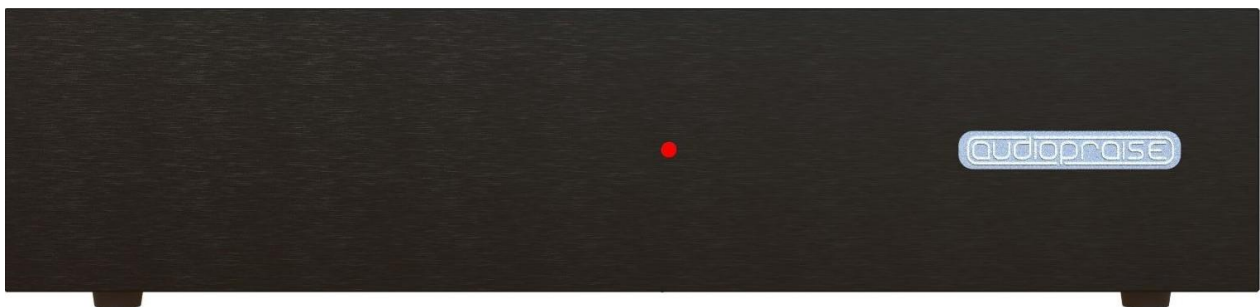


audiopraise

Vanity^{PSU}

User Manual



Hardware version V1

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1 Introduction

Low noise is crucial in power supplies for audio applications. In audio systems, especially high-fidelity or professional setups, the quality of the power supply directly impacts the quality of the audio signal. Noise in the power supply can introduce unwanted artifacts into the audio signal, such as hum, hiss, or interference, which can degrade the overall sound quality.

The Vanity^{PSU} is a very low-noise linear power supply designed specifically for the Vanity^{PRO}, but it can be used as a universal power supply too.

2 Highlights

The Vanity^{PSU} has three independent power rails, two with 5V and one with 12V DC outputs. Each 5V rail has two USB connectors USB-A and USB-C and each connector has its own secondary regulator. The 12V output is on standard 2.1mm DC jack. All outputs are fully protected against overvoltage, overcurrent, and short circuit. It comes in an enclosure design-matched to the Vanity^{PRO}.

The unique feature of our power supply is two stage linear regulation and each output regulated separately. Both regulator stages are discrete designs, with the second one being extremely low-noise type, not seen in stand-alone power supplies before.

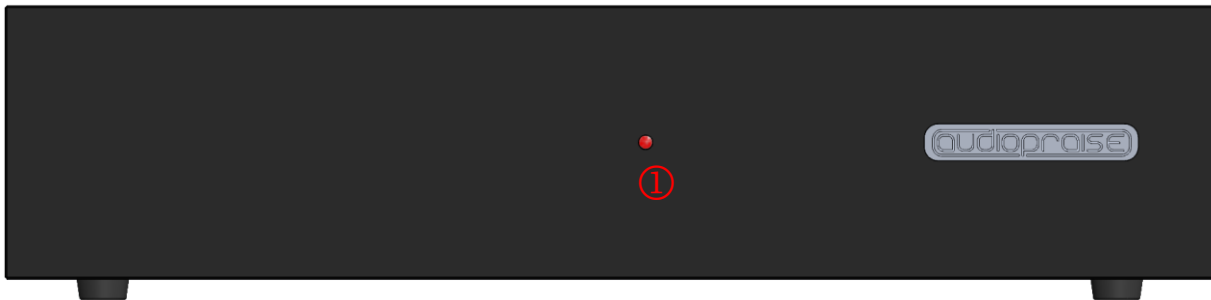
If used to power the Vanity^{PRO}, the additional 5V outputs can be used to power other HDMI devices such as splitters or selectors, while the 12V output can power a DAC, network switch or other equipment requiring clean 12V power input.

The AC input can be easily switched between 230V and 115V mains voltage.

Finally, the brightness of the front panel LED can be manually adjusted to match indicators of other equipment.

