Vera Audio P400/1000 power amplifier design

Vera Audio P400/1000 is a power amplifier designed with a lot of power, compact design, low noise, high CMRR and low THD+N, a special cooling system, and a sleek look with no visible screws or seams. We are confident this is a product that will last for many years. We also want to be transparent and provide all measurements and technical information about the product.

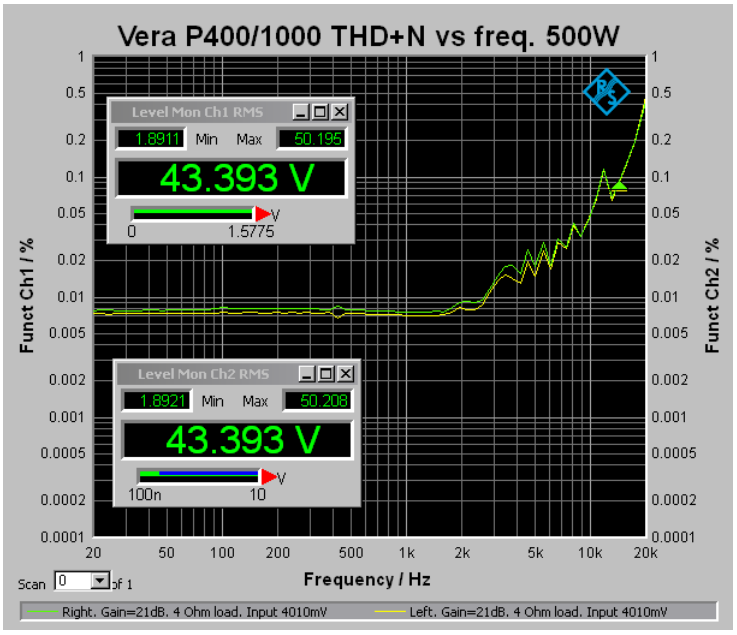
Powerful

With a PSU of 3kW, the P400/1000 is capable of of delivering high amounts of clean power. Distortion remains extremely low, and with a damping factor of >1600 in 8Ω the amplifier has exceptional control over the woofers and low frequencies.

For higher demands of power, the unit can be bridged to a mono block. Reaching whopping 1100W in 8 Ohm with max 0.01% THD+N distortion.

Bridging is achieved by a switch on the rear.

Unlike some other class D amplifiers, the Vera Audio P400/1000 doesn't suffer from higher distortion at lows with high voltage but is able to maintain very low distortion at the most demanding bass peaks. As shown with 43.93V or 500W power in the graph. Take note that the increases distortion we see in the graph above 2 kHz is only with very high output which doesn't happen with music material and tweeters.

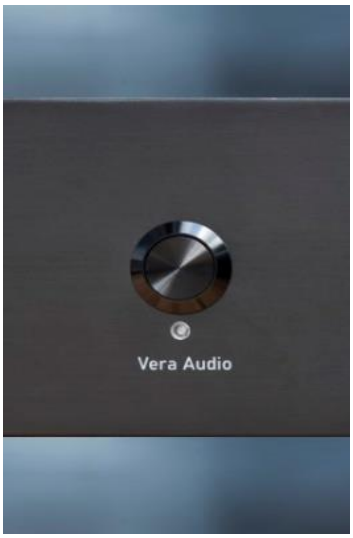


World class buffer and parts

Vera Audio has developed an input stage (buffer) with only the very best measurable parts.
No degrading potentiometers in the signal chain. A gain adjustment with 8-step rotary switches with gold contacts
0.004% precision resistor which helps to provide a CMRR (common mode rejection

ratio) of at least 100dB at 1kHz. The very low noise and high CMRR making it even a perfect combination with horns or other high sensitive speakers.

