KIM LIGHTING®

DMX
WHITE PAPER

DMX Overview

DMX is a technology that was created by the entertainment industry back in the 90's to help link theatrical lighting control equipment such as dimmers, control gear and automated lighting. DMX has been slowly finding its way into the general lighting market since multi-LED architectural lighting fixtures have become more mainstream which brings the need for DMX into non-entertainment lighting equipment for controlling sophisticated lighting projects. The DMX is best understood by talking explaining how it works and how it is wired.

How it Works

A single DMX wire can communicate 512 DMX values, often called channels. Each channel has an ID of 1-512 and each ID can communicate a value of 0%-100% as an 8-bit number (a range of 0-255 which correlated to 0%-100%). DMX controlled lighting fixtures and other DMX devices have their ID (or Start address) set so they know which channel of data to monitor for adjusting its intensity or color. Simple white fixtures might use just one address for intensity while a RGBW device requires four addresses so each color can be given a specific intensity. Each DMX wire of 512 control channels is referred to as a DMX Universe. If a project has the need to control more than 512 channels, two or more universes of control and separate wiring will be required.

The DMX Protocol uses a streaming serial RS485 data structure that is very robust for long wiring runs, with all 512 data points updating at about 33 times a second. Serial data of this nature, in order to be robust, must utilize the correct wire type and be wired from a DMX controller to DMX devices in a very specific topology.

Wiring

DMX data is conveyed down a wire utilizing 3 conductors. DMX+ (positive), DMX- (DMX negative) and Shield/Ground. Specialize Belden wire as well as approved Category wire can be used for DMX. Proper DMX wire can be run to nearly 1500 feet in ideal circumstances, but best practices aim for under 1000 feet. DMX devices are not all homeruns back to a control system but part of a Daisy-Chain. Because each device has a DMX start address, a single wire can be daisy-chain to many devices because each device will only listen to the channels it is set for. DMX must be wired in a strict Daisy-Chain and can only be Daisy-Chained thought a maximum of 32 devices or what

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Current⚡

the device manufacturer approves. More than 32 devices in a project will require a DMX splitter to properly split and repeat the DMX signal to additional groups of devices. At the last device in a Daisy chain, on every wiring run, a DMX Terminating resistor must be added unless the device auto-terminates. For example, for a 60 unit continuous run, daisy-chain 1 - 30 and use terminating resistor on 30. Daisy-chain fixture 31 - 60 and terminated by resistors at 60.

FIGURE 1 DMX DAISY CHAIN WIRING
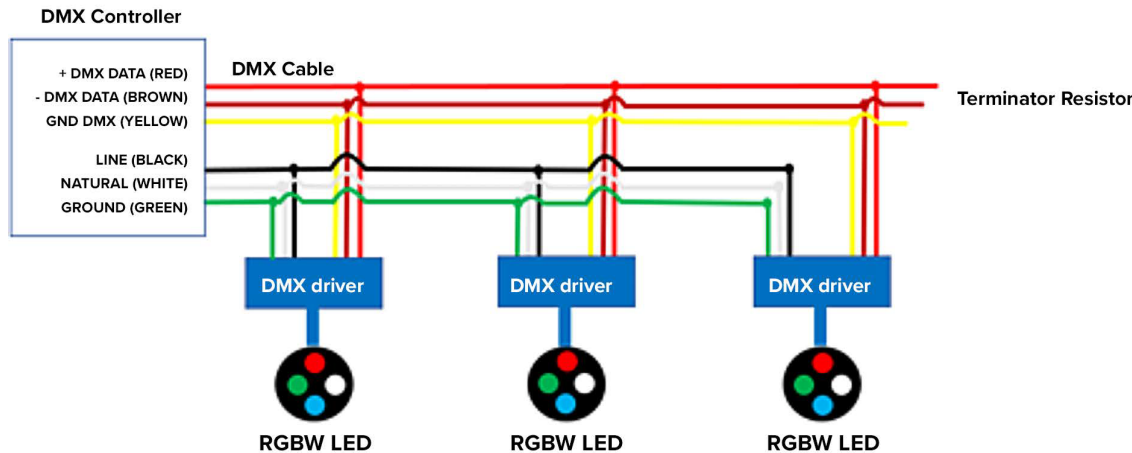
DMX is typically a one direction protocol where a DMX controller broadcasts the changes down the DMX wire for consumption by the devices on the Daisy-Chain. However, a new part of the DMX protocol, called Remote Device Management (RDM), bring new bi-directional feature to a DMX/RDM compatible system. RDM can allow for a DMX controller to discover DMX devices, identify them and set their DMX start address remotely. Other RDM discoverable data point and controls are available but these are very specific to what a certain DMX device can support.

