

Manual for
PHOCUS software preamplifier
with cartridge compensation



Chapter 1 - Introduction - miniDSP & PHOCUS preamplifier

Real-time vinyl replay benefits from the accuracy, stability and performance of digital signal processing (DSP) by employing a **Groove Sleuth** phono preamplifier to feed a third-party DSP platform acting as a digital preamplifier.



The third-party DSP platform may be used to implement RIAA equalisation (and other recording characteristics); as well as providing other preamplifier functions, such as source select and volume control (via IR remote).

The **Groove Sleuth** phono preamplifier provides the correct impedance match to the phono cartridge and sufficient gain to drive the A to D converter without over-loading, but *not to perform recording equalisation correction*.

Soft PHOCUS

The Phaedrus Audio **PHOCUS** is software only. The **miniDSP 2X4HD** DSP platform is available directly from miniDSP of Hong Kong

<https://www.minidsp.com/products/minidsp-in-a-box/minidsp-2x4-hd>

The **2X4HD1** plug-in should be purchased. The **IR remote control** is a worthwhile option too.

The **2X4HD1** plug-in provides tools for the programming of the Analog Devices SHARC ADSP21489 DSP which runs in the miniDSP platform. The miniDSP platform is powerful enough to incorporate many other features along with the **PHOCUS** functionality. For example: active-crossovers; and room-correction equalisation.

The Phædrus Audio **PHOCUS** product is a shortcut for those who don't wish to delve into the world of digital filter programming - or a baseline configuration for those who do. The RIAA/Pre-stereo LP and 78 RPM equalisations run in cascaded biquadratic digital filters on the platform. These filters were developed using iterative CAD techniques to offer a tight match to ideal analogue equalisation networks.

The Phædrus Audio **PHOCUS** software preamplifier is made available as four, XML configuration files which must be uploaded to the DSP unit via a computer (PC or Mac) running the miniDSP **2X4HD1** plug-in. These files are free (on request) to customers of the **Groove Sleuth MICRO, MK. II** and **Groove Sleuth LOCKDOWN** preamplifiers. They may be purchased independently by contacting sales@phaedrus-audio.com

Four personalities

Four separate preamplifier configurations provide the best equalisation options for:

- Stereo LPs;
- Mono LPs (Pre-stereo EQ, see Appendix 1);
- 78 RPM records (see Appendix 1);
- Digital sources which may be input to the amplifier via an optical TOSLINK connector, or from a computer via USB.

Vinyl record system performance (PHLUX-II, Groove Sleuth Mk. II, miniDSP 2X4HD RIAA output)

- Frequency response: 30Hz - 20kHz: $\pm 1.5\text{dB}\dagger$ ($\pm 0.35\text{dB}$ with Cartridge correction, see below)
- Channel separation: 28dB (1kHz)
- Distortion (300 Hz 45 μm): <0.3% lateral; 3% vertical*
- Noise (output): -94dBFS RMS‡

† JVC TRS-1007 lateral; includes variation due to wavelength loss on inner grooves.

