

User Manual for

SHUpHLER-IV – stereo signal matrix



Version 1.2 (January 2026)

Chapter 1 - Introduction

The Phædrus Audio SHUpHLER-IV is a high-quality stereo matrix product.

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 – Connecting the equipment

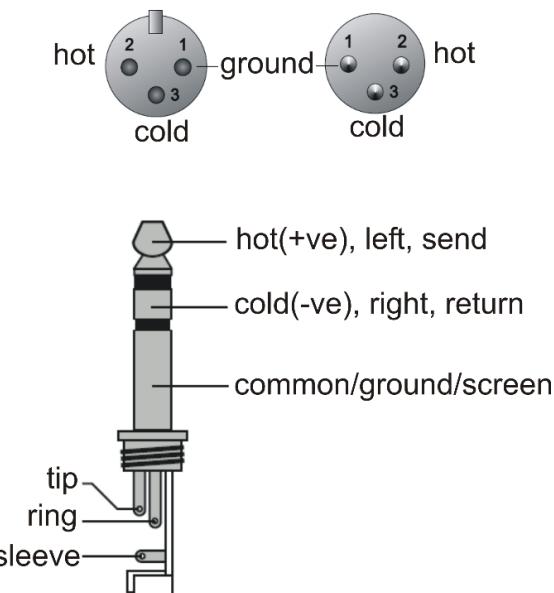
The rear of the panel Phædrus Audio **SHUpHLER-IV** is illustrated here. Connecting the **SHUpHLER-IV** is straightforward.



Signal connections

The **SHUpHLER-IV** uses 3-pole, 1/4" balanced jack sockets for balanced or unbalanced audio. Be sure to respect the correct channel polarity. The convention used in the Phædrus Audio **SHUpHLER-IV** is the left channel is labelled I and the right II. The following graphic illustrates how balanced signals should be connected.

connections

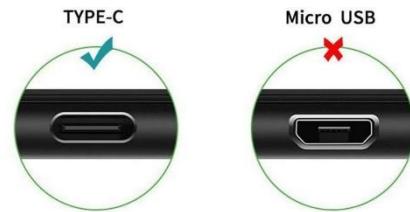


Power Supply



Finally, connect the USB power. Today, USB power – usually presented via a USB Type-A connector – is ubiquitous. It is available, either via the computer hosting the DAW, or via stand-alone plug top power supplies, as illustrated.

Note that the USB Type-C connector is not the same as the Micro USB connector.



USB power is not known for its stability or lack of noise. To that end, the **SHUpHLER-IV** preamplifier incorporates advanced power supply processing which filters any power supply noise and thereby achieves the excellent noise and dynamic range figures it does (see *Specifications*). The current load on the USB supply due to the **SHUpHLER-IV** is very light, less than 100mA. The unit may therefore be powered from USB 1.1, 2.0 ports (white plastic inside), or first or second-generation USB 3.0 & 3.1 ports (blue or red plastic inside).



Some customers may wish to use an external, linear power supply type. There are several manufacturers of this type of supply, and they deliver high-quality and low noise 5V DC at very reasonable cost (one is illustrated). An alternative – to keep away from mains power completely – is to use a USB Power bank. If you want to arrange your own PSU, be aware that USB power is specified to be 5V $\pm 5\%$ (4.75V to 5.25V) and these limits must be respected.

Chapter 4 – Operation and facilities

Phædrus Audio **SHUpHLER-IV** incorporates the following features:

- Five *stereo shuffling* circuits for
 - Cosine (figure of eight) microphones & pan-pot stereo
 - Binaural techniques (Blumlein's original "δ" technique)
 - Crossed Cardioids - unique, new circuit
 - Elliptical equaliser
 - Spaced microphones
- Balanced/unbalanced versions
- Clip indication: BLUE = safe zone; RED = clip.
- Flexible, line level connection at semi-pro and pro levels

Despite being discussed since the earliest days of stereophony, there remains much confusion about the term *Stereo Shuffling*. This is not surprising because the term actually refers to two, quite separate and different techniques.

Simply put, the earliest use of the term (coined by no less than Alan Blumlein, the inventor of stereo himself), refers to the processing of near-spaced omni' microphone signals so that they reproduce correctly on loudspeakers. The second *Shuffler* was invented some twenty years later for the processing of crossed, cosine (figure of eight) microphone signals to give better realism.

Why use the same name? Well the later "Shuffler" was invented by the same team who had worked with Blumlein before he was killed in WW2. Perhaps they sought to honour him in adopting the term which derived from him?

