AC Lighting Chroma-Q Color Split

By: Mike Wood

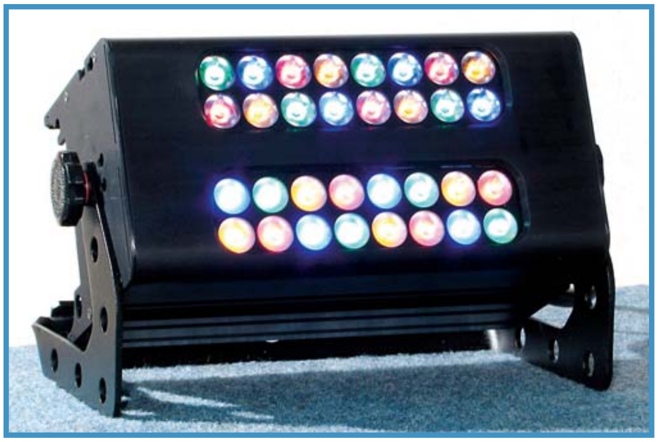

Fig.1: Unit as tested.

Fig.2: LED layout.

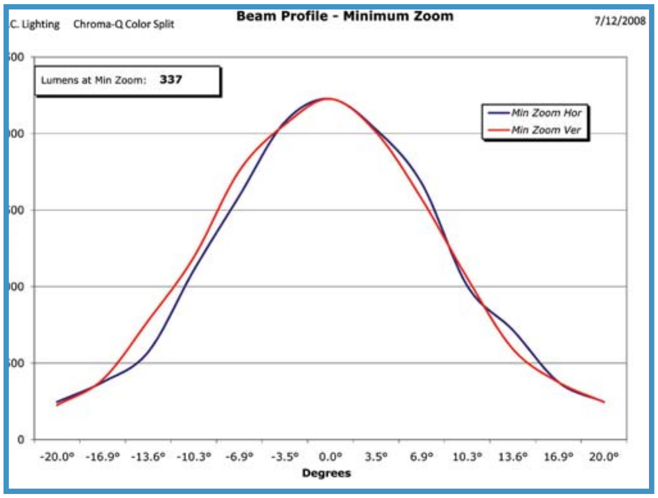

Fig.3: Output.

A.C. Lighting is perhaps best known as a stocking distributor of products from many different manufacturers; however, in recent years, the company has introduced a range of products it manufactures itself in its North American facility. Many of these are sold under the Chroma-Q brand name, which started with scrollers, but has more recently expanded into the chromatically related field of LED color-changing units. For this review, we are looking at the Chroma-Q Color Split. This is a relatively small RGBA LED unit, described by A.C. Lighting as being suitable for color washes and truss warming. Certainly its small size makes it very suitable for the latter. It's not the most powerful LED fixture on the market, but A.C Lighting has added a couple of novel features that make it an interesting unit to test. I'm finding the rapid evolution of these LED washes fascinating to watch—units that were bright enough to actually use for illumination, as opposed to direct view, only really appeared a year or so ago, and the rate of change is quite staggering. Being part of a disruptively changing market is both good and bad for a manufacturer—good because LED wash products are selling well, with steadily increasing demand, but bad because a product lifetime is potentially extremely short before the core LEDs have moved on to the next bigger and better stage in their rapid development.

As usual in these reviews, I'll try and measure everything I can in an objective a manner as possible and present the facts for you to use to form your own judgment. As A.C. Lighting markets the unit as a color wash and truss warmer, I'll try to judge it on those attributes. The unit supplied was a single cell containing 32 LEDs equally split across red, green, blue, and amber LEDs (Figure 1). Multiple Color Splits can be connected end-to-end to form a longer batten for backdrop lighting, and the unit has both electrical and mechanical features to facilitate that—more of that later. The Color Split is fitted with a universal power supply input; however, for all my tests, it was run from a nominal 115V 60Hz supply (actually 118V on the day).

