Dr. Zähl

ZÄHL H1

Manual V 1.1

H1 Reference headphones amplifier

Reference Amplifier with unprecedented transparency and precision, attention to detail and massive power performance.

For both high-end enthusiasts and professional users.

- perfect impulse reproduction
- ultra wide frequency response
- extremly low impedance output precisely controls complex loads
- pure analogue design
- consistent dual-mono layout
- logic circuits without clock generators
- straight linear power supply with Mu-Metal shielded mains transformer
- no-compromise selection of components
- no-compromise interior and exterior construction

Designed and manufactured in Germany.

CONTENTS

NOTES, SAFETY INSTRUCTIONS, WARRANTY

1. The equipment must only be used for the purpose described in this manual.
2. Keep the manual for further reference. When passing the equipment on, enclose the manual.
3. Do not operate the equipment at
   - very high air humidity (>85% relative humidity)
   - high ambient temperature (>40°C) or in the vicinity of heat radiating equipment or objects
   - places which are exposed to solar radiation
   - very low temperatures (<5°C)
4. Ensure appropriate air ventilation.
5. Do not store the equipment at temperatures below -20°C or above +50°C.
6. Do never expose the equipment to environmental conditions which can lead to the incidence of condensation water.
7. Do not expose the equipment to mechanical stress or shock.
8. Ensure that liquids cannot get into the equipment.
9. Ensure that foreign objects cannot get into the equipment.
10. Only operate the equipment on a safe, legally approved, mains power supply
11. Only clean the equipment with smooth cleaning tissues and soft detergents.
12. Never open the equipment.
13. In case the equipment has been dropped or there is any external or functional damage, do not continue to operate the equipment. Have the equipment checked at your dealer's workshop or a person who is qualified to do such checks.
14. When shipping, use a package which protects the equipment from environmental impact such as mechanical shock or humidity.
15. Manufacturer's warranty covers the equipment to be free from defects of quality at the time of delivery for a period of 36 month presumed that
    - the equipment was treated properly according to its intended use
    - all information and safety instructions given in this manual have been followed
    - the equipment shows no external damage
    - the equipment is shipped to the manufacturer or to an authorised repair-shop free of charge
    - a proof of purchase is supplied
    - a detailed failure description is supplied

    The manufacturer takes over cost of parts and labour incurred by repair. Unless otherwise agreed any other costs including shipping and packaging will be charged.
16. We expressly exclude any liability for incidental or consequential damages which might arise from operating the equipment, including failure of the equipment.
17. All information in this manual has been carefully reviewed. It has been updated at the time of passing for press. Nevertheless we do not take over any liability for sufficiency or errors.
18. EEC Declaration of Conformity: The equipment applies to applicable EMC rules 2014/30/EU

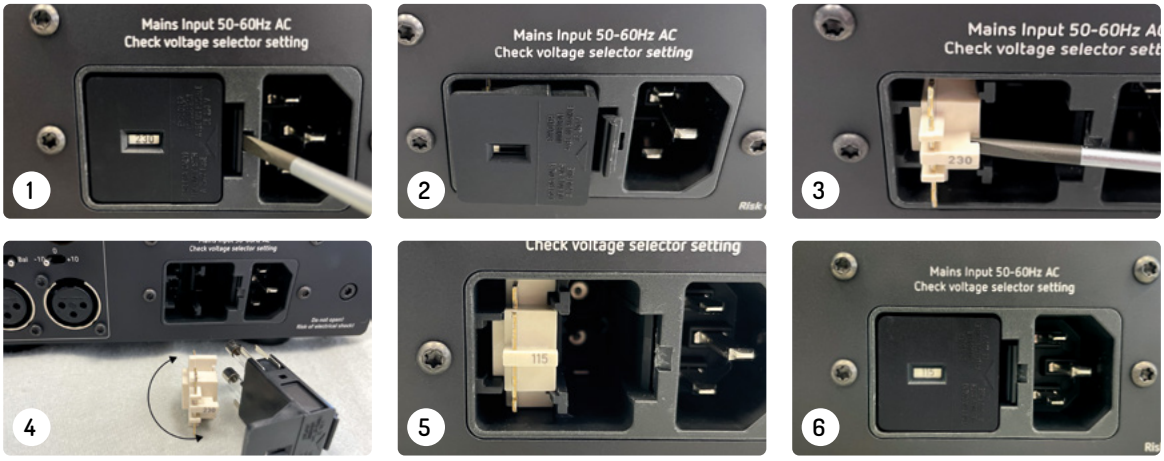
SCOPE OF DELIVERY

- H1 Unit
- Mains Cable(s)
- Spare Fuses
- Manual
- Tool for mains voltage setting and fuse replacement
- Microfiber cleaning cloth

