

## E-509 PISeca™ Signal Conditioner / Piezo Servo Module 3-Channel Sensor Module with/without Servo-Controller, for E-500 System



The E-509.E3 module offers sensor signal read-out and servo control for three channels

- **E-509.E03: 3-Channel Signal Conditioner Module**
- **E-509.E3: 3-Channel Sensor Module with Additional Servo Controllers for Piezo Positioning Systems**
- **Integrated Linearization System (ILS) for Maximum Linearity**
- **Optional: Measurement Range**
- **Variable Bandwidth**
- **Plug-In Modules for E-500 / E-501 Chassis**

The analog E-509.Ex sensor electronics is specially designed for the PISeca™ D-510 series of single-electrode, capacitive position sensor probes. Based on the E-500 modular controller system, it provides three channels of analog output featuring very high linearity, exceptional long-term stability, sub-nanometer position resolution and bandwidths up to 10 kHz.

Two models are available: E-509.E03 is a signal conditioner module. In addition, the E-509.E3 version includes a full servo-controller. With it, the position values from external single-plate capacitive sensors can thus be used for servo-control of piezo nanopositioning systems.

The combination of sensor and electronics provides a system for capacitive displacement measurement with flexible high-end solutions for best linearity and highest resolution.

### Selectable Bandwidth and Measurement Range

The selectable bandwidth setting allows the user to adapt the system to different applications. For the highest accuracy and sub-nanometer resolution, the bandwidth can be limited to 300 Hz.

For high-dynamics applications, a bandwidth up to 10 kHz is possible, with a resolution still better than 4 nm.

Factory-set measurement ranges from 20 to 500 µm are possible, depending on the nominal measurement range of the selected sensor head.

### Factory Calibration for Improved Linearity

Highest possible linearity and accuracy are achieved with factory calibration of the sensor electronics for the particular measurement range. Factory calibration also optimizes parameters like ILS (linearization), gain and offset and eliminates cable capacitance influences.

### Position Servo Control with PISeca™

The position servo-control portion of the E-509 is identical for all versions, consisting of an analog P-I (proportional, integral) controller. Proportional and integral gain can be set internally. Control bandwidth can also be set. A notch filter allows operation of the piezo positioning system closer to its mechanical resonant frequency.

### Multi-Channel Measurements

The three channels of the PISeca™ E-509.Ex sensor electronics are automatically synchronized for the use in connected sensor systems.

### Ordering Information

**E-509.E3**  
PISeca™ Sensor / Piezo Servo-Control Module for Single-Electrode Capacitive Sensor Probes, 3 Channels

**E-509.E03**  
PISeca™ Modular Signal Conditioner Electronics for Single Electrode Capacitive Sensors, 3 Channels

### Accessories:

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

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

**E-515.03**  
Display Module for Piezo Voltage and Displacement, 3 Channels

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

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

**E-515.E3**  
Analog Output for Controller Signal, Plug-In Module, 3 Channels

**Ask about custom designs**

### Application Examples

- Semiconductor technology / test & measurement
- Data storage
- Automotive industry
- Metrology
- Precision machining



The E-509.E3 servo-controller module in an E-501 9.5" chassis with E-503 piezo amplifier module and E-516 PC-interface/display module provides servo-control of piezo nanopositioning systems with external PISeca™ D-510 capacitive 1-plate sensors

**Technical Data**

Model	E-509.E03	E-509.E3
Function	Signal conditioner electronics for PISeca™	Sensor / Servo-Controller Module for PISeca™
Channels	3	3
<b>Sensor</b>		
Servo characteristics	–	Analog proportional-integral (P-I) algorithm with notch filter
Sensor type	PISeca™ single-electrode, capacitive	PISeca™ single-electrode, capacitive
Sensor bandwidth	3 kHz 0.3 / 10 kHz (selectable)	3 kHz 0.3 / 10 kHz (selectable)
Measurement range extension factors*	2 / 2.5 / 5 (option)	2 / 2.5 / 5 (option)
Synchronization	3 synchronized channels	3 synchronized channels
<b>Electrical properties</b>		
Output voltage	0 to 10 V -5 to +5 V, -10 to 0 V (selectable)	0 to 10 V
Thermal drift	<1 mV / °C	<1 mV / °C
Resolution @ 300 Hz (RMS)	<0.001 % of measurement range	<0.001 % of measurement range
Resolution @ 3 kHz (RMS)	<0.0025 % of measurement range	<0.0025 % of measurement range
Linearity @ nominal range	<0.1 % (<0.2 % for D-510.020)	<0.1 % (<0.2 % for D-510.020)
<b>Interfaces and operation</b>		
Sensor connection	3 x LEMO ECP.00.650.NLL.543 socket, triaxial	3 x LEMO ECP.00.650.NLL.543 socket, triaxial
Signal output	LEMO 6-pin FGG.0B.306.CLAD56	LEMO 6-pin FGG.0B.306.CLAD56
Display	–	3 x Overflow LED
Supported functionality	ILS	ILS
<b>Miscellaneous</b>		
Operating temperature range	+5 to +40 °C	+5 to +40 °C
Dimensions	7T/3H	7T/3H
Target ground connector	3 x banana jack	3 x banana jack
Operating voltage	E-500 system	E-500 system (p. 2-142)

\*Extension factors to multiply by the nominal measurement range of the selected sensor head D-510, to be specified with order

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