

# ULTRAVOLT HVA SERIES

## PRECISION HIGH VOLTAGE AMPLIFIER

The UltraVolt® HVA series of DC-to-DC high voltage power supplies operates a precision filter/divider and linear HV switch to produce a high voltage amplifier (HVA). These modules provide a high-resolution, programmable, high voltage DC to full scale waveform capability greater than 1 kHz output. This is optimized for bias applications while providing excellent line regulation, load regulation, dynamic response, and stability. It can both source and sink current.

### PRODUCT HIGHLIGHTS

- DC, reversible, and amplifier modes
- Fast slew rate (40 V/μs) and high bandwidth
- Can both source and sink current
- Bipolar models available at 0 to 5 kV
- Unipolar models available at 0 to 10 kV
- PPM level line and load regulation
- 50 ppm temperature coefficient (25 ppm optional)
- Available reduced ripple option
- Differential precision 0 to 10 VDC control input
- Precision output voltage and current monitors
- UL/cUL recognized component; CE Mark (LVD and RoHS)

### TYPICAL APPLICATIONS

- Drivers
  - PZT actuators
  - MEMS devices
  - Electroactive polymers
  - Electrorheological materials
  - Electrohydrodynamics
  - Electrostatic chuck
  - Pockels cells
  - Laser and electro-optic modulation
  - Electrophoresis
- Amplifiers
  - Beam devices such as mass spectrometers and electron microscopes as electrostatic deflection/focusing, flocking, coating, electrospinning, precipitation, and electrocoalescence

## ELECTRICAL SPECIFICATIONS

| Parameter                       | Conditions                     | Models  |                   |                   |              |             |              |       | Units |
|---------------------------------|--------------------------------|---|-------------------|-------------------|--------------|-------------|--------------|-------|-------|
| <b>Input</b>                    |                                | <b>All Types</b>  |                   |                   |              |             |              |       |       |
| Voltage Range                   | Full Power                     | 24 VDC ±10%   |                   |                   |              |             |              |       | VDC   |
| Current                         | Standby/Disable                | < 70 unipolar, < 105 bipolar                                |                   |                   |              |             |              |       | mA    |
| Current                         | Full Load, Max Eout            | < 420   |                   |                   |              |             |              |       | mA    |
| Current                         | No Load, Max Eout              | < 400   |                   |                   |              |             |              |       | mA    |
| <b>Output <sup>1</sup></b>      |                                | <b>1 kV/±1 kV</b>   | <b>2 kV/±2 kV</b> | <b>4 kV/±4 kV</b> | <b>±5 kV</b> | <b>6 kV</b> | <b>10 kV</b> |       |       |
| Power                           | Nominal Input, Max Eout        | 0.25  | 0.5               | 1                 | 1            | 1           | 1            | W     |       |
| Current                         | lout Entire Voltage Range      | 250   | 250               | 250               | 200          | 167         | 100          | µA    |       |
| Ripple                          | Full Load, Max Eout            | 0.05  | 0.05              | 0.05              | 0.03         | 0.03        | 0.01         | %V pp |       |
| Ripple with -F Option           | Full Load, Max Eout            | 0.0125  | 0.0125            | 0.0125            | 0.0075       | 0.0075      | 0.0025       | %V pp |       |
| Voltage Monitor                 | Normal Operating Conditions    | 0 to 10 ±0.5%   |                   |                   |              |             |              |       | VDC   |
| Current Monitor                 | Normal Operating Conditions    | 0 to 10 ±1%   |                   |                   |              |             |              |       | VDC   |
| Line Regulation                 | Vin Min to Vin Max, Max Eout   | < 0.01  |                   |                   |              |             |              |       | %     |
| Load Regulation                 | No Load to Full Load, Max Eout | < 0.01  |                   |                   |              |             |              |       | %     |
| <b>Programming and Controls</b> |                                | <b>All Types</b>  |                   |                   |              |             |              |       |       |
| Input Impedance                 | Normal Operating Conditions    | 10  |                   |                   |              |             |              |       | MΩ    |
| Adjust Voltage                  | Differential                   | 0 to +10  |                   |                   |              |             |              |       | VDC   |
| HV ON/OFF (Enable/Disable)      |                                | 0 to +0.8 V disable, +2.5 to +10 enable (default = disable) |                   |                   |              |             |              |       | VDC   |
| Reference Voltage               | T = +25°C, Initial Value       | +10.00 ±0.05%   |                   |                   |              |             |              |       | VDC   |
| Max Source Current              | T = +25°C                      | 5   |                   |                   |              |             |              |       | mA    |

| <b>Environmental</b>    |                                     | <b>All Types</b>         |  |  |  |  |  |  |        |
|-------------------------|-------------------------------------|--------------------------|--|--|--|--|--|--|--------|
| Operating               | Full Load, Max Eout, Case Temp.     | +10 to +45               |  |  |  |  |  |  | °C     |
| Temperature Coefficient | Over the Specified Temperature      | 50 PPM or 25 PPM         |  |  |  |  |  |  | PPM/°C |
| Thermal Shock           | Mil-Std 810, Method 503.4-2         | -40 to +65               |  |  |  |  |  |  | °C     |
| Storage                 | Non-Operating, Case Temp.           | -40 to +100              |  |  |  |  |  |  | °C     |
| Humidity                | All Conditions, Standard Package    | 0 to 95%, non-condensing |  |  |  |  |  |  | -      |
| Altitude                | Standard Package, All Conditions    | Sea level through 10,000 |  |  |  |  |  |  | ft     |
| Shock                   | Mil-Std-810, Method 516, Proc. 4    | 20                       |  |  |  |  |  |  | Gs     |
| Vibration               | Mil-Std-810, Method 514, Fig. 514-3 | 10                       |  |  |  |  |  |  | Gs     |

<sup>1</sup> Units listed without polarity can be ordered as positive (+) or negative (-). Units listed as (±) are bipolar.

