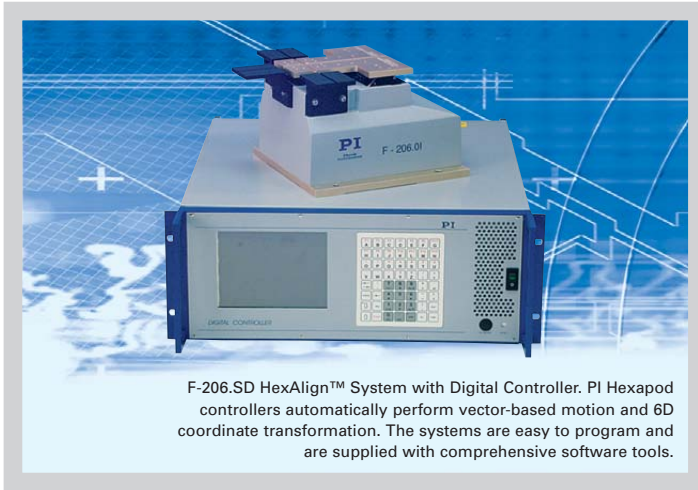


F-206.S

HexAlign™ 6-Axis Precision Alignment System / Manipulator (Hexapod)

>> Click <http://www.pi.ws/fwd/Photonics> for the Latest Specs on these Products



F-206.SD HexAlign™ System with Digital Controller. PI Hexapod controllers automatically perform vector-based motion and 6D coordinate transformation. The systems are easy to program and are supplied with comprehensive software tools.

- **Integrated Alignment Routines for Optical Fibers, Collimators and I/O Chips**
- **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...**
- **Choice of Optional Photometers**
- **Optional PIMotion&Vision with Integrated Real-Time Image Processing**

Application Examples

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

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-resolution, parallel kinematics stages. Unlike hexapods with variable-length struts ("legs"), the F-206 features constant-length struts and friction-free flexure guides. This gives the F-206 better resolution and repeatability than other hexapod designs.

Compact, Plug & Play

The F-206.S Hexapod is considerably smaller and more accurate than comparable serial

kinematics, six-axis systems (stacks of single-axis units).

The parallel kinematics of the F-206 is immune to the cumulative bending and guiding errors of the individual 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 around a pivot point freely definable in software. A high-performance controller does all necessary coordinate transformation for coordinating the six drives. Because all the actuators 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, inherent in stacked systems.

Virtualized Pivot Point

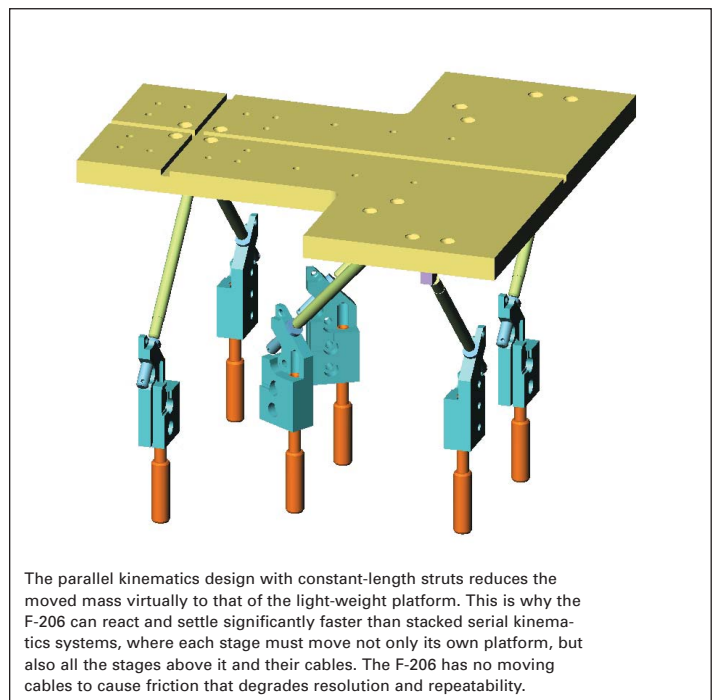
It is important to have a fixed pivot point for alignment tasks, especially in photonics packag-

ing. Because the parallel kinematics motion of the F-206 is calculated with complex algorithms in the digital controller, it was easy to allow programming any point in space as center of rotation. The cartesian coordinates of any position and any orientation can be entered directly and the specified target will be reached after travel along a smooth, direct trajectory.