* CBS STR-112

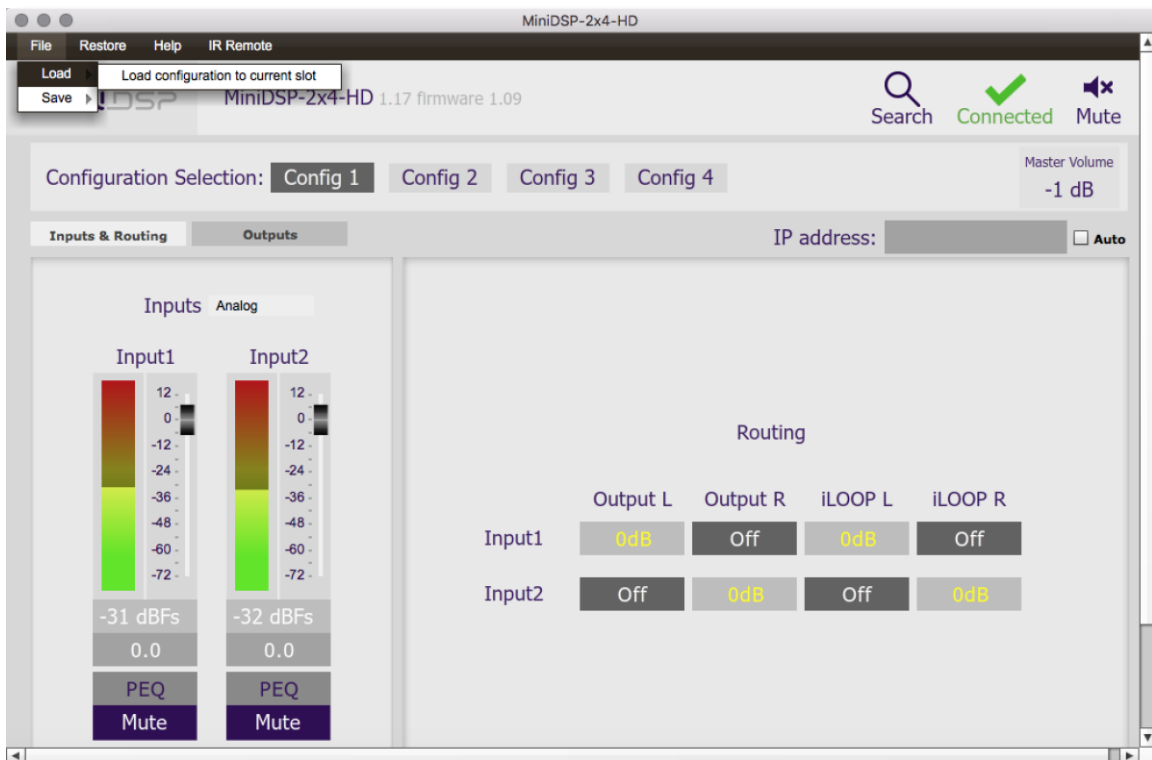
‡ Cartridge parked, platter (SL-1200 Mk. II) turning. A-weighted.

Chapter 2 - Getting going

Set up the miniDSP **2X4HD** unit as described in the miniDSP manual. There is no need to connect the turntable and **Groove Sleuth** preamplifier at this point.

Install the **2X4HD1** plug-in on the computer of your choice. *The plug-in must be purchased with the miniDSP platform.* Connect the DSP platform to your computer (see miniDSP manual for details).

Upload the four configuration files to the four configuration “slots” in the **2X4HD1** plug-in interface, shown below.



We suggest that you load these in the following order:

- Config 1 = 20_1_21_RIAA_config.xml
- Config 2 = 20_1_21_MONO_LP_config.xml
- Config 3 = 20_1_21_78RPM_config.xml
- Config 4 = 20_1_21_FLAT_config.xml

Now that these configurations have been uploaded, the computer is no longer required, the miniDSP platform will work stand-alone. Alternatively, the plug-in may be closed and the computer remain connected as a signal source and to record the output of the mini-DSP (via the USB interface).

