

Trade Shows

Come see us at:

UK

Micro '98, July 07-09 1998

China

EO, Taipei: July 1998

Germany

Optatec '98, June 16-19 1998

ACTUATOR '98, June 17-19 1998

Netherlands

Het Instrument '98: October 05-09 1998

Contents:

NanoPositioning Catalog

M-400 Translation Stages

High Power PZT Amplifier

PI Web-Catalog

NanoAutomation Controller

LISA NanoPositioner

PI Wins Photonics Award

M-105 Translation Stages

Pico PZT Translator with Sub-Nanometer ...

Custom PZT Actuators

AKTUATOR '98

M-500 Translation Stages

Catalog Vibration Isolation

Announcing the 1998 "NanoPositioning" Catalog

The all new 1998 PI "NanoPositioning" catalog is available now! This 300-page, hard-bound catalog is an essential reference book on the fundamentals of NanoPositioning and Micropositioning technology for every engineer's library (it is also on the web at www.physikinstrumente.com, see article on next page).

General properties, applications, dynamic performance, power requirements, and position-controlled operation of Piezoelectric NanoPositioning systems are explained in the special tutorial. This completely new catalog details **PI's** full range of high precision products including:

- PZT Actuators
- PZT Flexure NanoPositioners
- PZT Active Optics
- PZT Control Electronics
- Capacitive Position Sensors
- Motorized Linear- and Rotation Stages
- Micropositioning Systems (Hexapods, etc.)
- Motor Controllers

The catalog includes dimensions, specifications, and options for all standard products to help you select the system that best meets your needs.

Fax or call or email to receive your personal copy.

M-400 Precision Translation Stages: 50, 100 & 150 mm Travel

M-400 Series Translation Stages are leadscrew driven stages with a travel range of 50, 100 and 150 mm. Precision crossed roller bearings guarantee straightness of travel of 2 μm / 100 mm. The stage base is precision machined from high-density, stress-relieved aluminum for exceptional stability and minimum weight. Special steel inlays (patent pending) provide excellent thermal stability.

M-400 series translation stages are equipped with a closed loop DC motor with shaft mounted high resolution position encoder and backlash free reduction gearhead, featuring better than 0.1 μm resolution. Fast direct drive versions are in preparation. All stages are equipped with non contact hall-effect origin switches and limit switches.

M-400 stages are compatible with all PI DC Motor Controllers.

E-480 High Power HVPZT Amplifier/Controller With Energy Recovery

The E-480 High Power Amplifier/Controller is a unique amplifier for high capacitance PZT actuators providing a peak output power of **2000 W**. It is based on a novel design employing energy recovery technology and PWM (Pulse Width Modulation).

Instead of dissipating the reactive power at the heat sinks, only the active power used by the piezo actuator has to be delivered. The energy not used in the actuator is returned to the amplifier and reused as supply voltage by a step-up transforming process. E-480 can output and sink a peak current of 2000 mA in a voltage range of 0 to -1000 V (positive or bipolar range factory settable) and features a temperature sensor input and controller circuit to shut down the amplifier if the PZT exceeds a maximum temperature.

The new energy recovery technology is the key to new industrial, high-power PZT applications, such as vibration cancellation, machine tooling, etc.

NanoPositioning Catalog on the Internet

The new PI NanoPositioning catalog is available on the Internet at:

[http:// www.Physikinstrumente.com](http://www.Physikinstrumente.com)

For best results a frame-compatible browser (Netscape or Internet Explorer version 3 or higher) are recommended.

The PI Web-Catalog was intended to quickly provide customers with information on the latest technology in NanoPositioning. When we set it up, we focused on a layout that would allow fast data transfer and avoid the "World Wide Waiting" effect, caused by graphical gimmicks etc.

NanoAutomation Controller

The E-612 NanoAutomation Controller is a high speed, parallel command port position controller for Closed Loop PZT NanoPositioners. It was developed for applications that require highest precision and ultra-fast response ("Nanometer-Precision in Milliseconds"), requirements that are vital for more and more high-tech operations.

The new E-612 is the perfect controller for these applications: Its high-speed (10 μ s!) parallel command interface is opto-isolated for enhanced EMI immunity. An advanced trigger function automatically informs the controlling system in real-time, when the piezo-mechanics has reached the target position within a user-defined band. Unique multi-axis addressing capabilities allow multi-axis set-ups to be controlled via a single cable to the controlling PC or PLC.

