

User Manual for

# GROOVE SLEUTH MK.II

## NON-EQUALISING PHONO PREAMPLIFIER

(for needle-drop\* recordings with Stereo Lab Software which is supplied free with this product)



\* A *needle-drop* is a term which means a version of a music album that has been transferred from a vinyl record to a digital audio medium. Needle-drops are also sometimes called *vinyl rips*.

Version 5.1 (February 2018 – new universal **Groove Sleuth Mk.II**)

**PHÆDRUS**  
phaedrus-audio.com

## Chapter 1 - Introduction



Phædrus Audio's **Groove Sleuth Mk.II** preamplifier is designed to be used in conjunction with Pspatial Audio's **Stereo Lab** (Phonograph or Audiophile) app which runs under OS X on the Apple Mac. **Stereo Lab** has

a wide feature set but it devotes a large part of its functionality to software equalisation and decoding of analogue records.

This isn't just technology for technology's sake. There are real, audible reasons for doing this: phase-linear warp and rumble filtering is only possible in the digital domain and reveals a bottom octave with unprecedented clarity and realism. The accuracy of RIAA equalisation and perfect channel balance ensures an uncoloured sound with superb stereo sound staging. And the flexibility in recording characteristics will bring to life LPs you thought mediocre. Moreover, **Stereo Lab** also includes software decoders for QS and SQ quadrasonic and *Ambisonic* LPs; thereby bringing life to forgotten, analogue, multichannel gems.

For **Stereo Lab** to process needle-drop captures and equalise them, it needs recorded files of the "raw" signal, direct from the groove, unfettered by analogue equalisation. And that is where the **Groove Sleuth Mk.II** preamplifier comes in. It is a phono preamplifier of the very highest quality but *without* equalisation, so that the signal fed to the computer is the closest version of the signal direct from the groove, but at a suitable amplitude for digitisation. The **Groove Sleuth Mk.II** preamplifier has various options to augment this basic task to aid with monitoring and to ease integrating these units into a high-quality audio system. These are described in the pages that follow.

## Chapter 2 - Safety

### 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 on the unit, as well as 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.

## Chapter 3 - Gramophone record equalisation in software

The signal recovered from a gramophone (phonograph) record via an electrodynamic pickup (moving-coil or moving-magnet type) has the bass drastically attenuated and the treble boosted. Replay processing is therefore required to present a complimentary characteristic to restore the

original audio balance. The electronic amplifier which corrects for the equalisation applied during recording is today universally called an RIAA preamplifier. The design of good, accurate RIAA equalisation has taxed the ingenuity of audio hardware engineers for sixty years.

Pspatial Audio believe that, after 60 years, hardware RIAA equalisation has just about reached the end of the developmental road and that equalisation is nowadays better performed in software for the following reasons:

### **REASON 1: Greatly increased digital resolution**

**Stereo Lab** has internal processing in software which uses double-precision floating-point math. CD audio represents the audio signal with a dynamic range of 96dB, smaller than the capacity of the human hearing system, which has a dynamic range of about 120dB. The very best analogue circuits can just about match this dynamic range. But, by contrast, double precision floating-point math is a binary format which has a precision of 53 bits or 320dB. That's a dynamic range which is ten billion ( $10^{10}$ ) times greater than the hearing system.

### **REASON 2: Filter accuracy and stability and perfect left-right channel matching**

Even the very best electronic components can only be manufactured with a certain degree of accuracy which is rarely better than 1%. Physical components are also subject to ageing such that they go "off value". Digital processing ensures perfect channel balance and frequency response for ever, which guarantees an uncoloured sound with superb stereo sound staging.

### **REASON 3: Better warp and rumble handling - with phase-linear filtering in software**

In a perfect world, all gramophone records would be perfectly flat, there would exist no inevitable resonance of the arm-mass and the stylus mounting compliance and the mechanical vibrations from the driving motor would be eliminated. But LPs do not exist in a perfect world so, when warp or rumble (as these imperfections are named) are present, they are better eliminated. The technique always employed to remove these effects is high-pass filtering and that is the approach taken in **Stereo Lab** too: a slightly under-damped fourth-order filter may be employed as a *rumble filter* so that the response falls sharply below the audio passband. However, very differently, the rumble filter is a phase-linear,

non-causal design which means there is *no phase distortion introduced*. Phase distortion is inevitable, real and audible in causal, filters and can never be eliminated in analogue designs]. But it is entirely eliminated in software processing. The result is a bottom octave which will sound like you've never heard it before.

