

ifi

iCAN

PHANTOM 1.5

User Manual

Thank you for purchasing this PHANTOM series iCAN. The iCAN PHANTOM 1.5 is:

- (I) a professional analogue headphone amplifier
- (II) a fully-fledged, high-end stereo preamplifier
- (III) an audiophile-grade energiser for electrostatic headphones

WARNING: The iCAN PHANTOM 1.5 is VERY POWERFUL and can offer large amounts of sub-bass boost. As a starting point, always use the lowest gain possible and start with the volume set low and **XSpacs** and **XBass** set to OFF. iFi audio is not responsible for any ancillary equipment damage caused by the iCAN PHANTOM 1.5.

The **iCAN PHANTOM 1.5** is the ultimate headphone amplifier and preamplifier, conceived to extract the finest performance from any headphone ever created - from the most sensitive in-ears to the most demanding planar and electrostatic designs.

Version 1.5 refines this platform: controls now move with a smoother, more damped action; anti-fingerprint treatments keep the smoked glass looking pristine; optimised grounding, shielding, and component choices further quieten the signal path and improve operational stability. Updated control software delivers more consistent display behaviour and assured remote responsiveness.

Same uncompromising PHANTOM performance - now with uncompromising execution.

FEATURES

- The ultimate analogue headphone amp from world-leading head-fi manufacturer iFi Audio
 - Also performs as a high-end stereo preamplifier to connect to a power amp and speakers
 - Pure Wave PRO fully differential balanced circuit design delivers ultra-low distortion
 - Two discrete input stages, switch between solid state and GE 5670 vacuum tubes in real time
 - Remarkable power - up to 15,000mW to drive the toughest headphone loads with ease
 - Delivers up to 14V in Single-Ended mode and 27V in Balanced mode
 - Adjustable gain and load impedance plus iEMatch output attenuation to suit all headphone/IEM types
 - Pro iESL energiser technology with six voltage settings for electrostatic headphones
 - Capacitive battery power supply eliminates mains-borne noise from the audio signal
 - Multi-level XSpace and XBass analogue processing modes for headphones and speakers
 - Exemplary build quality, comprehensive connectivity and informative colour TFT display
-

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Quick Set-Up

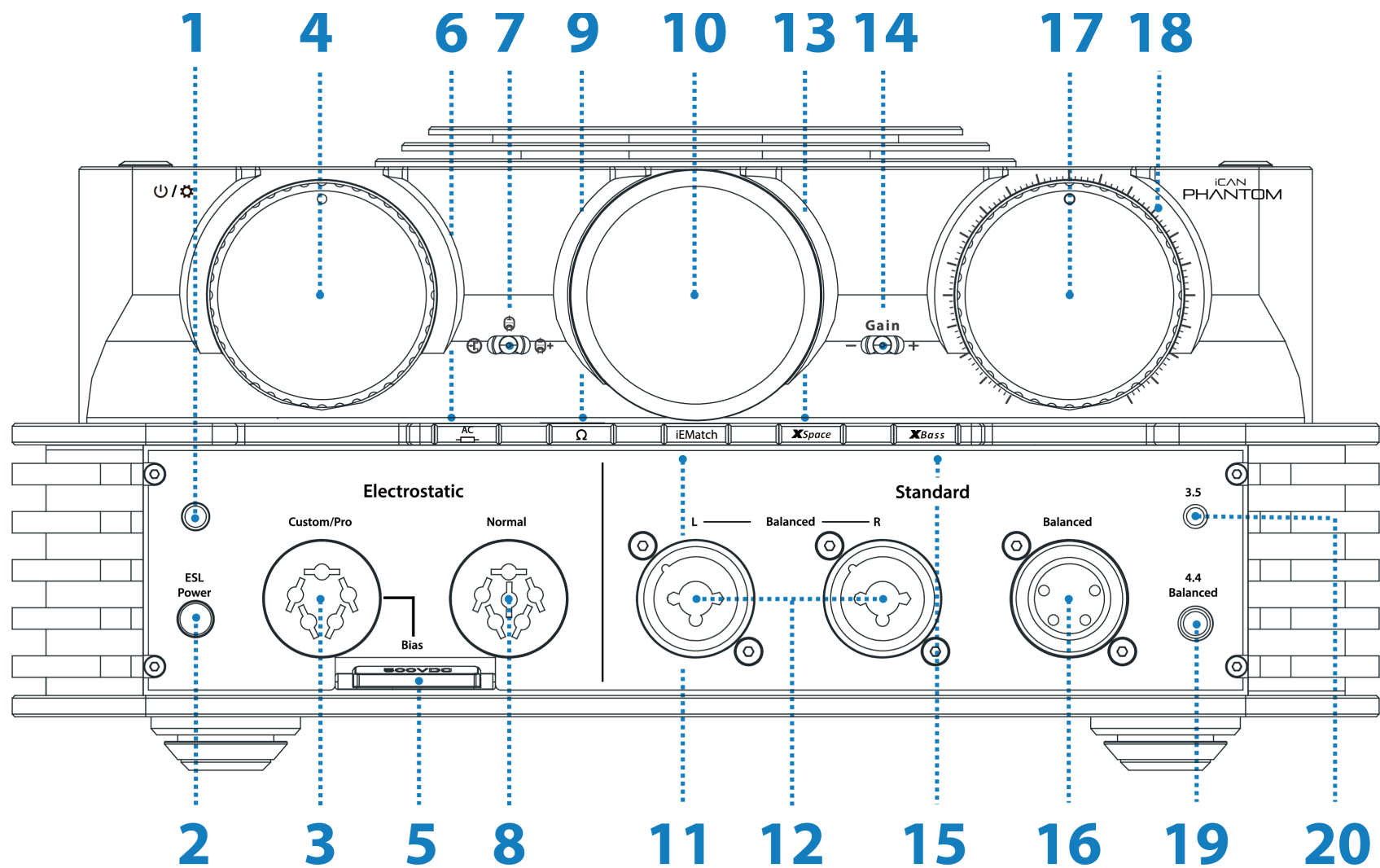
Set up your iCAN PHANTOM 1.5 using the iCAN PHANTOM 1.5 User Manual

Cautions

Prolonged Heat Exposure

Design Notes from the AMR/iFi Resonance

SPECIFICATIONS



1. Electrostatic Power LED

Lights up when the Electrostatic headphone power switch is turned on.

2. Electrostatic Headphone ON/OFF

Turns on/off the electrostatic headphone power, off by default.

Tip: If the "ESL Default" is not set to "ON", you will need to turn it on manually to use an electrostatic headphone.

3. Pro/Custom Bias Electrostatic Headphone Output

5-pin socket for Pro Bias headphones, 500V, 540V, 580V, 600V, 620V, 640V adjustable Bias Voltage.

4. Power/Mute/Input/Menu

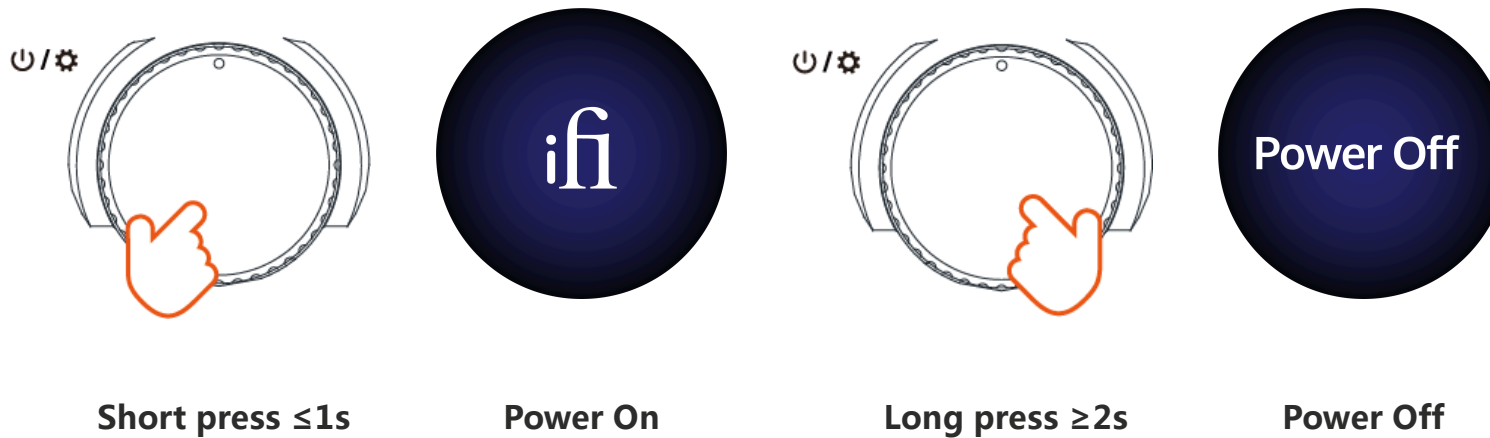
Controls:

- Power ON/OFF

- Mute/Unmute
- Settings Menu

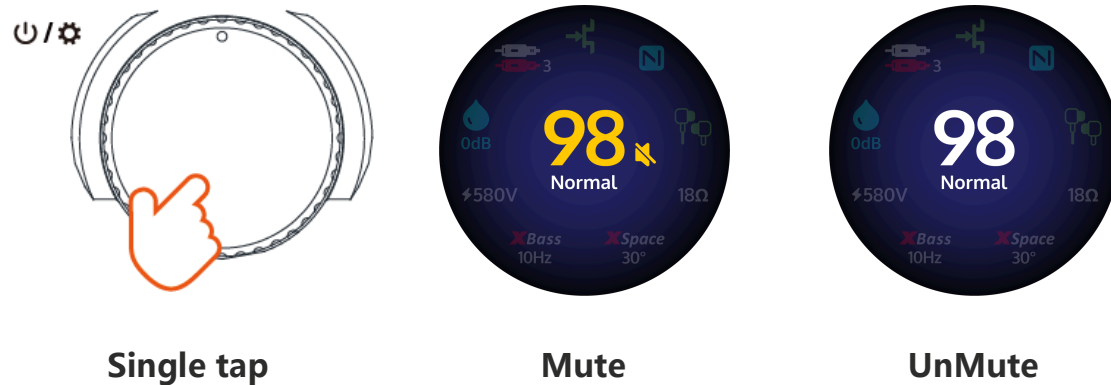
Power ON/OFF

Short press the dial for 1s to switch on, long press the dial for 2s to switch off.



