

**Bedienungsanleitung**  
**Spannungsverstärkersystem ENT/ENV**  
**instruction manual**  
**voltage amplifier system ENT/ENV**



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

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



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## 1. introduction

This manual describes the voltage amplifier system ENT/ENV 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 works 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 time and read this information. Piezo positioning systems are mechanical systems with highest precision. Correct handling guarantees the precision over long time.

### 3. Declaration of conformity



## CE Declaration of Conformity

The product

Product name: **ENT / ENV**  
Description: voltage amplifier system

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, 26 April 2012

FB4.14-21-01

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#### 4. instructions for using piezo-electrical elements and power supplies

- Piezoelectric actuators from piezosystem jena are controlled by voltages up to 150V. These values can be quite hazardous. Therefore read the installation instructions carefully and only authorized personal should handle the power supply.
- After transportation, piezoelectric actuators should be allowed to adapt for approximately 2 hours to the room temperature 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 piezoelectrical actuators. All piezo-elements are sensitive to bending or shock forces.
- Due to the piezoelectric effect piezo-actuators can generate electrical charges by changing the mechanical load or the temperature or such actions described above.
- Piezoelectric actuators are able to work under high compressive forces, only actuators with pre-load can be used under tensile loads (these tensile forces must be less then 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 specified values cited below.
- With increasing temperature, up to the Curie temperature (usual values approx. 140°C - 250°C), the piezoelectric effect disappears.
- Piezoelectric actuators such stacks or various tables work electrically as a capacitance. These elements are able to store electrical energy over a long period (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.
- Piezo-actuators can generate voltages by warming or cooling only. The discharge potential should not be ignored due to the inner capacitance. This effect is insignificant at usual room temperature.
- Piezo-actuators from piezosystem jena are adjusted and glued. Any opening of the unit will cause misalignment or possible malfunction and the guarantee will be lost.

- 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 be lost.

## 5. 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).
- Work with the units only in a clean and dry environment! Only specially prepared units (e.g. actuators) can work under other conditions!
- Please use only 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 demonstrate their excellent properties only 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 any heavy objects on any cables (e.g. power cords, sensor cables, actuator cables, optical cables). Damage may cause malfunction or 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

## 5.1 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, this may result in a fire or electrical shock.

## 5.2 environmental conditions

The amplifier can be used:

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

The recommended environmental conditions:

- indoor only
- altitude up to 2000 m
- temperature: 20...22 °C
- relative humidity: 5 ... 80% (non-condensing)

## 6. 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 plate of the actuator (if it does not have another shape) should be parallel each to each other, without 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.

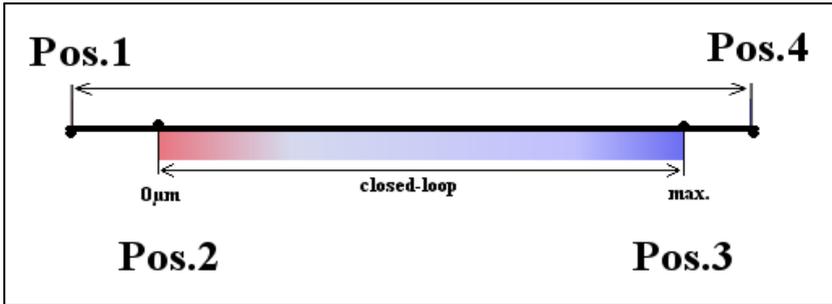
Before you switch on the system, please check:

- the power switch should be in the off position
- the main voltage supplied in your country is the same as installed for the system. (Check the voltage label on the backside of the electronics!)
- all potentiometers should be in maximum counter clockwise position
- the open/closed loop switch (if built in) is in the “closed loop” OFF position
- EDA switch (if built in) is in the position 1 (left)
- Connect the piezo-element. Connect the power cable.

Be sure the cables are connected properly to the electronics. If you use more than one actuator and / or multi channel electronics, match the serial number of the actuator to a corresponding label at the electronic module.

- Switch the system on (power = on). The red LED indicates the power supply is working. After a short delay time the amplifier modules are ready (green LED).
- open loop configuration: the display shows the output voltage
- closed loop configuration: the display shows the minimum position of the actuator (Pos. 1) in open loop operation (see sketch 1)

- Turn the potentiometer into the maximum clockwise position (Pos. 4). The display shows the maximum position. The total motion in open loop regime is Pos.4 – Pos. 1.



