

Electronic Supplies for Piezomechanics: Technical Data



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Analog Amplifiers SVR

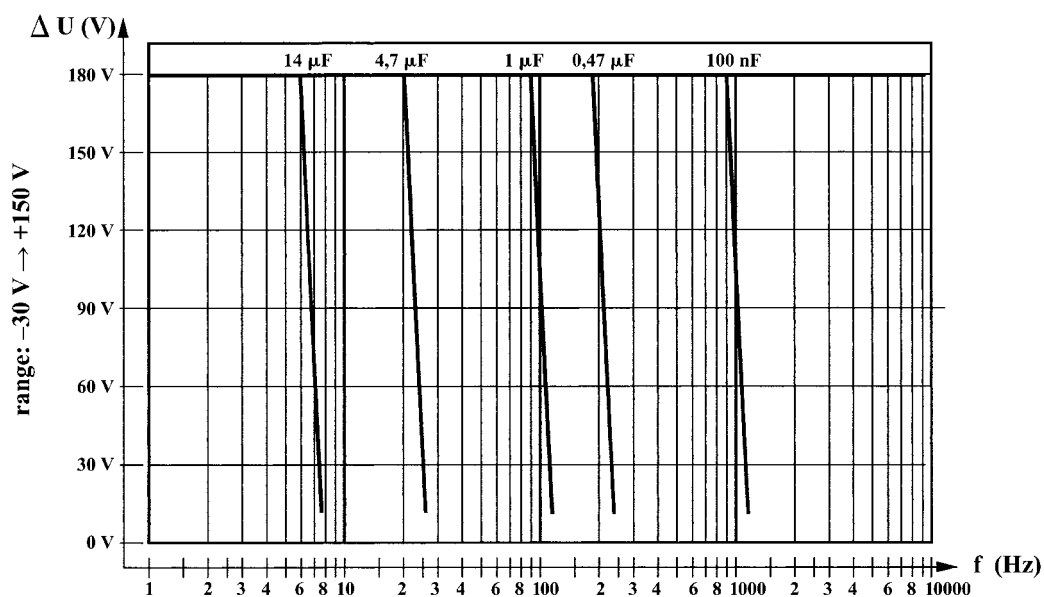
Low voltage/high voltage types available
 Lowest noise levels
 Semibipolar operation
 for enhanced actuator stroke/force generation

SVR 150/1 (single channel)
SVR 150/3 (3 independent channels)

Voltage range:
 -30 V thru +150 V (semibipolar)

Manual setting of DC-Offset
 (superimposed to external signal)

Variable attenuation



Input:

Signal: +/-5 V (+/-10 V with attenuation)
 Impedance: 5 kOhms
 Connector: BNC

Output:

Connector: BNC
 Voltage total: -30 V thru +150 V
 DC-Offset range: -30 V thru +150 V
 Gain: 30 (without attenuation)
 Max. current: 60 mA
 Noise: 0.3 mVpp (for 4.7 μFarad load)
 Display: LCD
 Dimensions W x D x H (mm):
 single channel: 165 x 200 x 65
 3-channels: 260 x 320 x 155
 Weight:
 single channel: 1.75 kg
 3-channels: 4.7 kg

Additional features of 3 channel SVR 150/3 amplifier:

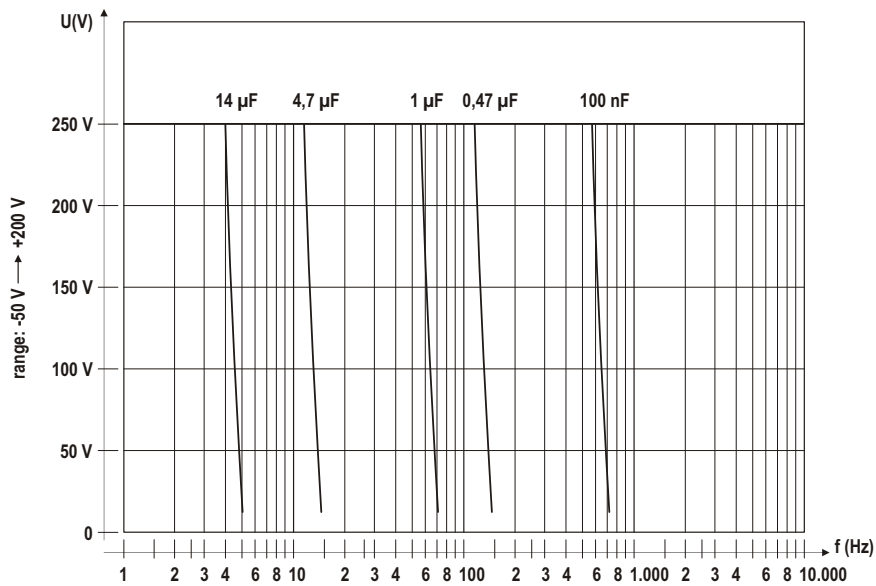
Monitor BNC output per channel:
 shows 1:1000 piezo voltage
 LC-Display per channel

SVR 200/1 (single channel)
SVR 200/3 (3 independent channels)

Voltage range:
 -50 V thru + 200 V

Manual setting of DC-Offset
 (superimposed to external signal)

Variable attenuation



Input:

Signal: +/-5 V (+/-10 V with attenuation)
 Impedance: 5 kOhms
 Connector: BNC

Output:

Connector: BNC
 Voltage total: -50 V thru +200 V
 DC-Offset range: -50 V thru +200 V
 Gain: 40 (without attenuation)
 Max. current: 45 mA
 Noise: 1 mVpp (for 4 μFarad load)
 Display: LCD
 Dimensions W x D x H (mm):
 single channel: 165 x 200 x 65
 3-channels: 260 x 320 x 155
 Weight:
 single channel: 1.75 kg
 3-channels: 4.7 kg

Additional features of 3 channel SVR 200/3 amplifier:

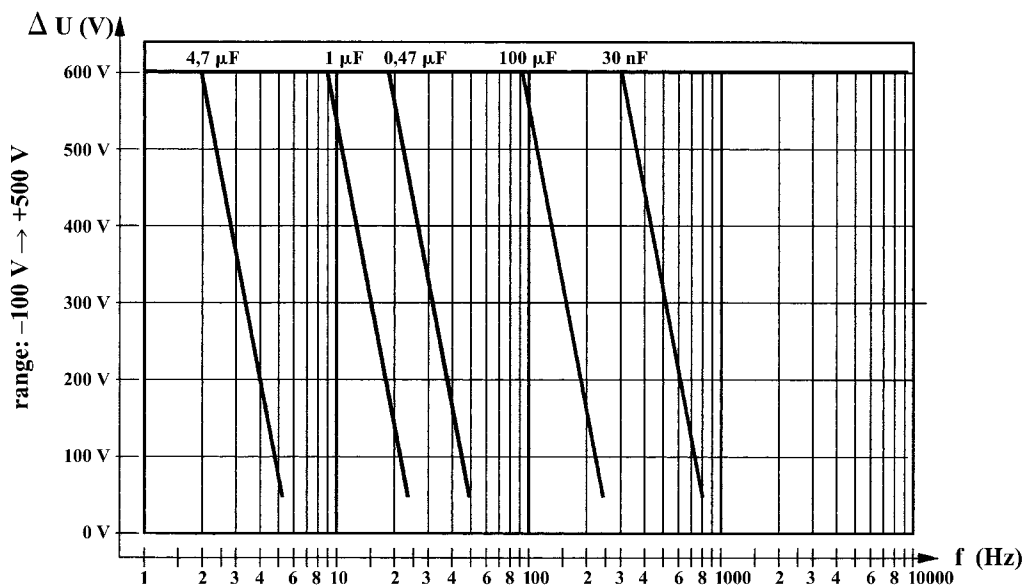
Monitor BNC output per channel:
 shows 1:1000 piezo voltage
 LC-Display per channel

