Fender-Sunn PCN-4

Stereo Three Way-Mono 24 dB/Octave

Linkwitz-Riley Electronic Crossover Network

Congratulations and thank you for purchasing the Fender-Sunn PCN-4 Stereo Electronic Crossover Network. We are sure it will provide you with many years of trouble free service. Please take a few minutes to read this manual, as it contains important information you may find helpful.

This manual is grouped into the following sections:

- An introduction section,
- A section for beginners on how to use an electronic crossover,
- Recomended hookup methods,
- A features description section,
- A reference section (spec sheet).

Please also be sure to fill out the enclosed warranty registration form, and return it to us here at Fender.

Introduction

The PCN-4 is a professional stereo 3 way electronic crossover network, which may also be used as a mono 4 or 5 way unit. The PCN-4 uses a unique and highly accurate 24 dB per octave Linkwitz-Riley filter system. Additionally, the PCN-4 is one of only a few units that provides flat summed response of the low and high frequency outputs regardless of the crossover frequency chosen. Not all Linkwitz-Riley 24 dB/octave 4th order crossovers provide a truly flat summed response. This is made possible in the PCN-4 by the use of precision 2% resistors, carefuly selected capacitors, the industry's only precision matched hand selected 1% four gang frequency range potentiometers, and careful design. We believe you will find that the PCN-4 outperforms even the most expensive competitive product on the market today.

Why Use An Electronic Crossover And An Active Multiway System (A Primer For Beginners)

If you have invested in good speakers for your sound system, and just seem to run out of "juice" and "clarity" when driving them hard, the natural inclination might be to run out and buy a really large new power amplifier. While buying a new amplifier might be a good idea, just increasing power might not do the trick.

If your amplifier puts out substantially more power than your speakers are rated to handle, instead of your songs heading up the charts with a bullet, your speaker cones might be acting like a bullet, heading straight towards your audience, and smoke may come pouring out of the passive crossover panel in the rear of your speaker! More power is not always the answer. Instead of brute force (i.e. more power), an active multiway system might be the answer to a variety of problems.

What Does A Crossover Do?

In most loudspeaker systems, separate speakers (drivers) are used to reproduce specific frequency ranges. Low frequencies are reproduced by the "woofer", mid frequencies by a midrange driver, and high frequencies are reproduced by the "tweeter". Sometimes, even additional speakers are used for very low frequencies (subwoofers). This is necessary due to the fact that the mechanics (physics) necessary to reproduce these frequencies are radically different and require totally different styles of construction. Low frequencies are reproduced best by cone style loudspeakers, while high frequencies require less area and mass but very close tolerances. As a result "woofers" that reproduce low frequencies are often large, power hungry devices, while "tweeters" are smaller devices that are not capable of handling as much power. Another problem occurs when low frequencies are feed to high frequency drivers. This will often destroy the high frequency driver quickly.

Because of this, most speaker systems include more than just the raw speaker/drivers loaded into a wooden box. An electronic circuit called a crossover network is used to split the frequencies between the different types of speakers, sending low frequencies to the "woofers", and high frequencies to the "tweeters", mid frequencies to midrange units, etc.. Just as different types of drivers have different characteristics, different types of crossovers are available as well. Some separate the audio bands sharply with little overlap between drivers, while others do it gradually, with a lot of overlap. In addition to separating the frequencies, the purpose of the crossover network is to match levels between the speaker components, and to protect the tweeter/midrange units from damage.

Problems With Passive Crossovers

While passive crossover networks can work very well, and are usually carefully crafted by the loudspeaker designer for optimum performance, like any device, they are less than perfect. Often the components used in the crossover network will handle less power than the speaker drivers can handle, resulting in a reduced power rating for the entire system. When driven hard, some of the components in a passive crossover heat up (particularly the inductors), increase their resistance, and can cause a significant loss of power to the drivers. Even worse, is the fact that under certain conditions, an inductor can "saturate", and no longer work properly, which can lead to blown speakers. That is another reason why simply increasing power can be the wrong answer. Probably one of the main problems with passive crossovers is the fact that any harmonic distortion generated by driving the amp hard at low frequencies not only goes to the woofer (which due to it's rolloff characteristics at high frequencies attenuates them), but also to the "tweeter", resulting in a distorted, and harsh sound.

