

# HIGH SPEED BIPOLAR AMPLIFIER

**HSA**<sub>SERIES</sub>

**BA**<sub>SERIES</sub>

DC to 10 MHz, High Speed and Broad Range  
Maximum 300Vp-p high output voltage  
plus, minus, source and sink operation are available



# Tough Bipolar Power Amplifier against High Speed, Broad Range, High Voltage, High Power and Various Loads.

HSA and BA series is a power amplifier which has high speed, broad band (HSA: DC to max.10 MHz, BA: DC to 2MHz) and the capability of supplying high voltage and high power. DC+/DC-signal is variable continuously with wide output range of maximum 300Vp-p without switching. Furthermore, as 4 dimensions output is possible, source mode (providing a power to load from a power amplifier in coincidence of voltage polarity and current polarity as normal amplifier) and sink mode (Sinking a power from load to power amplifier in reverse current) operation are available. Therefore, It is possible to drive smoothly a capacitive load and an inductive load like a piezo electric component, a solenoid and others.

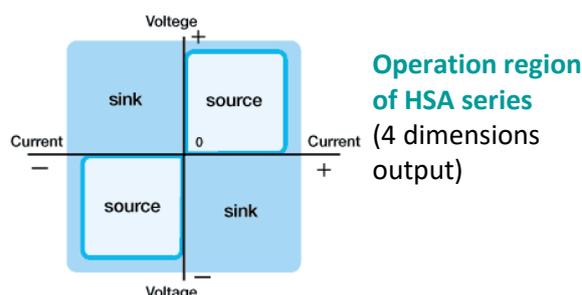
6 difference models concerning frequency range, output voltage and output current are available as HSA series.

| Selection Guide | HSA4051      | HSA4052  | HSA4101     | HSA42011   | BA 4825    |
|-----------------|--------------|----------|-------------|------------|------------|
| Frequency band  | DC to 500kHz |          | DC to 10MHz | DC to 1MHz | DC to 2MHz |
| Output voltage  | 300Vp-p      |          | 142Vp-p     | 150Vp-p    | 300Vp-p    |
| Output current  | 2.83Ap-p     | 5.66Ap-p | 2.8Ap-p     | 3Ap-p      | 0.5 Arms   |
| Slew rate       | 450V/μs      |          | 5000V/μs    | 475V/μs    | 500V/μs    |

More details on the following pages

## Step response

Slew rate which is important when large amplitude output is required, is maximum 5000V/μs (HSA 4101). Reproduce a signal in high fidelity by good response for high speed repetitive and high speed transient phenomenon signal.



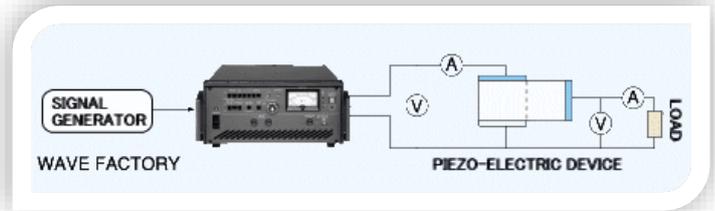
## Features

- **High speed, broad band and high slew rate** Frequency range is DC to max. 10MHz. Slew rate is max. 5000V/μs. A fast rise time pulse signal and a complicated waveform signal can be amplified with a high fidelity.
- **Function of output range shift** Equipped with the range shift function which is able to change output range.
- **High voltage output** Max. output voltage is 300Vp-p. Possible to drive piezo actuators and display devices by a big margin.
- **4 dimensions output** (bipolar output) Available for output plus/minus of voltage and current freely. Changing of plus/minus polarity continuously without switching.
- **Excellent step response** Possible to get a clean waveform of few overshoot and ringing.
- **Two inputs are provided** Input is A and B of dual inputs. One touch operation for addition and input change.
- **DC bias** Equipped with DC bias function enabling to add DC to the output.
- **Low output impedance** Enable to get excellent response in capacitive and inductive load.
- **Others** Equipped with DC offset adjustment function, protection circuit, monitor meter & monitor output, output ON/OFF switch and others.