Six Degrees of Freedom, Zero Moving Cables

In the F-206 Parallel kinematics design, all cable terminations are on the stationary base eliminating unpredictable friction and inertia, increasing resolution and repeatability. Further advantages of the system are:

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



The parallel kinematics design with constant-length struts reduces the moved mass virtually to that of the light-weight platform. This is why the F-206 can react and settle significantly faster than stacked serial kinematics systems, where each stage must move not only its own platform, but also all the stages above it and their cables. The F-206 has no moving cables to cause friction that degrades resolution and repeatability.

Open Command Set, Simplified Programming

Integration of the F-206 in complex applications is facilitated by the system's open command 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 userfriendly, fully documented macro language.

Automatic Optical Alignment

Optional internal and external photometers are available. Both types are fully integrated with the controller hardware and with routines designed for automatic alignment of collimators, optical fibers and arrays. For more information on the photometers see F-206.IRU and F-206.00U, p. 8-12 and F-361, p. 8-14.

Ordering Information

F-206.S0

Hexapod 6-Axis Precision Alignment System / Manipulator with 6 DOF Hexapod Controller

F-206.SD

Hexapod 6-Axis Precision Alignment System / Manipulator with 6 DOF Hexapod Controller, Built-in Display and Keypad

Options and Accessories

F-311

PIMotion&Vision Imaging Processing for Intelligent Automation (see p. 8-16)

F-206.AC8

Upgrade for 2 Additional Servo-Motor Control Channels on F-206 Controller

F-206.i3E

GPIO/IEEE 488 Interface for F-206 controllers

F-206.MHU

Force-Limiting Mounting Platform (included with F-206.Sx)

F-206.MFU

Mounting Platform with Force Sensors

Upgrades / Options

F-206.NCU

Rapid Nanopositioning Upgrade for F-206. Consists of P-611.3SF NanoCube® and E-760 Controller Card

F-206.MC6

6D Interactive Manual Control Pad

C-815.MC6

3 m Extension Cable for Manual Control Pad

F-206.00U

2-Channel Photometer Card, (Visual Range)

F-206.iRU

2-Channel Photometer Card (IR Range)

F-361.10

Absolute-Measuring Optical Power Meter, 1000-1600 nm Wavelength (see p. 8-14)

F-206.iiU

2-Channel Photometer Card (IR Range)

F-206.VVU

2-Channel Photometer Card, (Visual Range)

M-500.206

Adapter Plate for Mounting F-206 on M-511, M-521 and M-531 Translation Stages

Ask about custom designs!