Mute

Short press the dial to mute/unmute. A mute icon will appear next to the volume level to indicate that the mute function is active:

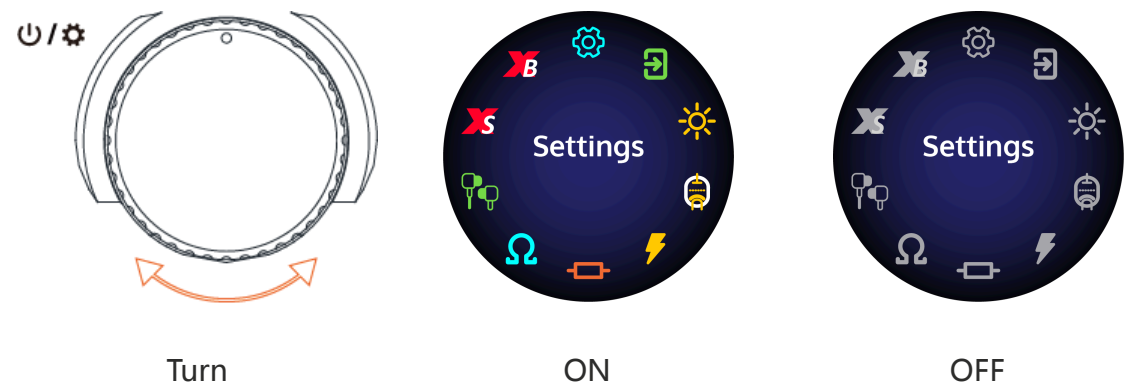


Tip: Mute mode cannot be cancelled by turning the volume control dial - after a short press to mute, mute mode can only be cancelled by short pressing the volume control dial again.

Settings Menu

Turn the dial to enter the settings menu. Turn the dial again to cycle through the options, then short press to confirm a selected option.

Once any settings adjustments are completed, if there is no input from the dial for 6 seconds the device will automatically exit the settings menu and return to the home screen.



Control Options:

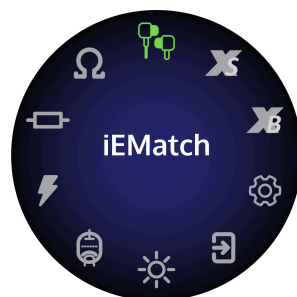




AC Termination



Impedance



iEMatch



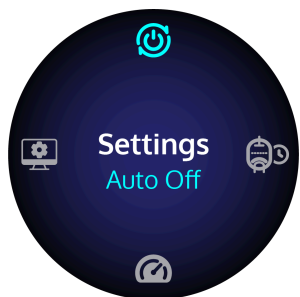
XBass Pro



XBass Pro

I) Settings

Control Options:



Auto Off



Vacuum Tube Info



VU Meter



System

(i) Auto Off

The default setting is **Off**.

Turn the dial to select between the four available automatic shutdown options.

The unit automatically shuts down when there is no input signal for the specified amount of time - this may include disconnecting the source device, and pausing or stopping audio.



Timer Disabled



Timer 30 mins



Timer 1 hour



Timer 3 hours

(ii) Vacuum Tube Info

View the cumulative Tube Mode usage time of the device. Select "Reset to Zero" to reset the time.

You can also carry out this procedure when fitting a new pair of vacuum tubes.



Reset to Zero



Back

(iii) VU Meter

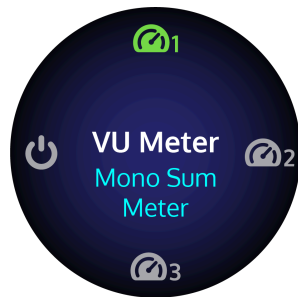
The default setting is **Disabled**.

This setting is used to adjust the VU meter mode displayed on the iCAN PHANTOM 1.5 home screen.

Turn the dial to select between the three available VU Meter modes.



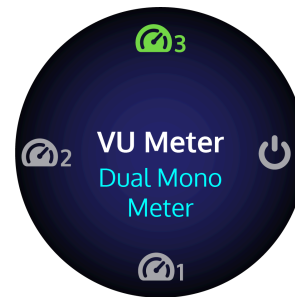
Disabled



Mono Sum Meter



Stereo Meter



Dual Mono Meter

(iv) System

System Status

View the current system version of the iCAN PHANTOM 1.5, as well as the XMOS and IoT versions (the image below is for reference only; please refer to the actual versions).



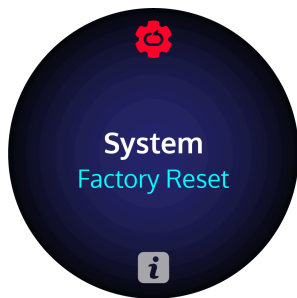
System



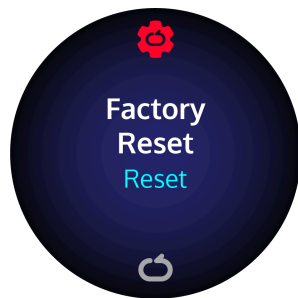
System Status

Factory Reset

Select "Reset" to perform a factory reset. The "Factory Reset..." indicator will appear on the screen and the device will reboot once the reset has successfully completed.



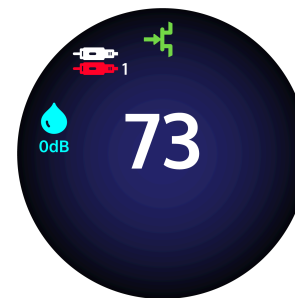
Factory Reset



Reset



Back



Reset complete

Warning: Factory reset will clear all current settings and restore the menu settings to their default state; circuit mode is solid-state by default; volume is 73 by default; input is set to RCA 1 (IN 1 on display) by default; ESL Power is Off by default; impedance is 96Ω by default; gain is 0dB by default; screen brightness is Bright by default.

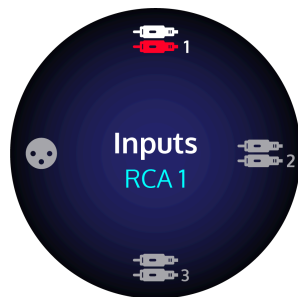
II) Inputs Selector

The default setting is **RCA1**.

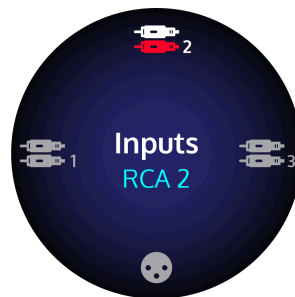
Turn the dial to select between the four available input modes.



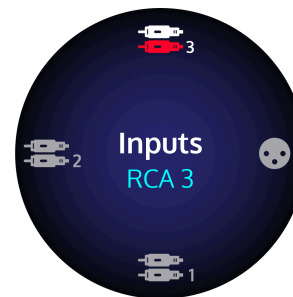
Inputs



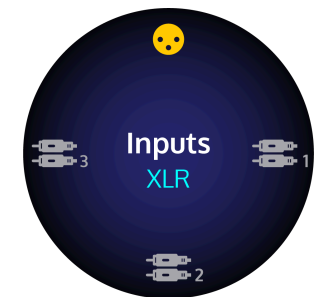
RCA 1



RCA 2



RCA 3



Balanced XLR 3-Pin

III) Brightness

The default setting is **Bright**.

Turn the dial to select between the three available TFT display brightness settings.



Brightness



Auto



Bright



Soft

IV) Operation Modes

The default setting is **Solid State**.

Turn the dial to select between the three available operation modes.

For more information about operation modes, see (7).



Operation Modes



Solid State



Tube



Tube+

V) Gain

The default setting is **0dB**.

Turn the dial to select between the three available Gain modes.

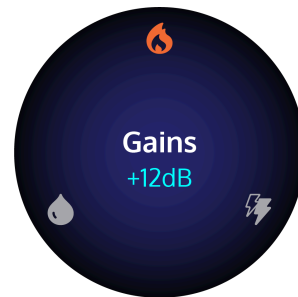
For more information about gain modes, see (14).



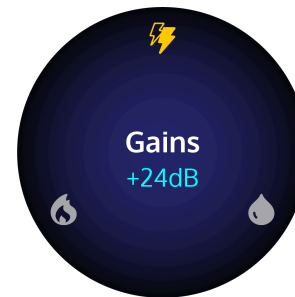
Gains



0dB



+12dB



+24dB

***Note:** Always start from 0dB and then increase the gain level gradually, to attain an enjoyable and comfortable level of volume from your headphones or speakers.*

***Warning:** Using excessive gain can result in damage to connected headphones, and/or permanent hearing damage. AMR/iFi audio is not responsible for any damage/injury resulting from misuse of this device.*

VI) AC Termination

To adjust the electrostatic headphone output mode, you must first switch on the "Electrostatic Headphone Power "(item 2).

Once the "Electrostatic Headphone Power Supply" (item 2) is switched on, the default setting is Off.



AC Termination



Disabled

To activate, switch on the electrostatic headphone power (item 2).

Once switched on, turn the knob to switch the electrostatic headphones on or off.



On



Off

Depending on the SD card you have selected, the following information will be displayed when it is inserted (using 600V as an example):



Display when the SD card is inserted and the ESL power is on



Display when the SD card is inserted and the ESL power is off



Eject the SD card

VII) Impedance

The default setting is **96Ω**.

