

**HIGH VOLTAGE AMPLIFIER
HVA 1500/50-2 (two channel)
Version 2**

USER MANUAL



info@smart-material.com
<https://www.smart-material.com>

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User manual for the High Voltage Amplifier HVA 1500/50-2 (Version 2)

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Manufactured by
Physical Instruments
Wichmannstr. 11
10787 Berlin
Germany

Phone: +49 (030) 2362 8510
Fax: +49 (030) 2362 8330
E-Mail: info@physical-instruments.de
Internet: www.physical-instruments.de

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1. Safety Instructions

This product has been designed and tested according to International Safety Requirements. To ensure safe operation and to keep the product safe, the information, cautions, and warnings in this manual must be heeded.

The High Voltage Amplifier HVA 1500/50-2 generates voltages up to 1500V. These voltages are present inside the unit and at the rear panel output connectors and are danger to life.

Make sure that no cable is electrically and mechanically defective.

Replace cables only with the high voltage amplifier switched off.

Before switching on the quad high voltage amplifier, make sure that all cables are connected to the corresponding socket of the load.

Before removing the cables from the load, switch off the amplifier and wait at least 10 minutes until the load capacitors are discharged.

Never operate the quad high voltage amplifier if any housing part of the unit is defective or removed.

Do not open the high voltage unit. Only qualified personnel may open the unit.

Warning!

HAZARDOUS VOLTAGES UP TO 1500V ARE PRESENT AT THE OUTPUT OF HIGH VOLTAGE AMPLIFIER.

TAKE APPROPRIATE PRECAUTIONS DURING MEASUREMENT PROCEDURES.

BEFORE TURNING ON THE AMPLIFIER, REMOVE HANDS AND ALL TEST EQUIPMENT FROM THE LOAD.

2. Introduction

2.1. Overview

This manual deals with the High Voltage Amplifier HVA 1500/50-2 which is designed to supply a number of different piezo-actuators. The Version 2 of the HVA 1500/50-2 will replace the Version 1. The version 1 will be phased out for sale during the second half of 2018. The two different Versions can be identified by the different layout of the back plate.

The HVA 1500/50-2 is a two-channel amplifier and consists mainly of two independent power amplifiers, two input circuitries, two monitoring and indicator circuitries, and an interlock control unit.

The voltage amplifier of each channel is capable of delivering an output voltage in the range of -500 V to +1500 V at an output current up to 50 mA DC. Each amplifier provides a large signal bandwidth of DC to 10 kHz depending on the load capacitance and has a gain of 200 V / V.

Each channel provides two independent signal inputs, a wave generator input and an audio signal input which can be selected by a rotary switch. The wave generator input accepts signals in the range of -2.5 V to +7.5 V at a frequency of 0 Hz to 10 kHz. The audio signal input accepts audio signals in the range of 0.2 VAC to 3 VAC at a frequency of 10 Hz to 10 kHz. Each channel provides two potentiometers to adjust the gain and the offset of the audio signal.

The monitoring circuitry of each channel allows output voltage and output current monitoring. Both monitoring signals are near ground potential, i.e. at no hazardous voltages. Furthermore a LED is used to indicate the states of the output voltage/current of the channel. The LED “Limit” illuminates if the output voltage/current exceeds the limits.

A rotary switch and a LED are provided to control the two outputs. The LED “HV On” illuminates if the output voltage is enabled by the rotary switch or by an interlock signal.

The interlock circuitry allows switching off and on the output voltage by an external signal.

2.2. Specifications

Function

Application	Control of piezo-actuators
Number of HV Amplifiers	Two independent high voltage amplifiers, called channels

Output of Any Channel

Output Voltage Range	-500 V to +1500 V
Output Current Range	0 to +/- 50 mA DC, 0 to +/- 60 mA peak AC
Connector	BNC connector

Wave Generator Input of Any Channel

Input Voltage Range	-2.5 V to +7.5 V corresponds to -500 V to +1500 V output
Input Resistance	100 k Ω
Signal Frequency Range	0 Hz to 10 kHz
Connector	BNC coaxial connector

Audio Signal Input of Any Channel

Input Voltage Range	0.2 VAC to 3 VAC
Input Resistance	100 k Ω
Gain Control Range	-12 db to +12 db, by using a 10-turn potentiometer
Offset Control Range	-500 V to +1500 V, by using a 10-turn potentiometer
Signal Frequency Range	10 Hz to 10 kHz
Connector	BNC coaxial connector

