Network: lights in the theatre
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Topic: Educational Lighting Site

Thin-net Advanced Thin-net Thick-net
Twisted pair Optical fibres Mixed solutions

In big theatres it is indispensable to verify the necessity of installing a lighting system connected to a network that branches in all the rooms of the theatres

The saying "time is money" is particularly true for theatres. Increasingly higher labour costs and the cost of the rental of appliances impose a careful design work in the construction of new theatres and in the restructuring of existing ones in order to minimize running costs. A network certainly allows to reduce the costs of preparation and management of a theatrical show by permitting the use of a few control consoles simultaneously. A typical example is the preparation of a show that requires both traditional and motorized lights. When the light designer recalls the memories, the console operator records them on the console in the lighting direction room, while the memories of the motorized lights, also recalled by the light designer, are memorized by an operator on a special console always connected to the main system located in the direction room. At the same time, the electricians can use a device to adjust the position of the lights on the stage without interfering with the creation of the memories. All these activities are controlled by the light designer from his/her own station equipped with monitors that visualize all the operations that are being carried out. If all this is to be effected simultaneously and with the possibility of using the various consoles and monitors in all the different stations without any limit, then it is indispensable to do it in a simple and economic way, i.e. by connecting the whole lighting control system to a network.

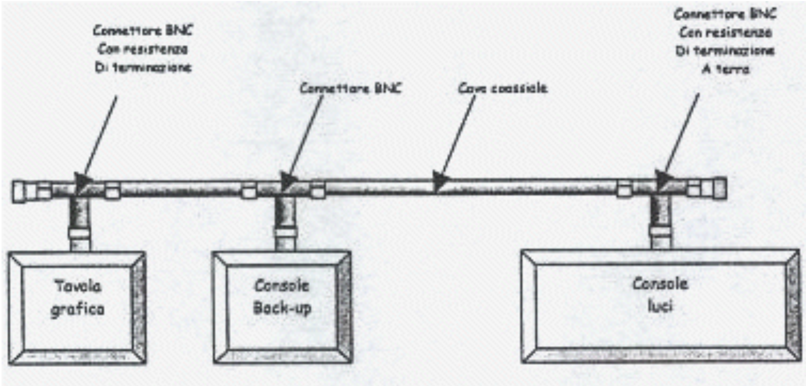
All networks for lighting control are commonly based on the IEEE802.3 standard generally known as Ethernet. It is also indispensable to remember that although Ethernet is a communication protocol normally used in personal computers networks, it is not possible to insert appliances in other cases of Ethernet networks or even on specific networks for lighting systems. A lighting network comprises, fundamentally, three components: the branch points are separate appliances equipped with input and output connectors, while transceivers are normally incorporated inside the consoles that can be connected to the network. The cable is the network component that characterizes the type of network, which can be briefly classified into four types: thin-net, thick-net, twisted pair and optical fibres. The choice among these four possibilities of network connection is linked to the kind of equipment to be connected and its disposition inside the theatre.

Torna all'inizio

Thin-net

The minimum network is based on the thin-net. In this case the total development of the net must not exceed 180 metres. Up to 30 devices can be connected to this net, among them repeaters and concentrators. The thin-net is certainly the most economic solution also because it uses a Belden9907-type coaxial cable and BNC connectors. Equipments are directly connected to the net with "T" BNC connectors and there must be at least 50 cm of cable between two devices. Each segment of the thin-net must be terminated on both extremities with 50ohm resistances, one of which must be earthed.

Example of thin-net network



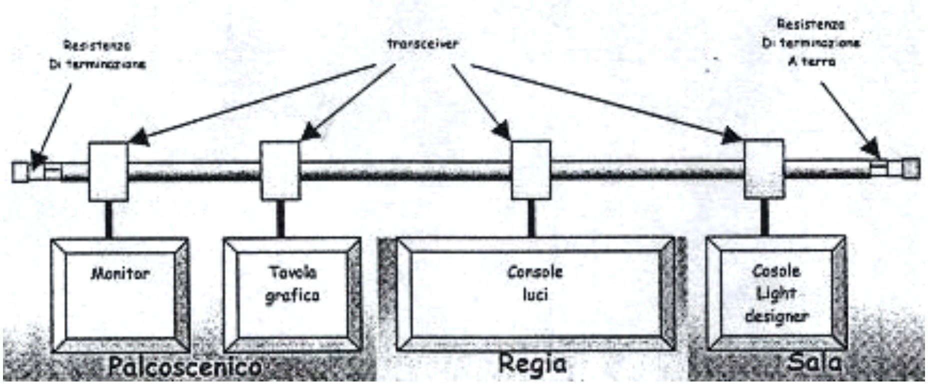
Torna all'inizio

Advanced Thin-net

With permanent installations it is preferable not to connect appliances directly to the net, but to have wall sockets that include end connectors and resistances to which it is possible to connect a provisional Belden222675-type cable. In this case all the problems caused by the connection of the net with end connectors and resistances are avoided, while the total length must take into consideration even the double length of the provisional cables.

Thin-net

When the total length of the net exceeds 180 metres, but does not reach 450 metres, it is advisable to employ the thick-net, which is quite similar to the thin-net except for the (Belden9880-type) coaxial cable which is thicker and more rigid and thus more difficult (and expensive) to install. Transceivers with DB15-type sockets are used to connect the equipment to the net, appliances are then connected to the transceivers by means of Belden49780 or 49781-type provisional cables. In this case the limit of the length of the provisional cable is 45 metres, each segment of the thick-net supports up to 100 transceivers, but since the transceivers can have 1,2, or 4 gates, a maximum of 400 devices can be connected to it.