\*The above mentioned functions are not equipped with some model. Please refer to the specifications as below for the detail functions and the comparison of each model.

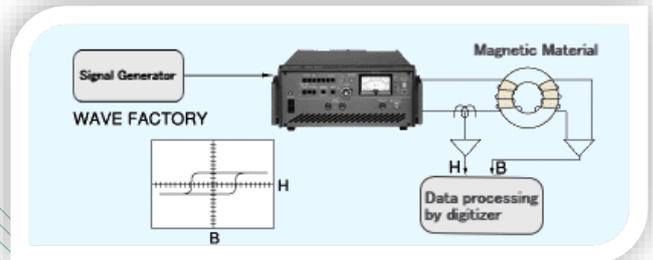
# Applications

## Driving of Piezo Electric Devices



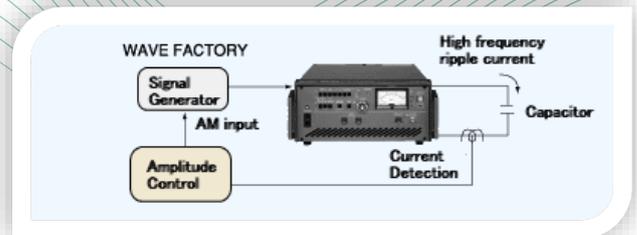
Example of a driving for piezo-electric devices which is used for piezo inverter, piezo actuator and etc. As HSA series have a very low output impedance, good step response is obtained against large capacitance of piezo-electric devices.

## Measurement of (B-H curve) for magnetized characteristics of magnetic material



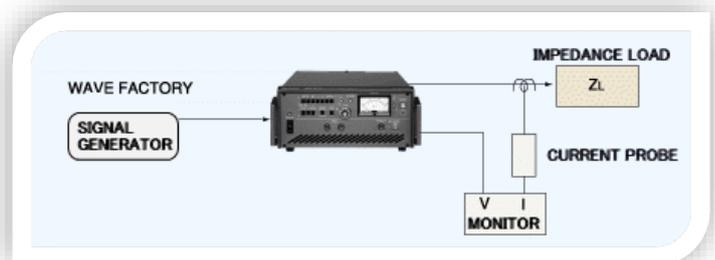
Example of magnetized devices for B-H curve measuring of high frequency magnetic materials. As HSA series have a flat and a wide frequency response and a high stability against inductive loads, high repeatability data is obtained with no influence of loads.

## High frequency ripple of capacitors



Example of a withstand ripple test for electric capacitors using a switching power supply. HSA series has not only bias function but also a stable operation against large capacitor loads. It is not caused a difference between a maximum charge current and a maximum discharge current for stable operation against large capacitor loads and symmetry of operation area.

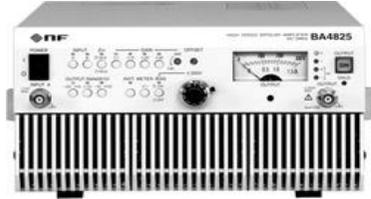
## Power amplifiers of signal generators



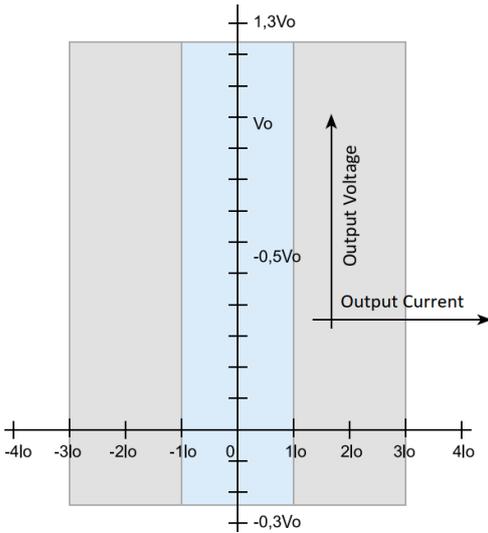
HSA series is suitable for a power amplifier of signal generators. It is possible to provide a stable power against inductive and capacitive loads with wide frequency range, high output voltage and low output impedance.

