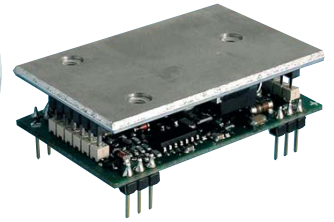


E-500 - E-501

Modular Piezo Control Systems (HVPZT & LVPZT)



Configuration example: E-500 chassis with three optional E-507 HVPZT amplifiers, E-509.L3 piezo servo-controller for LVDT sensors and E-516.i3 20-bit DAC interface/display.



Cost Effective Piezo Driver

- For High- and Low-Voltage Piezo Systems
- 19- and 9.5-Inch Chassis
- Optional Position Servo-Control Modules
- Optional Display and RS-232 & IEEE 488 Interface Module

The E-500 is a modular, 19" rackmount chassis for piezo amplifiers and position servo-controllers. An integrated multi-function power supply (E-530.00) provides operating voltages for all available modules including amplifiers, servo-controllers, display and interface modules (see system configuration, p. 6-19 ff.

A more-compact 9.5-inch version of the system is available

as the E-501. That chassis can hold one amplifier module (1- or 3-channel units available), one servo-control module (1- or 3-channel) and one display/interface module (1- or 3-channel).

E-500 and E-501 systems are assembled to order, tested, and, if a servo-controller is present, calibrated with the associated piezo mechanics.

A modified E-500 chassis for up to 6 channels is available on request. For systems with up to 12 channels, the E-500.621 chassis with E-621 amplifier/controller modules can be used (see p. 6-36).

Ordering Information

E-500.00
Piezo Amplifier & Position Servo-Controller, up to 3 Channels, Basic Chassis, 19"

E-501.00
Piezo Amplifier & Position Servo-Controller, up to 3 Channels, Basic Chassis, 9.5"

Ask about custom designs!



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



Configuration example: E-501 chassis with optional E-505 LVPZT amplifier, E-509.C1A piezo servo-controller for capacitive sensors and E-516.i3 20-bit DAC interface/display.

Technical Data

Models	E-500.00	E-501.00
Function	19" chassis for piezo electronics: amplifier modules, sensor modules, position servo-control modules, display/interface modules	9.5" chassis for piezo electronics: amplifier modules, sensor modules, position servo-control modules, display/interface modules
Channels	1, 2, 3	1, 3
Dimensions	450 x 132 x 296 mm + handles (see p. 6-10)	236 x 132 x 296 mm + handles (see p. 6-10)
Integrated power supply	E-530.00	E-531.00
Operating voltage	90-264 VAC, 50-60 Hz, E-530.00 primary switching P/S;	90-120 / 220-264 VAC, 50-60 Hz, E-531.00 linear P/S

E-709 Compact and Cost-Optimized Digital Piezo Controller For Piezo Systems with Capacitive Sensors



Compact single-channel digital controller E-709 with PIFOC® objective scanners

- Flexibility of Digital Signal Processing for the Cost of Analog
- Digital Control Algorithms with 10 kHz Sampling Rate
- For Capacitive Sensors
- Linearity to 0.02 %
- USB and RS-232 Interfaces
- Fast 25 Mbit/s Serial Interface
- Additional High-Bandwidth Analog Control Input / Sensor Input
- Analog Output, e.g. for External Amplifiers
- Low-Cost OEM-Versions Available
- Fast Digital Controller, Software-Configurable Servo Parameters
- Parameter Input Using Software

The E-709 piezo controller provides the flexibility and ease of use of a digital signal processing unit for the cost of an analog one. All motion and servo-control parameters can be set by software and adjusted on-the-fly during operation. In addition, digital 5th order polynomial linearization algorithms can improve the motion linearity of the attached piezo positioning system significantly over an analog servo system. In addition to a variety of digital interfaces, an analog input and output are also included. A software command allows the ana-

log input to be interpreted as position control signal or as a sensor value. The analog output can be configured for the control of external amplifiers or for the output of position values.