Contact AE for preset fixed outputs or other requirements.

ELECTRICAL SPECIFICATIONS (CONTINUED)

Sample HVA Series Waveforms



Figure A. 5HVA24-BP1 sine wave input



Figure B. 5HVA24-BP1 10 kV step wave input with no load



Figure C. 5HVA24-BP1 triangle wave input



Figure D. 5HVA24-BP1 square wave input



Figure E. Bandwidth vs. signal amplitude with no load



Figure F. Bandwidth vs. signal amplitude with 100 pF load

MECHANICAL SPECIFICATIONS



| Dimensions   |   |
|--------------|---|
| Construction | Aluminum alloy 5052-H32<br>Anodize MIL-A-8625E blue |

| Volumes and Weights |                 |                 |
|---------------------|-----------------|-----------------|
|                     | cm <sup>3</sup> | in <sup>3</sup> |
| Volume              | 468.34          | 28.58           |
|                     | kg              | lb              |
| Weight              | 0.68            | 1.5             |

## INTERFACE

| Connections     |                                  |
|-----------------|----------------------------------|
| Sub-miniature D | 15-pin, female                   |
| HV Connector    | LGH1/2L                          |
| HV Return       | #6-32 x 0.437 long threaded post |

| UV-HVA Input Connector Pinout Functions |                       |   |
|---|-----------------------|---|
| Pin                                     | Description           | Function  |
| 1                                       | Reference Voltage     | +10.00 V precision reference  |
| 2                                       | Voltage Programming - | 0 to +10 V or 0 to -10 V to program full output voltage, depending on polarity. Programming input is differential between pins 2 and 3. |
| 3                                       | Voltage Programming + |   |
| 4                                       | Voltage Monitor       | 0 to ±10 V represents 0 to ± full output voltage  |
| 5                                       | N/C                   | No connection   |
| 6                                       | Signal Ground         | Reference all control signals here.   |
| 7                                       | Input Power           | +24 V input power   |
| 8                                       | Input Power           |   |
| 9                                       | Power Ground          | Input power return  |
| 10                                      | Power Ground          |   |
| 11                                      | Enable                | TTL high to enable, low to disable, default is OFF  |
| 12                                      | Current Monitor       | 0 to ±10 V represents 0 to ± full output current  |
| 13                                      | Current Limit Adjust  | 0 to +10 V sets current limit from 0 to full rated output current   |
| 14                                      | N/C                   | No connection   |
| 15                                      | Signal Ground         | Reference all control signals here.   |

## ULTRAVOLT HVA SERIES

### ORDERING INFORMATION

|             |                                       |           |
|-------------|---------------------------------------|-----------|
| Type        | 0 to 1000 VDC Output                  | 1HVA      |
|             | 0 to 2000 VDC Output                  | 2HVA      |
|             | 0 to 4000 VDC Output                  | 4HVA      |
|             | 0 to 5000 VDC Output (Bipolar Only)   | 5HVA      |
|             | 0 to 6000 VDC Output (Unipolar Only)  | 6HVA      |
|             | 0 to 10000 VDC Output (Unipolar Only) | 10HVA     |
| Input       | 24 VDC Nominal                        | 24        |
| Polarity    | Positive Output                       | -P        |
|             | Negative Output                       | -N        |
|             | Bipolar Output                        | -BP       |
| Power       | 1 W Output                            | 1         |
| Option      | Ripple Stripper® Output Filter        | -F        |
|             | 25 PPM Temperature Coefficient        | -25PPM    |
| Connections | LGH                                   | Standard  |
|             | 5 kV SHV Type                         | -SHV-5kV  |
|             | 10 kV, BNC Type                       | -BNC-10kV |

Popular accessories ordered with this product include our full range of high voltage output connectors. (See Accessories and Connectors datasheet.)







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## ABOUT ADVANCED ENERGY

Since 1981, UltraVolt® — now part of the Advanced Energy (AE) family — has perfected how power performs for its customers. For both end users and OEMs, AE's comprehensive portfolio of standard and custom high voltage components precisely match system specifications to deliver unparalleled energy, quality, and performance. Through close customer collaboration, design expertise, application insight, and world-class support, AE creates successful partnerships and enables customers to push the boundaries of innovation and stay ahead of evolving market needs.

PRECISION | POWER | PERFORMANCE



**CAUTION:**  
High Voltage

Read and understand all documentation before you install, operate, or maintain Advanced Energy high voltage power supplies. Follow all safety instructions and precautions to protect against property damage and serious or possibly fatal bodily injury. Never defeat safety interlocks or grounds.

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