*sketch 1: motion open loop closed loop*

- Switch on the closed loop for this channel (closed loop = on).
- The actuator moves to its zero position in closed loop regime (Pos. 2). The display shows  $0.0\mu\text{m}$  ( $\pm 0.1$ ) if there is no offset to the system. Because of the fast motion of the actuator to Pos. 2 a noise or crack can be heard. This is normal and not a malfunction.
- Turn the potentiometer to the clockwise position. The actuator makes its maximum movement in closed loop regime (Pos. 3). The total motion in closed loop regime is Pos. 3 - Pos. 2. The specific value for that axis is given in the calibration curve of the actuator.
- Turn the potentiometer to its counter clockwise zero position, switch off the closed loop switch (closed loop = off).
- If the procedure is done you can switch off the electronics. Before you switch off the electronics, be sure that the potentiometer is in the left zero position and the closed loop switch is switched off!

If an EDA board is installed:

- Please connect the PC and the EDA board by using an the interface cable (both units must be switched off).
- Switch on both units.
- Please use a standard terminal program to operate the EDA board via your PC (The terminal program is part of your operating system normally, please refer your OS manual). Parameter: COMx:9600,n,8,1.

- by pressing the PUSH RESET button on the EDA board the red LED flash and the terminal program will submit the EDA version and the firmware number.

## **7. description of the voltage amplifier**

### **7.1. common introduction**

The voltage amplifier system ENT / ENV was specifically developed for positioning tasks.

The voltage amplifier system ENV was developed for one or more dimensional positioning requirements in optics, laser physics, microbiology, machining, etc.. With an output noise lower than 0.3mV, it is well suited for positioning in the sub-nm range. This amplifier can also be manufactured for the 19" casing.

The system consists of various modules, which can be combined. This allows you to customise your set of electronics. A complete system consists of at least one main supply ENT and one amplifier module ENV, wired in the casing.

It is possible to operate the amplifier module remotely by using the MOD (modulation input) socket. There is safety wiring integrated, which is helpful in avoiding voltage peaks during switching. Another safety guard avoids high voltages to the piezo actuator to prevent the damaging of the piezo-element.

The digital EDA board is available with RS232 and/or IEEE488 interface line.

Manual control can be done by using a 10-turn potentiometer for each channel.

The ENV voltage amplifiers have an excellent low noise behavior which allows fine positioning tasks in the sub-nm range.

Please note: when using a module "EDA" to remote the amplifier, the modulation input and the offset potentiometer will be disabled during the remote mode is active.

## 7.2. technical data

### 7.2.1. suitable casing

dimensions 28 TE / 3HE	
BxTxH [mm] standard	195 x 343 x 158 (incl. foot 8mm)
BxTxH [mm] small	164 x 272 x 140 (incl. foot 7mm)
dimensions 42 TE / 3HE	
BxTxH [mm] standard	265 x 343 x 158 (incl. foot 8mm)
BxTxH [mm] small	235 x 272 x 140 (incl. foot 7mm)
dimensions 63 TE / 3HE	
BxTxH [mm] standard	373 x 343 x 158 (incl. foot 8mm)
BxTxH [mm] small	342 x 272 x 140 (incl. foot 7mm)
dimensions 84 TE / 3HE	
BxTxH [mm] standard	480 x 343 x 158 (incl. foot 8mm)
BxTxH [mm] small	448 x 272 x 140 (incl. foot 7mm)
BxTxH [mm] double high	480 x 343 x 290 (incl. foot 8mm)
BxTxH [mm] rack	483 x 272 x 133

table 1: technical data suitable casing

(1 TE = 5.08 mm; 3 HE = 129 mm)

### 7.2.2. main power supply

main voltage	115V / 60Hz	230V / 50Hz
ENT 40		
fuse	2 AT	1 AT
current [A]	2	1
power ENT40 [W]	25	
width	14 TE = 71mm	
ENT 150		
fuse	2 AT	1 AT
current [A]	2	1
power ENT150 [W]	50	
width	14 TE = 71mm	
ENT 400		
fuse	Si1: 1 AT Si6: 4 AT	Si1: 1 AT Si6: 2 AT
current [A]	4	2
power ENT400 [W]	100	
width	18 TE = 91mm	

table 2: technical data main supply

The ENT module was specifically developed to operate the ENV modules of **piezosystem jena**. It is not recommended to be used it in combination with any other electrical devices. Replace damaged fuses only with same values.