Flexibility: Software Configurable Servo Parameters

All servo controllers require tuning and adjustment of servo parameters for optimum performance (e.g. as a result of changes to the load or the motion profile). With a digital controller, all adjustments are carried out by simple software

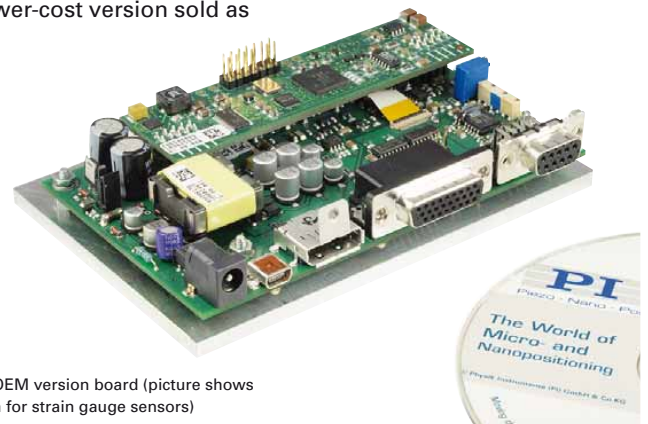
commands and the resulting motion or transient characteristics can be viewed, analyzed and further optimized immediately with the provided software. It is also possible to switch between previously found sets of parameters when the controller is in operation. Since jumpers and potentiometers no longer have to be set manually, system integration becomes much more straightforward.

Digital or Analog?

Digital controllers provide advantages when high positioning linearity is important or when servo parameters need to be modified frequently. This could be the case when load changes occur or to optimize motion profiles for both step operation and continuous operation achieving the fastest settling time and the highest tracking accuracy. With analog controllers a compromise has to be found during system setup and changes require physical access to the unit. With digital controllers the best parameters for either condition can be set on-the-fly by a software command.

OEM Versions for Cost Sensitive Applications

An unpackaged version of the E-709 is offered for OEMs. An even lower-cost version sold as



E-709 OEM version board (picture shows version for strain gauge sensors)

Ordering Information

E-709.CR
Digital Piezo Controller, 1 Channel, OEM Module, -30 to 130 V, Capacitive Sensor

E-709.CRG
Digital Piezo Controller, 1 Channel, -30 to 130 V, Capacitive Sensor, Bench-Top

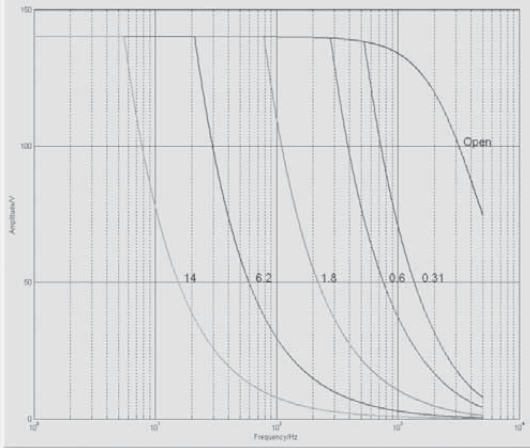
Accessories:

E-709.01
Adapter HD-Sub-D 26-pin to Sub-D 9-pin with I/O Lines, 0.5 m

E-709.02
Adapter Cable HD-Sub-D 26-pin to Open Leads, 1 m

The E-709 is also available for piezo systems with strain gauge and piezoresistive sensors.

the E-609 comes with an analog-only control input, maintaining the advantages of digital signal processing and parameter setting. This is designed for applications where analog control signals are readily available, (e.g. Autofocus).



E-709: operating limits with various PZT loads (open-loop), capacitance is measured in μF

Technical Data

Modell	E-709.CR / E-709.CRG
Function	Digital controller for single-axis piezo nanopositioning systems (.CR: OEM board)
Channels	1
Processor	DSP 32-bit floating point, 150 MHz
Sampling rate, servo-control	10 kHz
Sampling rate, sensor	10 kHz
Sensor	
Servo characteristics	P-I, 2 notch filter, sensor linearization
Sensor type	Capacitive sensors
Sensor bandwidth	5 kHz
Sensor resolution	16 bit
Ext. synchronization	No
Amplifier	
Output voltage	-30 V to +130 V
Peak output power	10 W (< 5 ms)
Average output power	5 W (> 5 ms)
Peak current	100 mA (< 5 ms)
Average current	50 mA (> 5 ms)
Current limitation	Short-circuit-proof
Resolution DAC	17 bit
Interfaces and operation	
Communication interfaces	USB, RS-232, SPI
Piezo / sensor connector	Sub-D-Special connector
I/O Connector	HD-Sub-D 26-pin, 1 analog input 0 to 10 V, 1 sensor monitor 0 to 10 V, 1 digital input (LVTTTL, programmable), 1 analog output, 5 digital outputs (LVTTTL, 3 predefined, 2 programmable)
Command set	PI General Command Set (GCS)
User software	PI MikroMove, NanoCapture
Software drivers	LabVIEW drivers, DLLs
Supported functionality	Wave generator, data recorder, auto zero, trigger I/O
Display	Status LED, overflow LED
Linearization	5th order polynomials
Target ground connector	- / yes
Miscellaneous	
Operating temperature range	12 to 50 °C (over 40 °C, max. av. power derated)
Dimensions	160 x 96 x 33 mm
Mass	260 g / 470 g
Motor voltage range	24 VDC
Max. power consumptions	24 W