- Driving for ultra sonic motor
- Research of IC card
- Testing for semiconductor devices
- Bioelectronics
- Chemical electronics

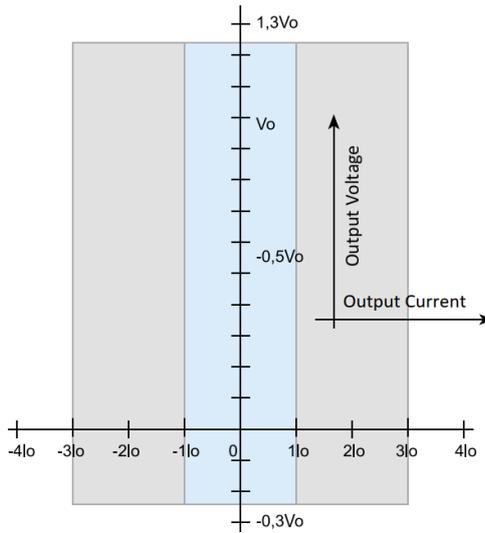
## Specifications HSA series

| Model                 | HSA 4051  | HSA 42011   | BA4825   |  |
|-----------------------|---|---|--|--|
| Model                 |                                  |    |   |  |
| Frequency range       | DC to 500kHz  | DC to 1MHz  | DC to 2MHz   |  |
| Output                | Maximum voltage   | 300Vp-p(±150V)<br><b>±150V range</b><br>RL=100Ω<br>100Vrms(40Hz to 200kHz)<br>40Vrms(20Hz to 500kHz)<br>RL=300Ω<br>±150V(DC to 50kHz)<br>±55V(DC to 500kHz)<br><b>-50 to +250V range RL=500Ω</b><br>-50 to +250V(DC to 50kHz)<br>+45 to +155V(DC to 500kHz)<br><b>-250 to +50V range RL=500Ω</b><br>-250 to +50V(DC to 50kHz)<br>-155 to -45V(DC to 500kHz) | 150Vp-p<br>RL=50Ω<br>53 Vrms (40 Hz to 1 MHz)<br>45 Vrms (20 Hz to 40 Hz)<br><br>RL=75Ω<br>±75 V (DC to 1 MHz)   | <b>±150V range (rated resistance load 200Ω)</b><br>100Vrms or greater 40Hz to 500kHz<br>70Vrms or greater 500kHz to 1MHz<br>40Vrms or greater 1MHz to 2MHz<br><b>±150V range (rated resistance load 450Ω)</b><br>±150V (300Vp-p) DC to 500kHz<br>±100V (200Vp-p) 500kHz to 1MHz<br>±56V (112Vp-p) 1MHz to 2MHz<br><b>+250V range (rated resistance load 1,250Ω)</b><br>-50V to +250V DC to 500kHz<br>+40V to +240V 500kHz to 1MHz<br>+80V to +200V 1MHz to 2MHz<br><b>-250V range (rated resistance load 1,250Ω)</b><br>-250V to +50V DC to 500kHz<br>-240V to -40V 500kHz to 1MHz<br>-200V to -80V 1MHz to 2MHz |
|                       | Maximum current   | 1 Arms, 2.83Ap-p(40Hz to 200kHz)<br>±0.5A(DC to 40Hz)   | 1.06 Arms, 3 Ap-p (40 Hz to 1 MHz) AC<br>±1 A DC   | 0.5Arms (±150V range, rated resistance load 200Ω)  |
|                       | Slew rate   | 450V/μs typ.  | 475V/μs typ.   | 500V/μs  |
|                       | Impedance   | 1Ω+3.2μH max.   | [0.19+0.0155 f (1+j)] Ω or less (typ.) f : frequency (Hz)  | 0.5Ω + 1.5μH or less (typ.)  |
|                       | Preamp output   | Opposite phase of input. (Available for 2 units BTL)  | —  | —  |
|                       | DC bias   | ±200V(by 10 turns potentiometer)  | ±75 V or above on/off with switch on front panel   | ±200V or more<br>Allows turning on/off by the front panel switch.  |
