DMX512 & RDM - An Introduction

DMX512

DMX512 (hereafter DMX), released in 1986, was created by the entertainment industry as a means of standardising the many different, existing lighting protocols into one single protocol which would allow separate manufacturers to 'talk the same language'. It was designed to control 512 channels per cable at near-video rates, so could produce smooth dimming and lighting effects. Since then DMX has been used in the majority of lighting fixtures and, due to its qualities in fading RGB devices, has also migrated into architectural fixtures.

Advantages

- Fast data rates
- Widely used in the entertainment industry
- Large choice of controllers and fixtures
- 512 channels per cable
- Can be converted for transportation over Ethernet allowing multiple universes (e.g. Art-Net, sACN)

Disadvantages

- Wiring is restrictive and expensive when using large quantities of fixtures
- High cost of DMX interfaces
- Most DMX equipment is not fully isolated
- Dimmers are relatively expensive compared to commercial dimmable lights

How it works - electrical

The wiring infrastructure for DMX has been precisely defined and all installers must follow these rules. At the beginning of every DMX line there must be a single DMX controller / transmitter. This can have a maximum of 32 standard devices connected over a maximum cable length of 300m. If more devices are required then a DMX splitter should be used. The output of a DMX splitter is considered a new DMX line, with the same rules applying. At the end of each DMX line a terminator should be fitted.

DMX fixtures are linked by 'daisy-chaining' cables; Y-Splits are therefore not possible and a DMX splitter must be used instead.

How it works - data

DMX controllers send out packets of data at rates of up to 44 times a second. Each packet starts with a start code (0 for intensity) and then 512 slots of data values.

All devices are given a starting channel, called the Start Address and, as they receive data, respond only to the channels that apply to them. For example, a device that uses 3 channels with a Start Address of 4 will respond to channels 4, 5 & 6.

Values are represented in their decimal form: i.e. 0 to 255. For example, dimming curves are usually linear which means a decimal value of 128 equals 50%, which signals the fixture to be at half power.

With pure DMX, all communications are one-way, so the controller talks and everything else listens. More than one fixture can listen to the same channels. For bidirectional communications, see the section on 'RDM'.

DMX512-A

DMX512-A (occasionally referred to by its old colloquial name of DMX2000) is the latest version of the DMX protocol, officially known as ANSI E1.11. This American National Standard Institute standard is managed by the PLASA organisation.

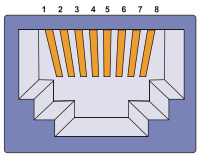
Key Features of DMX512-A

- DMX512-A is fully backwards compatible: equipment designed for DMX512-A will work with DMX512 (1990).
- DMX512-A defines higher levels of electrical protection for the data connection. This reduces the potential for damage from static electricity or lightning strike.
- Specific definitions of allowable earthing practices are given, minimising compatibility problems between installed equipment.
- The use of pins 4 & 5 is specifically defined. These pins can no longer be used for anything but RS485 data (note no power connection is allowed).
- The connector usage is specified. Most important is the fact that the 3-pin XLR must not be used for DMX512, to stop the confusion between DMX512 cables and audio cables.
- Electrical isolation, also called optical or galvanic isolation, is now defined. DMX512-A does not mandate optical isolation. However, it does define the requirements for isolated equipment. It also suggests that the DMX512 receiver should be isolated, while the transmitter is grounded.
- The System Information Packet or SIP is a new feature aimed at large installations. SIPs are transmitted at low frequency, by the lighting console, interleaved with normal lighting data. The SIP contains information about the console such as software revision, but also provides information such as the number of times the DMX signal has been processed. This could be passing through a merger or patching system. The SIP data can then be monitored at any point in the distribution chain.
- Another new feature is the Text packet. This allows text information to be sent via the DMX512 signal. The key benefit is that 'black box' products that do not contain a screen are able to display text information such as operating status and software revision numbers.
- The installation test packet is a special type of DMX512 data that contains the worst case type of data. Worst case means data that is most likely to make a data distribution problem visible. The benefit of this is that it becomes possible to test a DMX512 installation with a known type of data.
- DMX512-A introduces a new system of unique manufacturer identification codes. These allow processing equipment to be identified from anywhere within the installation.
- Finally, DMX512-A lays the foundations for the RDM or Remote Device Management protocol.

Cat x Cable & RJ45 Connectors

Part of the DMX512-A specification allows Cat5 cable and RJ45 connectors to be used for DMX installations.

The DMX wiring on an RJ45 connector is shown here:



XLR pin	RJ45 pin	Function	RJ45 colour
1	7	Ground	White/Brown
1	8	Ground	Brown
2	2	Data-	Orange
3	1	Data+	White/Orange
4	6	Aux Data-	Green
5	3	Aux Data+	White/Green

RDM

RDM stands for Remote Device Management. This is the colloquial name for the ANSI E1.20 standard managed by the PLASA organisation.

RDM allows bidirectional communication over the DMX512 cable. This occurs on the twisted pair connected to pins 2 and 3. This same pair of wires is used to transmit data from the console to the dimmers or moving lamps.

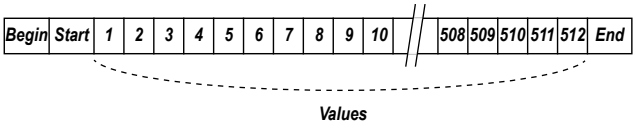
RDM requires intelligent DMX splitters that can monitor the data for a command to reverse the direction of the cable.

The large benefit of this approach, as opposed to using the spare pins 4 and 5, is that RDM can be retrofitted to installations wired with single pair cable. A second benefit is that many products already contain the electronics needed for bidirectional communication using pins 2 and 3. These products can be upgraded to RDM with a software only change.

Key Features of RDM

- Ability for the console to set the base address of the lamp - removes the need for DIP switches.
- Plug and Play: the console can search the DMX512 cable for all connected devices and then automatically patch them.
- Lamp personality: the console can use RDM to download personalities direct from the moving lamp. No more last minute panics to find the correct lamp library.
- RDM devices can be firmware upgraded via the DMX512 signal.
- RDM devices can send status and fault information back to the console.
- By allowing bidirectional communication, it becomes much easier to mix DMX installations with sophisticated ethernet protocols such as Art-Net or sACN.

A simplified DMX packet



A DMX/RDM system example