



INTRODUCTION TO DMX

Chromateq software and hardware solutions are designed to facilitate the process of designing and programming DMX-based lighting systems.

DMX is a communication protocol that makes it possible to send digital commands from a control device to digitally addressable lighting fixtures with unique identifiers (DMX addresses) that enable individual control of each fixture's capabilities and make possible the creation of complex synchronized lighting effects, scenes, programs and shows involving multiple fixtures.

Becoming familiar with the terminology used to describe DMX lighting systems will be helpful to understanding the functionality and features of Chromateq control solutions, which are based on industry-standard rules for controlling DMX lighting.

Glossary of Terms

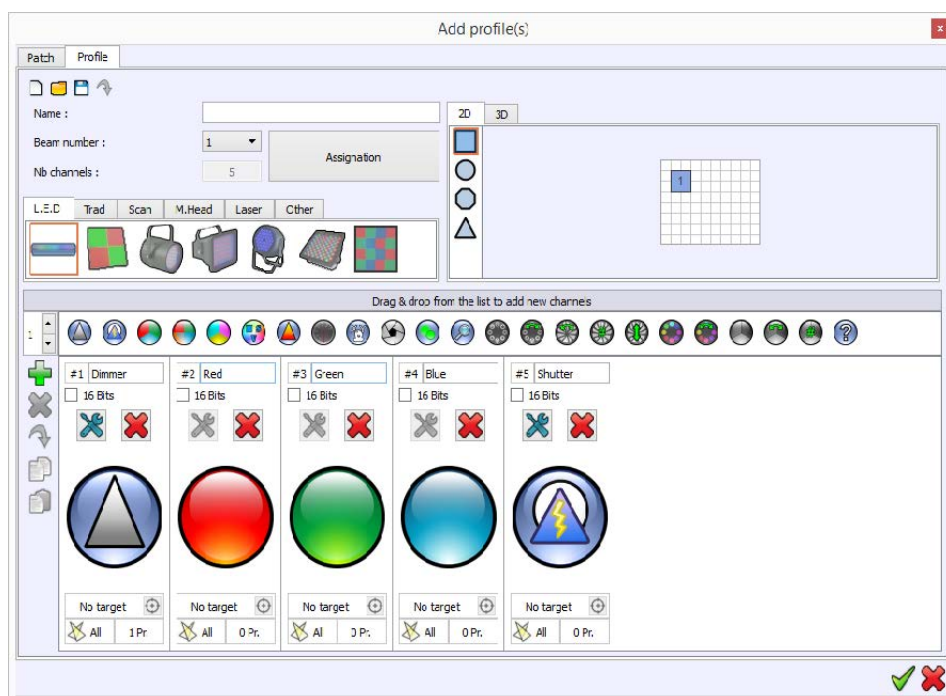
Below are descriptions of common terms that are key to understanding the basics of DMX programming :

- **DMX** : The acronym for **Digital MultipleX**. Also referred to as **DMX-512**, which references the number of DMX channels available in one DMX « Universe ».
- **Universe** : DMX lighting fixtures are typically linked together via cable networks that connect their DMX IN and OUT ports in a daisy-chain series. DMX commands are sent from the DMX OUT port of a controller that broadcasts up to 512 channels over one cable run to the connected fixtures.
- **DMX Address** : Each fixture in a DMX network includes an onboard decoder that receives and translates the DMX commands received from the controller. Each fixture must be set to a unique ID, i.e., its DMX address. Possible addresses range from DMX channels 001 ~ 512 and this « starting address » is typically selected by DIP switch or an LED/LCD display menu.
- **DMX Channel** : An individual control channel with a range of values from 0 – 255 that correspond to 0 – 100% output or to various fixture functions and presets. Common channel types and functions include dimmer, shutter, RGB, CMY, pan, tilt, focus, zoom, color wheel, gobo wheel, gobo rotation, prism, and iris.

• **Fixture Profile** : Intelligent (i.e., DMX-capable) lighting fixtures typically feature multiple channels, with channel presets (determined by the manufacturer) that control various functions. For example, a 5-channel LED fixture might utilize five DMX channels, allocating specific functions to each channel :

- Channel 1 : Dimmer
- Channel 2 : Red
- Channel 3 : Green
- Channel 4 : Blue
- Channel 5 : Shutter

The set of attributes of a fixture's DMX channel functions may also be referred to as its « personality ».



• **Starting Address (aka Starting Channel)** : In the example of a 5-channel fixture, the five channels would typically occupy a sequential range of five DMX channels in the particular 512-channel universe determined by the DMX network layout. Whereas the channel functions are predetermined by the manufacturer, the « Starting Address » is determined by the operator / programmer.

• **RDM** : Remote Device Management, an extension of the DMX protocol that supports bi-directional communication with dimmers and fixtures.

• **Art-Net** : a DMX-over-Ethernet protocol that distributes multiple universes of DMX data and enables the transmission of DMX-512 data over IP-based networks.

• **sACN** : Streaming ACN (Advanced Control Network), a DMX-over-Ethernet protocol that distributes multiple universes of DMX data and enables the transmission of DMX-512 data over IP-based networks.

- **Patch** : Patching fixtures tells lighting controllers about your fixture configuration and how to find and communicate with each fixture based on its assigned DMX starting address. The patch assigns DMX channel addresses to corresponding fixture profiles. DMX addresses are chosen from 1 to 512 and the first DMX channel number assigned to a fixture must match the DMX address on the fixture itself.

