

Bi-wiring & Beyond

Innovative wiring and amplification techniques for improving the performance of your hi-fi

A conventional loudspeaker is connected to the amplifier by a single length of two-conductor speaker cable. Like most speakers, the Linn loudspeakers may be installed in this manner. Unlike the majority of speakers however, most Linn models can also be bi-wired.

When bi-wired, the speaker's crossover network is divided into two electrically separate sections (*usually by the removal of a jumper or link on the rear of the speaker*). Two separate speaker cables are then run from the amplifier to each of the loudspeakers. One of these wires connects to the tweeter section of the speaker's crossover, and the other connects to the woofer section of the crossover.

An A/B comparison of the same speaker conventionally wired and then bi-wired will reveal a dramatic improvement in performance. This performance gain is quite startling and often seems to be totally out of proportion with the apparently small change that was made in the wiring of the speaker.

The Signal Path

To see how this performance gain is possible, we need only follow the signal on its path from the amplifier to (*and through*) the loudspeaker.

As shown in Figure 1, the signal travels along the speaker cable from the amplifier to the speaker. Upon reaching the speaker, the signal encounters the speaker's crossover network. A crossover network can contain dozens of components and perform several functions, including level adjustments, time delays, and phase correction. But, for the purpose of examining the effects of bi-

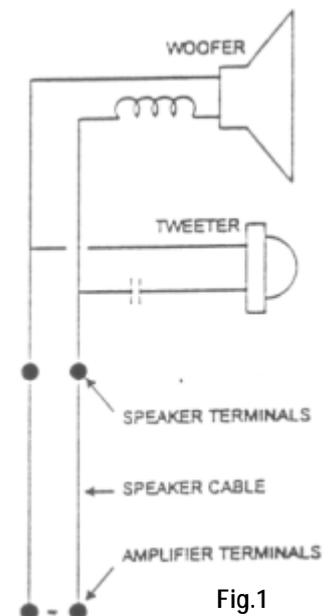


Fig.1



wiring, we need only look at the crossovers' basic function of dividing the signal into the ranges appropriate for each drive unit.

Figure 1 shows a very simple crossover configured for conventional, single-wire operation. It consists of only one capacitor and one inductor, and it routes the high frequencies to the tweeter and the low frequencies to the woofer.

After the signals pass through their respective drive units, they are recombined and share a common return path back to the amplifier. This path includes the ground circuit of the crossover board as well as the return leg of the speaker cable.

Thus, for the vast majority of their travel. The bass and treble signals share the same path. The only time the signals have separate paths is over the very few feet of wire that connect the drive units to the crossover.

Because the bass and treble signals do share the same path, there is an opportunity for the signals to interact. The amount of interaction may actually be quite small relative to the magnitude of the original musical signal. However, since the majority of the energy in a typical musical signal is at the lower frequencies, the bass signal is quite large when compared to the treble signal. Thus, if even a very small portion of the energy of the bass signal interferes with the much smaller treble signal the results can be quite serious.

Bi-Wiring

Bi-wiring virtually eliminates this interaction problem by providing totally separate paths for the bass and treble signals.

It should be noted that to accomplish this it is necessary to do more than just provide two lengths of speaker cable. The portions of the circuit inside the speaker that are usually common to both the bass and treble signals must also be separated. This requires that the crossover be designed in a manner that allows the ground circuit of the crossover board to be separated into two distinct sections. This is generally accomplished by providing removable links or jumpers.

As you can see in Figure 2, once separate speaker cables have been provided and the ground circuit broken, the crossover's capacitor blocks the woofer signal from the *entire* tweeter path. In a similar manner, the low pass section of the crossover prevents the tweeter signal from travelling along the bass path.

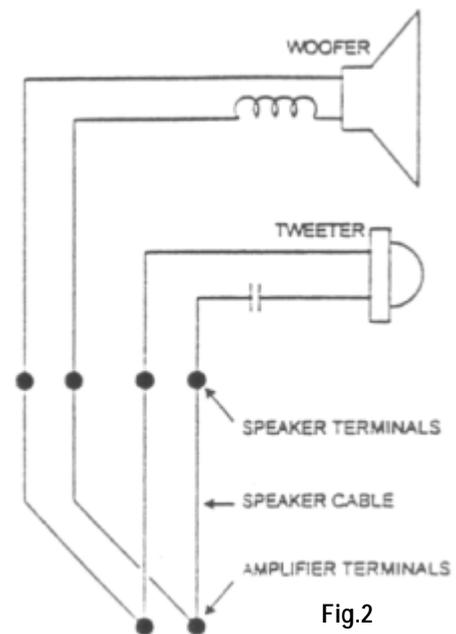


Fig.2



Tri-Wiring

The same techniques that are applied in bi-wiring can be used to tri-wire a loudspeaker with three drivers. The Linn AV5140 or Kaber are good examples of tri-wireable speakers. Removing links on the rear of the speaker electrically isolates the three drivers. This allows three speaker cables to be run to each loudspeaker, providing a separate signal path for each drive unit.

The Next Step

You may want to think of bi-wiring (*or tri-wiring*) as a method of improving the performance of your system in easy-to-manage steps, without the financial losses associated with repeatedly trading in equipment.

The first step, upgrading from conventional wiring to bi-wiring, requires only the purchase of an extra set of speaker cables. Because the cost is so low, you may even want to do this when you initially purchase your speakers.

Once you have bi-wired your speakers you can consider taking the next step to passive bi-amplification. In this configuration, one amplifier supplies the signal to the tweeter section of the speaker's crossover, and a second amplifier is used to drive the woofer section.

This technique not only provides more power, but also results in better control of the drivers and reduces any possibilities for interaction between the woofer and the tweeter. The result is a significant improvement in the musical performance.

We use the term passive bi-amplification because the filters provided by the speaker's original passive crossover network are still being used.

Active Multi-Amplification

In many of the Linn loudspeakers, further improvements are possible by taking yet a third step, replacing passive multi-amplification with active multi-amplification. This eliminates the speaker's passive crossover entirely by substituting a Linn Aktiv electronic crossover ahead of the amplifiers.

By removing the passive crossover from the circuit path and more closely coupling the drive units to the power amplifier, Aktiv operation delivers more power to the loudspeaker and more accurately controls the movements of the drive units.



When using a passive crossover, the power necessary to operate the crossover is actually provided by using part of the energy in the musical signal. With Aktiv operation, all signal processing is done in an active (i.e. powered) circuit prior to final amplification, eliminating the power drain caused by the passive crossover.

In addition, shaping and controlling the signal while it is still at line-levels provides the opportunity to use significantly more sophisticated crossover techniques. This results in better filtering and more accurate amplitude, phase, and time response. The flexibility of an active system also enables the system to be tuned to suit the room.

Cable

To simplify multi-wire and multi-amplifier installations, Linn manufacture speaker cable specifically designed for multiple runs. Use Linn K600 for tri-wire applications and K400 where bi-wiring is required. Linn K20 is also available where conventional single wiring is to be used.

