Chauvet's COLORado 6

By: Mike Wood

Fig. 1: Fixture as tested.

This month, we are taking a look at a type of luminaire that has become very common in the last year or so: the LED-based linear color-changing flood. These straight-batten-type units, with subtle and overt changes, are produced by a number of different manufacturers. Whatever the differences, the basic principle remains the same—a modular array of LEDs (often RGB) that can be used either as a color-changing wash to illuminate backings or cycs, or as a direct-view effects light or large pixel display. The unit under test is the COLORado 6 from Chauvet Lighting. Chauvet is well-known as a manufacturer of lighting products, and the move into LED effects products is a natural one.

Fig. 2: Rotated arrays.

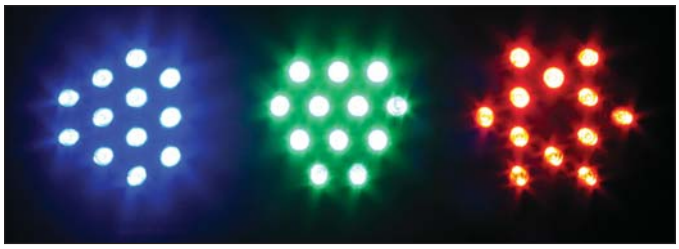

Fig. 3: Three colors of LEDs.

Fig. 4: LED lens array.

I would consider the Colorado 6 to be a light intended for color-wash effects and illuminating backings, and will review it as such. Any LED fixture using red, green, and blue LEDs from any manufacturer will inevitably have color limitations when it comes to white light and pastel colors, and it wouldn't be appropriate to single out the Colorado for those concerns. It's important to judge a unit for its intended use—which, in this case, is for producing colored washes and beams of light as a blinder or flood light (Figure 1).

The Colorado 6 is a three-module light where each module contains thirty-six 1W LEDs, 12 each of red, green, and blue. Through various DMX512 control modes, the user can choose to treat the unit as one large RGB color-mixing unit, or as three separate "pixels." The unit is also stackable in both directions, but we'll describe more of that later in the review.

As we've done before with LED-based units, I'll try to report measurements as well as I can where they compare with conventionally sourced units, but I'll also measure a few things which are specific to LEDs.

Power input

The Colorado 6 is fitted with a universal power supply that allows running from any voltage between 100 and 240V, 50/60Hz. However, for all my tests, the unit was run from a nominal 120V 60Hz supply.

Light source

As mentioned above, the Colorado uses 3 x 36 arrays of Cree RGB LEDs, rated for 50,000-hour life. Figure 2 shows the three arrays as they are laid out in the unit. Note that the center array is rotated through 30° relative to the two outer arrays. I assume this

is to try and help even out the color mixing across the composite beam. Within each array, the three colors of LEDs are distributed evenly across the field. Figure 3 shows how this distribution works and ensures you end up with evenly spaced triads of LEDs.

If we take a close-up look at those arrays, we can see that each LED is fitted with an individual total internal reflection (TIR) optic to control the beam angle (Figure 4). As an aside, the use of TIR optics is very common with LEDs. They work, as the name suggests, by reflecting the light off internal surfaces rather than by refraction, as used in a conventional lens. TIR optics are very efficient and suit the small size, but wide-angle output, of LED dies very well. Capturing the 160° output of an LED die can be extremely difficult to do with conventional refractive lenses. The unit as measured was supplied with the standard 15° lenses; however, although I didn't see them or test them, Chauvet offers 10° and 30° lenses as user-replaceable options. As to total LED power, the math is simple: one hundred eight 1W LEDs equals 108W.

Output

As I've done with other modular units, I measured the output of a single array, then multiplied it by three to get the total luminaire output. That meant I could measure a symmetrical beam, which always yields more consistent results. I measured the unit in peak white output, which isn't, as you might have thought, when all LEDs are at full output. As mentioned above, Chauvet has used equal numbers of each of the three colors of LEDs. This is good for even color mixing and the appearance of the unit when viewed directly, but isn't necessarily the right ratio to mix a pure white. As is often the case with LED luminaires, the green output is the limiting factor and, with green at full, both the red and blue LEDs have to be dimmed down to achieve a good blended white. With this done, the peak white output, as shown in Figure 5, was 2,430 lumens, which competes very well with other similar products. By comparison, the output when all three colors were set to full power was about 24% more at 3,000 lumens. As can be seen from Figure 5, the output distribution was very even and symmetrical, with a measured field angle of 24°. When all three arrays are powered up, the effective horizontal field angle will be slightly more than this, due to the physical horizontal separation of the three arrays. This angle will vary with the throw distance; it will be greater when the throw is small and will reduce as the throw lengthens, reducing back to the 24° figure at long throws. The shape of the beam means it should be possible to get good blending between adjacent units. Chauvet tells me that it also manufacture a barndoor attachment for the Colorado 6 with the ability to add diffusion to give a range of beam control; however, I didn't have one to test.

