Chauvet Professional Rogue R2 Spot

By: Mike Wood

The product up for review this month is the Rogue R2 Spot from Chauvet Professional. A number of companies that have produced this class of units combine a white-only LED source with dichroic filters for color changes. There are pros and cons to this approach as I see it; on the plus side, white LEDs are very efficient. Most of the R&D from commercial lighting manufacturers is focused on them, so they lead the way for efficacy. They also tend to have better color rendering than RGB LEDs, and you don't have to worry about homogenizing all the colors together into a single beam. O the minus side, however, as with any luminaire using a white light source, you inevitably lose light, and thus efficacy, when running them through a deeply saturated color filter.

Enough of the theory; the proof is in the numbers. How did the Chauvet Professional Rogue R2 Spot perform on the test bench? As usual, I've tried to test and measure everything I can, from power input to light output, and report the raw data so you have information to help you make your own determination. The results presented here are based on the testing, with the fixture operating on a nominal 115V 60Hz supply, of a single Rogue R2 Spot unit supplied to me by Chauvet Professional (Figure 1).

Figure 1: Fixture as tested.

Light source

As I've already mentioned, the Rogue R2 Spot uses a white light LED source. This is formed from a chip-on-board array of 49 phosphor white emitters. I didn't dismantle the unit to access them, but you get a good view of the array through the lens of the unit when you have it on at a low dim level. In Figure 2, you can clearly see the individual dies, as well as the small bond wires joining them together. You can also see the combination of blue LED light and yellow phosphor in that same photograph. Chauvet rates this array at 240W. As you've heard me mention many times, all LED ratings are nominal. What matters is how much you cool the LEDs and how you get the heat away to keep them at their rated operating temperature. Chauvet has mounted the array directly to a large aluminum heat sink that has embedded heat pipes to spread the heat load over a larger surface area. Figure 3 shows the edge of the heat sink and the six embedded heat pipes that pass under the LED array. The heat sink, in turn, is cooled by two speed-controlled axial fans.

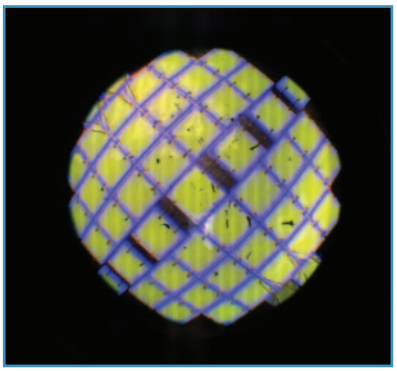

Figure 2: LED array.

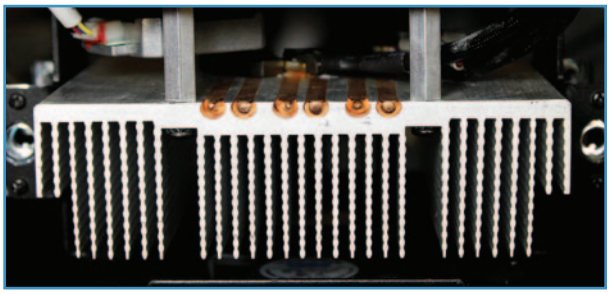

Figure 3: LED array and heat sink.

Dimming and strobe

Because this is an LED unit, all dimming and strobing is done electronically. Chauvet runs the LEDs with 16-bit dimming and this, coupled with a measured PWM rate of 2.2kHz, produced excellent smooth control. Figure 4 shows the dimming curve, which is very close to linear. Linear dimming is not my personal favorite, but you know where you are and the control is smooth enough to allow you to superimpose whichever curve you want from the desk. As you would expect from LEDs, strobing was also crisp and clean, with a measured range of speeds from 0.8Hz to 22Hz.