Performance

DC Voltage Gain	200 V / V for wave generator input, noninverting
DC Voltage Gain Accuracy	Better than 0.1% of full scale
Offset Voltage	Less than 0.1 V
Slew Rate	Greater than 50 V/ μ s
Large Signal bandwidth	DC to 10 kHz
Drift with Time	Less than 100 ppm/hr
Drift with Temperature	Less than 50 ppm/ $^{\circ}$ C
Warm-up Time	5 min

Output Voltage Monitoring of Any Channel

Conversion Factor	1/200th of the output voltage
Output Impedance	1 k Ω
Connector	BNC coaxial connector

Output Current Monitoring of Any channel

Conversion Factor	1 V / 5 mA
Output Impedance	1 k Ω
Connector	BNC coaxial connector

Indicator of Any Channel

Limit	A LED illuminates if the output voltage or current exceeds the limits
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Output Control

Control	Rotary switch allows enabling or disabling all four outputs
Indicator	LED "HVON" illuminates indicating that output voltage is on

Interlock

Function	The output voltage is turned on only if the interlock signal is closed, i.e. pin 1 and pin 2 of the interlock connector are connected together
Interlock Connector	A 3-pole socket on the rear panel.

Signals	Pin 1: output signal, +5 V Pin 2: input signal, i.e. interlock signal
Power	
Line Voltage	90-264 VAC, 47-63 Hz, 300 VA
Fuse	Two fuses 3.15 A slow blow
Connector	Standard three-prong power connector with fuse holder
Operating Conditions	
Temperature	0 °C to 40 °C
Relative Humidity	to 85 %, noncondensing
Mechanical	
Cabinet	250 mm W x 150 mm H x 400 mm D
Weight	8 kg
Scope of Delivery	
	High voltage amplifier unit HVA 1500/50-2 Line voltage cord Two coax-cables with BNC connectors 3-pin interlock connector User Manual

2.3. EU-Compliance Declaration

The high voltage amplifier HVA 1500/50-2 has the CE-sign. The EU-Compliance Declaration ensures that the device meets the requirements of the European Standard given by the regulation of the Council of the European Union for assimilation of the legal regulations of the members of the European Union concerning the Electromagnetic Compatibility (89/336/EEC). Conformity is shown by the compliance with the concerning standards EN 50081-1; EN 50082 or EN50081-2; EN 50082-2 respectively.

3. Inspection and Installation

3.1 Introduction

This section provides information for incoming inspection, damage claims, shipping, and installation of the control unit.

3.2 Scope of Delivery

The high voltage amplifier package consists of the following items:

- High voltage amplifier unit HVA 1500/50-2
- Line voltage cord
- Two coax-cables with BNC connectors
- 3-pin interlock connector
- User Manual

3.3. Incoming Inspection

The high voltage amplifier unit should be inspected for damage, scratches, dents, or other defects. Also the cushioning materials should be checked for sign of severe stress.

The electrical performance of the amplifier unit should be verified upon receipt. Make sure that no cable is electrically and mechanically defective.

If the unit is damaged in transit, or fails to meet the specifications upon receipt, notify the carrier and the sales office immediately. Retain the shipping carton and padding material for the carrier's inspection. The sales office will arrange for replacement or repair of your unit without waiting for claim settlement against the carrier.

Before returning the quad high voltage amplifier for any reason, notify the sales office of the difficulty encountered. They will furnish shipping instructions.

3.4. Installation

The ac power supplied to the amplifier unit should be 90 VAC to 264 VAC, 47 Hz to 63 Hz, single phase. Two 3.15 A slow blow fuses should be used.

For safety reasons, the power supply must be grounded through the ac power cord. When operating from ungrounded power sources, a secondary grounding method is mandatory.

Before operation, make sure that the output cable of the amplifier unit is connected to the load.

The cooling of the control unit is provided by convection. The location of the unit must ensure adequate air circulation.

4. Operation

4.1. General

This section outlines a general procedure for operating the high voltage amplifier and the load. For more operating information see also the manual of your piezo-actuators.

