



Reference Series

HEADPHONE AMPLIFIER

HPA RS 02



USER'S MANUAL



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CAUTION

**THE HIGH OUTPUT LEVELS
ACHIEVABLE WITH THIS UNIT
MAY DAMAGE YOUR HEARING
OR THE HEADPHONES
IF OPERATED CARELESSLY !!**

Cordial thanks for your decision in favour of a Lake People product !

Lake People electronic GmbH develops, manufactures and distributes products in the professional range, for broadcast, television, airports, exhibition halls, festival venues, theatres, large-scale installations, private studios and more. In the private sector as well, Lake People products become increasingly popular due to their outstanding quality.

Who develops Lake People equipment ?

The devices are exclusively developed in Germany by the engineers of Lake People electronic GmbH. In doing so, the team of developers can draw on thirty years of experience and countless products for the pro-audio domain.

Among others, the first German-made 20-bit A/D and D/A converters were developed by Lake People in the early nineties of the past century.

Who manufactures Lake People equipment ?

The devices are exclusively manufactured in Germany by Lake People electronic GmbH or contractors in the company's vicinity.

Lake People puts high emphasis on domestic manufacturing. As well, all component suppliers are chosen in order to achieve the main part of added value inland.

How do Lake People devices get to the customer ?

Lake People devices can be obtained from respective specialist suppliers. If there is none such accessible regionally, the customer is supported by transregional distribution partners (google may help...) and, of course, by Lake People on-line shop.

Å and if it doesn't work like it should ?

Lake People devices are covered by a 24-month warranty. In case of any malfunction during this period, they can be shipped to the manufacturer directly. Of course, the client will benefit from Lake People's full technical support even when warranty has expired. Any technical questions or need for advice is welcome.



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General Safety Instructions

WARNING

For your protection, please read the following:

Water, Liquids, Moisture:

This appliance should not be used near water or other sources of liquids. Care should be taken so that objects do not fall and liquids are not spilled into the enclosure through openings.

Power Sources:

The appliance should be connected to a power supply only of the type described in the operating instructions or as marked on the appliance.

Grounding:

Care should be taken that this appliance is operated with proper grounding only.

Power Cord:

Power supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon or against them, paying particular attention to cords at plugs, convenience receptacles, and the point where they exit from the appliance.

This unit is equipped with a 3-pole mains cable with German 3-pin mains plug. In some countries this unit must be operated with a mains adaptor, supplied by the owner.

Please refer to the table below to connect a mains plug:

OVERVIEW: POWER CORD FUNCTION AND COLORS			
CONDUCTOR		COLOR	Alternativ
L	LIVE	BROWN	BLACK
N	NEUTRAL	BLUE	WHITE
E 	PROTECTIVE EARTH	GREEN+YELLOW	GREEN

U.K. Mains Plug Warning:

A moulded mains plug that has been cut off from the cord is unsafe. Discard the mains plug at a suitable disposal facility.

NEVER UNDER ANY CIRCUMSTANCES SHOULD YOU INSERT A DAMAGED OR CUT MAINS PLUG INTO A 13 AMP POWER SOCKET. Do not use the mains plug without the fuse cover in place. Replacement fuse covers can be obtained from your local retailer. Replacement fuses are 13 amps and **MUST** be ASTA approved to BS 1362.

Mains Fuse:

The mains fuse of this appliance is soldered in place and accessible from the inside only!!

A blown fuse may indicate an internal problem and should be replaced during qualified servicing or repair work !!

Switchable Power Supply:

Connect this unit to the power source indicated on the equipment rear panel only to ensure safe operation !!

This unit is provided with a toroidal transformer which can be set to 230 VAC or 115 VAC operation by means of an internal Voltage-Selector+switch.

The 115 V versions are labelled 115 V AC+ on the back panel, while the standard 230 V version is labelled 230/115 V on the back panel.

