



help desk

DMX Dos and Don'ts | By Wayne Howell



DMX512 has been with us for some 30 years. It is a simple and resilient communication protocol that allows a lighting console to control up to 512 channels. Simplicity and resilience aside, it still generates a good flow of support tickets at my company's help desk. So let's look at the technical details and then the common pitfalls . . .

DMX512 describes a lot in its name: the 'DMX' is an abbreviation of Digital MultipleX and means simply that many signals are transferred on a single cable; the '512' means that 512 individual channels, slots or attributes can be controlled.

Back in the late '80s when DMX512 was invented, moving lights with multiple attributes (pan, tilt, gobo, colour) did not exist. Everything centred on single channel intensity - be it a PAR can for a rock tour or a Pat23 in a theatre. The only entity to be controlled was intensity. In modern lighting speak, these are fixtures with a single attribute and a footprint of one. Footprint is an important concept in DMX512, it tells you how many channels the fixture will consume.

This description leads neatly into the first area we see regularly on the support desk - terminology. Different countries and different manufacturers use subtly different terms for the same thing. So here is my translation:

TERMINOLOGY

Channel. This means one of the 512 'things' that can be controlled by DMX. It is a level that can range between 0 and 255 in value. Channels are also called slots or data slots.

Resolution. DMX512 has 8-bit resolution. That means that any given channel level is a number that can be contained in a binary number with eight digits. Most lighting folk do not feel the need to communicate in binary, so this simply means you can achieve 256 different levels for a given channel.

Numerous manufacturers consider this inadequate for functions such as the pan and tilt motion on a moving light. For this reason, the term '16-bit DMX' is often used. In fact, there is no such thing as 16-bit DMX512, this just means that two consecutive channels of DMX512 are used to control a single attribute. A 'pan' attribute of a moving light could be controlled in 16-bit mode by using two consecutive DMX512 channels. These two 8-bit channels are concatenated to provide a 16-bit value. Depending on the sophistication of the console, this may actually be a very high resolution controller for the attribute, or perhaps two faders which control the coarse and fine parts of the attribute.

Refresh Rate. This is the frequency at which DMX512 frames are sent. It is usually expressed in Hertz (Hz) which simply means the number of packets sent per second. For a full size DMX512 packet (containing 512 channels), the maximum refresh rate is approximately 44Hz. Sometimes the refresh rate is quoted in milliseconds (mS), but this is actually the time between two consecutive packets and is referred to as the period. The two descriptions are simply converted as one is the reciprocal of the other (44Hz refresh rate equates to approximately 23mS period).

THE PITFALLS

The pitfalls common to DMX512 installations fall into three of four categories, cable and topology being the most common.

Cable choice is the single biggest cause of problems with DMX512. The problems can be categorised by length, wiring topology and cable choice.

Length is really simple - the maximum is 300m or 1000ft. If you need to go beyond that, then a booster or splitter is needed. The cautious engineer will not run up to the 300m limit. I generally advise using a booster

beyond 250m.

Wiring topology simply means how the different equipment is interconnected; DMX512 is very picky about this. The most important rule is that the DMX512 cable must follow a single path which starts with the lighting console, loops through the fixtures and ends with a terminator.

There must not be any branches - often referred to as 'Y' connections - and the maximum number of fixtures that can be connected to one DMX cable is 32. The reason is that each DMX512 receiver draws a small amount of power from the signal - eventually it runs out. Again, the cautious engineer will not run everything to the maximum. I like each DMX512 cable to have no more than say 25 fixtures.

DMX512 cable choice is actually fairly simple, if one basic rule is followed: DMX512 requires twisted pair data cable. This can be the screened twisted pair cable made for DMX512 by companies such as AC, Belden and TMB, or it can be ethernet cable such as Cat5. The former has the benefit of being most robust in a touring environment; the latter has the benefit of allowing DMX512 to be wired using fast and inexpensive RJ45 connections in an installation environment.

The twisted pair design of the cable is critical to avoiding interference on the DMX signal. It is much more important than the screen, which is why it's fine to use unshielded Cat5.

The use of Cat5 for DMX512 regularly generates two questions; the first is about cable distance. It is often assumed that when DMX512 is sent over Cat5, the ethernet cable distance limit of 100m applies. This is incorrect, the working limit remains 300m. The second concerns the type of ethernet cable. The lighting industry - and to an extent, the IT industry - uses 'Cat5' as a generic term. In fact, we should all really use the term UTP (unshielded twisted pair). Cat5, Cat5e, Cat6 are all types of UTP and are fine to use with DMX512. One type of cable that must not be used is audio cable. Whilst this is usually twisted pair, it is designed to carry low frequency audio and corrupts the digital waveform that is DMX512.

TERMINATION

DMX512 requires that the very end of the cable be terminated - but what does that actually mean and why is it needed? A termination is a resistor that is connected between the data pins (pins 2 and 3 in the 5-pin XLR). It is of value 120ohms and its purpose is to match the cable impedance which allows the signal to see the cable as infinitely long. That in turn stops electrical reflections which will degrade the signal. I often hear technicians say they never bother because it seems to make no difference: bad call!

An often asked question is: "Do unused outputs on a splitter need to be terminated?" The answer is no - there is no benefit and it wastes both power and money.

CONNECTORS

DMX512 uses three conductors of the cable: ground, data minus and data plus. It is usually connected by a five-pin XLR with only the first three pins used. Sometimes a three-pin XLR is used, but this is strictly illegal. It was made illegal to stop people mixing up DMX512 and audio cables.

The RJ45 connector is now commonly used for DMX512 when Cat5 cable is employed. This is a great cost reducer in installations, particularly in patch bays.

FURTHER READING

Recommended Practice, by Adam Bennette.
Control Freak, by Wayne Howell (www.tinyurl.com/AL-control-freak). ☒

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