Electronic Crossover Networks To The Rescue

One way around this is to put the crossover network in another location, before the power amp! In this case, the crossover network divides the signal coming out of the mixer (or other line level device). The output of this crossover is then fed to multiple power amplifiers, where each power amplifier is used to drive just one band of frequencies and one type of driver. For example, one amplifier can be fed bass frequencies and it's output goes to the woofer, while another amplifier is fed only high frequencies and its output goes only to the tweeter. This type of a system is called a "multi-way, active system". A more common term for it is "bi-amping" (where two power amps are used), or "tri-amping" where three power amps are used. Such crossover networks are called "low level" because they operate with line level signals, not speaker level signals coming out of the power amp. While low level crossovers can be "passive", most are "active" which means they require a source of power (such as an A.C. wall socket), and use active electronic circuitry (such as integrated circuit amplifiers etc.) instead of the large inductors and capacitors found in a passive circuit. Theses low level active crossovers are commonly referred to as "electronic crossover networks".

Advantages of Multi-Way Systems

There are many advantages to multi-way systems using low level electronic crossover networks. Particularly in large systems, the overall sound quality can be greatly improved. Distortion is greatly reduced, and overall system headroom is improved. Since woofers require more power than tweeters, high frequency energy is not "sapped" by the demands of the woofer. In fact, a smaller (lower power) amplifier may be used in the high frequency part of the system. Since levels can be set for each individual frequency band, as can crossover frequency, precise system calibration is possible.

By using an active electronic crossover network placed ahead of the amplifiers, you completely isolate the low and high frequency sections. Distortion generated in the low frequency section when it is driven hard at low frequencies goes only to the woofer where it is rolled off, and not to the tweeter, where it would be very audible. This means that you can run your system harder, and it will be loud and clean!.

Using An Electronic Crossover Network

Since electronic crossover networks give the user control over each individual level, crossover frequencies, and other features, the user has to know how to set up the system properly in order to achieve optimum results. While an electronic crossover can be used to make a system sound better, misuse can really muck up the works! Most manufacturers of speaker systems provide detailed specifications on power capacity and frequency range, and often suggest a crossover frequency. If they do not, look at the spec sheet to find out what frequency the manufacturer used for the passive crossover, and start there.

IMPORTANT NOTE! There is a real danger in setting the crossover frequency too low, as you can easily damage your tweeter (or compression driver). If no spec is available, for a two way system, start at around 2500 Hz, and then move the crossover frequency down, **never going below 700 Hz.**, which is about the minimum a horn and driver will support. Be aware that the woofer will probably only give good response to about 2 to 3 kHz at the most, and also be aware that the directional characteristics of the woofer will change, narrowing significantly before it reaches 2 kHz, thus providing uneven coverage. The high frequency coverage will be determined by the coverage angle of the horn (usually 90 degrees horizontal by 40 degrees vertical).

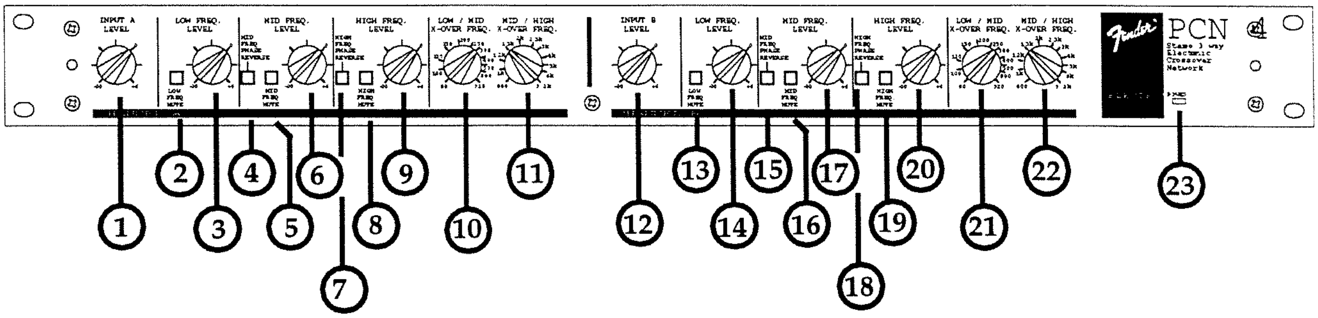
An alternative might be to use the system tri-amped, using a full range cabinet in conjunction with a subwoofer, like the new Fender SPL Tour Series 118s or 215s. Set the crossover frequency between the subwoofer and the full range speaker at around 100 to 150 Hz., and the crossover frequency between the woofer and the horn/compression driver at between 1250 to 2500 Hz. There is no substitute for using your ears, and varying the crossover frequency very gradually to find the best point.

