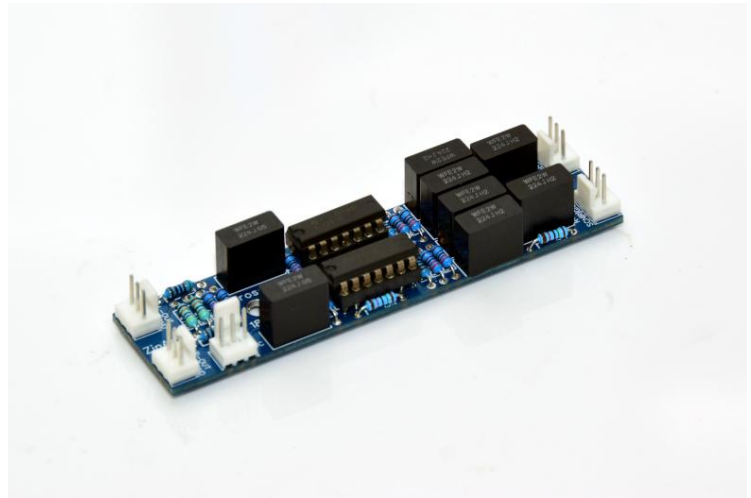


Application & Purpose:

Used to reduce surface and vertical noise from vinyl turntables. Normally added to the signal path after a phono-stage.

Merges low frequency signals below 100Hz to mono. The result is that rumble and other turntable noise is less intrusive as it is in mono. Can be selected/defeated with a simple switch



Specification:

PCB Dimensions	104mm x 19mm x 1.6mm
Channels	Two - stereo
Gain	Unity
Input Impedance	15k Ω
Frequency Response	Full Audio Band
Filter Type	High-pass cross-feed 18dB/oct
OpAmps	Standard - TL074ACN Can be upgraded to OPA4227PA
Output Impedance	< 100 Ω
Supply Voltage	Min +8/-8v DC (regulated power supply module available) Max +15/-15v DC (regulated power supply module available)
Idle Supply Current	20mA
Earth Nets	Power and Audio
THD	Typically < 0.001%

Description:

This cross-feed filter takes a portion of the signal from the left channel and feeds it to the right - and vice versa. As the frequency drops below 100Hz, the amount of signal fed to the opposite channel increases; by 18dB per octave. This makes surface and vertical noise from turntable motion and disk imperfection much less noticeable. Until now, most cross-feed filters were 6dB per octave and this could intrude into the stereo effect because the cross-feed had to start at a much higher frequency to achieve the same effect.

ZinAmp's 18dB cross-feed filter is a combination of published research by Langvad, McAuley and Self that utilises an all-pass filter in its feedback loop to achieve a much steeper and less intrusive cross-feed effect, preserving all of the stereo separation of the record.

Vinyl Records at low frequency:

The low frequency signal on a vinyl record is mastered in mono. There are technical reasons for this; mostly due to the tendency of a needle to bounce out of the record groove when presented with low frequencies in stereo. Because vinyl discs are not perfectly flat, they also generate subsonic noise (rumble) that is out of phase - this is referred to as vertical noise and can cause a number of unwanted effects in your amplifier and speakers.

Rumble filtering:

It is widely accepted that filtering the signal of a vinyl record below about 25Hz is a good thing. Turntable rumble and other vertical noise can cause motorboating and other unwanted effects in your amplifier. It is not uncommon to see speaker-cones visibly moving with the effect of very low frequency noise from an unfiltered phono amplifier! An acceptably steep rumble filter (12dB/oct) will mitigate the effects of rumble and low-f vertical noise. ZinAmp's phono stages all feature this filtering.

Cross-feed Filtering:

We can improve matters further with the use of a cross-feed filter. Although the low-f signal on a record is mastered to mono anyway, the irregularities (warps & imperfections) in the disc are not! These create unwanted surface noise which is audible in 'full stereo'. By merging this noise to mono, it is less noticeable. The way to do this unobtrusively is to have a very steep cross-feed filter below 100Hz, so that only the frequencies mastered in mono anyway will be cross-fed.

Why ZinAmp's Cross-feed filter is superior:

Until now, pretty much all attempts at cross-feed filters have resulted in a 6dB/oct slope, meaning the cross-feed has to start at a much higher frequency to tackle surface and vertical noise effects. This risks changing the stereo effect of the 100-250Hz portion of the signal.

By adding an all-pass filter to the feedback / error-correction path of the filter, we can take advantage of an anti-phase effect below 100Hz to achieve a much steeper filter curve. This is a much less intrusive cross-feed effect and better aligned with the way vinyl records are mastered. No 'flanging' or other unwanted artefacts are generated; the original audio is fully preserved.

The result:

...is a filter you're less likely to want to switch on and off. The pcb module has a switchable defeat/enable loop that requires a very simple switch to control, but you may well prefer to leave this permanently enabled.

