# *Bedienungsanleitung*
# *Spannungsverstärker 5V10*

# *instruction manual*
# *voltage amplifier 5V10*

Bitte die Bedienungsanleitung vor dem Anschalten des Gerätes sorgfältig lesen. Beachten Sie bitte insbesondere die Sicherheitshinweise!

Read carefully before switching on the power! Please also see the instructions for safety while using piezoelectric actuators and power supplies!

CE

piezosystem jena
incredibly precise

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(deutsch)

Instruction manual pages 14 ... 24
(english)

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## 1. introduction

This manual describes the voltage amplifier 5V10 from ***piezosystem jena***. You will also find additional information regarding piezoelectric products.

Definition: All systems from ***piezosystem jena,*** such as electronics, actuators, and optical systems, are called units.

If you have any problems please contact the manufacturer of the system: ***piezosystem jena GmbH***, Stockholmer Strasse 12, 07747 Jena.
Phone: +49 36 41 66 88-0

## 2. certification of *piezosystem jena*

The company ***piezosystem jena GmbH*** has worked according to a DIN EN ISO 9001 certified quality management system since 1999. Its effectiveness is verified and proven by periodic audits by the TÜV.

This instruction manual includes important information for using piezo actuators. Please take the time to read this information. Piezo positioning systems are mechanical systems that are capable of the highest precision. Correct handling guarantees the maintenance of this precision over a long period of time.

## 3. declaration of conformity

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# CE Declaration of Conformity

The product

| | |
|---|---|
| Part number: | **E-304-10** |
| Product name: | **5V10** |
| Description: | Spannungsverstärker |

Manufacturer: ***piezosystem jena* GmbH**
Stockholmer Straße 12
07747 Jena

to which this declaration relates is in conformity with the following standards or normative documents:

**EN 50082, part 2**
**EN 55011, class B**
**EN 60204-1**
**EN 61010-1**
**EN 61326-1**

The declaration is world-wide valid as the manufacturer´s declaration of compliance with the requirements of the above mentioned national and international standards.

Declaration issued by:

***piezosystem jena* GmbH**
Dr. Bernt Götz
President
Stockholmer Straße 12
07747 Jena

Jena, 11 July 2012

EB4.14-21-01

phone: +49 (3641) 66880 • fax: +49 (3641) 668866 • info@piezojena.com • http://www.piezosystem.com

## 4. purchased part package

Please check the completeness of the delivery after receiving the shipment:

- piezo amplifier 5V10
- instruction manual

## 5. instructions for using piezoelectric elements and power supplies

- Piezoelectric actuators from ***piezosystem jena*** are controlled by voltages of up to 150 V. These values can be quite hazardous. Therefore, read the installation instructions carefully and ensure that only authorized personnel handle the power supply.
- After transportation, piezoelectric actuators should be allowed to adapt to room temperature for approximately 2 hours before being switched on.
- Piezoelectric actuators are made from ceramic materials, with and without metallic casings. The piezo-ceramic is a relatively brittle material. This should be noted when handling piezoelectric actuators. All piezo elements are sensitive to bending or shock forces.
- Due to the piezoelectric effect, piezoelectric actuators can generate electrical charges by changing the mechanical load or the temperature, or by such actions as those described above.
- Piezoelectric actuators are able to work under high compressive forces, but only actuators with pre-load can be used under tensile loads (these tensile forces must be less than the pre-load, given in the data sheet).
- Please note that the acceleration of the ceramic material (e.g., caused by fall down, discharging, or high dynamic application) can cause damage to the actuator.
- Heating of the ceramic material will occur during dynamic operation and is caused by structure conditional loss processes. This may cause failure if the temperature exceeds the specified values cited below.
- When temperature increases up to the Curie temperature (usual values approx. 140°C - 250°C), the piezoelectric effect disappears.
- Piezoelectric actuators, such as stacks or various tables, work electrically as a capacitor. These elements are able to store electrical energy over a long period of time, (up to some days) and the stored energy may be dangerous.

- If the actuator remains connected to the drive electronics, it is discharged within a second after shutdown and quickly reaches harmless voltage values.
- Piezoelectric actuators can only generate voltages by warming or cooling. The discharge potential should not be ignored due to the inner capacitance. This effect is insignificant at room temperature.
- Piezo actuators from ***piezosystem jena*** are adjusted and glued. Any opening of the unit will cause misalignment or possible malfunction, and will make the guarantee invalid.
- Please contact ***piezosystem jena***, or your local representative, if there are any problems with your actuator or power supply.

**Caution!** Shock forces may damage the built-in ceramic element. Please avoid such forces, and handle the units with care, otherwise the guarantee will become invalid.

## 6. safety instructions

**Icons:**

**RISK OF ELECTRIC SHOCK! Indicates that a risk of electric shock is present and the associated warning should be observed.**

**CAUTION! REFER TO OPERATOR´S MANUAL – Refer to your operator's manual for additional information, such as important operating and maintenance instructions.**

**RISK OF ELECTRIC SHOCK!** 

- Do not open the units! There are no user serviceable parts inside, and opening or removing covers may expose you to dangerous shock hazards or other risks. Refer all servicing to qualified service personnel.
- Do not spill any liquids into the cabinet or use the units near water.

**CAUTION!** 

- Allow adequate ventilation around the units so that heat can properly dissipate. Do not block ventilated openings or place the units near a radiator, oven, or other heat sources. Do not put anything on top of the units except those that are designed for that purpose (e.g. actuators).