4.2. Front Panel Controls

Power

Toggle Switch Turns on and off the power supply

Input Control of Any Channel

WG/Audio Switch This rotary switch enables the wave generator input or the audio signal input

WG Input of Any Channel

Input Signal The Wave generator input accepts signals in the range of -2.5 V to +7.5 V at a frequency of 0 Hz to 10 kHz which corresponds to an output voltage of -500 V to +1500 V

Audio Signal Input of Any Channel

Input Signal The audio signal input accepts signals in the range of 0.2 VAC to 3 VAC at a frequency of 10 Hz to 10 kHz

Gain Potentiometer This potentiometer allows the gain adjustment in the range of -12 db to +12 db, i.e. a gain factor of 1/4 to 4

Offset Potentiometer This potentiometer allows the offset adjustment in the range of -500 V to +1500 V

Monitoring of Any Channel

Indicator "Limit" This indicator illuminates if the output voltage/current exceeds the limits

Voltage Monitor This output signal monitors the high voltage at the output. The conversion factor is 1 V / 200 V. This output signal is near ground potential

Current Monitor This output signal monitors the output current. The conversion factor is 1 V / 5 m A. This output signal is near ground potential

Out Control

On/Off Switch This rotary switch turns on or off the output voltage

Indicator “HV On”	This indicator illuminates if the output voltage is turned on both by the rotary switch in the Out Control section and by the external interlock signal
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4.3. Rear Panel Controls

Line Voltage Input

Connector	International standard three-wire connector
Line Voltage Range	90 VAC to 264 VAC
Power	300 VA
Fuse	Two 3.15 A slow blow fuses

Ground Screw

Function	Allows the grounding of the unit
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High Voltage Outputs

Connectors	Two BNC connectors
Voltage Range	-500 V to +1500 V

Interlock Input

Connector	3-pole socket on the rear panel
Pin Assignment	Pin1: 5 V output Pin2: interlock signal input Pin3: not used
	Amplifier output voltage is turned on if pin1 is connected to pin2 otherwise the output voltage is set to 0

4.4. Operating Requirements

4.4.1. Connections

Before making any connections, make sure that the amplifier unit is turned off.

- Connect the amplifier unit to the mains. Make sure the line voltage corresponds to the voltage selected on the unit
- Connect the high voltage output connectors of the amplifier to the load
- Connect the interlock cable to the interlock connector of the amplifier unit
- Connect a ground cable from the load to the GND screw on the rear panel of the amplifier unit if necessary

4.5. Operating Instructions

4.5.1. Controls Presetting

Before switching on the amplifier unit, preset the controls on the front panel as given below:

- Set the output control switch to “Off”

4.5.2. Operate Mode

The procedures described below cover typical high voltage amplifier operation:

Prior to the operation, the amplifier should be warmed up 5 minutes in order to achieve the nominal stability of the amplifier:

- Set the output control switch to “Off”
- Select the required input “WG Input” or “Audio Signal Input” by the rotary switch
- Make sure the interlock signal is activated at the rear panel socket “Interlock”
- Apply signal to the input selected
- Turn on the output voltage by setting the output control switch to “on”. The indicator “HV On” goes on. If not, check the interlock signal at the rear panel socket “Interlock”
- Check if output voltage is present at the output by monitoring the monitor signal “Voltage” or “Current” through an oscilloscope
- Should the indicator “Limit” goes on, lower the input signal amplitude or signal frequency. In case of audio signal, the gain or offset potentiometer can also be used
- To turn off the unit, just switch off the power.

