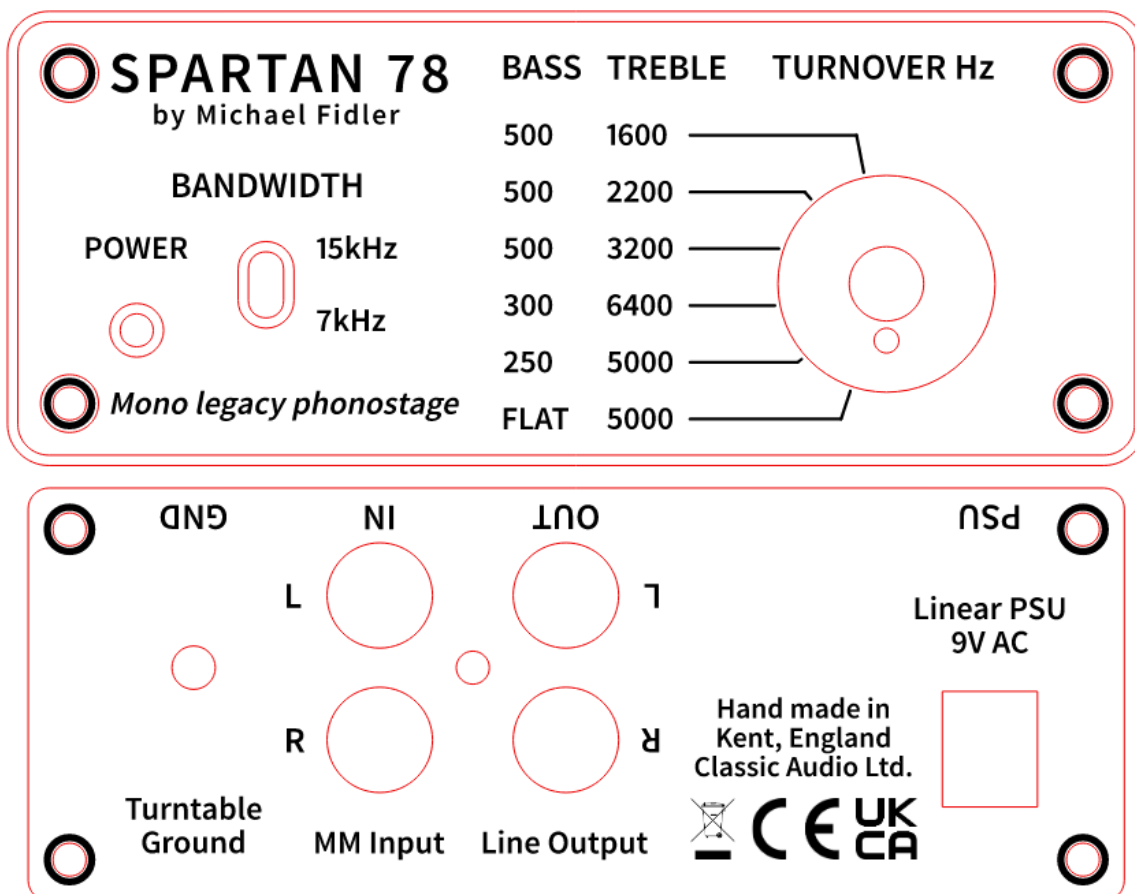




SPARTAN 78

Mono legacy phonostage

User Guide

Gain at 1kHz (5k Ω line load)	39.4-40.2dB, 93-102 times (all settings)
Equaliser accuracy	± 0.5 dB (70Hz to 9kHz), ± 1 dB (60Hz to 12kHz)
Signal to noise ratio (220Hz-22kHz flat)	79dB, at output ref 5mV cartridge load
THD (5k Ω line load)	<0.002%, 22Hz to 22kHz, 3V RMS output
Maximum output (2.5k Ω line load)	>8.5V RMS, 30Hz to 17kHz
Maximum input at 1kHz	90mV RMS (500 – 2200 EQ setting)
Maximum input at 10kHz	420mV RMS (500 – 2200 EQ setting)
Overload margin, ref 5mV	25dB, 18 times
Output impedance	75 Ω (150 Ω combined for stereo)
Input impedance	24k Ω + 240pF (48k Ω combined for stereo)
Low frequency high-pass filter	48Hz, 3 rd order (constant amplitude groove)
High frequency low-pass filters	7kHz, 15kHz, 3 rd order
Dimensions (W*H*D)	110*46*134mm
Power consumption (no signal)	<600mW

Introduction

The SPARTAN 78 phonostage is intended to make listening to 78 RPM records and early LPs easy and straightforward. This mono design uses six selectable replay curves to restore the correct tonal balance of the majority of coarse-groove discs recorded before the adoption of RIAA equalisation in 1954. Sharp out-of-band filtering then isolates the original recording from rumble and rising high-frequency noise to bring clarity and reduce listener fatigue.

Bridged RCA inputs sum the cartridge output to mono, with a combined input impedance of 24k Ω and 240pF representing a load of 48k Ω and 120pF for each stereo channel. The 5532 input amplifier (usually suboptimal for moving magnet inputs due to higher current noise) realises excellent noise performance due to the lower parallel mono impedance. The input stage applies 33dB of gain at 1kHz and active equalisation using hand-tested film capacitors, noiselessly switched into its feedback network via the rotary switch on the front panel.

In the second stage, a third-order low-pass filter, switchable to 15 or 7kHz, cuts out distracting surface noise lying outside of the recorded bandwidth. The upper limit of 15kHz attenuates excitation generated by shellac in the 15 to 20kHz region, exacerbated by the resonances of robust DJ type cartridges suited for 78 RPM replay. High-pass filtering at 48Hz removes subsonic disturbances and rumble brought up into the audio band by the higher groove velocity of 78s, forming a second order filter for later curves with a 50Hz constant-amplitude turnover, or a third order one for earlier constant-velocity discs with no such turnover point.