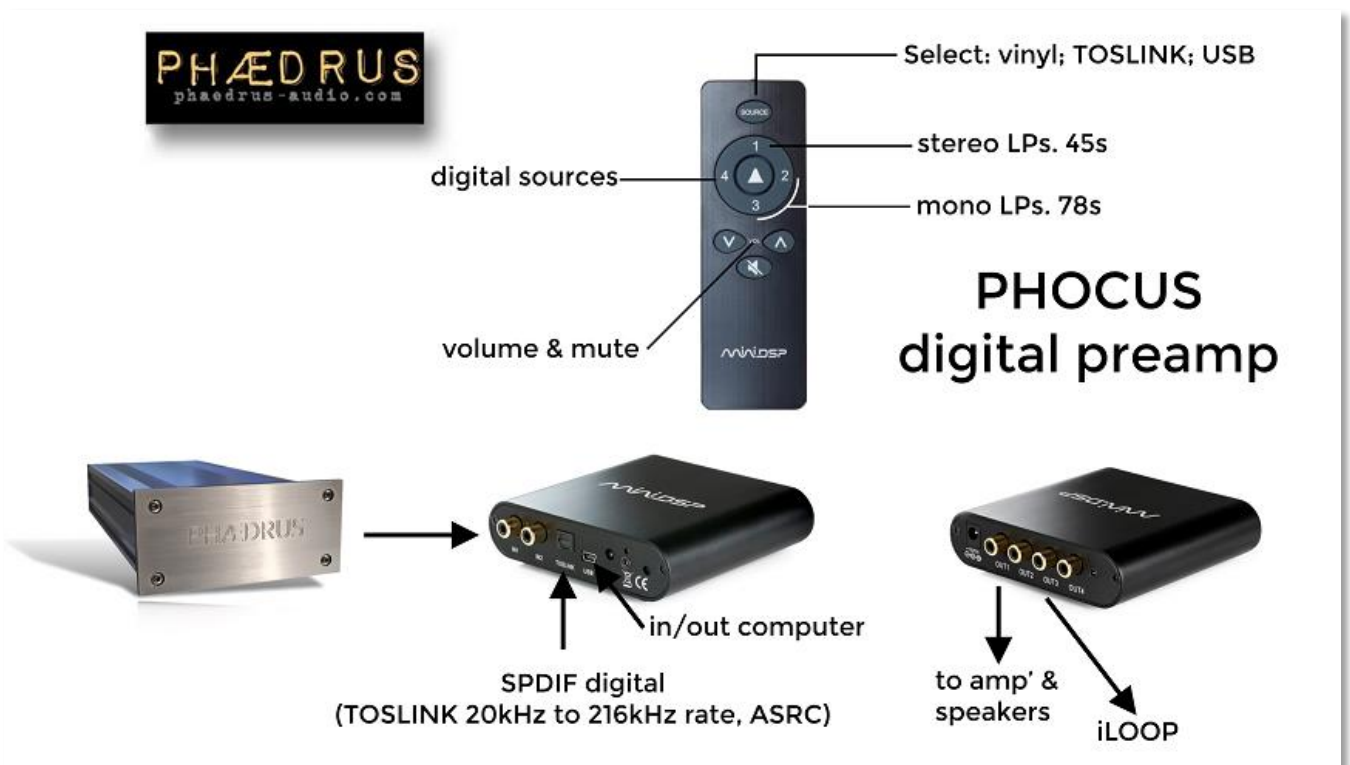
Chapter 3 - Connecting the turntable and other equipment



Connect the turntable to the **Groove Sleuth** preamplifier as described in the appropriate manual. Connect the **OUT** of the **Groove Sleuth Mk. II** or **Groove Sleuth LOCKDOWN** (LINE OUT for the **Groove Sleuth MICRO**) to the two inputs of the miniDSP **2X4HD**.

We suggest you stick to the convention that odd I/O numbers are *left channel* and even I/O numbers are *right channel*.

Connect the rest of your audio equipment as illustrated below.



Chapter 4 - In use

The **PHOCUS** preamplifier is best controlled by the remote control. (The alternative is to use the plug-in, but this is inconvenient.)



The interface is intuitive:

The **SOURCE** button steps through the three inputs: analogue (turntable); TOSLINK; and USB.

The **four numbers** select the configurations: stereo LP; mono LP; 78 RPM; digital inputs (TOSLINK & USB)

The **VOLUME** and **MUTE** buttons behave exactly as expected.

WARNING: Be careful when selecting input sources. If digital sources are selected in any of the first three configurations, a great deal of bass-boost is applied to the signal and this makes for loud, distorted reproduction. This does no damage to the PHOCUS or the turntable, but your loudspeakers may not thank you!

Chapter 5 – Technical information

Alignment

All the **Groove Sleuth** preamplifiers are aligned for 0dBFS = 2V RMS (default jumper setting in **miniDSP 2X4HD**).