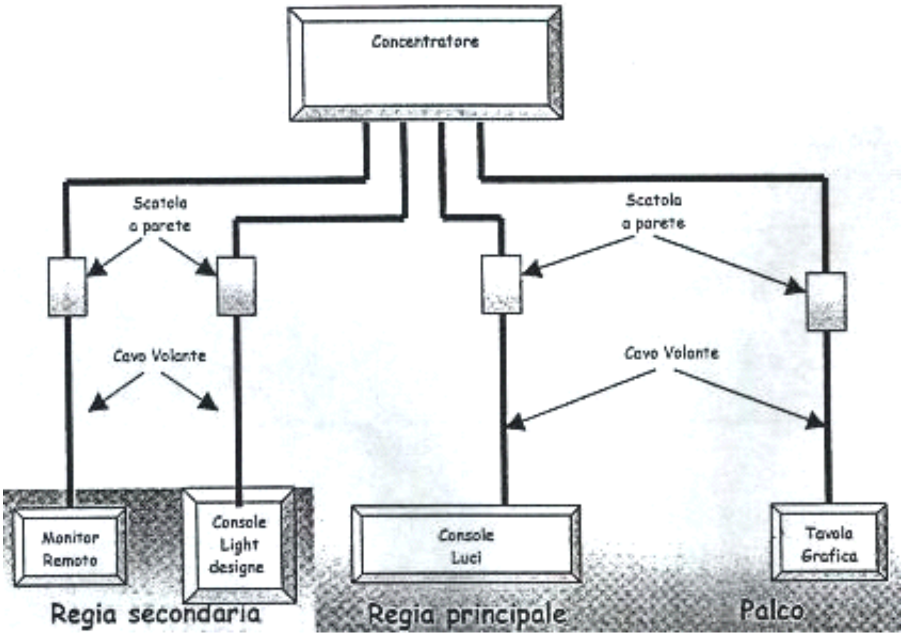


Torna all'inizio

Twisted pair

In the case of non fixed installation or when the economic factor is critical, it is possible to adopt the twisted pair. This network has a delta form with a concentrator in the middle that is connected to eight or twelve wall sockets by means of a Belden1583A-type twisted pair, the twisted pair cable is connected to the concentrator that is used for the provisional cables between the wall socket and the appliance. The advantage of this solution is certainly represented by the limited cost and the ease with which a fault is detected since each branch is directly connected to the concentrator. The disadvantages are represented by the limited number of devices that can be connected to it (8 or 12 according to the concentrator) and by the fact that the maximum length between the concentrator and the device can only reach 100 metres.

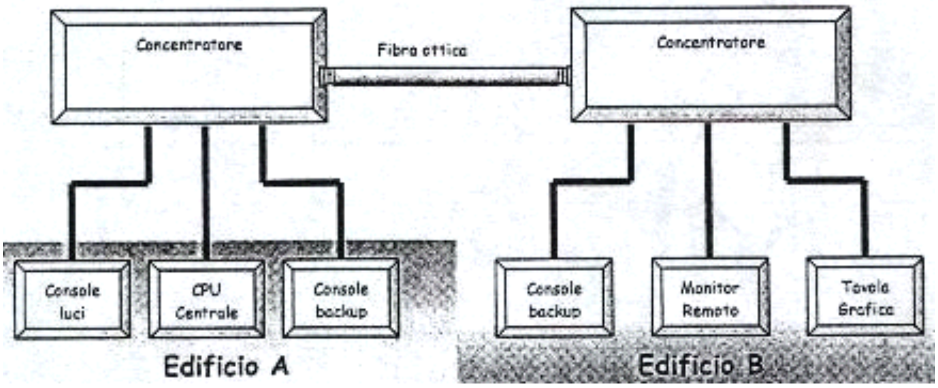
Example of twisted pair network



Optical fibers

When the length of the cable exceeds 450 metres optical fibres are usually employed, as they can have segments that reach up to three kilometres. These installations are normally used in big theatres and in cases in which the network must connect different buildings. The main disadvantage of this net is certainly the high cost of both the cable and the qualified technicians indispensable for the installation. The advantages, on the contrary, are numerous, starting from the extremely high electrical insulation that protects it from atmospheric discharges. The optical fibres system is normally used together with a network that also employs other kinds of cables, for instance an optical fibres (Belden227302-type) segment that connects two concentrators that in their turn are the central point of twisted pair nets.

Example of twisted pair/optical fibres network



Torna all'inizio

Mixed solutions

In many cases the best solution does not consist in a single network segment, but in different segments of different types of nets. In these cases, both repeaters and concentrators are used. Repeaters allow to increase the total length of the network, while concentrators are substantially repeaters which make possible the connection of two net segments. Since these devices are electronically active, they require a power supply and in the case of fault all the segments that depend on them for communication remain isolated. All kinds of network can be combined in countless configurations provided that IEEE802.3 regulations are complied with. All regulations on Ethernet connections can be summarized in the regulation called 5-4-3 which establishes that: there cannot be more than 5 segments between two distant devices, there cannot be more than 4 repeaters or concentrators between two distant devices, there cannot be more than 3 populated segments (segments to which devices are connected) in each net.

Example of the right application of regulation 5-4-3