The first item in the optical train, after the LED array, is a

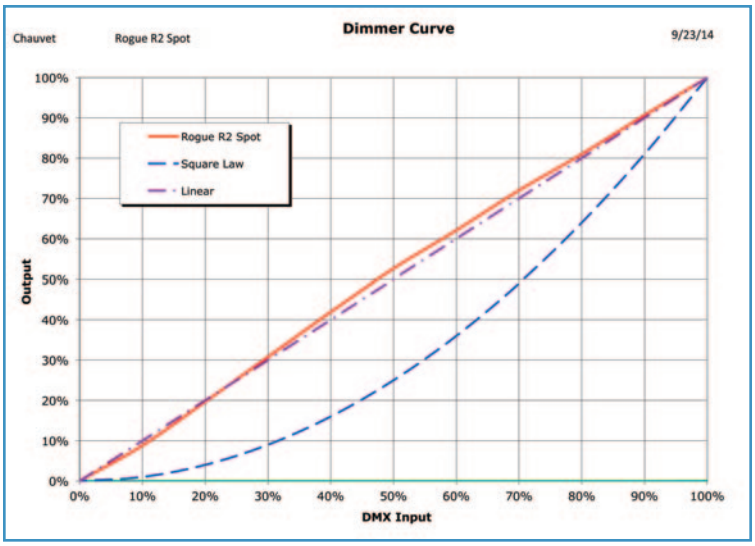

Figure 4: Dimmer curve.

lens group. This presumably serves to collate the light output and direct it through the remainder of the device. We'll return to that and the optical performance later in the review.

Color systems

As I mentioned earlier, the Rogue R2 Spot is a white light device that uses dichroic filters for color. There are two color wheels, each fitted with seven non-replaceable, wedge-shaped dichroic filters, plus an open position. Both wheels are operationally identical, although the color choice is different, of course. Normal functionality of quick path operation, split colors, and continuous wheel spins are provided on both wheels. (Perhaps split colors are another plus point for a hybrid solution using color wheels?).

COLOR WHEEL 1

Color	Yellow	Light Blue	Green	Red	Magenta	Blue	Orange
Transmission	98%	24%	61%	4.7%	5.5%	3.2%	23%

COLOR WHEEL 2

Color	CTO 3200K	CTO 5600K	Green	UV	Orange	Pink	Light Blue
Transmission	72%	65%	36%	0.4%	39%	23%	5.7%

COLOR WHEEL SPEED

Color change speed – adjacent	0.1 sec
Color change speed – worst case	0.4 sec
Maximum wheel spin speed	0.65 sec/rev = 92 rpm
Minimum wheel spin speed	132 sec/rev = 0.45 rpm

Figure 5 is a view of one of the wheels showing the glued trapezoidal colors and the narrow spokes. Figure 6 shows an example of a split color in use. The two wheels can also be used in combination to provide mixed colors and effects.

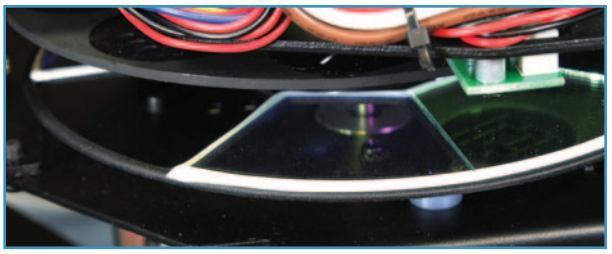

Figure 5: Color wheel.

I measured the color temperature of the unfiltered white light from the unit as 8197K with a CRI of 72 and CQS of 69; with the CTO 3,200K filter in place, it was 3,912K, and with the CTO 5,600K, it produced 4,566K.

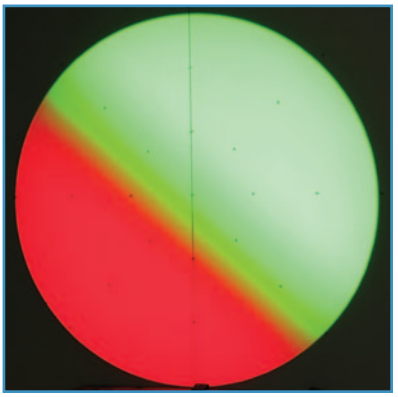

Figure 6: Split color.

