HVA200

High Voltage Amplifier

Operating Manual

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Part 1. Important Safety Notice

Danger High Voltage

The HVA200 can produce hazardous voltages and currents which may be harmful or even lethal. Use caution and exercise preventative safety measures to prevent contact between these high voltages and any personnel.

Warning!

The line switch and fuse must be set to the correct mains voltage. The unit is shipped ready to operate on 115 V. To operate on 230 V, the line switch and fuse must be changed. See Section 5.1: Fuse Replacement.

Do Not Open Housing!

The HVA200 has no user-serviceable parts. Service should only be performed by trained service personnel.

Part 2. Product Overview

The Thorlabs HVA200 High Voltage Amplifier is designed to directly drive the Thorlabs Electro-Optic Modulators. The amplifier features: a large, ±200 V output, a continuous current output of 100 mA, a wide, 1 MHz bandwidth, and low noise. The voltage gain of -20 boosts the input up to the high voltages needed to drive our lithium niobate broadband modulators. An adjustable bias allows for precise DC offset control.

The HVA200 uses a high voltage, wideband, high slew rate output amplifier to achieve an output range of ±200 V at a bandwidth up to 1 MHz. The input amplifier includes a summing junction which allows an adjustable DC bias to be added to the input modulation. This composite signal is then boosted by a fixed voltage gain of 20 by the output amplifier. For added safety, a front panel HV Enable button must be pressed to connect the HV output to the output BNC. The output is automatically disabled each time the HVA200 is powered on.

The DC Bias control consists of a rotary encoder which allows precise control and repeatability. The bias adjustment is typically used to shift the DC level of the output as needed by the application.

A voltage monitor output is provided to allow real-time monitoring of the high voltage output. The monitor has a scaling of 20:1 so that an output of 200 V results in a 10 V monitor voltage.

A USB port is provided to allow remote operation through a terminal interface.

Part 3. Setup and Operation

Warning

Before plugging the amplifier into an AC outlet, check that the line switch voltage matches your AC outlet. The amplifier is configured from the factory to operate on 115 V by default. The fuse and line switch will need to be changed for 230 V operation.
See section 5.1 on page 12 for more information.

To setup the unit, refer to Figures 1 and 2, and the legend table on the preceding page and perform the following steps:

1. See the warning above. Attach the supplied AC power cord to the AC connector on the rear panel and plug into a suitable AC outlet.
2. Connect an EO-modulator to the HV Output connector (6) on the front panel.

HV Output Warning

The HV output is capable of producing hazardous voltages and currents. The HV output will handle an accidental short circuit without damage, but the output should not be shorted continuously. The current is internally limited to 100 mA.

3. (Optional) Connect the HV monitor (4) to an oscilloscope or volt meter. The input impedance must be at least 50Ω; however, at this value the ratio will be 40:1. The true HV Output to monitor ratio can be calculated with the following equation:

$$V_{out} = \frac{20V_{monitor}\left(R_{input} + 50\Omega\right)}{R_{input}}$$

Where:
V_{out} is the HV output
$V_{monitor}$ is the HV Monitor output
R_{input} is the input impedance of the measurement device

For impedance values of 50Ω, the equation becomes:

$$V_{out} = 40V_{monitor}$$

For impedance values of greater than 10 kΩ, the internal impedance is insignificant and the equation becomes:

$$V_{out} = 20V_{monitor}$$

HV Output Monitor Warning

The HV Output Monitor requires a minimum load of 50 Ω. The port can handle an accidental short circuit without damage but must not be shorted for more than five seconds to prevent excessive heating of the output resistor. The output will source up to 200 mA when a short circuit is applied.

4. If a modulating signal is to be used, connect it to the Modulation Input connector (2) on the front panel. This signal will be amplified by a fixed voltage gain of -20.
5. Turn the power switch (1) on. At this point the amplifier is powered up but the HV Output is disabled. The power indicator should be illuminated. If not, check the AC fuse (see page 12). Confirm that the HV Enable LED (5) is off.
6. After confirming that all connections are correct, the amplifier output can be enabled by pressing the HV Enable button on the front panel (5).
7. Adjust the amplitude of the modulation signal as needed.
8. The DC level of the output can be shifted by adjusting the DC Bias Adjust control (3).