Don't hesitate to contact our staff, if you have any question.

## 7.2.3. voltage amplifier module

### 7.2.3.1. module ENV 40

power [W]	max. 6
width of the module itself	14 TE = 71mm
output voltage [V]	-10 ... 150
permanent output current [mA]	40
stability at constant environmental conditions	typ. <1mV
noise output voltage	0.3mV <sub>RMS</sub> @ 500 Hz
modulation input (MOD) [V]	0...10, BNC
input resistance [kΩ]	10
DC Level	10-turn potentiometer
LC Display (shows V in open loop configuration, μm in closed loop configuration)	3.5 digits
display (LEDs)	green LED for ON red LED for Out Of Range
connector for piezo element	LEMO 0S.302
monitor output (MON) [V]	-1 ... 15, BNC (output resistance 100kΩ)
special features	protection circuit against voltage peaks by switching on and off the system, over voltage protection (OOR)

table 3: technical data voltage amplifier module ENV40

### 7.2.3.2. module ENV 300

power [W]	max. 39
width of the module itself	14 TE = 71mm
output voltage [V]	-20 ... 130
permanent output current [mA]	300
noise output voltage	0.3mV <sub>RMS</sub> @ 500 Hz
modulation input (MOD) [V]	0...10, BNC
input resistance [kΩ]	10
DC OFFSET	10-turn potentiometer
LC Display (shows V in open loop configuration, μm in closed loop configuration)	3.5 digits
display (LEDs)	green LED for ON red LED for Out Of Range
connector for piezo element	LEMO 0S.302
monitor output (MON) [V]	-2 ... 13, BNC (output resistance 100kΩ)
special features	protection circuit against voltage peaks by switching on and off the system over voltage protection (OOR) overheating and short circuit protection soft start

table 4: technical data voltage amplifier module ENV300

### 7.2.3.3. module ENV 800

power [W]	max. 104
width of the module itself	14 TE = 71mm
output voltage [V]	-20 ... 130
permanent output current [mA]	800
noise output voltage	0.3mV <sub>RMS</sub> @ 500 Hz
modulation input (MOD) [V]	0...10, BNC
input resistance [kΩ]	10
DC OFFSET	10-turn potentiometer
LC Display (shows V in open loop configuration, μm in closed loop configuration)	3.5 digits
display (LEDs)	green LED for Ready red LED for <u>Out Of Range</u>
connector for piezo element	LEMO 0S.302
monitor output (MON) [V]	-2 ... 13, BNC (output resistance 100kΩ)
special features	protection circuit against voltage peaks by switching on and off the system over voltage protection (OOR) overheating and short circuit protection soft start

table 5: technical data voltage amplifier module ENV800

### 7.2.3.4. module ENV \*\* SG

You can read the common technical data in chapter ENV40, ENV300 and ENV800. Additional technical data's you find in the following table.

width of the module itself	20TE = 101mm
connector for measuring system	LEMO 0S.304
display (LEDs)	green LED for CL ON green LED for ON red LED for <u>Out Of Range</u>
button „closed loop“	button for switching closed loop on or off
monitor output (MON) [V]	0...10, BNC (output resistance <1kΩ)
adjustment of display-ZERO	user adjustable display value for closed loop zero position
type of feedback controller	PID
measurement system	strain gauges
time for regulation	typ. 0.01 ... 0.4 s (depending on actuator and voltage amplifier)

table 6: technical data module ENV \*\* SG

### 7.2.3.5. module ENV \*\* CAP

You can read the common technical data in chapter ENV40, ENV300 and ENV800. Additional technical data's you find in the following table.

width of the module itself	20TE = 101mm
connector for measuring system	LEMO 0S.650
display (LEDs)	green LED for CL ON green LED for ON red LED for <u>Out Of Range</u>
button „closed loop“	button for switching closed loop on or off
monitor output (MON) [V]	0...10, BNC (output resistance <1k $\Omega$ )
adjustment of display-ZERO	user adjustable display value for closed loop zero position
type of feedback controller	PID
measurement system	capacitive
time for regulation	typ. 0.01 ... 0.4 s (depending on actuator and voltage amplifier)