As far as the level controls on the crossover are concerned, start with both the input level, and the output level for each band in the unity gain position. Unity gain means that the output signal from the crossover bands will be identical in level to the full range input fed into the crossover. On the Fender PCN-4, this is indicated with a 0. Once you have set the crossover frequency, and started with the levels at unity, adjust the individual levels for each band, by turning them down until the system is balanced. The reason for turning them down instead of up is so you do not cut into the output headroom of the crossover.

Electronic crossover networks also have a slope to the filters (how fast the frequencies fall off). This can be 6 dB per octave (first order filter), 12 dB per octave (second order filter), 18 dB per octave (third order filter), or 24 dB per octave (fourth order filter). The choice of a crossover slope is related to system response smoothness, and driver excursion limitations. With some systems, a 12 dB per octave slope may sound all right, but with most systems the best results will be achieved with a 24 dB per octave slope. The best type of crossover for most applications is the Linkwitz-Riley, Fourth Order, 24 dB per octave circuit topology (which is what the PCN-4 is based on).

The PCN-4 also provides constant directivity horn equalization (which provides a gradual high frequency boost to compensate for the rolloff inherent in CD horns). Consult your horn manufacturer to determine whether it is needed in your application. The CD boost is +3 dB per octave starting at 3.5 KHz, rising 6 dB per octave to 22.5 KHz.

Front Panel Features



1. Channel A Input Level.
This control varies the input to the first channel of the PCN-4. It is variable from infinity to +6 dB above unity gain. When this control is set at the 0 position, it is at unity. This control works in the stereo two way mode, and also in the mono three way mode, where it then acts as the input level for the entire system.

2. Channel A Low Frequency Mute Switch
On the PCN-4, mute switches are provided to kill (turn off) each individual band, in order to help with system set up and calibration. Be carefull to never mute any band with signal playing through the unit, as a small signal transient can result, which could damage certain drivers.

3. Channel A Low Frequency Output Level Control.
This control varies the Channel A low frequency output. When it is turned to the 0 indicator, it is in the unity gain position. This control is variable from infinity (off) through unity gain, to 6 dB of gain above unity fully clockwise.

4. Channel A Mid Frequency Phase Reverse Switch
This switch changes the phase of the channel A mid frequency bandpass output. When the switch is out (not depressed), the output signal is in phase with the input signal. When the switch is engaged (pushed in), the output signal is 180° out of phase with the input signal.

5. Channel A Mid Frequency Mute Switch
Turns the channel A midrange bandpass output on (not depressed) and off (depressed)to aid in system calibration.

6. Channel A Mid Frequency Output Level Control.
This control varies the Channel A mid frequency output. When it is turned to the 0 indicator, it is in the unity gain position. This control is variable from infinity (off) through unity gain, to 6 dB of gain above unity fully clockwise.

7. Channel A High Frequency Phase Reverse Switch
This switch changes the phase of the channel A high frequency bandpass output. When the switch is out (not depressed), the output signal is in phase with the input signal. When the switch is engaged (pushed in), the output signal is 180° out of phase with the input signal.

8. Channel A High Frequency Mute Switch
Turns the channel A high frequency bandpass output on (not depressed) and off (depressed) to aid in system calibration.

9. Channel A High Frequency Output Level Control.
This control varies the Channel A high frequency output. When it is turned to the 0 indicator, it is in the unity gain position. This control is variable from infinity (off) through unity gain, to 6 dB of gain above unity fully clockwise.