SET-UP

- First read the chapter NOTES, SAFETY INSTRUCTIONS, WARRANTY in this manual.
- Remove the H1 from its packaging: insert your hands into the foam recesses on the front and back of the unit, reach your fingers slightly under the unit and then lift it upwards. Do not lift the unit by the knobs or the connectors.
- Check whether the mains voltage setting on the mains inlet on the rear panel complies to your local mains voltage. If not, set the voltage selector to the correct voltage, either 115V or 230V, as shown below

Note: The 115 V setting covers 104 ... 127,5 V, the 230 V setting covers 207 ... 255 V



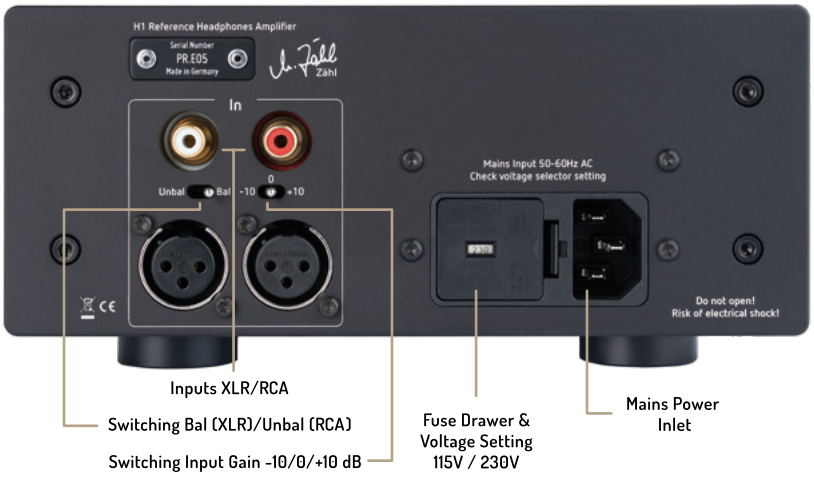
- Make sure that the power on/off button on the front panel is in the disengaged (not depressed) position, i.e. “off”.
- Plug one end of the mains cable into the H1 mains inlet connector on the rear panel and plug the other end into a legally approved mains socket.
- Press the power on/off button. The power button will illuminate.
- After several seconds the operating indicator (logo sign) right to the power button with illuminate.
- Now your H1 is ready for operation.

Note: Do not place the unit in very warm places or in direct sunlight. Always ensure that there is free airflow all around the unit, especially the heatsinks.

Note: Front and rear panels are black anodized with a matt finish, the lettering is lasered. The rest of the housing is power coated. All surfaces are very resistant and durable. You can easily remove contamination with the enclosed microfibre cloth. If necessary, a gentle cleaning agent can be used.

LEGEND


Operating Indicator
Power On/Off
Amp Mode
Volume
Class A
Class A &Servo
Power
H1 Reference Headphones Amplifier
Phones Outputs (parallel)
XLR 4pol & 1/4" Jack & Pentaconn
L/R Balance
Stereo Width / Mono


H1 Reference Headphones Amplifier
Serial Number
PR.E05
Made in Germany
In
Unbal
Bal
-10
0
+10
Mains Input 50-60Hz AC
Check voltage selector setting
Do not open!
Risk of electrical shock!
Inputs XLR/RCA
Switching Bal (XLR)/Unbal (RCA)
Switching Input Gain -10/0/+10 dB
Fuse Drawer &
Voltage Setting
115V / 230V
Mains Power
Inlet

SPECIAL FEATURES

UNIQUE: CLASS A POWER AND A STEP BEYOND

- Class A power amplifier in its purest form
- switchable negative feedback („servo“) while maintaining Class A operation

STEREO BASE CONTROL

Stereo base control for adjusting the sound stage to your preferences. Precision tool for widening or narrowing the stereo image or switching to mono.