SVR 500/1 (single channel)
SVR 500/3 (3 independent channels)

Voltage range:
 -100 V thru + 500 V

Manual setting of DC-Offset
 (superimposed to external signal)

Variable attenuation



Input:

Signal: +/-5 V (+/-10 V with attenuation)
 Impedance: 5 kOhms
 Connector: BNC

Output:

Connector: BNC
 Voltage total: -100 V thru +500 V
 DC-Offset range: -100 V thru +500 V
 Gain: 100 (without attenuation)
 Max. current: 15 mA
 Noise: 1 mVpp (for 1 μFarad load)
 Display: LCD
 Dimensions W x D x H (mm):
 single channel: 165 x 200 x 65
 3-channels: 260 x 320 x 155
 Weight:
 single channel: 1.75 kg
 3-channels: 4.7 kg

Additional features of 3 channel SVR 500/3 amplifier:

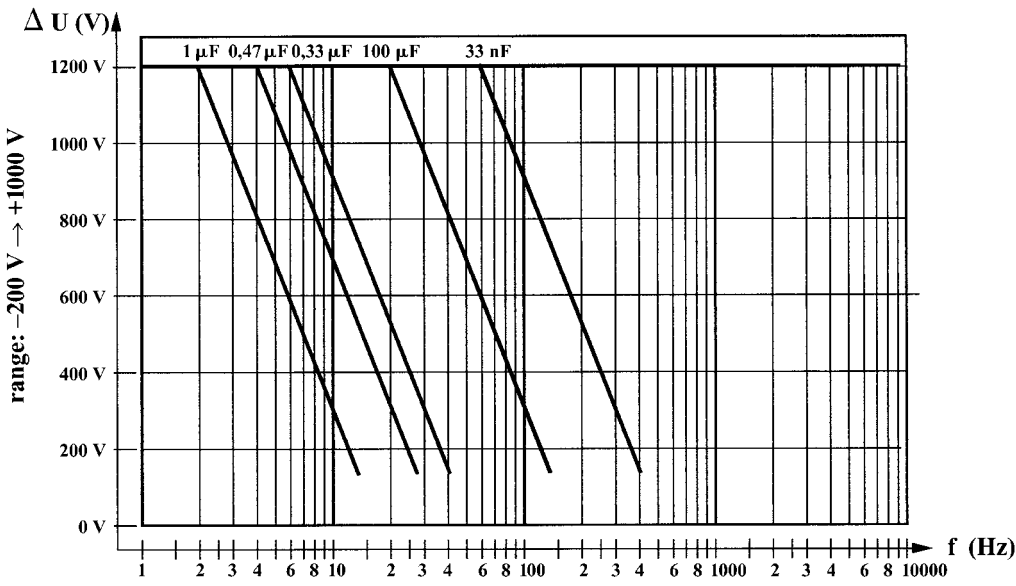
Monitor BNC output per channel:
 shows 1:1000 piezo voltage
 LC-Display per channel

SVR 1000/1 (single channel)
SVR 1000/3 (3 independent channels)

Voltage range:
 -200 V thru +1000 V

Manual setting of DC-Offset
 (superimposed to external signal)

Variable attenuation



Input:

Signal: +/-5 V (+/-10 V with attenuation)
 Impedance: 5 kOhms
 Connector: BNC

Output:

Connector: Lemo OS.250
 Voltage total: -200 V thru +1000 V
 DC-Offset range: -200 V thru +1000 V
 Gain: 200 (without attenuation)
 Max. current: 8 mA
 Noise: approx. 1 mVpp
 (for 0.47 μFarad load)
 Display: LCD
 Dimensions W x D x H (mm):
 single channel: 165 x 200 x 65
 3-channels: 260 x 320 x 155
 Weight:
 single channel: 1.75 kg
 3-channels: 4.7 kg

Additional features of 3 channel SVR 1000/3 amplifier:

Monitor BNC output per channel:
 shows 1:1000 piezo voltage
 LC-Display per channel

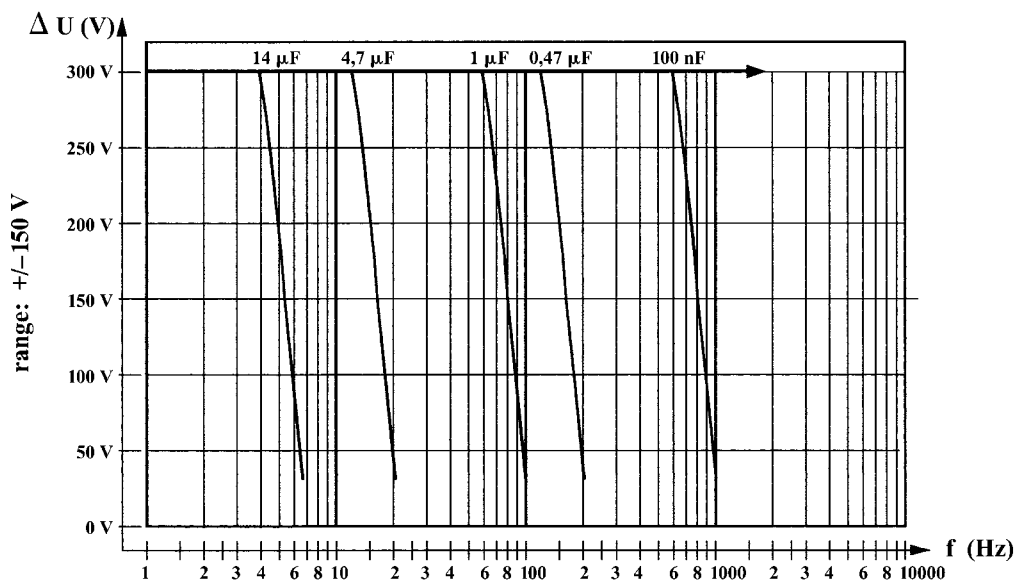
Bipolar Analog Amplifiers SVR

For operation of piezo bimorphs
 Bipolar stacks
 Shear elements
 Other symmetric voltage activation

SVR 150bip/1 (single channel)
SVR 150bip/3 (3 independent channels)

Voltage range:
 -150 V thru +150 V

Manual setting of DC-Offset
 (superimposed to external signal)



Input:

Signal: +/-5 V (+/-10 V with attenuation)
 Impedance: 5 kOhms
 Connector: BNC

Output:

Connector: BNC
 Voltage total: -150 V thru +150 V
 DC-Offset range: -150 V thru +150 V
 Gain: 30 (without attenuation)
 Max. current: 30 mA
 Noise: 0.3 mVpp (for 4.7 μFarad load)
 Display: LCD
 Dimensions W x D x H (mm):
 single channel: 165 x 200 x 65
 3-channels: 260 x 320 x 155
 Weight:
 single channel: 1.75 kg
 3-channels: 4.7 kg

Additional features of 3 channel SVR 150bip/3 amplifier:

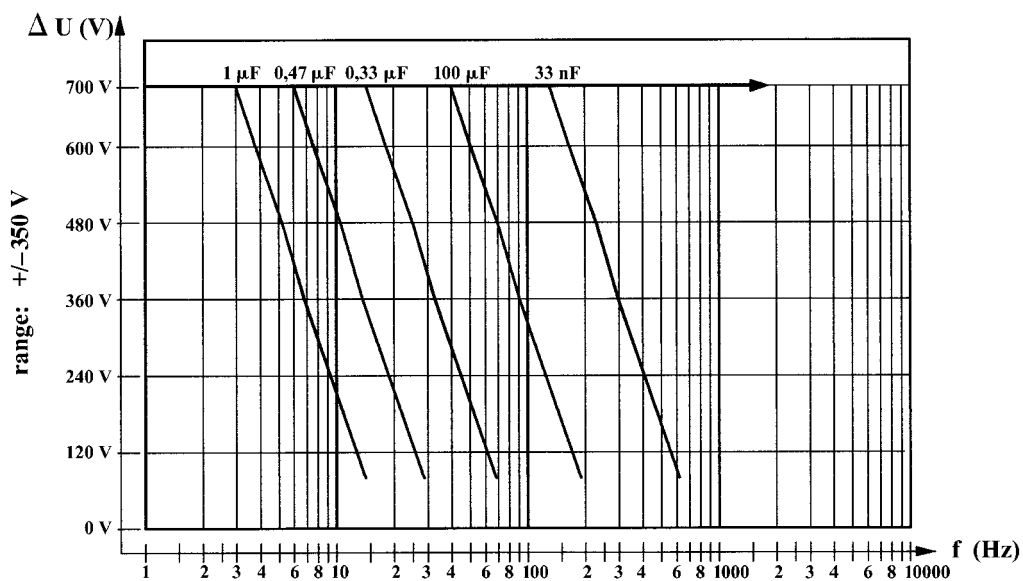
Monitor BNC output per channel:
 shows 1:1000 piezo voltage
 LC-Display per channel

**SVR 350 bip/1 (single channel)
SVR 350 bip/3 (3 independent channels)**

Voltage range:
-350 V thru +350 V

Manual setting of DC-Offset
(superimposed to external signal)

Variable attenuation



Input:

Signal: +/-5 V (+/-10 V with attenuation)
Impedance: 5 kOhms
Connector: BNC

Output:

Connector: BNC
Voltage total: -350 V thru +350 V
DC-Offset range: -350 V thru +350 V
Gain: 70 (without attenuation)
Max. current: 15 mA
Noise: 1 mVpp (for 1 μFarad load)
Display: LCD
Dimensions W x D x H (mm):
single channel: 165 x 200 x 65
3-channels: 260 x 320 x 155
Weight:
single channel: 1.75 kg
3-channels: 4.7 kg

**Additional features of
3 channel SVR 350bip/3 amplifier:**

Monitor BNC output per channel:
shows 1:1000 piezo voltage
LC-Display per channel

Analog Power Amplifiers LE

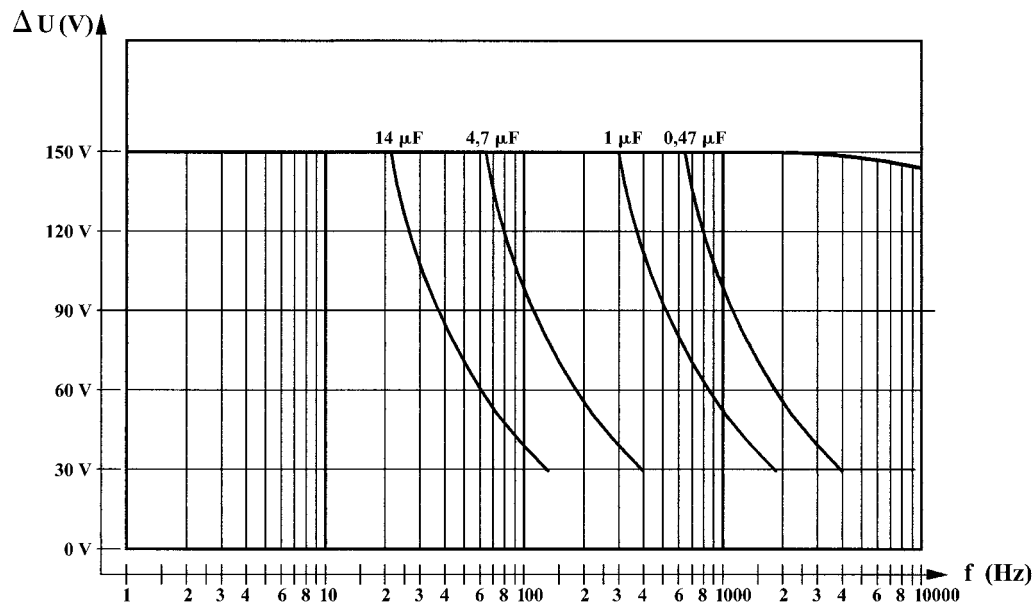
Unipolar devices for voltages +150 V and +200 V
Increased current output for increased dynamics
Lowest noise levels

LE 150/025 (single channel)

Voltage range:
0 V/+150 V

Manual setting of DC-Offset
(superimposed to external signal)

Variable attenuation



Input:

Signal: ± 5 V (± 10 V with attenuation)
Impedance: 5 kOhms
Connector: BNC

Output:

Connector: BNC
Voltage total: 0 V thru +150 V
DC-Offset range: 0 V thru +150 V
Gain: 30 (without attenuation)
Peak current: 250 mA (for 200 msec)
Average current: 70 mA
Noise: 5 mVpp (for 4.7 μ Farad load)
Display: LCD
Dimensions W x D x H (mm):
260 x 320 x 155
Weight: 4.6 kg

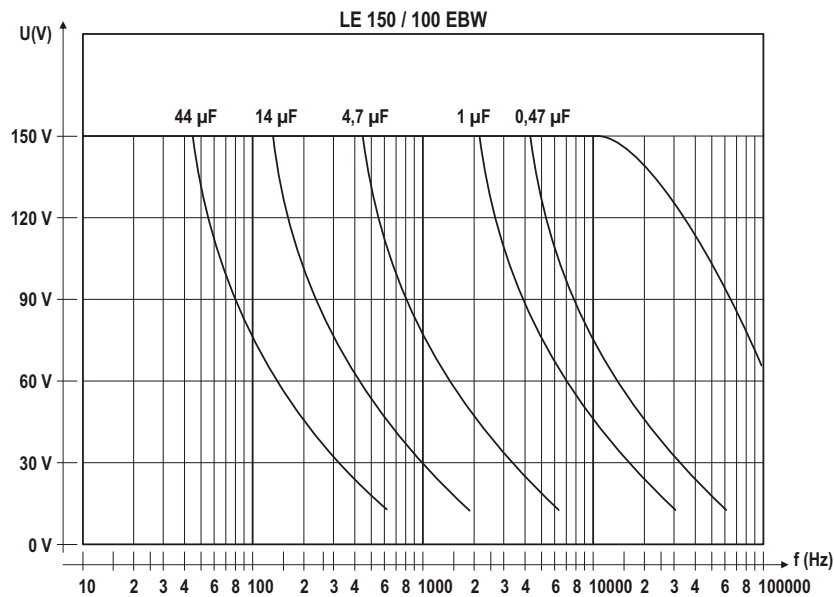
LE 150/100 EBW

Voltage range:
0 V/+150 V

Manual setting of DC-Offset
(superimposed to external signal)