Linear Actuators & Motors

Nanostelltechnik / Piezoelektronik

Piezo Flexure Stages / High-Speed Scanning Systems

Linear

Vertical & Tip/Tilt

2- and 3-Axis

6-Axis

Fast Steering Mirrors / Active Optics

Piezo Drivers / Servo Controllers

Single-Channel

Multi-Channel

Modular

Accessories

Piezoelectrics in Positioning

Nanometrology

Micropositioning

Index

E-500 - E-501

Module Survey & Ordering Examples

The following modules can be installed in E-500 / E-501 chassis:

■ **Amplifier modules**
(see page 6-23 ff.)

E-503.00 (E-503.00S)
LVPZT Amplifier Module,
3 Channels, -20 to +120 V,
3 x 14 W

E-505.00 (E-505.00S)
LVPZT Amplifier Module,
-20 to +120 V, 200 W, 1 Channel

E-507.00 (E-507.36)
HVPZT Amplifier Module,
-3 to -1100 V, 50 W, 1 Channel
or ± 250 V for Shear Actuators

■ **Display & DAC-Interface**
Modules (see page 6-26 ff.)

E-516.i1 / E-516.i3
20-bit DAC Interface/Display
Module, IEEE 488/RS-232, 1 or
3 Channels

E-515.01
Display Module for Piezo Vol-
tage/Displacement, 1 Channel

E-515.03
Display Module for Piezo Vol-
tage/Displacement, 3 Channels

■ **Sensor & Servo-Controller**
Modules (see page 6-22)

E-509.C1A
Piezo Sensor/Controller
Module, Capacitive Sensor,
1 Channel

E-509.C2A
Piezo Sensor/Controller
Module, Capacitive Sensor,
2 Channels

E-509.C3A
Piezo Sensor/Controller
Module, Capacitive Sensor,
3 Channels

E-509.S1
Piezo Sensor/Controller
Module, Strain Gauge Sensor,
1 Channel

E-509.S3
Piezo Sensor/Controller
Module, Strain Gauge Sensor,
3 Channels

E-509.L1
Piezo Sensor/Controller
Module, LVDT Sensor,
1 Channel

E-509.L3
Piezo Sensor/Controller
Module, LVDT Sensor,
3 Channels



E-507, p. 6-23



E-505, p. 6-25



E-503, p. 6-24



E-515, p. 6-28



E-516, p. 6-26



E-509, p. 6-22

Configuration Examples

■ LVPZT Amplifier, 3 Channels, (14 W) without Display:

1 x E-501.00 (E-500.00)
Modular Piezo Control System, 19" Basic Chassis

1 x E-503.00
LVPZT Amplifier Module, 3 Channels, 3 x 14 W

■ HVPZT Amplifier, 3 Channels, with DAC Interface & Display:

1 x E-500.00
Modular Piezo Control System, 19" Basic Chassis

3 x E-507.00
HVPZT Amplifier Module, 50 W

1 x E-516.i3
20-bit DAC Interface/Display Module, IEEE 488/RS-232, 3 Channels

■ HVPZT Amplifier & Position Servo-Controller (LVDT Sensors), 3 Channels, with Display & DAC Interface:

1 x E-500.00
Modular Piezo Control System, 19" Basic Chassis

3 x E-507.00
HVPZT Amplifier Module, 50 W

1 x E-509.L3
Piezo Sensor/Controller Module, LVDT Sensor, 3 Channels

1 x E-516.i3
20-bit DAC Interface/Display Module, IEEE 488/RS-232, 3 Channels

■ Closed-loop operation of P-733.2CL XY piezo stage (capacitive sensors) fastest possible step response, computer control:

1 x E-500.00
Modular Piezo Control System, 19" Basic Chassis

2 x E-505.00
LVPZT Amplifier Module, 200 W

1 x E-509.C2A
Piezo Sensor/Controller Module, Capacitive Sensor, 2 Channels

1 x E-516.i3
20-bit DAC Interface/Display Module, IEEE 488/RS-232, 3 Channels

■ Closed-loop operation of the P-733.2CL XY piezo stage (capacitive sensors) and P-721.CLQ PIFOC® objective positioner (capacitive sensor), static and/or slow operation, computer control, 9.5" chassis:

1 x E-501.00
Modular Piezo Control System, 9.5" Basic Chassis

1 x E-503.00
LVPZT Amplifier Module, 3 Channels, 3 x 14 W

1 x E-509.C3A
Piezo Sensor/Controller Module, Capacitive Sensors, 3 Channels

1 x E-516.i3
20-bit DAC Interface/Display Module, IEEE 488/RS-232, 3 Channels

■ Closed-loop operation of S-340 tip/tilt platform (LVDT sensors), shortest possible step response, external analog control:

1 x E-500.00
Modular Piezo Control System, 19" Basic Chassis

2 x E-505.00
LVPZT Amplifier Module, 200 W

1 x E-505.00S
LVPZT Driver Module, 100 V

1 x E-509.L3
Piezo Sensor/Controller Module, LVDT Sensor, 3 Channels

■ Closed-loop operation of P-733.2CL XY stage (capacitive sensors) and P-721.LLQ PIFOC® objective positioner (LVDT sensor), shortest possible step response, computer control:

1 x E-500.00
Modular Piezo Control System, 19" Basic Chassis

3 x E-505.00
LVPZT Amplifier Module, 200 W

2 x E-509.C1A
Piezo Sensor/Controller Module, Capacitive Sensor

1 x E-509.L1
Piezo Sensor/Controller Module, LVDT Sensor

1 x E-516.i3
20-bit DAC Interface/Display Module, IEEE 488/RS-232, 3 Channels

■ Closed-loop operation of 3 P-841.10 LVPZT translators (strain gauge sensors) static and medium dynamics operation, external analog control, future upgrade for high dynamics operation possible:

1 x E-500.00
Modular Piezo Control System, 19" Basic Chassis (can accommodate 3 x E-505, 200 W amplifiers)

1 x E-503.00
LVPZT Amplifier Module, 3 Channels, 3 x 14 W

1 x E-509.S3
Piezo Sensor/Controller Module, Strain Gauge Sensor, 3 Channels

Optional:

1 x E-515.03
Display Module for Piezo Voltage/Displacement, 3 Channels

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

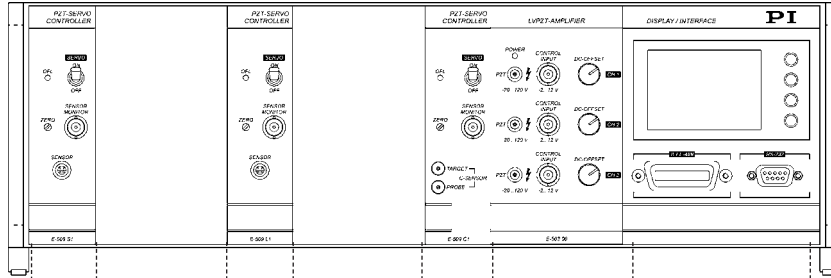
Index

E-500 - E-501

System Configuration

E-500, 19" Chassis Models

E-501, 9.5" Chassis



E-500 chassis with the following optional modules: E-503 LVPZT amplifier, three E-509 piezo servo-controllers (E-509.S1: strain gauge; E-509.L1: LVDT; E-509.C1A: capacitive sensor) and E-516.i3 20-bit DAC interface/display.

	Contr. Slot 3	Amplifier Slot 3	Contr. Slot 2	Amplifier Slot 2	Contr. Slot 1	Amplifier Slot 1	Display/Interface Slot
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Installable Amplifier Modules

E-503.00 (LV, 3 ch) / E-503.00S*							
E-505.00 (LV, 1 ch) / E-505.00S*							
E-507.XX (HV, 1 ch)							

Installable Sensor & Position Servo-Control Modules

E-509.C1A (Capacitive, 1 ch)							
E-509.L1 (LVDT, 1 ch)							
E-509.S1 (SGS, 1 ch)							
E-509.C2A (Capacitive, 2 ch)							
E-509.C3A (Capacitive, 3 ch)							
E-509.L3 (LVDT, 3 ch)							
E-509.S3 (SGS, 3 ch)							

Installable Display/Interface Modules

E-515 (1 / 3 ch)							
E-516 (1 / 3 ch)							

Minimal Configuration, PZT Amplifier Function only

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Extended Configuration, PZT Amplifier with additional Position Servo-Controller

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Extended Configuration, PZT Amplifier with additional Display (and interface, no Servo-Controller)

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Extended Configuration, PZT Amplifier with additional Servo-Controller and Display (and interface)

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Can be installed in E-500

Can be installed in E-501 or E-500

HV: High Voltage LV: Low Voltage

* For differential tip/tilt systems with one fixed voltage of +100 V.

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Hexapods / Micropositioning

Photonics Alignment Solutions

Motion Controllers

Ceramic Linear Motors & Stages

Index