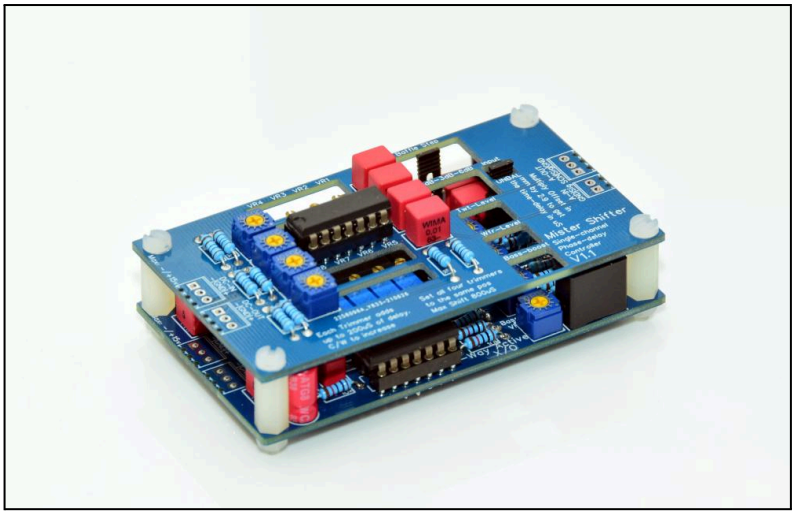
ZinAmp
Beautiful sound, for people who love music

Datasheet 2-Way Active Crossover

Application & Purpose:
2 Way Linkwitz-Reilly active crossover with a number of useful features including infinitely variable x/o slopes, baffle-step and variable bass-extention up to 15dB. This very flexible module can also be used as a gain stage providing up to x1.5 gain or 3.5dB. All slopes are 24dB/oct.

Phase delay is available as a separate module that fits on top of the crossover module. Crossover can be used with or without the phase-shifter module.



Specification:

PCB Dimensions	50mm x 88mm x 1.6mm
Channels	One
Gain	Up to x1.5 or 3.5dB
Input Impedance	20kΩ
Frequency Response	15Hz-35kHz
OpAmps	Standard - TL074ACN Can be upgraded to OPA4227PA
Output Impedance	< 100Ω
Supply Voltage	Min +5/-5v DC (regulated power supply module available) Max +15/-15v DC (regulated power supply module available)
Idle Supply Current	50mA - with phase-delay module
Earth Nets	Power and Audio
THD	Typically 0.003%
Crossover Point Limits	1,200Hz - 10,000Hz Lower x/o point can be achieved with component swaps E.g. 80Hz for use with a sub-woofer is achievable

B-EX
Bass Extention

Features:

Infinitely Variable Crossover Points: All four slopes can be moved independently, using trimmer pots; useful for removing humps or dips. All slopes are 24dB i.e. 4th order.

Baffle Step Filter - Three different baffle-widths can be selected and the filter slope trimmed with a pot from 0db to -6db

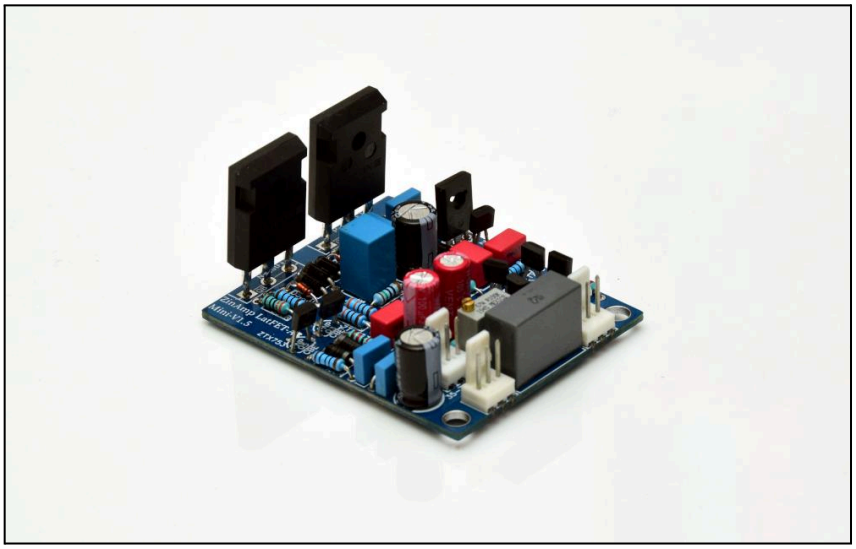
Bass Extension (B-EX) - An additional 15db of bass-response can be selected with a pot. This is similar to a linkwitz transform circuit, but is variable, rather than fixed. The increase begins at 150Hz and extends down to 25Hz. The steepness of the increase depends on the pot-position. Note, the optional phase-delay module features an adjustable high-pass filter to prevent over-excursion of the bass-driver when using bass-extention. This can be adjusted between 10 and 20Hz and is recommended.