THREE OUTPUT CONNECTORS

XLR 4-pole - ¼" Jack - Pentaconn

DETAILS

Power Stage

Class A - H1 realisation

The H1 power stage provides massive power reserves, which is already evident from the fact that it consumes more then 40W in idle mode. The output power is more than sufficient for any application, and in the millisecond range it is increased substantially. The output resistance is remarkably low. The optimum operating point of the power stage was first specified by theory, then by measurements on the sample units and finally fine-tuned during numerous listening tests with experts, especially mastering engineers. The same applies to the selection of components. This meticulous way of design largely compensates for the possible disadvantages of Class A described in the theory paragraph below.

Class A & Servo - H1 realisation

To take Class A one step further, we implement an idea which is as simple as it is ingenious: We take the best of Class A and the best of negative feedback amplifiers and put it together: Class A operation is supplemented by negative feedback ("Servo"). Since there is no crossover distortion, there is nothing for the feedback circuitry to correct. Rather, it only corrects the errors which result from the interaction between the power amplifier and the headphones. The feedback path is designed in such a way that no artefacts are created by the correction. The output resistance drops to a value which is smaller than the sum of headphones cables and connectors. In this way, headphone systems can be controlled precisely. One can say that with the H1, any headphones sound as they should.

Why Class A and Class A & Servo?

The previous paragraph may lead to the conclusion that the optimum is achieved with Class A & Servo operation.
So why do we still have the switching option? Quite simply because we judge our circuits by ear. Our Class A amplifier was developed with the highest musical demands in mind. We experienced that is does not sound the same as the servo version, but it sounds equally outstanding. Depending on headphones, music and personal preference, the user can make his choice. Even we were surprised to find that despite clearly different characteristics and measurement results, the hearing difference is rather subtle.

A little theory

Class A

Advantages: no crossover distortion at the output transistors and no artefacts caused by negative feedback.

Disadvantages: The internal resistance of the output transistors and usually also the emitter or collector resistors are in series with the load. Simplified, one can say that the material properties of the output stage components substantially determine the sound. And since both the resulting internal resistance of the output stage and the resistance of the load, i.e. the headphones, are complex items, the result is also complex: it is quite common that certain combinations of even very high-quality amplifiers and headphones do not produce optimal results. Experienced audiophiles know this experience.

Class AB with negative feedback

Advantage: Any error at the output caused by the effects described above is "corrected" by a negative feedback circuit. And furthermore, the output resistance of the power amplifier, as long as there is no overload condition, theoretically approaches zero; practically it is in the 2-digit milli-ohm range. The complex internal resistance of a headphone system is almost equalised by the low impedance output. A headphone system is therefore tightly “guided” by the power amplifier.

Disadvantage: The crossover distortion occurs first, then it is corrected. Thus, negative feedback control (at least theoretically) always runs a little behind the action, which can lead to artefacts in the signal. However, modern negative feedback audio power amplifiers are usually not purely Class AB. Very effective techniques are used to keep crossover distortion low without having to use the costly and power-intensive Class A technique. Certain techniques are used in the negative feedback signal, so that the "lagging" of the correction almost no longer plays a role.

Stereo Base

Stereo Base control, a little theory

A special feature is the possibility to adjust the stereo width. The perception of spatiality when listening with headphones differs from listening with loudspeakers. Instead of a cross-feed circuit, we use our stereo base width setting. It is based on the mid/side technique which is commonly used in professional studios. It provides additional benefits.

The stereo signal is converted into a mid signal (in simple terms, what L and R have in common) and a side signal (in simple terms, what distinguishes L and R). Summing mid and side signals in a 1:1 ratio will result in the original stereo signal. However, if you change the ratio between mid and side before summing them, you change the stereo base width. In our circuit, we leave the mid signal as it is. We only adjust the level of the side signal. If we lower the level, the stereo image becomes narrower, if we raise the level, the stereo image becomes wider.

Stereo Base control, what it does

You have direct access to the perception of spatiality. With a music programme which seems too "wide" in the headphones, one will turn the control one or two steps to the left. If you perceive a recording as too "dry" (centred), turn the control one or two steps to the right. The leftmost position is mono. This is the preferred setting for early stereo recordings, when individual instruments have been mixed to the extreme left or right - without spatial reference. Professional users check the spatiality of their mix with this function and may discover possible problems, especially in the extreme positions.

Balance

A precision potentiometer with 21 detents is available for balance control. The centre position is perfectly calibrated and haptically clearly defined. In fine increments, left/right volume differences of up to about 2.5 dB - caused by music programme, headphones or individual perception - can be compensated.

