

Piezo Controllers for Steering Mirrors

... Phase Shifters and Tip/Tilt / Z Platforms

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Piezo Controllers for Steering Mirrors

Single Axis Controllers



10 Single-channel OEM module



The E-621.CR module USB, RS-232 and Analog Interfaces

Multi Axis Controllers



E-500 High-Power Modular Controller



E-616 3-Axis Steering Mirror Controller



30-channel controller consisting of 3 E-500.621 chassis, each of which can accommodate up to 12 E-621 modules



E-725 Digital 3-channel controller with P-528 Z/tip/tilt nanopositioning platform

E-616 Low Cost Nanopositioning Controller for Piezo Tip/Tilt Mirrors Flexible Multi Channel OEM Electronics with Coordinate Transformation



The E-616 OEM controller and the S-334 fast steering mirror system providing a tip/tilt range of up to 60 mrad

The E-616 is a special controller for piezo based tip/tilt mirrors and tip/tilt platforms. It contains two servo controllers, sensor channels and power amplifiers in a compact unit. The controller works with high-resolution SGS position sensors used in PI piezo mechanics and provides optimum position stability and fast response in the nanometer and μ rad-range respectively. A high output power of 10 W per channel allows dynamic operation of the tip/tilt mirrors for applications such as (laser) beam steering and stabilization.

Tripod or Differential Piezo Drive? One for All!

PI offers two basic piezo tip/tilt mirror designs. Both are parallel-kinematics designs where the individual piezo actuators affect the same moving platform. With the tripod design (e.g. S-325, see p. 2-92) the platform is driven by three piezo actuators placed with 120° spacing. The differential drive design (S-330, see p. 2-88 or S-334, see p. 2-90) with two orthogonal axes and a fixed pivot point is based on two pairs of actuators operating in

push / pull-mode. The differential evaluation of two sensors per axis provides an improved linearity and resolution.

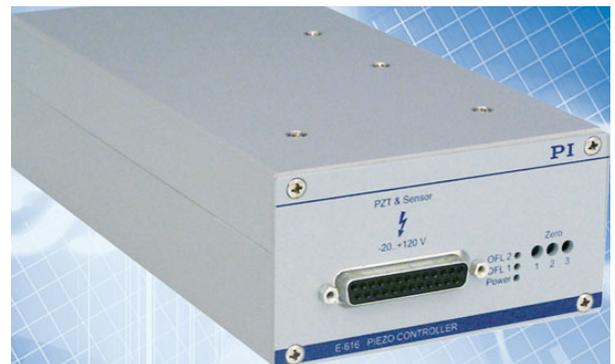
Internal Coordinate Transformation Simplifies Control

Parallel-kinematics require the transformation of the commanded tilt angles into the corresponding linear motion of the individual actuators. In the E-616.S0, this is taken care of by an integrated circuit, eliminating the need of additional external hardware or software. Additionally with the E-616.S0 all actuators can be commanded by an offset-voltage simultaneously. As a result a vertical movement, for example for optical path tuning, is obtained.

Simple Setup and Operation

To facilitate integration, setup and operation the E-616 features both front and rear panel connections: The 25 pin sub-D piezo & sensor connector is located on the front, along with offset trim pots and LEDs for Power and Overflow. A 32 pin rear connector allows commanding and reading the sensor and amplifier monitor outputs.

- Three Integrated Amplifiers Provide up to 10 W Peak Power
- Closed-Loop and Open-Loop Versions
- Internal Coordinate Transformation Simplifies Control of Parallel Kinematics Designs (Tripod & Differential Drive)
- Compact and Cost-Effective Design for OEMs