### **REASON 4: Flexibility of equalisation characteristics - to cope with records not equalised with RIAA curve**

Conventional wisdom has it that, by the mid-fifties in a *belle époque* of international cooperation, most American labels and most major European labels had adopted the new RIAA standard and had brought to an end a very chaotic situation which had existed since the dawn of electric recording in which the record companies all specified different equalisation for their discs. However, the truth is that many labels were much slower to adopt the RIAA curve and disc recording characteristics were not effectively standardised

None
Phonograph EQ A2 (Decca LP)
Phonograph EQ A3 (TELDEC/AES)
Phonograph EQ B1 (NAB)
Phonograph EQ B2 (Columbia LP)
Phonograph EQ C (CCIR/Coarse Groove)
Phonograph EQ D (Quad 22 all buttons)
Phonograph EQ E (500-Flat)
Phonograph EQ F (Flat/Acoustic)
Phonograph EQ G (European 78s)
Phonograph EQ H (American 78s)
Phonograph EQ J (Columbia 78s)
Phonograph EQ K (Ceramic)
Phonograph EQ S (Displacement)
✓ Phonograph EQ A1 (RIAA)
Phonograph EQ P1 (Strain-Gauge/Light-Valve Cartridge)
Phonograph EQ P2 (DisC Displacement Cartridge)
Phonograph anti-EQ A1 (RIAA)

until the late 1960s, or possibly even later. It is therefore a great boon to the vinyl enthusiast to have flexible equalisation characteristics. But such flexibility, combined with perfect mathematical precision is very complicated and expensive to implement in hardware.

In providing digital equalisation as part of **Stereo Lab**, Pspatial Audio wished to offer a comprehensive range of these non-RIAA equalisation options for gramophone disc collectors whilst avoiding a complex and over technical user-interface. So, **Stereo Lab** features equalisation options to cover any disc (or indeed cylinder) recording from the 1880s to the present day.

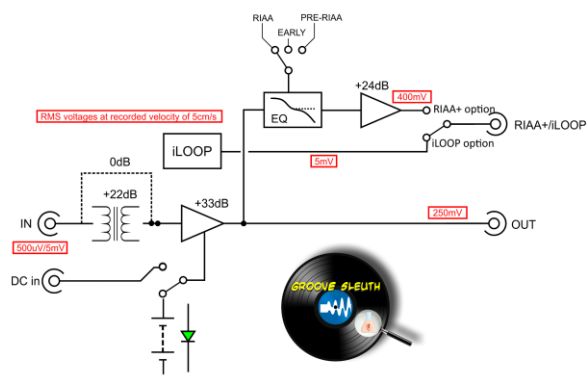
## Chapter 4 – The Groove Sleuth Mk.II Preamp

The signal from a gramophone pickup is too small to apply to the line input of most sound-cards or audio interfaces. What is required is a dedicated phono preamplifier to bring the small signal from the cartridge up to a healthy level for input to the computer sound-card.

Many phono preamplifiers exist at all price levels from a host of manufacturers. But, the vast majority of the phono preamplifiers apply RIAA equalisation in the hardware of the unit and that is not what is required here. We need a preamplifier which provides gain and impedance conversion, without applying the equalisation. These are unfortunately very rare, especially models which guarantee extremely low-noise, exemplary headroom, excellent linearity, and an accurate and extended frequency-response. It is to fill this need that the **Groove Sleuth** preamplifiers were developed.

### The Groove Sleuth Mk.II

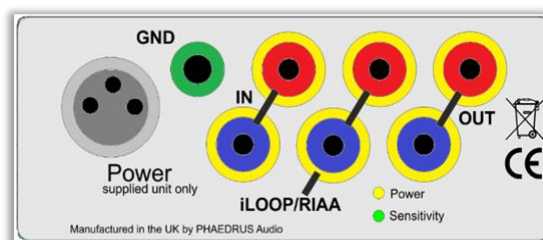
The **Groove Sleuth Mk.II** is a second generation product which replaces all the models in the original **Groove Sleuth** range. Please refer to this block diagram of the **Groove Sleuth Mk.II** preamplifier in the following description.



The **Groove Sleuth Mk.II** preamplifier is suitable for high-output moving-coil (HMC) and moving-magnet (MM) cartridges, and optional transformers may be fitted for low-output moving-coil (MC) cartridges. The **Groove Sleuth Mk.II** is

also suitable for Phaedrus Audio **PHLUX (PHLUX II)** active moving-magnet cartridges. (See Chapter 5 for more information about **PHLUX** active cartridges.)

