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Instruction Manual

Voltage Amplifier 12V40 Series



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1. Introduction

This manual describes the voltage amplifier series 12V40 from **piezosystem jena**. This series contains following amplifiers: 12V40, 12V40SG, 12V40CLE, 24V40, 24V40SG, 24V40CLE, 12V40C und 12V40CSG. This manual also offers you additional information about piezoelectric products.

2. Certification of **piezosystem jena**

The company **piezosystem jena** GmbH has been certified by DIN EN ISO 9001:2000.

ZERTIFIKAT



für das Managementsystem
nach DIN EN ISO 9001:2008

Die regelwerkskonforme Anwendung wurde nachgewiesen und wird gemäß Zertifizierungsverfahren bescheinigt für das Unternehmen



piezosystem jena GmbH
Prüssingstraße 27
07745 Jena

Geltungsbereich

**Entwicklung, Fertigung und Verkauf piezoelektrischer
Verstellsysteme und optischer Faserschalter.**

Zertifikat-Registrier-Nr. TIC 15 100 9679

Gültig bis 2012-09-11

Audit Bericht Nr: 3330 20YF J0

Erstzertifizierung 1999

Diese Zertifizierung wurde gemäß TIC-Verfahren zur Auditierung und Zertifizierung durchgeführt und wird regelmäßig überwacht.

A. Drechsel

TÜV Thüringen e.V.
Zertifizierungsstelle für
Systeme und Personal



Jena, 2009-12-14



TGA-ZM-03-06-00



Zertifizierungsstelle des TÜV Thüringen e.V. • Ernst-Ruska-Ring 6 • D-07745 Jena • ☎ +49 3641 390740 • ✉ zertifizierung@tuv-thueringen.de

3. Declaration of conformity

CE Declaration of Conformity

with EU directive 2002/95/EGT from January 27th 2003

Typ Reference: **12V40; 12V40 SG**

Description: piezo amplifier

Manufacturer: **piezosystem jena** GmbH
Prüssingstraße 27
07745 Jena

Herewith we can confirm that the part mentioned above has been manufactured since April 1st 2006 according to the EU guidelines for reduction of hazardous substances

2002/95/EG "RoHS"

Declaration issued by:



piezosystem jena GmbH
Dr. Bernt Götz
President
Prüssingstraße 27

07745 Jena

Jena, 24. January 2011

4. Instructions for using piezoelectrical 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. 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 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 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 as 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 become 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.

5. Safety instructions

- Do not open the units! There are no user serviceable parts inside. Opening or removing covers may expose you to dangerous shock hazards or other risks. For servicing please refer to qualified service personnel.
- 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 accessory designed for that purpose (e.g. actuators).
- Do not spill any liquids into the cabinet or use the units near water.
- 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.
- 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.
- Piezoelements 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.
- 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. 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 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.
- Connect the power cable.
- Connect the piezo-element by using the LEMO connector.
- Turn off closed-loop (12V40SG / 12V40CLE).
- Switch on the power supply. The red LED indicates the amplifier is working.
- By turning the potentiometer to its maximum position, the actuator will reach its maximum movement.
- Offset is accomplished by the offset potentiometer or external offset (e.g. a load). Because of the fast motion of the actuator a noise or crack can be heard. This is normal and not a malfunction.
- Turn the potentiometer into the minimum position.
- 12V40SG / 12V40CLE:
Turn on closed-loop. Turn the potentiometer into the maximum position, the actuator does its maximum closed-loop movement. Turn the potentiometer into the minimum position and switch off closed-loop.
- Switch off the power supply. Take care the potentiometer is in minimum position.
- The function check is completed now.

7. How to operate the 12V40

The voltage amplifier series 12V40 was especially developed for one channel positioning tasks in optics, laser physics, microbiology, machining. With an output noise less than 0.3mV it is well suited for positioning in the sub-nm range. It is well suited for OEM applications.

