Multi-Axis Systems:
Precision Positioning In 3 Dimensional Space

When to Use:

- Custom design
- Linear or Rotary Motion
- Integrated Motors, Gearheads and Gearmotors
- Turnkey Plug-and-Play

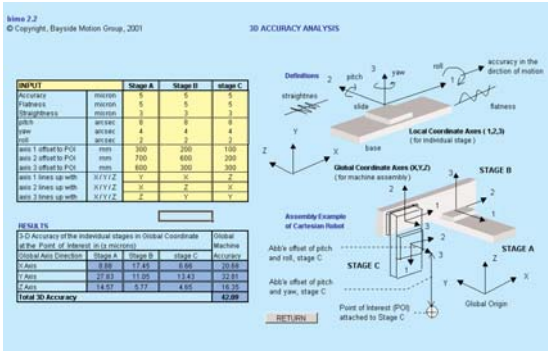
Bayside's Systems Group is a uniquely qualified team of application, design and manufacturing engineers that produce integrated customized solutions for your motion control requirements.

From one location, Bayside manufactures 3 core technologies: linear and rotary positioning stages, servomotors and drives, gearheads and gearmotors. This provides Systems Group engineers with the ideal ability to integrate precision products and components into one complete, turnkey motion control system... before it leaves the facility.

Bayside combines linear and rotary motion, servomotors and amps, precision gearing, and motion controllers into high performance, automated "drop-in" solutions that fit seamlessly within your application, saving you time, trouble, and effort. Bayside systems pack a tremendous amount of performance into "small footprint" designs, making it possible for companies to improve yield and increase throughput with smaller equipment and facilities.

Bayside uses these standard products in its integrated motion platforms:

- Linear and rotary stages
- Brushless rotary and linear servomotors
- High speed spinner motors
- Inline and right angle gearmotors
- Precision helical planetary gearheads



BIMO Analysis Tool

Let Bayside's Systems Group design the motion control system you need, so you can concentrate on your core business.

Acceptance Testing

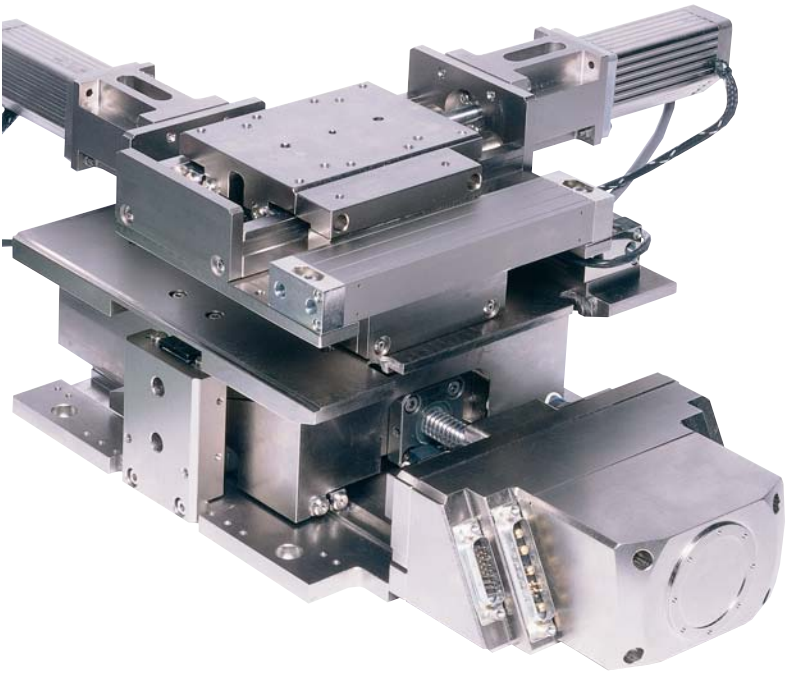
Multi-Axis Systems:
Applications

Vacuum Motion System for Interferometric Autofocus:

This vacuum-rated multi-axis system provides 3 axes of motion, complete with brushless servomotors, amplifiers and a motion controller. The system has the high stiffness and position repeatability required to autofocus a laser interferometer within a low vacuum environment. Intended for mounting to a platform that tilts in pitch/roll orientations, this system is able to maintain position and minimize deflection. We provide the complete system pre-tested to customer specifications and ready for immediate operation.