The NanoAutomation Controller is available as OEM board, single channel bench-top version, and modular bench-top chassis (1-4 channels). It is recommended for the new generation of NanoPositioners such as the P-752 Stages and the P-753 LISA Actuators.

Abb. E-501.10 with four E-612 Controller Boards and P-752.1C NanoPositioning Stage

LISA Miniature Piezo Flexure NanoPositioners and Scanners

The P-753 LISA Linear Piezo Stage Actuators are extremely compact and fast devices, providing a positioning and scanning range up to 45 μm with very short settling time. P-753 stages combine the small dimensions of a PZT stack actuator with the precise trajectory control of a flexure stage. They can be used both as linear actuators and as translation stages featuring extremely precise guiding systems (see Fig. 1). LISA actuators are equipped with capacitive position sensors providing **sub-nanometer** resolution and stability.

Careful attention to mass minimization results in significant reduction in inertial recoil forces applied to the supporting structures enhancing overall system throughput and stability.

LISA actuators are ideal for the following applications: Metrology, nanopositioning, Disk drive testing, scanning microscopy, fiber optics, scanning interferometry, bio-technology, micromanipulation etc.

Abb1. Typical 2 μrad bidirectional trajectory reproducibility means processes may be performed bidirectionally for twice the productivity.

Abb 2. LISA NanoPositioner (15 μm models, horizontal and vertical)

ACTUATOR 98

ACTUATOR is a biannual conference on new actuators and active materials. The 1998 ACTUATOR is held in Bremen, Germany, June 17-19.

The topics are

- Microactuators
- Piezoelectric Actuators
- Magnetostrictive Actuators
- Electro-/Magnetorheological Actuators
- Shape Memory Actuators
- Electromagnetic Actuators.

PI and PI Ceramic will present several papers on latest R&D results, e.g.

- mathematical processes to increase bandwidth of closed loop PZT positioning systems
- ultra high resolution multiaxis positioners with active trajectory control
- new PZT actuators for hydraulic valve actuation.

For further information contact PI or Messe Bremen GmbH, Bürgerweide, 28209 Bremen, Germany, Tel: +49 (421) 3505-230

PI Active PZT Stage Wins 1998 Photonics Circle of Excellence Award

The P-527.6C Active Trajectory Control PZT NanoPositioner was selected one of the twenty-five best products of the year by PHOTONICS SPECTRA magazine. The P-527.6C is an innovative XY NanoPositioner with six controlled axes providing active trajectory control with sub-nm and sub- μ rad straightness and flatness. All winning products were chosen for excellence, innovation and achievement in a sector of photonics technology. PI managing director Dr. Karl Spanner received the crystal award (see photo) at the official ceremony, on May 5 during the CLEO '98 conference in San Francisco, USA. PI has won this coveted award three times within the last eight years.

M-105 / 106 Translation Stages upgraded with Crossed Roller Bearings

The new M-105 and M-106 Translation Stages are now equipped with crossed roller bearings for ultra-high guiding precision. They feature a spring preloaded carriage for excellent repeatability and elimination of backlash.

Three drive systems are available:

- a) Micrometer drive: 18 mm travel, 1 μm sensitivity
- b) Differential micrometer drive: 5 mm travel, 0,1 μm sensitivity (model M-106)
- c) PiezoMike drive: 18 mm manual travel, 1 μm sensitivity, 30 μm piezoelectric fine range for remotely controlled ultra-high resolution (nanometer range).

M-105 and M-106 stages are available in one, two or three axis configurations.

Abb. P-105.3P XYZ Combination with PiezoMike Drives

Pico PZT Translators Provide Sub-Nanometer Resolution

The new Pico Series of Closed Loop Piezo Translators are ultra-high resolution linear actuators for static and dynamic applications. They combine the advantages of piezoceramic actuators and ultra-high accuracy capacitive position sensors in a small package and provide sub-nanometer resolution and repeatability.

Versions with 15, 30 and 45 μm travel are available; the Invar construction guarantees optimal thermal stability.

The excellent characteristics of Pico PZT Translators (controlled by standard E-500 Controllers) is shown in Fig. 2.

The three graphs show:

- Basic noise of the test setup with shorted PZT actuators. The figure of 0.147 nm (RMS) includes noise of all mechanical and electronic components in the test lab.
- Stability with activated closed loop control (the excellent figure of 0.179 is close to the resolution limit of the test system)
- Response to a control input signal equivalent to 1 nm stroke. (1 Hz square wave, 1 mV p-p).