When enabled, Turn the dial to select between the four available Impedance modes.

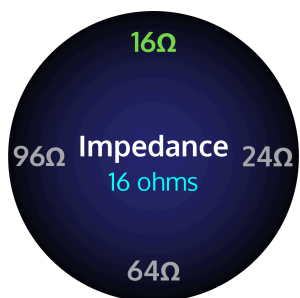
For more information about Impedance modes, see (9).



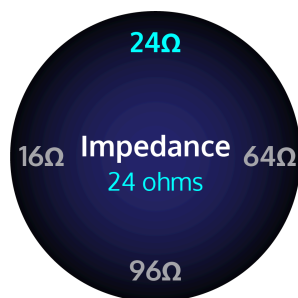
Impedance



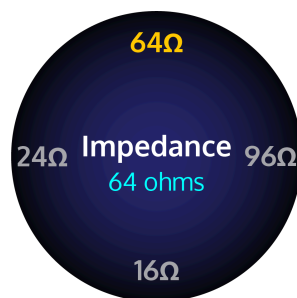
OFF



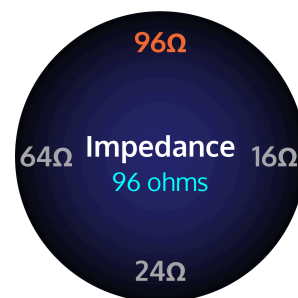
16 ohms



24 ohms



64 ohms



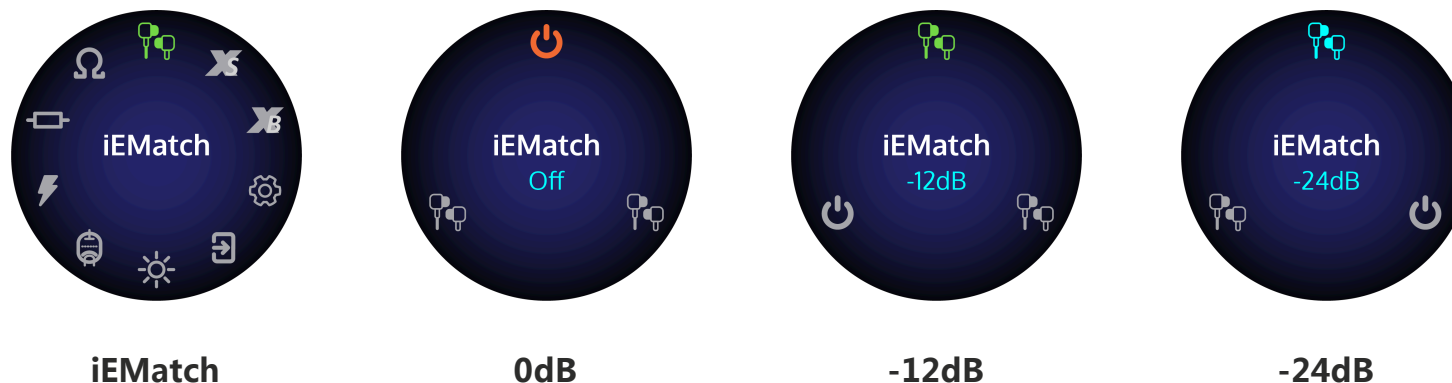
96 ohms

VIII) iEMatch

The default setting is "Disabled".

When enabled, Turn the dial to select between the three available iEMatch modes.

For further information on iEMatch mode, please refer to (11).



IX) XSpace Pro Mode

The default setting is **Disabled**.

When enabled, Turn the dial to select between the four available XSpace Pro modes.

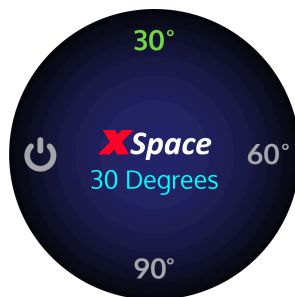
For more information about XSpace Pro, see (13).



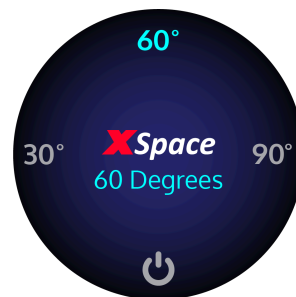
XSpace



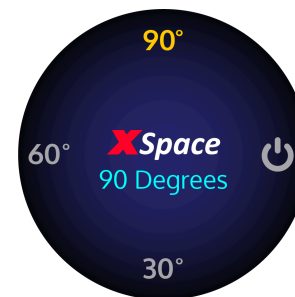
Disabled



30°



60°



90 °

X) XBass Pro Mode

The default setting is **Disabled**.

Turn the dial to select between the four available XBass Pro modes.

For more information about XBass Pro, see (15).



XBass



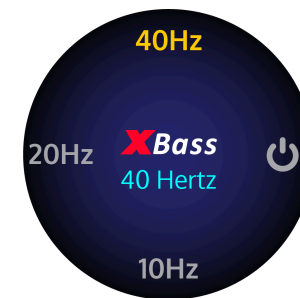
Disabled



10Hz



20Hz

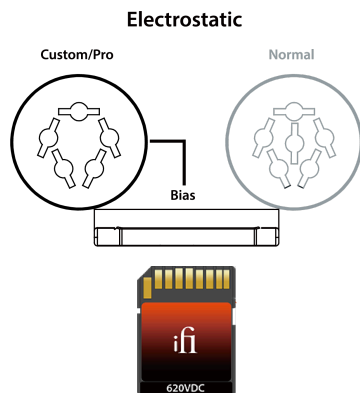


40Hz

5. Bias Memory Card Slot

Before using the Pro/Custom bias electrostatic headphone output port, select the bias voltage memory card according to the table below or according to the recommendations given by the electrostatic headphone manufacturer and the specifications of your electrostatic headphone.

Bias voltage usage:



500VDC Sennheiser Orpheus HE-90, Monoprice Monolith Electrostatic

540VDC Sennheiser HE-60, King Sound KS-H2/3/4

580VDC Stax Pro Bias ESHP, Audeze CRBN, Nectar HiveX, Muamp, VOCE

600VDC Koss ESP/950 & DROP Koss ESP/95X, Jade

620VDC HIFIMAN Shangri-La/La jr/Jade 2

640VDC Sennheiser HE 1, HIFIMAN Shangri-La/La jr/Jade 2, Phenomenon Librarium/Canorum

Tip: In the bias memory card holder/front cover (item 24), there are six bias voltage setting memory cards from 500VDC to 640VDC.

Tip: If you have questions or would like more detailed information on the bias settings for using electrostatic headphones, see the 'Notes on Electrostatic Headphones section' at the end of the manual.

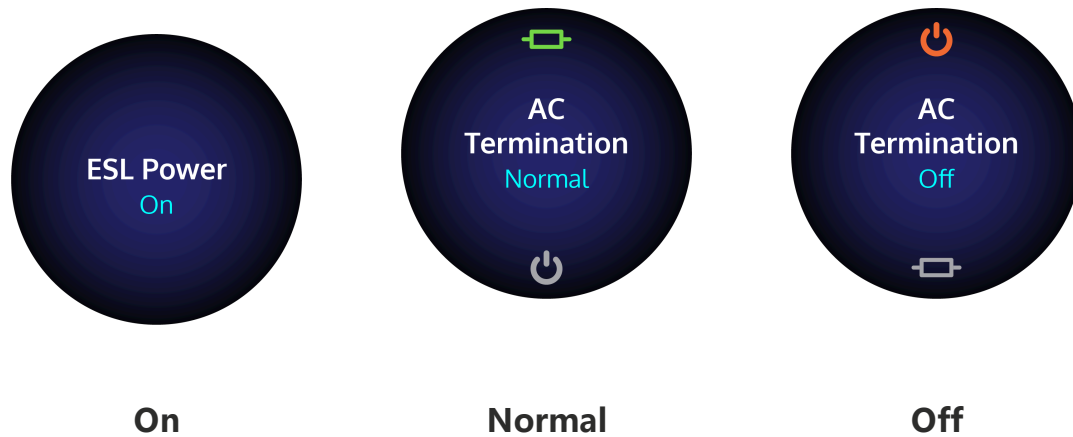
6. AC Termination Adjustment and Back

AC Termination

Adjust the electrostatic headphone output mode, which can be adjusted with Electrostatic headphone power (item 2) turned on.

Press briefly whilst on the main screen to enter the AC Termination Adjustment screen.

Display when the electrostatic headphones power are switched on but no SD card is inserted:



Display when the electrostatic headphones power are switched on and an SD card is inserted:



Normal



Pro/custom



**Both (Normal &
Pro/custom)**



Off

Tip: AC termination settings affect the operation of the headphone by either making the bias node that is shared between both channels high impedance, or low impedance for audio signals. This affects a complex set of parameters, but audibly mainly affects the presentation of the XSpace Holographic Matrix System. AC Termination ON means the bias node has low impedance. OFF is high impedance.