10. Channel A Low/Mid Crossover Frequency Control.
This control varies the crossover frequency between the low and mid frequency bands on channel A. This control is variable, and covers the range from 80 to 920 Hertz.

11. Channel A Mid/High Crossover Frequency Control.
This control varies the crossover frequency between the mid and high frequency bands on channel A. This control is variable, and covers the range from 800 Hz. to 9.2 KHz.

12. Channel B Input Level.
This control varies the input to the second channel (channel B) of the PCN-4. It is variable from infinity to +6 dB above unity gain. When this control is set at the 0 position, it is at unity.

13. Channel B Low Frequency Mute Switch
Turns the channel B low frequency bandpass output on (not depressed) and off (depressed to aid in system calibration.

14. Channel B Low Frequency Output Level Control.
This control varies the Channel B low frequency output. When it is turned to the 0 indicator, it is in the unity gain position. This control is variable from infinity (off) through unity gain, to 6 dB of gain above unity fully clockwise.

15. Channel B Mid Frequency Phase Reverse Switch
This switch changes the phase of the channel B mid frequency bandpass output. When the switch is out (not depressed), the output signal is in phase with the input signal. When the switch is engaged (pushed in), the output signal is 180° out of phase with the input signal.

16. Channel B Mid Frequency Mute Switch
Turns the channel B midrange bandpass output on (not depressed) and off (depressed to aid in system calibration.

17. Channel B Mid Frequency Output Level Control
This control varies the Channel B mid frequency output. When it is turned to the 0 indicator, it is in the unity gain position. This control is variable from infinity (off) through unity gain, to 6 dB of gain above unity fully clockwise.

18. Channel B High Frequency Phase Reverse Switch
This switch changes the phase of the channel B high frequency bandpass output. When the switch is out (not depressed), the output signal is in phase with the input signal. When the switch is engaged (pushed in), the output signal is 180° out of phase with the input signal.

19. Channel B High Frequency Mute Switch
Turns the channel B high frequency bandpass output on (not depressed) and off (depressed) to aid in system calibration.

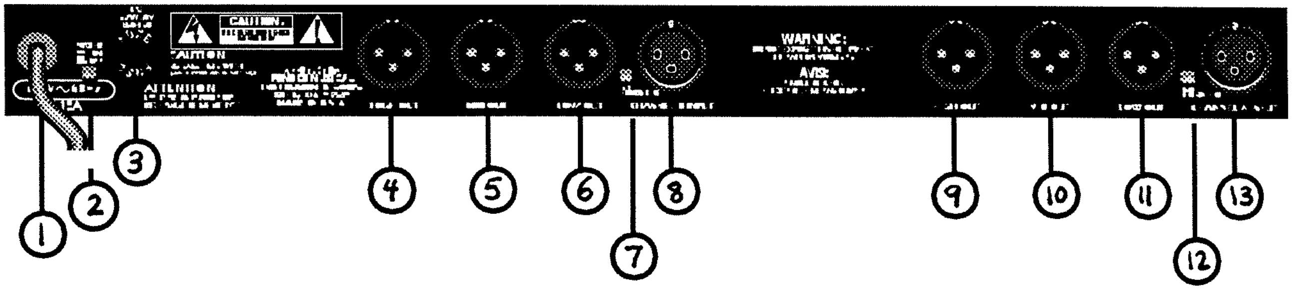
20. Channel B High Frequency Output Level Control.
This control varies the Channel A high frequency output. When it is turned to the 0 indicator, it is in the unity gain position. This control is variable from infinity (off) through unity gain, to 6 dB of gain above unity fully clockwise.

21. Channel B Low/Mid Crossover Frequency Control.
This control varies the crossover frequency between the low and mid frequency bands on channel B. This control is variable, and covers the range from 80 to 920 Hertz.

22. Channel B Mid/High Crossover Frequency Control.
This control varies the crossover frequency between the mid and high frequency bands on channel B. This control is variable, and covers the range from 800 Hz. to 9.2 KHz.