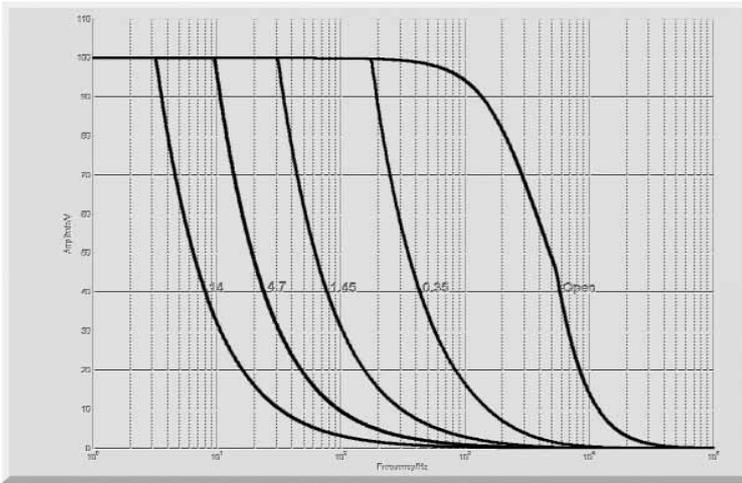


E-616 Bench top controller

Ordering Information

- E-616.SS0**
Multi Channel Servo-Controller / Driver for Piezo Tip/Tilt Mirror Platforms with SGS and Differential Drive
- E-616.S0**
Multi Channel Servo-Controller / Driver for Piezo Tip/Tilt Mirror Platforms with SGS and Tripod Drive

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E-616: operating limits with various PZT loads (open-loop), capacitance is measured in μF

Technical Data

Model	E-616.S0	E-616.SS0
Function	Controller for parallel-kinematics piezo tip/tilt mirror systems with strain gauge sensors, tripod design	Controller for parallel-kinematics piezo tip/tilt mirror systems with strain gauge sensors, differential design
Tilt axes	2	2
Sensor		
Servo characteristics	P-I (analog), notch filter	P-I (analog), notch filter
Sensor type	SGS	SGS
Sensor channels	3	2
External synchronization	200 kHz TTL	200 kHz TTL
Amplifier		
Control input voltage range	-2 V to +12 V	-2 V to +12 V
Output voltage	-20 V to +120 V	-20 V to +120 V
Amplifier channels	3	3
Peak output power per channel	10 W	10 W
Average output power per channel	5 W	5 W
Peak current	100 mA	100 mA
Average current per channel	50 mA	50 mA
Current limitation	Short-circuit-proof	Short-circuit-proof
Voltage gain	10	10
Amplifier bandwidth, small signal	3 kHz	3 kHz
Amplifier bandwidth, large signal	See frequency diagram	See frequency diagram
Ripple, noise, 0 to 100 kHz	<20 mVpp	<20 mVpp
Amplifier resolution	<1 mV	<1 mV
Interfaces and operation		
Piezo / sensor connector	25-pin sub-D connector	25-pin sub-D connector
Analog input	32-pin connector	32-pin connector
Sensor monitor output	0 to +10 V for nominal displacement	0 to +10 V for nominal displacement
Sensor monitor socket	32-pin connector	32-pin connector
Display	Power-LED and sensor OFL display	Power-LED and sensor OFL display
Miscellaneous		
Operating temperature range	5 °C to 50 °C	5 °C to 50 °C
Overheat protection	Max. 75 °C, deactivation of the piezo voltage output	Max. 75 °C, deactivation of the piezo voltage output
Dimensions	160 mm x 100 mm x 10 TE	160 mm x 100 mm x 10 TE
Mass	700 g	700 g
Operating voltage	12 to 30 V DC	12 to 30 V DC
Power consumption	30 W	30 W

E-610 Piezo Amplifier / Nanopositioning Controller Card

1-Channel OEM Piezo Driver Module with Optional Position Servo-Control



E-610 Single-channel OEM module with optional position servo control

- **Cost-Effective 1-Channel OEM Solution**
- **Closed-Loop and Open-Loop Versions**
- **Notch Filter for Higher Bandwidth**
- **Position Control with Strain Gauge or Capacitive Sensor**
- **18 W Peak Power**

The E-610 is an OEM amplifier & position servo-control board for low-voltage piezo actuators and positioning systems. It integrates a low-noise piezo amplifier which can output and sink peak currents of 180 mA in a voltage range of -20 to +120 V. Three versions are available: E-610.00 (only amplifier) and closed-loop versions E-610.S0 and E-610.C0 with additional components for position measurement and servo control.

Closed-Loop and Open-Loop Piezo Positioning

The units are designed to provide high-resolution operation of piezo actuators and positioning systems in voltage-controlled mode (open-loop) and in position-controlled mode (closed-loop).

In closed-loop position control mode, displacement of the piezo is highly linear and proportional to the analog signal. The servo modifies the ampli-

fier output voltage based on the position sensor signal. Thus, positioning accuracy and repeatability down to the sub-nanometer range is possible, depending on the piezo mechanics and on the sensor type.