- Only work with the units in a clean and dry environment! Only specially prepared units (e.g. actuators) can work under other conditions!
- Please only use original parts from ***piezosystem jena***. ***piezosystem jena*** does not give any warranty for damages or malfunction caused by additional parts not supplied by ***piezosystem jena***. Additional cables or connectors will change the calibration and other specified data. This can change the specified properties of the units and cause them to malfunction.
- Piezo elements are sensitive systems capable of the highest positioning accuracy. They will only demonstrate their excellent properties if they are handled correctly! Please mount them properly only at the special mounting points.
- Do not insert objects of any kind into the cabinet slots, as they may touch dangerous voltage points, which can be harmful or fatal, or may cause electric shock, fire, or equipment failure.
- Do not place heavy objects on any cables (e.g. power cords, sensor cables, actuator cables, optical cables). Damage may cause malfunction, shock, or fire!
- Do not place the units on a sloping or unstable cart, stand, or table as they may fall or not work accurately.

Immediately unplug your unit from the wall outlet and refer servicing to qualified service personnel under the following conditions:

- when the power supply cord or plug is damaged
- if liquid has been spilled or objects have fallen into the unit
- if the unit has been exposed to rain or water
- if the unit has been dropped or the housing is damaged

## 6.1 maintenance and inspection

**CAUTION!** 

- Before cleaning the exterior box of the voltage amplifier, turn off the power switch and unplug the power plug. Failure to do so may result in a fire or electrical shock.
- Clean the exterior box using a damp cloth that has been firmly wrung-out. Do not use alcohols, benzene, paint thinner, or other inflammable substances. If flammable substances come into contact with an electrical component inside the voltage amplifier, it may result in a fire or electrical shock.

## 6.2 environmental conditions

The amplifier can be used:

- indoors only
- at an altitude up to 2000 m
- at a temperature of 5 ... 35 °C
- at a relative humidity of 5 ... 95% (non-condensing)

The recommended environmental conditions:

- indoors only
- at an altitude up to 2000 m
- at a temperature of 20...22 °C
- at a relative humidity of 5 ... 80% (non-condensing)

## 7. instructions for checking the function of the system / quick start

When you open the package, please check to make sure all the necessary parts are complete (see packing list) and nothing is damaged.

Check the electronics and the actuator for any visible damage:

- The top and bottom plates of the actuator (if it does not have another shape) should be parallel each to each other, and not contain any scratches.
- If there is any damage to the system please contact our local representative immediately!
- If the packaging material is damaged please confirm this with the shipping company.

Before you switch on the system, please check**:**

- The main voltage supplied in your country is the same as installed for the external power supply (not included in the shipment).
- The secondary voltage (DC) matches with the amplifier (+5V).
- Connect the power cable.
- Connect the piezo-element by using the LEMO connector.

The offset is accomplished by the external offset (e.g. a load). Because of the fast motion of the actuator a noise, crack can be heard. This is normal and not a malfunction.

## 8. description of the voltage amplifier 5V10

### 8.1. common introduction

The voltage amplifier 5V10 was especially developed for one channel positioning tasks in optics, laser physics, microbiology, machining. With an output noise less then 3mV it is well suited for positioning in the sub-nm range. It is well suited for OEM applications.

## 8.2. technical data

| | |
|---|---|
| supply voltage [V] | 5V DC |
| max. current [mA] | <100 |
| dimensions w x d x h [mm] | 80 x 55 x 20 |
| mass [g] | 200 |
| channels | 1 |
| output power [W] | 1.5 |
| output current [mA] | 10 |
| output voltage [V] | 1 ... 150 |
| output connector (OUT) | LEMO 0S.302 |
| modulation voltage [V] | 0...5 BNC |
| inner resistance | 10kΩ |
| output noise | <3mV$_{RMS}$ |
| polarity | positiv |

*table 1: technical data*

## 8.3. initiation

Please connect the device with the wall outlet by using an external power supply. The actuators are driven by voltages up to +150V. Please pay attention to shock hazard protection.

## 8.4. service

The actuator is connected to the power supply by a LEMO socket. The rest position of the actuator is adjusted, if the external triggering signal (range of 0...+5V) at the MOD input connector (BNC) is 0V. To avoid damage to the actuators, it is recommended to adjust triggering signal in this way before switching on the amplifier. We recommend to switch on the amplifier approx. two hours before the measurement in the sub-µm range takes place to guarantee stable temperature circumstances. A constant temperature environment is necessary for precise positioning tasks. Please note, that a temperature change of ΔT = 5K will cause a 13µm increase in length of a 20cm steel rod. The special qualities of piezo-ceramics like hysteresis and creep can cause inaccuracies in

the case of non-observance. These basic qualities of piezo-elements are described in the "piezoline" tutorial in our catalogue. Do not hesitate to contact our staff, if you need further information. By increasing the external triggering voltage the motion of the actuator will be done. The motion depends on the actuator specs, please refer the hysteresis data curve for details.

## 8.5. modulation input: MOD

The motion of the actuator may be remote controlled by using this input. The control signal must be in the range of 0 ... +5V. Switching signals are suitable as well as signals, generated by a function generator.

## 8.6. actuator output: OUT

Please connect the piezo actuator by using this LEMO socket.

## 8.7. cable configuration of the external power supply

| Pin | Synonym | Description |
|---|---|---|
| **White** | **PVR** | operating voltage +5V |
| **Brown** | **GND** | Ground |
| **Green** | | not used |
| **Shield** | | connected with the Ground |

*table 2: pinning of the external power supply*

The equipment concept makes adaptations to customer preferences possible concerning the technical threshold values such as the main voltage or the output voltage. Please, contact our technical service department in order to discover the possibilities for your specific problem.

Adaptations are always to be paid by the customer**.**

## 9. your notes