23. Power On LED
This lights up green when the PCN-4 is on.

Rear Panel Features



1. A.C. Mains Line Cord.
For domestic (U.S.A.) units (model numbers 071-5510-000), this should only be plugged into 120 V.A.C., @ 60 Hz. Do not plug this into any other voltage, or damage will result.

For export models (model numbers 071-5510-030, 071-5510-040, 071-5510-050, 071-5510-060), the primary mains voltage can be between 220 V.A.C. @ 50 Hz. to 240 V.A.C., @ 50 Hz. Do not plug these units into any other voltage or damage may result.

2. Power On/Off Switch
This turns the unit on and off. Early models of the PCN-2 do not have this switch. Instead, a screw is installed where the switch hole is.

3. A.C. Mains Fuse
In case of failure, replace only with the same type of fuse, as indicated.

4. High Out Channel B
Feed this output into the input of the channel B high frequency amplifier. This is a male 3 pin XLR style jack with a balanced output. This output is fully balanced and floating. If you wish to use this output unbalanced, you should tie the unused pin (either 2 or 3) to ground (pin 1 of the XLR connector). No reduction of signal level will occur, and no headroom will be lost.

5. Mid Out Channel B
Feed this output into the input of the channel B mid frequency amplifier. This is a male 3 pin XLR style jack with a balanced output. This output is fully balanced and floating. If you wish to use this output unbalanced, you should tie the unused pin (either 2 or 3) to ground (pin 1 of the XLR connector). No reduction of signal level will occur, and no headroom will be lost.

6. Low Out Channel B
Feed this output into the input of the channel B low frequency amplifier. This is a male 3 pin XLR style jack with a balanced output. This output is fully balanced and floating. If you wish to use this output unbalanced, you should tie the unused pin (either 2 or 3) to ground (pin 1 of the XLR connector). No reduction of signal level will occur, and no headroom will be lost.

7. Channel B - C.D. Horn Equalization Switch
This switches the C.D. Horn Equalization in (when pressed in)and out (when the switch is in the out position.

8. Channel B Input
Use this balanced female 3 pin XLR style jack for the channel B input. It may be used with an unbalanced input as well.

9. High Out Channel A
Feed this output into the input of the channel A high frequency amplifier. This is a male 3 pin XLR style jack with a balanced output. This output is fully balanced and floating. If you wish to use this output unbalanced, you should tie the unused pin (either 2 or 3) to ground (pin 1 of the XLR connector). No reduction of signal level will occur, and no headroom will be lost.

10. Mid Out Channel A
Feed this output into the input of the channel A mid frequency amplifier. This is a male 3 pin XLR style jack with a balanced output. This output is fully balanced and floating. If you wish to use this output unbalanced, you should tie the unused pin (either 2 or 3) to ground (pin 1 of the XLR connector). No reduction of signal level will occur, and no headroom will be lost.

11. Low Out Channel A
Feed this output into the input of the channel A low frequency amplifier. This is a male 3 pin XLR style jack with a balanced output. This output is fully balanced and floating. If you wish to use this output unbalanced, you should tie the unused pin (either 2 or 3) to ground (pin 1 of the XLR connector). No reduction of signal level will occur, and no headroom will be lost.

12. Channel A - C.D. Horn Equalization Switch
This switches the C.D. Horn Equalization in (when pressed in)and out (when the switch is in the out position.

13. Channel A Input
Use this balanced female 3 pin XLR style jack for the channel A input. It may be used with an unbalanced input as well.

IMPORTANT NOTE:
When you are using any of the PCN-4's outputs unbalanced, always be sure to ground the unused leg of the balanced line. On a mid or high frequency output, if one side of the balanced line is allowed to float (not grounded to pin one) and the phase revere switch is pushed on, the output could have no signal at all!

Specifications:

Crossover Filter Type: 4th Order State Variable Linkwitz-Riley design, 24 dB/octave slopes
Crossover Frequency Range: Low 80 to 920 Hz., High 800 to 9.2 KHz.

Frequency Response: 10 Hz. to 20 KHz. (+ .5 dB)

C.D. Horn Equalization: +3 dB @ 3.5 KHz. rising 6 dB/octave to 22.5 KHz.