Service / Repair:

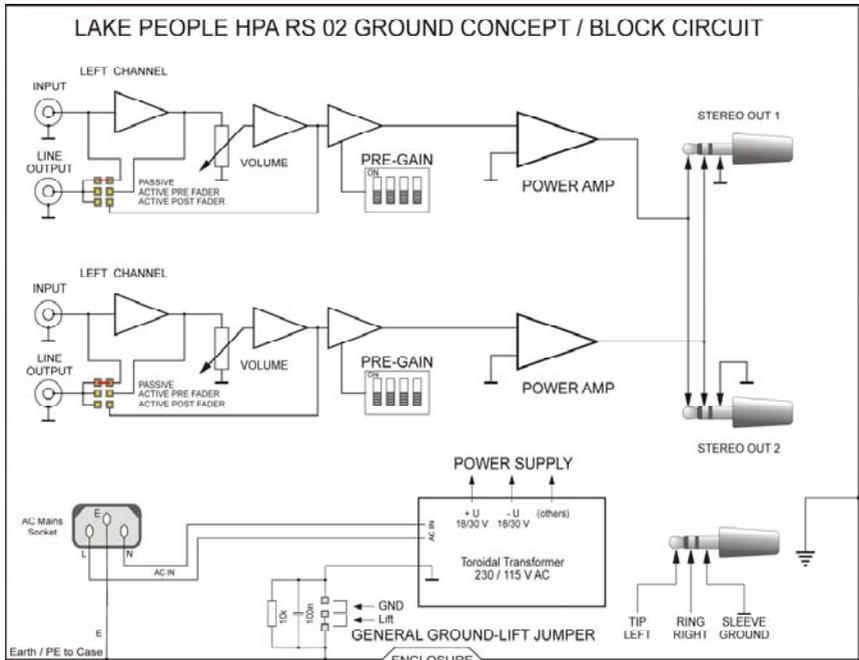
To reduce the risk of fire or electric shock, the user should not attempt to service the appliance beyond the measures described in the operating manual. All other servicing or repair should be referred to qualified personnel !!

**Electromagnetic Compatibility**

This unit conforms to the Product Specifications noted as **Declaration of Conformity** at the end of this manual. Operation is subject to the following conditions:

- this device may not cause harmful interferences
- this device must accept any interference received, including interference that may cause undesired operation
- this device must not be operated within significant electromagnetic field

THE EARTH / GROUNDING CONCEPT



**General GROUND-LIFT Jumper - accessible from the inside.
Mind the SECURITY INSTRUCTIONS !!**

Ex-works this jumper is set to the **LIFT** position.

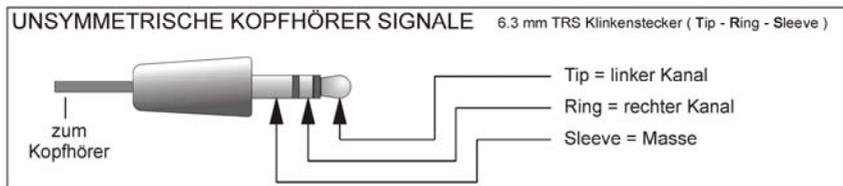
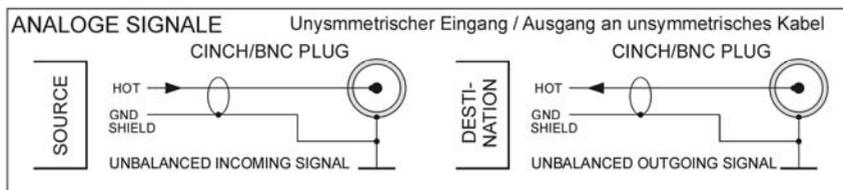
The internal ground potential is **lifted** by means of this jumper.

As a result, the interconnection for DC voltages and lower frequencies (< 150 Hz) will be cut. Higher frequencies will be bled off to earth potential through the RC filter. The LIFT position is helpful in case of hum or jitter caused by different ground/earth potentials.