Piezo Actuators

Nanopositioning & Scanning Systems

Active Optics / Steering Mirrors

Tutorial: Piezo-electrics in Positioning

Capacitive Position Sensors

Piezo Drivers & Nanopositioning Controllers

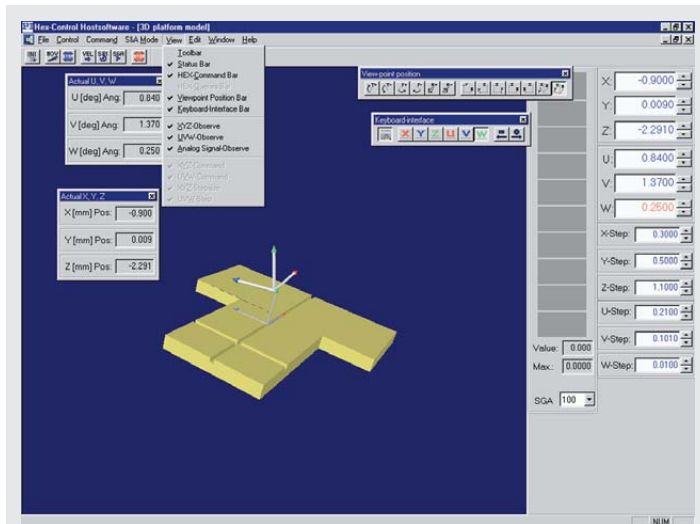
Hexapods / Micropositioning

Photonics Alignment Solutions

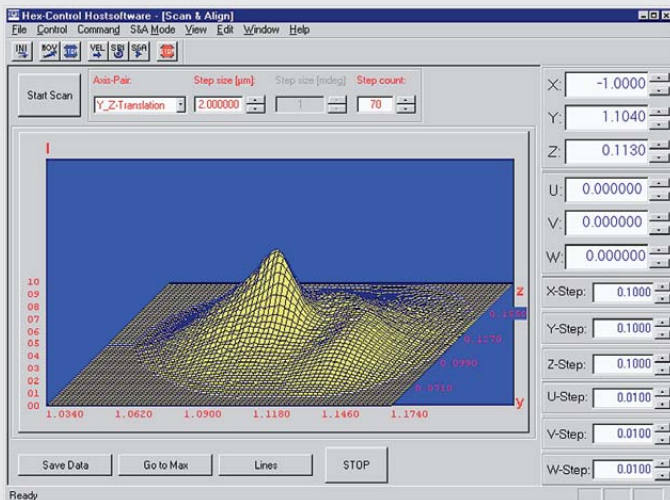
Motion Controllers

Ceramic Linear Motors & Stages

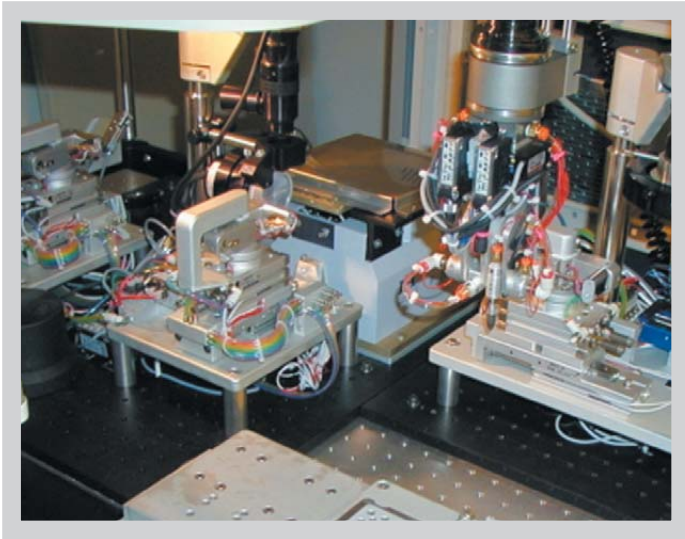
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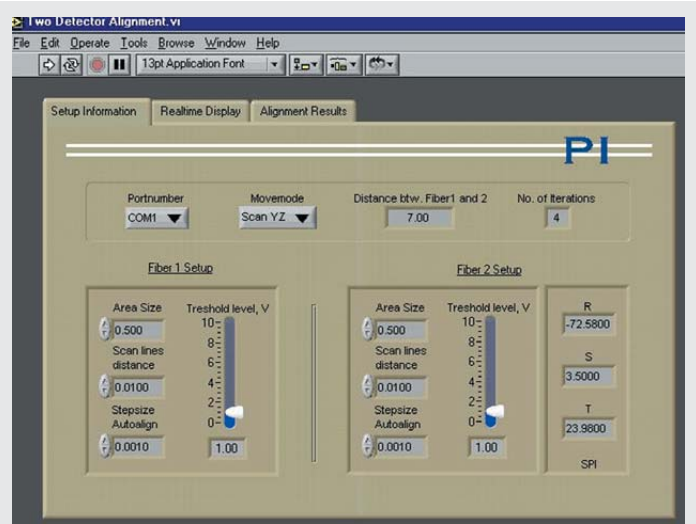
HexControl™ Software, manual mode. 3D view of the F-206 platform in space, with coordinate vectors and pivot point.



