Chroma-Q Color Block 2

By Mike Wood

Fig. 1 - Fixture as tested

Fig. 2 - Color Block 2 and power supply

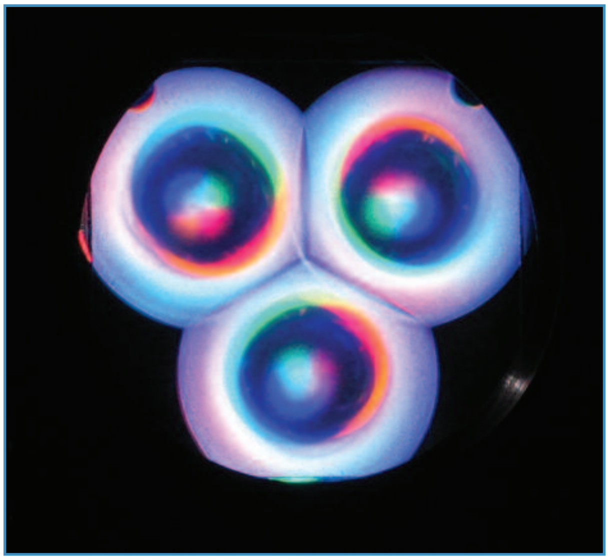

Fig. 3 - View into lenses

We first took a look at a Chroma-Q LED product last year when we reviewed the Color Split. (At the time, we referred to it as A.C. Lighting's Chroma-Q Color Split; the relationship to A.C. is still there, but the company is now marketing Chroma-Q as a separate brand, with its own website, www.chroma-q.com.) The pace in development in LEDs and LED-based lighting is extremely rapid, however, and a lot has changed in those nine months. If you recall from previous discussions here, LED brightness and efficiencies have been closely following the empirical Haitz's Law, which, based on historical developments, predicts that the output of LEDs will double every 18 months. Development has been following this prediction for four decades now, and shows no sign of faltering. This means that, in the few years since Chroma-Q developed its first Color Block, the LEDs the company uses for light sources have moved on apace. This is both a curse and a blessing; the LEDs get brighter, but that makes for rapid product obsolescence as the manufacturers of LED products have to continually update and upgrade their products.

As with the Color Split, the Chroma-Q Color Block 2 is manufactured in Toronto. The company supplied me with a set of Color Block 2s and the PSU-05B power supply as typical of the production; I've measured them in as objective a manner as I can to give results that you can judge for yourselves. The Color Block 2 is a very compact unit containing 48 LEDs arranged in four cells of three arrays with each of those 12 arrays comprising a red, green, blue, and amber LED (Figure 1). It's a highly modular unit, both electrically and mechanically, and multiple units can be connected together to form larger arrays or battens. That modularity extends within the unit, too, as each of the four cells can be controlled independently or as a single block. For the purposes of these tests, I ran a single Color Block unit with all four cells running as a block—this seems an appropriate test of it when running as a luminaire as opposed to a display. The Color Block 2 is run from an external universal voltage input power supply (Figure 2)—but more on that later. As usual for my tests, the unit was run from a nominal 115V 60Hz supply (actually 119V on the day).

Light source and optics

As ever in these reviews, we start with the light source. As mentioned above, the Color Block 2 has 48 LEDs, configured as 12 RGBA arrays. Each of those arrays is fitted with a large TIR optic covering all four emitters, which serves to both homogenize the colors and constrain the light to a more usable angle. Native LEDs are Lambertian, or 180° emitters, and this first optic is critical to capturing that broad spray of light. To work efficiently, TIR optics must be mounted right on top of the LED dies, as close as they can get. Figure 3 shows the view into those optics when the output is very low, so you can get an idea of how the light from each of the four LEDs is captured and distributed through the optic and blended with its three neighbors. Figure 4 shows a close-up of one of these triple TIR assemblies and how close they come to the LED dies themselves. Also visible in Figure 4 is a thin cap of optical diffusing film material on top of the TIR lens. I suspect this is key to getting good homogenization of the output beam and helping to stop the colored shadows that are the bane of many LED fixtures. This combination gives the Color Block 2 a field angle (10% point) of around 52° and a beam angle (50% point) of 25°. Figure 5 shows the spectral output of the four emitters. Chroma-Q has chosen a 460nm blue for this product, which is slightly longer in wavelength than in the Color Split measured last year. This slight increase should help with improved output; the eye's sensitivity to wavelength is changing very rapidly in that region, so even a small increase in wavelength shows as a large increase in apparent brightness. Finally, Figure 6 shows the luminaire in its four native colors; red, green, blue, and amber.

