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- Software and Support Tools

MA LIGHTING INTERNATIONAL
An der Talle 26-28
33102 Paderborn · Germany

Phone +49-5251-688865-0
Fax +49-5251-688865-88

eMail: sales@malighting.de
http://www.malighting.de

Basic Concepts for New Comers

by Mike Falconer

Introduction

This document was designed to explain some of the basic issues that control consoles have to deal with. Most of these issues have to do with moving light programming. People who have programmed moving lights in the past should be familiar with these issues. If you are not acquainted with these issues, please feel free to read on!

The Nature of DMX

DMX512 was designed by a group of technicians and manufacturers which wanted to create a common standard to link control desks and dimmers of any type. The original standard was released in North America by the USITT in 1986 and redefined in 1990.

Since then DMX512 is the undisputed but unofficial, industry protocol for controlling lighting equipment and related devices such as media servers, smoke machines, etc. The 512 in 'DMX512' refers to the number of channels that DMX supports. When DMX was originally designed it was envisioned to control just the intensity of conventional lights. The resolution for each channel was represented in an 8-bit value so each channel would be able to be controlled from zero to 255. These 256 step resolution was considered more than enough for conventional lighting at that time.

When referring to a channel, particularly an intensity channel, it is common to use a percentage rather than the more accurate number between zero and 255. We may say a value is at one hundred percent or "full," but what we actually mean is that the value of 255. It is common to refer to a value in its zero through 255 format as a decimal value.

With conventional lights the difference between percentage points can be almost impossible to see. Since each percentage value is worth two or three decimal values, there is no reason to worry about the decimal value being off by a few points as the console still fades between two values with the maximum resolution of 8-bit.

With its maximum update rate of approx. 44 Hz (depending on the console processing the signal) DMX refreshes the value for each of the 512 channels up to 44 times per second. It is common practice to use more than one DMX-line (also called DMX-universe) in parallel to increase the number of channels on a system.

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This all changes, of course, when you are dealing with more complex devices such as moving lights, color scrollers or media servers. With these devices, each DMX channel still only has 255 steps and still only got 44 Hz update, but it is now controlling something where it is possible to see the difference between a single decimal value. For example: a moving-head fixture has 360 degrees of pan. 360 degrees divided by 256 steps means that each step is more than a degree of movement. If there is any distance between it and what it is trying to light, that single decimal value could translate into a very large movement on stage.

For this reason, it is unusual to see parameters other than intensity referred to in percentage. To get a better resolution for parameters such as pan and tilt, most moving lights and consoles combine two DMX channels together, one for coarse movement, and then a second for fine adjustment. This gives a total of 65,536 steps (256 x 256) and is sometimes referred to as 16-bit DMX though the DMX-signal behind always sticks to its 8-bit nature. Also DMX512 won't be the ideal signal for a "real" 16-bit control as it would take more than 1,500 seconds to transmit all 65,536 steps if the maximum resolution is desired (like for color scrollers or theater film projectors).

Moving lights, and in particular media servers, tend to have a lot of parameters. This means that 512 channels, quite often, are not enough for a single show. The solution is to have more than one set of 512 channels. Each set of 512 channels is referred to as a universe, and usually a letter is used to differentiate between them. 'C512' would be the last DMX channel on the third DMX universe.

HTP = Highest Takes Precedence

Highest Takes Precedence is a method of deciding what happens when two conflicting instructions are given to the same parameter. It is normally used for intensities only when being controlled from different sources (such as two playbacks, various submasters or simply two independent consoles).

For example: one section of the lighting console tells channel number one to go to 100 percent intensity and then a different section of the same lighting console tells the same channel to go to 50 percent. Because these two sections of the lighting console are independent from one another, there is a conflict. Should light number one go to 50 percent or 100 percent? HTP dictates that the Highest Level Takes Precedence. Therefore, light number one would go to 100 percent.

HTP, normally, is only appropriate for intensity parameters. If you have ever used a conventional lighting console, then it almost certainly used HTP to settle conflicts. The thinking behind HTP is that the worst that can happen when using it is that the look on stage does not look right as opposed to there being darkness.

Most controllers for conventional lights with only a dimmer parameter will use HTP protocol to calculate their DMX-output. Though this is sufficient to control intensities it's quite hard to use HTP for any other parameter used by a moving light. In practice a moving light controller would rather use LTP to produce the desired DMX-signal.