Variable attenuation

70 kHz bandwidth (-3 dB)



Input:

Signal: ± 5 V (± 10 V with attenuation)
Impedance: 5 kOhms
Connector: BNC

Output:

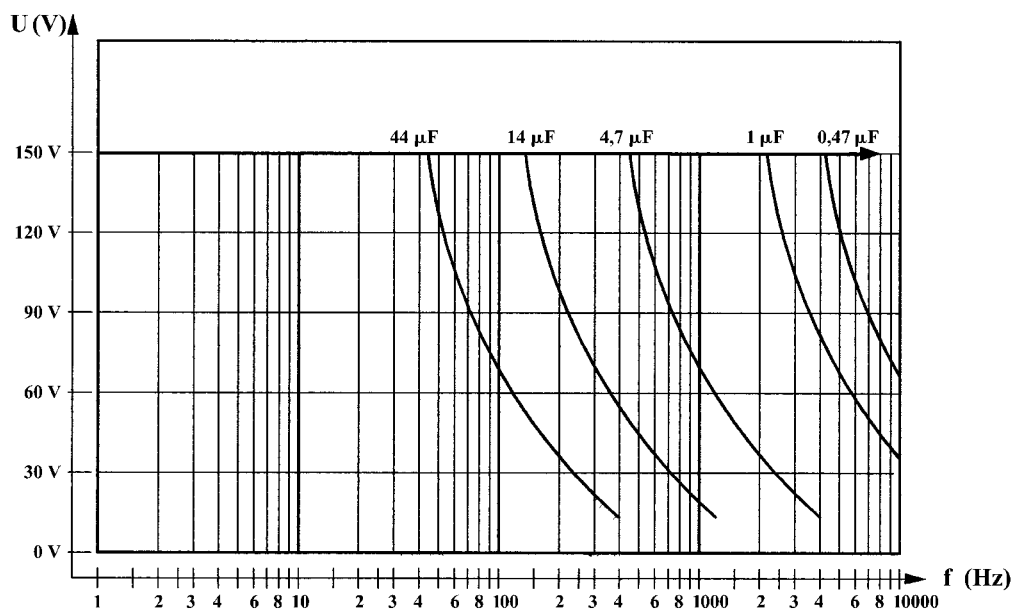
Connector: BNC
Voltage total: 0 V thru +150 V
DC-Offset range: 0 V thru +150 V
Gain: 30 (without attenuation)
Peak current: 1200 mA
Average current: 350 mA
Noise: 20 mVpp (for 4.7 μ Farad load)
Display: LCD
Dimensions W x D x H (mm):
260 x 320 x 165
Weight: 6.8 kg

LE 150/200 (single channel)

Voltage range:
0 V/+150 V

Manual setting of DC-Offset
(superimposed to external signal)

Variable attenuation



Input:

Signal: ± 5 V (± 10 V with attenuation)
Impedance: 5 kOhms
Connector: BNC

Output:

Connector: BNC
Voltage total: 0 V thru +150 V
DC-Offset range: 0 V thru +150 V
Gain: 30 (without attenuation)
Peak current: 2000 mA
Average current: 350 mA
Noise: 20 mVpp (for 4.7 μ Farad load)
Display: LCD
Dimensions W x D x H (mm):
(single channel): 340 x 380 x 180
Weight:
(single channel): 9 kg

Modular concept:

Up to three independent channels can be integrated into one cabinet.

Ordering code: LE 150/200-2: double channel device

LE 150/200-3: triple channel device

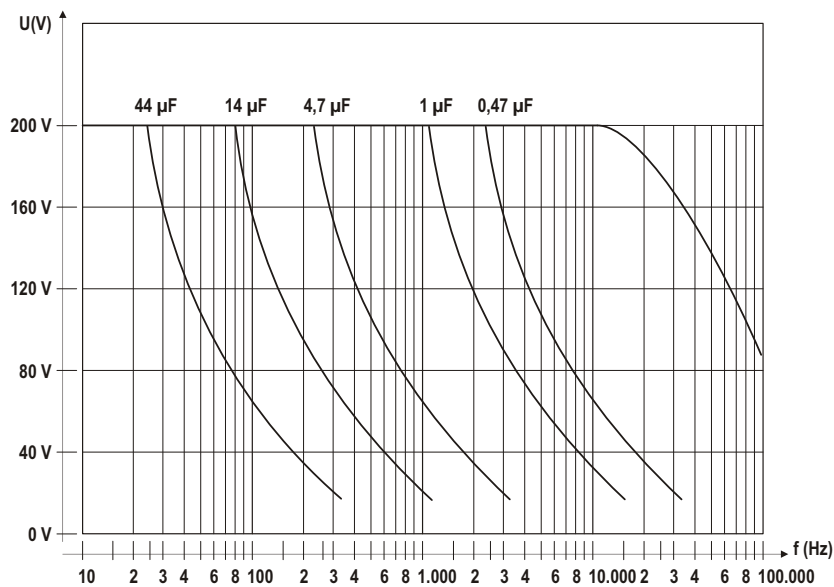
LE 200/070 EBW

Voltage range:
0 V/+200 V

Manual setting of DC-Offset
(superimposed to external signal)

Variable attenuation

70 kHz bandwidth (-3 dB)



Input:

Signal: ± 5 V (± 10 V with attenuation)
Impedance: 5 kOhms
Connector: BNC

Output:

Connector: BNC
Voltage total: 0 V thru +200 V
DC-Offset range: 0 V thru +200 V
Gain: 40 (without attenuation)
Peak current: 700 mA
Average current: 250 mA
Noise: 20 mVpp (for 4.7 µFarad load)
Display: LCD
Dimensions W x D x H (mm):
320 x 260 x 165
Weight: 7 kg

