

PurePower+ 2000HV

A new name in mains regeneration, hailing from Canada, springs a surprise by introducing a product that, if needed, can also run your hi-fi during a power cut...
 Review & Lab: **Keith Howard**

If memory serves, articles about the influence on sound quality of the mains supply began appearing in UK hi-fi magazines during the early 1980s. Concern initially centred on the use of VDRs (voltage dependent resistors) to truncate spikes on the mains waveform, but it wasn't long before attention turned to mains plugs, mains cables, contact cleaners, and mains filters and conditioners of various descriptions.

In 1982, Linn Products introduced the Valhalla mains regenerator board for the LP12 – which should have been a wake-up call about the wider potential of mains regeneration – but it wasn't until the late '90s that the first standalone mains regenerator arrived in the form of the original PS Audio Power Plant, the P300. Since then PS Audio has pretty much ruled the roost in AC regeneration products – but in the £4295 PurePower+ 2000HV we have a challenger with a difference.

What all mains regenerators do is provide isolation from the vagaries of the mains supply. Typically the mains voltage waveform, which should ideally be a sine wave, is flat-topped as a result of odd-order distortion caused by devices that draw charging current only near peak voltage. Additionally, radio frequency interference (RFI) can be present – a situation exacerbated if you or a neighbour use powerline networking – and there may be occasional transients imposed on the waveform, caused by switching loads.

Mains filters and conditioners cannot tackle all these problems, and are often accused of increasing mains source impedance. Only mains regeneration – which creates a mains waveform afresh using what is effectively a high-voltage power amplifier – promises a complete fix. Conventional mains regenerators rectify and smooth the mains voltage to generate high-voltage DC rails for the power

amplifier within. Fed a clean waveform from an oscillator, it then generates (in Europe) a 230V 50Hz output waveform that's used to power equipment via the regenerator's output sockets. Actually this is an oversimplification: the oscillator waveform is not necessarily sinusoidal, and the output voltage is often adjustable, but these are elaborations.

UNINTERRUPTIBLE SUPPLY

What sets the two-box 2000HV apart is that one half of it is a battery power supply for the second, regenerator, section. Mains connection is used to charge the battery power supply, rather than feeding the regenerator directly, which provides – notionally, at least – 'quieter' voltage rails for the amplifier in the regenerator. It is possible to operate the 2000HV without

any mains connection at all – making it the audio equivalent of a computer UPS – although of course its operating time is then limited by available battery charge.

Rather than opting for an exotic battery technology, PurePower+ has chosen to use familiar, relatively inexpensive and readily available sealed lead-acid cells in the 2000HV's 'PowerPack'. Battery life is specified as typically five to seven years, and the cost of battery replacement (easily done by the user) is currently £150.

Installation and operation is simple. The PowerPack and Regenerator can be used either one (the Regenerator) on top of the other, or side by side – in either case requiring adequate ventilation. The two units are connected by an umbilical that is captive to the PowerPack and links to the Regenerator via a screw-lock multi-



RIGHT: Compared to the PS Audio P10, there is plenty of empty space within the 2000HV's Regenerator box, and its amplifier makes do with a surprisingly small heatsink



pin connector. This sprouts at 90° from the Regenerator back panel and can be rotated through one quarter-turn either way from vertical to accommodate side-by-side placement of the PowerPack unit.

Both components have manual circuit breakers on their back panels, while on the front of the Regenerator are three recessed push-buttons labelled On, Display and Off, arranged vertically to the left of a 45x45mm white-on-blue display. While this, in combination with the Display switch, conveys a lot of information (load, battery charge, input voltage, input frequency, battery voltage, output voltage, output frequency, etc), it is much too small. Some of the icons are barely readable

'It elicited great improvements in detail, dynamics and imaging'

unless you are close, and there should be a clearer indication of when bypass mode is selected, which connects the seven three-pin mains output receptacles on the back panel to the wall supply rather than the synthesised output.

Regenerator output voltage can be set to 208, 220, 230 or 240V; for this assessment it was used exclusively at the default 230V. Rated

output power is 1800W continuous, so the 2000HV is well able to accommodate power amplifiers.