PI employs proprietary position sensors for fast response and optimum positioning resolution and stability in the nanometer range and below. For high-end applications, capacitance sensors provide direct and non-contact position feedback (direct metrology). Strain gauge sensors (SGS) are available for cost-effective applications. The integrated notch filters (adjustable for each axis) improve the stability and allow high-bandwidth operation closer to the resonant frequency of the mechanics.

In open-loop (voltage-controlled) operation the output voltage is determined by an external analog signal. Open-loop operation is ideal for applica-

tions where fast response and very high resolution with maximum bandwidth are essential. Here, commanding and reading the target position in absolute values is either not important or carried out by external position sensors (see p. 2-104).

Remote Control via Computer Interface

For digital-interface computer control, consider the E-621 (see p. 2-160) and E-625 (see p. 2-114) instead.

Alternatively control via PC using a D/A board is possible. PI offers a LabVIEW driver set which can be used with certain D/A boards from National Instruments.

Operation / Contents of Delivery

A single stabilized voltage in the range of 12 to 30 V is sufficient to operate the E-610. An integrated DC/DC converter generates the piezo operating voltage and all other voltages used internally. All inputs and

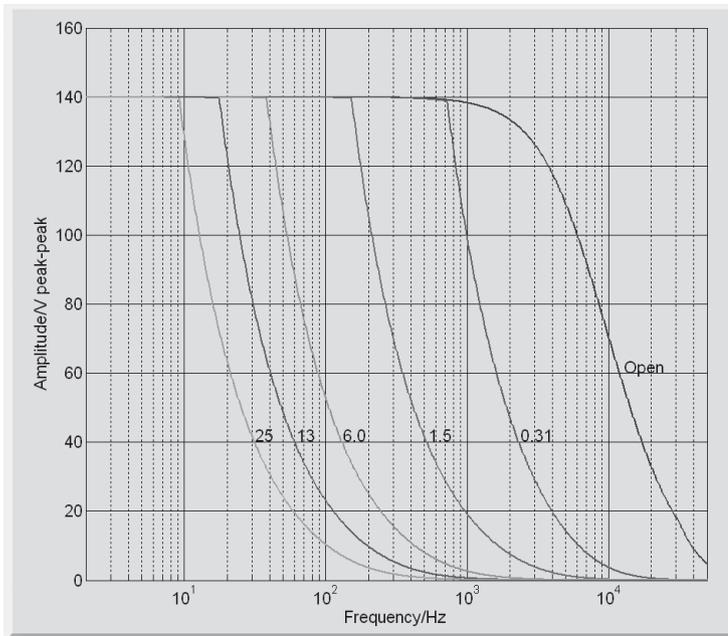
Ordering Information

- E-610.00**
Piezo Amplifier, 1 Channel, OEM Module, -30 to 130 V
- E-610.C0**
Piezo Amplifier / Servo-Controller, 1 Channel, OEM Module, -20 to 120 V, Capacitive Sensor
- E-610.S0**
Piezo Amplifier / Servo-Controller, 1 Channel, OEM Module, -30 to 130 V, SGS-Sensor
- E-500.ACD**
LabVIEW Driver Set for Analog Controllers
- E-500.HCD**
HyperBit™ Functionality for Enhanced System Resolution (Supports Certain D/A Boards)

outputs (except capacitive sensor lines) are available on the male 32-pin rear connector. A matching female 32-pin connector is included in the contents of delivery to interface with your circuitry.



An OEM version with a digital controller is available – the E-609



E-610.00 and E-610.S0: Operating limits with various PZT loads (open-loop), capacitance is measured in μF