Of course full electrical protection is granted as the case is always connected to ground/earth potential !

**Please note that with jumpers in LIFT or GROUND position
EMC emission might occur,
for which the user is responsible only !**

Anschluss / Steckerbelegung



GENERAL

The HPA RS 02 is a stereo headphone amplifier designed for low-, medium- and high-Z loads (16 ... 600 ohms), as typical for most high-quality headsets. Due to its circuitry layout optimized in terms of noise/THD and specially adapted to the headphones mentioned above, the HPA RS 02 fulfils highest quality demands.

Features:

- Unbalanced inputs with gold-plated RCA connectors
- Unbalanced line-outputs with gold-plated RCA connectors
- **PRE-GAIN** = switchable input gain in five steps
- Line-outputs internally switchable to three modes:
 - o Passive feed-through
 - o Active feedthrough without volume control (pre fader)
 - o Active feedthrough with volume control (post fader)
- ALPS RK27 High-Grade volume control
- High-Quality op-amps in the signal path
- High-quality MKP capacitors in the signal path
- 0.1 and 1% metal film resistors throughout the unit
- **power amps with 4 transistors per channel**
- 2 silver-plated Neutrik headphone outputs
- Relay-based delayed headphone output cut-off

- toroidal transformer
- Large filtering capacitors in the power supply
- Switchable ground lift
- Rugged aluminum case, black anodized
- Aluminum front- and back panel

Despite its compact dimensions, the HPA RS 02 offers optimum flexibility and highest output power. In addition, this amp is equipped with internal filters to prevent overload by inaudibly high or low frequencies.

THE CASE

The case of HPA RS 02 is made of black anodized aluminium, including the front- and back panels. This provides high mechanical stability and resistance against rough handling.

The cases surfaces are providing excellent electrical conductivity for optimum EMC characteristics.

EARTH AND GROUND

The Case of HPA RS 02 is connected to earth potential. The internal ground potential is set to **↑FT+** position but may be connected to earth by means of a jumper. If required, the jumper may be set to **↓GND+** position (see page 7: "The earth/grounding concept" and page 19: "Jumper settings").

POWER SUPPLY

Mains power is provided via a three-pin IEC/CEE socket and mating "cold-appliance" mains cord with a dedicated wall plug. The device is set to 230 or 115 V AC mains internally, whereas the actual voltage may vary between 190 ÷ 240 V for 230 V and 85 ÷ 120 volts for 115 V for flawless operation. Altering the mains voltage can easily done by a simple internally accessible **Voltage Selector** switch. An oversized toroidal transformer provides the internal operating voltages.

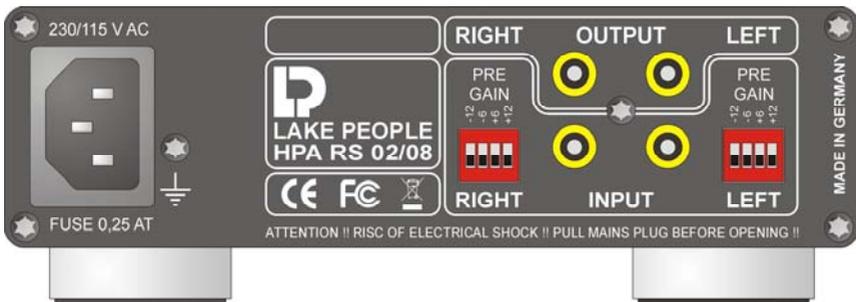
The 115 V versions are labelled **115 V AC** on the back panel, while the standard 230 V version is labelled **230/115 V** on the back panel.

MAINS FUSE

The 0.25A time-lag fuse is soldered in place on the circuit board. In case, it must be replaced with a fuse of the same type only.

CAUTION !! MIND THE SAFETY INSTRUCTIONS:

A blown fuse indicates an internal fault and should be replaced during qualified repair or servicing only !!



THE LINE INPUTS

For the use with unbalanced signals, RCA sockets are provided. They are labelled as "INPUT LEFT" and "INPUT RIGHT".