Legend Table for Facing Page

Legend	Description
1	Main Power Switch
2	Modulation Input Signal - BNC
3	DC Bias Adjust Knob & Indicator Dial
4	HV Output Monitor - BNC
5	HV Enable Button
6	HV Output – BNC (**DANGER**, High Voltage)
7	AC Input Connector – IEC and Fuse Drawer
8	Cooling Fan
9	Line Voltage Selector Switch
10	USB 2.0 Port

3.1. HVA200 Controls and Features

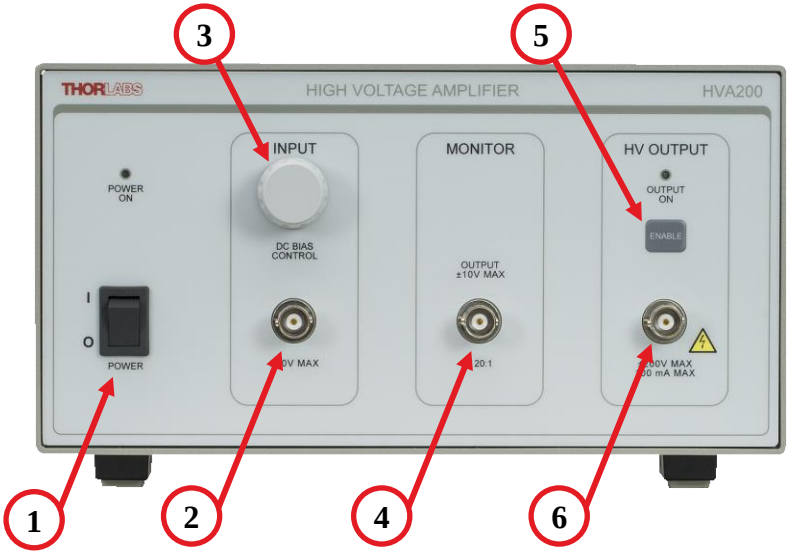


Figure 1: HVA200 Front Panel Features

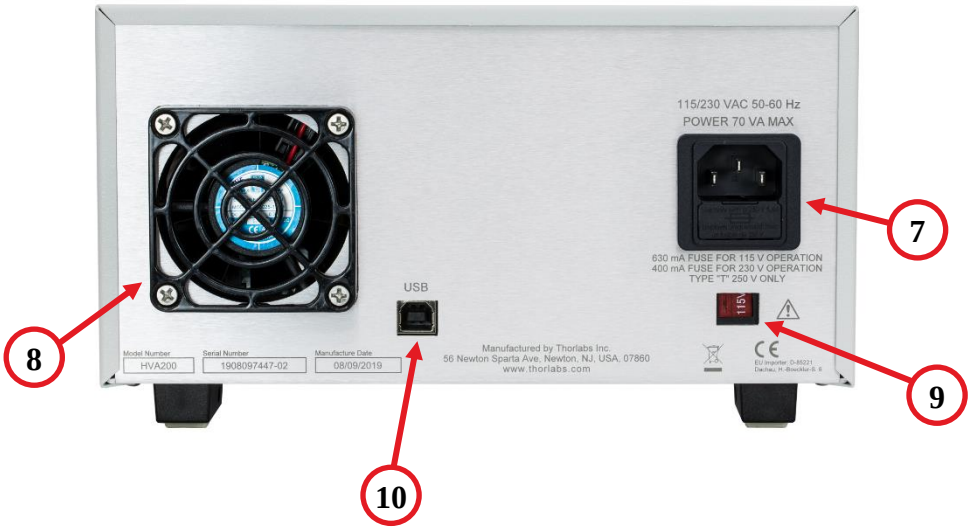


Figure 2: HVA200 Rear Panel Features

3.2. Computer Controlled Operation

The HVA200 may also be controlled by a command line language through the USB port (10). This is offered to enable operation through a terminal interface or for those who may want to write their own program to control the unit. The command language is described below. Prior to running the command line interface, the included drivers should be installed, the unit should be powered, and a USB cable should be connected between the HVA200 and the host.