Technical Data

Model	E-610.00	E-610.C0	E-610.S0
Function	Piezo Amplifier, 1 Channel, OEM Module	Piezo Amplifier / Servo-Controller, OEM Module	Piezo Amplifier / Servo-Controller, OEM Module
Sensor			
Servo characteristics	–	P-I (analog) + notch filter	P-I (analog) + notch filter
Sensor type	–	Capazitiv	SGS
Amplifier			
Control input voltage range	-2 to +12 V	-2 to +12 V	-2 to +12 V
Output voltage	-30 to 130 V	-20 to 120 V	-30 to 130 V
Peak output power	18 W (< 15 ms)	18 W (< 50 ms)	18 W (<15 ms)
Average output power	10 W	10 W	10 W
Peak current	180 mA (< 15 ms)	180 mA (< 50 ms)	180 mA (<15 ms)
Average current	100 mA	100 mA	100 mA
Current limitation	Short-circuit proof	Short-circuit proof	Short-circuit proof
Noise, 0 to 100 kHz	1.6 mV _{rms}	0.5 mV _{rms}	1.6 mV _{rms}
Voltage gain	10 \pm 0.1	10 \pm 0.1	10 \pm 0.1
Input independence	100 k Ω	100 k Ω	100 k Ω
Interfaces and operation			
Input / Output	32-pin (male) on rear panel (DIN 41612 / D)	32-pin (male) on rear panel (DIN 41612 / D)	32-pin (male) on rear panel (DIN 41612 / D)
Piezo connector	LEMO	LEMO	LEMO
Sensor connection	–	LEMO	LEMO
DC Offset	External potentiometer (not included), adds 0 to 10 V to Control In	External potentiometer (not included), adds 0 to 10 V to Control In	External potentiometer (not included), adds 0 to 10 V to Control In
Miscellaneous			
Operating temperature range	+5° to +50° C	+5° to +50° C	+5° to +50° C
Dimensions	7HP/3U	7HP/3U	7HP/3U
Mass	0.3 kg	0.35 kg	0.35 kg
Operating Voltage	12 to 30 V DC, stabilized	12 to 30 V DC, stabilized	12 to 30 V DC, stabilized
Current consumption, max.	2 A	2 A	2 A

Modular & Bench-Top Piezo Nanopositioning Controller

Digital and Analog Interfaces: USB, Fast 24-Bit D/A Converters, Analog Servo



The E-621.CR module features USB, RS-232 and Analog Interfaces

- **Integrated 24-Bit USB Interface**
- **Network Capability with up to 12 Channels**
- **Up to 12 W Peak Power**
- **Position Control with Strain Gauge or Capacitive Sensor**
- **Notch Filter for Higher Bandwidth**
- **Additional Analog Interface**
- **Table for User-Defined Curves**

The E-621 is equipped with an RS-232 and USB interface and precision 24-bit converters for exceptional positional stability and resolution. It integrates a low-noise piezo amplifier which can output and sink peak currents of 120 mA for low-voltage piezoelectric actuators. Servo-controller versions for position sensing with capacitive or SGS sensors are available.

Closed-Loop and Open-Loop Piezo Positioning

The E-621 controller module provides precision control of piezo actuators and positioning systems both in closed-loop and open-loop operation. The piezo controllers comprise additional circuitry for position sensing and servo-control. Displacement of the piezo is controlled by an analog signal. Positioning accuracy and

repeatability down to the sub-nanometer range is possible, depending on the piezo mechanics and sensor type. High-resolution position sensors provide optimum positional stability and fast response in the nanometer range. Capacitive sensors measure position directly and without physical contact (direct metrology). Alternatively compact cost-effective strain gauge sensors (SGS) are available. The integrated notch filters (adjustable for each axis) improve stability and allow high-bandwidth operation closer to the resonant frequency of the mechanics.

In open-loop operation the output voltage is determined by an external analog signal. Open-loop operation is ideal for applications where fast response and very high resolution with maximum bandwidth

are essential. Here, commanding and reading the target position in absolute values is either not important or carried out by external position sensors.

High-Resolution Digital Interface

The digital interface includes high-precision 24-bit A/D converters for optimum position stability and resolution and supports fast communication with the host-computer.

Multi-Axis Network for up to 12 Channels

Up to twelve E-621s for capacitive or SGS sensors can be networked and controlled over a single PC interface. The different modules are connected in parallel (not daisy-chained) over the link. Only an additional 10 ms internal bus communications time is required to reach any of the units behind the one actually connected to the host PC.

Waveform Memory

The built-in wave table can store user-defined data points internally. These values can then be output automatically (or under the control of an external signal) and programmed for point-by-point or full-scan triggering. Thus,

Ordering Information

E-621.CR
Piezo Amplifier / Servo-Controller Module, 1 Channel, -30 to 130 V, Capacitive Sensor, USB, RS-232

E-621.SR
Piezo Amplifier / Servo-Controller Module, 1 Channel, -20 to 120 V, SGS-Sensor, USB, RS-232

E-500.621
19"-Chassis for up to twelve E-621 Modules, Power Supply

E-501.621
9,5"-Chassis for up to four E-621 Modules, Power Supply

trajectory profiles can be repeated reliably and commanded easily.

