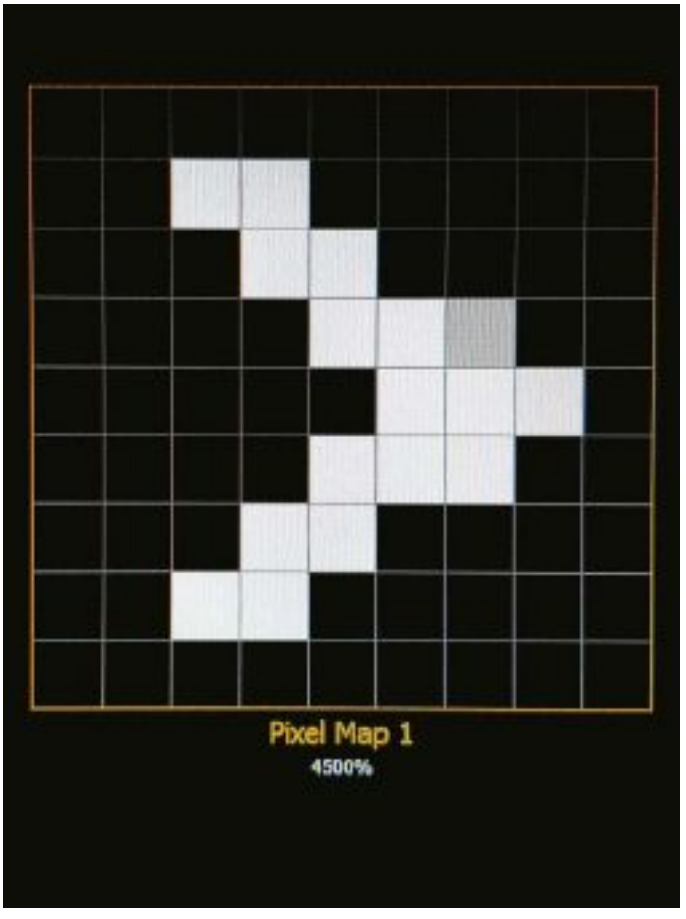
Pixel mapping stage lighting

John Black explains how pixel-mapped lighting effects are created and controlled

John Black, theatre manager for Seoul Foreign School

IF YOU'RE FAMILIAR WITH THE term 'pixel' but have not heard the term 'pixel mapping' used in reference to lighting, you may be wondering why this is a topic in the lighting section. Isn't 'pixel' used in reference to video and graphical hardware and media content? That's true! However, the worlds of video and lighting have been converging both at the console level and the fixture level, and this has opened up a whole realm of lighting effects and possibilities that used to either reside in the video department or would have taken a huge quantity of lights and consumed excessive programming time.

Hopefully by the end of this piece, you will have an understanding of pixel mapping and how it has entered into the lighting field. I will highlight some of the products available on the market that can be used for pixel mapping and also discuss the basic process of pixel mapping and how it can be implemented into your events. Understand that I will not highlight the programming process for any one console, but will explain in general so that you have an idea of how to start with the equipment that you have available.



A console preview of a pixel-mapped lighting effect

What is a pixel and what does it mean to map them?

Every digital image is comprised of pixels. Millions of them. We often hear the term pixel used when specifying the resolution of a display screen on mobile devices and TVs, or when comparing the specifications of digital cameras. A pixel is a single, programmable unit (think single dot) of coloured light. Within a given space, the smaller the pixels (and thereby the greater the quantity of pixels), the higher the resolution of the image (sharper, clearer and more detailed).

A good example of this would be to think of an LED videowall display panel. These units are manufactured with certain 'pixel pitch' specifications. Pixel pitch is the physical distance between each LED diode (or pixel). For example, Barco makes an outdoor model, the T10, with a 10mm pixel pitch. They also produce an indoor model, the X1.2, with a 1.29mm pixel pitch. The smaller the pixel pitch, the higher resolution the image will be – but also the more expensive each panel will be due to the increased number of diodes.

Let's bring this into the lighting department now. If a pixel is a single, programmable unit of light, then we can consider every stage light source a pixel – it doesn't matter whether it is a conventional or moving head fixture, LED or tungsten light source. We can create a grid of any of these fixtures and all of a sudden we have a 'display' made up of 'pixels'.

Just as is true with pixel pitch on LED videowall panels, the more lighting fixtures we have in the grid and the closer together, the higher the resolution of the image. It's important to realise, however, that in lighting we are using pixel mapping for effects (think very complex chases) as opposed to displaying high-resolution images, so this isn't a problem.

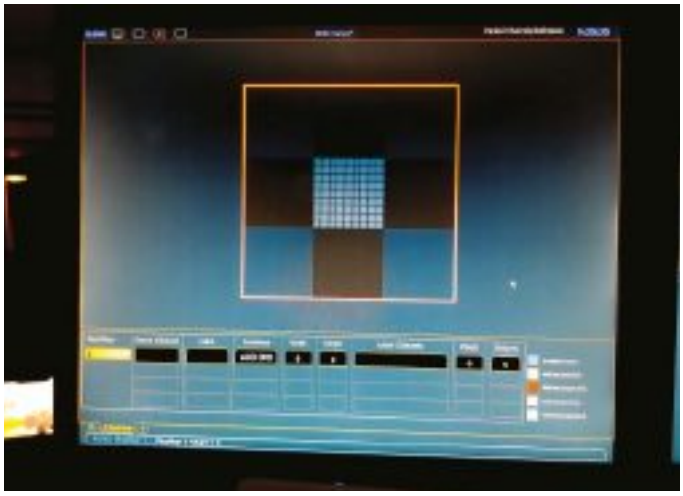
Elation's ACL 360 Matrix mappable fixture

In order for content to be displayed correctly, the controller (lighting console for us) must know where each pixel is located in the grid. This is what is called pixel mapping. Again, each fixture in the grid is treated as an individual pixel and the controller will send each fixture intensity and colour (if applicable) data based on the media content you want to output. Note that mapping the position of your fixtures is important because you don't necessarily have to create a rectangular grid. Fixtures can be rigged in any shape or multiple shapes with gaps in between and still have content played 'across' them. So long as the controller knows how many fixtures are in the grid and where they are located, you will be able to create any layout you desire.