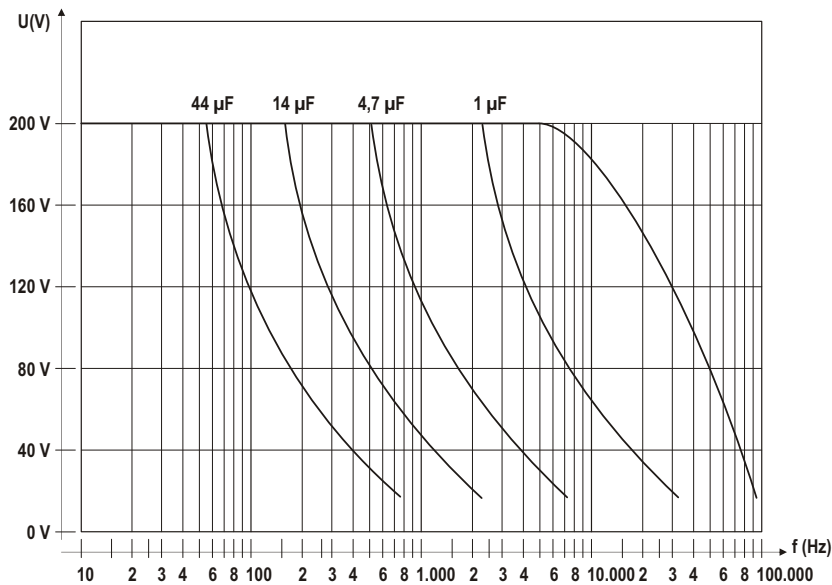
LE 200/150 EBW (single channel)

Voltage range:
0 V/+200 V

Manual setting of DC-Offset
(superimposed to external signal)

Variable attenuation

70 kHz bandwidth (-3 dB)



Input:

Signal: ± 5 V (± 10 V with attenuation)
Impedance: 5 kOhms
Connector: BNC

Output:

Connector: BNC
Voltage total: 0 V thru +200 V
DC-Offset range: 0 V thru +200 V
Gain: 40 (without attenuation)
Peak current: 1500 mA
Average current: 500 mA
Noise: 20 mVpp (for 4.7 µFarad load)
Display: LCD
Dimensions W x D x H (mm):
(single channel): 380 x 340 x 180
Weight:
(single channel): 9 kg

Modular concept:

Up to three independent channels can be integrated into one cabinet.

Ordering code: LE 200/150-2: (2 channels)

LE 200/150-3: (3 channels)

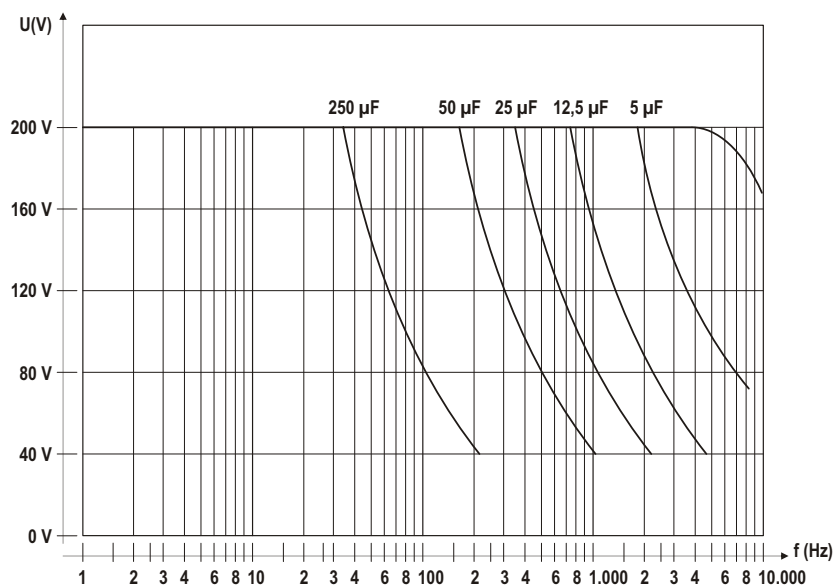
LE 200/500

Voltage range:
0 V/+200 V

Manual setting of DC-Offset
(superimposed to external signal)

Variable attenuation

For high capacitance actuators > 2 μF



Input:

Signal: ± 5 V (± 10 V with attenuation)
Impedance: 5 kOhms
Connector: high current bunch type or coaxial systems on request:
Ask PIEZOMECHANIK for details

Output:

Connector: BNC
Voltage total: 0 V thru +200 V
DC-Offset range: 0 V thru +200 V
Gain: 40 (without attenuation)
Peak current: 5 A
Average current: 1800 mA
Noise: 50 mVpp (for 10 μF load)
Display: LCD
Dimensions W x D x H (mm): 440 x 370 x 230
Weight: 15 kg

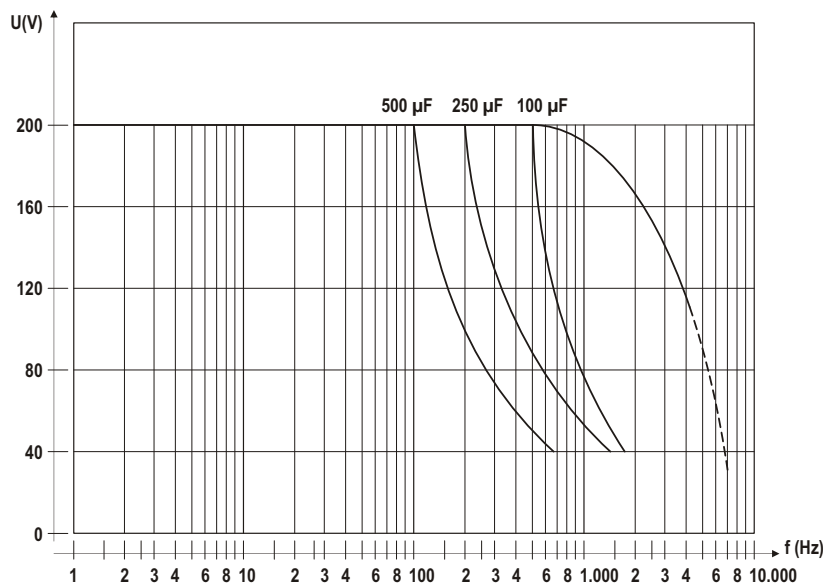
High Power Switching Amplifier RCV 200 V/30 A

Voltage range 0 V/+200 V

Manual setting of DC offset
(superimposed to external signal)

Variable attenuation

For capacitive loads > 50 μF typically



Input:

Signal: ± 5 V (± 10 V with attenuation)
 Impedance: 5 kOhms
 Connector: BNC

Output:

Connector: High current bunch type or coaxial systems on request:
 Ask PIEZOMECHANIK for details
 Voltage total: 0 V thru +200 V
 DC-Offset range: 0 V thru +200 V
 Gain: 40 (without attenuation)
 Peak current: 30 A
 Average reactive current: 10 A
 Noise: > 1 V (depends on load)
 Display: LCD
 Dimensions W x D x H (mm):
 (single channel): 370 x 440 x 230
 Weight: 15 kg