Light source and optics

As usual, we start with the light source. In the case of the Color Split, the light source and color mixing both come from those same 32 LEDs (Figure 2). The 32 LEDs (A.C. Lighting's literature doesn't say, but I assume these are nominal 1W LEDs) are arranged in two parallel banks of 16, each containing four sets of red, blue, green, and amber LEDs. As supplied, the two banks are not identical—the top one (as seen in Figure 2) has a 5° optical diffusing film in front of the LEDs, while the bottom bank has a 20° optical diffusing film. As the two banks are accessible and controllable separately, this gives the user the ability to decide which beam angle to use or to use them together to get an interesting mixed beam, designed, A.C. Lighting says, to give good coverage on a backing by covering both the near and far portions with different LEDs. For most of my tests I ran both banks together, as they would be used in wall-washing mode. A.C. Lighting also offers additional kits to increase the beam angle to 30° and 60°.

Output

To make comparison with the other LED units I've tested as fair as possible, I ran the Color Split in two modes to measure output—first with all LEDs at full, which produces a rather pink output, and secondly with the color mix adjusted to give white. (As usual with LED fixtures, green is the weak link, and red and blue need to be reduced in output to mix a white). Figure 3 shows the output curve. Light output with all LEDs at full was 337 field lumens across a total field angle of 40°. As with other LED units we have measured in these reviews, I believe the lumens figure to be lower than the eye might see because of the inability for regular CIE calibrated light meters to properly indicate the output of the blue LED, particularly when it is a short wavelength blue as used in the Color Split. If in doubt, trust your eyes!

As a footnote, it is perhaps worth mentioning that I always report field lumens in these reviews—that is, the total light output where the illuminance (measured in footcandles or lux) is greater than 10% of the center illuminance. You may also see other lumen figures quoted by different manufacturers that could be higher or lower than this, such as beam lumens (light that is greater than 50% of the center), cut-off lumens (light that is greater than 3% of the center), or total light lumens, where all the light emitted by the fixture in all directions, as seen by an integrating sphere, is included. All of these techniques are valid, but all will give you different answers, so make sure you know which one is being used and that you are comparing apples with apples before making any comparisons.

Now for the first interesting wrinkle that A.C Lighting has added to the Color Split: When I adjusted the color mix to make white—by reducing the red and blue outputs to get the output back close to the black body line, necessitating a 30% or so drop in those two channels—the total output hardly changed at all—less than 1%, in fact. What's going on?

I took a closer look at the outputs of each color and discovered that, as I dimmed down the red and blue LEDs, the green LED increased to maximize the light output. A.C. Lighting is being quite clever here to help improve the output when used in white or mixed colors, while still keeping the unit small. Figures 4 and 5 show what's going on. Figure 4 shows the

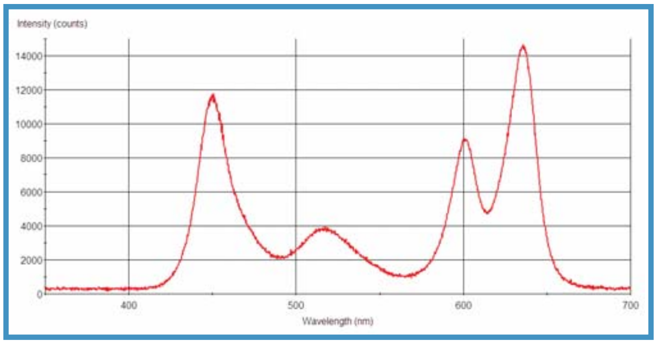

Fig.4: All colors at full.

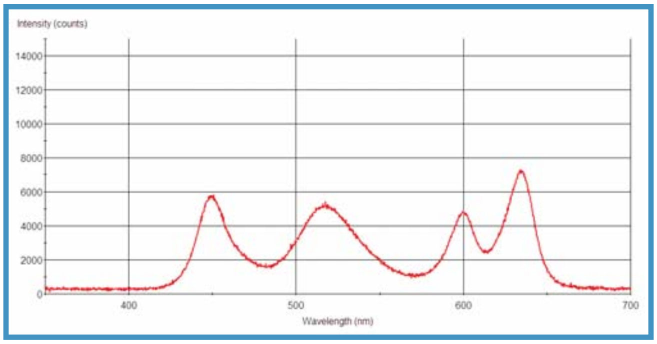

Fig.5: Mixed white.