Headphones Outputs / Balanced Connection

XLR 4-pin, Pentaconn and ¼ inch jack connectors are wired in parallel and are intended for alternative use. Theoretically, you could use them at the same time, the power amplifier is strong enough. However, for a reference quality listening experience, we do not recommend such use.

Ideally, XLR 4-pin and Pentaconn are used in conjunction with balanced wired headphones. In this case, the signal currents of the two power amplifiers are not mixed with each other, mutual interference is impossible. The H1 can unfold its full quality (also refer to chapter "Dual Mono Design").

Dual Mono vs. Balanced amplifier design

With its dual mono design, the H1 features the same advantages as a balanced output stage but avoids the drawbacks.

The drawbacks of a balanced output stage are the significantly increased number of electronic components - a balanced output contains two output stages per channel which work in reverse phase. Two output stages result in doubling the output impedance. More components result in an increased risk of non-linearities.

¼ inch jack compatible

Another advantage of the H1 architecture is that unbalanced headphones with ¼ inch jack plugs can also be operated without any problems.

Line Inputs

Balanced signals (XLR) or unbalanced signals (RCA) can be connected.
Note: XLR and RCA are not meant to be used simultaneously!
The Bal/Unbal switch does not select XLR or RCA, but sets the input to balanced (Bal) or unbalanced (Unbal) mode.
Balanced mode behaves transformer-like: hot or cold may be connected to ground without any loss.

Use as a standard
XLR with Bal Mode or RCA with Unbal Mode

In this case, the internal pin assignment is ...
XLR with Bal Mode: Pin 1=Ground, Pin 2=hot, Pin 3=cold / RCA with Unbal Mode: Case=Ground, Center Contact=hot

Use in special cases
XLR with Unbal Mode or RCA with Bal Mode

In this case, the internal pin assignment is ...
XLR with Unbal Mode: Pin 1+3=Ground, Pin 2=hot / RCA with Bal Mode: Case=cold, Center Contact=hot (Ground Lift mode)

INPUT Gain

The basic voltage amplification rate from input to output is 6dB, with the Volume set to maximum.

The 3-position gain switch (-10/0/+10) reduces or increases input gain by +/-10dB. It allows adjustment to sources with different output levels.

It is also useful for adapting to headphones of varying sensitivity. The -10dB setting is recommended if headphones with low power requirements, like IEMs (in ear monitors) are used.

Dual Mono Design

The idea

The idea behind strictly separating left and right channels is to keep any interference away from the circuits. A term like "crosstalk" does not get to the core of the matter. Music signals usually have left/right references, so that an extremely low crosstalk value - moreover, usually measured with sine waves - does not mean so much. But with music highly energetic signal pulses occur, and then high currents are individually demanded by the output stages. It is extremely important that in these cases there is no coupling via a common power supply or via ground lines carrying signal current. Only this way an amplifier can produce absolutely undistorted output signals.

Realisation inside the H1

In the H1, the power supplies for left and right channels are separate, for preamplifiers and power amplifiers. The mains transformer has independent, completely potential-separated windings for each channel. Rectification, filtering and voltage regulation for each channel are individual. For logic circuitry and front-panel indicators, there is another winding and separate rectification, filtering and voltage regulation.

The ground potentials of the two channels are connected to each other at one point only, but this is done purely as potential equalisation; it is impossible for signal currents to be mixed.

Optimal output connection

If the XLR 4-pin or the Pentaconn output is used in combination with balanced wired headphones, the dual mono principle is implemented in full consequence.

When using the jack output, the ground wires of both channels are connected in the jack socket and the jack plug of the headphones. The use of headphones with jack plugs therefore is not that ideal. In the H1, however, an optimised ground routing ensures that the disadvantageous effects are as low as possible.