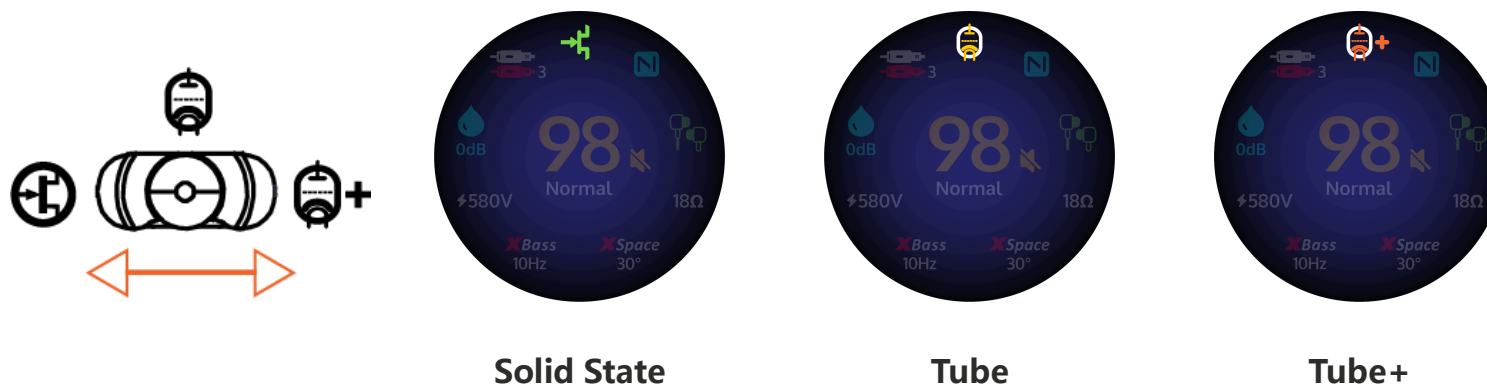
Tip: When a bias memory card is not inserted into the memory card slot (item5), the Pro/Custom bias ESL headphone output socket cannot be used, and PRO/Both modes cannot be adjusted.

Back

Press briefly whilst on any other screen to return to the previous screen or the main screen

7. Operation Mode Selector

The iCAN PHANTOM 1.5 has 3 operation modes:



Solid-State is a pure, solid-state circuit and uses JFETs and is fully-discrete Class A.

Tube 2 x NOS GE5670s* are engaged with the JFET circuitry switched out for valve Class A operation.

Tube+ reduces negative feedback to a minimum. As a result, a greater amount of the tubes' natural harmonics are produced, where even order harmonics dominate.

Note: Upon switching between modes, there will be a brief pause as the circuit switches. To maximise tube life, the iCAN PHANTOM 1.5 has a built-in intelligent monitor; after an extended period of operation (~10 min) in Solid-State mode, the tubes will switch off. If the tube circuit is shut-off, upon switching back to Tube/Tube+ mode,

the tubes will need to warm up again (~30 s) as if the unit was powered up from OFF. Music will continue to play via the Solid-State section until the tubes are ready.

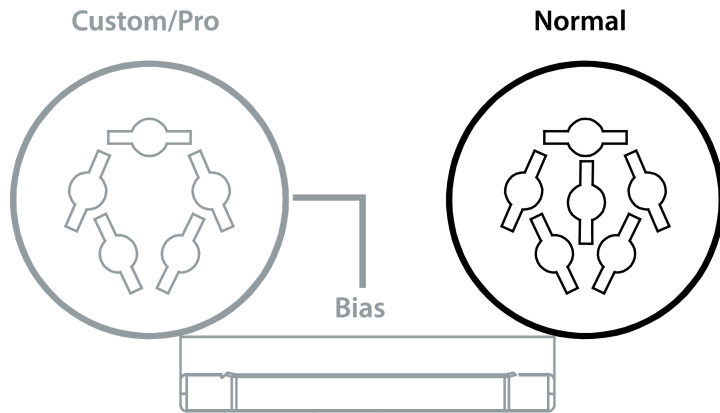
Tip: The iCAN PHANTOM 1.5's predecessor, the Pro iCAN, was the world's first headphone/preamp with real-time switching between transistor and tube. For the first time, one could enjoy both the sound of Solid-State and Tubes in a single package (rather than as an 'effect type' add-on within an otherwise conventional Solid-State design) and be able to switch in real time. For some recordings and headphones/loudspeakers, Solid-State may sound more lively. For others, Tube and Tube+ (especially Tube+) will sound more luxurious.

Tip: New Old Stock General Electric 5670 x 2. Each GE5670 tube has undergone a special rejuvenation process and the tube circuit is specially-designed for long life. This means the tubes should offer many years of enjoyment. Note that a 5670 to 6922/6DJ8 adapter is required in order to use these tubes (included).

8. Normal Bias Electrostatic Headphone Output

6-pin socket for normal bias headphones (eg. previous generation Stax units). 230V Bias Voltage.

Electrostatic



Tip: If a bias memory card is not inserted into the bias memory card slot (item 5), the PRO and Both modes cannot be adjusted.

9. Impedance Adjustment

The impedance response can be adjusted from 16Ω to 96Ω. It is 96Ω by default. This impedance describes the load impedance for the driving amp with a "standard" electrostatic headphone connected.

Lower impedance settings create a greater step-up and will produce a louder sound level at the same headphone amplifier volume setting.

Lower impedance settings are a more difficult load for the driving amplifier.



16Ω



24Ω



64Ω

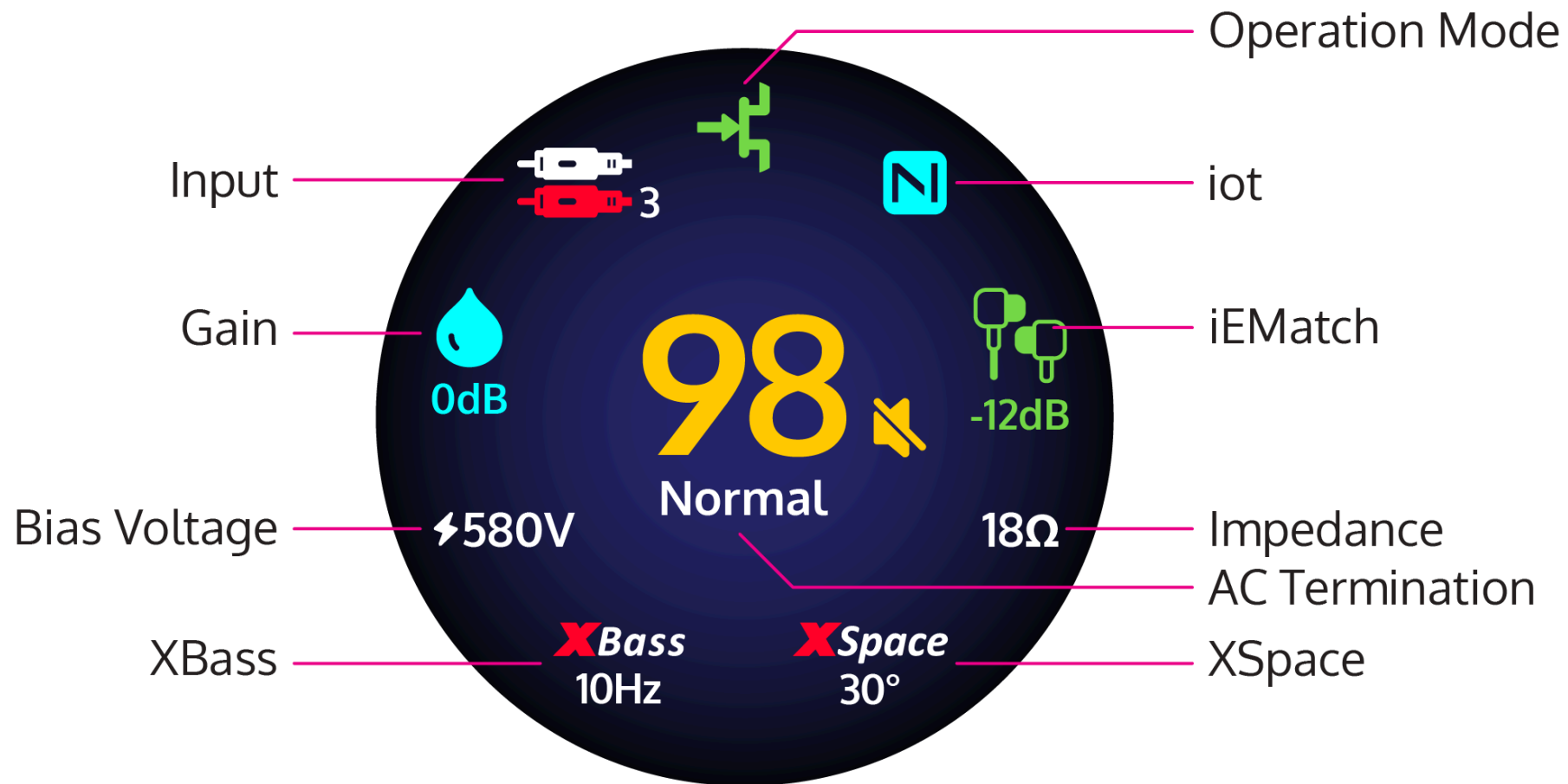


96Ω

Tip: Please adjust to suit listening preferences, however, in most cases the higher impedance setting is recommended.

10. TFT Display

The TFT Display shows the Input, Operation Mode, IOT, Bias Voltage, iEMatch, AC Termination, Volume, Impedance, XBass, XSpace and Gain Settings.



11. iEMatch Adjustment

The iEMatch adjustment button, off by default.



Off



12dB



-24dB

This feature reduces the output level, so that even the most sensitive In-Ear-Monitors (IEMs) can be matched to the iCAN PHANTOM 1.5.

iEMatch can increase the dynamic range of sensitive IEMs by reducing background amplifier hiss.

Tip: S-Balanced headphone output reduces the level by 6/12dB and balanced headphone output lowers it by 12/24dB.

12. Balanced XLR L/R , Stereo Single-Ended 6.3mm $\pm$ Phase Output

Balanced

XLR – 3 Pin x 2

6.3mm TRS x 2 (iFi SEC balanced system)

Note: The iFi SEC (Single-Ended Compatible) balanced connection uses one 6.3mm jack for L+/R+ (left jack) and the other for L-/R- (right jack) with both sleeves being Ground (GND). This makes it directly compatible with standard non-balanced headphones. With the correct headphone cable it allows a balanced connection using two 6.3mm plugs.