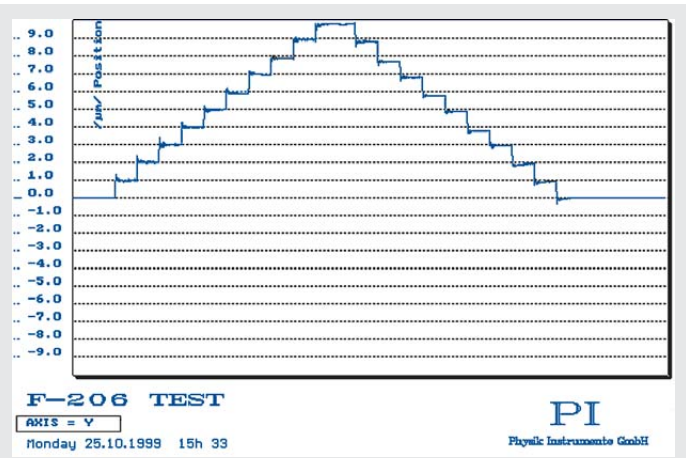
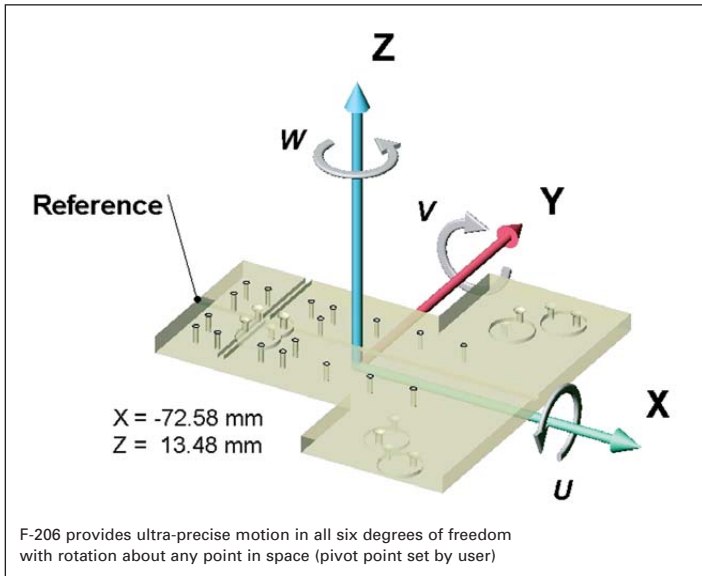
HexControl™ Software displaying scan of photonics component.



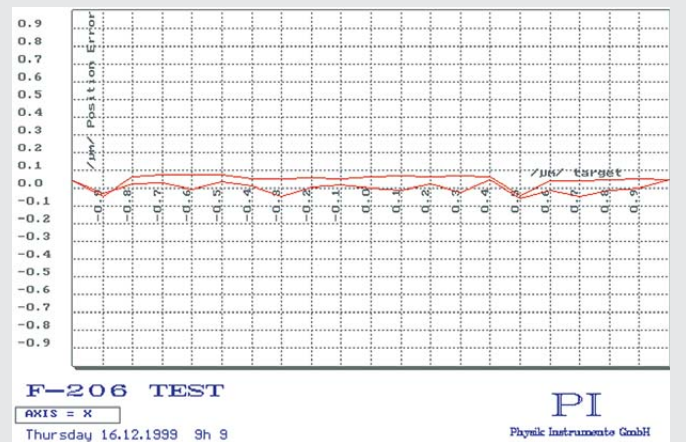
F-206 HexAlign™ Alignment System deployed as a photonics alignment subsystem for automated assembly of fiber pigtailed devices, courtesy of Aries Innovation



