

## A. Introduction

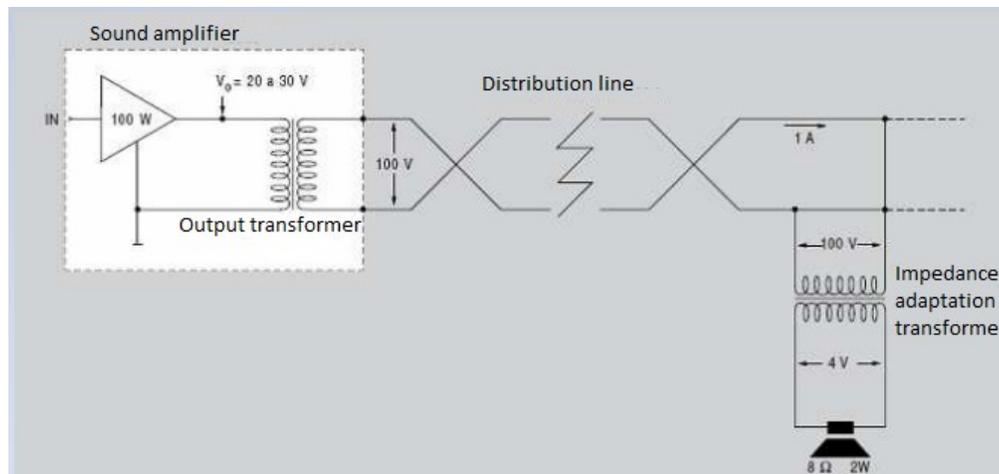
Public address and voice alarm systems are formed by different elements each of which plays a fundamental role in the sound chain. From the input sources, through the analog/digital converters, digital matrix and amplification, to the electroacoustic transducers (speakers), they all play a fundamental role to maintain the integrity and quality of the audio signal.

The purpose of this document is to serve as a handbook for choosing the most suitable wiring for public address and voice alarm installations.

## B. High impedance lines

One of the main parameters to be taken into account in the calculation of the lines is to minimize as much as possible the signal the signal losses that may be generated by the distance, section and material used in the loudspeaker lines. In low impedance lines it is important to take into account the resistance of each speaker so that the set series/parallel does not exceed the nominal impedance of the amplifier.

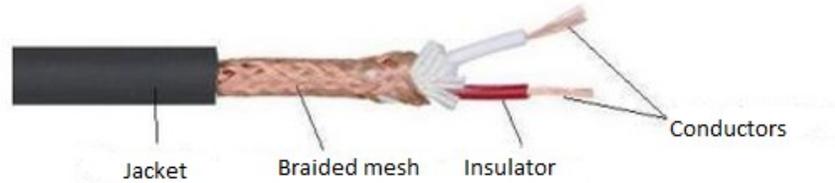
To simplify the calculations and limit the power losses, a system called *constant voltage line* or *high impedance* was developed, which works using an audio transformer to raise the output voltage of the amplifier to a higher level (100V), thus reducing the current flowing through the cables. This process involves reducing this voltage again through another transformer down to the necessary value upon reaching the loudspeaker, depending on the impedance and the power of the latter.



These transformers must work in the frequency range of the audio signal, that is, from 20 to 20KHz.

## C. Types of cable

Cables are made out of four different parts: the external protection/jacket, the mesh/metallic shield, the insulation and the conductor.



The mesh or shield is used for reducing the electromagnetic interferences that exist in the environment due to the emissions of radiofrequency devices and disturbances generated by electrical and electronic devices. This protection system consists in the use of conductive material that surrounds the signal conductor(s) in such a way that it provides a low impedance path for electromagnetic interferences.

Depending on the composition, we differentiate three types of wiring in public address:

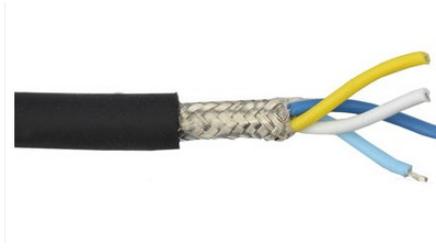
- **Twisted pair cabling:** it has the advantage that when interconnecting the conductors, a certain rejection of electromagnetic interferences occurs.



- **Conductor with mesh or coaxial:** it has a high degree of protection against electric and magnetic fields thanks to the mesh.



- **Pair of conductors wound with mesh:** it has the advantages of twisted pair of conductors in addition to having the mesh that intercepts electromagnetic fields.



## D. Wiring choice

For choosing the most appropriate wiring for the public address system, the following parameters must be taken into account (among others):

- **Electrical protection regulations:** public address lines work with a voltage up to 100V so there is a need for greater electrical insulation requirements. This voltage can not be considered “Very Low Voltage”, because it exceeds the 50 Vac limit. So the materials required by the Low Voltage Electrotechnical Regulation (REBT) and its corresponding Complementary Technical Instructions (ITC-BT-01 to ITC-BT-52) must be used in wiring, as well as Standard UNE 20.460, especially in public places of attendance (ITC-BT 028: Installations in public places).
- **Voice alarm systems regulations:** it must comply with EN 50575, the 100V cable is considered an electric cable and therefore must be Cca, that is, it will be of the minimum fire reaction class Cca-s1b, d1, a1. The cables with characteristics equivalent to those of the UNE 21123, parts 4 or 5, or to the UNE 211002 standard (depending on the assigned cable voltage) comply with this requirement.
  - Non-propagating flame UNE-EN 60332-1
  - Halogen-free UNE-EN 50267-2-1 / IEC 60754-1
  - Low smoke opacity UNE-EN 50268 / IEC 61034
  - Low corrosivity of gases UNE-EN 50267-2-2 / IEC 60754-2
- **Electromagnetic Interference in the installation:** the choice of a shielded cable type or not depends on the possible electromagnetic disturbances that may be induced in the installation. Thus, if the channeling of our wiring is proper and free of external interferences, we can opt for a twisted pair. If, on the contrary, our public address system is shared with another installation (for example, low voltage), the use of shielded cable is recommended.

## E. Methods to reduce electromagnetic interferences

In industrial environments, electromagnetic emissions can induce interference in the elements of the public address system and, consequently, equipment damage (especially in amplification), so it is advisable to protect the lines from these disturbances.

The following measures are proposed to reduce such interference:

1. Install the wiring through separate conduits or in different cable trays
2. If the wiring must cross a power line, it should do so, as far as possible, at an angle of 90 degrees maintaining the maximum possible separation.
3. Prevent loops from forming in the wiring, it must be installed as straight as possible.
4. Using a shielded twisted pair cable to carry the audio signal minimizes electromagnetic interference. If a shielding is used, a way is provided so that the current generated by the possible electromagnetic interference flows towards the ground.
5. Connect one end of the shield to ground, preferably to the ground point that has the least electrical noise.
6. Minimize the length of unshielded cables from the control room and verify that the exposed wires remain well braided throughout their trajectory to the connection points.

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Please contact LDA support department for more information

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