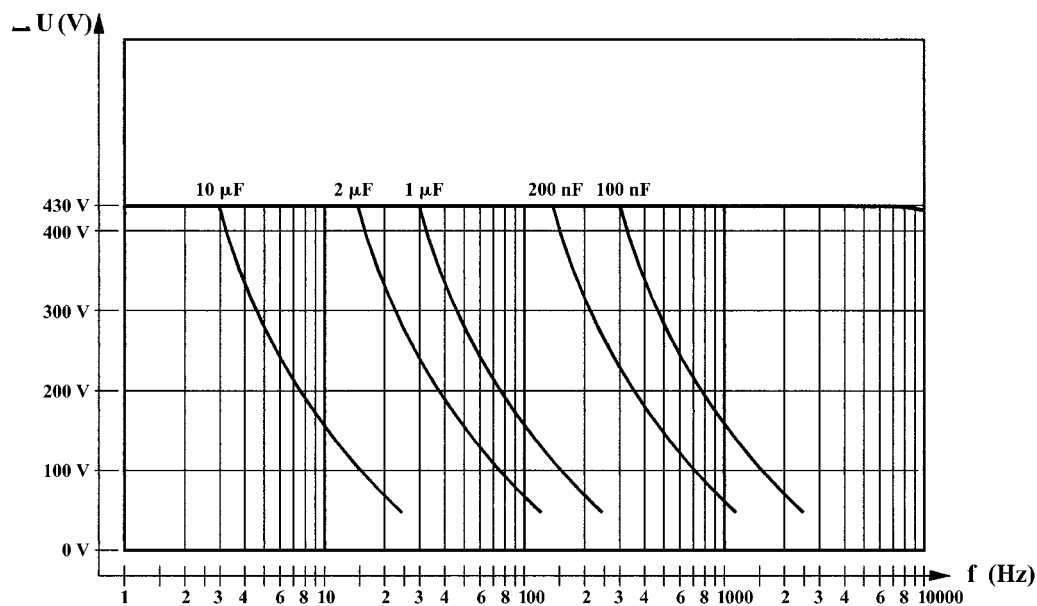
Analog High Voltage Amplifiers LE

LE 430/015 (single channel)

Voltage range:
0 V/+430 V

Manual setting of DC-Offset
(superimposed to external signal)

Variable attenuation



Input:

Signal: ± 5 V (± 10 V with attenuation)

Impedance: 5 kOhms

Connector: BNC

Output:

Connector: BNC

Voltage total: 0 V thru +430 V

DC-Offset range: 0 V thru +430 V

Gain: 86 (without attenuation)

Peak current: 150 mA (for 200 msec)

Average current: 30 mA

Noise: 10 mVpp (for 2.2 μ Farad load)

Display: LCD

Dimensions W x D x H (mm):
260 x 320 x 155

Weight: 4.6 kg

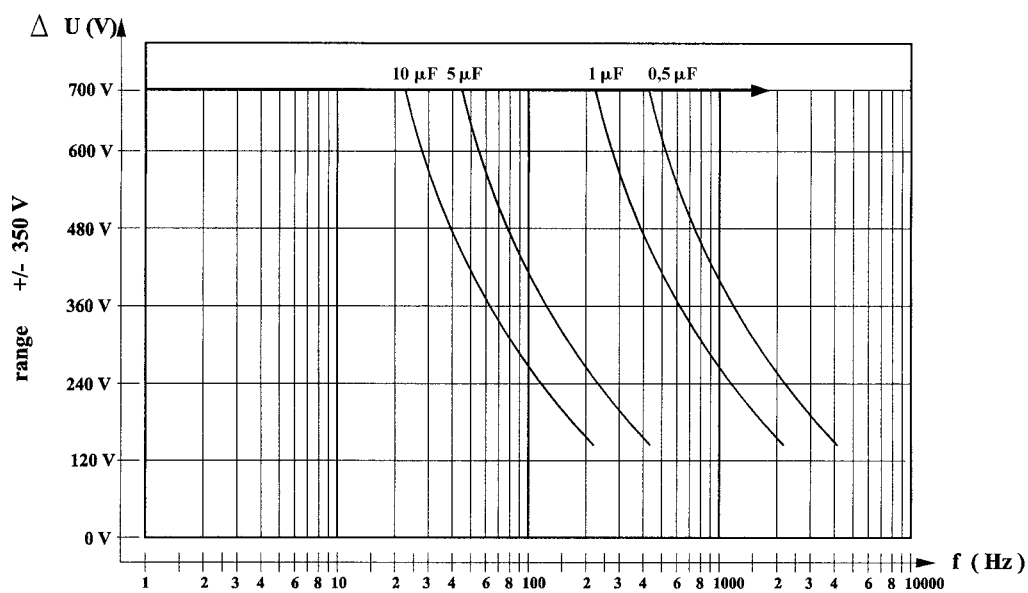
Bipolar amplifier LE 350 bip / 050 (single channel)

Amplifier optimized for the operation of bipolar stacks PSt 350bip without the risk of overvoltage and depoling

Voltage range:
+/-350 V

Manual setting of DC-Offset
(superimposed to external signal)

Variable attenuation



Input:

Signal: +/-3.5 V (+/-10 V with attenuation)

Impedance: 1 kOhm

Connector: BNC

Output:

Connector: Lemo 0S.250

Voltage total: -350 V thru +350 V

DC-Offset range: -350 V thru +350 V

Gain: 100 (without attenuation)

Peak current: 500 mA (for 200 msec)

Average current: 180 mA

Noise: 100 mVpp (for 2 μFarad load)

Display: LCD

Dimensions W x D x H (mm):
260 x 380 x 205

Weight: 8.5 kg

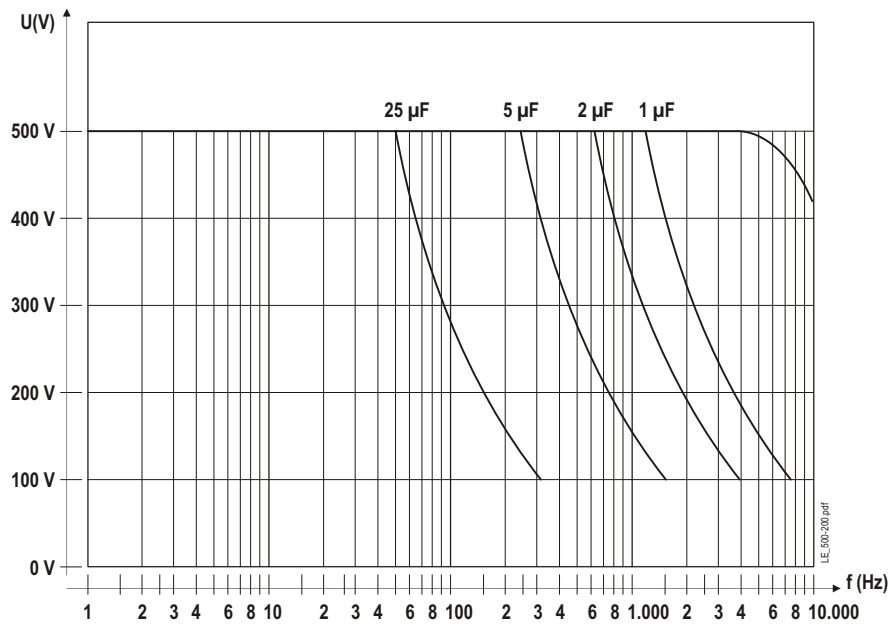
LE 500/200

Voltage range:
0 V/+500 V

Manual setting of DC-Offset
(superimposed to external signal)

Variable attenuation

For high capacitance actuators > 1 μF



Input:

Signal: ± 5 V (± 10 V with attenuation)

Impedance: 1 k Ω

Connector: BNC

Output:

Connector: High current bunch type or coaxial systems on request:
Ask PIEZOMECHNIK for details