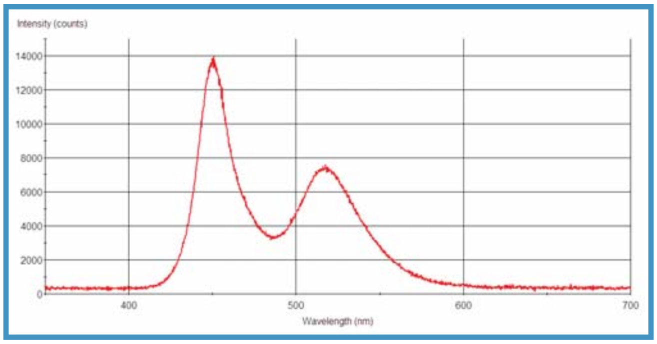

Fig.6: No red and amber.

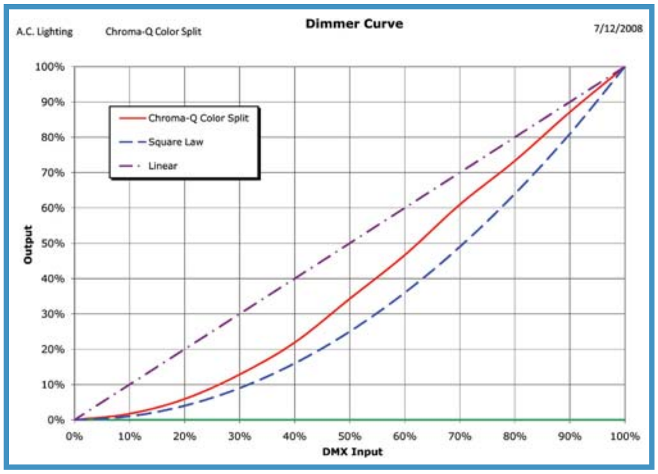

Fig.7: Dimmer curve

spectral output when all LEDs are at full. You can clearly see the four peaks for the four LED colors—from left to right, we have blue, green, amber, and red. Figure 5 shows the same unit adjusted for approximately 3,350K white—blue, amber, and red have dropped in output but the green output has significantly increased. As our eyes are most sensitive to green, and it forms the largest percentage of a total lumen calculation, this increase in green is enough to offset the losses from the other three colors.

Figure 6 shows an extreme example of this technique—in this spectrum, only blue and green LEDs are running, and you can see that the output of both is much higher than in Figures 4 or 5, thus maximizing the unit's output in mixed colors.

The output curves show a nice smooth light distribution; it is symmetrical in both the horizontal and vertical directions, which should blend well.

As with all units using separate LEDs for the different colors, there was clear evidence of color fringing and colored shadows when used close to a surface. Move it a few feet away, and the colors merge much better. I imagine that using multiple adjacent units also helps with the beam homogenization.

Dimming

Figure 7 shows the dimming curve. It's a well-defined, smooth curve halfway between the linear and square law curves, which should make it easy to use with other fixtures. There were no visible discontinuities or jumps in the output, as it was dimmed. Again, as we've seen before—and this is one of my pet gripes with LED fixtures as a class—you can see each DMX512 step when you get down to low levels in a slow fade. Somebody needs to better resolve that problem of lack of thermal inertia! It's not visible with the Color Split until you get below about 25%, which seems to be par for the course.

In some of its operation modes, the Color Split offers an internal strobe accessible through DMX512, which I measured as giving a range from 2.2Hz-30Hz. The PWM frequency is 360Hz, which is more than fast enough to avoid any aliasing issues with the DMX512 signal.

Color system

LED units like this are all about color, of course, and, with a name like the Chroma-Q Color Split, it's clear that A.C Lighting thinks so, too—like New York, New York, they thought it was so good they should name it twice. I'm pleased to see the addition of amber to the usual RGB triad; to my eyes, this significantly improves color mixing in pastels and whites. A.C. Lighting provides a number of ways to use the color mixing. You can access all four colors individually, or you can use three-channel RGB or HSI control models. In the RGB case, the Color Split automatically adds in the amber channel as needed to augment the mix. As far as I can see, it does this by always including amber at a level which matches whichever is the lower of the red or green channels. This makes sense, as this is effectively using amber as a mixed yellow halfway between the red and green LEDs. However the actual calculation is done, the use of the amber is invisible to the user (A.C Lighting calls it "Magic Amber"), and it definitely adds depth to mixed colors. I suspect it also increases the color rendering, although I have no means to measure that. I was able to mix the colors I wanted, and the ultimate true-life test of using the output on skin tones produced satisfactory results.