You might notice in the above table for Color Wheel 1 that the first yellow filter appears to have an unbelievably efficient transmission of 98%. Why is that so high? It looks like quite a saturated yellow, so why wasn't the light output reduced more? This is a result of a combination of the technique used to produce white light—a blue LED with a yellow phosphor—and the inadequacies of the current standard used in light meters. Figure 7 shows the spectrum of the Rogue white LED with no filters,

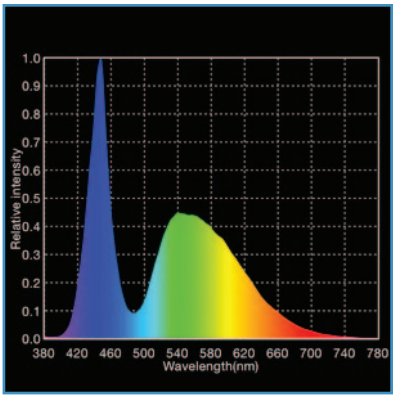

Figure 7: Spectrum in open white.

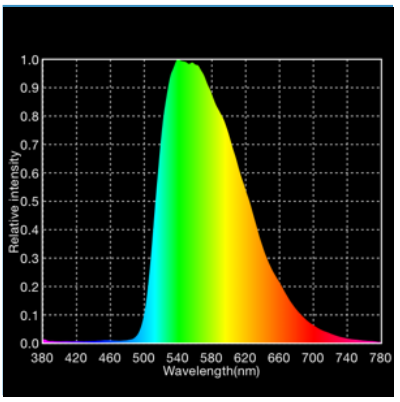

Figure 8: Spectrum with yellow filter.

while Figure 8 shows the spectrum with the yellow filter in place. You can see that pretty much the only difference between the spectra (ignore the rescaling) is that the yellow filter cuts out the large blue spike from the LED, leaving just the emission from the phosphor. As you may have heard me rant about in previous articles, the current CIE standard used in light meters is deficient in the amount of blue it recognizes. In fact, it can't really see that blue spike at all! Thus, when it is removed with a yellow filter; the light meter doesn't notice it's gone! In reality of course, the human eye can see that blue perfectly well; if we couldn't, the light would never look white, and it contributes significantly more than the 2% of the output that the measured transmission predicts. This is in no way Chauvet's fault; it's a problem with our established measuring standard for light output.

Gobo wheels

The Rogue R2 Spot has two gobo wheels, one fixed and one rotating. The rotating gobo wheel has seven replaceable metal patterns and an open hole. Following the current industry trend, the gobos are mounted in carriers that can be easily snapped in and out of the mounting slots on the wheel. Figure 9 shows one of the gobo patterns in its carrier, while Figure 10 shows the access panel (top—panel in place, bottom—panel removed)

Figure 9: Rotating gobo.

Figure 10: Gobo access panel.

that can be snapped open on the outside of the unit, allowing easy changing of the gobos without having to fully remove the head covers.

ROTATING GOBO SPEEDS	
Gobo change speed – adjacent	0.2 sec
Gobo change speed – worst case	0.8 sec
Maximum gobo spin speed	0.47 sec/rev = 128 rpm
Minimum gobo spin speed	51 sec/rev = 1.2 rpm
Maximum wheel spin speed	1.1 sec/rev = 55 rpm
Minimum wheel spin speed	71 sec/rev = 0.8 rpm

FIXED GOBO SPEEDS	
Gobo change speed – adjacent	0.1 sec
Gobo change speed – worst case	0.5 sec
Maximum wheel spin speed	0.98 sec/rev = 61 rpm
Minimum wheel spin speed	112 sec/rev = 0.5 rpm

Positioning and rotation of the rotating gobo wheel were a little slow and jerky in some spots. I measured the positioning accuracy/hysteresis at 0.28° which equates to 1.2" at a throw of 20' (50mm at 10m). Both wheels use a quick-path algorithm to minimize change times.