|                       | Other functions   | Monitor meter*1, Monitor output, DC offset adjustment, Output ON/OFF switch   | Monitor meter*1, Monitor output, DC offset adjustment, Output ON/OFF switch, Protection function: Overload, Output overvoltage, Internal power supply error, Cooling fan error | Output polarity switching, output range shift, output monitoring, external output on/off control, DC bias addition, and DC offset adjustment   |
| Input                 | Type  | 2 inputs of A and B(Enable to add),Same phase both of A and B input against output  | Input A, Input B or addition of input A and input B (When two inputs are on, the maximum input voltage is within ±10 V in total)   |  |
|                       | Impedance   | 50Ω/600Ω selectable   | 50 Ω±5%,10 kΩ±5% switchable (Unbalanced, switch between two inputs A and B at once)  |  |
| Gain                  | ×20,×40,×100,×200 and×(1 to 3)variable continuously   | Fixed : ×1, ×10, ×20, ×50 Variable: ×1(CAL) to ×3 consecutive Gain Setting is (Fixed)×(Variable).   | Fixed: ×1, ×10, ×20, ×50<br>Variable: ×1 (CAL) to ×3, consecutive<br>The set gain equals to (Fixed x Variable).  |  |
| Frequency response    | 500kHz(+0.5 to -3dB, 20Vrms,±150V range)  | DC to 100 kHz : -1 dB to +1 dB<br>100 kHz to 1 MHz : -3 dB to +1 dB (Output Amplitude 10 Vrms, reference 400 Hz)  | DC to 100kHz, ±0.5 dB<br>100kHz to 2MHz, +1, -3 dB<br>Conditions: Output amplitude 20 Vrms, reference 1 kHz  |  |
| Input voltage         | AC100V (One of 120V/200V/220V/240V can be modified by factory option), 48Hz to 62Hz                               | AC100 V to 230 V±10% (Maximum voltage 250 V), Overvoltage category II 50 Hz ±2 Hz or 60 Hz ±2 Hz (Single-phase), Power factor 0.95 or mo  | ±10V   |  |
| Power consumption     | 340W/500VA  | 290VA   | 350VA or less  |  |
| Dimensions(mm)/Weight | 290(W)×132.5 (H)×450(D)/approx.13kg   | 220(W)×132.5(H)×450(D)/approx.10kg  | 58(W)×132.5(H)×390(D) (not including protrusions)/ approx. 7kg   |  |
| Reference             | *1 Average value indication of DC+AC<br>*2 DC mode :DC to 100kHz ,AC mode :40Hz cutoff frequency HPF is inserted. |   |  |  |