Voltage total: 0 V thru +500 V

DC-Offset range: 0 V thru +500 V

Gain: 100)

Peak current: 2 A

Average current: 700 mA

Noise: 50 mV for 2 μF load

Display: LCD

Dimensions W x D x H (mm):

440 x 370 x 230

Weight: 8.5 kg

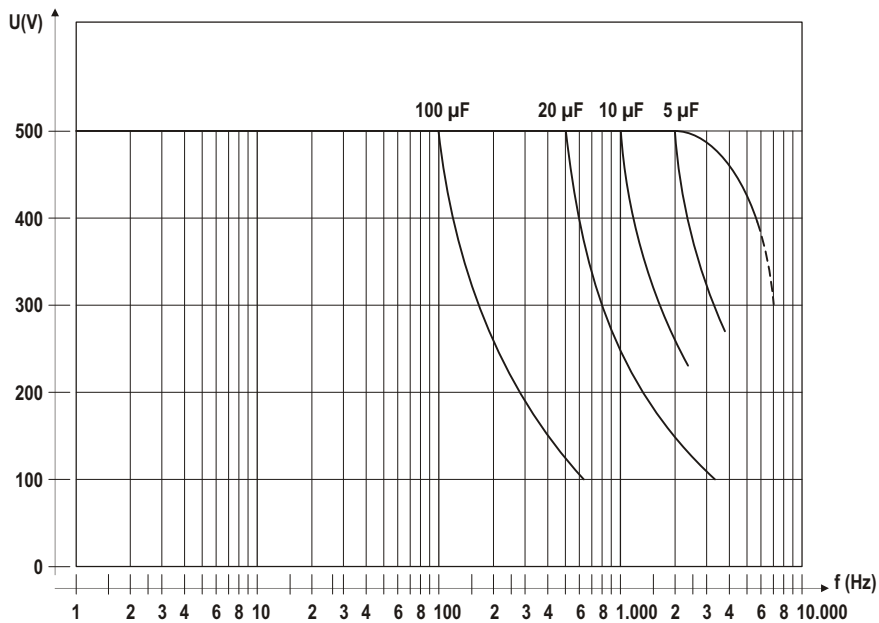
High Power Switching Amplifier RCV 500/15 (single channel)

Voltage range:
0 V/+500 V

Manual setting of DC-Offset
(superimposed to external signal)

Variable attenuation

For capacitive loads > 5 μF typically



Input:

Signal: ± 5 V (± 10 V with attenuation)

Impedance: 1 k Ω

Connector: BNC

Output:

Connector: High current bunch type or coaxial systems on request:
Ask PIEZOMECHNIK for details

Voltage total: 0 V thru +500 V

DC-Offset range: 0 V thru +500 V

Gain: 100

Peak current: 15 A

Average reactive current: 5 A

Noise: > 1V f(depends on load)

Display: LCD

Dimensions W x D x H (mm):
440 x 370 x 230

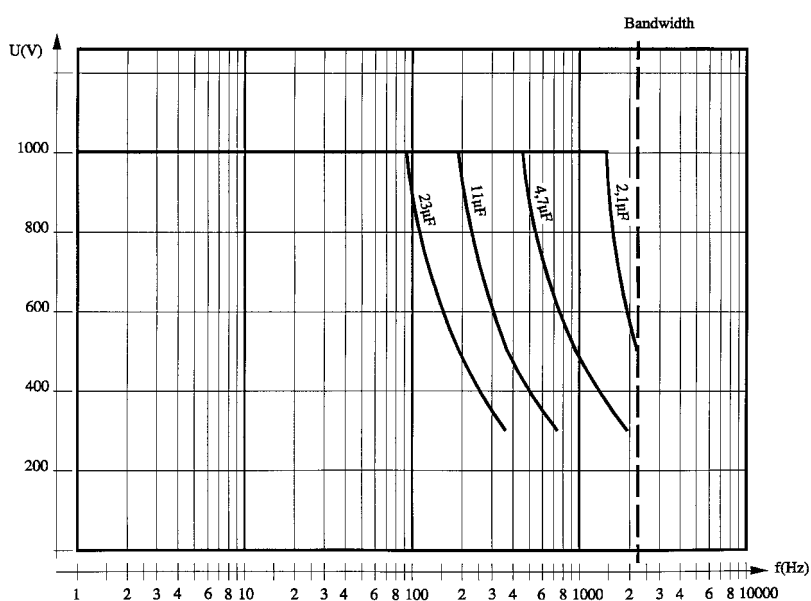
Weight: 15 kg

High power switching amplifier RCV 1000/7 (single channel)

Voltage range:
0 V/+1000 V

Manual setting of DC-Offset
(superimposed to external signal)

Variable attenuation



Input:

Signal: ± 5 V (± 10 V with attenuation)

Impedance: 1 kOhm

Connector: BNC

Output:

Connector: Lemo 0S.250

Voltage total: 0 V thru +1000 V

DC-Offset range: 0 V thru +1000 V

Gain: 200 (without attenuation)

Peak current: 7 A

Average current: 2.2 A

Noise, switching ripple:
up to 2 Vpp
(depends on actuator's capacitance)

Display: LCD

Dimensions W x D x H (mm):
360 x 440 x 225

Weight: 20 kg

High Voltage Pulser HVP

Applications:

- Acoustical, hydraulic, mechanical shock generation
- Material testing
- High g – testing (up to $> 10^4$ g)
- μ sec-precise mechanical pulse trigger

Caution:

Your actuator system must be specially designed to withstand intense mechanical shocks.

Standard stacks (even preloaded ones) can be immediately destroyed, when naively operated with the power pulsers HVP.

Ask PIEZOMECHANIK

Operating principle of the HV-pulsers HVP

A high voltage capacitor is used as the electrical power reservoir.

It is charged to a distinct high voltage level by a permanently operating power supply.

Upon a trigger pulse, the charging switch releases a high current peak towards the piezo actuator capacitance. A serial resistor R_{CH} acts as current limiter.

By this technique current pulses up to several hundreds of Amperes can be generated.

The electrical rise time (RC-time coefficient) is defined by the PZT actuator capacitance C and the resistor R_{CH} .



Discharging of the PZT-actuator is done in a similar way towards ground. The discharge current limiter R_{DCH} defines the discharge time constant.

Piezomechanik's HVP switches are able to provide electrical peak powers up to 100 kW. Higher ratings on request.

The achievable repetition rate is defined by the power supply's charging power and is about 40 W standard. Higher power ratings for higher repetition rates are offered on request.

Example:

The electrical RC rise time for a HVP 1000/10 pulser (1000 V, 10 A peak, $R = 100$ Ohms) together with a $1 \mu\text{F}$ -actuator is 100 μsec .

