

12V40 piezo-amplifier

- closed casing
- 12Volt power supply
- excellent cost effectiveness
- small dimensions

application:

- driving piezoelements
- space-saving format
- OEM-applications

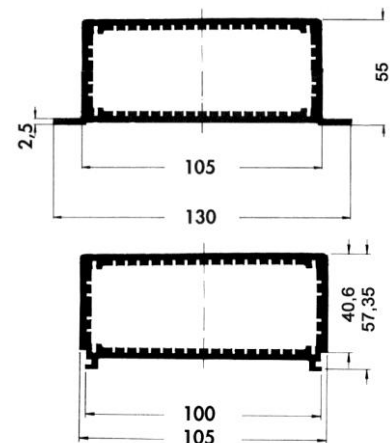
The voltage amplifier **12V40** is well suited for low voltage piezo elements. Two different types of casing are available. The amplifiers requires only 12V DC for supply. The amplifier can be controlled via MOD input (front- or backside). The output voltage can be supervised on the monitor output. Special circuits are integrated to protect the piezo element from voltage peaks and too high voltages. Due to very low voltage noise of only 0.3mV_{PP} this amplifier is well suited for sub-nm positioning tasks. All sockets are also available on the backside so this amplifiers can be integrated as an OEM-product easily.

technical data:

output power	6W
output voltage	-10 ... +150V
output current (continuous)	40mA (±10%)
voltage noise	0.3mV _{RMS} @500Hz
modulation voltage (protected)	0 ... 10V SMB / 0 ... 10V (back panel)
input resistance	10 kΩ
DC-offset	3/4 turn potentiometer
output connector	LEMO 0S.302
monitor output	-1 ... 15V SMB (front panel) / 0 ... 10V (back panel)
inner resistance	100kOhm SMB (front panel)/10kOhm (back panel)
dimensions	181mm x 130mm x 45mm (screw slot version) 181mm x 105mm x 45mm (plug-in version)
specials	turn on delay overdrive protection (UDL/OVL) also available with measuring system and closed-loop



Abb. 1: amplifier in screw-slot casing



- part-nr. E-440-011 [12V] (screw slot)
- part-nr. E-440-012 [12V] (plug-in)
- part-nr. E-440-031 [24V] (screw slot)
- part-nr. E-440-032 [24V] (plug-in)

Rev. 04.12.2007DW

12V40 SG piezo-amplifier

- ◆ 1-channel unit, closed casing
- ◆ 12 Volt power supply (24 Volt optional)
- ◆ integrated measuring system and closed-loop controller
- ◆ manual and external operation
- ◆ excellent cost effectiveness

applications:

- driving piezoelements with position feedback sensors
- dynamic applications
- OEM-applications



fig.1 12V40 SG (screw-slot casing)

The voltage amplifier **12V40 SG** is well suited for low voltage piezo elements with the strain gauge measurement system. Two different types of casing are available. The amplifier requires only 12V DC (optional 24V DC) for supply. The amplifier can be controlled via MOD input (front or back). The output voltage can be supervised on the monitor output. Special circuits are integrated to protect the piezo element from voltage spikes and excessive voltages. This amplifier is well suited for sub-nm positioning tasks due to a very low voltage noise of only 0,3mVRMS. Using the electrical positioning control prevents creep and hysteresis typical of piezos. All sockets are also available on the back so this amplifier can be easily integrated into an OEM-product.

technical data:

power supply
output power
output voltage
output current (permanent)
voltage noise
modulation input
input resistance
DC-Offset
output connector (piezo)
output sensor
monitor output
output resistance
dimensions (L x W x H)
specials

part.-no. **E-440-111 [12V]** (screw-slot)
 E-440-112 [12V] (plug-in)
 E-440-131 [24V] (screw-slot)
 E-440-132 [24V] (plug-in)

+12V (1A); +24V (0,5A) DC
6W
-10...150V
40mA
< 0,3mVRMS @ 500 Hz
0 ... 10V SMB* / 0 ... 10V**
10 kΩ
3/4 turn potentiometer
LEMO 0S.302
LEMO 0S.304
0 ... 10V SMB* / 0 ... 10V**
100 kΩ SMB* / 10 kΩ **
181 x 130/105 x 45mm
turn on delay
overdrive protection (UDL/OVL)