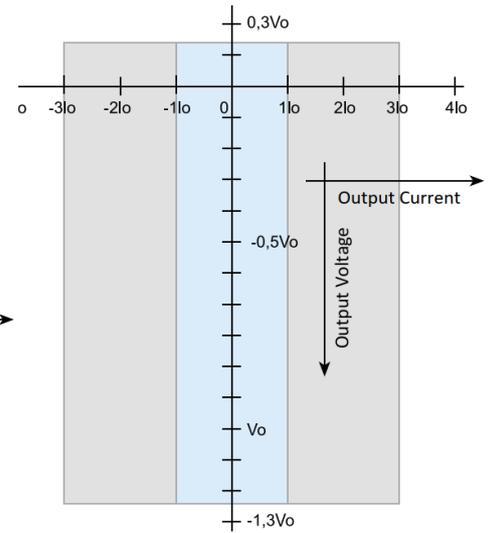
# HSA 4051, HSA 4052 and HSA 4101



For the +250V to -50V range of the **HSA4051** and **HSA4052**.



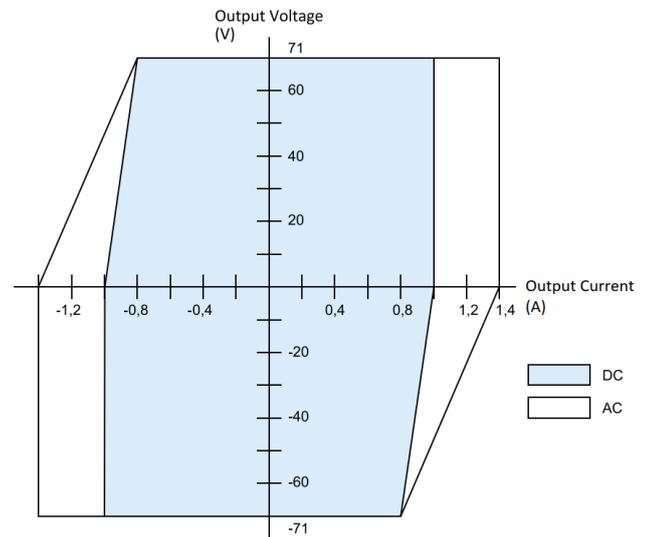
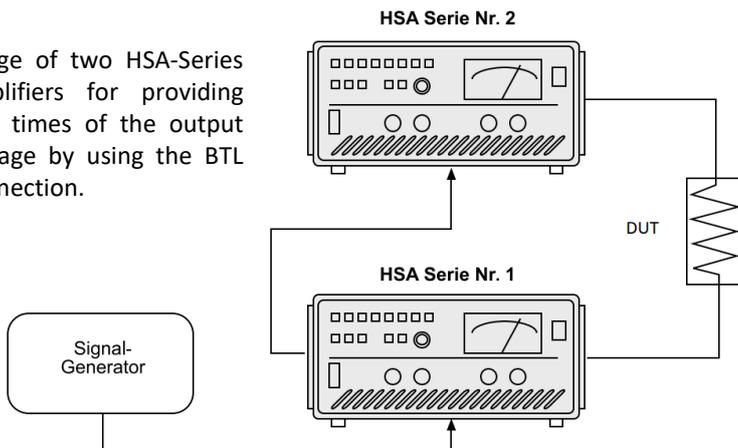
For the  $\pm 150$ V range of the **HSA4051** and **HSA4052**.



For the +50V to -250V range of the **HSA4051** and **HSA4052**.

- For DC (including AC at 1Hz or less) or the mean value of AC.
- For the peak value of AC at 40Hz or more.

Usage of two HSA-Series amplifiers for providing two times of the output voltage by using the BTL connection.



For **HSA 4101**

# HSA 42011

Unless otherwise noted, below setting and conditions are specified after 30 minute warm up period.

- Output Waveform: sine wave
- Output Polarity : In-phase
- Load: 50 Ω (Power Factor 1, nominal value)
- Input Impedance : 50 Ω
- Gain Setting : x50 (CAL)

The following values with accuracy represents warranted performance, values without accuracy are not warranted, they are typical values(typ.) or reference values. Reference values are only supplementary data to use for reference, they do not guarantee performance.