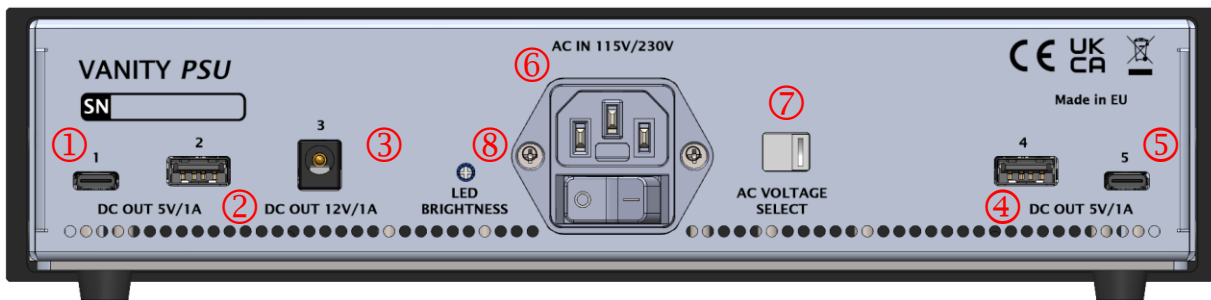
3 Description

3.1 Front



- 1) Power On LED

3.2 Back



- 1) DC Output 5V/1A, USB-C
- 2) DC Output 5V/1A, USB-A
- 3) DC Output 12V/1A, 2.1mm DC Barrel Jack
- 4) DC Output 5V/1A, USB-A
- 5) DC Output 5V/1A, USB-C
- 6) AC Input 115/230V, Filtered IEC C14 Socket with Switch
- 7) AC Voltage Selector
- 8) Power ON LED Brightness Adjustment Potentiometer

4 Installation

4.1 AC Input

The Vanity^{PSU} has an AC voltage switch to select between two major world AC voltages 115Vac and 230Vac. This switch must be set to the correct voltage before switching the unit on. Failure to do so may lead to permanent damage of the unit.



Voltage selector set to 230V

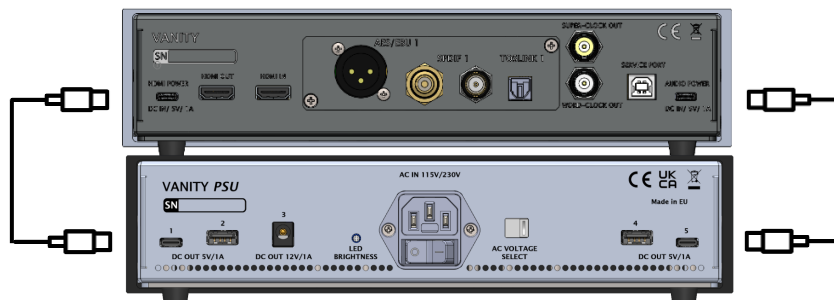


Voltage selector set to 115V

AC power input should be connected with a standard 3-wire IEC C13 mains cable (kettle lead). The Vanity^{PSU} is a class 1 appliance with earthed chassis and requires earth connection for safety reasons. Please note that the chassis is not galvanically connected to the DC output negative wire.

4.2 Position

Depending on the DC load, the unit may become warm during operation due to linear regulation losses and should be placed with enough free space around for air circulation. If used to power the Vanity^{PRO} only, where the losses are minimal, and the units can be stacked on top of one another.



Power connection of the Vanity^{PRO} from Vanity^{PSU}

4.3 DC Outputs

The USB-C DC outputs are in the same locations as on the Vanity^{PRO}. This allows for shortest possible connection if units are stacked on top of one another. Additional USB-B outputs with own secondary regulation are provided to power auxiliary HDMI and audio equipment, such as HDMI splitters, switches, and multiplexers. The 12V DC output can be used to power a DAC, network switch or other equipment requiring clean 12V power.

4.3.1 Power Derating

Due to efficiency characteristics inherent to linear regulation the thermal losses are proportional to load power. Higher load on the Vanity^{PSU} means higher losses and higher unit temperature. To keep the unit in safe operation will different combinations of load, power derating is specified. Please consult the specifications paragraph for details.