Here, sources like CD players, network players, tuners or similar maybe connected.

Too loud ? Too soft ? The PRE-GAIN method

The RS 02 is specially designed to drive headphones. Headphones however can present load impedances from 8 to 2000 ohms and efficiency ratios from 85 to 115dB per milliwatt. Thus it can be quite tricky to fulfil all demands, since...

ō owners of high-effectivity headphones will rarely set the volume control higher than 9 o'clock in order to exclude hearing damage, while

... the maximum setting may still be too soft for low-efficiency headphones, but

ō all users expect highest quality at lowest noise and distortion.

Thus, the *circuitry* must adapt itself as the headphone won't !

WE CALL THE SOLUTION TO THIS PROBLEM **PRE-GAIN**

The alignment between amplifier and headphone is provided by the preamp stage, which can boost or attenuate the input signal in four steps of 6dB each. For this purpose, two switching devices are located on the rear panel for left and right channel individually.

CAUTION !!

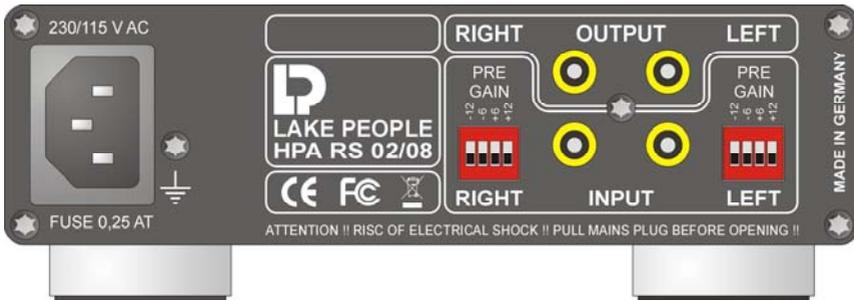
The settings should be altered under the following conditions only:

- The unit must be switched OFF
- the "VOLUME" control must be set to minimum
- left and right channel should ALWAYS be set the same
- never increase the setting by more than ONE step per channel at a time.

If you find your HPA RS 02's volume could be somewhat softer (in order to improve volume control range e.g.), push the switch labelled "-6dB" (half gain) or "-12dB" (quarter gain) in upward direction.

If you find your HPA RS 02 should provide more gain, do so with the switch labelled "+6 dB" (double gain) or "+12 dB" (quadruple gain).

Ex-factory, all switches are set to their lowest position - i.e. 0 dB or unity gain - which should be sufficient for most applications.



THE LINE OUTPUTS

For some set-up it may be practical and helpful to insert the HPA RS 02 into an existing signal path. To do so, gold plated RCA sockets are provided on the back panel, labelled "OUTPUT LEFT" and "OUTPUT RIGHT".

These outputs can be configured in three ways by means of internal jumpers after opening the case:

(about their configuration, see page 19)

1. Passive feedthrough

The mirrored input signal is present on the output sockets. As this is a passive feedthrough, no power supply is necessary. But please note that the input impedances of the connected units may interact among each other and may cause problems.

2. Active feedthrough (without volume control)

The actively buffered input signal is present on the output sockets. It has the same signal level. As it is buffered, it may drive several meters of cable without affecting the quality.

3. Active feedthrough (with volume control)

The actively buffered input signal is present on the output sockets. The signal level is affected by the volume control of HPA RS 02. Again, it may drive several meters of cable which can be useful for operating active speakers.

For active operation the output impedances on these line outputs are well beyond 1 ohm. The signal strength is not affected by the Pre-Gain setting.



POWER SWITCH

The unit is put into operation by means of the power switch. Power-on status is indicated by the green LED below.

VOLUME CONTROL

The "VOLUME" control sets the desired output volumes for left and right channel simultaneously.

THE AMPLIFIERS

The input signals are fed to a special stereo amplifier. The amp circuitry is derived from the famous Vioelectric HPA V100 !