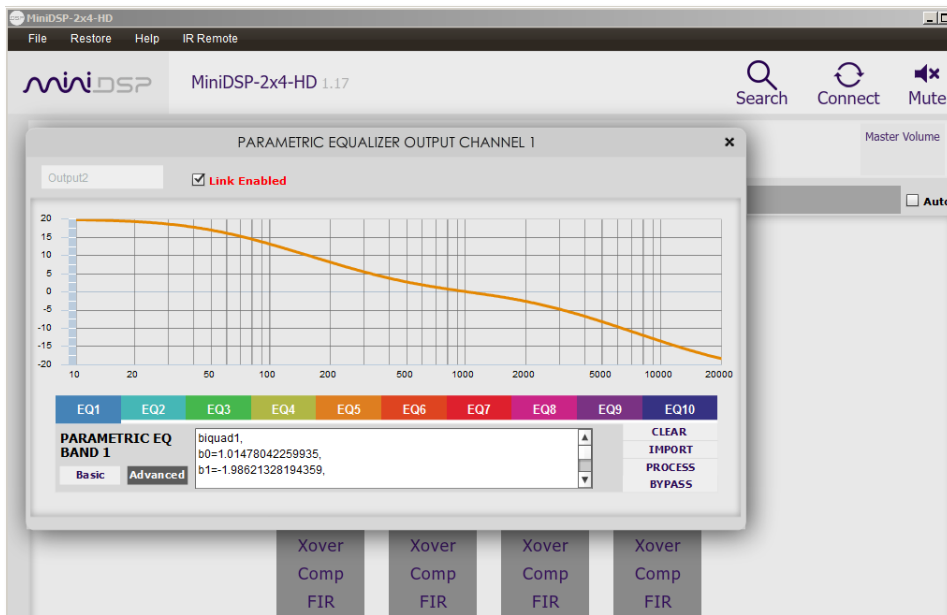
Assuming the “standard” sensitivity of moving-magnet phono cartridges of 1mV/cm/s (and for moving-coil cartridges of 0.1mV/cm/s), the **Groove Sleuth** preamplifiers will drive the A to D within a couple of dB of full-scale from maximum velocity modulation, thereby just leaving a bit of headroom for pathological signals (severe record damage, needle-down thump etc.).

But, of course, the output level is also a function of the cartridge sensitivity and this is beyond our control. Extra gain can be configured in the input module of the **2X4HD1** plug-in to compensate for low output cartridges. Most cartridges have a sensitivity *below* the standard figures quoted above. For example, the **PHLUX-II** active cartridge sensitivity is 0.7mV/cm/s.

Rumble-filter

The **PHOCUS software preamplifier** incorporates rumble-filtering with 12dB/octave filters with 15Hz turnover in a third, cascaded *biquad* filter. These are disabled on shipping but may be enabled in the **2X4HD1** plug-in.

To do this: click on the **EQ3, green button** in the **2X4HD1** plug-in interface and deselect **BYPASSED** at the bottom right of the PARAMETRIC EQUALISER window. The curve will immediately change to reflect the high-pass filter in the overall transfer-function.



These rumble filters are not in the path to **iLOOP** outputs (3 and 4 of the miniDSP **2X4HD** DSP platform) so that the high-quality, linear-phase rumble filter in **Stereo Lab** may be employed.