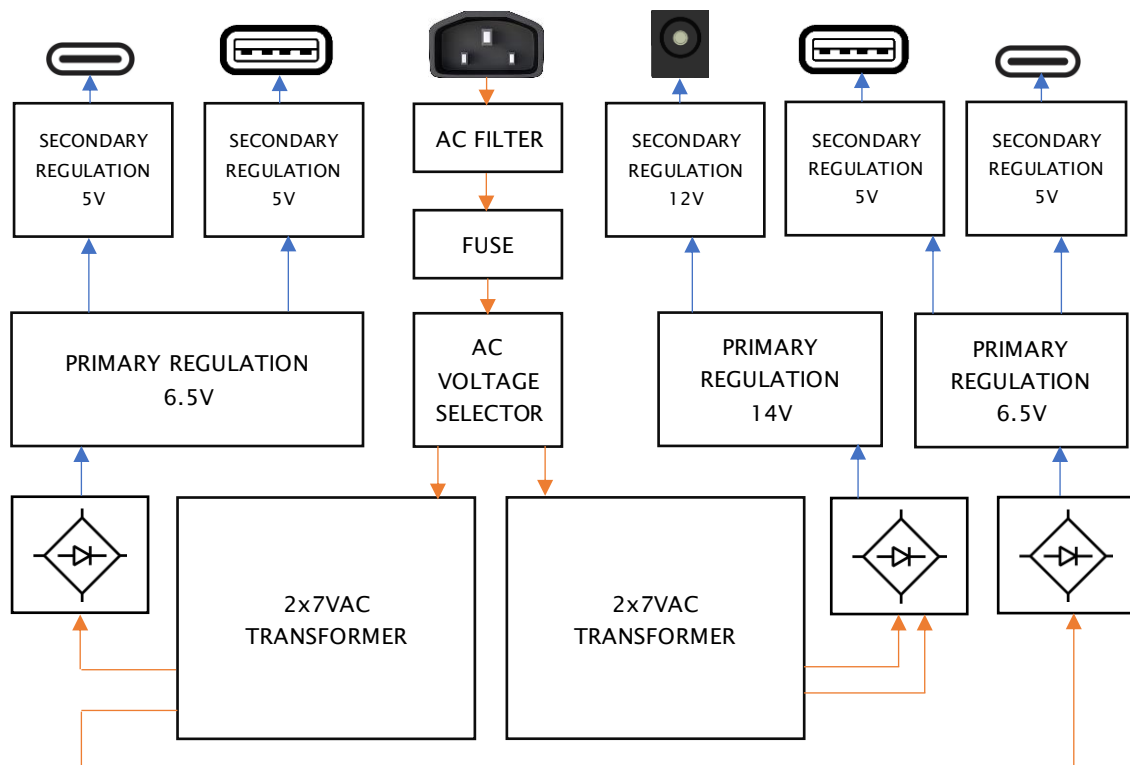
4.4 Brightness Adjustment



The Vanity^{PSU} has exposed potentiometer on the back panel. This potentiometer controls current for the LED power indicator on the front panel. By turning the potentiometer left and right the user can control brightness of the indicator to match it to other equipment and make it less disturbing in low light conditions. Use a small flat head screwdriver to operate the potentiometer.