The amplifier's frequency range stretches from nearly DC to over 200kHz (-3dB cutoff frequency) in order to obtain absolutely linear characteristics within the audible range. Overall gain is set to +8 dB in order to provide sufficient reserves also for high-impedance headphones.

THE UNBALANCED HEADPHONE OUTPUTS

The HPA RS 02 offers two stereophonic headphone outputs, each equipped with a 1/4" (6.3mm) jack socket. Both sockets are connected in parallel. A relay serves for delayed switch-on and rapid switch off to protect the headphones from noise and pops during powering on/off.

Unbalanced Headphone socket pinout:	
TIP	Left channel
RING	Right channel
SLEEVE	GND

Things to know Å

Why makes it sense to make such huge efforts ?

A headphone amplifier is a device designed to condition audio signals with regard to the very specific requirements of headphones. This doesn't sound too spectacular at the first glance and can be achieved relatively easily. As with many things however, the devil is in the details and much more effort is required to design **one** amplifier for **all** current headphone models.

Headphones per se are quite diverse, and there are two essential parameters: impedance and sensitivity.

In general, headphones with higher impedance can be regarded as less sensitive than headphones with low impedance (which is not generally true, but in the majority of cases). The sensitivity of headphones is usually stated in dB (sound pressure level) per Milliwatt.

Extremes in this sense are the AKG K1000 with 74dB/mW on the one hand, and the Sennheiser HD25 with 108 dB/mW on the other hand: The K1000 requires 2500 times the power to achieve the same sound pressure as the HD25.

There is also the fact that headphones with high impedance usually require much higher voltage to achieve high loudness. Thus the amplifier *must* be designed with high internal supply voltages.

Why are op-amps ideal for low-level signal processing ?

Discrete amplifiers (designed with transistors) are very popular in high-end audio design also for preamplifier stages. This is often marketed as an optimization measure, but the partially exorbitant extra expenses are of course to be paid by the customer. But an op-amp consists of transistors as well...

Moreover, its structure has the advantage of thermal coupling between its internal components. Also ageing issues play a much less important role. Due to the large number of op-amps types offered, it is possible to pick an optimum type for any specific application.

Why does PRE-GAIN make sense ?

Two extreme examples with the HPA RS 02 at 8dB gain, volume control set to full cw:

1st example:

The (pre-)amplifier provides 4V output voltage, whereas the headphone requires only 2V for 100dB sound pressure level.

With the control fully turned up, the RS 02 would deliver 10V output at 8dB gain. Therefore the volume control would have to be operated very carefully in order to avoid hearing damage. Moreover, any interference at the input should be avoided since it would be "unforgivingly" amplified as well. With PRE-GAIN, the input level can be reduced by 12dB (a fourth), with 1 V instead of 4 V as the result. This 1 V is again amplified by 2.5, then equalling 2.5V. Now the volume control can be turned over almost the entire range.

2nd example::

The (pre-)amplifier provides 1V, whereas the headphone requires 10V to release 100dB of sound pressure.

With the volume control fully clockwise, the RS 02 would provide 2.5V at 8dB gain only - much too low for the headphone. By means of PRE-GAIN, input level can be boosted by 12dB (four times), resulting in effective 4V. These are again multiplied by 2.5, now equalling 10V. This meets exactly the target voltage.

Why does frequency bandwidth limiting make sense ?

In signal processing, sound is represented by AC voltages. Sound is audible - for young people - from about 20 to 20000 Hz. The elder the listener, the less he will hear high frequencies in particular.

In order to transmit these frequencies at optimum quality, the frequency response of an amplifier should be as wide and as "flat" as possible. At the low end of the scale, this limit is represented by DC, as there is no frequency lower than zero. In upward direction, the limit can be set to practically any frequency, but the higher, the more susceptible the device becomes concerning electro-magnetic interference. This is not

audible in the first place, but may interfere with the useful signal and then become evident. Therefore, unrestricted frequency response attests thoughtlessness rather than remarkable engineering skill.