| Input                                   |   |
|---|---|
| Input type                              | Input A, Input B or addition of input A and input B (When two inputs are on, the maximum input voltage is within ±10 V in total)  |
| Input impedance                         | 50 Ω±5%, 10 kΩ±5% switchable<br>Unbalanced, switch between two inputs A and B at once)  |
| Maximum input voltage                   | ±10 V   |
| Non-destructive input voltage           | ±11 V   |
| Input terminals                         | BNC connector Input A : Front panel, Input B : Rear panel Lo side is connected to the chassis. BNC connector Input A : Front panel, Input B : Rear panel Lo side is connected to the chassis. |
| Output                                  |   |
| Output mode                             | Constant Voltage (CV)   |
| Output polarity                         | In-phase or reversed phase (switchable with switch on front panel)  |
| Gain setting function                   | Fixed : x1, x10, x20, x50 Variable: x1(CAL) to x3 consecutive Gain Setting is (Fixed)×(Variable).   |
| Gain error                              | ±5% (Fixed Gain : x1, x10, x20, and x50, Variable Gain : CAL, at 400 Hz)  |
| Maximum output voltage                  | Load of Resistance 50 Ω 53 Vrms (40 Hz to 1 MHz)<br>45 Vrms (20 Hz to 40 Hz)<br>Load of Resistance 75 Ω ±75 V (DC to 1 MHz)   |
| Maximum current (AC)                    | 1.06 Arms, 3 Ap-p (40 Hz to 1 MHz)  |
| Maximum current (DC)                    | ±1 A  |
| Low amplitude frequency characteristics | DC to 100 kHz : -1 dB to +1 dB<br>100 kHz to 1 MHz : -3 dB to +1 dB<br>(Output Amplitude 10 Vrms, reference 400Hz)  |
| Slew rate                               | 475 V/μs or above (Input Square wave, output 150 Vp-p)  |
| Output DC offset                        | Adjustment Range : ±0.5 V or above (Input Terminal Short circuit)<br>Temperature Drift : within ±(1+0.1×G) mV/°C (typ.)<br>※G is gain (DC bias off)   |
| Output DC bias                          | ±75 V or above on/off with switch on front panel  |
| Harmonic distortion factor              | 0.1% or less (40 Hz to 1 kHz, output 40 Vrms)<br>0.5% or less (1 kHz to 100 kHz, output 40 Vrms)  |
| Spurious                                | -30 dBc or less (100 kHz to 1 MHz, output 40 Vrms)  |
| Output noise                            | (3.6+0.08×G) mVrms or less<br>※G is gain (Input terminal short circuit, bandwidth 10 Hz to 1 MHz)   |
| Output impedance                        | [0.19+0.0155 f {1+j}] Ω or less (typ.) f : frequency (Hz)   |
| Output terminals                        | BNC connector<br>Terminal Number : 2 (1 for front panel and 1 for rear panel) Lo side is connect to chassis.<br>Terminals on front panel and rear panel are connected in parallel.            |
| Output voltage monitor                  |   |
| Monitor ratio                           | 1/100 of output voltage (1 V / 100 V), same polarity as output voltage  |
| Monitor accuracy                        | ±5.0% (DC to 1 MHz) (Error between output voltage and monitor output conversion voltage, load impedance 1 MΩ)   |
| Output impedance                        | 50 Ω±5%   |
| Output terminal                         | BNC connector (rear panel)  |
| Output level LED meter                  |   |
| Display item                            | Output voltage and Output current   |
| Detection method                        | Level display from 0% to 100% with 11 LEDs.<br>Average value detection (AC+DC). Calibrated with sine wave.  |
| Full scale (100%)                       | Voltage : 75 V Current : 1.06 A   |

| Protection function         |  |
|-----------------------------|--|
| Overload                    | By detecting excessive output current or excessive internal power loss, the output current is clipped and the front panel overload LED lights up. Output turns off if the overload condition continues for 10 seconds or longer. If the overload continues for 60 seconds or longer, the mode switches to disabled mode. |
| Output overvoltage          | Output turns off when an error is detected. If the error continues for 60 seconds or longer, the mode switches to disable mode.  |
| Internal power supply error | The internal power error LED on the front panel flashes when an error is detected. Then output off, the mode switches to disable mode.   |
| Internal temperature error  | The front panel overload LED lights up when an error is detected. Output turns off if the temperature error continues for 10 seconds or longer. If the overload continues for 60 seconds or longer, the mode switches to disable mode.   |
| Cooling fan error           | Output turns off when an error is detected. The mode switches to disable mode.   |

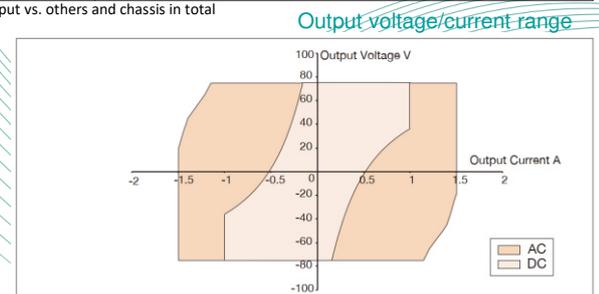
| External control input/output |  |   |
|-------------------------------|--|---|
| Control input                 | Control item                             | Output on/off   |
|                               | Control input valid/invalid              | Setting with the DIP switch on the rear panel   |
|                               | Input level                              | Hi : +4.0 V or more Lo : +1.0 V or less   |
|                               | Non-destructive input                    | +6 V/-5 V   |
|                               | Input type                               | Photocoupler LED input (series resistance 150 Ω)  |
| Status output                 | Signal detection cycle                   | 50 ms   |
|                               | Output type                              | Open collector output   |
|                               | Range of voltage and current             | 15 V or less, 10 mA or less   |
|                               | Status item                              | Output on/off (output on is short-circuited), Overload (output overload is short-circuited) |
| State update cycle            | 10 ms                                    |   |
| Terminals                     | D-sub 9-pin multi connector (rear panel) |   |