INDEFINABLE 'RIGHTNESS'
For auditioning I used my usual music source: a Chord Electronics QuteHD DAC [*HFN* Sep '12], TC Electronic Impact

ABOVE: In combination with the Display button, the 45mm square display provides plenty of information but is impractically small. Icons are difficult to discern except very close up

Twin FireWire S/PDIF interface and second-generation Mac mini running Windows XP and JRiver Media Center v19. It quickly became apparent that the 2000HV is capable of eliciting remarkable improvements in sound quality, principally in the areas of dynamics, imaging and detail retrieval.

I began by listening to the 2000HV's effect on a single, relatively low-power item, namely my favoured Teac HA-501 headphone amp [*HFN* Apr '14]. I partnered it with a Sony MDR-MA900 headphone [*HFN* Oct '12] – sadly discontinued but the most tonally neutral and hear-through £300 headphone I've ever experienced – and listened out for differences when power was supplied via the 2000HV or straight from the wall, using the Regenerator's bypass facility (press On and Display together for five seconds to toggle between regenerated and wall supply).

I didn't have to listen very hard to notice that sound quality was obviously improved with the synthesised waveform supplying the power. Diana Krall's 'Temptation' [96kHz/24-bit file ripped from the DualDisc of *The Girl In The Other Room*; Verve B0003758-82] was much more vivid with the 2000HV doing its stuff. Dynamic range seemed effortlessly wider, bass more solid, and the sound took on that indefinable 'rightness' which affirms that you've ↻

FLAT TOP

The fact that the mains waveform we receive in our homes is typically flat-topped and contains quite high levels of odd-order distortion has nothing to do with the quality of the generated waveform – which is a clean sinusoid – but everything to do with finite impedance in the mains distribution network and the behaviour of the power supplies used in many items of equipment to convert AC to DC. In the conventional transformer/rectifier/reservoir power supply, charging current is drawn over only a small part of the cycle, when the voltage of the mains waveform is near its positive and negative peaks. This intermittent current draw results in a voltage drop across the finite mains source impedance, with the result that the waveform becomes flattened at the peaks. Spectrally the result is the addition of odd-order harmonics at multiples of the mains frequency (150Hz, 250Hz, 350Hz, etc), an obvious symptom of which can be increased mechanical hum from the mains transformers of attached equipment.

LAB REPORT

PUREPOWER+ 2000HV

Because testing mains regenerators falls outside the normal field of audio equipment measurement, I've needed to build two special items of equipment to undertake it. The first of these uses an inline Hall-effect current transducer from LEM Components that can record currents of up to 80A at slow rates of greater than 60A/μs over a bandwidth exceeding 100kHz, while adding a series resistance of just 0.18mohm (0.00018ohm). Built into a box with flying leads terminated in a mains plug at one side and a mains socket at the other, it can be inserted into the mains feed to any component to measure mains charging current.

Overlaid charging current waveforms from the wall socket [red trace, Graph] and from the 2000HV [green trace] are shown below, the load being an Arcam FMJ A49 amplifier outputting 20Vrms on each channel into a 4ohm dummy test load (ie, 100W per channel). The 2000HV's current pulses are almost textbook whereas those from the wall socket have both a lower peak value and longer duration as a consequence of the mains waveform being flat-topped.

Measurement of output distortion has to accommodate mains regenerators that have unbalanced, balanced or floating outputs, for which I've built a balanced attenuator that feeds a battery-powered INA217 low-noise, low-distortion instrumentation amplifier. This gives an output voltage one-hundredth that of the difference between the live and neutral lines. Voltage waveforms from the wall socket [red trace, Graph 2] and 2000HV [green trace], under the same operating conditions as above, are shown overlaid below, while the test table lists individual amplitudes of the first four odd harmonics (each referenced to the amplitude of the 50Hz fundamental) plus a THD figure calculated from the first 14 harmonics. The reduction in distortion achieved by the 2000HV is notably less than we recorded with the PS Audio P10 [HFN Apr '13]. KH



ABOVE: Seven 13A output sockets, plus two Hubbell L6-15 locking receptacles, may be used interchangeably to power source components or amplifiers. The battery PowerPack unit [below] connects via an umbilical and cells are good for 5-7 years

taken a significant step closer to what's on the master. Crucially, it was an improvement not just to delight any audiophile but also any lover of the music, which lived and breathed with a new intensity.