Single-Ended

6.3mm TRS x 2

Please use the left jack for single-ended headphones (positive phase). You can, however, drive two separate headphones simultaneously if desired by using the right jack (negative phase) for the additional headphone.

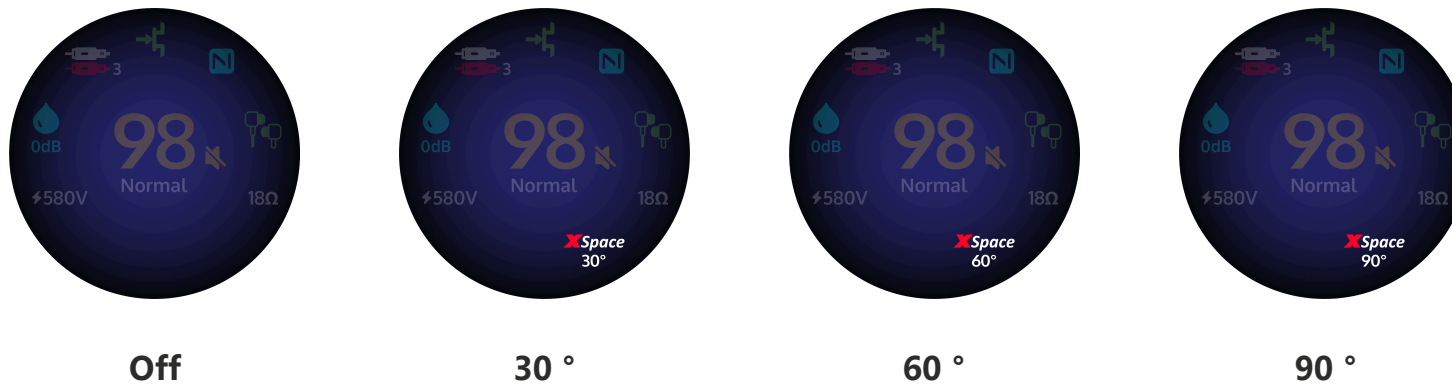
13. XSpace Adjustment

There are two separate Analogue Signal Processing (ASP) matrix circuits that switch automatically between headphone and loudspeaker use.

It's true that traditional cross-feed tends to produce an 'out of head' sound, but with greatly diminished spatial components and a narrower soundstage, sometimes almost approaching mono. Most DSP-based 3D designs produce an unnatural, echo-

like sound, which may initially be impressive, but soon becomes tiring.

By contrast, **XSpace** Holographic for Headphones, provides not only 'out of head' placement of the sound sources, but renders the whole sound field in a manner that strongly parallels listening to loudspeakers in a normal room, all achieved without the added reverb.



Tip: XSpace Holographic for Headphones is not based on a standard cross-feed system, as found in some high-end headphone amplifiers. Many so called '3D systems' are usually DSP based. This artificially effects the sound and adds unwanted reverb in order to simulate a spacious type of sound.

For Headphones: (Headphone Outputs)

XSpace OFF XSpace Holographic is disabled This allows the 'direct' sound to be enjoyed.

**XSpace 30°
Loudspeaker
Angle:**

This matrix simulates a narrow loudspeaker placement (e.g. loudspeakers either side of a large computer monitor) and can also be used for recordings that have been artificially enhanced for spaciousness or early 'Ping-Pong' type stereo recordings.

**XSpace 60°
Loudspeaker
Angle:**

This matrix simulates traditional 'textbook' loudspeaker placement in an equilateral triangle.

**XSpace 90°
Loudspeaker
Angle:**

This matrix simulates a wide loudspeaker placement favoured by some audiophiles. It may also be used to enhance recordings that lack spaciousness (some minimalist 'single point' recordings fall into this group).

*Note: When using the headphone outputs, the **XSpace** Holographic matrix for headphones is engaged. When using the line outputs (RCA/XLR), the **XSpace** Holographic matrix for loudspeakers is engaged.*

For Loudspeakers: (Line Outputs)

The **XSpace** Holographic for Loudspeakers is an analogue matrix circuit that has two distinct functions. It

1. Corrects the fundamental spatial distortion in stereo recording
2. Increases the width of the apparent soundstage beyond the width dictated by the loudspeaker placement

XSpace OFF **XSpace** Holographic is disabled (this allows the 'direct' sound to be judged).

XSpace 30°: This matrix corrects the spatial distortion caused by the recording/mixing/mastering process and restores the original width of the soundstage. This is the recommended default setting if the loudspeakers are already ideally placed for imaging.

XSpace 60°: This matrix corrects the spatial distortion caused by the recording/mixing/mastering process and adds an approximate **30°** to the apparent width of the soundstage. Thus, loudspeakers with narrow placement (e.g. loudspeakers closely located either side of a TV set) can offer a soundstage that extends beyond the left and right past the loudspeakers and is close to the ideal placement.

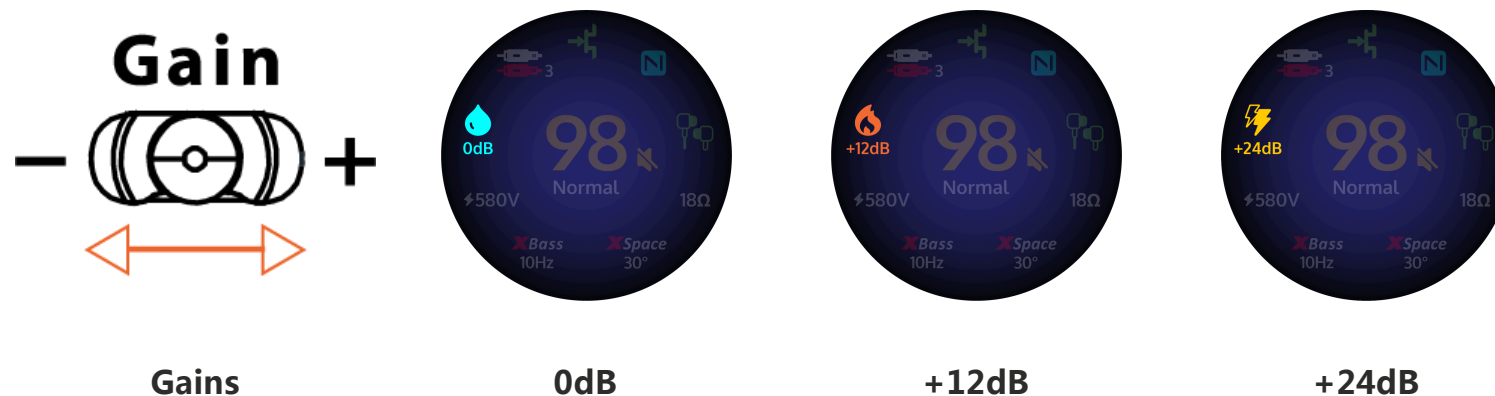
*The **XSpace** Holographic circuit for loudspeakers corrects a distortion of the **XSpace** sound field caused by recording via microphones and playback via loudspeakers. This sound field distortion was first described by Alan Dower Blumlein (the inventor of Stereophonic sound) and corrected by EMI in early 'Stereosonic' recordings.*

*However, the original Stereosonic circuit tended to result in a narrower soundstage than if recorded straight and often overcompensated distortion of the soundstage perspective. iFi's **XSpace** Holographic systems avoid this and instead, allow an expansion of the width of the sound stage.*

Tip: These modes can also be used to enhance the imaging of recordings that offer poor spatiality.

14. Gain Selection

The toggle switch allows you to select between three available gain modes:



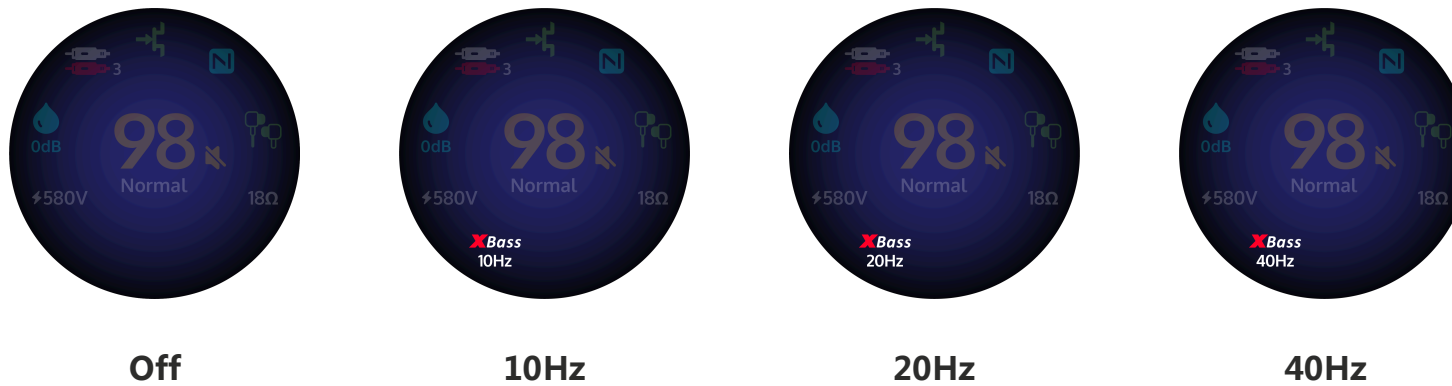
Tip: Use the lowest gain possible for the best sound. At normal listening levels, the volume control should be around 12 o'clock. Increase the gain if the 12 o'clock position does not provide satisfying listening levels.

Note: Please be aware that the iCAN PHANTOM 1.5 can output >14V in Single-Ended mode and over 27V in Balanced mode. These levels are very high and can damage many headphones and/or drive most amplifiers (if used as a line-stage) into very hard clipping. Damage to headphones and/or loudspeakers may result from excessively high volume settings.