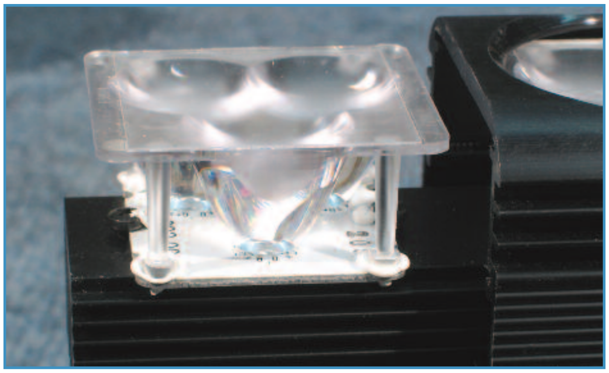

Fig. 4 - LED array and TIR lenses

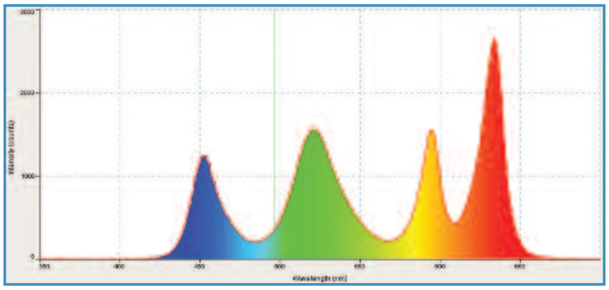

Fig. 5 - Color Block Spectra

Fig. 6 - Four native colors

Output

As has become the norm with LED fixtures I expected to report two separate readings for light output—one with all LEDS at full (usually a pinkish white, as there never seems to be enough green output) and another with the mix adjusted to a real white closer to the black body curve. However, Chroma-Q has configured the Color Block 2 so that taking all four color channels to full produces white. It looks like the company does a good job of trimming the colors when everything is at full, so that the resultant mix is close to white. Figure 7 shows the resultant curve, with light output in this mode measured at 316 field lumens in a field angle of 52°. (I always measure and report field lumens, which is the total light output where the illuminance is greater than 10% of the center illuminance). The beam is slightly asymmetric, with the horizontal spread a couple of degrees larger than the vertical.

The color temperature of this full up white was approximately 4,900K. I then mixed a 3,200K white by reducing the blue and green outputs and, interestingly, got a good result with the light output only reduced by 5% from the 4,900K value. As with its previous products, Chroma-Q is playing some clever fixture management-games here, dynamically adjusting the driver settings to the array to optimize the output. For example, as I reduced blue output, the fixture was able to compensate so that the brightest possible output for a mix is obtained. Figures 8 and 9 show this in operation. Figure 8 has all channels at full while Figure 9, at the same scale, shows the same unit with just red at full. This is a smart way to maximize the output from a compact fixture.

Beam homogenization was good—that diffusing film was doing its job—and colored shadows and fringing, although still visible to some extent, were acceptable. With a single