Chapter 6 - Integration with Stereo Lab

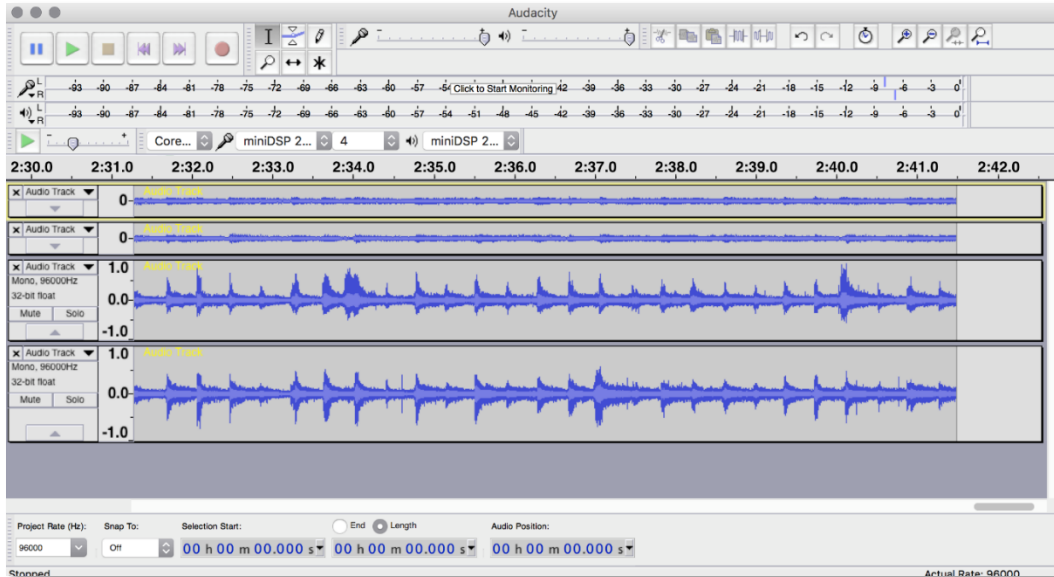


In all four of the **PHOCUS** configurations, channels 3 and 4 of the **miniDSP 2X4HD** are programmed to be a copy of the two-channel input signals (**iLOOP**).

These are available as analogue signals at output 3 and 4 of the DSP platform (0dBFS = 2V RMS) and to any computer connected via USB. The computer interface is XMOS asynchronous USB audio, 44.1 to 192 kHz, USB Audio Class 2 compliant. (ASIO driver for Windows, driverless for Mac OS X.)

These **iLOOP** signals are programmed so that channels 3 and 4 may be used for making unequalised needle-drop recordings to a connected computer whilst monitoring (with equalisation applied) via channels 1 & 2.

A screen capture of an Audacity session (below) illustrates equalised and non-equalised signals from a vinyl needle-drop being recorded simultaneously from the **PHOCUS** to a connected computer.



Chapter 7 - Cartridge compensation option

The phono cartridge is the most fragile link in reproduction from records. The technology is more like watchmaking than normal audio work. And the analogy with watchmaking is interesting because it also explains how, just like wrist watches, prices of cartridges go from about the price of a full-price CD to the price of a car.

The good news is that using **PHOCUS** software preamplifier, it is possible to improve the performance from your cartridge whatever your budget by complementary signal processing; at least in terms of frequency response variations.

The cartridge compensation option is implemented in multi-tap FIR filters, the convolution parameters being determined by Pspatial Audio from extensive cartridge tests. We offer generic compensations for various cartridges.

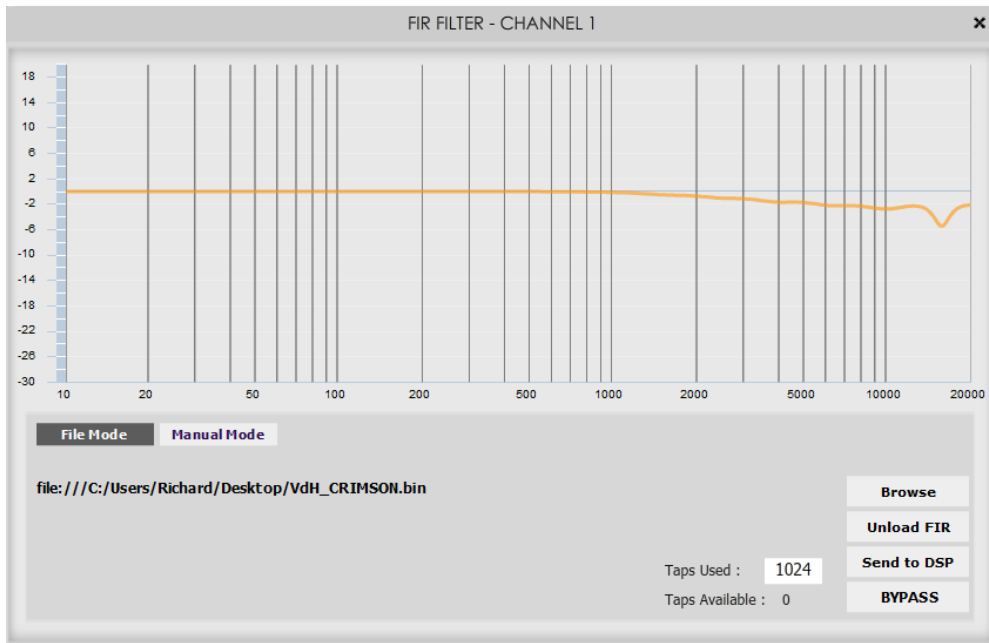
Cartridge compensation is supplied as a data file (in IEEE 754 single-precision binary floating-point format). This is uploaded to the miniDSP **2X4HD** platform with the associated **2X4HD1** plug-in. The files contain the 1024 convolution coefficients.