The terminal emulator should be set as follows:

- Baud Rate: 115.2k b/s (bits per second)
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: None

If the connection is correct and after pressing the Enter key, you will see the following: *Command error CMD_NOT_DEFINED* followed by the command prompt, "*>"*

The basic structure of the interface is a keyword followed by either an equals sign (=) or a question mark (?). The (=) or (?) will determine if the string is a command or a query. All strings, commands and queries, must be terminated by a carriage return (CR) or pressing the ENTER key on the computer.

The command structure is as follows:

Keyword = argument (CR)

Where "keyword" defines the function and "argument" is a numerical value followed by a carriage return (CR).

The query structure is a follows:

Keyword? (CR)

The "keyword" defines the function and the question mark (?) indicates a query. The string is terminated with a carriage return (CR).

There are a few exceptions to this which are noted below, also noted are unique shortcut keys. The following table lists the commands and queries available with this device. The prompt symbol (>) will appear on power up and after a command is accepted by the HVA200 indicating it is ready to receive another command line.

If the keyword, format, or argument are incorrect or out of range the unit will return an error string.

Command	Syntax*	Description
Get ID	id?	Returns the model number and firmware version
Command Query	?	Returns a list of these commands
Set Output Enable	enable=0	Output is disabled
	enable=1	Output is enabled
Get Output Enable	enable?	Returns current output enable state
Set Output Value[1]	value=	Sets Output value based on 16 bit number.
Get output Value	value?	Returns set Output value

Notes:

** All commands and queries are in lower case letters.*

[1] value= *adjustment range based on 16 bit; from 0 – 65535.*

- *0 = maximum value*
- *65535 = minimum value*
- *To accurately set the output voltage, use the output monitor BNC.*

Part 4. HVA200 Specifications

Specification	Description
Electrical Characteristics	
Max Input Voltage Range	-10 to 10 V
Input Impedance	1 kΩ
Output Voltage	-200 to 200 V
Output Impedance	50 Ω
Slew Rate	400 V/µs
Output Noise	1.5 mV RMS
Voltage Gain[1]	-20 ± 2%
DC Bias Adjust	-200 to 200 V
HV Monitor to Output Ratio:	
With Input Impedance of 50Ω	40:1 (Vout / 40 ± 6%)
With Input Impedance of >10 kΩ	20:1 (Vout / 20 ± 6%)
HV Monitor Output Impedance	50 Ω
AC Power	115 V/230 V, 50 – 60 Hz, 70 VA
Max Ratings	
Max Output Current	100 mA DC
Max Input Voltage Range	-10 to 10 V
Fuse Rating	630 mA @ 115 VAC (5x20 mm SLO-BLO) 400 mA @ 230 VAC (5x20 mm SLO-BLO)
Operating Temperature Range	10 to 40 °C, Max 85% RH
Physical Features	
Input Connector	BNC (± 10 V, 10 mA)
HV Output Connector[2]	BNC (± 200 V, 100 mA)
HV Monitor Connector[3]	BNC (± 10 V, 200 mA, Min Load 50 Ω)
Bias Adjustment	Digital Encoder
Output Enable	Front Panel Pushbutton
Output HV Indicator	Bright LED
Power Switch	Rocker Switch
Dimensions	9″ x 5″ x 12.5″ 228.6 mm x 127 mm x 317.5 mm
Weight	11.6 lbs
Other	Tilting Rubber-Padded Feet

[1] The voltage gain is inverted to preserve the high slew rate of the output amplifier (i.e., a -1 V input results in +20 V output).

[2] The HV output will handle an accidental short circuit without damage, but the output should not be shorted continuously.