Each base unit is equipped with a high-quality looping path called **iLOOP**, and the **Groove Sleuth Mk.II** preamplifier has an option for RIAA and limited alternative equalisations.



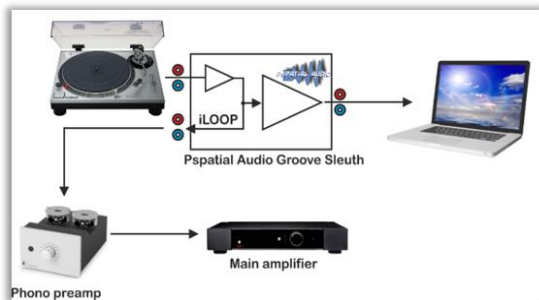
In the base options, the unit simply presents the cartridge with the correct impedance at the IN phonos and amplifies the signal. The output is presented on the phonos marked OUTPUT on the rear of the **Groove Sleuth Mk.II** unit.

The gain of this preamplifier is a little lower than the typical mid-band gain of an RIAA preamplifier because, without RIAA equalisation, the crest-factor of the signal is somewhat greater than with a typical music signal (by about 4dB). The signal amplification is designed for the lowest possible distortion and noise-floor; a discrete transistor stage with multiple, paralleled transistors being necessary for the latter. This amplified signal is sent to an external audio interface for digitisation and subsequent recording equalisation in **Stereo Lab**.

### Transformer option

When ordered with the MC option (**GS-MC**), the **Groove Sleuth Mk.II** preamplifier includes a step-up transformer stage. Transformers are heavy and expensive, but they sound great! And they do offer the lowest possible noise-floor. The transformers selected for the **Groove Sleuth Mk.II** preamplifier are of the highest quality: they possess high primary inductance, very low leakage and are fully mu-metal screened.

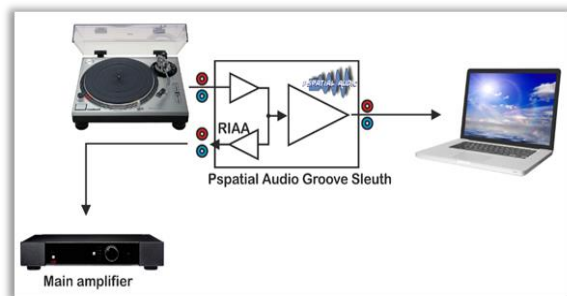
## Signal loop (iLOOP)



The **Groove Sleuth Mk.II** preamplifier features the **iLOOP**; a wide-bandwidth, low-noise and distortion buffered loop-through. This is especially convenient for enthusiasts who already have an excellent LP replay solution but who want to introduce computer audio into their system. This is because the **Groove Sleuth Mk.II** integrates transparently into a pre-existing setup and provides new functionality without upsetting what's there already.

**iLOOP** always outputs the phono signal at high-output HMC (or MM) signal levels. In fact, if moving-coil cartridge transformers are fitted and the **iLOOP** output is fed to a moving-magnet input, the **Groove Sleuth** will function as a first-rate, wide-bandwidth, low-noise MC preamplifier.

## RIAA+



The **Groove Sleuth Mk.II** preamplifier may include a high-quality equalisation stage (**GS-RIAA+**) so that the "loop" signal is equalised and emerges at line level on the phonos marked iLOOP/RIAA. The equalisation filter is a high-precision, passive network. Previously, we have only offered optional RIAA equalisation for monitoring. However, because Pspatial Audio's **Stereo Lab** software has its greatest application in equalising the many recording characteristics of historical recordings, it was felt helpful to incorporate limited, variable equalisation in the hardware preamplifier to make record monitoring less fatiguing (it's hard work listening to a 78RPM equalised with the RIAA

curve). Three carefully judged, generalised settings are included:

- RIAA, labelled **RIAA**
- pre-RIAA (for late 78s and early LPs), labelled **LP**; and
- Early (which is for all records made up until the late 1940s) labelled **78**.

In this way record-monitoring may always be comfortable and accurate. This is followed by slightly more make-up gain (+24dB) than the mid-band loss in the RIAA network because the signal now has the crest-factor of the original music signal.