At launch (Jan 2012), we have generic compensation filters for the cartridges listed in [end-note. 4 on this page](#). We will continue to add to this list in later versions of the software.

Installing the cartridge correction filter

The cartridge correction filters are uploaded to the FIR slots from the **2X4HD1** plug in as shown. Install in channel 1 and 2 for listening and 3 and 4 if you wish to apply correction to recorded needle-drops.

Make sure that the Taps Used field (lower right) is set to 1024 before uploading the .bin file. Bear in mind that the miniDSP **2x4HD** can compute a total of 4096 taps.



Appendix 1 – non RIAA equalisations

Pre-stereo LPs (500R-10.5)

The German Standards Authority (DIN) introduced a series of standards (DIN 45533, 45536 and 45537) in 1959 as a kind of "European RIAA" with reduced preëmphasis.

The time constants of these DIN standards (common for 33 $\frac{1}{3}$, 45 and 78 RPM discs) were 50, 318 and 3180 microseconds: close to RIAA, but different enough for recordings recorded with the former and played back with the latter to sound a little dull.

The RIAA Wikipedia article says this of the DIN (45537) characteristic,

“The extent of usage of this curve is unclear”.

It may have been quite extensive. Copeland¹ agrees and adds,

“there was much heart-searching before Germany adopted 75 microseconds instead of 50, to bring them into line with the RIAA microgroove standard. ”

We also believe that the use of this characteristic was widespread: Deutsche Grammophon records are considered by some record collectors to lack the brilliance of sound quality of recordings by HMV (EMI). This is possibly due to the DIN recording characteristic being used instead of RIAA into the 1960s.

Mono, Telefunken LPs clearly indicate that DIN45537 and not RIAA recording characteristic was employed and Neumann lathe electronics provided for either RIAA or DIN equalisation up until 1966 and the introduction of the VMS 66 lathe.²

The TELDEC characteristic is very like that used by Decca in the UK after 1950 and before 1956 when they switched to RIAA equalisation. During this period, Decca used the Decca 33 $\frac{1}{3}$ characteristic (which is tabulated by Moir³) and which we could label 500C-11.5. We have determined the time-constants of this curve to be 1590/318/60 μ s. So, TELDEC equalisation is widely useful for pre-stereo LPs.