Phase Delay - An additional PCB module can be fitted 'on-top' of the crossover that adds up to 600uS of phase delay to two of the three channels from the crossover. The Crossover can still be adjusted through holes in the phase-shifter board.

Details:

The Linkwitz-Reilly Active crossover is not a new development. However, advances in DSP technology have seen a shift from conventional analogue crossovers to digital crossovers with Class D amplification becoming a popular choice.

The sound of DSP and Class D is not to everyone's taste; especially with analogue sources like vinyl records which require analogue-to-digital conversion for the DSP, then back to analogue for amplification. To address this, we have created these fully-featured analogue active crossovers and a set of compact class A/B power amplifier modules to make an analogue active crossover with class A/B amplification a practical proposition.
Phase-delay, bass-extention, baffle-step and infinitely variable crossover slopes are all featured here. I.e. true analogue sound-shaping.



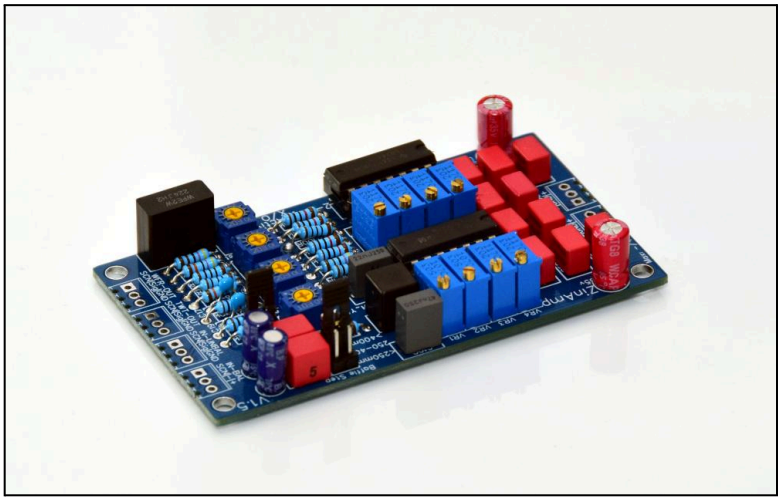
ZinAmp Compact Class A/B Power Amp - available separately

Setting the Crossover Points:

Please Note: the crossover can be used to achieve a crossover point from as low as 80Hz up to 10,000Hz. There are two crossover ranges available and these require different capacitor values to be achieved:

Standard Range: 450Hz - 5000Hz - requires 10nF caps
Low Range: 50Hz - 500Hz - requires 100nF caps

A simple spreadsheet can be downloaded from ZinAmp's website. This calculates the trimmer-resistor settings required for any given set of crossover points. The resistance of each trimmer is measured using a meter placed across 2 terminals below each trimmer and set according to the value indicated in the spreadsheet. This is a far-more flexible method than fixed x/o points and resistor packs sold by other manufacturers. It also allows compensation for variations in driver performance i.e. each slope can be moved to either squeeze or stretch the crossover region, if this is required.



