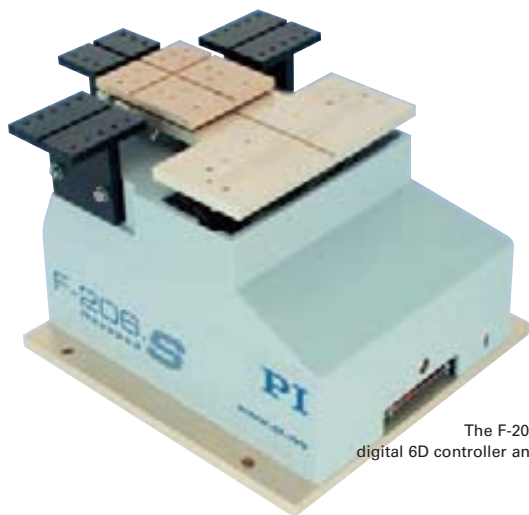# F-206 Six Axis-Stage

Parallel-Kinematics Precision Alignment System / Manipulator, with Controller

The F-206.S Hexapod comes with a digital 6D controller and comprehensive software

- **Parallel Kinematics with 6 Degrees of Freedom**
- **0.033 µm Actuator Resolution**
- **Repeatability 0.3 µm in Space**
- **No Moving Cables for Improved Reliability, Reduced Friction**
- **Better Dynamics, More Compact than Serial Kinematics Systems**
- **For Scanning and Alignment**
- **Cartesian Coordinate Control with Virtualized Pivot Point**
- **Powerful Digital Controller with Open Source LabView™ Drivers, DLL Libraries...**
- **Integrated Fiber Alignment Routines**

The F-206.S HexAlign™ Hexapod is a highly accurate micro-positioning system for complex multi-axis alignment tasks. It is based on PI's long experience with ultra-high-res-olution, parallel kinematics stages. Unlike hexapods with vari-able-length struts ("legs") the F-206 features constant-length struts and friction-free flexure guides. This gives the F-206 even higher precision than other hexapod designs.

Compact, Plug & Play

The F-206.S Hexapod is consid-erably smaller and more accu-rate than comparable serial kinematics six-axis systems (stacks of single-axis units).

The parallel kinematics of the F-206 is immune to the cumula-tive bending and guiding errors of the various axes which, together with the inertia and friction of the moving cables, can limit accuracy in stacked systems. In addition, rotations are not set in hardware, but about a pivot point freely defin-able in software. A high-per-formance controller does all necessary coordinate transfor-mation for coordinating the six drives. Because all the actua-tors are attached directly to the same moving platform, there are none of the servo-tuning problems associated with the loading and inertia differences of the different axes, as are inherent in stacked systems.

Virtualized Pivot Point

It is important to have a fixed pivot point for alignment tasks, especially in photonics packag-ing. Because the parallel kine-matics motion of the F-206 is calculated with complex algo-rithms in the digital controller, it was easy to allow program-ming any point in space as center of rotation. Further-more, the cartesian coordi-nates of any position and any orientation can be entered directly and the specified tar-get will be reached after travel along a smooth path.

Six Degrees of Freedom, No Moving Cables

In the F-206 parallel kinematics design, all cable terminations are on the stationary base, eliminating unpredictable fric-tion and inertia, improving resolution and repeatability. Further advantages of the sys-tem are:

- No cable guides required
- Reduced Size and Inertia
- Improved Dynamic and Settling Behavior
- Identical Modular Actuators for Simplified Servicing

### Open Command Set, Simplified Programming

Integration of the F-206 in com-plex applications is facilitated by the system's open com-mand set and comprehensive tool libraries. The controller can be operated either through a host PC, or directly through a keyboard and monitor. It can also run programs stored in a user-friendly, fully documented macro language.

Automatic Optical Alignment

Optional internal and external photometers are available.

Application Examples

- Micromachining
- Photonics packaging
- Fiber alignment
- Semiconductor handling / test systems
- Micromanipulation (life science)
- Optical device testing
- Collimator and fiber bundle alignment
- MEMS positioning/alignment