* front ** back

Rev. 12/4/07DW

types of casings:

case:	part. no.	dimensions [mm]
screw-slot	E-440-111 [12V] E-440-131 [24V]	
plug-in	E-440-112 [12V] E-440-132 [24V]	

typical parameter of example configurations:

12V40 SG + PA 100/14 SG (P-159-01)

nonlinearity*	< 0,7%
repeatability*	< 0,05%
motion open loop (+20/-10%)	100 μm
motion closed loop	80μm
step response @100% motion, 20g load*	< 60 ms

* data for closed loop mode

12V40 C piezo-amplifier

- ◆ 1-channel-19" slot card
- ◆ 12 Volt power supply (24 Volt optional)
- ◆ manual and external operation
- ◆ excellent cost effectiveness

applications:

- driving piezoelements
- dynamic applications
- OEM-applications



fig.1: 12V40 C

The voltage amplifier **12V40 C** is well suited for low voltage piezo elements. The amplifier requires only 12V DC (optional 24V DC) for supply and has been designed as a 19" slot card. The amplifier can be controlled via MOD input (front or back). The output voltage can be supervised on the monitor output. Special circuits are integrated to protect the piezo element from voltage spikes and excessive voltages. This amplifier is well suited for sub-nm positioning tasks due to a very low voltage noise of only 0,3mV_{RMS}. All sockets are also available on the back so this amplifier can be easily integrated into an OEM-product.

technical data:

part-no. **E-301-21 [12V]**
E-446-110 [24V]

power supply	+12V (1A); +24V (0,5A) DC
output power	6W
output voltage	-10 ... 150V
output current (permanent)	40mA
voltage noise	< 0,3mV _{RMS} @ 500 Hz
modulation input	0 ... 10V SMB* / 0 ... 10V**
input resistance	10 kΩ
DC-Offset	3/4 turn potentiometer
output connector (piezo)	LEMO 0S.250
monitor output	-1 ... 15V SMB* / 0 ... 10V**
output resistance	100kΩ SMB* / 10kΩ**
dimensions (L x W x H)	19" module, 3HE 6TE x 160mm (eurocard)
specials	overdrive protection (UDL/OVL) also available with measuring system and closed-loop

* front ** back

REV: 29-10-2004 SF ÄZO

12V40 CSG piezo-amplifier

- ◆ 1-channel unit, closed casing
- ◆ 12 Volt power supply (24 Volt optional)
- ◆ integrated measuring system and closed-loop
- ◆ manual and external operation
- ◆ excellent cost effectiveness



fig.1 12V40 CSG

applications:

- driving piezoelements with position feedback sensors
- dynamic applications
- OEM-applications

The voltage amplifier **12V40 CSG** is well suited for low voltage piezo elements with the strain gauge measurement system. The amplifier requires only 12V DC (optional 24V DC) for supply and has been designed as a 19" slot card. The amplifier can be controlled via MOD input (front or back). The output voltage can be supervised on the monitor output. Special circuits are integrated to protect the piezo element from voltage spikes and excessive voltages. This amplifier is well suited for sub-nm positioning tasks due to a very low voltage noise of only 0,3mV_{RMS}. Using the electrical positioning control prevents creep and hysteresis typical of piezos. All sockets are also available on the back so this amplifier can be easily integrated into an OEM-product.

technical data:

**part.-no. E-301-21 [12V]
E-446-110 [24V]**

power supply	+12V (1A); +24V (0,5A) DC
output power	6W
output voltage	-10...150V
output current (permanent)	40mA
voltage noise	< 0,3mV _{RMS} @ 500 Hz
modulation input	0 ... 10V SMB* / 0 ... 10V**
input resistance	10 kΩ
DC-Offset	3/4 turn potentiometer
output connector (piezo)	LEMO 0S.250
output sensor	LEMO 0S.304
monitor output	0 ... 10V SMB* / 0 ... 10V**
output resistance	100kΩ SMB* / 10kΩ**
dimensions (L x W x H)	19" modul, 3HE 6TE x 160mm (eurocard)
specials	turn on delay overdrive protection (UDL/OVL)

* front ** back

REV: 26-10-2004 SF ÄZO

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Bedienungsanleitung Spannungsverstärker 12V40 Serie

instruction manual voltage amplifier 12V40 series



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!