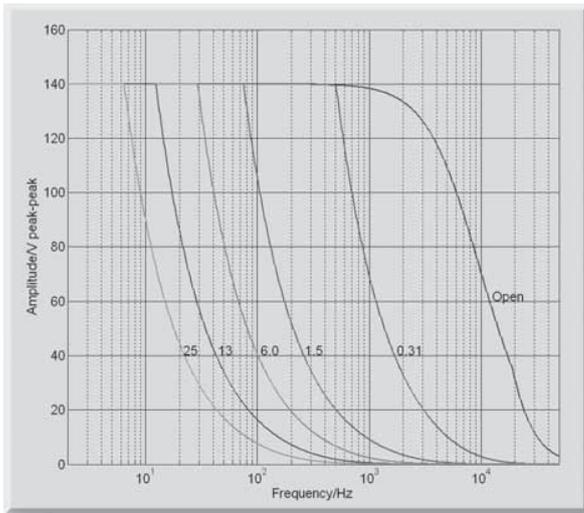
Software / GCS Command Set

The E-621 controller comes with Windows installation software, DLLs and LabVIEW drivers. The extensive command set is based on the hardware-independent General Command Set (GCS), which is common to all current PI controllers for both nano- and micropositioning systems. GCS reduces the programming effort in the face of complex multi-axis positioning tasks or when upgrading a system with a different PI controller.



E-625 (top), E-665 and 12 x E-621 in an E-500 chassis (bottom)

E-621.CR: operating limits with various PZT loads (open-loop), capacitance is measured in μF



E-625.CR Bench -Top Version

Bench Top Version

E-625.CR
Piezo Amplifier / Servo-Controller, 1 Channel, -30 to 130 V, Capacitive Sensor, USB, RS-232

E-625.SR
Piezo Amplifier / Servo-Controller, 1 Channel, -20 to 120 V, SGS-Sensor, USB, RS-232

E-625.CN
Network Cable for Networking of Two E-625

E-625.C0
PIFOC[®] Piezo Amplifier / Servo-Controller, 1 Channel, -20 to 120 V, Capacitive Sensor

E-625.S0
PIFOC[®] Piezo Amplifier / Servo-Controller, 1 Channel, -20 to 120 V, SGS-Sensor

Technical Data: Modular Card

Model	E-621.SR / E-621.CR
Function	Power amplifier & piezo controller
Sensor	
Servo characteristics	P-I (analog), notch filter
Sensor type	SGS (.SR) / capacitive (.CR)
Amplifier	
Control input voltage range	-2 to 12 V
Output voltage	-20 to 120 V / -30 to 130 V
Peak output power, <5 ms	12 W
Average output power	6 W
Peak current, <5 ms	120 mA
Average current	60 mA
Current limitation	Short-circuit-proof
Noise, 0 to 100 kHz	0.8 mV _{rms}
Voltage gain	10 ±0.1
Input impedance	100 kΩ
Interfaces and operation	
Interface / communication	USB, RS-232 (9-pin Sub-D connector, 9.6–115.2 kBaud), 24-bit A/D, 20-bit D/A
Piezo connector	LEMO ERA.00.250.CTL (.SR) / Sub-D special (.CR)
Sensor connection	LEMO EPL.0S.304.HLN (.SR) / Sub-D special (.CR)
Analog input	SMB
Sensor monitor output	SMB
Controller network	up to 12 channels, parallel
Command set	PI General Command Set (GCS)
User software	PIMikroMove™
Software drivers	LabVIEW drivers, DLLs
Supported functionality	Wave table, 256 data points, external trigger, 16 macros
DC Offset	External potentiometer (not included), adds 0 to + 10 V to Control In
Miscellaneous	
Operating temperature range	+5 °C to +50 °C (10 % derated over 40 °C)
Overheat protection	Deactivation at 75 °C
Dimensions	7HP/3U
Mass	0.6 kg
Operating Voltage	12 to 30 V DC, stabilized
Current consumption, max.	2 A