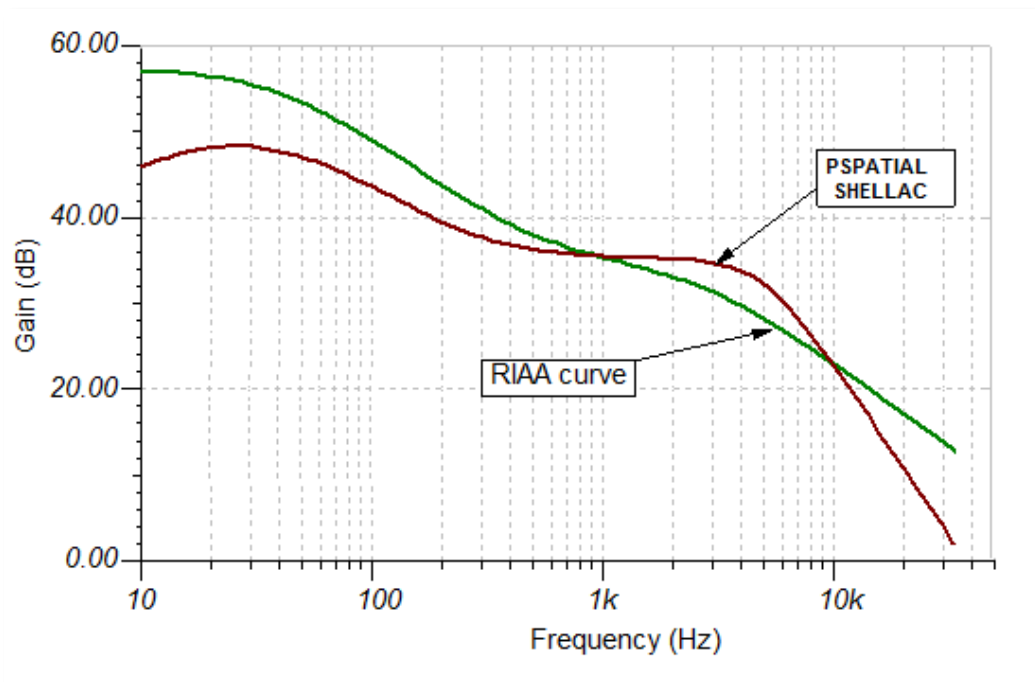


¹ Manual of Analogue Sound Restoration Techniques, Peter Copeland The British Library London, 2008 and available on line from the British Library site.

² The Needle-drop Handbook. Brice, R. http://pspatialaudio.com/NDH_book2.htm

³ High Quality Sound Reproduction by James Moir, Chapman & Hall Ltd., London, 1958

Universal Shellac characteristic



The 78 RPM (shellac records) equalisation curve was developed with the benefit of Pspatial Audio's years of experience of working with shellac-era records. We worked with them to develop to a compromise equalisation, known as the **Pspatial Audio Universal Shellac characteristic** which serves for the majority of 78s.

If shellac records are replayed using the RIAA curve, the low-frequencies are over-boosted and this results in exaggerated bass and rumble due to surface roughness of the record-lathe bearings. The Pspatial Audio **Universal Shellac** characteristic offers much less bass-boost (in fact, a 300Hz turnover) which helps suppress any bearing rumble.

The spectrum of the groove noise from a 78 RPM record rises from about 500Hz to very high frequencies: in fact, to frequencies way beyond the recording technology of the nineteen-thirties and nineteen-forties, which was limited to about 7kHz after which the recording characteristic was said to be *constant acceleration*.

The Pspatial Audio **Universal Shellac** characteristic maintains the flat characteristic until about 7kHz whereupon it falls rapidly so that surface noise however is drastically reduced.

By contrast RIAA characteristic also attenuates the treble at much too low a frequency which leads to unacceptably "woolly, or unfocused" reproduction.

Appendix 2 – Safety (Groove Sleuth equipment), also see miniDSP manual for 2X4HD unit

General

Before using any piece of equipment manufactured by Phædrus Audio, be sure carefully to read the applicable items of these operating instructions and the safety suggestions. Keep them for future reference. Follow the warnings indicated in these operating instructions.

THE USER SHOULD NOT ATTEMPT TO SERVICE THE UNIT. ALL SERVICING SHOULD BE REFERRED TO QUALIFIED SERVICE PERSONNEL OR FACTORY ONLY.

Phædrus Audio products should NEVER be connected to the external power supply or in any other way energised when the case is opened and/or the circuit boards are accessible.

General Safety Instructions

- Do not operate this equipment near any source of water or in excessively moist environments.
- Keep this equipment away from babies, children and pets.
- Do not let objects do not fall, or liquids be spilled, onto the enclosure.
- Situate this equipment away from heat sources or other equipment that produce heat.
- Ensure this equipment has adequate ventilation. Improper ventilation will cause overheating, and can damage the equipment.
- When cleaning this equipment, remove all connections to the unit; including power and gently wipe with a clean lint-free cloth; if necessary, gently moistened with lukewarm or distilled water. Use a dry lint-free cloth to remove any remaining moisture. NEVER use aerosol sprays, solvents, or abrasives on this equipment.

This equipment should be serviced by qualified service personnel or returned to Phædrus Audio when: an object (or objects) have fallen into the enclosure; or liquid has fallen into, or been spilled into the unit; or the unit has been exposed to rain or high humidity; or the unit does not operate normally or exhibits a marked change in performance; or the unit has been dropped, or the enclosure has been damaged