Why is a good volume control essential ?

A volume potentiometer is a mechanical control element, which can be obtained on the market at any low price. Meanwhile it is often replaced by electronic circuitry, exhibiting essential disadvantages concerning dynamic range, noise and distortion.

Conductive-plastic resistive tracks, high-quality multi-tap wipers and separated chambers for the individual sections are highly desirable for sophisticated applications, and high quality is inevitable to ensure trouble-free operation for years. Since the market for really good pots is a small one, manufacturers like Noble or Panasonic don't offer these any more. A current sample of top of the line pots is the RK27 by ALPS, which is also used in your HPA RS 02.

Why is a low output impedance essential ?

When actuated, electro-dynamic systems respond with a counterforce. When the voice coil of a headphone has been displaced by the signal, an (error-) current will be induced when it swings back to its initial position. This current must be suppressed as far as possible, which is effected best if the amplifier's output impedance is the lowest possible. The damping factor describes nothing but the ratio between output impedance of an amplifier and a given load.

Since there is no known technical specification, we define the load (voice coil impedance) as 50 ohms. With RS 02 having an output impedance of <0.15 ohms this results in a damping factor 360.

Why are high supply voltages essential ?

A headphone doesn't really require high power, but from the equation $P = U^2 / R$ we can see that the square of the supply voltage determines the power into a given load resistance. The higher the headphone's impedance, the more voltage will be needed. But this deals with the

achievable loudness to a limited extent only:

Technically spoken, music lives on fast transients which put high demands on signal processing. And thus a fast transient can easily push an average amplifier with +/-15 volts supply to its limits (90 % of all headphone amps in the market are operated with these or even lower supply voltages). Due to the high supply voltage of HPA RS 02 you will benefit from more than doubled output voltage swing capability.

Why we are designing our amps exactly this way.

They are made with transistors in the power stage and operated with +/- 30 Volts DC because it makes sense. But real power is not the question concerning headphone amps.

Each channel consists of 4 transistors, 2 x low power, 2 x medium power but fast video transistors. All this is controlled by an NE5532 op-amp, it is connected non-inverting with a gain of only 8 dB (factor 2.5).

As with all our amps, no idle current adjustment is necessary.

For high impedance headphones this amp provides a very high output voltage of $53 V_{ss} = 19 V_{eff}$ For low impedance/low sensitivity headphones there is high power of up to 2400 mW @ 100 ohm.

The damping factor relative to 50 ohm is 360 which equals an output impedances of < 0,15 Ohm.

All this is achieved with distortions as low as possible and a dynamic range as high as possible.

Why does a relay make sense when switching power ?

Amplifiers generate unwanted output signals when applying or removing power, which can damage the connected headphones. The relay breaks the connection between amplifier and headphone and thus protects the latter until electrical conditions have stabilized.

DISMANTLING / JUMPER SETTINGS

Hint: Here we are talking about some internal settings inside your HPA RS 02. You are in need of a screw drivers TORX style size T10 or 2.5 mm allen key.

You should by all means

PULL THE MAINS PLUG !!!

Only thereafter the settings can be altered without any hazard.

DISMANTLING

To avoid damages please follow the instruction below:

1. screw off both upper screws on the front panel
2. screw off both upper screws on the back panel.
3. now lift the upper lid
4. make your personal jumper settings
5. assemble the unit in reverse order

DISPOSAL



Disposal of Old Electrical & Electronic Equipment
(Applicable in the European Union and other European countries with separate collection systems)