Figure 11 shows the typical focus quality achievable with the rotating wheel. There is minimal edge-to-center difference (spherical aberration) and color fringing (chromatic aberration). The fixed wheel was very similar, although it exhibited a little more spherical aberration. Figure 12 shows the effect of changing focus from one gobo wheel to the other, or morphing.

Figure 11: Image sharpness.

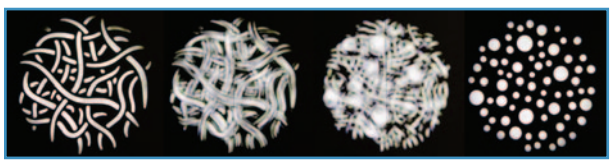

Figure 12: Gobo morph.

Iris

The last focusable component is the iris. The fully closed iris reduces the aperture size to 13% of its full size, giving an equivalent field angle of 2.0°. I measured the opening/closing time at around 0.4 seconds.

Prism and frost

The moving focus lens is immediately after the iris, followed by the prism and frost flags. The three-facet glass prism can be inserted or removed from the beam in approximately 0.5 seconds. Once in place, it can be rotated at speeds from 0.33rpm (180sec/rev) up to 3.8rpm. The image separation is shown in Figure 13, which also shows that the image focus quality is fairly well maintained through the prism, with the introduction of a small amount of chromatic aberration. (This is usual; I don't know of any manufacturer who uses an achromatic prism for effects.)

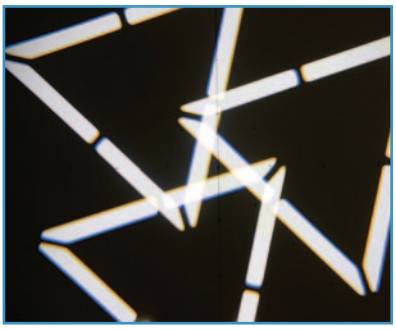

Figure 13: Prism separation.

The frost flag is actually more like a piece of diffusion breakup glass than a frost filter, thus it provides an overall wash effect rather than softening gobo edges. This is an all-or-nothing frost, with no intermediate positions. Frost insertion or removal again took 0.5 seconds.

Lenses and output

The final element in the optical train is the large output lens. There are three lens groups in total: the collimator just after the LED array, a moving focus lens group (0.6 seconds end to end in movement time) after the iris, and the output group. I measured the output of the Rogue R2 Spot at 8,279 lumens with a field angle of 16°. With a measured 292W of consumed power this equates to an efficacy of just under 30lm/W. The output profile is extremely flat,

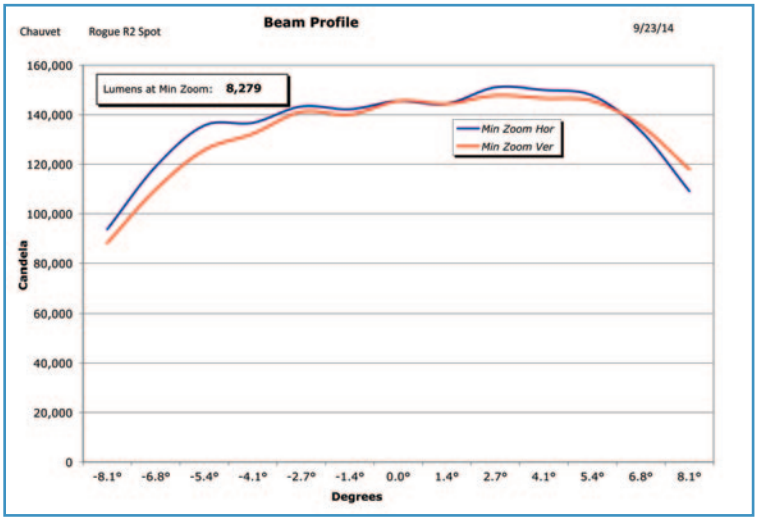

Figure 14: Output

which is great for gobo projection, but not so good if you wanted to blend adjacent beams. This perhaps points to the intended use as an effects unit. Figure 14 shows the very flat output curve.