5 Theory of Operation

5.1 Block Diagram



Block Diagram of the Vanity^{PSU} showing the main functional blocks

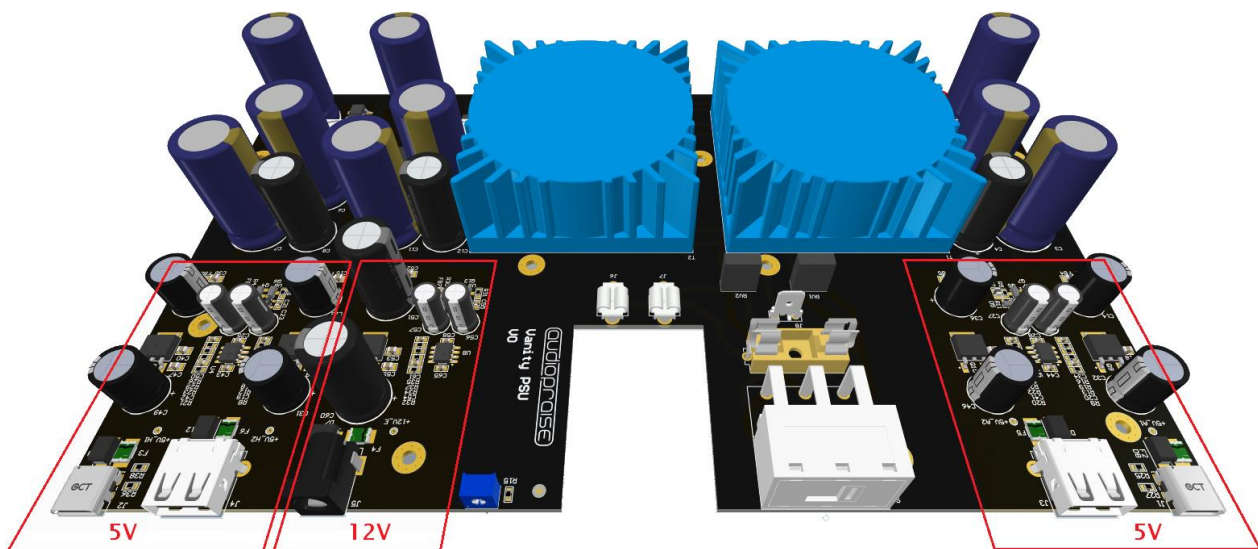
5.2 Two-Stage Regulation

It is one of the key features of the Vanity^{PSU}, which contributes to its extremely low noise performance. The first regulation stage eliminates residual voltage ripple from the rectifier and creates intermediate voltage for the second stage and its voltage reference. The design of the second stage is fully discrete without any monolithic regulators.

Both stages are optimized to minimize the voltage drop across power components under all loading scenarios. Either of the two regulator stages has thermal losses dependent on momentary loading of the outputs and it is important to minimize those losses. Since linear regulators regulate voltage by dissipating excess energy as heat, the efficiency is inherently limited.

5.3 Dielectric Barriers

The Vanity^{PSU} features three independent rails. Two with 5V and one with 12V. This is to support one of the key features of the Vanity^{PRO}, which has a galvanic barrier between the HDMI and audio parts. With the Vanity^{PSU} both parts can be powered without creating ground connection between them.