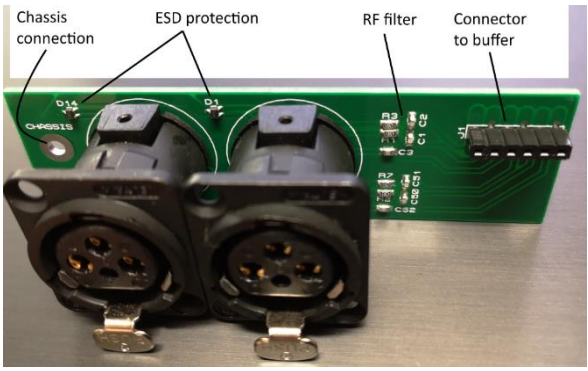
Micro controller and clipping indicator



A micro controller is constantly monitoring the output for clipping. If the load is too low it's signaled with blue blinks in the front LED light, and if the voltage is too high it will be signaled with green/red blinks depending on the channel. This is very useful function, knowing that when a blink is seen one should dial back a dB or two or consider buying a second amplifier for bridging and more power available.

The micro controller also monitors the heat on both channels and intelligently increase the fan speed as necessary. No internal part will exceed 65° no matter how you use it or where you install it.

RFI/EMI filter and protection



Multi-step EMI filtering in the input stage to effectively keep harmful radio waves away from the audio circuit. In addition, the entire entrance stage is mounted inside a screen in a separate chamber inside the cabinet. The Neutrik XLR connectors are also shielded.

Special ESD precautions then can handle up to 7A(!) short ESD pulses.
Overvoltage precautions that can handle high currents up to several tens of volts without damaging the input.

Trigger input

The 12V trigger input allows the P400/1000 to be switched remotely from standby to operating mode and vice-versa from an auxiliary equipment such as a DAC, preamplifier, AV processor, etc.

When the trigger input is used a LED light indicator on the rear turns on.

Gain adjustment

3 dB steps gain adjustment from 12 dB to 30 dB, besides a mute function. The gain adjustment is within 0.02 dB on both channels.

Gain adjustment can be used to lower the signal the noise ratio, to match different preamps or DACs or to incorporate to active speakers with amps to each drivers.

Cooling system

A lot of power combined with compact design without compromising on life expectancy due to raised temperatures was a challenge and it became early clear that this is only achievable by introducing fans.

The fans we use can operate down to 300RPM and are truly 100% silent up to 1000RPM. At 1600RPM the noise is 8,2dB(A).

The fan tunnels are designed with unequal length to avoid amplification of coinciding frequencies if run at higher RPMs. It is impossible for the fans to create any vibration in the cabinet since it is milled out of a massive aluminum block and the fan tunnels are in fact several centimeters thick. To further safeguard from any possible vibrations they are decoupled from the chassis using rubber mounting screws.

The fans are controlled using intelligent fan control software that monitors how the user uses the amplifier and how high the environmental temperature is. The input to the intelligent fan control is taken from three temperature sensors. One inside the cabinet and one mounted on each output coil.

As long as the temperature is under a certain limit the fans will not start at all.

The air exhaust is in front bottom of the cabinet through generously sized holes. When the fans are not active, there is a moderate natural convection cooling effect from the air going the opposite direction and exiting through the fans.

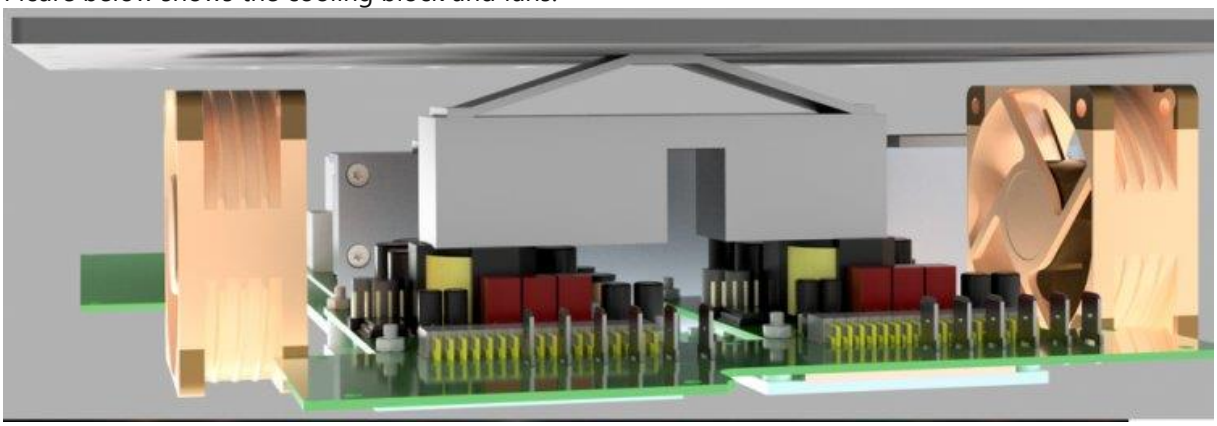
Both fans RPM are individually monitored by the microcontroller.

