



# A Guide to Wadia Technology

Direct-Connect Technology

# Wadia Direct-Connect Technology

One of the greatest advantages of digital audio is that a music signal, once converted to digital, can be processed with little loss of information or added noise. Analog circuitry, no matter how well executed, adds significant distortion and removes musical detail. From this realization, a rule-of-thumb for high-performance emerges:

Minimize analog processing by keeping the signal in the digital domain for as far along the audio chain as possible.

In 1992, Wadia developed the Direct-Connect system for integrating CD playback into high quality audio systems. With Direct-Connect, the CD playback system can be connected directly to the power amplifier, eliminating the analog preamplifier from the audio chain, and more completely approaching the theoretical ideal than any other system currently available.

Following is an overview of the methods for integrating digital playback into high-end systems, including a comparison between the most common systems and Wadia's Direct-Connect.

## The Early Days of Digital Audio

Originally many digital audio manufacturers — including Wadia — designed CD playback systems to connect to a preamplifier, as shown below.

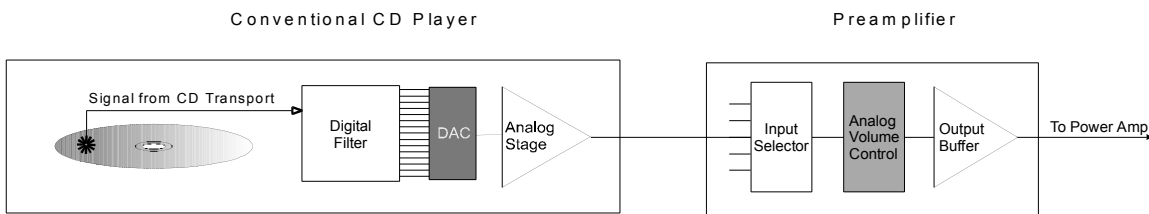


Figure 1. A Conventional CD player connected to a preamplifier.

This approach has several advantages. First, these digital audio components can be easily integrated into existing analog systems because they work like existing line-level sources. Also, this method ensures good matching between the preamp and power amp, since existing high-quality preamplifiers provide sufficient output to drive long or high capacitance cables and low-impedance amplifier inputs.

An additional little-known benefit of this arrangement is the ability of the preamp to protect the system from high-frequency noise. Digital equipment, particularly less-sophisticated designs, can create high-frequency noise that contaminates the analog signal, causing audible degradation. Many preamps, particularly vacuum-tube units, reject high-frequency noise by limiting high-frequency response.

The primary disadvantage of this preamp-based system is the sonic losses that inevitably occur with complex analog circuitry. Better preamps can reduce the sonic degradation, but even the finest designs available cannot eliminate the losses of analog circuitry. In addition, the cost of this type of system can be very high. The better the preamp, the less degradation, but the greater the cost. A preamp of sufficient quality can cost as much or more than the digital playback equipment.

## The Second Step: Built-in Preamp

To overcome some of the shortcomings of the preamp-based systems, several manufacturers introduced digital components that incorporated the functions of a preamp, as shown below.

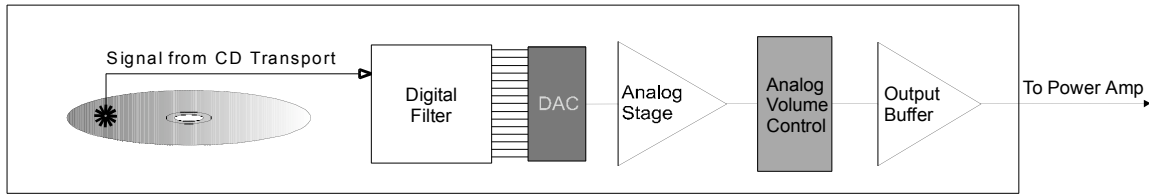


Figure 2. A Conventional CD player with a built-in preamplifier.

This system partially reduces the complexity of a preamp-based system by eliminating cables and connectors required to connect to the preamp. It also reduces cost by combining the preamp and digital circuitry into the same chassis. However, there are drawbacks as well:

1. High-frequency noise contamination  
In the vast majority of these designs, the digital and analog circuits are powered by the same power supply. This allows digital noise to pass through the power supply to the analog output and directly into the power amplifier, degrading sonic performance.
2. Low-output buffer  
Derived from the same technology as standard CD player output stages, the output buffer on many of these units does not have sufficient voltage or current capability to properly drive a power amplifier.
3. Analog circuit complexity  
This configuration has the same *circuit* complexity as a preamp-based system

Recently, several manufacturers have introduced CD players and D-to-A converters with built-in remote-controlled volume controls that appear to be digital. Some of these designs are actually *digitally operated* analog volume controls. These systems suffer from the same — or greater — performance degradation as conventional analog volume controls.

## “Passive Preamps” - One step forward, one step back

In another attempt to simplify digital playback systems, so-called “passive preamps” — with an input switch and volume control but no active gain or buffer circuitry — were introduced.