*table 7: technical data module ENV \*\* CAP*

### 7.2.3.6. module ENV \*\* CLE

You can read the common technical data in chapter ENV40, ENV300 and ENV800. Additional technical data's you find in the following table.

width of the module itself	20 TE = 71mm
connector for measuring system	ODU 4pin
display (LEDs)	red LED for ON red LED for UDL ( <u>Under Load</u> ) red LED for OVL ( <u>Over Load</u> )
switch "closed loop"	switch for switching closed loop on or off
monitor output (MON) [V]	0...10, BNC (output resistance <1k $\Omega$ )
adjustment of display-ZERO	user adjustable display value for closed loop zero position
type of feedback controller	PID
measurement system	external
time for regulation	typ. 0.01 ... 0.4 s (depending on actuator and voltage amplifier)

*table 8: technical data module ENV \*\* CLE*

### 7.2.3.7. module ENV 40 C/CSG/CCP

You can read the common technical data in chapter ENV40. Additional technical data's you find in the following table.

width of the module itself	6TE = 30,5mm
connector for piezo element	LEMO 0S.302
connector for measuring system	LEMO 0S.304 (CSG) LEMO 0S.650 (CCP)
display (LEDs)	red LED for ON red LED for UDL ( <u>Under Load</u> ) red LED for OVL ( <u>Over Load</u> )
DC OFFSET	3/4-turn potentiometer
switch "closed loop"	switch for switching closed loop on or off
type of feedback controller	PID
measurement system	none (ENV40C) strain gauge (ENV40CSG) capacitive (ENV40CCP)
modulation input (MOD) [V]	0...10, SMB (input resistance 10k $\Omega$ )
monitor output (MON) [V]	ENV40C: -1..15, SMB (output resistance 100k $\Omega$ ) ENV40CSG / ENV40CCP: 0..10, SMB (output resistance <1k $\Omega$ )

table 9: technical data voltage amplifier ENV40C / CSG / CCP

### 7.2.3.8. module ENV 40 nanoX \*\*

These amplifiers were developed for use with nanoX-positioners only. They are not suited to drive other piezo actuators.

The amplifiers of the series „nanoX“ differ from the standard ENV40 (or rather SG/CAP) amplifiers in the following points.

power [W]	max. 12
output voltage [V]	-10 ... 150
output nanoX [V]	150 ... -10
output current [mA]	2 * 40
connector for piezo-element	ODU series L (3pin)

table 10: technical data module ENV 40 nanoX \*\*

### 7.2.3.9. module ENV 300 nanoX \*\*

These amplifiers were developed for use with nanoX-positioners only. They are not suited to drive other piezo actuators.

The amplifiers of the series „nanoX“ differ from the standard ENV300 (or rather SG/CAP) amplifiers in the following points.

power [W]	max. 39
output voltage [V]	-20 ... 130
output nanoX [V]	130 ... -20
output current [mA]	2 * 150
connector for piezo-element	ODU series L (3pin)

*table 11: technical data module ENV 300 nanoX \*\**

### 7.2.3.10. module ENV 800 nanoX \*\*

These amplifiers were developed for use with nanoX-positioners only. They are not suited to drive other piezo actuators.

The amplifiers of the series „nanoX“ differ from the standard ENV800 (or rather SG/CAP) amplifiers in the following points.

power [W]	max. 104
output voltage [V]	-20 ... 130
output nanoX [V]	130 ... -20
output current [mA]	2 * 400
connector for piezo-element	ODU series L (3pin)

*table 12: technical data module ENV 800 nanoX \*\**

## 7.2.4. measurement module ECP1

width of the module itself	6TE = 30,5mm
connector for measurement	LEMO 0S.650
range	200µm or 500µm
sensitivity	100mV/µm or rather 40mV/µm
output	±10V
power supply	±15VDC / ±50mA
resolution	≤0.005% FS
temperature range	sensor: -50 ... +150 °C cable: -50 ... +150 °C electronic: +10 ... +40 °C
humidity range	5 ... 95% (not condensing)
sensor diameter	10mm
weight (sensor + cable)	56g
cable length	1.6m
min. diameter measure object	12mm
temperature stability electronic	≤ 0.005% FS / K
long time stability	≤ 0.04% FS / Month
european standards	EN 50081-1, EN 50082-2
protection standard (electronic and sensor)	IP 40
linearity	typ. < 0.05 % FS
repeatability	typ. < 0.04 % FS