| Output on/off control |   |
|-----------------------|---|
| Output on/off         | Controlled by front panel switch or external control input (When the external control input is valid, only output off is valid for front panel operation) |

| Power-on status setting |   |
|-------------------------|---|
| Setting method          | The DIP switch on the rear panel  |
| Setting items (8 items) | Output (on/off), Gain, External control (on/off), Output polarity, input A (on/off), input B (on/off), Input impedance (50Ω/10kΩ), DC bias (on/off) |

| Power-on status setting |  |
|-------------------------|--|
| Power input             | AC100 V to 230 V±10% (Maximum voltage 250 V), Overvoltage category II 50 Hz ±2 Hz or 60 Hz ±2 Hz (Single-phase), Power consumption (Maximum) 290 VA<br>Power factor 0.95 or more |
| Withstanding voltage*   | AC1500 V   |
| Insulation resistance*  | 10 MΩ or higher (DC 500 V)   |
| Operating environment   | 2000 m or lower  |
| Altitude                | 0°C to +40°C 5% RH to 85% RH,<br>(Absolute humidity 1 to 25g/m3, no condensation)  |
| Guaranteed operation    | +5°C to +35°C 5% RH to 85% RH,<br>(Absolute humidity 1 to 25g/m3, no condensation)   |
| Guaranteed performance  | +5°C to +35°C 5% RH to 85% RH,<br>(Absolute humidity 1 to 25g/m3, no condensation)   |
| Storage conditions      | -10°C to +50°C 5% RH to 85% RH,<br>(Absolute humidity 1 to 29g/m3, no condensation)  |
| Dimensions (W×H×D) mm   | 220×132.5×450 (no protrusions)   |
| Weight (approx.)        | 10 kg  |

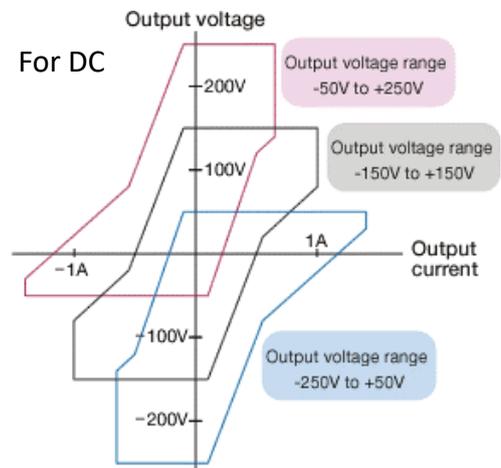
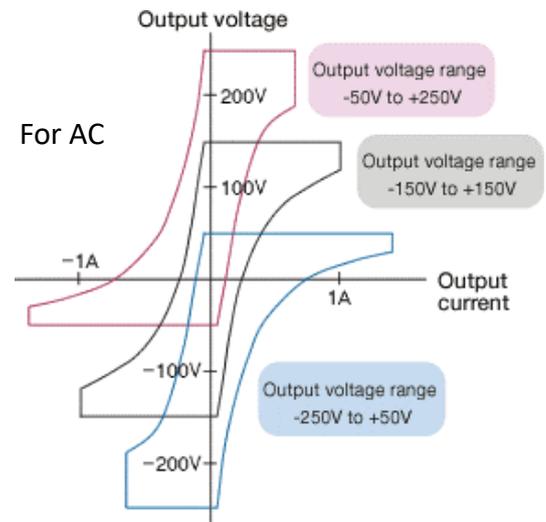
\*Between power input vs. others and chassis in total