PCB Showing 8 Trimmer Resistors - four per slope

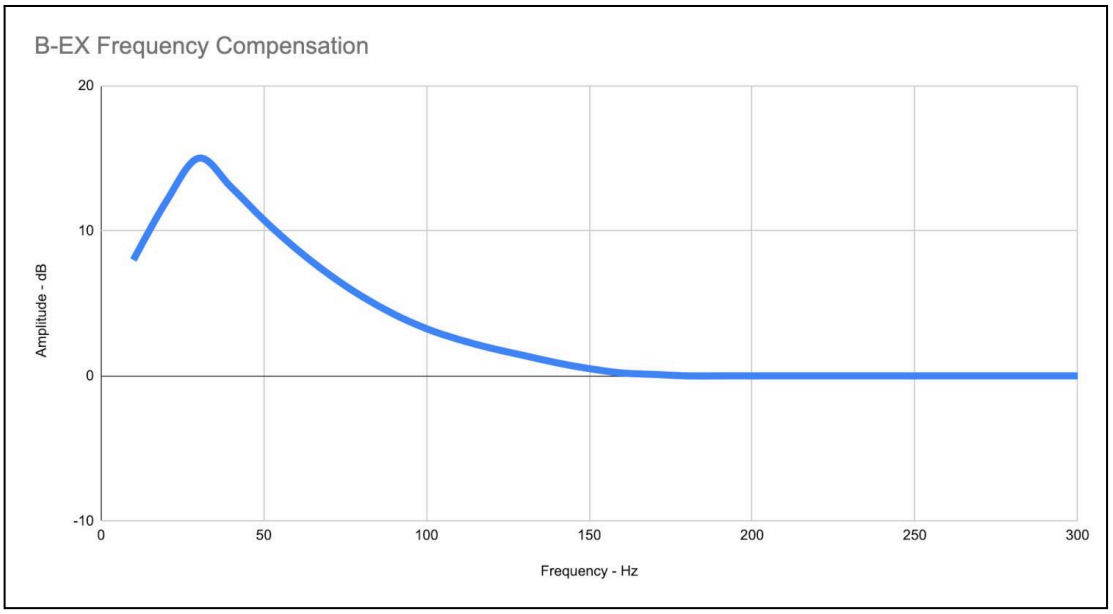
Balanced or Unbalanced Inputs

Hot and cold (+|-) terminals allow for a balanced connection. Grounding the cold unbalances the input for standard line-level sources. A simple jumper switch grounds the cold pin, making wiring more convenient. Output is unbalanced only.

Driver Level Settings:
The output Level of each driver is set using a single-turn pot. Clockwise to increase, to a max of +3.5dB of gain. More gain (or less) can be achieved with some resistor swaps - email help@zinamp.co.uk for assistance.

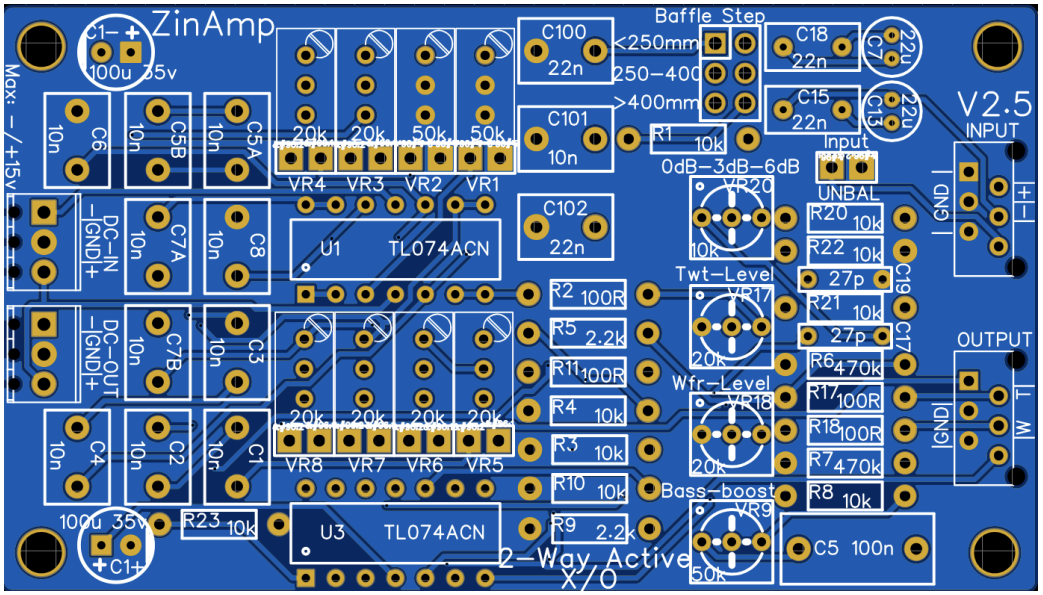
Baffle Step:
A jumper switch selects the approx baffle width: <250mm; 250-400mm and >400mm. The amount of baffle compensation is set using a single-turn pot - from 0dB to 6dB.