table 13: technical data measurement module ECP1

## 8. operation

### 8.1. initiation

First check that your system uses the correct supply voltage (see the label on the backside of the casing). Please connect the device with the wall outlet by using the power cord. The piezo-actuators use operation voltages up to +150Volt. Please be careful for any electric hazards. Do not remove the actuator plug until the amplifier has been switched off. Piezoelectric actuators such stacks or various tables work electrically as a capacitance. These elements are able to store electrical energy over a long period (up to days) and the stored energy may be dangerous.

When using the ENV 40 CSG/CCP please be sure to notice that before switching on the system, that the closed-loop switch is set to the "off" position.

Turn all potentiometers to maximal counter clockwise position. Remove external modulation signals from MOD plug. Make sure all cable from the actuators (OUT and SENSOR) are plugged into the correct amplifier.

Switch on the system, the LED on the power supply will light up. After short initialization time the amplifier will be ready (LED "ON" lights up). Turn on closed-loop if required.

## 8.2. common operation

### 8.2.1. power supply ENT \*\*\*

On the front panel is the main switch for the ENT/ENV system along with an LED signal, which indicates that the power supply is working.

### 8.2.2. ENV display, LEDs

After turning on, the left "ON" LED announces the amplifier is ready.

**open loop configuration (ENV40 / ENV300 / ENV800 / ENV40C / ENV \*\* nanoX):**

The display shows the output voltage always.

**closed loop configuration (ENV \*\* SG/CAP):**

The display shows the non-controlled actuator motion [ $\mu\text{m}$ ] immediately. The actuator is outside of the controlled range by adjusting the potentiometer to the extreme counter clockwise position (most negative point of the total control range (Pos.1 to Pos.4, see sketch 1). If it is then switched to closed loop, the actuator moves to the zero closed loop position (Pos.2), the display shows 0.0 ( $\pm 0.1$ )  $\mu\text{m}$ .

Depending on the position set currently, the actuator may carry out a jump. This is because the closed loop control range is approximately 80% of the open loop control range.

When the potentiometer "DC-Level" is turned to the max. clockwise position, the controlled maximum motion is covered (Pos.3) and shown in the display. The value depends on the specifications of the actuator and can vary depending on actuator model.

The red "OOR"-LED announces a malfunction or overload. Remove the modulation signal from the MOD socket. If the "OOR" is still on check whether removing the sample loaded on the actuator will solve this problem. Please, try to avoid overload in this case.

If the "OOR" is still on immediately switch off the system and contact your local representative for support. It is possible that the actuator protection mechanisms are not functioning properly.

display / LED	closed loop system	open loop system
3.5 LC display	displays the motion in $\mu\text{m}$	shows the output voltage in V
green LED for "CLON"	display closed loop ON/OFF	n.c.
green LED for "ON"	There is a time delay of about 2 sec. after switching on the power supply to avoid voltage peaks. If the green LED is on, the amplifier is ready to work.	
red LED for <u>Out Of Range</u>	It is possible to generate voltages higher than 150V by adding modulation input voltage and offset level. These voltages can cause damages to the actuator. A protection circuit cuts off higher voltages and the red LED indicates this status.	

table 14: ENV display / LEDs

### 8.2.3. potentiometer "DC-Level"

Manual adjustment of the offset voltage.

### 8.2.4. modulation input: MOD

An analog modulation signal of 0 to +10V can be driven into this socket to realize a remote-controlled operation. A sum of the MOD socket voltage and the offset voltage set at the potentiometer "DC-level" occurs. The local-mode voltage is also in the range of 0 to +10V. Both, externally driven voltages and internal OFFSET must be between 0 and +10V. Voltages outside of the permissible field are signaled by the OOR-LED.

### 8.2.5. monitor output socket: MON

In open loop configuration the MON output shows a tenth of the output voltage.

In closed loop configuration the MON output shows the sensor signal. When closed loop is turned on the voltage is in the range from 0 to +10 Volt. In open loop mode the voltage can be outside this range. Values below 0 Volt and above 10 Volts belong to the motion reserve for closed loop operation.