Both types are fully integrated with the controller hardware and with routines designed for automatic alignment of colli- mators, optical fibers and arrays. For more information on the photometers see www.pi.ws.
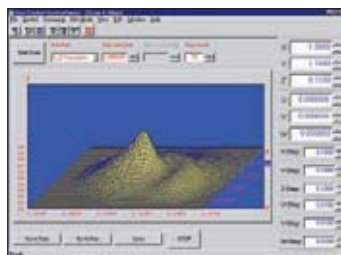
HexControl™ Software displaying scan of photonics component
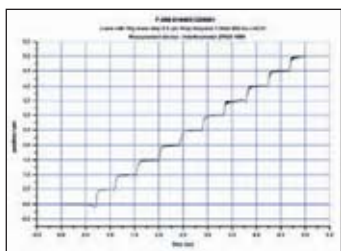
Interferometer test of an F-206.S system shows the excellent repeatability of small steps, here 0.5 µm spaced at 100 ms
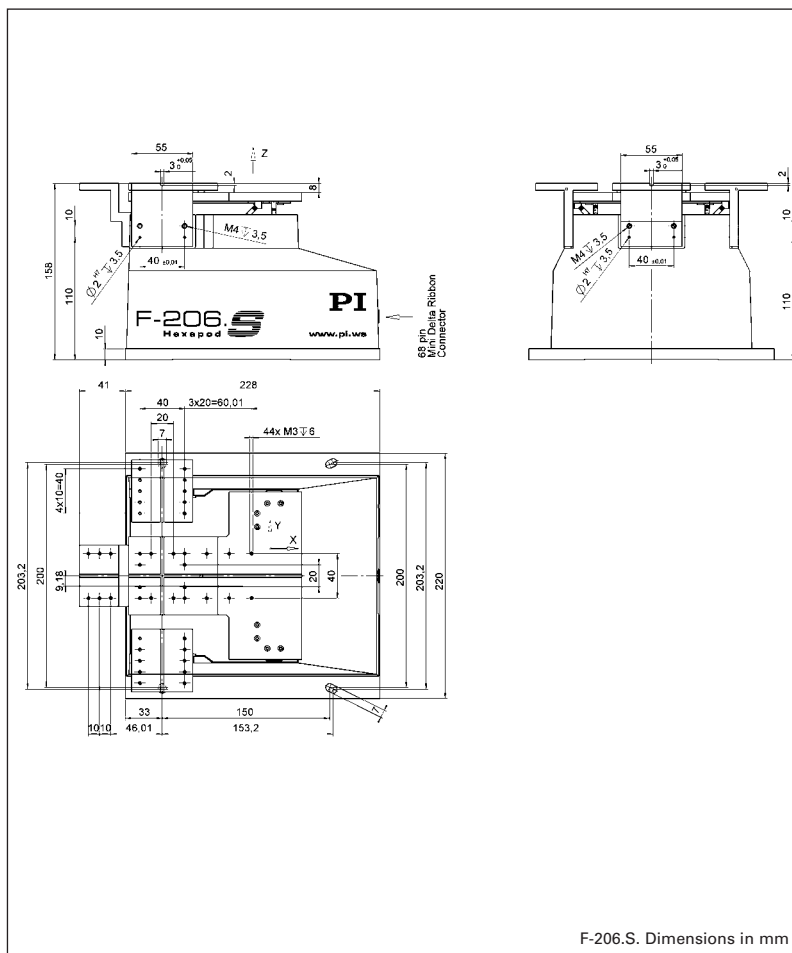
F-206.S. Dimensions in mm

Technical Data

Model	F-206.S0 / F-206.SD
Travel range X*	-8 to +5.7 mm
Travel range Y*	±5.7 mm
Travel range Z*	±6.7 mm
Travel range θ_X *	±5.7°
Travel range θ_Y *	±6.6°
Travel range θ_Z *	±5.5°
Actuator resolution	33 nm
Minimum incremental motion X, Y, Z**	0.1 µm (6-axis move!)
Minimum incremental motion θ_X, θ_Y, θ_Z**	2 µrad (0.400115°) (6-axis move!)
Bidirectional repeatability X, Y, Z	0.3 µm
Bidirectional repeatability θ_X, θ_Y, θ_Z	3.6 µrad
Speed X, Y, Z	0.01 to 10 mm/s
Maximum load in Z	2 kg (centered on platform)
Mass	5.8 kg
Controller	Digital Hexapod controller with optional photometer card and integrated scan and align routines
Operating voltage	100–240 VAC, 50/60 Hz
Software	LabView™ drivers, software for alignment of arrays, DLL libraries, HexControl™, scan and align software, terminal software

*Travel ranges in the coordinate directions (X, Y, Z θ_X, θ_Y, θ_Z) are interdependent. The data given shows maximum travel range of the axis in question (i.e. its travel when all other axes are at their zero positions). If this is not the case, the available travel may be less.

**Six-axis move. No moving cables (unlike serial-kinematic stacked systems) to intro- duce bending forces, torque and friction which degrade positioning accuracy.