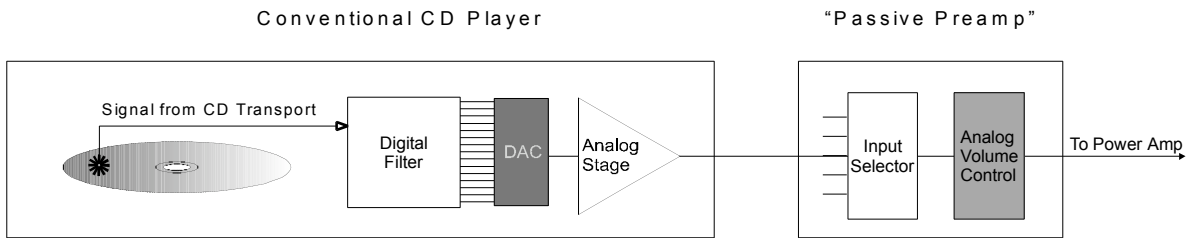


Figure 3. A Conventional CD player connected to a “passive preamplifier”.

Passive preamps do offer great circuit simplicity compared to conventional analog preamps and they cost less than good quality conventional preamps as well. However, with no output buffer to drive the cable and power amplifier, performance is unpredictable and highly variable depending on cable type, volume level, amplifier impedance, and the quality of the CD player’s output buffer. In addition, passive preamps offer no protection from high frequency noise coming from CD player circuitry.

## Wadia’s Direct-Connect System

In 1992, Wadia introduced the first version of Direct-Connect technology — a system designed to allow digital playback systems to be connected directly to a power amplifier with minimal analog circuitry. Since then, Direct-Connect has been refined so that it provides state-of-the art performance in a wide range of systems.

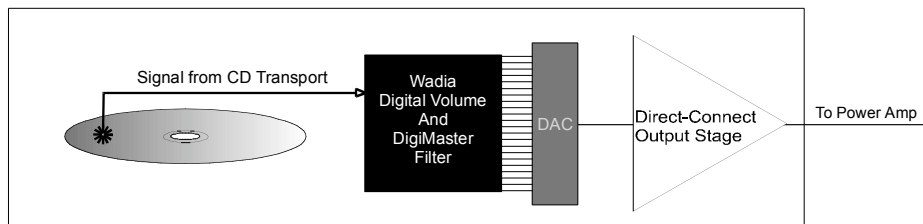


Figure 4. Wadia CD player with Direct-Connect Technology.

There are many features of the Direct-Connect system, each of which is necessary, but not sufficient by itself, for top performance connected directly to the power amp. It is the combination of all these elements that allows the Direct-Connect system to perform at such a high level.

### 1. Digital volume control

In 1992, Wadia developed the first audiophile-quality digital volume control. After years of refinement, it remains the only volume control that delivers the theoretical advantages of volume control in the digital domain, maintaining greater than 16-bit resolution for the majority of its operating range, and using no analog processing.

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2. High-current output stage  
Wadia's output stage can provide up to one-quarter amp (250 mA) of current, to drive very long cables and low input impedance amplifiers
3. High-voltage output stage  
The Direct-Connect output stage can produce up to 9 Volts (depending on which Wadia model), producing sufficiently loud volume levels even in low-sensitivity systems.
4. Low output impedance  
With less than 15 ohms output impedance, the Direct-Connect output stage is unaffected by highly capacitive and low-impedance loads.
5. *NoiseBlock* analog output  
This innovative circuit prevents high-frequency noise from contaminating of the audio chain, but preserves all subtle high frequency musical details.
6. True-balanced output  
Fully-balanced circuit design — with the inverted signal is produced in the digital domain, balanced DACs and analog output — realizes the benefits of amplifiers with balanced inputs.
7. Digital inputs  
Although CD is the reference source for most listeners, Direct-Connect components have provisions for additional digital inputs as well. These allow alternative digital sources, such as Laser disc, DVD, DSS, DAT or Digital FM, to benefit from the Wadia decoding and direct-connection technology. As an alternative, listeners can connect analog sources by using a Wadia analog-to-digital converter.

### Delivering on the Promise of Digital

The Direct-Connect system can eliminate several stages of analog circuitry, the analog volume control, and cables from the audio chain. This typically results in a dramatic improvement in sound quality — particularly in clarity and dynamic impact. The improvement is often described as sounding “closer to the music”, which is literally accurate.

In addition, costs saved by not having expensive analog circuitry allows the CD player to be equipped with higher quality components in other critical areas, such as the DAC, power supply, or transport mechanism. Alternatively, the savings can be used to buy a higher quality amplifier or loud speaker system, improving the overall sonic value of the system.

Wadia's Direct-Connect system brings digital audio an important step closer to its full potential. By eliminating the preamp from the audio chain, the true quality of digital audio is revealed.