Color mixing

Color	Cyan	Magenta	Yellow	Red	Green	Blue
Output	84%	51%	106%	46%	82%	5%

One thing about the above table that immediately stands out is that yellow on its own is apparently brighter than white. This is another consequence of the Color Split's compensation system: to mix yellow, I brought the red and green channels to full and left blue at zero. The "Magic Amber" system then matched the amber channel to full as well. With blue at zero, the control system pushes the other three up to provide maximum output and, in this case, achieves an output higher than in white. Another figure worth mentioning is that apparently very low output in blue. This is likely a consequence of the issue we've seen before, where the blue wavelength (around 450nm in this case) is too low for regular light meters to see and is in the area where the standard CIE curve is incorrect. To my eye, the Blue output looked significantly higher than this figure would suggest—because of this problem, you should always view figures with educated skepticism and make a final decision on LED fixtures using your eye as the judge.

As mentioned above, A.C. Lighting offers various control models for the Color Split. As well as RGB and RGBA, you can also use HSI control channels. The HSI mode works well but, as with other units using it, shows you that eight bits for HSI control isn't really enough. Slow crossfades on the H (or hue channel) gives visible steps in the color output. I really like the use of HSI for programming, so I'd like to see—and this is a generic comment not aimed at A.C. Lighting in particular—an improvement in its use for crossfading.

In the stand-alone mode, the Color Split offers various color temperatures of white ranging from 2,600K to 8,000K. It's difficult to measure the color temperature of these discontinuous spectra sources; however, I found the actual CT to be higher than rated. For example, I measured the 3,200K mode at 3,350K (pretty close) but the 5,600K mode at a much higher 7,600K. If color temperature is important to you—either for matching or use on video—then I would recommend testing out the range with your video camera and selecting the one you like rather than relying on the rating.

Noise

The Color Split has a single fan, which runs at a low speed. I measured a peak level of 36dBA at 1m, which is only 1dB above the 35dBA of my test room's ambient floor noise (Figure 8).

Electrical parameters

The Color Split uses an internal auto-ranging (100-240V 50/60Hz) power supply, and initialization time from power up is two to three seconds.

Electronics and control

The Color Split has power and five-pin XLR DMX512 input connectors on one end and a power and DMX512 output connector on the other. This allows them to be easily connected end-to-end, to produce longer, batten-style units (Figures 9 and 10). Power in and out are through PowerCon connectors. These are good-quality connectors and are becoming common enough these days that their use isn't a problem.

The unit has a simple menuing system using three 7-segment LED displays and three selector buttons. Through the menu system, you can select protocol, address, and other effects modes, including pre-programmed and stand-alone operation. Of note is the fact that you can choose to configure the unit as a single device or control the upper and lower, and narrow and wide-beam, banks independently. This allows some interesting split or dual-color effects on a back-cloth or truss (Figure 11). A neat feature of the display is its dual use as a power, data, and signal level indicator when not being used as a menu. It reverts to this mode a few seconds after use, and gives you a visual indication of the DMX512 signal strength as well as the usual power and data indicators.

I dismantled the unit to see how it was put together and how easy it might be to service. This was pretty simple—remove four screws and an end of the unit can be lifted off. You can slide out the entire electronics and LEDs on two chassis units. Figure 12 shows the two major assemblies. On the left is the power supply and main control board, while on the right are the two LED banks, each with their own board and integral heatsink (Figure 12). Maintenance would be very straightforward. As we've said before in these reviews, the temperature you run LEDs at—and, therefore, the heat-sinking and heat management systems—are absolutely critical for consistent output and good performance. It appears that the Color Split is fine in this respect—no part of the unit got hot in my testing. With only 40W to dissipate, the single low-speed fan draws low-speed air over the LED heatsinks and the main power supply, and easily removes the heat.