15. XBass Adjustment

Different recordings and different headphones exhibit different frequency responses. **XBass** is an analogue signal processing (ASP) circuitry. It is sonically superior to Digital Signal Processing (DSP) systems. **XBass** is tailored to correct the bass deficiency

in the headphone/loudspeaker and achieve the desired level. It is NOT a traditional tone or loudness control. The maximum boost is 12dB and the frequency at which this maximum boost is achieved is as follows:



- **XBass OFF** is disabled (this allows the 'direct' sound to be enjoyed).
- **XBass 10Hz** for headphones/loudspeakers missing only the very lowest bass (below 40Hz).
- **XBass 20Hz** for headphones/loudspeakers missing some bass (below 80Hz).
- **XBass 40Hz** for headphones/loudspeakers missing substantial bass including some mid-bass (below 160Hz).

*Note: Please be careful with the **XBass** settings especially at high gain and high volume control settings, as even the most power-hungry headphones may be damaged by the power of the iCAN PHANTOM 1.5.*

*Tip: The **XBass** circuit is designed to correct different levels of bass deficiency inherent in many headphones/loudspeakers. It is NOT a gimmick to add artificial bass to recordings. Great care has been taken in the design to ensure there is no degradation of sound quality.*

16. Stereo Balanced XLR Headphone Output

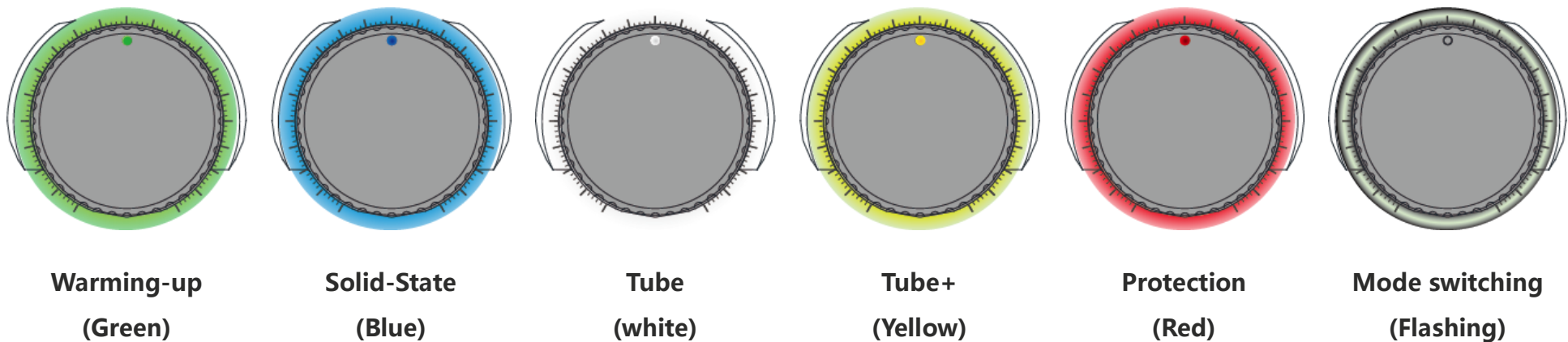
Connect XLR – 4 Pin Balanced headphones.

17. Analogue Volume Control Dial

Turn the dial to control the volume. The analogue volume control in the iCAN PHANTOM 1.5 is audibly superior to any digital volume control.

Tip: For normal listening levels, the volume control should be between 10 and 2 o'clock. Adjust the gain upwards if the volume is unsatisfactory. If one cannot turn up the volume to even 10 o'clock (at the lowest gain setting), please connect the headphone to the iEMatch Balanced 4.4mm or Single-Ended 3.5mm or connections, which are matched to high-sensitivity headphones such as in-ear-monitors and other high-sensitivity modern headphones designed to operate from portable devices.

18. Operating Status LED



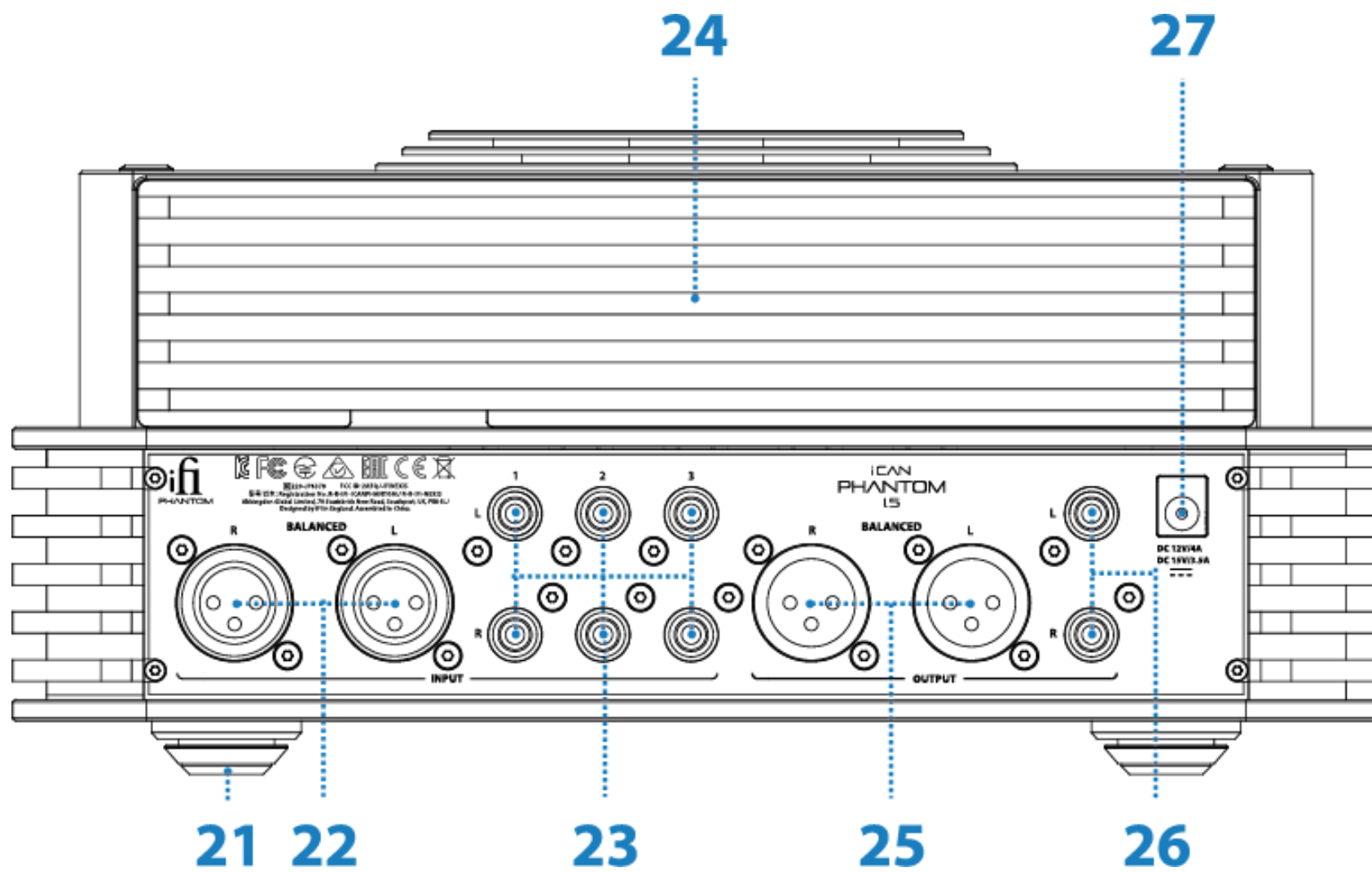
19. Balanced 4.4mm Headphone Output

Connect balanced 4.4mm headphones.

Tip: If possible, use balanced headphones to take full advantage of the true balanced nature of the iCAN PHANTOM 1.5 circuitry.

20. Single-Ended 3.5mm Headphone Output

Connect 3.5 mm stereo headphones (compatible with single-ended TRS and balanced TRRS configurations). This output supports both single-ended TRS and balanced TRRS configurations.



21. Dual Damped Anti-Vibration Foot Post

Base support, please set the iCAN PHANTOM 1.5 on a flat surface

Tip: The double layer damped anti-vibration footbed is specifically designed to provide the ultimate in vibration control. It consists of a double sandwich of a customised elastomer (silicone layer and a copolymer layer of ethylene and vinyl acetate) and a metal alloy (AL-Mg-Si aluminium alloy with hollow internal structure), allowing for minimisation of resonance in the iCAN PHANTOM 1.5 chassis.

22. Balanced XLR 3-Pin Signal Line Input

Balanced XLR line input.

23. Single-Ended RCA 1-3 Signal Input

Connect single-ended (SE) input.

24. Bias Setting Memory Card Storage Back Cover

Magnetically attached cover containing 6 memory cards for voltage bias settings from 500VDC to 640VDC.

This attachment can also be used to cover the front output panel when not in use or when the iCAN PHANTOM 1.5 is used as a preamplifier.

Tip: For information regarding the 6 memory cards please refer to item 5.

25. Balanced XLR 3-Pin Line Output

Balanced XLR line output. This output may be connected to an active speaker or balanced amplifier.

Please ensure the connected device does not connect pin 3 (negative phase signal) to ground.

26. Single-Ended RCA Line Output

Single-ended analogue signal output to an amplifier.

27. DC Power Supply Input

DC 12V/4A - 15V/3.5A* power input. Please connect the iCAN PHANTOM 1.5 with the enclosed power supply.

Tip: Any 9v to 18v DC power source with a typical 25W (maximum 75W) rating can be used with the iCAN PHANTOM 1.5 (including vehicular, RV and boat based 12V DC power). The iCAN PHANTOM 1.5 uses double-conversion power supplies that make it impervious to power supply noise and related problems. However, we strongly recommend the use of the included iPower Elite. It offers the latest in power supply technology and is better and cleaner than battery and aftermarket linear power supplies.