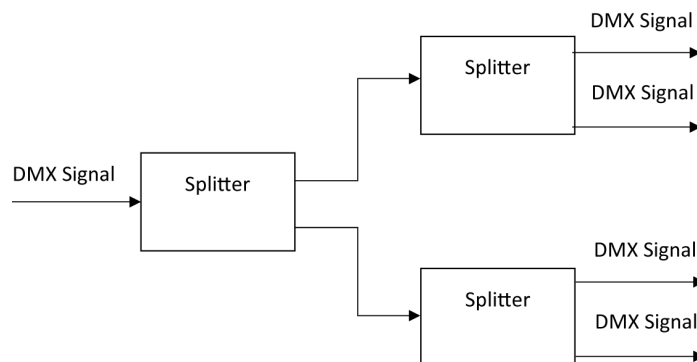
- **Step** : A Step records an instance of DMX channel levels (from 0-255) for all 512 channels in a DMX universe. When programming with Chromateq software, steps are the building blocks used to create Scenes that can be played back in Sequences.

- **Scene** : A Scene contains one or more Steps. Scenes are played back one at a time in a Sequence.

- **Sequence** : A Sequence contains several Scenes that are played consecutively.

- **Program** : When programming with Chromateq software, « Programs » are similar to Scenes and Steps, but with several important differences: Programs are played back by selecting one or more Programs in Live mode, and multiple Programs can be played at the same time. Unlike Scenes, Programs do not play sequentially but rather add layers of effects (movement, colors, strobing, etc.) during Live operation. Unlike Steps, which record and play back DMX values for all 512 channels, Programs only apply their DMX values to a set of active channels.

- **DMX Splitter** : DMX transmits 512 channels (one universe) per cable. Splitting the DMX signal is required to expand the DMX network to multiple universes. The output of a DMX splitter is considered a new DMX line.



- **DMX Terminator** : Typically a 120Ω 0.5W resistor soldered to pins 2 and 3 of a male XLR plug and installed in the DMX OUT port of the final lighting fixture on a DMX cable run. The purpose of the terminator is to reduce signal noise that may arise due to stray signals bouncing or reflecting back along a daisy-chained cable run.

- **Firmware** : A piece of software that is stored on a hardware device in order to make it run properly. Firmware is programmed into the read-only memory of a lighting fixture or lighting controller. Upgrading firmware is typically done to improve a device's performance and/or to update its compatibility with other devices.

Basic DMX Deployment

• Fixture Settings :

One of the initial steps when deploying a network of DMX lighting fixtures is to confirm the settings on the physical fixtures.

DMX Mode : Advanced fixtures may offer multiple « DMX modes » (i.e., a selection of different fixture profiles with various DMX channel quantities and layouts) with the possibility to choose a simpler profile (with fewer DMX channels) or a more complex profile (with a greater number of DMX channels).

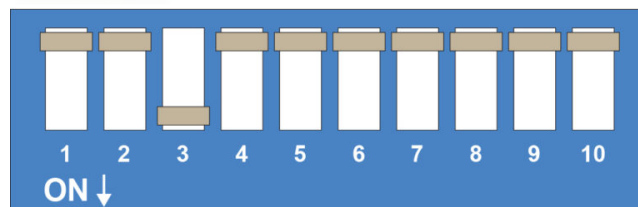
Note the number of DMX channels used by the fixture in the chosen DMX mode.

DMX Starting Address : Fixtures that include an LCD or LED display will typically include a menu for setting the DMX starting address, which will be displayed as a number between 001 and 512 :



Fixtures without displays may use DIP switches and a hexadecimal system for setting the starting address. Chromateq software includes a visual tool that aids in calculating the correct combination of switch settings for the values between 1 and 512. In the below example, the DIP switches are set to DMX starting address 004 :

Dip	1	2	3	4	5	6	7	8	9
Value	1	2	4	8	16	32	64	128	256



Unique or Shared Addressing : If all fixtures share the same profile (e.g., all are 3-channel RGB fixtures) and individual control is not required, it is possible to set the fixtures to the same DMX address. Otherwise, individual fixture control requires that each fixture be set to a unique address and that no DMX fixture channels overlap.

• **Cabling :**

Another critical initial aspect when deploying a network of DMX lighting fixtures is following best practices for clean data transmission.

The DMX standard specifies cable runs up to 4,000 feet (1,200 meters) but in practice potential cable lengths are affected by cable quality, the characteristics of the DMX fixtures being daisy-chained together, and other factors.

For cable runs over 1,000 feet (300 meters) a repeater/booster may be needed. Placing a terminator at the end of each cable run will help avoid degraded data transmission. Best practice calls for twisted-pair, shielded, low-capacitance data cable, *not* audio cable.

Faulty fixtures or incorrect fixture settings can complicate troubleshooting DMX networks. For example, a moving head set to operate as a « master » fixture will disrupt a DMX network and should be set to « slave » mode.

• **Programming :**

Once all fixtures have been set to their intended DMX addresses and modes, and stable communication established between the controller and the fixtures on the DMX chain, programming can begin.

Programming DMX lighting typically follows this basic process :

- 1) Fixture selection (creating a patch in the DMX control system that allocates DMX channels to fixture profiles). Fixture profiles may be chosen from a « Fixture Library » or created by the programmer using a « Profile Editor ».
- 2) Organizing fixture groups and/or attributes for convenient selection of shared functions (e.g., pan/tilt, colors, dimming, shutters, effects, etc.).
- 3) Creating and saving scenes and programs (building light show sequences and desired lighting looks and effects).
- 4) Selecting a playback format (e.g., storing scenes to standalone controller memory for automated playback, or programming buttons for live operation).

Chromateq software facilitates the DMX programming process by automatically generating useful presets and effects based on the patch and fixture profiles, offering a panoply of tools for organizing and visualizing lighting projects, and numerous playback options and features.