**Bedienungsanleitung Seite 3 ... 18
(deutsch)**

**instruction manual pages 20 ... 32
(english)**

Deutsche Version: 04.12.2007 von DW
english version: 2007-12-04 by DW

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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. 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.

2. certification of piezosystem jena

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



3. Declaration of conformity

EU-Declaration of conformity

This certificate is issued for the system:
voltage amplifier 12V40 / 12V40SG

manufactured at:
piezosystem jena GmbH
Pruessingstrasse 27
07745 Jena / Germany

The system as described above herewith complies with the
requirements of the European standards as follows:

EN 55011, class B

EN 50082 (DIN VDE 0875 part 11) group 1, part 2

declaration issued by:
piezosystem jena GmbH

(head of the electronic R&D department
Jena, Feb.15th, 2001

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 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

- 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.
- 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).

- 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, 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.

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 (opt. +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 12V40SG / 12V40CLE) 0 ... 10V backside
Inner resistance	100k Ω (SMB) / 10k Ω (backside)
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 170V 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! We recommend you switch on the amplifier approx. 2 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 $\Delta T = 5\text{K}$ will cause a $13\mu\text{m}$ 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 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 backside connector, OFFSET and MOD (modulation input) are switched off. The remote control via Pin7 of the backside 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. Especially at dynamical operation it is worth to do it. Pay attention to the inner resistance of the monitor output, only high ohmic measurement ($>100\text{k}\Omega$) devices 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. Especially at dynamical operation it is worth to do it. Pay attention to the inner resistance of the monitor output, only high ohmic measurement ($>100\text{k}\Omega$) 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)

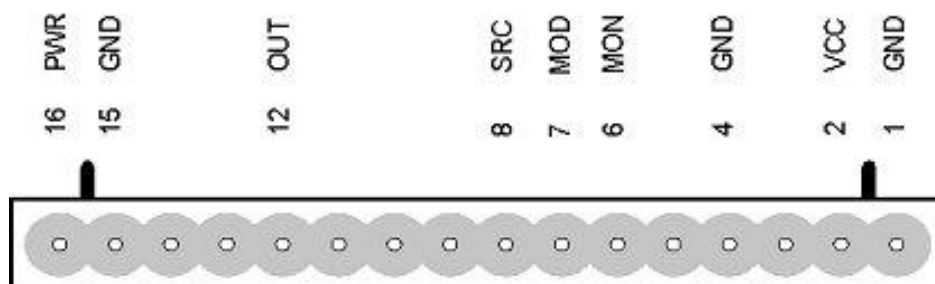
Using this switch the closed loop operation can be turned on. The amplifier 12V40SG includes an electronic closed-loop and a strain gauge measurement system. The 12V40CLE uses a measuring system which is combined with the actuator. This allows to compensate drift and hysteresis of the piezo actuator.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

7.8. wiring of the backside connector

To realize OEM applications, all main control signals are available at the backside 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 U_{out} -10 ... 150V (works only if J1 is closed)
15	GND	ground (operating voltage)
16	PWR	+ operating voltage

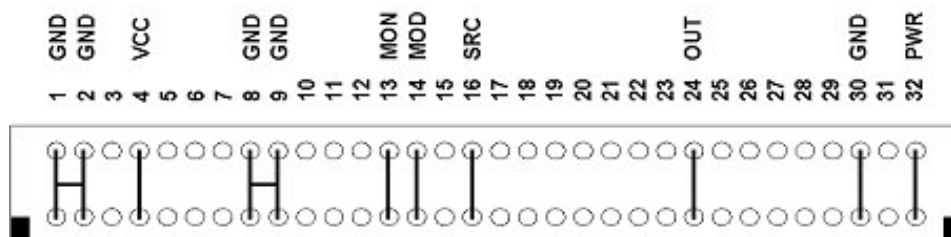
table 2: pin wiring of the backside connector (12V40 / SG / CLE)



The voltage amplifier 12V40C/ -CSG/ -CLE are do not have a casing. They should be integrated into costumer 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 U_{out} -10 ... 150V (works only if J1 is closed)
30	GND	ground (operating voltage)
32	PWR	+ operating voltage

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



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 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.

Any adjustments necessary are to be paid by the costumer.

8. your notes