The System Utilizes:

- Two small lead screw-driven axes with linear encoders and 40mm diameter brushless servo motors, mounted in X/Y orientation.
- Precision crossed rollers on each axis for exceptional bearing stiffness; linear encoders on rotary motors to assure repeatability.
- A Z Wedge for vertical positioning, with an integral brushless servo mounted to the ball screw shaft.
- Crossed roller bearings in the horizontal, vertical, and incline planes for high stiffness, eliminating deflection.

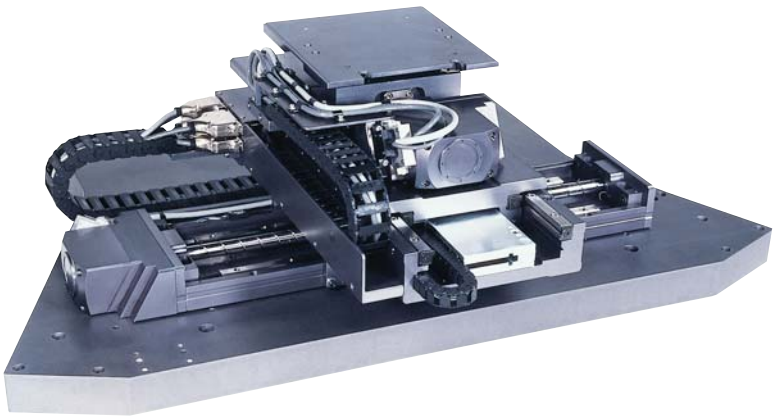


Positioning System Wafer Fabrication and Inspection:

This 3-axis system consists of X/Y/Z motion drive complete with brushless linear and rotary servomotors, amplifiers, and a high performance motion controller. The system provides exceptionally high constant velocity required to measure film thickness on the fly. We configure our motion systems for easy installation. Customers can just drop our systems into their pre-existing machine frames, mount their metrology equipment, plug it in and go. The result is a complete system that supports the customer's specific measurement process, with a base plate and customer mounting over the motion system.

The System Utilizes:

- An indexing axis with an integrated rotary brushless servo mounted directly to a ball screw, eliminating the coupling and motor mounting, reducing package size, and providing exceptional dynamic stiffness.
- A scanning axis with a patented bearing structure that provides "air bearing" performance with the linear motor, providing high constant velocity.
- An autofocus Z Axis that uses a vertical wedge with a patented Two Wire® servo motor, allowing the customer to use a brush-type amplifier to control a brushless motor.



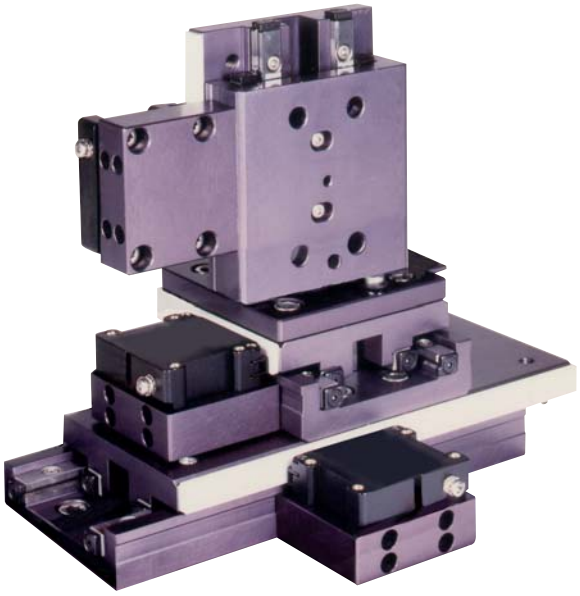
Multi-Axis Systems:
Applications

Nanopositioning Systems for Fiber Optic alignment, Attachment, and Component Manufacturing:

This multi-axis X/Y/Z system provides 3 axis of motion, complete with three piezo motors. The system has the ability to make extremely small incremental moves, ranging from 50 to 100 nanometers and stop and hold a stable position without dither. It also combines the benefits of high resolution motion with the ability to achieve high speeds and long travels. In one compact package, this system can address load/unload positions, rapid moves (200mm/sec), and the critical motion characteristics for fiber process.