28. Nexis App Connection Status

The colour of the logo indicates the current Nexis (IoT) network connection status of the iCAN PHANTOM 1.5.



No connection



Internet
Super Remote
function available



**Local network (no
Internet)**
Super Remote
function unavailable

Quick Set-Up

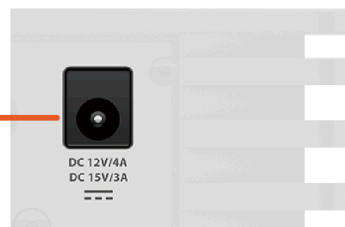
Quick Set-Up





1 Power

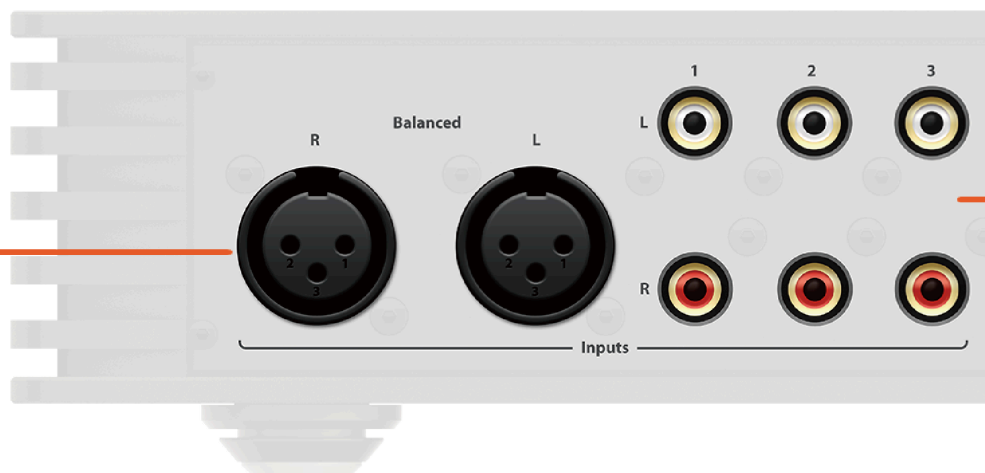
DC 12V/4A-15V/3A



Press and wait for warm up (item 4)

2 Input

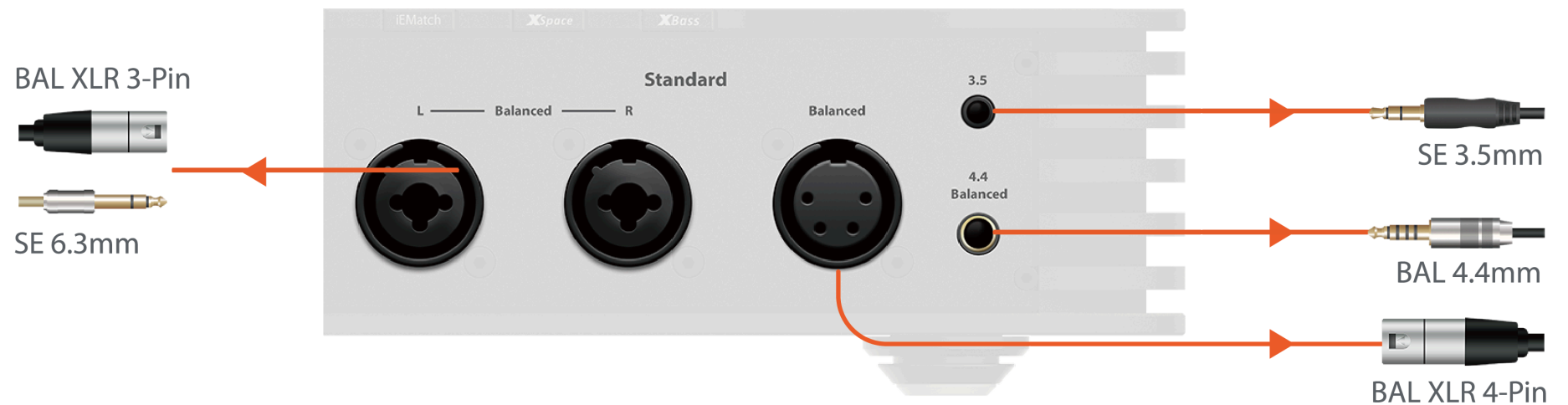
BAL XLR 3-Pin



3 Analogue output

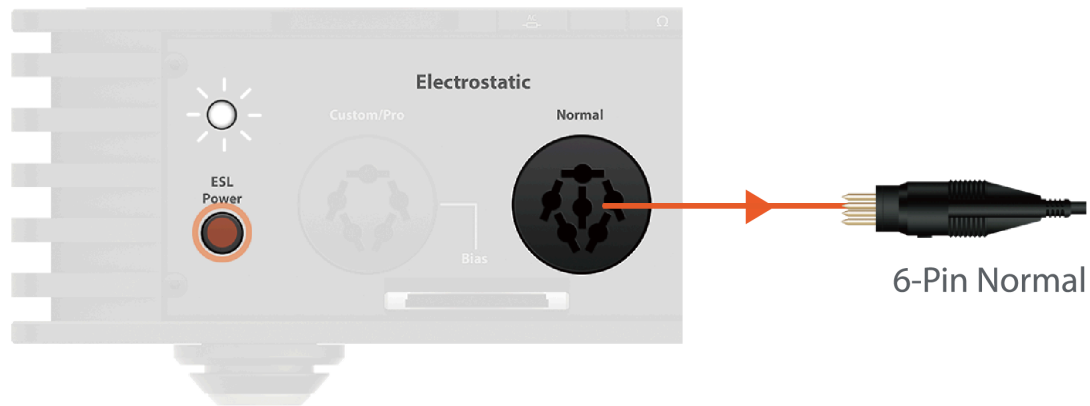


4 Headphones output - Standard

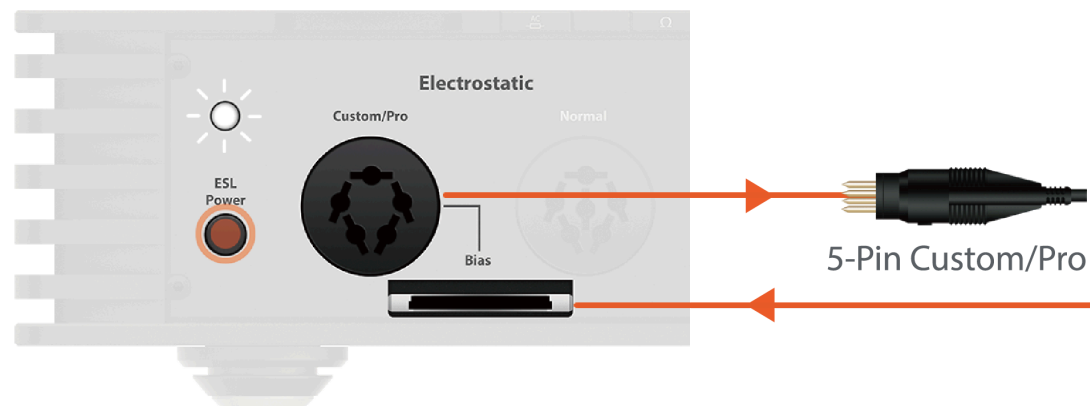


5 Headphones output - Electrostatic 🎧

Normal



Custom/Pro



Set up your iCAN PHANTOM 1.5 using our iFi Nexis App



"iFi Nexis"



Download the Nexis app for added features and future updates

Please search for "iCAN PHANTOM 1.5" within the iFi Nexis app.

The iFi Nexis app helps you to use all the features and settings of the iCAN PHANTOM 1.5, such as OTA upgrades*, remote control** and more.

**OTA (Over the Air Technology), or Over the Air download technology, automatically downloads firmware upgrade packages and upgrades automatically over the network.*

***Provides users with a convenient and easy-to-use way to control their device, as an alternative to the traditional remote control and adjusting all the functions and settings of the iCAN PHANTOM 1.5 more easily, conveniently and freely.*

Cautions

1. Avoid extreme heat, cold and humidity.
2. Avoid dropping or crushing the iCAN PHANTOM 1.5.
3. If you experience discomfort or pain, try lowering the volume or discontinuing use temporarily.
4. Always check the actual output volume on your earphone, headphone, or loudspeakers before playing audio, as many music player software and operating systems do not appropriately apply industrial standards governing volume control (e.g., USB Device Class Definition for Human Interface Devices). If in doubt, before playing any music, turn off volume synchronisation feature on the iFi Product and bring the volume down to the lowest setting.

Prolonged Heat Exposure

Your iFi Product may become very warm during normal use. It is important to keep your iFi Product on a hard, stable, and well-ventilated work surface when in use or charging.

Warning: To prevent possible hearing damage, do not listen at high volume levels for long periods.

Design Notes from the AMR/iFi Research & Development department

The iCAN PHANTOM 1.5 circuit is fully-balanced with completely equal circuit sections for Positive (Hot) and Negative (Cold) signal phase of each channel. The volume control is a 6-way motorized ALPS type, 4 tracks are used to adjust the volume for the balanced signal, the other two are used for monitoring the volume control operation.

Maximum output is > 27V in balanced mode, > 14V in single-ended mode, maximum peak current is 1.4A for single-ended headphone connections and 0.7A for balanced headphone connections. The continuous output current is limited by protection circuitry that only engages in case of sustained overload. A short term sustained output of around 15,000mW is possible in balanced operation.

The amplifier audio circuit is a development of iFi's revolutionary 'TubeState' design. It is fully discrete, fully balanced with either tube or JFET input switchable, bipolar transistor second stage and MOSFET-buffered bipolar class A power stage (with Class AB for low impedance headphones at very high levels). The resulting circuit may be best described as 'tri-brid' where each device is used to greatest sonic advantage while minimising any drawbacks. Furthermore, the circuit is DC-coupled to avoid using any sonically-degrading coupling capacitors.