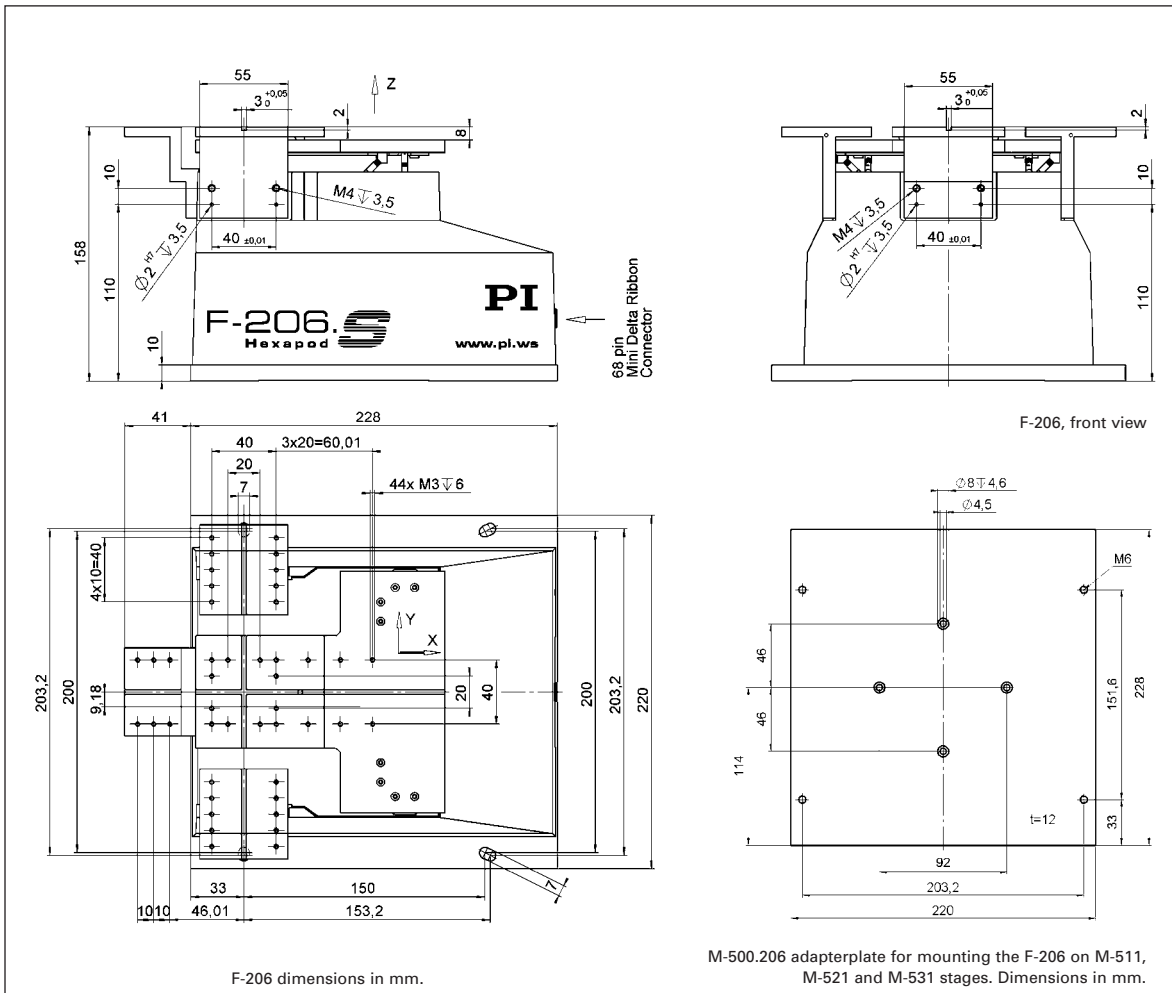
LabView™ drivers for automated fiber bundle alignment are part of the F-206 software package.



F-206 Interferometer test: Y-axis settling behavior



F-206 Interferometer test: Accuracy and repeatability of 20 sequential 0.1 μm steps in both directions.



Technical Data

| Models | F-206.S0 / F-206.SD |
|--|--|
| * Travel range X | -8 to +5.7 mm |
| * Travel range Y | -5.7 to +5.7 mm |
| * Travel range Z | -6.7 to +6.7 mm |
| * Travel range θ_x | -5.7 to +5.7° |
| * Travel range θ_y | -6.6 to +6.6° |
| * Travel range θ_z | -5.5 to +5.5° |
| Actuator resolution | 33 nm |
| ** Minimum incremental motion X, Y, Z | 0.1 μm (6-axis move!) |
| ** Minimum incremental motion $\theta_x, \theta_y, \theta_z$ | 2 μrad (0.4 arc seconds) (6-axis move!) |
| Bidirectional repeatability X, Y, Z | 0.3 μm |
| Bidirectional repeatability $\theta_x, \theta_y, \theta_z$ | 3.6 μrad |
| Speed X, Y, Z | 0.01 to 10 mm/s |
| Maximum load in Z | 2 kg (centered on platform) |
| Weight | 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 $\theta_x, \theta_y, \theta_z$) 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.

** Move involving all 6 actuators. No moving cables, unlike serial kinematics (stacked) systems. Eliminates bending, inertia and friction, improving accuracy.

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