In any case, the Phædrus Audio **SHUpHLER-IV** incorporates *both type of historical Shuffler*, plus some newer shuffling (or matrix) processes, so that you can experiment and use these amazing techniques on your own recordings.

The Phædrus Audio **SHUpHLER-IV** is a line-level device which may be used in unbalanced and balanced circuits. The balanced device has a high overload margin (>+18dBu), and low-noise, so that it's equally useable connected at insert-points, across the stereo bus/ stereo signal or used in a balanced or unbalanced send-return loop with a DAW.



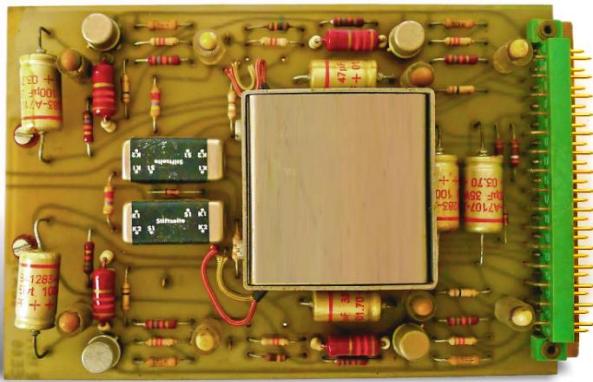
The front panel of the **SHUpHLER-IV** is simplicity itself. In addition to the "off" position, five selectable shuffling techniques are available, each of which is described below.

What the correction switch does

None

This is effectively the "OFF" position. In this position, the input signals are left unprocessed and simply pass through the low-distortion, low-noise line amplifiers.

Elliptical

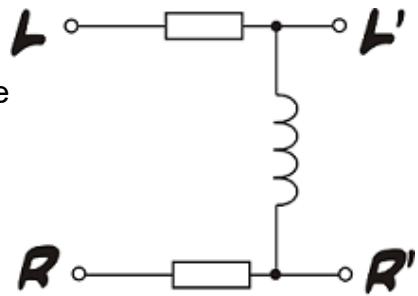


Vertical modulation of the cutting stylus must be limited when cutting records because, if these modulations aren't carefully restricted, at the peaks of the wave the cutter chisel either digs so deep that it scrapes the aluminium substrate of the lacquer master disc or it produces a groove so shallow that the stylus slides out on playback. Out-of-phase information, or excessive L-R information is especially problematic when cutting a record because it causes these vertical movements of the cutter.

Mindful of the above, recording engineers are all taught not to plague their recordings with excessive energy in the channel-difference signal (bass and bass-drum are usually panned to the centre and so on). But large amounts of low frequency channel-difference energy can arise due to operational oversights. For example, spaced microphones can respond to very low-frequency air-conditioning or traffic noise and, by dint of their physical spacing, result in excessive channel difference information. The recording engineer, listening on small loudspeakers, may be completely unaware of the effect until the horror is unleashed on the disc mastering team.

To contend with problems such as these, lathe electronics include a piece of equipment dedicated to eliminating vertical modulation below a certain frequency known as the **elliptical equaliser**.

This special equaliser (in the case of Neumann' lathes, the EE66 or EE70) is a relatively simple device, at the heart of which are just three impedances. The reactance of the cross-feed inductor (visible within its mu-metal can in the image of the EE70 above) is substantial at high-frequencies which ensures good channel separation. But, as the reactance of the inductor falls with reducing frequency, the channels separation is reduced until – at a theoretical zero-frequency, when the reactance of the inductor is zero – the resulting L' and R' signals are identical and no channel-difference information exists at all.

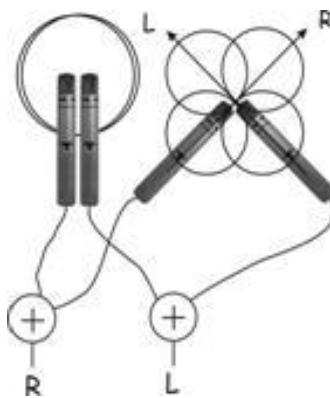


The elliptical equaliser in the Phædrus Audio **SHUpHLER-VI** may be used in several ways. Clearly, it may be used as Neumann intended; to reduce problematical signals for a project destined for vinyl release. But, it may also be used to concentrate bass and bass-drum signals within the mix, and it works very well as a headphone shuffler - making mixes easier to judge on headphones. Or make listening simply more enjoyable on headphones.

Cardioid

The shuffling technique selected here is an entirely new technique and is intended to compensate for various shortcomings in crossed-cardioid recordings which are usually accused of lacking "spaciousness".