The color-mixing output on a white screen looked fine. As with any luminaire with individual LEDs, get too close and you start to see multi-colored shadows from all those LEDs. However, at throws of 10' or more, the beams all merge pretty well. This would also improve when multiple adjacent units are blended together, as will often be the case. I know some lighting designers use those colored shadows as an effect—which shows the importance of using a luminaire to its best advantage.

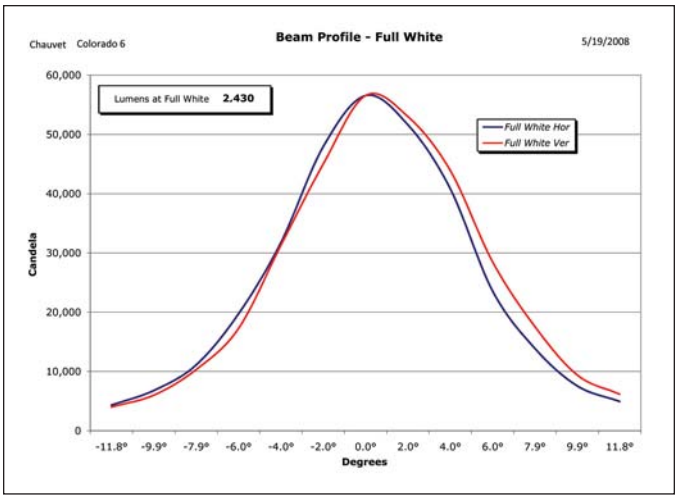

Fig. 5: Output in peak white.

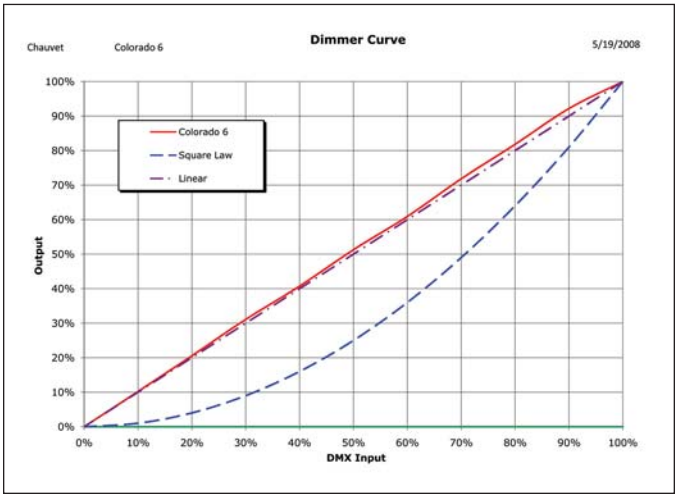

Fig. 6: Dimmer curve.

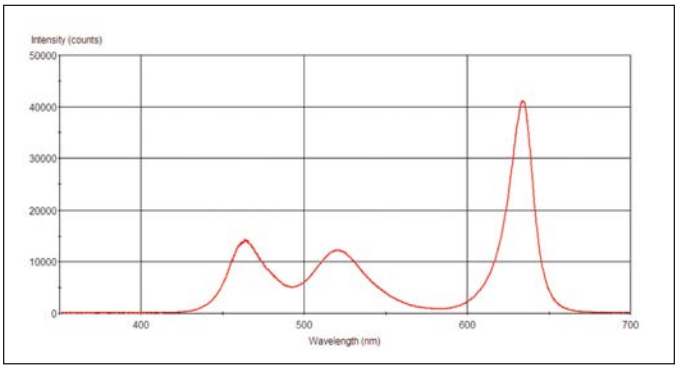

Fig. 7: Colorado at full.