5. Figures

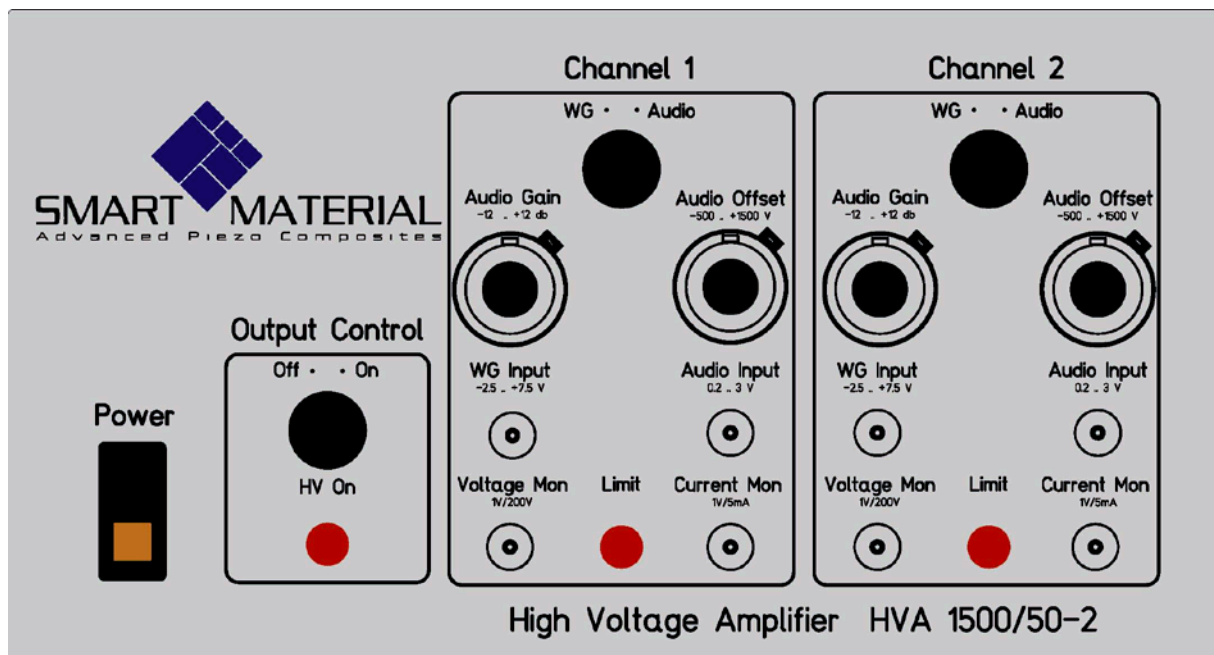


Figure 1: Front Panel View

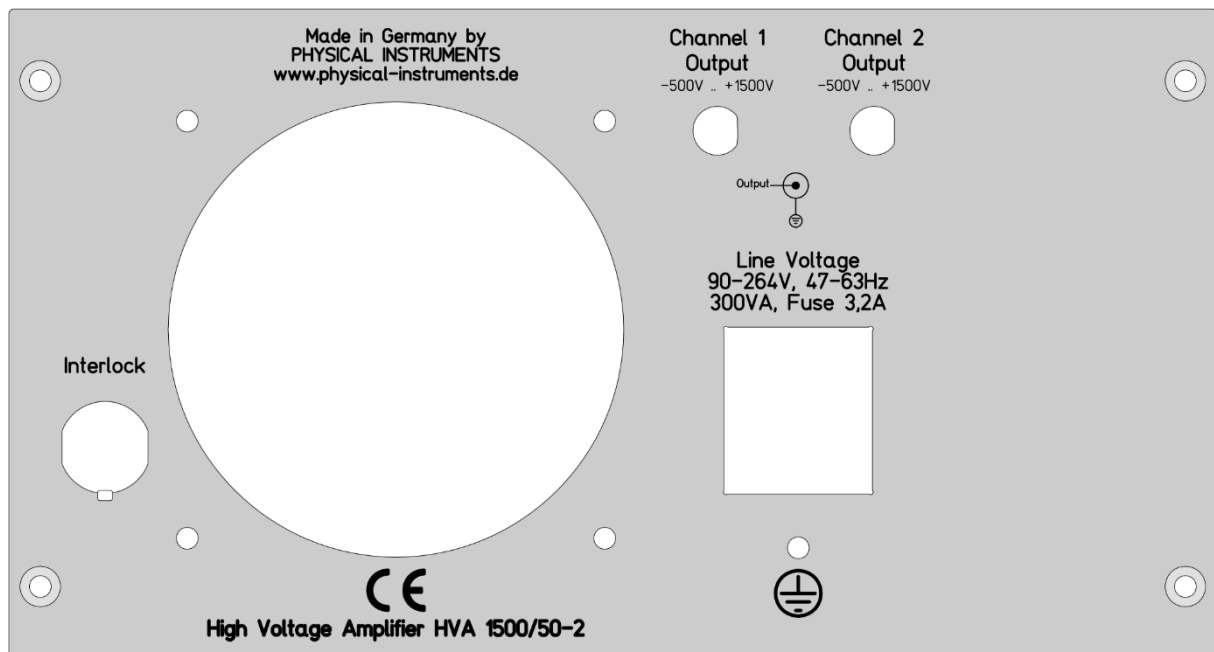


Figure 2: Back Panel View

6. Warranty

This product is warranted against defects in materials and workmanship for a period of 2 years from date of shipment. During the warranty period, the manufacturer will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by the sales office. Buyer shall prepay shipping charges to the service office and service office shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to service office from another country.

6.1. Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied interfacing, unauthorized modifications or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.