Distortion stays below 30ppm at maximum output (15ppm at 2V RMS output) thanks to gain sharing between two stages, with the last 7dB in the second stage. Bandwidth filters before the final gain also mean that high and low frequency artefacts can't degrade the overall headroom at the output – 1.8V RMS of input is possible at 20kHz without overload.

As the single amplifier IC consumes very little power, an unregulated RC power supply is used, so power consumption falls under 600mW at idle, making power switching and startup circuitry unnecessary. The $\pm 14V$ split supply keeps distorted amplifier power currents out of the reference ground and allows the line output to drive over 8.5V RMS into a heavy 2.5k Ω line load, while the external linear transformer keeps magnetic fields out of the enclosure.

Happy listening,

Michael Fidler – Classic Audio Ltd.

Test results (use -20dB input attenuator)

Serial number		Date of test	
Power up + noise		Frequency response	
3V output THD tests	40Hz	1kHz	10KHz
Clip		Cancel + rock	

Instructions

For the sake of completeness, some guidelines and instructions for basic use are as follows:

- Remove the SPARTAN 78 from its packaging and place in proximity to the setup
- Attach the turntable ground connection to the binding post on the rear panel
- Connect the turntable's RCA moving magnet output to the inputs labelled 'IN'
- Using an RCA cable, connect the 'OUT' outputs to a suitable amplifier line input
- Connect only the supplied 9V AC power supply to the SPARTAN 78's rear 'PSU' socket
- Adjust the curve selection dial and bandwidth switch as appropriate for your records
- Use a dedicated 78 RPM stylus for playback with a tip radius of around 3 thou (75µm)
- Hot-swapping of cartridge headshells is possible while the phonostage is powered on

Try to keep the SPARTAN 78 in as close proximity to the turntable as possible, so as to minimise the lengths of the turntable output leads and avoid hum pickup. Excess length should be coiled and then flattened with a cable tie to minimise the magnetic loop area. After prioritising the input side, choose as short a cable as is practical between the SPARTAN 78 and the amplifier. It is also a good idea to keep as much distance between the input cabling and mains or digital cables to avoid interference.

When selecting a replay curve, the most important thing to keep in mind is when and where the record was cut and therefore what recording system was used, rather than just looking at the record label itself. A very brief guide to replay curves prior to 1954 is given below:

- **FLAT – 5000:** Acoustic cut discs predating electrical recording, before 1925. 5000Hz treble roll-off counters rising high frequency surface noise. Use 7kHz bandwidth mode.
- **250 – 5000:** Recordings made on Western Electric systems type 1A and 1B and their copies. All electrical recordings up to 1932, recognisable by a capital (W) in the lead-out area. Use the 7kHz bandwidth mode as cutter responses were limited to 5kHz.
- **300 – 6400:** Recordings made on Blumlein and FFRR 78 systems, recognisable by squares in the matrix numbers or the letter (C) in the lead-out area. Almost all British recordings from 1933 to 1954. Most pre-war era discs are limited to 6kHz – use 7kHz.
- **500 – 3200:** Recordings made on Western Electric systems type 1C and 1D and most American recordings from 1933 to 1954, recognisable by a diamond in the matrix code. Also Decca FFRR LPs and a few later FFRR 78s from about 1950 onwards.
- **500 – 2200:** Some American recordings with audibly more pre-emphasis than above, all 78s from 1954 onwards (RIAA). EMI and modern LPs can be equalised by this curve.
- **500 – 1600:** Some 1950s USA Columbia 78s, pre-1954 Columbia LPs, NAB/NARTB curve.

Replay curves extend down to 48Hz before subsonic/rumble filtering takes over, and are generally shown in chronological order as more cutting emphasis was used as time passed.

For a full guide on replay equalisation see *Manual of Analogue Sound Restoration Techniques* by Peter Copeland (freely available as a PDF download from the British Library Website).

The bandwidth switch may be used at 7kHz to limit the frequency response of damaged discs to make them more listenable. Most American discs from 1935 onwards and post-war British discs have a response exceeding 7kHz, so 15kHz is recommended for discs in good condition.

Cautions

Some of these appear obvious but have to be included for the usual reasons:

- To avoid mutual destruction of both the SPARTAN 78 and an inappropriate power supply, use only the optimal 9V AC power supply included at sale
- Keep the linear AC adapter away from water, in a well ventilated space
- Do not use the SPARTAN 78 outdoors, as surprisingly it is intended for indoor use only
- For best results keep the SPARTAN 78 out of close proximity to switching/power electronics to avoid interference. Likewise, maximise the distance between the SPARTAN 78 and its AC adapter to realise the full magnetic benefit of a remote PSU
- Make sure that the RCA and PSU connectors are clean before making a connection, as dirt on the connectors may abrade the connector plating, reduce the effective contact area, and in extreme cases introduce noise and blocking distortion

On a more technical note, the ill-advised may be tempted to try swapping the op-amp in the SPARTAN 78, as it's socketed. The circuit design has been optimised specifically for the 5532 IC. Substituting others will lead to poor compromises and worse performance.

The OPA2134, LM4562, and almost any device other than the one specified are not suitable for this design. Substituting op-amps not intended for audio use is highly inadvisable, particularly those of the high speed variety. There is a popular saying in analogue design; *those who ask for more bandwidth than they need get what they deserve*. Not heeding this warning, especially with some of the more exotic devices out there, may provoke circuit instability, turning your phonostage into a self-destructive radio transmitter, dramatically degrading the performance, potentially damaging your power amplifier and possibly your loudspeakers and headphones.

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