To control the motion especially in dynamic application the use of an oscilloscope is recommended. Please take care that the used measuring device has an inner resistance of at least  $10\text{M}\Omega$ . The MON output is not short-proof. Do not drive any voltages into the MON output.

### 8.2.6. actuator socket: OUT

Output socket for the actuator, voltage -10 ... +150V (ENV40) or rather -20...+130V (ENV300 / ENV800).

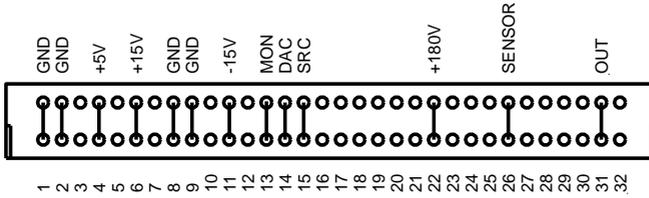
### 8.2.7. adjustment of the ZERO position (ZERO)

It allows to adjust the display value for closed-loop zero position (only in closed loop systems).

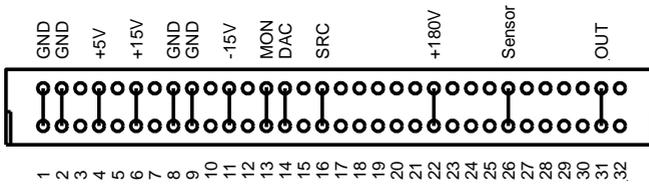


## 9.2. wiring connector voltage amplifier module

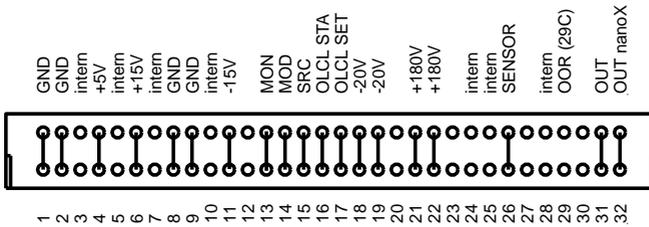
### 9.2.1. module ENV 40 (CL)



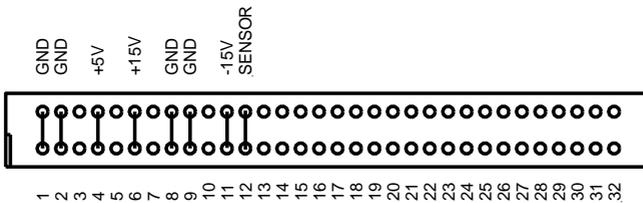
### 9.2.2. module ENV 40 C / CSG / CCP



### 9.2.3. module ENV 300 / ENV 800



### 9.2.4. measuring system ECP1



### 9.3. possibilities of the error correction

In some rare cases it might happen that the main fuse breaks when the system is switched on. Before opening the power supply be sure that the power cord is removed from the system. The main fuse is placed inside the power supply module. Use only fuses with same value for replacement. Do not hesitate to ask your local representative for support.

Please protect the power cords from harm or shorts, which could cause malfunction of the equipment. Large strains on the cords can cause interruptions. In open loop configuration the output voltage can be read from the display without plugging in the actuator.

<b>error</b>	<b>possible correction</b>
nothing happens after switching on the device	check power cord and the fuse inside the ENT module, make sure the system is unplugged before opening
erroneous, illogical display values	check the sensor cable and connection
ON-LED don't works	please check the power supply
LED "OOR", "OVL" or "UDL" is illuminated	check the position of the adjustable potentiometer and the amplitude of the modulation signal. High modulating voltage overdrives the amplifier. Decrease the modulation signal or reduce the control voltage until OOR-LED is off.

*table 15: possible error correction*

**The equipment is calibrated before delivery for the appropriate actuator with integrated measuring system. An exchange of the actuator-amplifier-combination leads to inaccuracies in setting movement and positioning accuracy is lost. If the equipment is damaged during effort of another actuator, no assurance can be undertaken!**

The equipment customization makes adaptations according customer preferences that are possible in terms of the technical threshold values e.g. the main voltage or the output voltage. Please contact our technical service department in order to find out the possibilities for your specific application. Special adaptations must be paid for by the customer.

## 10. your notes