7.1. Technical data

supply voltage	+12V DC (optional +24V DC)
max. current	1A @ 12V DC (0.5A @ 24V DC)
dimensions BxHxT [mm]	173mm x 130mm/105mm x 45mm
mass [g]	800
channels	1
output power [W]	6
output current [mA]	40
output voltage (OUT)	-10...+150 V
output connector (OUT)	LEMO 0S.302
modulation input (MOD)	0...+10V SMB
inner resistance	10k Ω
monitor voltage (MON)	-1...+15V SMB (0..+10V on SG / CLE) 0...+10V rear panel
Inner resistance	100k Ω (SMB) / 10k Ω (rear panel)
output noise	<0,3 mV _{RMS} @ 500Hz
bandwidth [Hz]	400
polarity	positiv
measuring system	strain gauges (12V40SG) external (12V40CLE)
measuring system connector	LEMO 0S.304 (12V40SG) ODU 4pin series L (12V40CLE)

table 1: technical data 12V40 series

7.2. Initialization

Please connect the device with the wall outlet by using the external power supply. It must be suitable to the type of amplifier. The power LED ON lights up after the power supply is switched on. Pay attention to the correct assignment of modulation signal and monitor signal on the front-panel SMB sockets, if you use this.

The actuators are driven by voltages up to +150V. Please pay attention to shock hazard protection.

7.3. Service

The actuator is connected to the amplifier by a LEMO socket. The potentiometer is used to adjust the level of the output voltage (OFFSET). The rest position of the actuator is hereby adjusted. An external triggering signal in the range of 0...+10V (MOD input socket) can control the output voltage. Utilizing this input high dynamic scanning functions are possible.

To avoid damage to the actuators, it is recommended to adjust the potentiometer to the maximum counter clockwise position before switching on the amplifier.

By superposition of the modulating voltage and adjusted offset, voltages up to 160V might occur. This operating state is to be avoided to protect the ceramics and increase the MTBF. In addition, the OVL-LED lights up in the case of a limit error. No automatic disconnection of the overvoltage occurs in that case! To guarantee stable temperature circumstances, we recommend to switch on the amplifier approx. 2 hours before the measurement in the sub- μ m range takes place. A constant temperature environment is necessary for precise positioning tasks. Please note, that a temperature change of $\Delta T = 5K$ will cause a $13\mu m$ 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 nonobservance. These basic qualities of piezo-elements are described in the "piezoline" tutorial in our catalog. Do not hesitate to contact our staff, if you need further information.

After switching ON, the red LED indicates "ready to operate". If the OFFSET potentiometer is in the max. counter clockwise position, the actuator is in the rest position. By turning the potentiometer into the max. clockwise position, the max. motion will be done. The motion depends on the actuator specs, please refer to the hysteresis data curve for details.

The red OVL-LED indicates overload, the red UDL-LED underload. Please avoid over- & underload in these cases or switch off the device, if the LED is still lighted.

7.4. SMB modulation input: MOD

The motion of the actuator may be remotely controlled by using this input. The control signal must be in the range of 0 ... +10V. There is an internal addition of the MOD signal and the adjusted OFFSET potentiometer. If there is an HIGH TTL level at the Pin8 of the rear panel connector, OFFSET and MOD (modulation input) are switched off. The remote control via Pin7 of the rear panel connector is active and possible.

7.5. SMB monitor output socket: MON

12V40:

The output voltage in ratio 10:1 (-1 ... +15V) is available at this socket and can be monitored by using an analogue oscilloscope. This is especially recommended for dynamical operation. Pay attention to the inner resistance of the monitor output, only high ohmic measurement devices (>100k Ω) should be used. The output is short protected, please avoid injected voltages.

12V40SG / 12V40CLE:

The measuring voltage (0...10V) is available at this socket and can be monitored by using an analogue oscilloscope. This is especially recommended for dynamical operation. Pay attention to the inner resistance of the monitor output, only high ohmic measurement (>100k Ω) devices should be used. The output is short protected, please avoid injected voltages.

