Last month I was invited to see a show in Rio de Janeiro when I noticed a moving light that was rocking back-and-forth and flashing in a scene where it should not have been on at all. That got me thinking about how that light might have been connected to the lighting table. It had to be controlled by DMX. But how was it circuited?

The use of DMX in all productions, whether it is in theatre, dance or concerts has been increasing since the standard was adapted in 1986. Prior to that time, there were an amazing number of new companies manufacturing innovative technologies for lighting. Each new device, like the Vari*Lite, electronic dimmers, color scrollers and smoke machines would use their own type console and connections to control each device. For example, manufacturers of analog electronic dimmers were using the Cinch-Jones plug to directly connect them to a two-scene preset board and color scrollers had their own unique control boards. Vari*Lite's original custom-built consoles looked like a science project!

Before DMX, no manufacturer wanted to use another manufacturer's technology, and every equipment manufacturer wanted to keep secret "how" their systems worked. This meant that you needed a specialty control board for each type of equipment you wanted to use. In practice, it would also mean that you needed to hire an electrician with at least 3 arms. (This type of technician is difficult to find and very expensive!) It quickly became clear that this situation needed to be changed. And that's why the United States Institute for Theatre Technology (USITT) created and then offered a standardized protocol for equipment manufacturers to use. It became know as the DMX512 protocol.

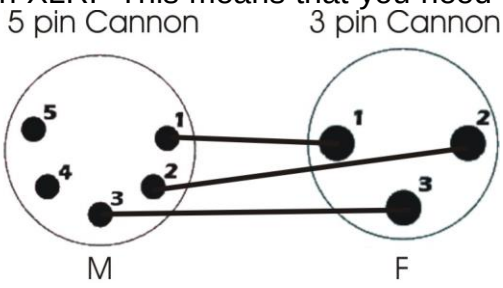
What is the DMX512 protocol? DMX stands for **D**igital **M**ultiple**X**ed. The information for each control channel is transmitted in digital form and sent through a cable. The speed at which this takes place is so fast that it seems instantaneous. Essentially, the information is sent as one package of data containing two parts. The first part is the channel number and the second part is the value (or intensity).

With the introduction of computerized lighting consoles, it became possible to connect with DMX, the dimmers, scrollers, special effects machines (like foggers and hazers) and moving lights together to create technically complex and beautiful scenes on stage.

But this technology also had technical tribulations. The simplest is that DMX can only travel 100 meters before the signal weakens. And a weak signal means that lights and effect machines may not respond when you want them to. Or worse they will do something you do NOT want them to but cannot stop. Therefore you need rules to set-up DMX properly.

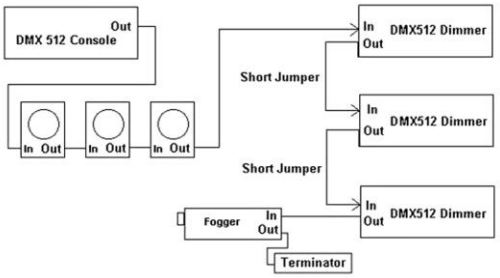
The rules are simple really. You need to use 5-pin XLR plugs because most lighting consoles use them as output for the DMX signal and most equipment use the 5-pin XLR plug as well. But there are exceptions. The most frequently used non-standard XLR

plug, used by many brands of moving lights, are 3-pin XLR. This means that you need to buy or build a converter from a male 5-pin to a female 3-pin plug. Take a look at drawing #3 for the correct pin connections. Pin #1 on the male plug is connected to pin #1 on the female plug. Likewise pin #2 on the male is connected to pin #2 on the female. Pin #3 is connected the same way. Pins #4 and #5 have never been used with DMX although some scroller manufacturers have used them to supply power to their scroller motors.



The temptation after that would be to use standard microphone cables because they use 3-pin XLRs at both ends. But if you use microphone cables you will be placing your DMX signal at risk because they do not have the electrical characteristics that DMX requires. DMX needs a cable that has an impedance of 120Ω and a capacitance of no more than 40 pF per meter. Essentially, this means that you need cable that uses a larger gauge than what is commonly used in microphone cables.

But it is more than just the length of the cable or the quality of the wires that create the best environment for a DMX signal. DMX is a serial control system. This means that the signal comes from one location (the lighting console) and passes from one device (DMX In) through another (DMX Out) for a maximum total of 32 devices. You should NEVER use a Medusa (two-fer) to split a DMX signal.



On the last instrument will you need to place a terminator. This is simply a male 3-pin or 5-pin plug that has a 120Ω resistor soldered between pins #2 and #3. When you use the end cap on the last DMX device you are closing the DMX circuit. This keeps the signal strong within the DMX line. I know many electricians who keep spare terminators in their pockets when setting up a show. (You always seem to need one when you are on top of a ladder or walking on a hung truss over a stage.)

What do you do when your lighting console is more than 100 meters away from you first DMX device? There are two things you can do. The first is to use a DMX Opti-splitter. This device is a signal amplifier that allows you to take one DMX line and split it into 4 or 8 DMX lines. Each line after the splitter can then be as long as 100 meters containing a maximum of 32 devices. This type of system is perfect for most theatrical situations. It is known as a single universe system and uses a maximum of 512 DMX channels. If you need to add a second universe, you would then also need to have a second Opti-splitter.

Another way to defeat the 100 meter limitation is to use wireless DMX. This type of system uses a transmitter at the lighting console and a receiver somewhere on stage where it can then be connected to an Opti-splitter and/or DMX cable which sends the signal to the various devices backstage. On truly large productions you might even want to have a DMX receiver on every truss hanging in the air. But then you would also need to have separate transmitters near your lighting table for each truss because, as of today, there are only 32 frequencies for wireless DMX systems.

But in most situations you would simply use a single DMX line from your lighting table in the back of the theatre to your lights onstage. Once this cable is backstage, do not put it near any feeder cables. The high amperage of these cables produce a magnetic field that can affect the DMX signal. The effectiveness of cable shielding on low frequency magnetic fields is almost non-existent. To avoid this problem, attach the DMX cables to the dimmers after you have tied the feeder cables in place and before you run the cables out to the lights.

Following these simple guidelines your DMX signal should remain strong and the number of control errors will remain small. Cheat anywhere along the signal pathway and you are inviting trouble for yourself. Live performances have enough unknown variables. But a properly set-up DMX system should rarely give you any problems during your show.

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