With the unit apart it was possible to get a closer look at the LEDs and optics. Figure 13 shows a close-up of the main LED board, and you can clearly see the LED chips each with its own TIR (total internal reflection) optic to direct the beam. It appears that both banks use the same lenses and the different beam angles come solely from the two different diffractive films stuck on top of the lenses. These diffractive films typically have very low losses and are a very efficient way of controlling light (Figure 13).

Construction

The unit's mechanical construction is very straightforward and centers around a single U-shaped extrusion into which the components and heatsinks shown in Figure 12 slide. As mentioned above, multiple Color Split units can be connected end-to-end to form a batten (A.C. Lighting recommends no more than ten units be connected in this manner). Figure 14 shows the pins that protrude from one end of the unit. These pins drop into keyhole slots on the end of the adjacent unit to accurately align the units, and a butterfly lock connector—just like those on road cases—is used to secure the two units (Figure 14). The butterfly lock can be clearly seen in Figure 10. It's a simple system and, given that this is a small, lightweight unit, should work fine.

Conclusions

Well there you have it: the A.C. Lighting Chroma-Q Color Split LED wash unit. It's a compact unit with nice color mixing, and is an easy unit to hide away behind or within scenery or in trussing. In some ways, it's a basic unit but, as I said earlier, with a couple of interesting wrinkles. Is it the right unit for your needs? As always—and, even more importantly, with LED-based units—I leave that decision to you.

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Fig.8: Fan and heatsink.

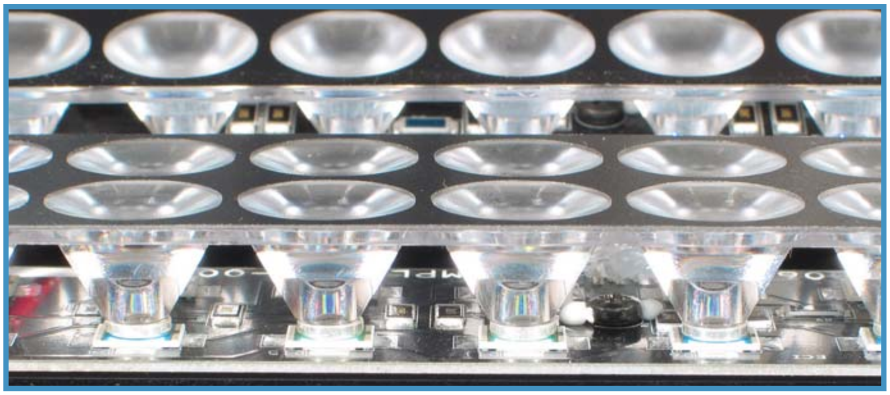

Fig.13: LEDs and optics.

Fig.9: Input connections.

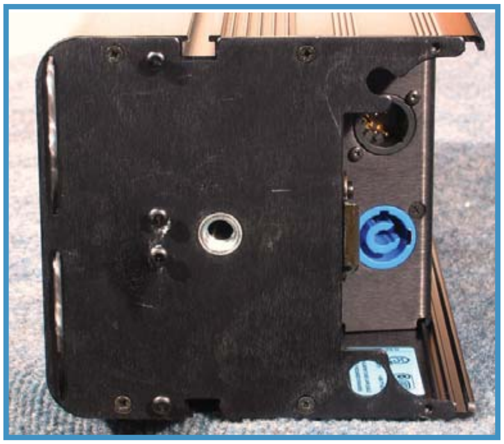

Fig.14: Linking connections.

Fig.10: Output connections.

Fig.11: Rear of unit.

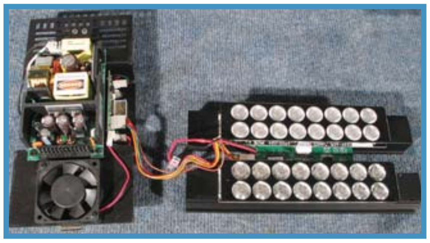

Fig.12: Unit dismantled.

Power consumption as tested at 118V

	Current, Power	Power Factor
Electronics only, no LEDs	7W	0.90
All LEDs illuminated	40W	0.96