Addition to fans and vents underneath the chassis, a thick aluminum-cooling block on the inside is used to reduce the temperature. This cooling bar lowers the temperature on the NC500's coils by 15 degrees celcius.

Heat is transported away from the output coils and into the massive cabinet through the cable channel. Some heat is also transported down to the bottom lid through the aluminum spring that keeps this cooling bar securely in place. This arrangement gives us probably the coolest running NC500's in the market. At least the NC500's that are capable of the same or near the same power output.

All of this to make sure the amplifier with have a long life span, no matter how it's being used or where it's placed.

Picure below shows the cooling block and fans.



Chassis and finish

The chassis is cut out from one block with absolute no seams and there are no visible screws. Combined with a brushed surface offered in either black and silver finish, it creates a beautiful, endurable, timeless but minimalistic design. The thick walls also contributes to better cooling.

The button on front operates as standby button. In standby mode, the amplifier only draws 0.25W.

A main rear power switch can be used when one doesn't intend to use the amplifier for some time.

The speaker terminals accepts up to 6mm2 stranded wire, spades and banana plugs

Testing

Every amplifier is tested before it leaves the bench and everything is made sure to be within very strict specifications. An amplifier that doesn't meet the required specifications or measurable data will not be released to the market.

Here is the gain spec of one amp.

Gain setting:	MUTE	12	15	18	21	24	27	30
Right measured:	-67	11,98	14,98	17,98	20,97	23,97	26,97	29,96
Left measured:	-67	11,97	14,98	17,98	20,97	23,97	26,97	29,96
Error between channels. (dB)	0	0,01	0	0	0	0	0	0
Absolute error from setting. Left (dB)		-0,02	-0,02	-0,02	-0,03	-0,03	-0,03	-0,04
Absolute error from setting. Right (dB)		-0,03	-0,02	-0,02	-0,03	-0,03	-0,03	-0,04
Max deviation from 3dB step (dB)			-0,01	0	0,01	0	0	0,01

As can be seen form the table above, the error between the channels is less than 0.00dB for all gain setting except the 12dB setting that has 0.01dB error. The absolute gain error from the indicated gain is maximum 0.04dB at the 30dB setting. This ensures that when the user set the switch to 24dB he knows it is 24dB and nothing else. When installing this amp in a system we feel this is important.

More about the Micro controller

Since we are in the technical corner, we want to talk a little about the things we measure and control using the microcontroller (MCU).
It continuously measures the status of the NC500 modules and the SMPS power supply.
* Speaker output current (up to 25A).
* NC500 overcurrent conditions individually on both channels (500.000 times per second).
* NC500 signal clipping individually on both channels (up to 20kHz).
* NC500 error status signal from both modules.
* SMPS rail voltages.
* SMPS error status.

These signals are used to give the user information on the front panel RGB LED. Different colours and combination of colours will inform the user if the output is overloaded. Both overcurrent conditions and clipping conditions are reported individually for both channels through different colour combination. The user can then easily identify if the clipping is due to too high current or too high voltage and if this occurs on left, right or both channels.
It can also mute the two channels. This is important in bridged mode. If one channel fails, the other has to be muted very fast to avoid damage to connected speakers. Much faster than just disabling the SMPS and just waiting for the SMPS filter caps to discharge.

Other jobs for the MCU is of course the operation of the front RGB LED, the fans, the on/off button and the on/off of the SMPS.