The controller bandwidth was set to 240 Hz. Reduced bandwidth allows even higher resolution.

Pico Translators are ideal for industrial nanopositioning applications; they feature internal preload and a special safety construction to protect the ceramics from external torque applied to the top piece.

Fig. 1 Pico Translators

Fig. 2 Resolution of Pico Translators

Custom PZT Actuators

With our in-house ceramics manufacturing capabilities at PI Ceramic we are in a position to offer **custom PZT stack translators, benders, shear actuators and tubes** for almost any OEM application. Depending on the specifications, custom designs and form factors may be available at prices similar to standard models– even for small quantities (on the order of 10). For larger quantities, prices below standard products are feasible. Fig. 1 shows a variety of custom PZT Ring Actuators and Stack Actuators manufactured by PI Ceramic.

Example: Tubular PZT Translators for Optics and Precision Mechanics

The P-300 series of Tubular PZT Stack Actuators are especially well suited for fine positioning of optical components and for precision mechanical applications.

The actuators boast displacement from 5 μm to 40 μm and are available with two standard diameters:

- 10 mm OD (outer diameter) and 5 mm ID (inner diameter)
- 16 mm OD (outer diameter) and 8 mm ID (inner diameter)

The axial bore allows integration of the actuators into optical beam lines. Active correction of aberrations and **tuning of interferometers** can be achieved by mounting lenses or partially reflecting mirrors onto the end pieces of the actuator.

P-300 series actuators can also be used for **fast valve control** systems or other precision mechanical applications. UHV (Ultra High Vacuum) versions and integrated displacement sensor versions are also available. The tube shaped actuators are compatible with all PI HVPZT amplifiers and controllers.

Fig. 1: Variety of Custom PZT Actuators

Abb. 2: P-306 Tubular PZT Stack Actuators

M-500 High Resolution Translation Stages, 4", 8" & 12" Travel

The new M-500 Series Translation Stages are designed to meet demanding positioning requirements in quality control, automation, semiconductor test equipment, metrology, disk drive test set-ups, etc. They are available with travel ranges of 4, 8 and 12" and feature a load capacity of 100 kg.

M-500 stages combine a functional flat design to allow multiaxis combinations and feature a precision machined base from high-density, stress-relieved aluminum for exceptional stability and minimum weight. Precision ground recirculating ballscrews (better accuracy than rolled ballscrews) with preloaded nuts provide low friction, backlash free positioning.

Three different motor drives are available:

- DC Motor Direct Drive with integrated linear encoder and integrated power amplifier
- DC Motor/Gearhead Drive
- Stepper Motor Drive

The direct drive features a velocity range up to 50 mm/sec with 0.1 μm minimum incremental motion and 0.2 μm repeatability. An optical linear encoder (mounted in the center of the stage, as close as possible to the ballscrew drive) eliminates drivetrain errors such as non-linearity, backlash and elastic deformation.

For maximum dynamic performance the DC servo motors are directly driven by high efficiency PWM power amplifiers integrated into the stage. The stages can directly be operated by any motor controller card without additional amplifier.

The DC Motor/Gearhead Drive provides minimum incremental motion of 0.1 μm and maximum velocity of 6 mm/sec.

All versions are equipped with non contact hall-effect origin switches and limit switches. An optional motor brake is available for the direct drive version.

New Catalog on Vibration Isolation and Opto-Mechanical Components

The new catalog features honeycomb table-tops, breadboards, vibration isolation systems and the PI opto-mechanical components. General properties and basics of vibration isolation systems are explained in the introduction section.

Please send Information on:

Please fax to your local representative or email to info@physikinstrumente.com

Pico Piezo Translators
LISA NanoPositioners
Motor Controllers
M-400 Translation Stages
M-500 Translation Stages
PZT Flexure NanoPositioners
Capacitive Position Sensors

E-480 Piezo Power Amplifiers
NanoAutomation Controllers
Tubular PZT Translators
M-105 Translation Stages
PZT Translators
PZT Ceramics

Mail the "1998 NanoPositioning" Catalog
Components" Catalog

Mail the "Vibration Isolation /Opto-mechanical

Name:

Title:

Company:

Dept:

Field or work:

Address:

City:

State/ Zip

Tel:

Fax:

Email:

Please add me to your mailing list

Please take me off your mailing list