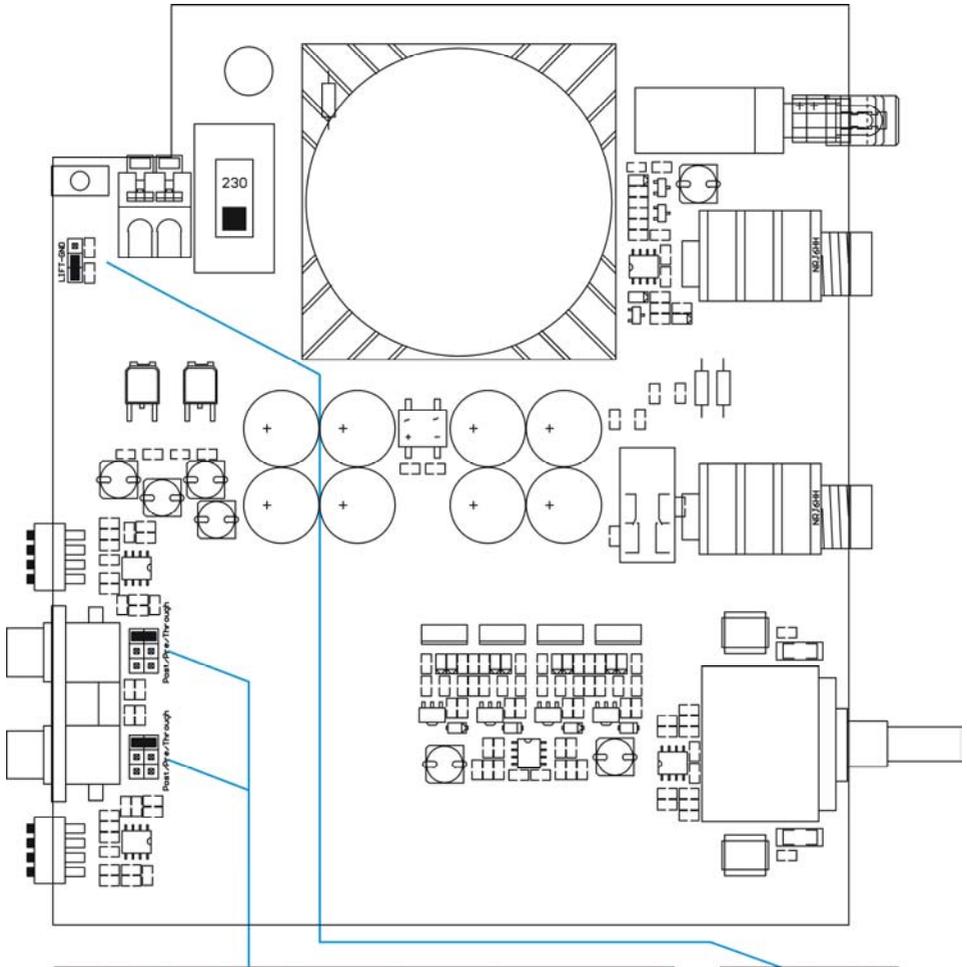
This symbol on the product or on its packaging indicates that this product shall not be treated as household waste. Instead it shall be handed over to the applicable collection point for the recycling of electrical and electronic equipment.

By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product.

The recycling of materials will help to conserve natural resources.

For more detailed information about recycling of this product, please contact your local Civic Office, your household waste disposal service or the shop where you purchased the product.

JUMPER SETTING HPA RS 02



LINE-OUT JUMPERS

PASSIVE



Das Eingangs-Signal wird passiv durchgeschleift.



Kein Stromversorgung nötig.
(Ab Werk Einstellung)

PRE FADER



Das Eingangs-Signal wird aktiv durchgeschleift. **Keine** Regelung der Lautstärke. Stromversorgung nötig.



POST FADER



Das Eingangs-Signal wird aktiv durchgeschleift. **Mit** Regelung der Lautstärke. Stromversorgung nötig.