(also refer to chapter: Headphones Outputs / Balanced Connection)

TECHNICAL DATA

Headphones Output

Class A	Impedance 0,8Ω	max. level +23dBu
Class A & Servo	Impedance 0,045Ω	max. level +23dBu

unbalanced / dual mono design

Output Power per Side

RMS	4W@30Ω / 7W@15Ω
Peak	7,6W@30Ω / 11W@15Ω / 12W@10Ω (18W for 1,5ms)

Headphones Output THD (Total Harmonic Distortion)

Class A	0,07%
Class A & Servo	0,0005%

(typ. @ +20dBu/7,75Veff / 30Ω load / 2W RMS / Gain Switch at "0" / Volume at maximum)

Frequency Response

10Hz ... 30kHz	-/+0,05dB
1Hz ... 500kHz	better than -3dB @ +6dBu output level

Line Input

Impedance	20KΩ
max. level balanced	Gain Switch at "0": +23,5dBu / Gain Switch at "-10": +29dBu / Gain Switch at "+10": +13,5dBu
max. level unbalanced	Gain Switch at "0": +23,5dBu / Gain Switch at "-10": +23,5dBu / Gain Switch at "+10": +13,5dBu

Gain

voltage gain Input to Output	+6dB with Gain Switch at "0" (centre position) -4dB with Gain Switch at "-10" +16dB with Gain Switch at "+10"

Noise

Headphones Output	-101,5dBu with Volume at maximum and Gain Switch at "0"
20Hz...20kHz flat, RMS	-104,5dBu with Volume at mid position, Gain Switch as above
	-104,0dBu with Volume at maximum and Gain Switch at "-10"

Power Supply

Mains Voltage	AC 50-60Hz, 230V / 115V adjustable, Range 230V: 207...255V, Range 115V: 104V...127,5V
Power Consumption	43W typ., <0,5W when power off
Mains Fuses	5x20 mm, rating 0,63A time-lag (2x) or 0,8A time-lag (2x)

Measures & Weights

H1	WxHxD approx. 195 x 90 x 300mm, approx. 4,5kg
H1 incl. accessories, boxed	WxHxD approx. 410 x 410 x 180mm, approx. 6,6kg

TROUBLESHOOTING

no function

- In case the power-on button on the front panel does not light up after being engaged, check the mains connection. When you are sure, that the mains cable carries the correct mains voltage, check the H1 mains input fuses (see below).

no audio signal at output

- In case the power-on button on the front panel is illuminated but the operating indicator (the logo sign to the right to the power-on button) does not light up after a few seconds, the output protection circuit is active. It disconnects all outputs via a relay. Output protection is activated by overtemperature or a number of other unusual conditions in the amplifier circuit. If the H1 is very hot, switch it off, allow it to cool down and switch it on again. If it still does not work, there is a fault that requires repair. Please contact us or your local dealer.

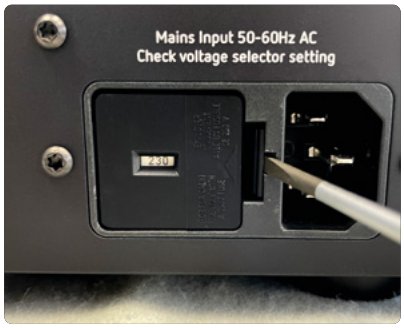
  Note: Do not operate the unit in very warm places or in direct sunlight.
  Always ensure that there is free airflow all around the unit, especially the heatsinks.

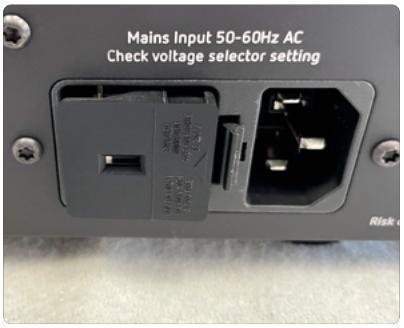
In all other cases please contact us or your local dealer and describe the fault as precise as possible.

Checking/replacing mains fuses

In case your H1 does not show any function although it is correctly connected and switched on, you may check the mains fuses.

- Unplug the power cable.
- Find the fuse holder drawer on the mains input assembly, just right to the IEC input connector.
- Use the small flat-blade screwdriver from the accessory bag (or a similar 1/8" type) to unlock the latch on the right of the drawer (refer to picture #1). The drawer will pop out slightly (refer to picture #2).
- Take the fuse drawer out completely. It contains two identical fuses, size 5x20 mm (refer to picture #3).
- If a fuse is blown, replace it with a time-lag type in the 5x20 mm format, rated either 0,63A or 0,80A. There are two sets of these fuses in the accessory bag.
- **Even if only one is blown, always replace both.**
- Put the fuse drawer back in place. Push it firmly until it latches with a hearable click.
- Repower your unit.
- If it still does not work properly, contact us or your local dealer in order to get it serviced.





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