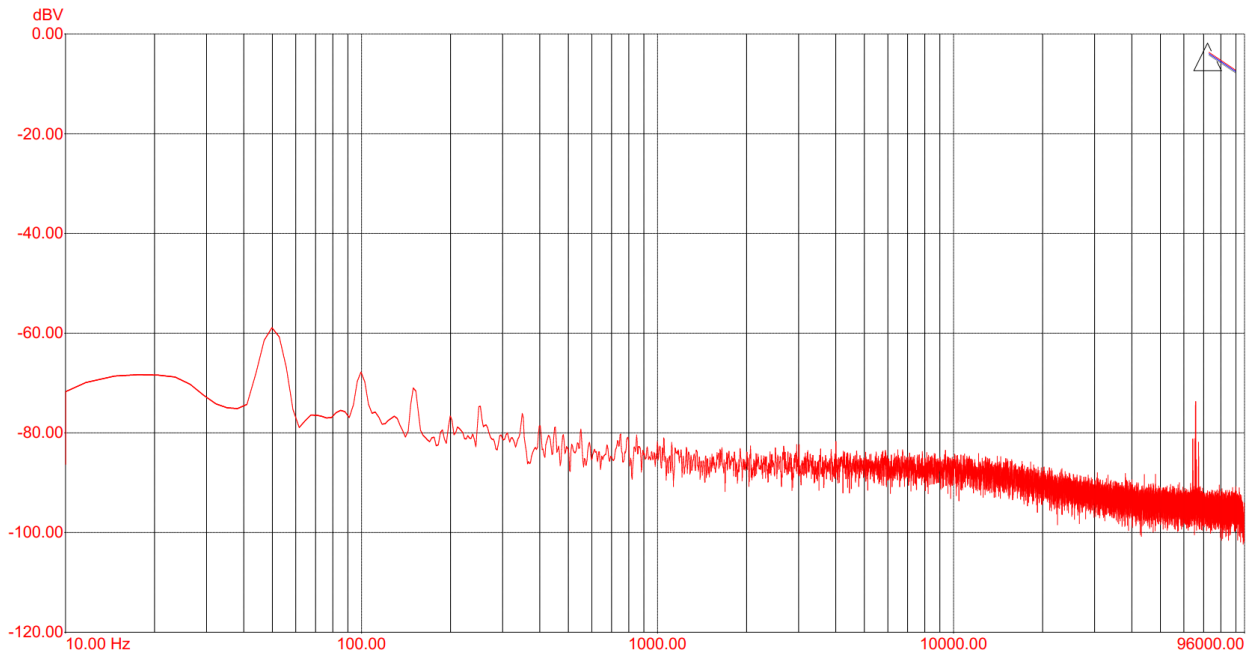


Dielectric domains of the Vanity^{PSU} shown in the 3D model of the main PCB

5.4 Very Low Noise

The Vanity^{PSU} achieves exceptionally low noise performance by utilizing a collection of design techniques. It is the two-stage regulation, very high filtering capacitance values, low noise voltage reference for the secondary regulator, dual feedback in the discrete regulator circuit and other. The noise profile remains virtually constant across the whole range of loads up to 1A.

Below is an image of the noise spectrum measured with a 60dB AC amplifier and an audio analyser. The integrated RMS amplitude is -49dBV, after subtracting 60dB of the amplifier gain the noise RMS amplitude is -109dBV.



Noise spectrum of the Vanity^{PSU} 5V, 0.5A, 60dB gain

6 Specifications

AC Input

- 115V or 230V AC user selectable, 50Hz/60Hz
- Filtered IEC C14 socket with ON/OFF switch
- Internally fused 1A medium blow
- Maximum input power 50W
- Class 1 electric appliance (earthed)

DC Outputs

- Five DC output connectors
- Outputs 1+2: 5V DC USB-C+USB-A, 1A max combined
- Output 3: 12V DC barrel jack 2.1mm, 1A max
- Outputs 4+5: 5V DC USB-A+USB-C, 1A max combined
- Output voltage accuracy (all outputs): max $\pm 1\%$
- Load regulation (all outputs, 0–1A): max $\pm 2\%$
- Noise – outputs 1,2,4,5 (5V): $<4\mu\text{VRMS}$ 10Hz–95kHz @1A
- Noise – output 3 (12V): $<5\mu\text{VRMS}$ 10Hz–95kHz @1A

Power Derating

- Total output DC power should not exceed 15W
- Outputs 1+2 have combined 1A limit (0.5A each)
- Outputs 4+5 have combined 1A limit (0.5A each)
- Outputs 1+2+4+5 have combined 1.6A limit (0.4A each)
- Output 3 load must observe total output power limit

Dimensions & Weight

- w/d/h: 266/180/65 mm
- weight: 2.5kg

7 Revision History

Date	Version	Description
07.05.2024	1.0	Initial release

8 Disclaimer

The product has been designed and manufactured using high quality materials in accordance with best practices in the industry and international harmonized safety standards. Audiopraise accepts no responsibility for any damage or injury caused by incorrect installation, use or operation of the product.

9 Warnings

**MAINS VOLTAGE: HAZARD OF ELECTRICAL SHOCK.
DO NOT DISASSEMBLE THE PRODUCT
NO USER SERVICABLE PARTS INSIDE**