The System Utilizes:

- Crossed roller bearings that provide exceptional stiffness with smooth rolling action.
- A linear encoder mounted down the center to minimize the effects of angular error.
- Piezo linear motors, which can drive both linear and rotary stages. The motor can operate in the 5 nanometer range.
- Standard positioning systems support 50 nanometers encoder resolution and ZERO servo dither when the desired position is achieved.

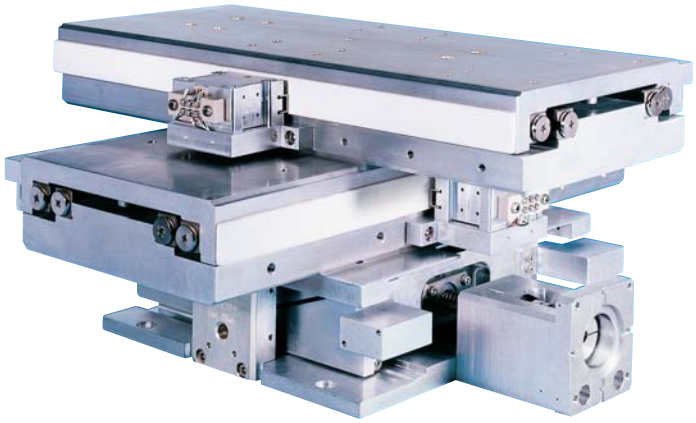


Ultra High Vacuum for Chemical Analysis and Thickness Measurement:

Rated to 10-10 Torr, this multi-axis stage uses high resolution piezo motors on the X/Y axes to eliminate servo dither and provide a 0.1μ resolution. The system features high resolution and smooth scanning capability allowing it to move a 300mm wafer under an analyzing sensor inside a vacuum chamber. The X/Y sits on top of a Z Wedge stage to provide vertical positioning, controlling the distance to the object. This completely integrated system features servo and piezo motor amplifiers and a 3 axis motion controller.

The System Utilizes:

- Two piezo-driven stages with 0.1μ resolution linear encoders.
- Side-mounted motors to provide velocity to 200mm/sec without adding to the overall length of the stage assembly.
- A Z Wedge for vertical positioning, driven by a vacuum compatible rotary servomotor that provides stability to position the X/Y during scanning.
- The servo controller commands both traditional servo and piezo amplifiers.



Multi-Axis System 3U Series:
Integrated Control Electronics

Highlights

- Fully integrated 3U, four axis chassis with all power supplies
- 48, 160 or 320 Vdc bus voltages
- Controllable by third party motion controllers:
  - Delta Tau PMAC1 PCI
  - ACS SPii PCI
  - Galil DMC PCI
  - MEI PCI
- Robust DIN connectors for amplifiers, protected DIN motor connectors and standard SUB D encoder connectors
- Fault protection circuits for over-temperature, over-speed, over-voltage and stalled motor
- Digital inputs for amplifier enable/disable, brake and bi-directional travel limits
- Open PC slot to provide for custom function implementation
- All boards and fuses accessible via a removable hinged front door
- Continuous amplifier output power range 140 to 4,800 watts with currents up to 15 amps continuous and 25 amps peak

The Bayside Motion Chassis (model 3U BMC) is a complete power drive/interface assembly capable of controlling a variety of motors, both rotary and linear, for up to four axes.

PWM amplifiers are best for high continuous and peak power applications requiring minimum dissipation whereas linear amplifiers are recommended for application requiring smooth, constant velocity and minimal electrical noise and interference.

In addition, drive modules are available to power piezo actuators for high resolution precision motion applications.

1

The rack mountable 3U chassis is specifically designed to suit the requirements of the OEM - flexibility, ease of maintenance and straight forward system design and operation in a multi-axis environment.

2

Fans to cool drives

3

Connectivity to the mechanical stages always remains the same via predefined, separate feedback, transducer and motor power connectors.

4

It has a uniquely designed personality backplane which reduces the cost of integration and increases system reliability since signal routing, grounding and shielding have been pre-configured and remain constant from unit to unit.