Current DMX Wiring

Current RGBW fixtures follow the addressing below for DMX wiring:

DMX Address	RGBW Fixture (4 Channels)	RGBW plus Pan & Tilt (6 Channels) [1]
Start Address		
Address +1	Red Channel – 0-255 Intensity	Red Channel – 0-255 Intensity
Address +2	Green Channel – 0-255 Intensity	Green Channel – 0-255 Intensity
Address +3	Blue Channel – 0-255 Intensity	Blue Channel – 0-255 Intensity
Address +4	White Channel – 0-255 Intensity	White Channel – 0-255 Intensity
Address +5	N/A	X-Tilt – 1-63 Left, 192-254 Right (Default 127)
Address +6	N/A	Y-Tilt – 1-63 Up, 192-254 Down (Default 127)

<u>Max. Fixtures on a DMX Universe:</u>

128 fixtures utilizing 4 DMX Channels
85 fixtures utilizing 6 DMX Channels

[1] DMX Channel 5 and 6 are only for Kim Lighting's In-grade LTV8RGBW fixtures with Pan & Tilt features.

[2] Current fixtures are RDM compatible.

NOTE: DMX and Power cables must NOT run in the same conduit. Fixture cabling from control box to fixture shall be installed per NEC and Local Codes.

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Zoning with DMX

Because DMX Devices are digitally controlled and have unique DMX Addresses, there is no need to wire a zone of lights with its own dedicated DMX wire. DMX devices, regardless of where they exist on a project, can be grouped and zones together digitally by the DMX controller. Simply daisy-chain all the DMX devices on one wiring run, limit of 32 + terminator, and assign them all unique, non-overlapping DMX ranges for control. Inside the DMX controller software lighting can be arranged in 1 or more groups for unique control and global commands.

DMX Troubleshooting

DMX Wire Termination – All DMX wire runs, require the end of the wire at the last fixture to be terminated, normally with a 121 Ohm resistor across the DMX+ and DMX- wires. There are DMX terminator boxes that have a resistor inside, with two screw terminals to make the installation simpler. A maximum of 32 devices can be on a daisy chain without repeating/boosting hardware.

A non-terminated DMX bus can exhibit jittering control, non-control, flickering or delayed response to control.

Wire length – Wire length normally can be as long as 500 – 1500-meter-long. Always use a DMX rated cable to make the connections. Be sure to keep all connections well made, solder them if possible. Water can deteriorate wire performance, even if it is in the insulation. Terminate the wires if there are issues. DMX splices should be avoided. Wire Nuts should be avoided.

Wire type – The wire type should be Belden 9841, 9729 or Category 5e, 6 only. Wire size does not matter.

Maximum Fixtures per DMX Universe – A maximum of 32 DMX fixtures per DMX daisy-chain or if using DMX splitters, a Maximum of 512 channels of uniquely addressed fixtures. For every 32 DMX fixtures, make sure to use a DMX Splitter (RDM) to maintain integrity of DMX data.

Reversing DMX+ and DMX- wires – The wires might get reversed during installation at any segment of the wiring run. A reversed wire connection may seem to work but not all colors and control will be definite, sporadic control or inverted control may occur. Take a logical approach to check that each wiring connection point has the correct polarity.

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