Bass Extension (B-EX) - An additional 15db of bass-response can be selected with a pot. This is similar to a linkwitz transform circuit, but is variable, rather than fixed. The increase begins at 150Hz and extends down to 25Hz. The steepness of the increase depends on the pot-position. Note, the optional phase-delay module features an adjustable high-pass filter to prevent over-excursion of the bass-driver when using bass-extention. This can be adjusted between 10 and 20Hz and is recommended.



WARNING: Only increase bass-extention to the point where it no longer makes a difference, otherwise you may overdrive your bass power-amp. Don't set this to more than 50% initially whilst experimenting.

Bare PCB - Crossover:



Power Supply:

The op-amps in the crossover and shifter modules can be powered by a minimum of -/+6v and a maximum of -/+15v. More headroom is available at higher voltages.

ZinAmp makes and sells a very clean linear regulated supply, powered by a 30v wall-wart.

Both the crossover and phase-shifter modules have two sets of power connections. One is marked DC-In and one marked DC-Out. They are linked in parallel so you can chain-wire, saving cable-space in your enclosure.

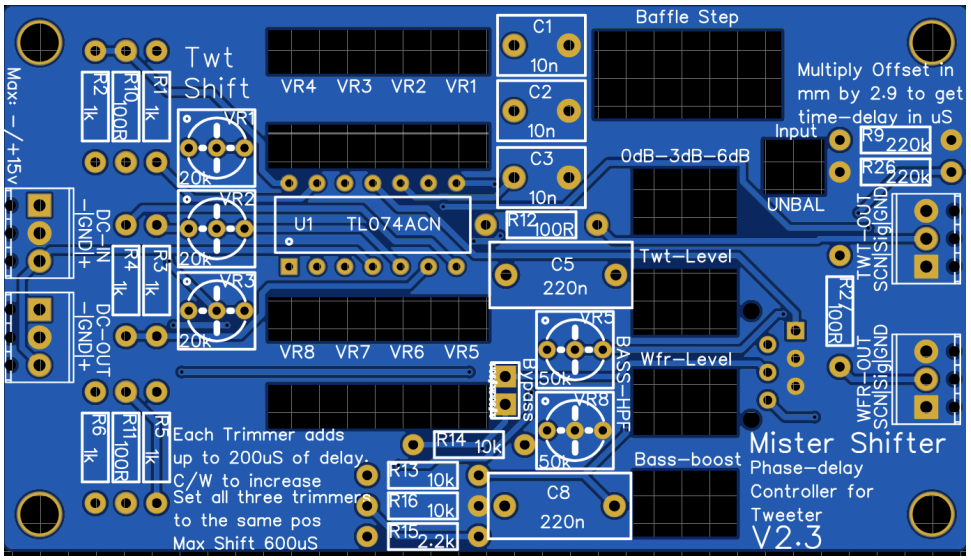
The zero-volts point needs to be grounded, so a split-rail or floating supply is necessary.

Connecting to Power Amps:

The crossover has three audio-outputs: Bass, Mid and Tweeter. Each of these connects to its own power amplifier. Input impedance of the power amp is more critical for the lowest frequency, which ideally should be 10k or more. Your power amplifiers should have coupling capacitors on their inputs. Whilst there are coupling caps at the input to the crossover, there are no coupling caps at the output, as there is almost no DC offset there.