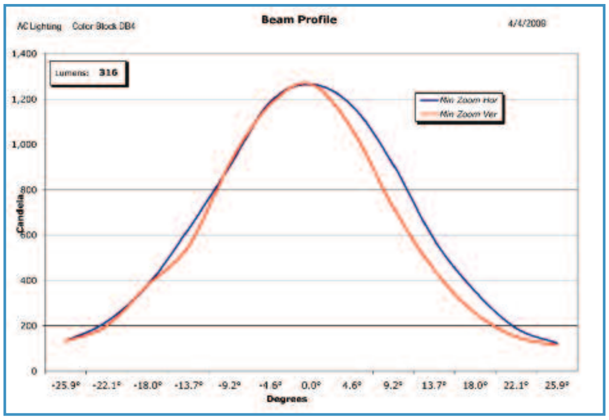

Fig. 7 - Output

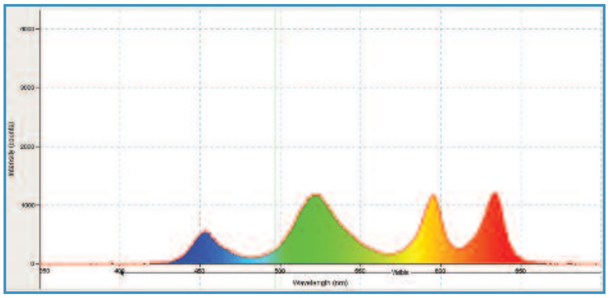

Fig. 8 - All colors at full

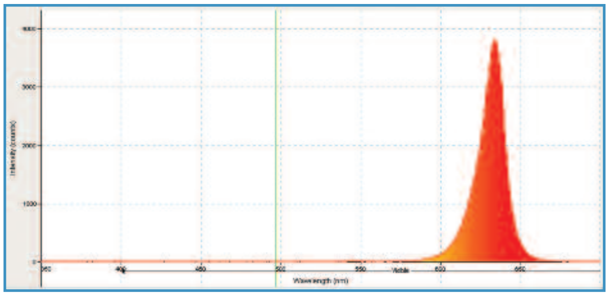

Fig. 9 - Red at full

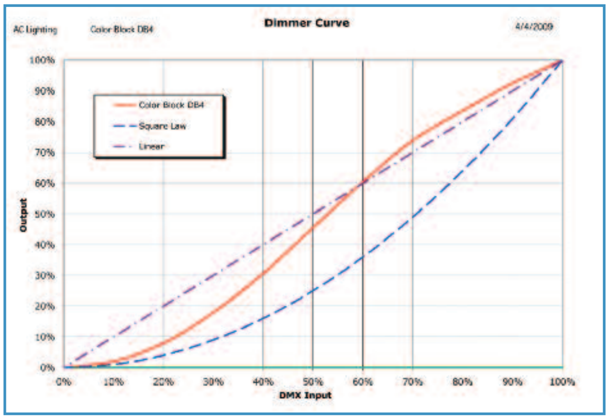

Fig. 10 - Dimmer Curve

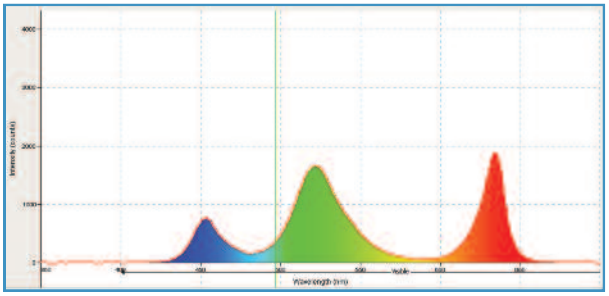

Fig. 11 - Spectra RGB White

unit I did see a slight color shift in the beam from slightly “reddish” on the left to slightly “bluish” on the right. I suspect this is an edge effect that happens at the end of the run and would be masked when using adjacent overlapping units in the way the Color Block is intended to be installed. As you can see from the output curve in Figure 7, the beam distribution was even and should blend well with adjacent units.

Dimming

The dimming curve is shown in Figure 10. Interestingly, Chroma-Q has moved to a theatrical “S” curve, which gives increased resolution at the top and bottom rather than in the middle. It’s perhaps a slightly unusual curve to use for an LED unit but, in operation, it performed well and the dimming was very smooth, with no visible glitches or jumps. It seems Chroma-Q is trying to provide an incandescent “feel” to the luminaire—and there’s nothing wrong with that! Some intensity stepping was visible when fading slowly below 20%, which is an area of weakness of many LED units. The PWM frequency of the Color Block 2 is adjustable on the power supply unit to 360Hz, 600Hz, 1,200Hz, and 2,400Hz, which should be more than fast enough to avoid issues with DMX512 aliasing or conflicts with video rates. For this review, I ran the tests at the default 360Hz. One interesting point: After trying all the modes, I found the smoothest and cleanest dimming was achieved by running the unit in RGBI mode (red, green, blue, and intensity) and dimming just using the Intensity channel.

Color system

The Color Block 2 four-color additive system using RGBA LEDs is becoming increasingly familiar. The addition of amber to the RGB triad adds warmth to skin tones, which are something of a weakness of RGB-only units, and helps fill in the large gap between red and green in an area where the human eye is very sensitive. If you don’t want to mess with mixing in a fourth color to your RGB mix, then Chroma-Q offers a way to add amber automatically in the “magic amber” mode, where amber is included at a level matching whichever is lower of red and green. This may be a compromise over using all four colors independently but is, nevertheless, a very effective one that produces pleasing results.