[3] The HV monitor output will handle accidental short circuits without damage, but must not be shorted for more than 5 sec to prevent excessive heating of the output resistor. The HV monitor output will source up to 200 mA when a short circuit is applied.

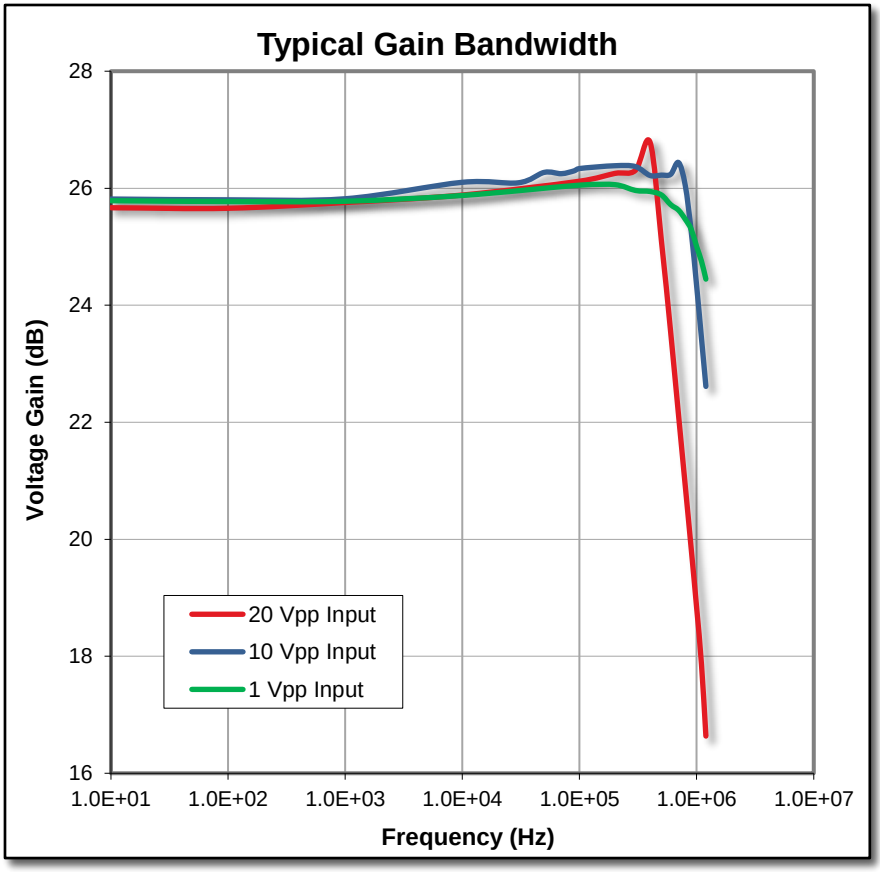


Figure 3: Typical Gain Bandwidth

Part 5. Maintenance

The HVA200 amplifier needs very little maintenance under normal operating conditions. There are no serviceable parts in the HVA200. The enclosure may be cleaned by wiping with a soft damp cloth. If you suspect a problem with your HVA200 please call Thorlabs and technical support will be happy to assist you.

5.1. Fuse Replacement

The AC input is protected by a fuse located in a pull out compartment drawer on the rear panel AC connector. Refer to Figure 2 on page **Error! Bookmark not defined.**. If replacement is needed, disconnect the power cord from the back of the amplifier and pull the fuse compartment drawer out to expose the fuse. A small screwdriver may be used to pry the drawer open.

Replace the fuse with the correct rating. Do not use a fuse with a current rating higher than the unit is rated for. The fuse ratings are as follows:

- 115 V: 630 mA 5x20 mm SLO-BLO
- 230 V: 400 mA 5x20 mm SLO-BLO

5.2. Ventilation

For proper operation and protection of the output amplifier, it is important that the ventilation passages located on the sides and rear of the unit not be obstructed from free airflow.