7.6. Actuator socket: OUT

Please connect the actuator by using this socket.

7.7. Switch closed loop (12V40SG / 12V40CLE)

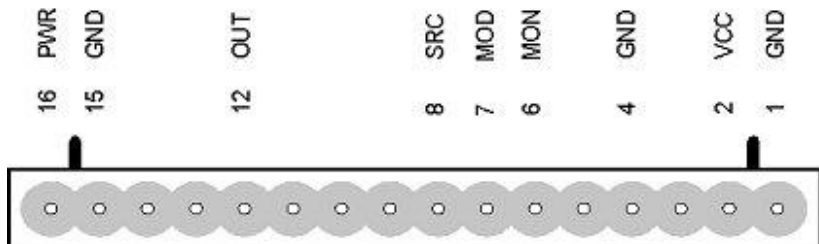
Using this switch the closed loop operation can be turned on. The amplifier 12V40SG includes an electronic closed-loop and a strain gauge measurement system. The 12V40CLE uses a measuring system which is combined with the actuator. This allows to compensate drift and hysteresis of the piezo actuator. Please take care of settling time when using in dynamic operation.

7.8. Wiring of the rear panel connector

To realize OEM applications, all main control signals are available at the rear panel connector too.

Pin	name	description
1,4	GND	ground (Signal)
2	VCC	+5V output, for switching SRC
6	MON	monitor signal 0...+10V
7	MOD	modulation input 0...+10V
8	SRC	source, choice of the amplifier control by HIGH or LOW TTL level HIGH: Pin 7 is active, OFFSET potentiometer and MOD (modulation input) at the front panel are switched off LOW: Pin 7 is not active, motion of the actuator will be controlled by the OFFSET potentiometer and the MOD (modulation input) at the front panel
12	OUT	output voltage Uout -10...+150V (* option)
15	GND	ground (operating voltage)
16	PWR	+ operating voltage

table 2: pin wiring of the rear panel connector (12V40 / SG / CLE)

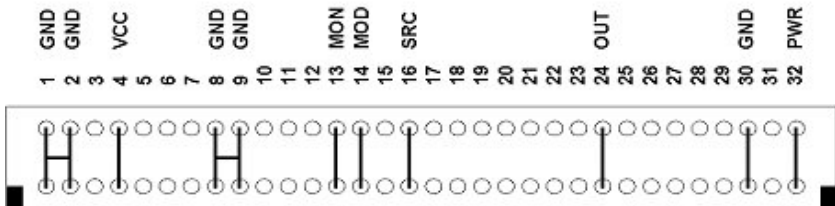


* option: is set at the factory, must be specified when ordering

The voltage amplifier 12V40C/ CSG do not have a casing. They should be integrated into customer systems for OEM applications.

Pin	name	description
1,2,8,9	GND	ground (Signal)
4	VCC	+5V output, for switching SRC
13	MON	monitor signal 0...+10V
14	MOD	modulation input 0...+10V
16	SRC	source, choice of the amplifier control by HIGH or LOW TTL level HIGH: Pin 7 is active, OFFSET potentiometer and MOD (modulation input) at the front panel are switched off LOW: Pin 7 is not active, motion of the actuator will be controlled by the OFFSET potentiometer and the MOD (modulation input) at the front panel
24	OUT	output voltage Uout -10...+150V (* option)
30	GND	ground (operating voltage)
32	PWR	+ operating voltage

table 3: pin wiring of the rear panel connector (12V40C / 12V40CSG)



* option: is set at the factory, must be specified when ordering

7.9. Possibilities of the error correction

Please check the power cord at first, if the system does not works properly.

error	possible correction
ON-LED is off	please check the power supply
OVL or UVL-LED flash	over- or underload, please check the modulation input and offset

table 4: possibilities of the error correction

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

Any adjustments necessary are to be paid by the costumer.

8. Your notes



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