The directional response of a cardioid microphone is equivalent to the combination of a cosine (figure-of-eight) and omni-directional response. (In fact, the earliest cardioid microphones were made in this way). So, the signals from a crossed-pair of cardioid microphones are mathematically equivalent to those produced by a crossed pair of eights, mixed equally with a mono signal.

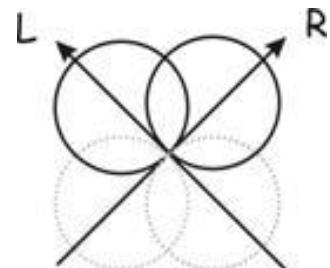


It's not surprising this technique is often accused of lacking "spaciousness".

The truth is, the only reason the crossed-cardioid technique gives reasonable results is due to the HF "beaming" of the microphones which cause high-frequency channel differences to predominate over the mono signal at higher frequencies.

One way to improve the situation is to set the microphones at a greater angle than 90 degrees, or separate them slightly, so as to add a time-delay "helper" cue, as is done in the ORTF and NOS arrangements. But, it is also possible to correct for the effect of the unwanted, omni-response electrically; and that is what is done in the **SHUpHLER-IV** when the switch is in the CARDIOID position.

One special advantage of the electronic process is that the correction results in a suppressed rear-lobe. Because this looks like half of an eight response (see diagram), we term this technique, *Phædrus crossed-fours™*.



Stereosonic



Read Hugh Robjohns explanation of the problems with intensity-coded (pan-pot) stereo from the Sound on Sound [review of the Phædrus Audio SHUpHLER](#) at <https://www.soundonsound.com/reviews/phaedrus-audio-shuphler>

When the British team developed the Stereosonic, two-channel, stereo recording system after the war which killed its inventor [Alan Blumlein](#), they incorporated special circuitry which corrects for known problems with a standard stereo signal.

In naming this special circuit, its inventors (H. A. M. CLARK, G. F. DUTTON and P. B. VANDERLYN) honoured their old boss (Blumlein) in borrowing the term he had coined for an earlier stereo processor and called it the *Shuffler*. Unfortunately, this borrowing of the earlier term has led to much confusion about stereo "shuffling" over the years because a "stereo Shuffler" is actually two, quite different inventions which share a common name!

For a full description of their work, Clark (et al.)'s paper is available [here](#).

In effect what Clark, Dutton and Vanderlyn found was that, a standard, panned stereo signal (or that derived from crossed-mic's) has the drawback that, for a given position away from centre, or of the pan-pot away from the centre, the high-frequency components of a signal actually appear further from the centre in the reproduced "stereo-image" than do the lower frequency components. This is directly reproduced from their 1958 JAES paper.

Subjective tests were made with a number of observers using two loudspeakers supplied with known relative voltages from a source of recorded music. First a filter was inserted passing all frequencies up to 700c/s from a variety of sources of sound including male and female speech, solo, orchestral and brass-band music. The experiment was repeated using all frequencies above 600c/s. Quite definite location within about $\pm 2^\circ$ was obtained in each case, but whereas at low frequencies the angle was in agreement with that predicted from eqns. (1) and (2) for a given loudspeaker ratio, that obtained at high frequencies was greater. The relationship obtained is in agreement with that published by other workers who rely primarily on intensity differences.¹⁵ By introducing a factor of approximately 0.7 into the ratio $(L - R)/(L + R)$ above 700c/s, the results for high and low frequencies can be brought into line, except for extreme positions of the source.

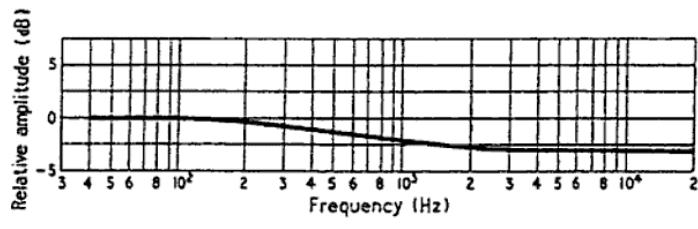
The circuit to introduce the 0.7 loss-factor in the ratio $(R - L)/(R + L)$ above 700Hz is the circuit Clark and his team called the *Shuffler*. To avoid confusion, we suggest that Clark's circuit be termed the *Stereosonic Shuffler*, reserving *Shuffler* for Blumlein's original circuit.

The result of not utilising this Stereosonic Shuffler, on a real music signal is a "smeared" stereo image in which the high and low frequencies are not "mapped" on top of one another. The image below is an attempt to give a visual analogy for this effect in which the acoustic effect is analogous to chromatic aberration in a lens, in which the high frequency blue light is refracted differently to the low-frequency red light.