What gear do I need?

I've already mentioned that you need lighting fixtures and that it doesn't matter what type of fixtures they are. Keep in mind that if using conventional fixtures with tungsten sources (PAR cans, Fresnels or other), the only data that will be sent to them is intensity. If you are using LED wash fixtures, colour data can also be sent, which will allow for coloured media to be reproduced in the lighting grid. In either case, any brand or model fixture will work and each fixture will be treated as an individual 'pixel' by the lighting console.

ETC's Ion xe 20 lighting console



Setting up a pixel-mapping grid

High End Systems' Road Hog 4 lighting console

There are also a number of LED products available on the market that allow for independent control of the LEDs in the fixture itself – fixtures that consist of many LED sources that are individually programmable, allowing you to treat them as more than one 'pixel' in your setup. The only real downside is that in order to be able to control each LED, the number of control addresses the fixtures eat up will seem to exponentially increase. For example, one such fixture houses 150 tri-colour (RGB) LEDs. Each LED takes four channels – one to control the red, green, blue and intensity values. When in a mode allowing individual pixel control, you're looking at 450 control channels per fixture! Almost an entire DMX universe for that one fixture, which leads into the next piece of gear needed to use pixel mapping.

The control console is the piece of equipment that will determine not only the size and scale of the system you can put together, but will also make the process of setting up and using pixel mapping a breeze or a nightmare. Let's first consider the system capabilities of the control console. As we just saw, depending on the fixtures that you plan to use and the number of control channels they will consume, having a console with the capacity to handle a large number of universes is a must. Many of today's houses of worship, unless still holding on to equipment older than 10 years old, probably will have a console capable of handling no fewer than four DMX universes, as well as having the ability to add additional universes via Artnet or another networked lighting protocol.

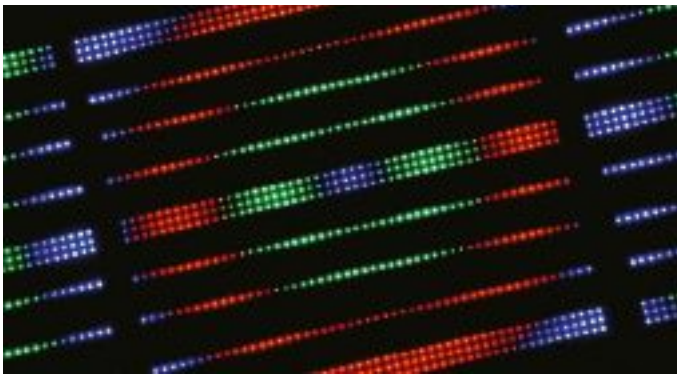
What's the process?

Regardless of the console in use, the first step in the process, after setting up the actual fixtures and connecting them to power and/or DMX, is to patch them into your console.

The fixtures do not need to be patched in a particular channel order, but I would recommend doing that, and you'll see why in the next step. You could either patch them in rows, moving left to right from top to bottom, or vertically from top to bottom and moving left to right. Whatever the case, pick an order and be consistent with it throughout the entire rig.

Once all of the fixtures are patched, the next step is to set up the pixel map in the console. As mentioned earlier, it is vital that the console knows the location and layout of the 'pixels' you've set up so that media is played back in the correct position and orientation. The first step is to set the size (width and height) of the grid, which will then create a grid (a width and height of nine would create a grid of 81 'pixels'). Once that has been created, you will need to assign fixtures to each pixel. If you've patched your fixtures in a pattern, some consoles will allow you to assign the whole grid in a single step once you have told it how to auto-assign fixtures to the pixels.

Once this step is complete, you've now successfully set up a pixel map in your console. The final step is to make sure that the fixtures in the pixel map know where to get their information from. Each console handles this differently. In all of my consoles, the media server exists internally in the console, so I need to patch the media server itself into console channels to be able to control it. Once that is done, I can operate and manipulate the various features of the server, which will play back on my fixtures. I will also be able to record cues for a show that includes playback data from the media server channels.



Lighting patterns pixel mapped on Chauvet's Epix Strip (1 x 50) and Epix Bar (3 x 50) lighting fixtures

Chauvet's Epix Bar Tour lighting fixture

Assigning channels on an ETC lighting console, step one

Assigning channels on an ETC lighting console, step two

Endless possibilities

With the ability to add still or video media content to the libraries of lighting consoles, the possibilities for playback effects really are endless. In this article, I've approached pixel mapping from the standpoint of a grid of fixtures that you would be able to look at from the front, but you could also use these techniques for creating some interesting effects from your stage wash fixtures or another group of fixtures. Just because a fixture is included in a pixel map, doesn't mean it can't also be programmed normally when the media server is not active. I hope this has demystified pixel mapping a little bit and given you confidence in trying it out for yourself.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