5.3. Troubleshooting

Problem	Solutions
"PWR ON" not illuminating, unit is not functioning	Check that the power switch in the on position, the mains connection is correct, and the fuse has not been damaged.
Output will not enable, "OUTPUT ON" is flashing	The amplifier has gone into a protection mode because the circuitry has sensed that one of the HV supplies is not working correctly.

Part 6. Declaration of Conformity

Konformitätserklärung
Declaration of Conformity
Déclaration de Conformité

Thorlabs Inc
435 Rt 206
Newton, NJ
USA

erklärt in alleiniger Verantwortung, dass das Produkt:
declares under it's own responsibility, that the product:
déclare sous notre seule responsabilité, que le produit:

HVA200

mit den Anforderungen der Normen
fulfills the requirements of the standard
satisfait aux exigences des normes

72/73/EEC	Low Voltage Directive 19.02.1973
93/68/EEC	Change of Low Voltage Directive
DIN EN 61010-1:2001	Safety of Test and Measurement Equipment
DIN EN 61326:97 + A1:98 + A2:2001	EMC of Test and Measurement Equipment
CISPR 16-2-1: 2003	Conducted Emmissions
CISPR 16-2-3: 2006	Radiated Emmissions
DIN EN 61000-4-2	Electrostatic Discharge Immunity
DIN EN 61000-4-3	Radiated RF Electromagnetic Field Immunity
DIN EN 61000-4-4	Electrical Fast Transient/Burst Immunity
DIN EN 61000-4-5	Power Line Surge Immunity
DIN EN 61000-4-6	Conducted RF Immunity
DIN EN 61000-4-11	Voltage Dips and Interruptions Immunity

übereinstimmt und damit den Bedingungen entspricht.
and therefore corresponds to the regulations of the directive.
et répond ainsi aux dispositions de la directive.

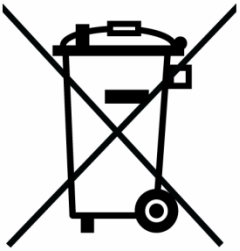
Newton/ Dachau, 21. Januar 2009

Ort und Datum der Ausstellung Place and date of issue Lieu et date d'établissement	Name und Unterschrift des Befugten Name and signature of authorized person Nom et signature de la personne autorisée

Part 7. Regulatory

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return "end of life" units without incurring disposal charges.

- This offer is valid for Thorlabs electrical and electronic equipment:
- Sold after August 13, 2005
- Marked correspondingly with the crossed out "wheelie bin" logo (see right)
- Sold to a company or institute within the EC
- Currently owned by a company or institute within the EC
- Still complete, not disassembled and not contaminated



Wheelie Bin Logo

As the WEEE directive applies to self contained operational electrical and electronic products, this end of life take back service does not refer to other Thorlabs products, such as:

- Pure OEM products, that means assemblies to be built into a unit by the user (e.g. OEM laser driver cards)
- Components
- Mechanics and optics
- Left over parts of units disassembled by the user (PCB's, housings etc.).

If you wish to return a Thorlabs unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

7.1. Waste Treatment is Your Own Responsibility

If you do not return an "end of life" unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

7.2. Ecological Background

It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of live products will thereby avoid negative impacts on the environment.

Part 8. Thorlabs Worldwide Contacts

For technical support or sales inquiries, please visit us at www.thorlabs.com/contact for our most up-to-date contact information.

USA, Canada, and South America
Thorlabs, Inc.
sales@thorlabs.com
techsupport@thorlabs.com

UK and Ireland
Thorlabs Ltd.
sales.uk@thorlabs.com
techsupport.uk@thorlabs.com

Europe
Thorlabs GmbH
europe@thorlabs.com

Scandinavia
Thorlabs Sweden AB
scandinavia@thorlabs.com

France
Thorlabs SAS
sales.fr@thorlabs.com

Brazil
Thorlabs Vendas de Fotônicos Ltda.
brasil@thorlabs.com

Japan
Thorlabs Japan, Inc.
sales@thorlabs.jp

China
Thorlabs China
chinasales@thorlabs.com

THORLABS

www.thorlabs.com