Phase-delay Module

The optional Phase-shifter module connects to the output of the Crossover. This connection is made with a simple and convenient Molex Picoflex ribbon cable that carries both audio and DC power. This is supplied when purchasing the phase-shifter and crossover modules together.



High-pass filter (Bass-HPF)
The phase-shift module features a bass high-pass filter. This is for use with the bass-extention (B-EX) feature on the crossover. Boosting bass response increases the risk of woofer over-excursion. The high-pass filter on the phase-shift module cuts the bass below about 20Hz. The cut-off frequency can be adjusted with two 50k pots that must be set to the same amount of rotation. Turning them clock-wise lowers the cutoff frequency from 25Hz to 10Hz. This filter can be bypassed by jumpering the Bypass pins.

Setting the desired Phase-shift

Phase shift is usually employed to compensate for the relative forward or backward center-point of a given driver in a cabinet and to tune out driver phase-differences at the crossover point. For example, a mid-driver may be 20mm further forward than a bass driver and a tweeter another 20mm forward from the mid. In this example we require 40mm of delay for the tweeter.

Phase-shift(uS) = Offset(mm) x 2.9

To select 40mm of shift for the tweeter, multiply 40mm x 2.9 to give 116 microseconds. The **figure of 2.9** is a time-constant, based on the **speed of sound** at sea-level.

Each of the three trimmers on the phase-shifter-board can provide up to 200uS or 600uS in total. For 116uS, each trimmer needs to be set to around 39uS. (39÷200)x100=20%, so each trimmer should be set to approx 20% of its rotation.

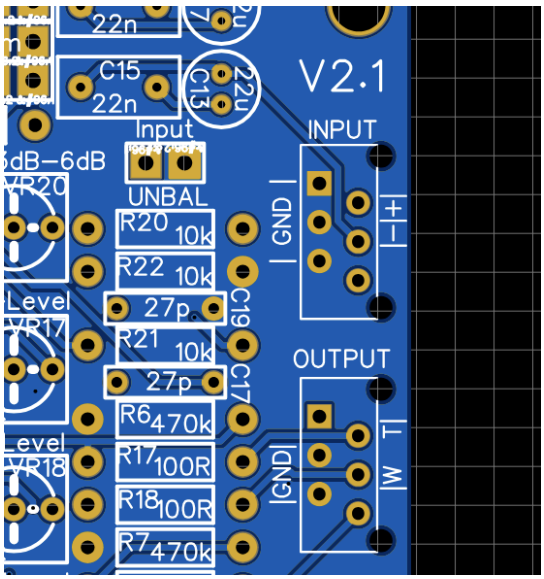
Note: The above example serves as a guide because in reality, setting a pot to 20% rotation is tricky to do by eye - and to verify by ear! Accurate adjustment of phase-shift is more easily done with an SPL mic and room EQ software. This ensures factors such as the frequency-dependent phase-shift of each driver are properly compensated for.

Balanced and Unbalanced Inputs

The input and output connections to these crossovers changed at version 2.1. The previous versions had separate connectors for Balanced and Unbalanced sources (IN-BAL and IN-UNBAL).

From version 2.1 we made it easier to use a wider variety of connectors on the PCB, including molex picoflex ribbon connectors. The holes are all 2.54mm apart so any connector of that pitch will work as long as its pins are no thicker than 0.75mm. Holes are 0.8mm

You can solder bare wires in these holes too - see image below:



Input:
Balanced, connect GND, - and + pins to ground, cold and hot respectively. Place the jumper over the UNBAL pins.

Unbalanced, connect GND and + pins to the GND and + of your source. Do not connect the - pin. Remove the jumper from the UNBAL pins.

There are three ground pins - use any of them.

Output:
W is the woofer signal, M is the Mid signal and T is the Tweeter signal. There are three ground pins. Connect each to one of your downstream amplifiers.

If you are using the phase-shift module, we recommend soldering an eight-pin molex picoflex connector into the output terminal of the crossover and the input terminal of the phase shifter. Note the input to the phase shifter is on the underside of the shifter board.