Technical Data: Bench Top Version

Model	E-625.SR / E-625.CR
Function	Piezo Amplifier / Servo-Controller
Axes	1
Sensor	
Servo characteristics	P-I (analog), notch filter
Sensor type	SGS (.SR) / capacitive (.CR)
Amplifier	
Control input voltage range	-2 to 12 V
Min. output voltage	-20 to 120 V / -30 to 130 V
Peak output power, < 5 ms	12 W
Average output power	6 W
Peak current, < 5 ms	120 mA
Average current	60 mA
Current limitation	Short-circuit-proof
Noise, 0 to 100 kHz	0.8 mV _{rms}
Voltage gain	10 ±0.1
Input impedance	100 kΩ
Interfaces and operation	
Interface / communication	USB, RS-232 (9-pin Sub-D connector, 9.6–115.2 kBaud), 24-bit A/D and 20-bit D/A E-625.S0 and E-625.C0 without interface
Piezo connector	LEMO ERA.00.250.CTL (.SR) / Sub-D Special (.CR)
Sensor connection	LEMO EPL.0S.304.HLN (.SR) / Sub-D Special (.CR)
Control input sockets	SMB
Sensor monitor socket	SMB
Controller network	up to 12 channels, parallel
Command set	PI General Command Set (GCS)
User software	PIMikroMove™
Software drivers	LabVIEW drivers, DLL's
Supported functionality	Wave table, 256 data points, external trigger, 16 macros
Miscellaneous	
Operating temperature range	+5 to +50 °C
Overheat protection	Deactivation at 75°C
Dimensions	205 x 105 x 60 mm
Mass	1.05 kg
Operating voltage	12 to 30 V DC, stabilized (power supply included)
Current consumption	2 A

E-725 High-Performance 3-Channel Digital Piezo Controller For 3-Axis High-Speed Precision Positioning Systems



E-725 Digital 3-channel controller with P-528 Z/tip/tilt nanopositioning platform

- For Nanopositioning Systems with Capacitive Sensors
- 3-Channel Version
- Powerful Digital Controller: DSP 32-bit Floating Point, 225 MHz; 20 kHz Sampling Rate; 24-bit DAC
- Communication via Ethernet, USB, RS-232
- 4th Order Polynomial Linearization for Mechanics & Electronics
- Dynamic Digital Linearization (DDL) Option for Improved Path Accuracy
- Auto-Loading of Calibration Data from Stage ID-Chip for Interchangeability of Controller and Mechanics
- Additional High-Bandwidth Analog Control Input / Sensor Input
- Optional High-Speed Parallel I/O Interface
- Flexible Wave Generators
- Digital I/O Lines for Task Triggering
- Extensive Software Support

The E-725 digital piezo controller is a compact, high-performance drive electronics for nanopositioning systems with up to three axes. High-power amplifiers permit dynamic scans even for piezo systems with large range or direct drive. State-of-the-art processor technology optimizes the operating parameters for improved linearity and tracking accuracy. High-resolution D/A converters provide for nanopositioning that deserves this name.

With the E-725.3CM, PI for the first time offers a digital controller for the P-363 PicoCube™ (see p. 2-66), a fast precision scanner for atomic force microscopy.

Optional interfaces and analog in- and outputs make it possible to process external sensor or control values.

Digital Linearization and Control Algorithms for Highest Accuracy

Linearization algorithms based on higher-order polynomials improve the positioning accuracy to better than 0.01 % for capacitive sensors, typically 10 times better than achievable with conventional controllers.

More than just a Controller – Trajectory Control and Data Recording

During fast periodic motion, as typical for scanning applications, the tracking accuracy can

be further improved with Dynamic Digital Linearization (DDL, E-710.SCN). This optionally available control algorithm reduces the tracking error by a factor of up to 1000.

This control algorithm enables the spatial and temporal tracking during a dynamic scan. The integrated wave generator can output periodic motion profiles. In addition to sine and triangle waves, arbitrary, user-defined motion profiles can be created and stored. The flexibly configurable data recorder enables simultaneous recording and read-out of the corresponding data.

Extensive Software Support

The controllers are delivered with Windows operating software. Comprehensive DLLs and LabVIEW drivers are available for automated control.

Automatic Configuration

PI digital piezo controllers and nanopositioning stages with ID-Chip can be operated in any combination, supported by the AutoCalibration function of the controller. Individual stage data and optimized servo-control parameters are stored in the ID-Chip and are read out automatically by the digital controllers.