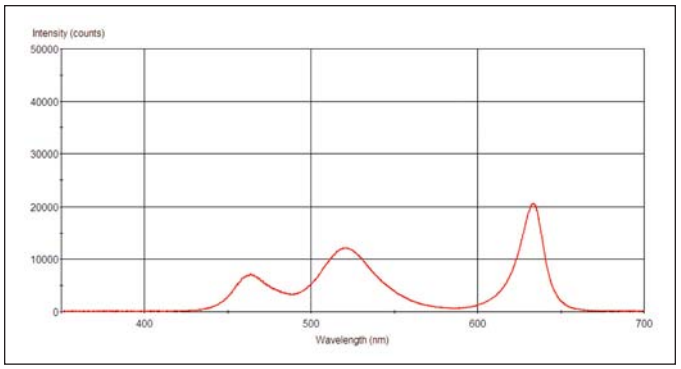

Fig. 8: Colorado White.

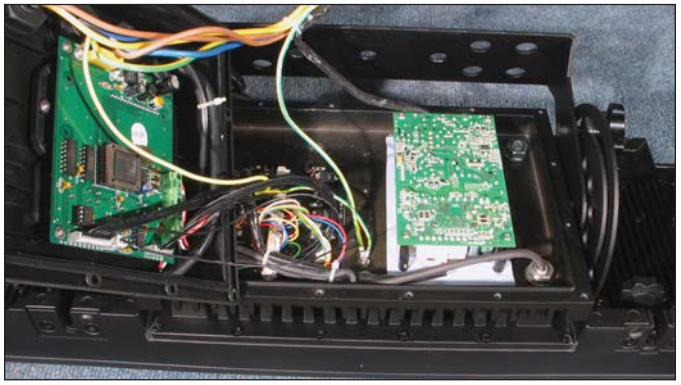

Fig. 9: Electronics.

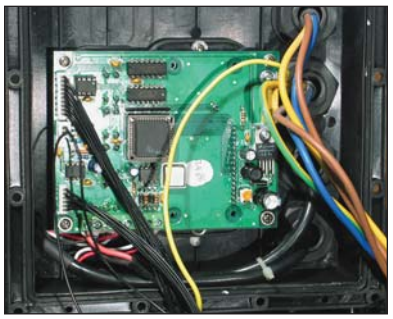

Fig. 10: Main processor.

Fig. 11: Rear panel.

Dimming and strobe

Figure 6 shows the dimming curve, which is extremely linear. I have to say that dimming is not the Colorado's strongest point. I found the dimming to be extremely steppy and, with a 30-second fade, it was possible to see every step once the unit was dimmed below 50%—which, I think, further emphasizes its intended use as an effects unit. LEDs react so quickly to changes in input that it's extremely difficult to get smooth dimming; however, it does make them an ideal light source to use as a strobe. Accordingly, the Colorado offers an internal strobe with a rate controllable from 1.6Hz to a very rapid 24Hz. I measured the PWM frequency at 400Hz, which should avoid any aliasing issues with DMX512 control.

Color system

Of course, an LED RGB luminaire is all about color, and the Colorado does a fine job of mixing mid-range and saturated colors. It's not so good on pastels, of course, but it shares that trait with any of its RGB competitors. This is also the area where the high output of an LED fixture in deeper, more saturated, colors really comes into its own in comparison with fixtures using conventional light sources and colored filters.

Color Mixing

Color	Cyan	Magenta	Yellow	Red	Green	Blue
Transmission	68%	41%	90%	32%	59%	9%

The color-mixing figures above illustrate a measurement problem we've come across before with reviews of LED-based units. In my opinion, the measured figure for blue output is lower than the perceived blue brightness I saw. This is because the very-narrow-angle blue light emitted falls in an area of the CIE curve where light meters give widely varying, and usually incorrect, readings. The only way to judge the real brightness in these deeply saturated colors is to use your eyes and ignore the meter.

To illustrate what's actually going on, I measured the spectra of the light output at two settings: first, when all three channels were at full output (Figure 7), and then again when the red and blue were reduced to mix the brightest possible white (Figure 8). In both curves, you can see the three peaks from the LEDs: A sharp red peak at about 630nm, a broader green at 520nm, and blue at about 460nm. You can clearly see the reduction in red and blue that was needed to mix the peak white in Figure 8 from its maximum value in Figure 7.

Noise

The Colorado is convection-cooled and has no moving parts, so I could detect no noise at all above the 35dBA of my test room's ambient floor noise.

Electrical parameters

The Colorado 6 uses an internal, fully power factor corrected auto-ranging (100 – 24V 50/60Hz) power supply.