GROUND LIFT JUMPER



Ground Lift

Lift-Operation
The internal ground is low impedance for high frequencies (ex Works setting)



Ground Lift

Ground-Operation
The int. Ground is connected to earth potential

TECHNICAL DATA HPA RS 02

All Measurements RMS unwt'd., 20 Hz - 20 kHz, Pre-Gain set to 0 dB

Inputs: 2 x RCA, unblanced,
 Max.input voltage: + 21 dBu,
 Input impedance: 10 kohms
 Line Outputs: 2 x RCA, unbalanced
 active or passive operation
 Nominal input sensitivity: +6 dBu
 Amplifier gain: +8 dB
PRE-GAIN: -12 / -6 / 0 / +6 / +12 dB relative
PRE-GAIN: -4 / +2 / +8 / +14 / +20 dB absolute
 Frequency range: 5 Hz ... 70 kHz (- 0,5 dB)
 3 Hz ÷ 200 kHz (-3 dB)
 Output impedance: < 0,15 Ohm
 Damping factor (Load 50 Ohm): 360
 Dynamic range: > 127 dB (A-wtd)
 Noise: < -99 dBu (A-wtd)
 THD+N (1kHz/2x10V/100R = 1W) < -97 dB / < 0,001 %
 THD+N (1kHz/2x4V/32R = 0,5W) < -99 dB / < 0.0014 %
 Crosstalk: -105 dB (1 kHz) / -90 dB (15 kHz)
 Headphone outputs: 2 x ¼" (6.3 mm) Phone Jack

Max. output level:

(1kHz / < 0.1% THD+N)

Both channels driven

R _L (x 2)	U _a (dBu)	U _a (V)	P _a (mW)
600	27,8	19,0	600
300	27,2	18,1	1100
100	26,0	15,5	2400
50	21,9	9,7	1900
32	18,0	6,2	1200
16	12,8	3,4	710

Power supply:

230 V AC / 115 VAC max.10 VA

Case, Front, Back:

Aluminum

Dimensions:

168 x 49 x 145 mm (W x H x D)

EC CONFORMITY STATEMENT:

We herewith declare that the following unit

Name: **VIOELECTRIC HPA RS 02**

Serial No. : -all -

is in conformity with the following EC directives:

2006/95/EG	Low voltage directive
20014/30/EC	EMC directive
EN 60065:2002+A12:2011	Security directives for audio-, video- und similar electronic devices
JIS C6065:2013	
2001/95/EC	General Product Safety Directive

For verification of conformity with regard to electromagnetic compatibility the following harmonized standards are applied:

EN 50081-1:1992	Generic emission standard
EN 50082-1:1992	Generic immunity standard

Product family standard for audio, video, audio-visual entertainment apparatus:

EN 55013:2001	EN 61000-3-2:2000
EN 55020:2002	EN 61000-3-3:1995

2011/65/EU, RoHS directive

2012/19/EU, WEEE directive / Member No.: DE 26076388

This declaration is given under responsibility of:



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Konstanz 28.08.2016 Fried Reim CEO

WARRENTY

Since 1986 we are constructing and manufacturing sophisticated electronics for ambitious customers.

Since the early beginnings we are trying hard by accompanying measures, the use of 1st choice components and multiple quality checks during production to avoid faults at large.

We are quiet effective in that and this is . amongst others - why we enjoy such a good reputation.

Despite all accurateness faults may occure which may derogate the proper operation of your product.

In this case your unit is protected by a **5-year Warranty !**

Needless to say that we will care for your product even after the expiration of the warranty. If it is necessary please dispatch your item to:

Lake People electronic GmbH
Turmstrasse 7a
D-78467 Konstanz

Fon +49 (0) 7531 73678
Fax +49 (0) 7531 74998
E-Mail info@lake-people.de

Your warranty claim begins with the date of purchase, which should be denoted on your proof of purchase.

Do not forget to include the receipt of sales or a copy of the receipt.

Please also include a short description of the fault(s).

For the reshipment we need you correct address !!

Care for a safe packaging. Best is to use the original packaging.

Please keep in mind that we cannot accept collect freight.

We will grant a quick repair and quick return of the unit.

In case of a warranty repair we will reship free of charge.

Please denote here the serial number and the date of purchase:

Serial Number

Date of Purchase