Power Requirements:

It is critical that this module is powered using a DC supply of no less than +8v and -8v. This provides the requisite headroom for the signal from an RIAA preamp of 40dB gain at 1000Hz. Max is +15v and -15v and this is a limitation of the op-amps used.

Vinyl scholars will be aware that there is a maximum signal amplitude achievable from a vinyl master cut with a lathe. This equates to a maximum signal amplitude in an MM cartridge of 40mV peak. Multiply this by 40dB (i.e. x100) and we have a maximum potential of 4v peak being fed to the cross-feed filter. This must be handled without clipping.

To ensure our signal is well within the voltage rails of the op-amps in the cross-feed filter, we stipulate an additional 4v of headroom. 2v is for the op-amps themselves as they can clip at 2v below rail voltage, plus an additional 2v as a margin of safety/quality.

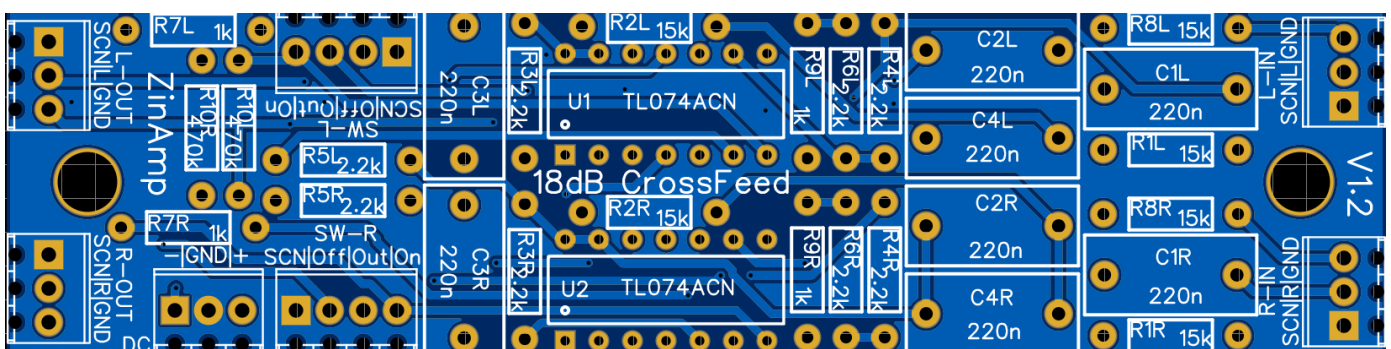
Gain and RIAA response:

Gain of this filter is unity. However, if you measure the RIAA response of your phono amp in one channel with this filter enabled, you may notice the low frequency peak of the RIAA curve is down 2 or 3 dB. This is because a portion of the low-f signal is being fed to the opposite channel. Feeding both channels with an identical signal will produce the expected RIAA response.

Switching On/Off:

If you wish to toggle this filter on and off, a simple toggle-switch of double-pole-double-throw (DPDT) type is all that is required. The PCB has switch terminals for left and right channels marked SW-L and SW-R. The common pin is labelled "Out" and there is a pin for "Off" and "On". If not using a switch, simply jumper or solder Out-to-On on both SW-L and SW-R terminals. Use the toggle switch to connect Out-to-Off for disabled and Out-to-On for enabled. An additional pin marked SCN is for the cable screen and is grounded. The cables from the filter module to the switch will benefit from being screened as they won't pick up any EMI this way. We recommend 3-core screened cable for this application - one length for left and one for right - and one DPDP toggle switch.

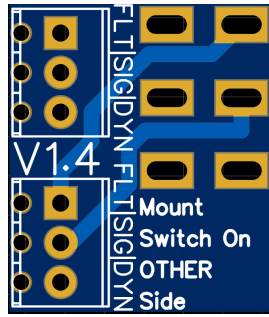
Blank PCB:



Panel Switch:

ZinAmp's EQ switch pcb can be reused as a board to mount a DPDT switch to enable/disable the cross-feed filter. It is shown below:

The pins must be connected as shown in the following table:



EQ switch PCB

EQ Switch Pin	Cross-feed Pin (V1.2)	Cross-feed Pin (V1.3 and on)
FLT	Out	Off
SIG	Off	Out
DYN	On	On
Not connected	SCN (screen)	SCN (screen)

Please note: V1.2 boards have the Out and Off pins reverse-assigned. This means the EQ switch must be connected as **high-lighted** above.

Parts List:

CONNECTORS: Both blank and ready-built PCB requires connectors be purchased and soldered on by the constructor. This is to give the constructor a choice of how they wire their own particular installation. Terminal block connectors are indicated in the list below in **blue** and can be swapped for equivalent 2.54mm pitch connectors e.g. Molex KK254 headers, which are provided to the constructor in kits with ready-made wiring.

This parts list is currently being updated. Email parts@zinamp.co.uk for help

Parts available from [RS Online](#). Also try [Farnell](#), [Mouser](#) and other online suppliers.

Parts from different manufacturers can be substituted where spec is sufficient

Supplier trading names may differ by country.