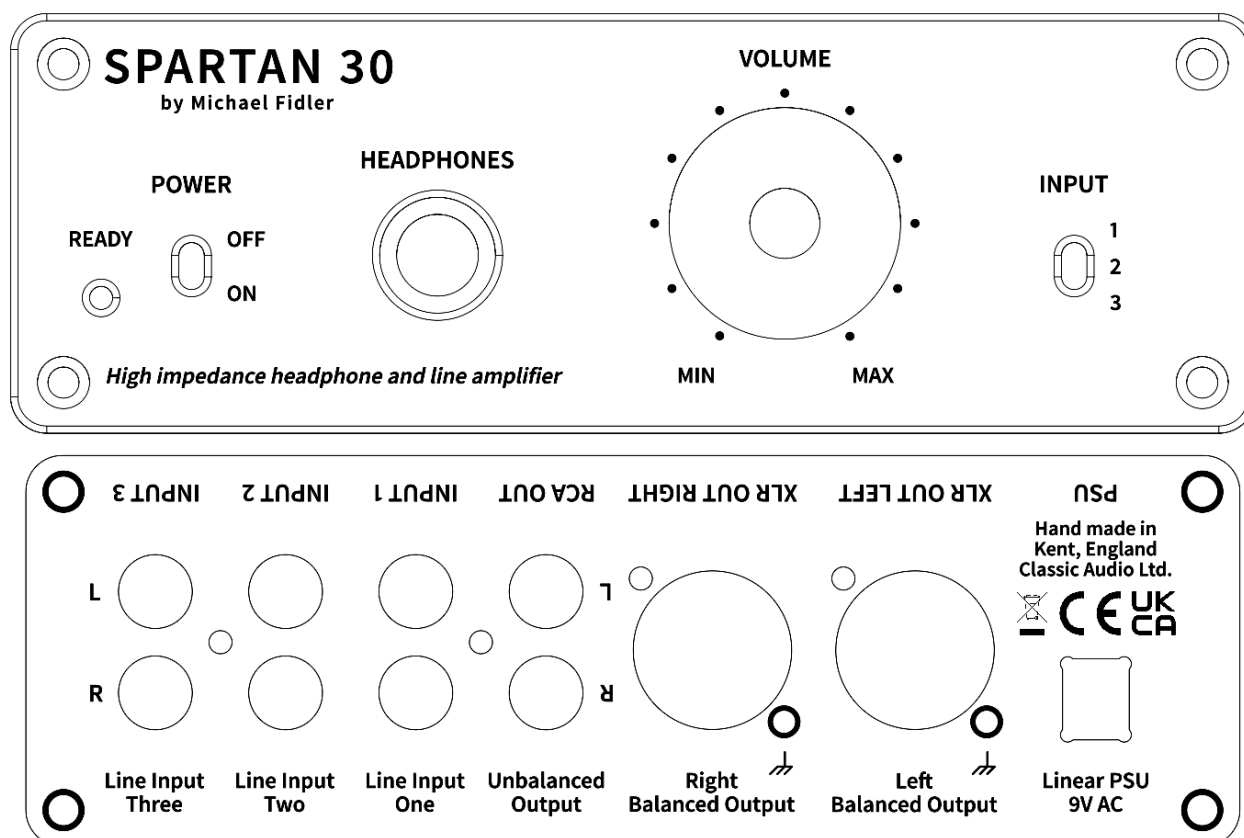




SPARTAN 30

High impedance headphone and line amplifier User Guide

Gain control range	17.5dB to -86dB (RCA), 23.5dB to -80dB (XLR)
Channel balance	±0.3dB (-20dB to maximum gain)
Frequency response (0dB gain)	15Hz to 40kHz, ±0.1dB
Output noise, 20Hz to 22kHz, 100Ω line source	-108.5dBV (0dB gain), -113.5dBV (-10dB gain)
THD – line output (6dB gain)	<0.0005% at 21V RMS output, 20Hz to 22kHz
THD – headphone output (6dB gain)	<0.001% at 500mW into 150Ω, 20Hz to 22kHz
Maximum line input level	10.5V RMS, 15Hz to 40kHz
Maximum line output level	21V RMS (XLR), 10.5V RMS (RCA)
Maximum headphone output power	700mW into 150Ω, <0.0016% THD at 5kHz
Line input impedance	220kΩ
Line output impedance	75Ω (RCA), 150Ω (XLR)
Minimum line load impedance	1kΩ (RCA), 2kΩ (XLR)
Headphone output impedance	2Ω, damping factor of 75 into rated 150Ω
Dimensions (W*H*D)	172*62*132mm
Power consumption	6W at full output, 0.2W powered off

Introduction

Thank you for your vote of confidence in the SPARTAN 30 headphone and line preamplifier. It takes a new look at traditional potentiometer-based preamplifiers to further increase practical performance through original circuit architecture, resulting in a compact device that can replace traditional integrated amplifiers when used with active speakers.

Three high-impedance RCA line inputs ensure minimal insertion loss with modern and vintage equipment alike, with electromechanical selection being performed via Panasonic relays right at the input connectors. A new active balanced volume control circuit yields an inherently balanced output that eliminates extra circuitry on the line outputs, for a shorter signal path with lower noise. Decreasing the value of the potentiometer from the more conventional 10k Ω to 5k Ω also increases its signal to noise ratio by 3dB.

As the volume control is the most essential control in any sound system, a great deal of time was spent sourcing the potentiometer. During development, all the conventional devices tested in the design failed to meet the project's channel tracking and lifespan requirements. After many hours of searching, a custom part, rated for 5 million cycles and initially intended for industrial applications, was used to ensure excellent stereo consistency for years to come.