Frequency response (0.5Hz -500kHz @ 0dB), noise (-142dB @ 0dB) and distortion (0.0008% @ 0dB) depend on gain and on which input device is selected. However (generally speaking), the levels of noise and distortion, especially in balanced operation challenge the limits of the Audio Precision test system.

The XLR and RCA outputs on the back offer full preamplifier function, but are not switched off if headphones are connected. Nonetheless, the iCAN PHANTOM 1.5 should be used either as preamplifier or headphone amplifier, as generally a mixed use setup is not recommended.

The **XSpace** Holographic matrices are tightly integrated into the signal circuit. Not only is there no use of DSP and the linked AD/DA conversion, there are also no additional active elements.

If disabled, the passive elements (resistors, capacitors and inductors) that form the analogue matrix are completely removed from the circuit, so the fidelity of the signal in 'OFF' remains unaffected.

If enabled, the **XSpace** Holographic matrix fundamentally re-shapes the transfer function of the actual amplifying circuit to do its job. So again, the fidelity of the signal is as if the **XSpace** Holographic matrix was designed integrally to the circuit. This is a highly unusual design, as normally signal processing functions add extra circuits to the main amplification circuit. Such additional circuitry cannot but negatively impact sound quality when in use and often even when disabled.

Notes on Electrostatic Headphones

Electrostatic headphones require very high voltages for operation. For example, Stax are around 101dB @ 100V, compared to around 105dB @ 1V for a common inefficient full size headphone. On top of that, they need a DC bias voltage, usually 580V for modern Stax.

The iCAN PHANTOM 1.5 offers both the original (normal) 230V bias for 6-pin plug connected Stax headphones and adjustable bias from 500V to 640V (including a dedicated 580V setting for Stax Pro bias) for 5-Pin connected Stax electrostatic headphones. It can also accommodate many other manufacturers electrostatic headphones if adapters to Stax 5-Pin pro connection are used.

Different bias settings may be tried. Note that it will take a considerable time for the voltage to fall from a previous higher setting. Therefore, if testing different bias settings, it is best to start with the lowest setting and slowly work up towards the nominal voltage.

More bias produces a louder mid-range, while the bass remains at the original level. So lower bias may give a more warm sound, higher more bright.

Exceeding the rated bias for a given headphone may damage it, so it is not recommended and exceeding the rated bias is done at your own risk.

Warning: AMR/iFi is not responsible for any damage arising from using the iCAN PHANTOM 1.5 with incorrect settings.

Notes on Use with iCAN PHANTOM 1.5

Most electrostatic headphones are very inefficient. Due to the limited voltage handling and the low sensitivity, electrostatic headphones generally do not play very loudly, especially compared to traditional dynamic headphones.

Depending on the impedance control setting the iCAN PHANTOM 1.5 can deliver between 320V RMS (910V PP) to 640V RMS (1820V PP).

These are very high voltage levels and may exceed the rated limit of the electrostatic headphones. Please confirm with your electrostatic headphone manufacturer what levels are allowed and, if in any doubt, only use the high impedance settings.

When using the iCAN PHANTOM 1.5, remember to keep the Gain, XBass and XSpace settings moderate. Gain is recommended at the lowest setting for comfortable listening, XSpace only at the lower settings and the same for XBass, as otherwise the stress on both amplifier and headphone may be excessive.

Under the above conditions the volume on the iCAN PHANTOM 1.5 should be able to be advanced to maximum (using an iFi DAC) without risk of protection circuitry engaging or damaging ANY electrostatic headphones as long as the impedance setting is 64Ω or 96Ω.

Note on the design of the ESL section

In principle, an energiser for electrostatic headphones is a trivial challenge. All we need are a pair of transformers to create the very high signal voltages for the electrostatic headphones and some form of bias supply. Of course, what seems simple usually hides unexpected complexity.

For example, to make transformers that can turn 20V audio signals into a 640V signal, with low distortion, a flat frequency response and without obnoxious resonances is a serious challenge. Get it wrong and the sound will be coloured, something especially objectionable with the crystal-clear sound of electrostatic headphones.

In addition, while making a high voltage bias supply seems easy, we must remember that this bias voltage provides one part of the motive force that moves the diaphragm. Any noise on the bias supply will modulate the drive strength of the moving diaphragm and thus the sound. Obviously, this must be avoided.

Given the high voltages involved even trivial jobs like circuit board design become challenging as we must avoid any chance of these high voltages to get out of control. Therefore great amounts of spacing between voltage carrying traces and pins are needed, making a simple circuit board layout suddenly very challenging.

Then we need to make sure we can select multiple sources, with minimal impact on sound quality from the switches and good long term reliability, something that simple mechanical switches fail to deliver.

The Transformers

In order to produce the high voltages requires by electrostatic headphones, the iCAN PHANTOM 1.5 employs custom-made transformers of the highest quality.

The extremely critical core of the transformers is a hybrid that combines ultra-thin GOSS with pinstripe permalloy lamination. A 100% GOSS core suffers from hysteresis at low levels causing distortion in quiet passages.

Meanwhile a 100% permalloy core cannot handle high levels without gross distortion. Combining the two materials makes sure each operates at its best. This reduces distortion dramatically, when compared to traditional cores, be they GOSS, amorphous iron or similar materials.

In order to combine a high step-up ratio with good behaviour without excessive resonances or bandwidth limitations, our custom transformers use a complicated multi-section winding with both vertical and horizontal sectioning. Extremely thin wire must be wound precisely and tightly to create the performance we required.

Combining this complex winding with an exceptional core produces a transformer that handles all levels without obvious distortion as well as offering a completely flat frequency response without colorations well past the audio band.

Only with such an exceptional transformer can we approach and even exceed the best transformer-less amplifier in terms of performance.

The Bias System - Capacitive Battery Power Supply

Commonly the bias voltage is created using the 50/60Hz mains power and a so-called Villard or Greinacher cascade rectifier (which is also sometimes called a Cockcroft-Walton voltage multiplier) is employed. This circuit can deliver very high voltages using rather generic and inexpensive components, but its operation is noisy.

Given the low frequencies of the AC used, large value capacitors tend to be needed, usually requiring rather nonlinear electrolytic capacitors, which have high leakage currents and so the cascade rectifier must operate constantly to keep the bias voltage from dropping.

At iFi we decided to completely toss out all existing solutions.

First, we decided to use a battery of multiple parallel film capacitors to provide the bias voltage. Film Capacitors hold their charge almost indefinitely. Given that isolation resistance of the electrostatic headphone is also very, very high, no current flows to discharge the capacitor bank.

Therefore, if we charge the capacitor bank up to the nominal bias one time, we can simply leave the charged capacitor bank to 'float' at the Bias Voltage.

In order to provide this one time charge we employ a very high frequency switching system (approx. 750kHz). This system uses a tiny, fully shielded transformer and exotic ultra-fast high voltage rectifiers. More crucially, this system shuts down completely as soon as the correct bias voltage has been established in the capacitor bank.

As some minor discharge happens even through air, we do need to top up the capacitor bank every 30 second or so. This process usually takes a few millionth of a second (microseconds) as usually one or two switching cycles suffices to replenish the lost charge. Then the switching system is again off completely.

Any noise that this system creates is confined to medium frequency radio bands for the infrequent short durations during which it is active. For over 99.999% of the time the charging circuit is completely off.

The result is in effect a perfect high voltage battery to provide the bias for the electrostatic headphones. Two completely separate and independent bias circuits are employed, one for the 230V normal bias and another adjustable, to cover a wide range of modern electrostatic headphones.

The Signal Routing

The entire signal switching for the input selection utilises gold-plated silver contact miniature relays filled with an inert gas. This makes sure the contacts will remain like new for a long time to come.

The loudspeaker connections are switched using sealed silver alloy contact relays for minimum impact on the sound quality of the loudspeaker path.

DISCLAIMER

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provided "as is" with no warranties, and use of it is at the user's own risk.

SPECIFICATIONS

Gain: 0dB, 12dB and 24dB user-selectable

Frequency Response: 0.5Hz to 500kHz(-3dB)

THD & N:

Balanced

Solid-State ≤0.0015%

Tube ≤0.002%

Tube+ ≤0.012%

Single-Ended

Solid-State ≤0.007%

Tube $\leq 0.006\%$

Tube+ $\leq 0.2\%$

SNR:

Balanced $> 145\text{dB(A)}$

Single-Ended $> 130\text{dB(A)}$

Output Power: Balanced

Max $> 15,000\text{mW (@ } 16\Omega)$

RMS $> 6,250\text{mW (@ } 16\Omega)$

Balanced

Max $> 15,000\text{mW (@ } 16\Omega)$

RMS $> 6,250\text{mW (@ } 16\Omega)$

Single-Ended

Max $> 5,760\text{mW (@ } 16\Omega)$

RMS $> 4,500\text{mW (@ } 16\Omega)$

Output Voltage:

Balanced	>27V (@ 600Ω)
Single-Ended	>14V (@ 600Ω)
DC Input voltage:	DC 12V/4A or 15V/3A (iCAN PHANTOM 1.5)
AC Input voltage:	AC 85 – 265V, 50/60Hz (iPower Elite)
Power consumption:	< 27W idle, 75W max.
Dimensions:	256 x 185 x 120 mm (10.1" x 7.3" x 4.7")
Net weight:	4.2 kg (9.3 lbs)
Limited Warranty:	12 months

**12 months typical or as permitted/required by local reseller laws.*

***Specifications are subject to change without notice.*

Test conditions: Gain = 0dB, 0.775V(0dBu) with 300 Ohm load unless stated otherwise SNR Balanced re 27V, SNR SE re. 14V