Power consumption as tested at 118V

	Current, Power	Power Factor
Electronics only, no LEDs	0.12A	0.85
All LEDs illuminated	1.52A, 180W	0.98

Initialization time from power up was a snappy three seconds, and the unit behaved well on power up, with no visible flashes or blinks.

Electronics and control

The electronics are all on two circuit boards in the rear of the unit (Figure 9). On the right of the photograph, you can see the rear of the power supply, which provides 48V to the main driver board in the middle. On the left of the picture is the main processor board, which is mounted on the back of the removable cover. This is a double-sided board, with the display and controls on one side and processor and associated electronics on the other (Figure 10). It's a simple layout, and quite easy to get to for maintenance. This assembly is mounted on the rear of the main aluminum extrusion body of the unit, which also acts as the heatsink for the drivers and, most importantly, the LEDs. The LED boards are all mounted on the other side of this main extrusion, which extends the whole length of the unit. To access the LED boards, you have to remove the front bezel and lenses. To get to anything means removing a lot of screws, but this is because the Colorado is an IP66-rated unit and needs to be kept sealed. IP66 is the highest equipment ingress protection rating short of being rated to run underwater and signifies that the unit is dust-tight and keeps out powerful water jets. I have no means of testing this rating, so I present it untested. The IP rating makes it difficult to use any kind of fans, so the Colorado is purely convection-cooled. The large heatsink gets pretty warm during operation, although never dangerously so.

The Colorado offers a standard menuing system on the rear panel (Figures 11 and 12). This allows configuration of the unit, and its various DMX512 control modes, and also gives the user options for stand-alone and macro-driven operation. Chauvet also offers remote and automatic addressing, for use when an array of Colorados is connected together on a single DMX512 universe.

Because of the IP66 rating, the Colorado is fitted with sealed connectors for both power and data (Figure 13). As well as the usual power in and data in and out, the Colorado is also fitted with a power-out connector for daisy-chaining up to 12 adjacent fixtures when run on 120V, or 24 when run on 240V. All these connectors are proprietary, so Chauvet provides adaptors to convert back to conventional power cords or to a three-pin XLR for serial data. You then need to provide your own three-pin to five-pin adaptor to convert this to a standard DMX512 connector.

Fig. 12: Control panel.

Fig. 13: Connectors.

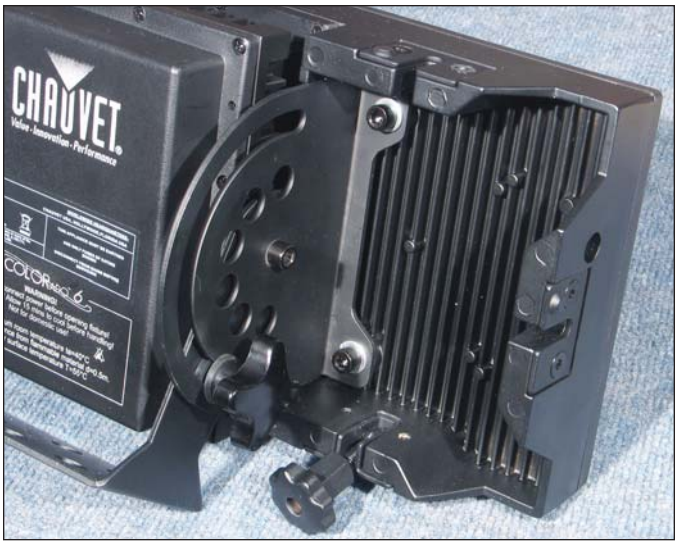

Fig. 14: Stacking system.

Construction

The mechanical construction is neat and simple. The unit has a central extruded aluminum spine to which everything else is bolted. This spine performs dual roles as both the main structure and as a large heatsink. The Colorado comes with a combined stand and hanging bracket, but also incorporates integral clamps on all four sides, which allow the connection together of units both horizontally and vertically to create a stacked array. These clamps allow you to build a large wash light or a cyc strip in a single unit and fold away neatly when not needed (Figure 14).

Conclusion

The Chauvet Colorado is a workhorse unit competing in the busy arena of modular LED RGB wash lights. As differentiators it offers good output, IP66 protection, and a useful built-in stacking system. Does it meet your needs? Only you can decide, but I hope I've provided some useful information that will help you decide if the Colorado is right for you.

Mike Wood provides technical and intellectual property consulting services to the entertainment technology industry. He can be contacted at mike@mikewoodconsulting.com