

Technical Guide – Low & High Impedance Loudspeaker Circuits

There are two types of loudspeaker and loudspeaker circuit that we can use when designing a sound system. One is “low impedance” and the is “constant voltage, high impedance” or more commonly known as 100v line.

Both systems have advantages and disadvantages, briefly explained below.

Low impedance “8 ohm”

Used for domestic hi-fi systems, professional live entertainment and music systems, car hi-fi and whenever high level playback of music is required. The amplifiers within a low impedance system will generate high current at relatively low voltages; therefore cable diameter is an important factor when designing a low impedance system.

Advantages

- Will produce full range sound (depending on equipment)
- Lower cost for basic setups

Disadvantages

- Cable diameter is a limiting factor in long cable runs
- Odd and multiple numbers of loudspeakers are difficult to fit or design into a low impedance system & require complex impedance matching calculations

High impedance or constant voltage (100v line)

Constant voltage systems are used within commercial and industrial public address sound systems. Best electrical practice is required when installing these types of system as the loudspeaker output from the amplifier is running at a relatively high voltage and low current compared with a low impedance system; therefore cable diameter is less of an issue, and long cable runs can be achieved without considerable loss of power.

Advantages

- Easy to fit odd and multiple numbers of loudspeaker to a single amplifier circuit
- Long loudspeaker circuits can be achieved using relatively thin cable
- The majority of 100v loudspeakers have multiple tapings to enable different volume levels to be set

Disadvantages

- Loudspeaker costs are higher than low impedance versions, especially when considering full range sound. Cheap 100v transformers within loudspeakers will saturate at bass frequencies, so to obtain equivalent sound quality to a low impedance system the loudspeaker transformer needs to be high quality.
- Not really suitable for pro-sound live applications where kilowatts of power are used and reproduction of very low frequencies required.

Loudspeaker cabling

When designing audio systems, loudspeaker cable is often not considered as being as important as the amplifier or loudspeaker to be used. This is a common mistake and more importantly can degrade the performance of the system considerably. There is no point in spending thousands of pounds on high performance loudspeakers and amplifiers unless a quality cable of suitable diameter is used.

This is most important in low impedance systems. Cable diameter and therefore resistance will have a direct effect on the loudspeaker circuit and overall response of the loudspeaker. It can also have a detrimental effect on the power of the amplifier and how it performs.

The following chart shows the size of cable that should be used with low impedance and 100v line loudspeaker loads. 'YES' is shown where the loss of power within the cable is acceptable. 'NO' is shown where the loss is unacceptable and will result in heating the cable instead of powering the loudspeaker.

An acceptable loss is judged to be less than 1dB attenuation in output at the loudspeakers.

Each chart shows the loudspeaker impedance, the power put into that loudspeaker and the recommended diameter of cable for each distance.

The cable length is shown in Metres.

		Cable diameter mm ²							Cable diameter mm ²				
8 ohm 100W input	Cable length m	0.75	1	1.5	2.5	4	4 ohm 100W input	Cable length m	0.75	1	1.5	2.5	4
	5	YES	YES	YES	YES	YES		5	YES	YES	YES	YES	YES
	10	YES	YES	YES	YES	YES		10	NO	YES	YES	YES	YES
	20	NO	YES	YES	YES	YES		20	NO	NO	YES	YES	YES
	30	NO	NO	YES	YES	YES		30	NO	NO	NO	YES	YES
	50	NO	NO	NO	YES	YES		50	NO	NO	NO	NO	YES
	100	NO	NO	NO	NO	YES		100	NO	NO	NO	NO	NO
100v line 100W load	Cable length m	0.75	1	1.5	2.5	4	100v line 400W load	Cable length m	0.75	1	1.5	2.5	4
	50	YES	YES	YES	YES	YES		50	YES	YES	YES	YES	YES
	100	YES	YES	YES	YES	YES		100	NO	NO	YES	YES	YES
	200	YES	YES	YES	YES	YES		200	NO	NO	NO	YES	YES
	300	NO	YES	YES	YES	YES		300	NO	NO	NO	NO	YES
	500	NO	NO	YES	YES	YES		500	NO	NO	NO	NO	NO
	1000	NO	NO	NO	NO	YES		1000	NO	NO	NO	NO	NO