Ordering Information

E-725.3CD
Digital Multi-Channel Piezo Controller, 3-Channel, Sub-D Connector for Capacitive Sensors

E-725.3CM
Digital Multi-Channel Piezo Controller, for PicoCube™ and Capacitive Sensors

Ask about custom designs

Technical Data

Model	E-725.3CD	E-725.3CM	Tolerance
Function	Digital Controller for Multi-Axis Piezo Nanopositioning Systems with Capacitive Sensors	Digital Controller for Multi-Axis Piezo Nanopositioning Systems with Capacitive Sensors	
Axes	3	3	
Processor	DSP 32-bit floating point, 225 MHz	DSP 32-bit floating point, 225 MHz	
Sampling rate, servo-control	20 kHz	20 kHz	
Sampling rate, sensor	20 kHz	20 kHz	
Sensor			
Servo characteristics	P-I, two notch filters	P-I, two notch filters	
Sensor type	Capacitive	Capacitive	
Sensor channels	3	3	
Sensor bandwidth (-3 dB)	5.6 kHz	5.6 kHz	max.
Sensor resolution	18 bit	18 bit	
Ext. synchronization	Yes	Yes	
Amplifier			
Output voltage	-30 to 135 V	-250 to 250 V	±3 V
Amplifier channels	4	4	
Peak output power per channel	25 W	47 W	max.
Average output power per channel*	10 W	10 W	max.
Peak output current per channel	190 mA	190 mA	max.
Average output current per channel*	120 mA	60 mA	max.
Current limitation	Short-circuit proof	Short-circuit proof	
Resolution DAC	24 bit	24 bit	
Interfaces and operation			
Communication interfaces	Ethernet, USB, RS-232	Ethernet, USB, RS-232	
Piezo / sensor connector	Sub-D special connector	Sub-D special connector	
Analog input	1 x Lemo, ±10 V, 18 bit	1 x Lemo, ±10 V, 18 bit	
Digital input / output	MDR20; 2 x IN, 8 x OUT	MDR20; 2 x IN, 8 x OUT	
Command set	PI General Command Set (GCS)	PI General Command Set (GCS)	
User software	NanoCapture™, PIMikroMove™	NanoCapture™, PIMikroMove™	
Software drivers	LabVIEW driver, DLLs	LabVIEW driver, DLLs	
Supported functionality	Wave-Gen, Trigger I/O	Wave-Gen, Trigger I/O	
Display	LEDs for Power, On Target, Error, Cmd	LEDs for Power, On Target, Error, Cmd	
Linearization	4th order polynomial, DDL (Dynamic Digital Linearization)	4th order polynomial, DDL (Dynamic Digital Linearization)	
Separate protective ground connector	Yes	Yes	
Miscellaneous			
Operating temperature range	5 to 50 °C	5 to 50 °C	
Overheat protection	Max. 71 °C, deactivation of the piezo voltage output	Max. 71 °C, deactivation of the piezo voltage output	
Mass	3.5 kg	3.6 kg	
Dimensions	263 x 89 x 302 mm (with handles)	263 x 89 x 302 mm (with handles)	
Power consumption	70 W	70 W	max.
Operating voltage	24 VDC from external power supply (included)	24 VDC from external power supply (included)	

* The total output power of all 4 amplifier channels should not exceed 34.5 W to avoid overcurrent (E-725 is equipped with a 3. 15 AM fuse).

E-500 and E-501 Racks

Modular Piezo Nanopositioning Controller for High Power Amps

Analog Servo, Digital & Analog Interfaces



Configuration example: E-500 Chassis with optional modules: E-505, 200 W High-Power piezo amplifier (3 x), E-509.S servo-controller, E-517.i3 24-bit interface / display module



Configuration example: E-501 chassis with optional modules: E-503 piezo amplifier, E-509.C2A servo-controller for capacitive position sensors, E-517.i3 24-bit interface / display module

- Up to 3 Axes, Custom Systems up to 12 Axes and More
- Choice of Amplifier Modules for Low-Voltage and High-Voltage, 14 to 400 W Peak Power
- Choice of Position Servo Control Modules for SGS & Capacitive Sensors, 1 to 3 Channels
- Choice of PC Interface / Display Modules
- 19- & 9½-Inch Chassis

The E-500 modular piezo controller system offers a broad choice of control modules for nanopositioning systems and actuators. This includes piezo

amplifier and position servo controller modules for up to three channels with different features as well as display and interface modules. Flexible



30-channel controller consisting of 3 E-500.621 chassis, each of which can accommodate up to 12 E-621 modules

configuration makes the system adaptable to a wide range of applications.

E-500 systems are assembled to order, tested, and, if a servo-controller is present, calibrated with the associated piezo mechanics.

Remote Control via Computer Interface

Installing the E-517, computer interface/display module (see p. 2-156) with 24-bit resolution makes possible control from a host PC.

