CONTROL PROTOCOL

INFORMATION

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Current Digital Control Information

DMX 512

First developed in the mid 1980’s as a utility protocol to be used alongside the various proprietary protocols being used by lighting manufacturers, it eventually replaced them and was adopted as a “standard” by USITT in 1986. Several manufacturers resisted adopting the standard, but user demand prevailed and many of them either fell into line or paid for their stubbornness with their own existence. There exists to this day a couple companies who specialize on building converters that take a newer DMX 512 console and allow it to “speak” to dimmer racks made by long forgotten manufacturers. Although DMX 512 is currently being supplanted by Ethernet based control systems, it’s still the most common protocol in use today and is what 99% of what lighting professionals will have to deal with for years to come. It is the standard found on all manner of consoles, dimmers, moving lights and LED effect fixtures.

DMX512 on 5 pin XLR Standard Pinout

The Standard connector for DMX512 is the 5 pin XLR connector [Note 1]. Male is always plugs into the console/controller and female is the device end.

Pin1: Shield. This is the Shield and Ground Reference. This should never be grounded to the shell of the connector because if you were to pick up two DMX connectors that have differing ground potentials, you could get a very nasty (or fatal) shock.

Pin2: Black conductor. DMX 512 Data –

Pin 3: White conductor. DMX 512 Data +

Pin 4: Green conductor. Spare (unused) Data –

Pin 5: Red conductor. Spare (unused) Data +

(Pins 4 and 5 have been abused by some manufacturers for various things over the years, including carrying voltage. This was a very bad idea, and thankfully has fallen out of practice for the most part.)
DMX512 on 3 pin XLR Standard Pinout

The 3 pin XLR was never accepted as a proper DMX512 connector. It is used mostly by some moving lights and cheaper Chinese manufactured lighting equipment. Of course, there is no "proper" pinout, so a few variations where the + and – data were reversed exist. Martin Lighting was the prime offender in "getting it backwards" during the 1990's but they have since changed their ways and have adopted the standard. When using 3 pin XLR for DMX 512 control, the correct pinout is as follows:

**Pin1:** Shield, This is the Shield and Ground Reference. This should never be grounded to the shell of the connector because if you were to pick up two DMX connectors that have differing ground potentials, you could get a very nasty (or fatal) shock.

**Pin2:** Black conductor. DMX 512 Data –

**Pin 3:** White conductor. DMX 512 Data +

DMX512 - Cables

Whenever possible, it is best to use the proper cable for the transmission of DMX 512, as standard microphone cable is not of the correct impedance. Lighting control cables have to be tough enough to survive repeated use, and but also capable of conducting the signal at the appropriate speed. In a pinch, DMX512 will work being conducted along almost any twisted pair cable, standard microphone being a common popular choice among the budget-minded. However it is likely that such applications will be more troublesome than one done using the correct cables. Belden 9842 is the standard for permanent installation while something like Proplex PC224P is a good tough portable cable.

In theory, the length limit of a DMX512 cable (from source to final termination) is about 3200 feet. However, it is never a good idea to push anything to its limits, and multiple shorter runs through something like an optically-isolated splitter is a much better idea.

The 75176 Driver Chip

The SN75176 is a RS-485 transceiver chip, used for both sending and receiving DMX512. All DMX 512 devices including dimmers, consoles, moving, light, effects and processors use this chip. In many devices, (particularly consoles) it can be susceptible to damage from static electricity. They are reasonably priced, therefore it's not a bad idea to have a couple of these on hand. Ruggieri Lighting & Staging stocks these chips in our parts inventory.
Other Digital Control Information

Ethernet, ARTnet and so on....

The DMX 512 standard is now over 25 years old, and coming from an age where an absolutely huge lighting system would contain at most a couple hundred dimmer channels, it was more than adequate for its time. However with moving lights, LED and video applications demanding more and more channels to control them properly, it's not uncommon to see rigs with many thousands of control channels. The band-aid solution has been to offer consoles with multiple universes of DMX, each with 512 channels of control. But that has also come with its own set of challenges, including sending us back to the days of 2 inch thick control lines as seen during the days of analog control.

