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Low Inertia 6DOF Parallel Kinematic Mechanisms (PKM) from PI

Sub-Micron Precision Hexapod Technology

For Your Applications in:

- Semiconductor Technology
- Telecommunications
- Astronomy
- Biotechnology
- Life Science, Medical Robots
- Precision Engineering
- Microsystems Technology
- Quality Assurance

Advantages

- 6 Degrees of Freedom
- Ultra-Low Inertia and High Stiffness for Fastest Response
- Sub-Micron Resolution
- Compact
- True Path Control
- PivotAnywhere™: Freely Selectable Common Pivot Point for All Axes
- Digital Controller, Software and Drivers

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A major advantage of parallel kinematics vs. stacked serial multi-axis systems made up of separate stages is that the accuracy of motion is the same in all directions.

- No moving cables, hence no cable friction or wear
- No accumulation of guiding errors—repeatabilities of a few micrometers anywhere space
- No cosine error—greater trajectory and positioning accuracy in space and along the axes
- No disproportional loading—same accuracy on all the logical axes

M-840

PivotAnyWhere™
A basic requirement for all advanced fine-adjustment tasks is the ability to rotate about a given point (pivot point, e.g. the tip of an optical fiber or the reference mark on a semiconductor wafer). PivotAnywhere™ allows setting the pivot point anywhere in space with a single software command.

Beyond microsystems technology: custom M-850 robot with a positioning frame measuring some 1.0 x 1.5 meters.

Water resistant model of the M-850 with extra-large positioning frame.

Precision Engineering Quality Assurance

- Microsystems Technology
- Micromanipulation
- Tool Positioning
- Sample and Instrument Positioning
- Alignment of Masks and Templates
- X-ray Diffraction

Astronomy

- Fine Alignment of Secondary Mirrors
- Antenna Positioning

Drive options:
DC motors or brushless DC motors

Environmental Conditions:
Optional, for vacuum down to 10^{-6} hPa
Optional, water resistant

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M-850

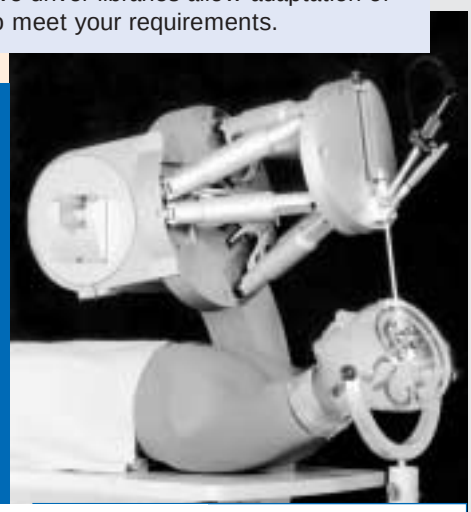
Semiconductor Technology

- Wafer Handling
- Wafer Alignment
- Mask Alignment

Controller and Software
Control and programming of PI Hexapods is simply based on the logical X, Y, Z and Θ_X, Θ_Y, Θ_Z axes. The firmware calculates the path to the target using complex coordinate transformation algorithms and controls the individual struts accordingly. Comprehensive driver libraries allow adaptation of the system to meet your requirements.

Biotechnology / Life Science:

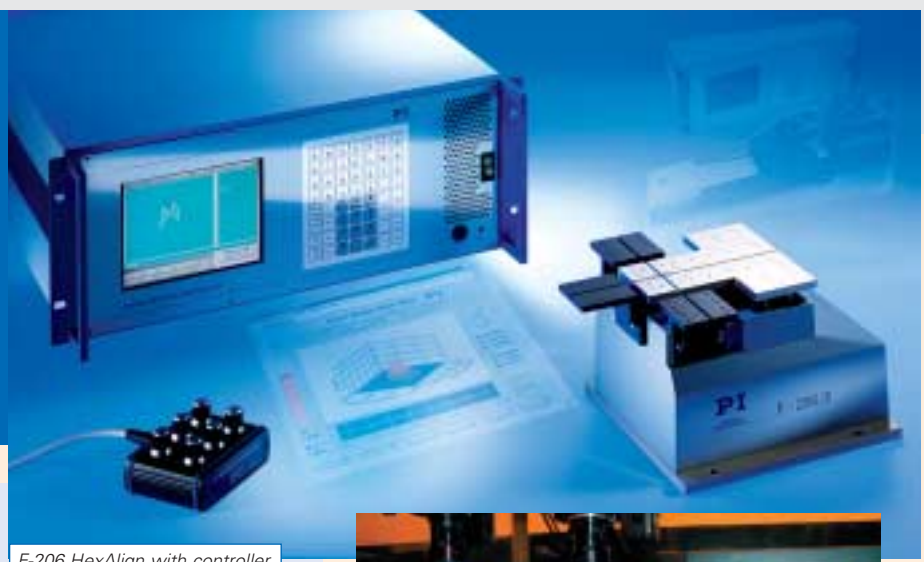
- Medical Robots
- Optical Fiber Positioning
- Endoscope Positioning/Adjustment
- Sample Positioning
- Micromanipulation



Custom M-850 medical hexapod robot in operating robot for neurosurgery.

