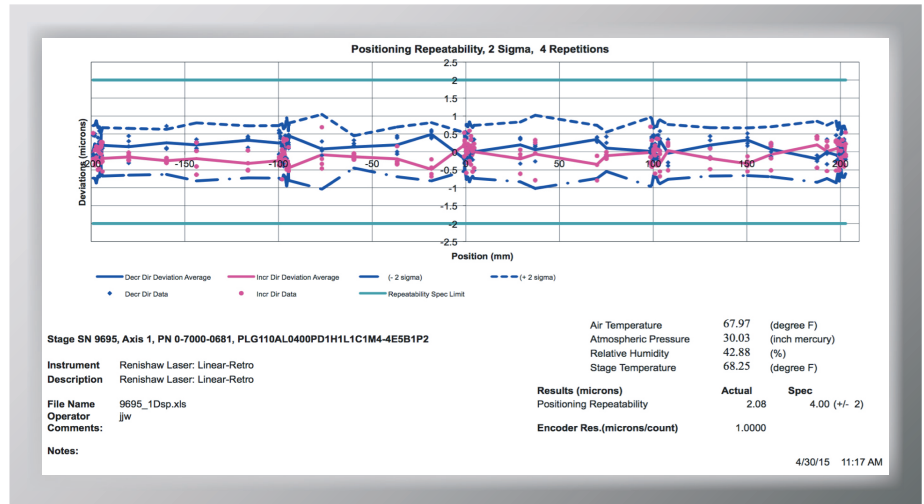
## Test & Verification

All Primatics products are subjected to a battery of tests to verify compliance with specifications and other requirements. Specialized test reports are often provided with custom products.

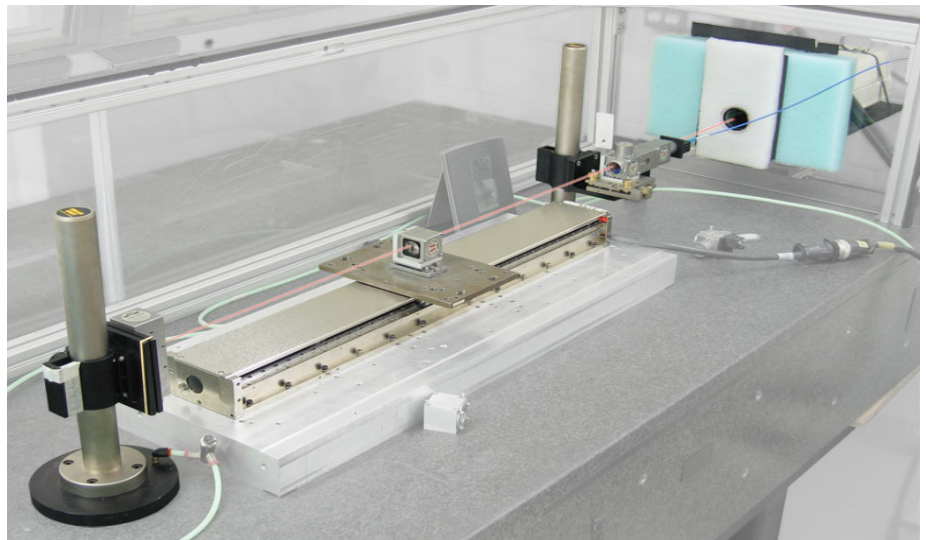
Test data is also used to measure quality of our production processes. With a vast amount of archived test data from various products, components and configurations, Primatics can reliably predict the performance of custom projects.

## Metrology

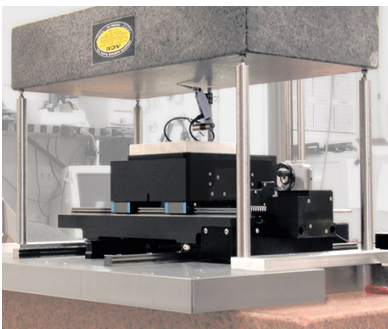
High precision motion systems require high precision measuring equipment for testing and verification. Primatics employs a variety of instruments including laser interferometers, optical autocollimators, precision levels, specialty encoders, and a variety of contact and non-contact sensors. Assembly and testing is performed in temperature controlled workrooms using automated data collection.



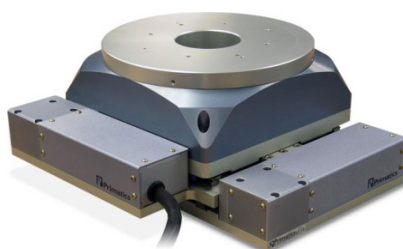
Example laser test results plot for a custom linear stage. The blue and pink lines are measured data, the green lines are the specified performance limits.



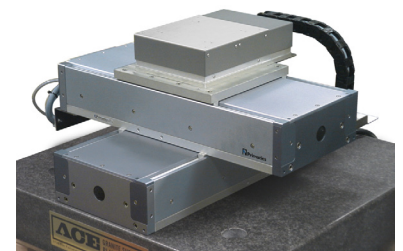
Laser testing a customized linear motor stage. This is an example of a method used for both compliance & assurance.



Custom measuring tool used to verify the flatness of a multi-axis stage against a granite surface.



Custom low profile XY with PDR210 rotary axis



XYZ stack with cable management

## Schedule Guidelines

After a review of initial requirements, we provide an estimated schedule and cost. The biggest factors for determining a schedule are finalizing the requirements and part availability.

## Associated Costs

There are three costs associated with custom projects: engineering, prototype and production.

### Engineering Cost

A one-time charge to cover our design, documentation and other engineering tasks. This is based on complexity and project schedule.

### Prototype Cost

The unit cost to build one or more prototypes. This is based on component and labor costs, build quantity and schedule.

### Production Cost

The cost of a production unit. This may require a minimum order quantity with scheduled delivery.

Most projects exist to meet a targeted production cost, therefore the design, components and processes used to manufacture the product are directed toward this goal.

## Modifications

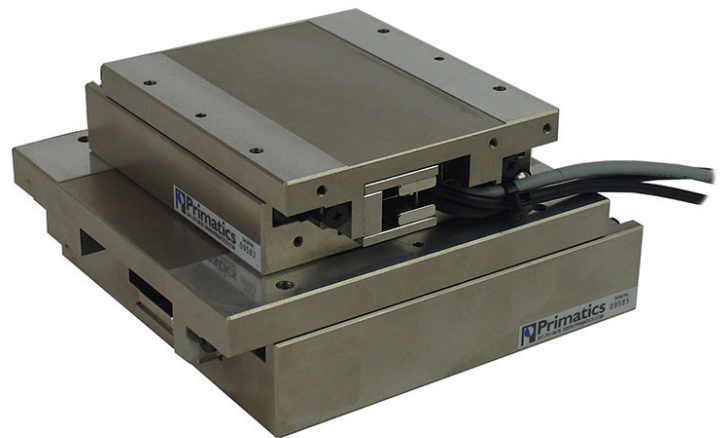
Even if the prototypes meet or exceed all requirements, changes may be necessary for many reasons: reevaluation of performance based on prototype, new or revised features or business changes that affect the project.

Modification costs are based on extent of changes and schedule.



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PXL33 and PXL43 xy configuration for use in applications for precision assembly and inspection