Optionally, digital control via an external D/A converter is possible. For several D/A boards from National Instruments, PI offers a corresponding LabVIEW driver set which is compatible with the PI General Command Set (GCS), the command set used by all PI controllers. A further option includes the patented

Ordering Information

E-500.00
19"-Chassis for Modular Piezo Controller System, 1 to 3 Channels

E-501.00
9½"-Chassis for Modular Piezo Controller System, 1 to 3 Channels

E-500.ACD
LabVIEW Driver Set for Analog Controllers

E-500.HCD
HyperBit™ Functionality for Enhanced System Resolution (Supports Certain D/A Boards)

Ask about custom designs!

HyperBit™ technology providing enhanced system resolution.

Two chassis are available:

The E-500.00 19" rackmount chassis provides operating voltages for all compatible modules including amplifiers, servo-controllers, display and interface modules (see system configuration see p. 2-144).

Technical Data

Model	E-500.00	E-501.00
Function	19"-Chassis for Piezo Controller System: Amplifier Modules, Sensor- / Servo-Control Modules, Interface / Display Modules	9.5"-Chassis for Piezo Controller System: Amplifier Modules, Sensor- / Servo-Control Modules, Interface / Display Modules
Channels	1, 2, 3 (up to 3 amplifier modules)	1, 3 (1 amplifier module)
Dimensions	450 x 132 x 296 mm + handles	236 x 132 x 296 mm + handles
Operating voltage	90–264 VAC, 50–60 Hz	90–120 / 220–264 VAC, 50–60 Hz
Max. power consumption	180 W	80 W

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Available Modules for E-500 and E-501 Racks

E-505.00 is a high-performance amplifier module for the piezo servo-controller system E-500



E-505.00
Piezo Amplifier Module, 200 W,
-20 to 120 V, 1 Channel

E-505.10
Piezo Amplifier Module for
Switching Applications, 1000 W,
-20 to 120 V, 1 Channel

E-505.00S
Offset Voltage Supply for Tip/Tilt
Systems, One Fixed Voltage of
+100 V

E-503.00 Piezo
amplifier module



E-503.00
Piezo Amplifier Module,
-20 to 120 V, 3 Channels

E-503.00S
Piezo Amplifier Module,
-20 to 120 V, 3 Channels,
Modified E-503.00 for S-330, S-334,
S-340 Tip/Tilt Systems, with
One Fixed Voltage of +100 V,
Two Variable Voltages

- 200 W Peak Power
- Output Voltage Range -20 to 120 V

- 3 x 14 W Peak Power
- Output Voltage Range -20 to 120 V

Available Modules for E-500 and E-501 Racks

E-509 3-channel servo-controller module for nanopositioning systems with strain gauge sensors



- E-509.C1A**
Sensor / Piezo Servo-Control
Capacitive Sensor, 1 Channel
- E-509.C2A**
Sensor / Piezo Servo-Control
Capacitive Sensors, 2 Channels
- E-509.C3A**
Sensor / Piezo Servo-Control
Capacitive Sensors, 3 Channels
- E-509.S1**
Sensor / Piezo Servo-Control
SGS Sensor, 1 Channel
- E-509.S3**
Sensor / Piezo Servo-Control
SGS-Sensors, 3 Channels

- High-Speed Analog Servo for Piezo with Capacitiv & SGS
- 1-, 2- and 3-Channel Versions
- Improves Linearity, Increases Piezo Stiffness
- Eliminates Drift and Hysteresis
- Notch Filter for Higher Bandwidth
- ILS Circuitry Maximizes Capacitive Sensor Linearity

The E-517 piezo display and D/A converter module, provides USB and TCP/IP connectivity



- E-517.i1**
Interface / Display Module,
24 Bit D/A, TCP/IP, USB, RS-232,
Single Channel
- E-517.i3**
Interface / Display Module,
24 Bit D/A, TCP/IP, USB, RS-232,
3 Channels

- Low-Noise 24-bit D/A Converter
- Sample Rate 25 kHz
- TCP/IP, USB, IEEE 488 and RS-232 Interfaces
- 6-Digit Display for Voltage and Position
- 1- & 3-Channel Versions
- Wave Generator with Programmable Trigger-I/O

Program Overview

- Piezo Ceramic Actuators & Motors
- Piezo Nanopositioning Systems and Scanners
- Active Optics / Tip-Tilt Platforms
- Capacitive Nanometrology Sensors
- Piezo Electronics: Amplifiers and Controllers
- Hexapod 6-Axis Positioners / Robots
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Request or download the complete PI Nanopositioning & Piezo Actuator Catalog



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