## Power supply and warm up

The **Groove Sleuth Mk.II** preamplifier is designed so that the analogue sections remain energised all the time since this is consistent with the best audio practice

The **Groove Sleuth Mk.II** incorporates the very low-noise battery supply which was previously only in the Groove Sleuth MINI. This means the preamplifier can be powered from a conventional, international-style power supply but be switched to battery supply during needle-drops to ensure the very best possible noise and aliasing performance. This delivers first-rate quality at a very reasonable price. A switch on the front-panel allows the battery supply to be selected and a LED indicates battery health and charge.

The **Groove Sleuth Mk.II** has well over 24 hours' operational charge, but we recommend battery play be limited to approximately 12 hours. The unit may be kept in charge mode when listening with only a minute loss of quality. By means of an advanced power-supply design, this condition is achieved whilst remaining compatible with European Eco-Consumption directives.

If the unit is unplugged or the power is removed or interrupted, the analogue circuitry is held in a muted state for about 5 seconds until the various bias voltages are stabilised. Therefore, do not be alarmed if the unit does not produce an audio output immediately after connecting power.

## Connecting the Groove Sleuth to your sound card



The

GROOVE SLEUTH  
OUTPUT PHONOS

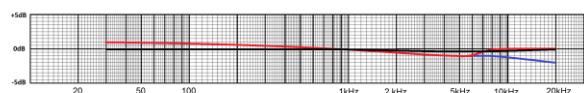
**Groove Sleuth Mk.II** is connected to your sound-card's line inputs (as shown above). Levels should be set on the interface in the normal way and you will find that the preamplifier delivers audio at a sufficiently high level for all commercial sound-cards, both internal and external.

## Chapter 5 – Phaedrus Audio PHLUX II - Active Phono Cartridge

The Phaedrus Audio **PHLUX II** active phono cartridge a new development in phono cartridge technology in which a moving-magnet motor system is buffered by a miniature amplifier thereby securing the performance of a moving-coil cartridge with the superior tracking and general convenience of the moving-magnet type. Using a combination of the **PHLUX II** cartridge, the **Groove Sleuth Mk.II** and Pspatial Audio's **Stereo Lab** software, first-rate needle-drops may be obtained. More information is available from [www.phaedrus-audio.com/PHLUX.htm](http://www.phaedrus-audio.com/PHLUX.htm)

The power to the **PHLUX/PHLUX II** active cartridge is supplied via the signal cable: rather as phantom power is delivered to modern microphones. In this way, the **PHLUX** may be fitted to any standard turntable without any rewiring. All that is required is that the phono preamplifier supplies the appropriate current and voltage to the turntable leads. This circuitry is provided within the **Groove Sleuth Mk.II**.

### PHLUX-II digital correction



PHLUX-II Lateral frequency response (JVC TRS-1007): blue is inner radius  
Black trace is corrected response at all recorded diameters using Stereo Lab (Ver. 3.1) PHLUX-II & wavelength-loss correction

The PHLUX-II cartridge has a very level frequency response. Variation is confined to  $\pm 1$ dB. This is a very good result and is illustrated in the graph above by the red trace.

Nevertheless,  $\pm 1$ dB is just perceptible; especially when it is a monotonic 2dB drop as shown in the graph. The result is a very slightly "warm" tonal balance. So, before applying recording-characteristic equalisation, it is possible to correct this very slight response anomaly in Stereo Lab software. The black trace indicates the corrected response which brings the variation of the PHLUX-II frequency-response to less than  $\frac{1}{2}$ dB; a result below accepted levels of perceptibility.

The combination of PHLUX-II, Groove Sleuth Mk.II and Stereo Lab offers a solution with which to extract the information captured on the original record with forensic accuracy.

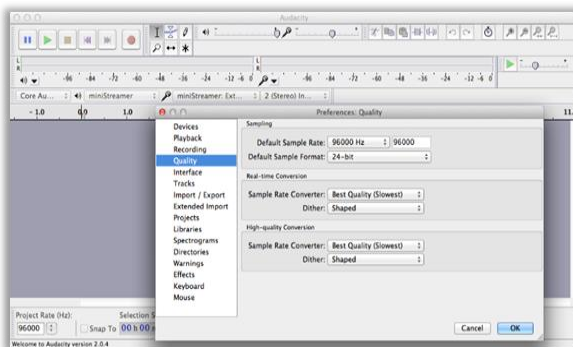
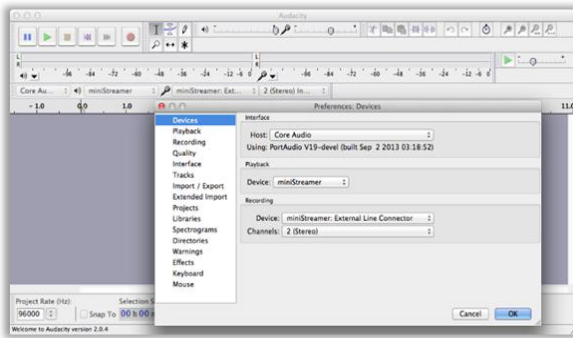