Ethernet-based systems have been slowly changing the landscape, offering almost unlimited control through a single category 5 data cable similar to what your computer network uses. This is being accomplished in a number of ways:

1) The console outputting DMX512 and a processor converting it to net and another converting back to multiple DMX 512 universes distributed to onstage devices. This is really only happening with LDs who are attached to their old consoles and outboard gear...not very often

2) The console outputting 'net and a processor converting it back to multiple DMX512 universes distributed to onstage devices.

3) Both the consoles and the onstage devices speaking some form of Ethernet. This is reality on the largest of shows, not so much for smaller stuff, although it is the way of the future and those manufacturers who choose to dig in their heels and not adopt it will be left behind again. (Are you listening Strand?)

Microplex.

Developed in the 1980s by Fender guitars for its “sunn” brand of musical instrument store lighting systems. This protocol will be found on “bar/wedding band” lighting rigs from manufacturers like Leviton, Lighttronics and sunn. Some lower-end Leprecon gear uses this protocol as well.

This protocol is still in widespread use due to its low cost. The trouble with it is that it offers a very limited number of control channels and it does not conform to any other standards. The risk associated with this system is that it feeds voltage back to the console to power up their own proprietary consoles, and because it uses a 3 pin XLR cable with the right adaptors it is possible, even likely to feed voltage into the driver chip on a DMX console. This will prove to be a fatal experience for the DMX console and should be avoided at all costs.
Yorkville Sound

In Canada there is another “music store” protocol used by Yorkville Sound on their little gopher stomper foot control lighting packages. These systems are proprietary and do not interface with microplex or anything else, even though they use a 3 pin XLR as well.

AMX 192.

Developed by Strand as the protocol for their lighting systems during the early ‘80s, AMX 192 was actually an analog multiplex as opposed to the digital multiplex. (DMX) AMX192 had its own set of issues, including limiting the number of available control channels to 192. When DMX512 was adopted by USITT in 1986, Strand stubbornly dug in their heels and continued to flog AMX for over a decade until finally giving in to the standard. It’s not uncommon to see Strand products from the mid-1990s still using AMX192. As is typical of Strand, there were several different connectors used for AMX 192, the most common being a mini – cannon that is impossible to find anywhere but the most well equipped electronics parts supplier.

RS 232.

Users of early personal computers such as Commodore and Radio Shack should be familiar with RS-232. Martin Lighting used it for some of their earlier nightclub moving lights. Should you encounter any lighting equipment that requires RS232 to control it, move as quickly as you can in the opposite direction. RS 232 controlled equipment can be easily identified by the “computer style” connector that looks similar to the old fashioned serial port.

ECMUX, Lightwave, etc, etc......

Systems designed by various manufacturers during the 1980s and 1990s. When DMX 512 was adopted as a theatre standard, most of these protocols fell to the wayside. That said, you might still encounter old gear with these systems today. No newer consoles will drive this equipment unless it accepts DMX as an “optional” protocol like some of the Lightwave Research stuff does.
Analog Control Information

Analog Control Standards.

Analog dimmer control uses a control voltage to proportionally dim a lamp. Simply put, it substitutes a low “control” voltage to command a high “line” voltage through the use of triacs or solid state relays. To call any form of analog control “standard” is probably incorrect, because next to nobody uses this system anymore. But most (but not all) of these systems used a graduated scale of 0 to 10 volts DC for control. 0v being “off” and 10v being “full” on. A rheostat (fader) controlled the low voltage signal into the dimming device.

The major drawback to these control systems is that by using voltage for a control system there must be a cable conductor for every channel of control being used, plus a common for each device being controlled. This made for very bulky control lines and a limited amount of channels available. For this reason analog has never had any real automation/moving light applications because in those applications each light or device uses multiple channels of control.

All that said, analog was used as the only option for decades until the advent of multiplexed digital & analog protocols in the 1980s. Previous to analog was the direct manipulation of high line voltages through bulky rheostats and resistors.