Professional quality NJM5532 op-amps, mounted in turned IC sockets, are used for the line input and volume control stages, leading to a dynamic range of over 128dB, with less than 5ppm distortion at 0dB gain. Thanks to the $\pm 17V$ internal supply rails, they can deliver over 21V RMS of undistorted output at the XLR connectors and tolerate 10.5V RMS maximum input, making overload with even the hottest source signals very unlikely.

The headphone output, designed to work best with the most critical high-impedance types, uses purpose-designed NJM4556 high-current op-amps, found in some of the best Japanese equipment from the 1990s onwards. Unlike these products, separate ICs for each channel working in parallel pairs allow for over 700mW per channel to be delivered into a 150 Ω load while halving the effective noise power of each amplifier section. In addition to this, their operation as unity gain buffers maintains maximum feedback to keep distortion below 10ppm at 500mW output, so excellent clarity is maintained even at the most ear-splitting levels.

All of this is powered by a regulated split supply, using positive and negative power rails to keep non-linear amplifier power currents out of the reference ground where they might add distortion. As the power is delivered via an external linear transformer, its magnetic fields stay well outside of the compact enclosure. The linear operation also precludes any high-frequency switching noise from getting into the audio path via the RCA inputs and outputs.

Finally, a start up muting circuit operates 3 output relays to prevent any unpleasant thuds and bangs from getting through the system when powered on and off.

Happy listening,

Michael Fidler – Classic Audio Ltd.

Test results (use 150Ω load fixture)

Serial number			Power up test		Time	
Tracking test	-20dB		-30dB		-40dB	
Headphone noise	0dB		Min		Max	
Headphone THD	700mW		250mW		500mW	
Frequency response	15Hz		35kHz		5kHz	
Crosstalk test			Headphone mute			
Input switching	1		2		3	
Line noise	Min		Centre		Max	
Date of test						

Instructions

Having decided upon this preamplifier over many other offerings, it should go without saying that the user knows what they're doing! However, full instructions for setup and use are still provided for completeness and future reference:

- Remove the unit from its packaging and place it into a suitable location in your setup
- Connect your active speakers or power amplifier to the 'XLR OUT' or 'RCA OUT' connectors, using the balanced XLR outputs wherever possible to reduce interference
- Connect unbalanced line input sources via the RCA connectors labelled 'INPUT 1/2/3'
- Plug the supplied 9V AC power supply into your wall socket and insert the barrel jack into 'PSU' connector on the rear of the SPARTAN 30
- Switch the unit on by depressing the front panel 'POWER' switch to its 'ON' position
- Once 4-6 seconds have elapsed, the 'READY' LED will illuminate and the output muting relays will close, passing audio from the inputs through to the outputs
- Use the 'INPUT' switch on the right of the front panel to select a line input for listening
- To use headphones, plug a 6.35mm headphone jack into the 'HEADPHONES' output on the front panel, which will also mute the relays to the XLR and RCA outputs on the rear
- Adjust the volume control to a comfortable setting, taking care to avoid long listening sessions at high volume, as this can cause to poor audio quality due to hearing loss

Although 160mW of output is possible with headphone impedances as low as 32Ω, the SPARTAN 30's driver stages are designed for more output voltage than current. For the best results, higher impedance headphones from 64Ω upwards are recommended, as this will ensure an undistorted power output of 300mW or greater up to 300Ω. By making full use of the SPARTAN 30's double digit output voltage, while also being less immune to voltage noise at the output, these headphone types will also realise a better signal-to-noise ratio.

When using the balanced XLR outputs, prioritise shortening the RCA input cables as much as possible, so as to reduce the ability of ground loop currents in the unbalanced connections to create corresponding ground loop voltages in the resistance of excess cable length.

Cautions

A few of these may appear obvious but are included for the usual reasons:

- Keep the SPARTAN 30 and its AC adapter away from water, and also in a well ventilated space to prolong the life of heat-sensitive components inside the enclosure
- Do not use the SPARTAN 30 in outdoor conditions; it is designed for indoor use only
- To minimise the possibility of interference keep the SPARTAN 30 out of close proximity to power and digital cables, likewise maximise the distance between the main unit and its AC adapter and other transformers for the full magnetic benefit of a remote PSU
- Make sure that the XLR, RCA, and PSU connectors are clean before making connection, as dirt on the connectors may abrade the connector plating, causing corrosion with increased contact resistance, which can introduce noise and blocking distortion
- Try not to connect the headphone jack with very high audio levels present, as brief short circuits can sometimes occur during insertion and stress the drive circuitry
- Switch the unit off when not in use to save power and increase component lifespan
- Please see warning label on the AC adapter for further instruction on safe use

On a more technical note, it may be very tempting to try swapping the op-amps in the SPARTAN 30, especially as they're mounted in IC sockets for easy replacement in the unlikely event of failure. Please note that the NJM5532 and NJM4556 device selected were chosen specifically as the best parts for the design. Using unspecified devices such as the LM4562, OPA2134, or any other IC op-amp is highly discouraged. Doing so may lead to radio frequency instability with corresponding overheating, excessive noise and distortion, and even premature failure with damage to the rest of the internal circuitry.

Please be forewarned that the failure mode of many IC op-amps often results in their output assuming the voltage of one of the supply rails. This continuous DC offset fault can be more than enough to fry the coils of most headphones, with permanent loss of audio!



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