The color-mixing table below clearly shows further consequences of the dynamic optimization system, with some mixed colors apparently being brighter than full-up white. In particular, note that a three-color-mix RGB white is 13% brighter than a full up RGBA white. Why should this be so? Well, amber is the most inefficient color of the four, so removing amber completely allows other, more efficient, colors to step in and produce more output, albeit with a lower

Color Mixing, percentage of full RGBA output									
Color	Red	Green	Blue	Amber	Magenta	Cyan	Yellow	3200K White	RGB White
Output	46%	73%	50%	35%	96%	121%	117%	95%	113%

Fig. 12 - Rear of unit

Fig. 13 - Power supply menu

Fig. 14 - Power supply connections

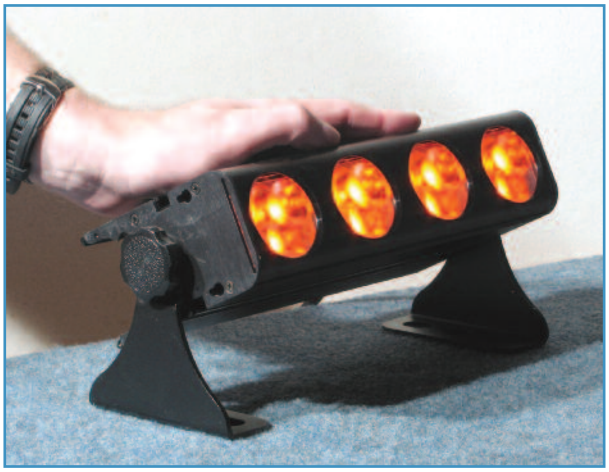

Fig. 15 - Scale of unit

color rendering. Figure 11 shows the spectra when mixing an RGB white with no amber—this is on the same scale as Figures 8 and 9 and shows the increased output from other colors, particularly green, with amber disabled. If all you need is raw power, then you might want to experiment with various ways of mixing colors and find the one that gives you the highest output. Looking at the more saturated colors, you can see that magenta was particularly striking with an output of 96% of full white; the Color Block 2, as many LED luminaires, is most effective when producing deep shades.

Noise

The Color Block 2 is fitted with a single fan that draws air in and over the electronics from one end of the unit, exiting at the other. Figure 12 shows the arrangement with the fan on the left and exit air vent on the right. A noise level of 38dBA at 1m was measured (compared with the <35dbA ambient level in my test room).

Electronics and control

The Color Block 2 is driven by an external auto-ranging (100 – 240V 50/60Hz) power supply; the initialization time from power up was under two seconds. The power supply I used was the PSU-05, which is capable of driving up to five Color Block 2 units connected in daisy-chain fashion using four-pin XLRs. This arrangement is very similar to that used for scrollers, and most users should be familiar with the connections. Figures 13 and 14 show the front and rear of the power supply unit, with the control and menu system and connections respectively. The menu and control system are accessed through the horizontally mounted encoder wheel; two push buttons, seen in Figure 13, give access to a good range of options, particularly to the many choices for DMX512 control. The use of a remote supply like this allows a little more room than would be available on the heads themselves for the controls, so there was space for a two-line 32-character LCD display; it is very legible and makes the messages somewhat less cryptic than the more common seven-segment, four-character displays. This display is where you select, for all connected units, whether you are addressing by cell or by block; it is also where you decide if you want RGB, RGBA, HIS, or effects control. My preferred mode, if only eight bits are available, is RGBA. HSI is quick and easy for setting colors—and is perfect for color effects—but is a little limiting when it comes to cross-fading between those colors; eight bits is just not enough for defining color, and leads to steppy color crossfades if you aren't careful. For maximum smoothness in crossfades, you should stick to RGBA, but, for maximum color effects, use HSI. The Color Block 2 offers both, so the choice is yours.

The many control options include the ability to address the Color Block 2 as a single luminaire, with all four LED arrays working together, or, instead, to address each of the four cells independently for pixel-type effects. As mentioned above, you also have the option of RGB, RGBA, or HSI color modes. Finally, you can choose to engage a comprehensive effects engine with many options for color scrolling, color, and intensity fanning, and all the usual ramp/snap strobe effects. These would be particularly useful when you used the Color Block 2 in multiples and batten configurations.

The connection side of the power supply (Figure 14) offers five-pin XLR DMX-512 in and out connectors and a single four-pin XLR output connector carrying both 48V power and data for the Color Block 2 chain.

Turning to the Color Block 2 head itself, this is a very small and compact unit. To give you some idea of scale, I took a photograph with my hand in shot (Figure 15). The construction is based around a main chassis comprising the four LED cells, their associated circuit boards, and a heat sink with a small circuit board mounted behind them containing the local power supply (dropping from the supplied 48V), and LED drivers. This whole assembly then slides into an external extrusion, which serves as both enclosure and heat sink. Figure 16 shows an overall view of the chassis after it's been removed from the external enclosure. Once it's removed, access to all components is very easy, so this should be a simple unit to clean and maintain. Figure 17 shows an elevation view of the complete assembly—note the interlocking slide at the bottom where the LED heat sink slides into the outer enclosure. I presume this serves as a path to conduct heat from the internal heat sink out to the enclosure extrusion. Slides like this are tricky to make work well in aluminum extrusions; Chroma-Q has done a good job making this a push fit. Also seen in Figure 17 is the heat management system—the fan forces air along the length of the heat sink and the air space above it before exiting. In my tests, the unit ran cool at all times; I saw no evidence of unreasonable output drop as the unit warmed up. (All LEDs drop in output to some extent as they heat up.)