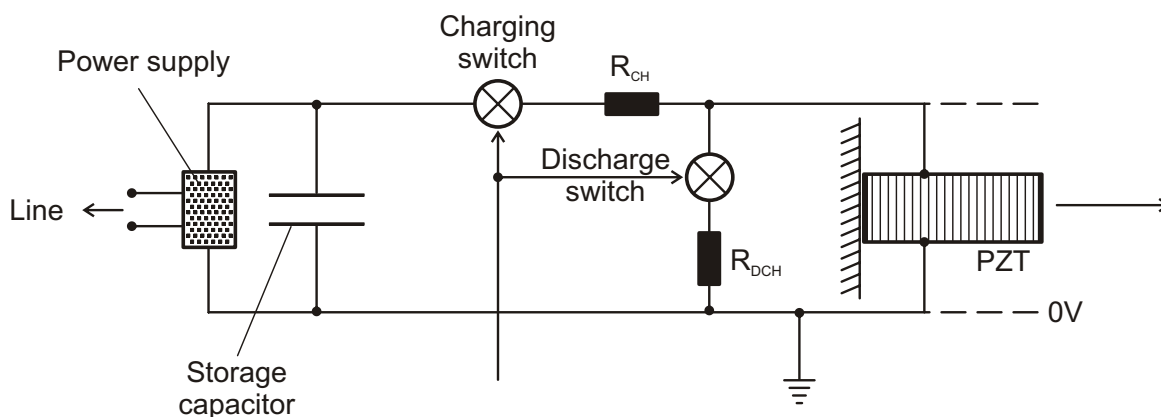


Fig.: Schematic of a HV-power pulser

U (variable)

Mech. pulse

Mechanical rise/fall of piezo actuators

The mechanical elongation rise-time of a piezo actuator is limited by the elastic properties of the actuator material and the geometrical dimensions of the actuator.

It is the result of the sound velocity within the PZT stack defining the propagation time of an elastic deformation transient.

The main consequence is that even the shortest electrical pulses cannot produce short actuator pulses below a distinct limit.

The minimum reaction time T_{react} (mechanical rise time of actuator)

is $T_{\text{react}} \approx (1/3) T_{\text{res}}$

with T_{react} is the period time of actuator's self-resonance.

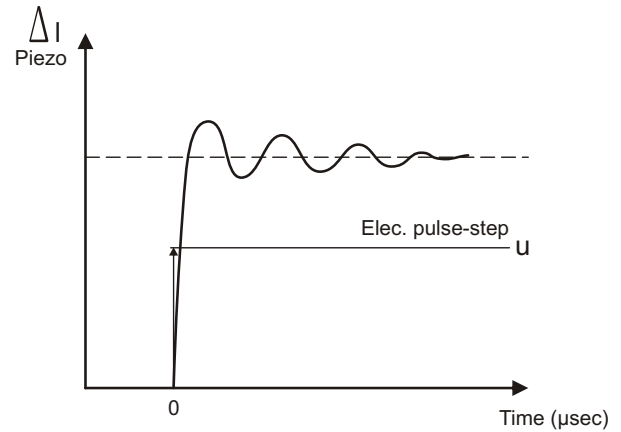


Fig: Typical reaction of a piezo actuator upon application of a short electrical pulse leading to the equivalent actuator's stroke with some mechanical over-shooting and residual resonant ringing.

Technical data

Input signal:

> 3 V charge
 < 0.4 V discharge
 Impedance 100 Ohm
 Connector BNC

Variable voltage setting within above ranges by front potentiometer

Set voltage is represented by a 3-digit front LC-Display

Order code e.g. for a max. + 500V/100 A pulser:
 HVP 500/100

Average power: 40 W

(Notice: Average power defines the repetition rate of pulses, depending further on actuators capacitance)

Connector types:

Depends on voltage and current ratings
 Bunch type or coaxial systems on request:
 Ask PIEZOMECHANIK for details

Dimensions WxDxH (mm): 265x260x165
 Weight: 3.5 kg

Output:

Max. voltage ranges:

Peak current ratings
 (please select)

HVP 200 : 0 V / +200 V

100 / 200 / 400

HVP 500 : 0 V / +500 V

50 / 100 / 200

HVP 1000: 0 V / +1000 V

20 / 50 / 100

PCI-based High Voltage D/A Converters

The PC plug in cards generate high voltage outputs for the direct operation of piezo actuators.

This solution of computer assisted piezooperation is space and cost saving compared to alternatives using external D/A converters and analog amplifiers.

Speed and reliability of data handling is superior to data management via interfaces.

The PC-AHV cards are available as single and triple channel devices for voltage levels up to 500 V.

The supplied software runs under

Windows 95/98/ME/NT/2000/XP.

DLLs are available for **MicroSoft C++6.0**
MicroSoft Visual Basic 6.0
Borland Delphi 5.0
Borland C-Builder 4.0

General data

- PCI-Bus
- 8 bit data bus
- Voltage resolution 14 bit for unipolar output
13 bit for bipolar output
- Width 1 slot
- PC board dimensions



Technical Data

PC-AHV +150/1 single channel

Output voltage: 0 V thru +150 V
Max. peak current: 75 mA
Max. average current: 25 mA
Resolution: 14 bit
Noise: 5 mV
Output connector: BNC. Adapters to LEMO 00 250 and 0S250 available.

PC-AHV +150/3 triple channel

Output voltage: 0 V thru +150 V
Max. peak current: 75 mA/channel
Max. average current: 25 mA (total for 3 channels)
Resolution: 14 bit
Noise: 5 mV
Output connector: BNC. Adapters to LEMO 00 250 and 0S250 available.

PC-AHV 150bp/1 single channel

Bipolar output voltage: -150 V thru +150 V
Max. peak current: 50 mA
Max. average current: 15 mA
Resolution: 13 bit
Noise: 5 mV
Output connector: BNC. Adapters to LEMO 00 250 and 0S250 available.

PC-AHV 150bp/3 triple channel

Bipolar output voltage: -150 V thru +150 V
Max. peak current: 50 mA/channel
Max. average current: 15 mA (total for 3 channels)
Resolution: 13 bit
Noise: 5 mV
Output connector: BNC. Adapters to LEMO 00 250 and 0S250 available.

PC-AHV +500/1 single channel

Output voltage: 0 V thru +500 V
Max. peak current: 15 mA
Max. average current: 5 mA
Resolution: 14 bit
Noise: 5 mV
Output connector: LEMO 0S250 (other LEMO types on request), adapter to BNC available.

PC-AHV +500/3 triple channel

Output voltage: 0 V thru +500 V
Max. peak current: 15 mA/channel
Max. average current: 5 mA (total for 3 channels)
Resolution: 14 bit
Noise: 5 mV
Output connector: LEMO 0S250 (other LEMO types on request), adapter to BNC available.

Accessories

PIEZOMECHANIK supplies a wide range of connecting systems, adaptors, extension cable to make the installation and compatibility of components as easy as possible.

When a complete actuator/amplifier system is ordered, the actuators will be equipped with the plugs corresponding the amplifier's connector.

Further adaptors are available for the combination of different connector systems.



Adaptors:

Plug	coupler
BNC	LEMOSA 00.250 (low voltage systems)
BNC	LEMOSA 0S.250 (high voltage systems)
LEMOSA 00.250	BNC
LEMOSA 0S.250	BNC

Coaxial cable RG 178 with plug – one end blunt, length 1.5 m standard, other lengths on request

LEMOSA plug 00.250
LEMOSA plug 0S.250
BNC

Extension cables with plug and coupling end, length standard 2 m, other lengths on request

LEMOSA 00.250 system
LEMOSA 0S.250 system

Extension cables combining different connector systems e.g. BNC-LEMOSA on request.



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