6

Front door to access drives

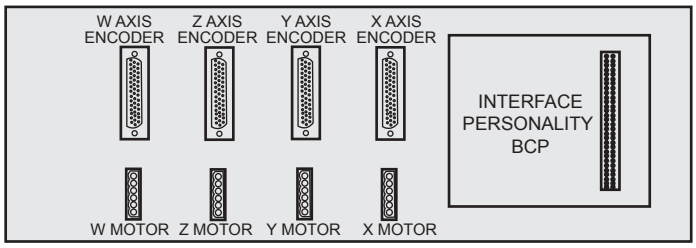
5

Accomodating up to four servo amplifiers, the 3U BMC can interface to a variety of third party motion controllers. It can be supplied with either linear or PWM (20 KHz) servo amplifiers to drive both brushless and brush rotary and linear motors. The drive topology can be either trapezoidal or sine wave (driven by the sine error outputs of the controller).

Multi-Axis System 3U Series:
Amplifier

Amplifiers

PWM sine commutation	15A cont./25A peak @ 160 Vdc bus
PWM trap commutation	15A cont./25A peak @ 160 Vdc bus
PWM sine commutation	15A cont./25A peak @ 320 Vdc bus
PWM trap commutation	15A cont./25A peak @ 320 Vdc bus
Linear Brush	3A cont./9A peak @ 48 Vdc bus
Linear sine commutation	3A cont./9A peak @ 48 Vdc bus
PWM sine commutation	10A cont./18A peak @ 48 Vdc bus
PWM trap commutation	10A cont./18A peak @ 48 Vdc bus
LS4 Piezo for 4 element high precision accuator	0.8A @ 48Vdc at maximum load
HR4 Piezo for 4 element high force actuator	0.8A @ 48Vdc at maximum load
LS8 Piezo for 8 element high precision actuator	1.2A @ 48Vdc at maximum load
HR8 Piezo for 8 element high force actuator	1.2A @ 48Vdc at maximum load



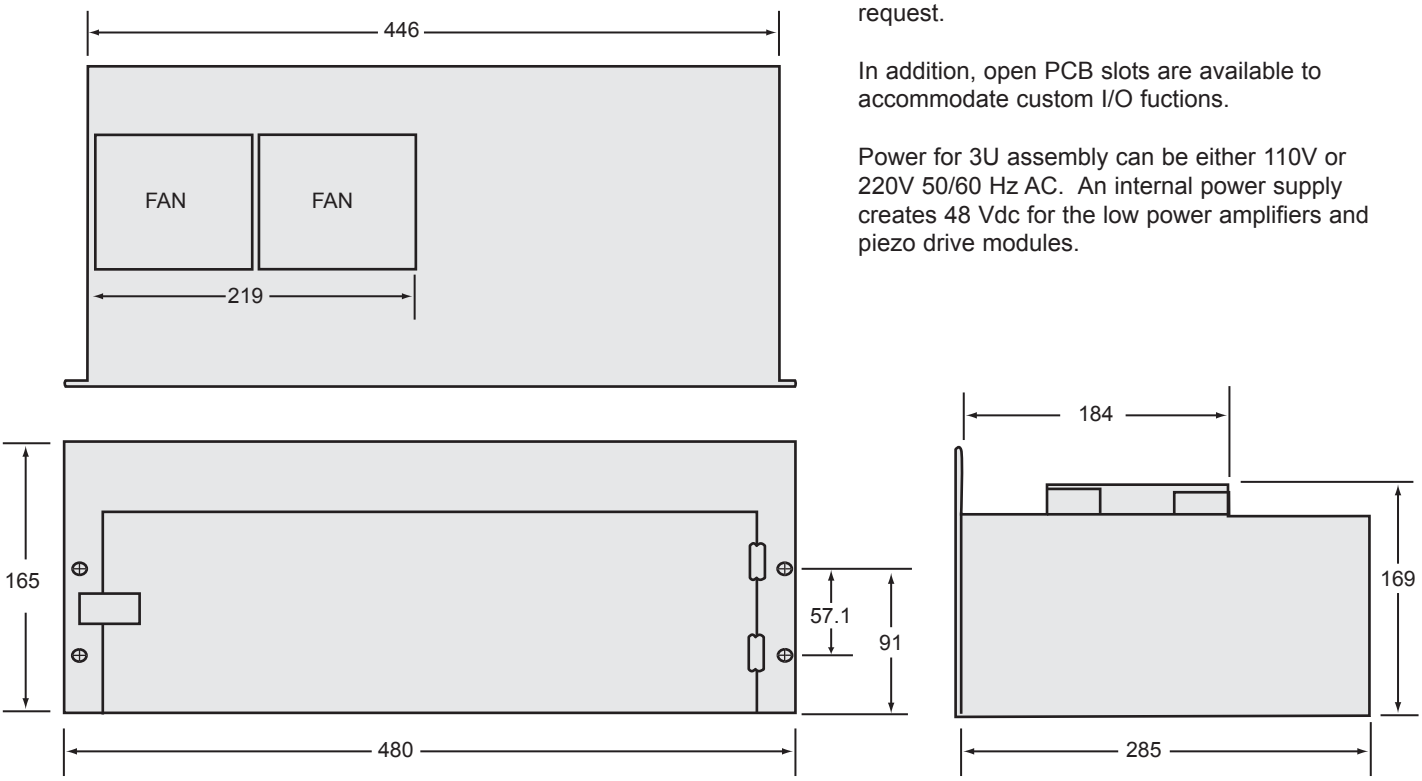
Personality modules are available to interface to several of the leading edge controllers such as:

- Delta Tau
- ACS SPii
- GALIL
- National Instrument

The modular design of the 3U allows other controller interfaces to be easily supplied upon request.

In addition, open PCB slots are available to accommodate custom I/O fuctions.

Power for 3U assembly can be either 110V or 220V 50/60 Hz AC. An internal power supply creates 48 Vdc for the low power amplifiers and piezo drive modules.



Multi-Axis System 3U Series:
How to Order

Order Numbering Example: 3U 1 C 3 A A A Z

(A) (B) (C) (D)

A — Size & Power

1	3U, 110VAC Input, 160VDC Bus
2	3U, 220VAC Input, 320VDC Bus
3	3U, 110VAC Input, 48VDC Bus
4	3U, 220VAC Input, 48VDC Bus

B — Number of Axes

A	1 Axis
B	2 Axis
C	3 Axis
D	4 Axis

C — Personality Module for:

1	ACS SPii/Analog ENC.
2	ACS SPii/Quad. ENC.
3	Delta Tau PMAC PCI/Quad ENC.
4	Galil 1700, 1800/Quad ENC.
5	National Instrument/Quad ENC.

NOTES:

(1) Software sine requires controller to supply two sinewave error signals 120 electrical degrees apart.

(2) Trapezoidal drive requires controller to supply ±0 -10Vdc error signal

(3) LS drives are for high precision motor; HR drives are for high force motors (see pg70)

(4) PWM amplifiers can be configured to drive either brushless or brush motors

Specifications are subject to change without notice.

D — Amplifiers

Use one character per amplifier-maximum of four. All amplifiers in a chassis must have the same bus voltage

A	PWM sine commutation / 15A cont./ 25A peak @ 160 Vdc bus	(1) (4)
B	PWM trap commutation / 15A cont./ 25A peak @ 160 Vdc bus	(2) (4)
C	PWM sine commutation / 15A cont./ 25A peak @ 320 Vdc bus	(1) (4)
D	PWM trap commutation / 15A cont./ 25A peak @ 320 Vdc bus	(2) (4)
E	Linear sine commutation / 3A cont./9A peak @ 48 Vdc bus	(1)
F	PWM sine commutation / 10A cont./18A peak @ 48 Vdc bus	(1) (4)
G	PWM trap commutation / 10A cont./18A peak @ 48 Vdc bus	(2) (4)
H	LS4 Piezo for 4 element high precision accuator / 0.8A @ 48Vdc	(3)
I	HR4 Piezo for 4 element fhigh force actuator / 0.8A @ 48 Vdc	(3)
J	LS8 Piezo for 8 element high precision actuator / 1.2A @ 48 Vdc	(3)
K	HR8 Piezo for 8 element high force actuator / 1.2A @ 48 Vdc	(3)
Z	Blank	

How to Order

Bayside's Multi-Axis Systems are supported by a worldwide network of offices and local distributors. Call **1-800-305-4555** for application engineering assistance or for the name of your local distributor. Information can also be obtained at **www.baysidemotion.com**.