NEW LIFE FOR OLD FAVES

It was the same story with the 192kHz/24-bit download of the playful 'Take Five' from Sabina Sciubba and Antonio Forcione's *Meet Me In London* [Naim label]. Dynamic range again seemed expanded at both ends so that peaks were more telling at the same time as the studio 'acoustic' being better resolved, and the performance of both musicians had a veracity which went AWOL when the HA-501 was powered direct from the National Grid. What is already a captivating musical experience was given new life by the 2000HV.

To see if the 2000HV could turn the same trick with a power amp and loudspeakers, I next tried it with a Naim NAP300 fed from a DACT stepped attenuator 'passive preamp' – a doubly challenging task given that the NAP300 has a regulated power supply and has proven resistant to the charms of mains regenerators in the past.

So it was again. Although the 2000HV seemed to refine the sound quality it also softened it, removing some of the incisiveness and musical engagement that are classic Naim characteristics, bleeding some of the character from, for instance, Owen Brannigan's incomparable 'When a felon's not engaged in his employment...' from *The Pirates Of Penzance* [Decca 425 196-2].

I would counsel against generalising this finding with the NAP300, however, as the result

with other power amplifiers may well be quite different. While my experience with the 2000HV/NAP300 emphasised the point that mains regenerators, for all the magic they work in some combinations, should not be considered a panacea, I was keen to return to my earlier headphone-based listening.

Now I powered the Teac HA-501, the Chord DAC and the Impact Twin interface into the 2000HV regenerator. My reward was another improvement, principally in clarity and imaging quality. When I repeated the inline/bypass switching with all three components connected to the regenerator, the difference in sound quality was extraordinary on Joni Mitchell's 'You're My Thrill' [96kHz/24-bit rip from *Both Sides Now*; Reprise Records DVD-A, 9362-47620-9].

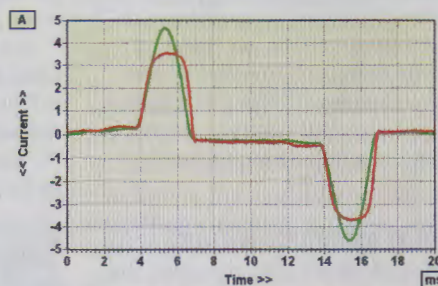
Switching out of bypass, the big orchestral opening expanded both spatially and dynamically, and became immersive in a way that left the bypass sound understated and distanced by comparison. ☺

HI-FI NEWS VERDICT

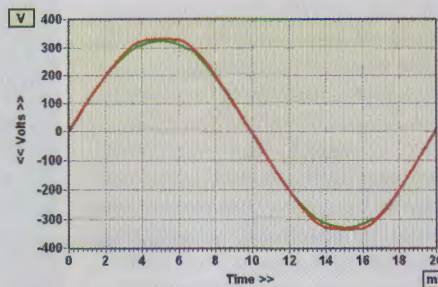
Combined with the 'right' components the 2000HV is capable of eliciting an astonishing improvement in sound quality, particularly in respect of dynamics, imaging and sheer involvement in the music. That it can also act as an uninterruptible PSU will be of secondary value to most users but perhaps occasionally a boon. Use with power amps should be assessed case by case, as not all benefit.

Sound Quality: 85%

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ABOVE: Distorted mains (charging) current waveform (red) versus significantly more linear waveform delivered by the PurePower 2000HV (green)



ABOVE: Mains voltage waveform, from wall socket (red) versus PurePower 2000HV (green)

HI-FI NEWS SPECIFICATIONS

Harmonic	Mains	PurePower 2000HV
3rd	0.86%	1.45%
5th	1.62%	0.79%
7th	0.67%	0.34%
9th	0.41%	0.13%
THD (2nd-14th)	1.99%	1.75%