| Frequency                                    |   |                |
|--|---|----------------|
| Frequency bandwidth                          | DC to 2MHz  |                |
| Output                                       |   |                |
| Maximum output voltage                       | ±150V range (rated resistance load 200Ω)  |                |
|  | 100Vrms or greater  | 40Hz to 500kHz |
|  | 70Vrms or greater   | 500kHz to 1MHz |
|  | 40Vrms or greater   | 1MHz to 2MHz   |
|  | ±150V range (rated resistance load 450Ω)  |                |
|  | ±150V (300Vp-p)   | DC to 500kHz   |
|  | ±100V (200Vp-p)   | 500kHz to 1MHz |
|  | ±56V (112Vp-p)  | 1MHz to 2MHz   |
|  | +250V range (rated resistance load 1,250Ω)  |                |
|  | -50V to +250V   | DC to 500kHz   |
|  | +40V to +240V   | 500kHz to 1MHz |
|  | +80V to +200V   | 1MHz to 2MHz   |
|  | -250V range (rated resistance load 1,250Ω)  |                |
|  | -250V to +50V   | DC to 500kHz   |
|  | -240V to -40V   | 500kHz to 1MHz |
|  | -200V to -80V   | 1MHz to 2MHz   |
| Rated output current                         | 0.5Arms (±150V range, rated resistance load 200Ω)   |                |
| Output power                                 | Constant voltage (CV)   |                |
| Output polarity                              | In-phase or reversed phase (toggled with the panel switch)  |                |
| Characteristics of small amplitude frequency | DC to 100kHz, ±0.5 dB<br>100kHz to 2MHz, +1, -3 dB<br>Conditions: Output amplitude 20 Vrms, reference 1 kHz         |                |
| Gain setting                                 | Fixed: ×1, ×10, ×20, ×50<br>Variable: ×1 (CAL) to ×3, consecutive<br>The set gain equals to (Fixed × Variable).     |                |
| Slew rate                                    | 500V/μs   |                |
| Output DC offset                             | Adjustment range: ±0.5V or more (input terminal short circuit)  |                |
| Output DC bias                               | ±200V or more<br>Allows turning on/off by the front panel switch.   |                |
| Output impedance                             | 0.5Ω + 1.5μH or less (typ.)   |                |
| Output terminal                              | BNC connector (front panel), Lo side grounded to the cabinet  |                |
| Monitor output                               | 1/100 of output voltage, in-phase   |                |
| Monitor meter                                | Displays output voltage or current (toggled with the switch)  |                |
| Output on/off                                | Front panel switch or external control input.   |                |
| Input  |   |                |
| Maximum input voltage                        | ±10V  |                |
| Number of terminals                          | 2 (A input: Front panel, B input: Rear panel)<br>(Input type may be A input, B input, or both A input and B input.) |                |
| Input terminals                              | BNC connector, Lo side grounded to the cabinet  |                |
| Input impedance                              | 5Ω and 10kΩ, switchable   |                |

| Miscellaneous                      |   |
|------------------------------------|---|
| Protection function                | Output overcurrent, output overvoltage, power section failure, abnormal internal temperature                        |
| External control input/output      | 2 (A input: Front panel, B input: Rear panel)<br>(Input type may be A input, B input, or both A input and B input.) |
| Settings at power-on               | Settings power-on made by dip switches on the rear panel (10 settings)  |
| Power input                        | AC100V to 230V ±10% (at 250V or less), 50Hz/60Hz ±2Hz   |
| Power consumption                  | 350VA or less   |
| Operating temperature and humidity | 0 to +40°C, 5 to 85%RH<br>(Absolute humidity 1 to 25g/m <sup>3</sup> , no condensation)                             |
| Dimensions (mm)                    | 258(W)×132.5(H)×390(D) (not including protrusions)  |
| Weight                             | Approx. 7kg   |

■ BA4825 output voltage and current range



Qualitätsprodukte

Fachkompetenz

Zuverlässigkeit

Top Service

Flexibilität

Faire Preise

Schnelligkeit

**7 gute Gründe, die für COSINUS sprechen.**



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