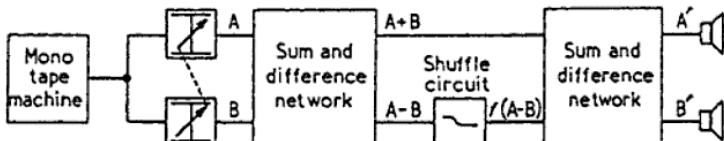


The solution to this was to incorporate sum and difference circuits into the stereo bus of the mixers (derived in a series of transformers) and introduce HF loss into the difference circuits so that, when matrixed back to left and right signals, the required correction had been made.

This method however has the disadvantage that the HF-loss filter-circuits require phase-correction to be applied and moreover require that the sum circuit be delayed. The result, together with the matrixing transformers, is a very expensive assembly, illustrated below.



(c)



This expense, as well as irresolvable problems of slight audio colouration due to inaccuracies in the phase-correction circuits (note the hand-written "almost" and "substantially" in the text above.), led this vital circuit to be ignored in later stereo equipment. Uncorrected stereo was reckoned to be "good enough".

It's important to point out what this actually means: that *all stereo recordings are "broken" and have been since Electronic and Musical Industries' management sanctioned throwing the last of their tube mixers on the dumpster.* (Yes, they really did that!).

The **SHUpHLER-IV** incorporates a modern (yet still completely passive) implementation of the *Stereosonic Shuffler* in which the uneven frequency-response and group-delay problems of the original implementation have been entirely resolved. This is the technique developed in the 1990s called **FRANCINSTIEN**. Audio demonstrations of the *Stereosonic Shuffler* are available [here](#).

Blumlein - binaural to loudspeaker conversion

The greater part of [Alan Blumlein's](#) (1933) patent is concerned with a binaural stereophonic microphone arrangement in which,

"two pressure microphones a1 and a2 [are] mounted [20 cm apart] on opposite sides of a block of wood or baffle b which serves to provide the high frequency intensity differences at the microphones in the same way as the human head operates upon the ears".

Blumlein noted that, when listened to with headphones, the direct output from the microphones produced an excellent stereo effect but, when replayed through loudspeakers, the stereo effect was very disappointing.

The transformation Blumlein required was the translation of low-frequency, inter-microphone phase differences into inter-channel intensity differences. To do this, he invented an ingenious circuit which he called the *Shuffler*. (His was the original use of the term.) A modern implementation of Blumlein's circuit is implemented within the **SHUpHLER-IV**. The full technique is explained [here](#).

The advantages to the recording engineer of this technique are legion. Omnis are usually considered to sound slightly more "open" and "uncoloured" than their cardioid brothers; even as mono microphones. This is due to the acoustical devices which cardioid mic's employ to deaden the sound in the rear lobe of the directional response. Most agree that the stereo recordings with the best stereo "image" are derived from crossed cardioids or cosine (figure-of-eight) microphones. But many engineers are prepared to sacrifice stereo image just to be able to use the more natural sounding omni's.

Using "Blumlein delta" (Blumlein δ) technique, this compromise is no longer necessary: omni's may be employed to capture pin-point sharp stereo images. The microphones should be placed about 22cm apart (not widely spaced as in conventional technique). Various baffles may be inserted between the microphones to good effect too, so this technique suits various binaural and quasi-binaural microphone arrangements like the Jecklin's OSS disc, Faulkner's "Phased-array", the various spherical microphone baffles and the in-ear microphones available on the market. (In fact Blumlein saw the δ technique as a binaural to loudspeaker-stereo conversion process: which is what it is!)

An example of the process is given [here](#) as a FLAC file. Once again, The first part of the musical extract is the signal direct from near-spaced omni microphones and the reprise is treated with the Blumlein δ process. Beware.. FLAC is great but the file sizes are appreciable! An alternative 192kbps mp3 file is [here](#).

The technique of near spaced microphones may even be extended to use near-spaced cardioids which enables very nice recordings to be made which suppress rear pick-up. In fact, even hyper-cardioids and gun microphones may be employed which permit good, full-width stereo recordings to be made of relatively distant events - something which no other technique can achieve. This has obvious applications to TV, film and live theatre and music.

WaRP

The stereo correction techniques collectively known as **FRANCINSTIEN** have been continuously developed since the 1990s when the first, passive matrix was produced and sold by Perfect Pitch Music.