Telecommunications

- Alignment of Fibers, Collimators and Arrayed Components
- MEMS Positioning
- Micro-Optics Adjustment
- MEMS Manufacturing/Microsystems Technology
- Test of Optical Fiber Systems, Diodes



F-206 HexAlign with controller and manual control pad.

F-206 HexAlign™

- Complete 6-Axis Alignment Engine
- Compact and Extremely Flexible
- XYZ PZT-Option with Sub-nanometer Resolution
- Automatic Alignment Functions
- DLL, COM and LabVIEW™ Drivers
- Min. Incremental Motion of 0.1 µm and 2 µrad
- Parallel Kinematics for Equally Good Repeatability in all Axes and in Space
- PivotAnywhere™ for Freely Selectable Common Pivot Point for All Axes
- Fiber Alignment Times under 4 s
- Integrated Photometer Card

F-206 as a photonics alignment subsystem for automated assembly of fiber pigtailed devices. Curtesy of Aries Innovations, Inc.

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Technical Data Overview

Ordering Information

F-206.00
HexAlign™ 6-Axis Alignment System, Photometer Card, vis.

F-206.IR
HexAlign™ 6-Axis Alignment System, Photometer Card, IR

M-840.5PD
HEXALIGHT 6-Axis Robot w/Controller, 50 mm/s

M-840.5DG
HEXALIGHT 6-Axis Robot w/Controller, 5 mm/s

M-850.11
Hexapod 6-Axis Robot w/Controller, 0.5 mm/s

M-850.50
Hexapod 6-Axis Robot w/Controller, 8 mm/s

Custom Designs on Request

Did you know that PI is the world leading manufacturer of micropositioning and nanopositioning parallel kinematic mechanisms? We have designed sub-micron precision Hexapods for more than a decade and our experience with PZT driven parallel kinematic nanopositioning mechanisms dates back to the 1980s. Request our 400 page catalog to learn more about our precision motion control products.

Request the 400 page PI NanoPositioning Catalog!

Technical Data

Model	F-206	M-850.11	M-850.50	M-840.5PD	M-840.5DG
Travel X, Y [mm]	± 6	± 50	± 50	± 50	± 50
Travel Z [mm]	± 6	± 25	± 25	± 25	± 25
Travel θ_x, θ_y [deg]	± 5	± 15	± 15	± 15	± 15
Travel θ_z [deg]	± 5	± 30	± 30	± 30	± 30
Min. Incremental Motion X, Y [µm]	0.1	1	1	3	3
Min. Incremental Motion Z [µm]	0.1	0.5	0.5	1	1
Min. Incremental Motion θ_x, θ_y, θ_z [µrad]	2	5	5	5	5
Repeatability X, Y [µm]	0.3	± 2	± 2	± 2	± 2
Repeatability Z [µm]	0.3	± 1	± 1	± 1	± 1
Repeatability θ_x, θ_y, θ_z [µrad]	6	± 10	± 10	± 20	± 20
Velocity X, Y, Z (typ.) [mm/s]	5	0.3	5	30	2
Velocity X, Y, Z (max.) [mm/s]	10	0.5	8	50	2.5
Velocity θ_x, θ_y, θ_z (typ.) [mrad/s]		3	50	300	20
Velocity θ_x, θ_y, θ_z (max.) [mrad/s]		6	100	600	30
Maximum load (vertical/random) [kg]	2/—	200/50	200/50	20/10	20/10
Weight [kg]	5.5	17	17	12	12
Dimensions (L x B x H) [mm³]	220x228x150	348x348x328	348x348x328	348x348x328	348x348x328
Interfaces					
RS232	standard	standard	standard	standard	standard
IEEE 488	optional	optional	optional	optional	optional
Manual control pad	optional	optional	optional	optional	optional
Photometer	VIS/IR – optional				
NanoCube™, PZT NanoAligner	optional				

Micro & NanoAutomation Solutions for Emerging Technologies:

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