Construction

We've already talked about internal construction. Externally, the Color Block 2 offers many options for connecting units in arrays or to various mounting brackets. Figure 18 shows the interlocking pins and associated keyhole slots on the adjacent units used to connect units end to end. Slide the pins into the keyhole slots and then lock the assembly in place with the "road case" butterfly lock shown in Figure 19. (There are many more options for connection and mounting—there's probably a bracket, widget, or gizmo to connect them in any way or shape you can think of.

Conclusions

This is the first time we've reviewed a second generation LED unit. Has Chroma-Q learned from the first unit and made improvements? Clearly, the output is significantly better, as you would expect from use of the latest LED devices. The Color Block 2 is an extremely compact unit with very respectable optics and electronics. Is it the right unit for your application? I hope I've given you some useful information to help you make that choice. As always, it's your decision but, if you forgive me, I'll repeat the mantra I've stated a number of times with LED-based units. LEDs don't behave the same as incandescent or HID-based light sources, so it is even more important than ever to try units out in your application to see if they will do the job. I suspect you will see many differences you are happy with and a few you aren't. If you want color, then LEDs are for you; for white, then conventional sources still have a slight edge. Whatever you do, don't rely on published numbers or even on reviews like this—try the Color Block 2 for yourself and make your own determination.

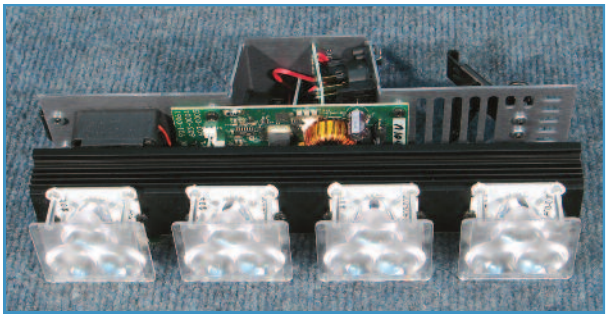

Fig. 16 - Main chassis

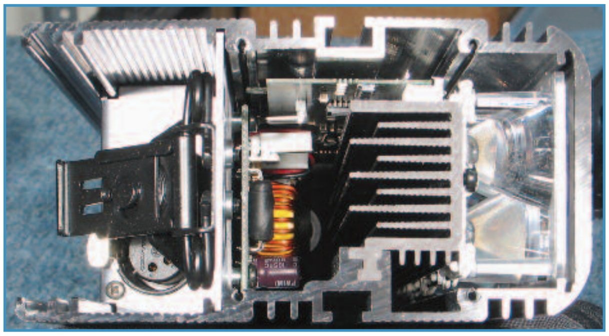

Fig. 17 - Side view showing construction

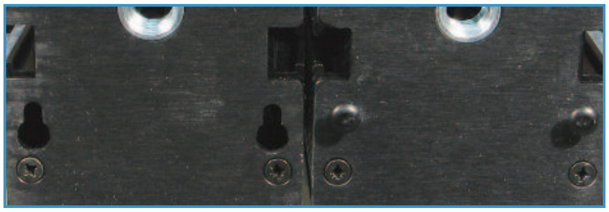

Fig. 18 - Joining mechanism

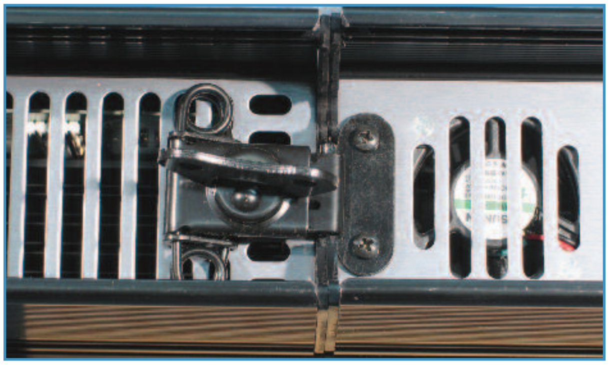

Fig. 19 - Locking