T.H.D.: <.005% THD 20 to 20 KHz. @ +8 dBU (1.95 volts), RL=2Kohms.

Maximum Output Level: RL=2 Kohms, +21 dBU @ <.05% THD 20-20 KHz.

Maximum Voltage Gain: 6 dB

Hum and Noise: <-100 dBU

Signal To Noise Ratio: 108 dB @ +21 dBU

Input Type: Balanced Differential

Input Impedance: 20 kohms

Output Type: Floating and Balanced Line Drivers

Output Impedance: 300 ohms

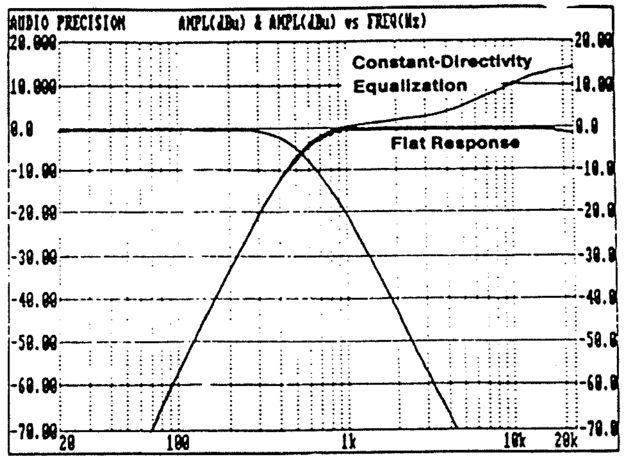
Controls: Input Level continuously variable from +6 dB gain to 90 dB attenuation, Output Level continuously variable from 0dB (unity gain) to 96 dB attenuation.

Dimesions: (WxHxD): 19" x 1.75" x 7.5"

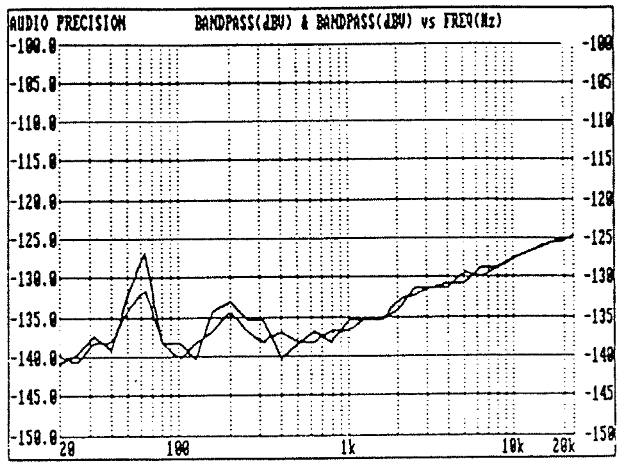
Net Weight: 8 pounds

0 dBu=0.775 v rms

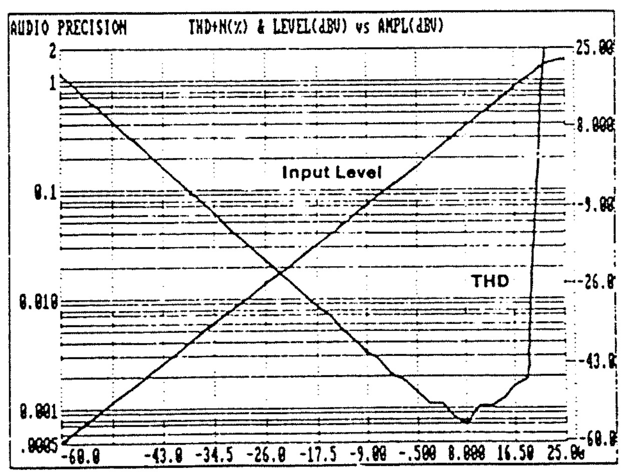
Features, Pricing, and Specifications Subject To Change Without Notice



Flat Response & Constant-Directivity Equalization.



Swept One-third Octave Noise Spectrum @ Unity Gain



Swept THD as a Function of Level.

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ELECTRONICS