## Chapter 6 - Recording "Needle-drops"



To record a needle-drop, you will first need a program which records audio. Pspatial Audio can recommend *Audacity*, a free, easy-to-use, audio editor and recorder which runs on the Mac platform (and, in fact, on Windows and GNU/Linux too). *Audacity* is free software, developed by a group of volunteers and distributed under the GNU General Public License (GPL). *Audacity* features, not only the recording tools you need, but other tools which you can use to enhance your needle-drops like click and noise filtering and speed change. You can read about and download *Audacity* on their website (<http://audacity.sourceforge.net/>).

## Setting parameters



You will also need to configure *Audacity* so that it matches the settings you have made in the **Audio MIDI Setup** utility. The selections are made in the **Preferences/Devices** and **Preferences/Quality** dialogues as illustrated above. You may also need to adjust buffer depths in the software (**Preferences/Recording**) for the higher sampling rates. We'd recommend you adjust the **Audio to buffer** parameter to **50 milliseconds** as a good starting point.

## Recording levels

Set recording level so that peak music levels reach between -12dBFS and -6dBFS. Do not be tempted to over-record because this will cause distortion which **Stereo Lab** cannot rectify. It is recommended that loudness processing is also applied during the **Stereo Lab** software equalisation process. In this way you can be assured of the best dynamic range from your music and of good matching between needle-

drops and other audio files (for example CD rips). There is no need to anticipate the effect of the RIAA filtering in **Stereo Lab** because the software will automatically adjust the level of the input file for best resolution of the processed file.

**Remember to depress the front-panel switch of the Groove Sleuth Mk.II to switch to battery supply (green LED) before making a needle-drop: this will ensure that the needle-drop recording is of the highest quality. Reselect external supply when the recording is made to preserve battery charge.**

## Chapter 7 – Decoding Quadraphonic and Ambisonics discs

There were many interesting and important recordings made in Quadraphonic sound and versions of many classic recordings were mixed in Quad'. Many still only available as vinyl records, recording these LPs and decoding these recordings in software allows us to revisit, and indeed rediscover old friends.



*Many beautiful and important recordings were made in Quadraphonic*

**Stereo Lab** allows decoding of **SQ** and **QS** Quadraphonic and Ambisonics recordings to multichannel audio files so that they can be played over a square of four loudspeakers (as was the intention in the 1970s) or over a modern 5.1 system. No special precautions need to be made in recording needle-drops of quadraphonic or Ambisonics discs. It is recommended that equalisation is applied to the needle-drop in **Stereo Lab** before decoding.

## Chapter 8 - Specifications

**Size:** Groove Sleuth Mk.II: 112 × 50 × 225 mm (W-H-L)

**Preamplifier Supply:** DC input on screw locking connector.

**Power:** Groove Sleuth preamplifiers are designed to be compatible with European Eco-Consumption directives.

Consumption is less than 4 Watts in all configurations and active. The unit is intended to remain energised all the time.

## Groove Sleuth Mk.II Preamplifier

**Sensitivity @ 5cm/s recorded velocity:** Nominal 5mV RMS (-44dBu); or 500 $\mu$ V RMS (-64dBu) when GS-MC option fitted.