The most radical improvement came with **FRANCINSTIEN T-Sym** which was launched in 2016 as part of Pspatial Audio's **Stereo Lab** software. **FRANCINSTIEN T-Sym** is radical because it incorporates findings derived from a theoretical analysis of a stereophonic sound reproduction system as a sub-optimal wavefront reconstruction system which post-dates the original research which informed the original Stereo Shuffling techniques by thirty years.¹

¹ Bennett, J.C. et al. A New Approach to the Assessment of Stereophonic Sound System Performance. J.Audio Eng. Soc., Vol.33, No.5, 1985 (May)

Bennett, Barker and Edeko's theoretical analysis of a two-loudspeaker stereo system as a flawed "audio hologram" permits us to build a complete theoretical model for the derivation of two-channel stereo correction signals so that we can correct for shortcomings in stereo with unparalleled accuracy.

But **T-Sym** was developed for Pspatial Audio's **Stereo Lab** software as a purely digital, file-based process and was implemented with non-causal digital filters. **FRANCINSTIEN WARP** (for WAvefront Reconstruction Processor) is an innovative, real-time implementation of the original, non-causal **FRANCINSTIEN T-Sym** algorithm.

The table below gives our recommendations for the various SHUpHLER matrices which may be applied in various recording situations.

Type of SHUFFLER

Mic' arrangement	Elliptical	▼	FRANCI	Blumlein δ	WaRP	OFF
Crossed cardioids	Good results	Ideal*: Crossed-fours™	Good results	Not suitable	Good results	No processing
Crossed cosines	Good results	Possible; widens image	Ideal*	Not suitable	Good results	No processing
Pan-pot	Good results	Possible; widens image	Good results	Not suitable	Ideal*	No processing
Near spaced omnis	Good results	Possible; narrow image	Worth a try!	Ideal*	Worth a try!	No processing
Near spaced cardioids	Good results	Possible; narrow image	Worth a try!	Ideal*	Worth a try!	No processing
Near spaced hypercardioids	Good results	Possible; narrow image	Worth a try!	Ideal*	Worth a try!	No processing
Binaural microphones	Good results	Possible; narrow image	Worth a try!	Ideal*	Worth a try!	No processing
Phased array cosines (Faulkner)	Good results	Possible; narrow image	Good results	Ideal*	Good results	No processing
Wide spaced omnis	Good results	Not suitable	Good results	Not suitable	Good results	No processing
NOS	Good results	Worth a try!	Good results	Good results possible	Good results	No processing
ORTF	Good results	Worth a try!	Good results	Good results possible	Good results	No processing
Decca Tree	Good results	Not suitable	Good results	Not suitable	Good results	No processing

*The term "Ideal" refers only to a theoretical ideal: artistic judgments may differ.

Appendix 1 - Specifications

SHUpHLER-IV Stereo Matrix

Size: 112 × 50 × 225 mm (W-H-L)

Power Supply: 5V DC. USB V-bus on USB C-Type connector

Power: Compatible with European Eco-Consumption Directive 2009/125/EC.

Inputs: Balanced or unbalanced on 3-pole, 1/4" jack. Tip is "hot". (Unbalanced: tip = signal, ring and body = earth)

Gain: 0dB non-inverting, in balanced and unbalanced operation

Frequency response: 30Hz to 20kHz (±1dB) in bypass mode

Distortion: Better than 0.1% THD on 1kHz at 0dBu input

Equivalent input noise: -100dBu (A weighted in 20kHz): measured with linear PSU

Max input: +18dBu balanced†; +5dBV unbalanced*

Max output: +18dBu balanced†; +5dBV unbalanced*

Headroom indicator: Operation LED (normally blue): extinguishes at -2dB from headroom limit: lights red at level -1dBFS from headroom limit

† Operation according to EBU R64-1992: PPM4 = 0dBu = -18dB from headroom limit

* Operation according to EIA RS-490 (Electronic Industries Association consumer audio standard)/IEC 60268-3 (Sound System Equipment – Part 3: Amplifiers): Reference level: (0VU) –10 dBV = 0.316 V RMS

Phædrus Audio reserves the right to alter specifications without notice.

Appendix 2 - Warranty and service

Service

If you experience a problem with a Phædrus Audio product, contact 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



Appendix 3 - Declaration of Conformity

The Manufacturer of the Products covered by this Declaration is

Phædrus Audio
Newtown House
38 Newtown Road
Liphook
Hampshire
GU30 7DX

The directives covered by this declaration are:

2014/30/EU Electromagnetic Compatibility directive
2014/35/EU Low Voltage Equipment directive
UK Statutory Instrument 2012 No. 3032 The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

The products covered by this declaration are:

SHUpHLER-IV stereo matrix

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: 2005. - 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 2020.

Signed:



Richard Brice, Technical Director Date: December 2025