LTP = Latest Takes Precedence

Latest Takes Precedence is also a method of deciding what happens when two conflicting instructions are given to the same parameter.

For example: one section of the lighting console tells light number one to go to 100 percent, and then a different section of the same lighting console tells light number one to go to 50 percent. Because these two sections of the lighting console are independent from one another, there is a conflict. Should light number one go to 50 percent or 100 percent? LTP dictates that the Latest change Takes Precedence. Therefore light number one would go to 50 percent because this was the later value.

LTP makes the most sense when thinking about parameters other than intensity. For example: if one section of a lighting console tells moving light number one to point at the lead singer, and then another

section of the same console tells light number one to point at the drummer Latest Takes Precedence would dictate that the light should point at the drummer. It does not make sense for there to be any other outcome. With intensity it can be argued that an increase in intensity is a valid solution because it is just more of the same. With position, color or gobo, there is not the same linear relationship between one value and the next. One position on stage is not greater than another; just like red cannot be greater than yellow, when talking about the color wheel on a moving light.

Sometimes LTP even makes sense in conjunction with intensity channels; if one light is controlled by two console (let's say main and backup system) this light will take the highest level of both consoles when using HTP. But how to take control of a light that is already at 50 percent and to under ride that value? Here LTP would be the ideal alternative. Very often DMX-mergers which are combining two DMX-signals into one DMX512 output are offering this LTP-option. At the moment where that 50 percent value from DMX-A is overridden by the second DMX-signal it takes control and even undercuts the former 50 percent output if lowered.

On moving light consoles LTP playbacks also are the only reasonable option for taking control of the same moving light (including intensity) from one cuelist to another..

Tracking

Tracking is the principle to just memorize the changes from one cue to the next. Instead of taking a complete snapshot from stage a tracking console will put just these values into a cue which differ from the previous look. This follows the way a designer would think about his cues as well as it saves console's processing power and memory. But...

Tracking can be a powerful friend and a dreadful enemy.

Quite simply, tracking is the idea that once a parameter is set to a level, it stays there until it is told to go somewhere else.

This has the advantage of making changes spanning several cues very easy

For example:

In cue one, channel eight goes to full (100 percent.)

In cue two, that information is tracking through.

As it is in cue three...

...and in cue four.

In cue five, channel eight goes to 50 percent.

If you now edit cue one and make channel eight go to 70 percent, cues two, three and four will also change. Cues two through four don't actually contain any information for channel eight, so information just tracks through them. If you edit cue three and store channel eight at 30 percent, it will track through into cue four. However, if you store it using "cue only," the console will automatically add channel eight at 70 percent to cue four. This is the value it would have be at if you had not made the edit. 'Cue Only' is a standard tool on tracking consoles is so that you can edit a single cue and not affect other cues unless you want to.

If you edit cue two and store channel eight at full, there will be no difference to the look of the cue as this is the level that the channel was already at. However, technically there is a difference as cue two now has information for channel eight rather than just having tracked information from the previous cue. If you now edited cue one and changed the value of channel eight, it would have no effect on cue

two. Cue two has been blocked. 'Blocked' is a term given to channels or parameters that are stored in a cue when they could be tracking through. Blocks are very useful as they allow you to specify that information is really important and cannot be changed unless specifically edited.

Blocks can get in the way, however, and there is often a need to unblock parameters and even whole cues.

Tracking is a powerful tool that, when used wisely, can significantly empower your programming. It can also cause great confusion if you are not used to it and do not understand the principles involved.

Value at Zero and an Absence of Value

A lot of the confusion with tracking often comes from the fact that tracking consoles only store values that you tell to go somewhere.

If you select all of your moving lights bring them up at full, position them down stage center and store all this information in a cue, what color are your lights in?

They may look like they are in white, but they actually have no color in them because you did not tell them to have a color. They have an absence of value. The same goes for the conventional channels in the cue you have made. Since you did not tell them to do anything in this cue, they have no value.

This becomes important when you start thinking about copying cues from one location to another or from different places in your show. If the cue you made is cue one and you proceed over the next several hours to build twenty more cues, with each cue featuring more parameters and conventional channels, what happens when we want to copy the look of cue one to cue twenty-one?

Your moving lights will be at full and pointing downstage center, but you will also have all the color, gobo and other parameter information from cue twenty. Don't forget that you will also have all the conventional channel information as well.

An easy way to avoid problems like this is to make sure that when you store your first cue you have information for every parameter for every device you are controlling in the cue, even if it is just to have them at zero.

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