**Input load:** 47kohms // 220pF (MM); 100R (GS-MC option); 150kohms, 9V dc phantom supply (PHLUX)

**Gain (to computer output):** 33dB ( $\times$  45)

**Frequency response:**  $\pm$ 0.1dB from 20Hz to 50kHz

**Distortion:** 0.005% THD at maximum output level

**Equivalent input noise (EIN):** <500nV RMS (-124dBu), A-weighted. Input shorted.

**Signal to noise (wrt nominal sensitivity and un-weighted):** 80dB

**Maximum input signal (prior to clipping at full charge):** 75mV RMS

**Maximum input signal (prior to clipping after 6 hours on battery):** 60mV RMS

**Headroom (wrt nominal sensitivity at full charge):** 23dB

**Headroom (wrt nominal sensitivity after 12 hours on battery):** 20dB

**Battery:** 9V Ni-MH (nickel-metal hydride) E-block type.

## iLOOP (Intelligent Loop)

**Function:** Wideband, buffered loop-thru

**Frequency response:**  $\pm$ 0.1dB from 20Hz to 50 kHz

**Output load:** 47kohms (non-critical). Suitable for feeding any MM input

## RIAA+ correction circuit option

**Gain (to RIAA output):** 37db/58dB (MM /MC); RIAA curve; pre-RIAA curve: Blumlein curve

**RIAA response accuracy:**  $\pm$ 0.2dB from 40Hz to 20kHz (RIAA)

**RIAA IEC amendment:** Not implemented; rumble roll-off performed in software

**RIAA Neumann Pole or eRIAA:** Not implemented <sup>1</sup>

*Phædrus Audio reserves the right to change specifications without notice.*

## Chapter 9 - Warranty and service

### Service

If you experience a problem with a Phædrus Audio product, contact [support@phaedrus-audio.com](mailto:support@phaedrus-audio.com). We will diagnose the problem remotely and advise you of the warranty status. If a repair or replacement is required, we will issue a Return Merchandise Authorization (RMA) number and tell you where to send the unit to be repaired. You **MUST** have an RMA number before you return the equipment to Phædrus Audio's support service. Phædrus Audio will not accept responsibility for loss or damage in shipping or for equipment returned without valid paperwork and/or a valid RMA number. Remember, warranty is void if product serial numbers have been removed or altered, or if the product has been damaged by abuse, accident or unauthorized modification and/or repair (see Phædrus Audio Limited Warranty for details). There are no user serviceable parts inside.

PLEASE RETAIN YOUR SALES RECEIPT. IT IS YOUR PROOF OF PURCHASE COVERING YOUR LIMITED WARRANTY. LIMITED WARRANTY IS VOID WITHOUT SUCH PROOF OF PURCHASE.

### Phædrus Audio's Limited Warranty

*Warranty service conditions are subject to change without notice. For the latest warranty terms and conditions and additional information regarding Phædrus Audio limited warranty, please see complete details online at [www.phaedrus-audio.com](http://www.phaedrus-audio.com).*

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<sup>1</sup> The **Groove Sleuth** preamplifier's RIAA equalisation does not include the *Neumann pole* in the transfer-function of the equaliser. The truth is that the inclusion of a zero in the playback RIAA de-emphasis at 3.18 $\mu$ s compensates for *pole which never existed in the record equaliser* (see [http://www.pspatialaudio.com/neumann\\_pole.htm](http://www.pspatialaudio.com/neumann_pole.htm))





## Appendices

### Appendix 1 - Model Codes

The model/order codes for **Groove Sleuth Mk.II** preamplifier are:

**GS-II**- Cost-effective, battery-assisted preamplifier with **iLOOP** and support for MM (MC options) and Phaedrus Audio **PHLUX/ PHLUX II** active phono cartridge. Optionally equalising. Supplied with basic external, high-quality, universal power-supply unit.

#### *Options*

**GS-RIAA+** - EQ option including: RIAA; pre-RIAA (for late 78s and early LPs); and Early (which is for all records made up until the late 1940s). (Note that RIAA+ options replace **iLOOP**)

**MC-INPUT** – Addition of transformer input stage for all MC cartridges.

### Appendix 2 - Declaration of Conformity

The Manufacturer of the Products covered by this Declaration is

**Phædrus Audio**  
**Maidstone**  
**Kent**  
**UK**

The directives covered by this declaration are:

**89/336/EEC Electromagnetic Compatibility directive**

**73/23/EEC Low Voltage Equipment directive**

The products covered by this declaration are:

**Groove Sleuth Mk.II non-equalising phono preamplifier**

The basis on which conformity is being declared: The manufacturer hereby declares that the products identified above comply with the protection requirements of the EMC directive and with the principal elements of the safety objectives of the Low Voltage Equipment directive, and that the following standards have been applied:

IEC INTERNATIONAL STANDARD 60065 - Audio, video and similar electronic apparatus – Safety requirements

The technical documentation required to demonstrate that the products meet the requirements of the Low Voltage Equipment directive has been compiled and is available for inspection by the relevant enforcement authorities. The CE mark was first applied in 2015.

Signed:



Richard Brice, Technical Director

Date: October 2017