Pan and tilt

I measured the pan-and-tilt range of the Chauvet Rogue R2 Spot at 540° and 230°, respectively. A full-range 540° pan move took 2.7 seconds to complete, while a more typical 180° move finished in 1.2 seconds. Tilt took 1.5 seconds for a full 230° move and 1.3 seconds for 180°. Both pan and tilt movements were smooth, with no jumps or steps. This is a mechanically stiff system, so movement was quick and hysteresis was low. I measured hysteresis on both pan and tilt at a very low 0.05°, equivalent to 0.2" at 20' (8mm at 10m). The downside of a stiff system is that there is significant bounce when the head comes to a halt. Both axes have optical encoders to reset position if the unit is knocked.

Noise

The cooling fans were by far the noisiest item, with only the tilt exhibiting some resonance at some speeds and raising the noise floor any significant amount.

SOUND LEVELS

	Normal Mode
Ambient	<35 dBA at 1m
Stationary	45.5 dBA at 1m
Homing/Initialization	51.2 dBA at 1m
Pan	46.4 dBA at 1m
Tilt	49.4 dBA at 1m
Color	45.5 dBA at 1m
Gobo	45.6 dBA at 1m
Gobo rotate	45.6 dBA at 1m
Focus	45.6 dBA at 1m
Iris	45.7 dBA at 1m
Frost	45.6 dBA at 1m
Prism	47.2 dBA at 1m

Electrical parameters and homing/initialization time

I measured power consumption with the LEDs at full power at 2.42A from a nominal 115V 60Hz supply. Power was 282W, with a power factor of 0.96. Quiescent consumption with the LEDs off was 0.43A, 48W at a power factor of 0.92.

Full initialization from either a cold start or a DMX512 reset command took approximately 25 seconds. Homing was partially well-behaved and partially badly behaved, in that the fixture fades out smoothly, then resets, but fades up again before final positioning is complete.

Construction and electronics

The Rogue R2 Spot follows current conventional techniques and uses a distributed control system with the main motor control board mounted in the head and power supplies in the base. Figure 15 shows the two yoke arms with the pan-and-tilt motors, and Figure 16 the main motor control circuitry. Construction isn't really modular, but it looks simple enough to disassemble and work on. Interestingly, Chauvet has chosen a "soft feel" finish for the outside of the molded components which has a very good matte, non-reflective finish. It will be interesting to see how this survives the application, as I've not previously found those finishes to be very durable. If it is, then it's a good choice. Both pan and tilt are fitted with locks for transport.

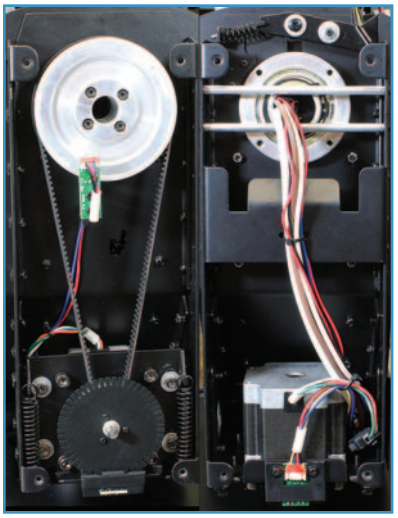

Figure 15: Yoke arms.

Figure 16: Motor control board.

The Chauvet Rogue R2 Spot has both five-pin XLR DMX connectors and three-pin data connectors as well as powerCon in and out to allow for daisy-chaining of units. Figure 17 shows the connection panel. Local control is through a color LCD screen and menu system that contains the usual setup, self-test, and maintenance functions.

Figure 17: Connectors.

Figure 18: Display.

That just about finishes it for the Chauvet Professional Rogue R2 Spot, a spot luminaire that combines the efficacy and control of LEDs with the saturated colors of dichroic filters. As I mentioned earlier, this combination has both pros and cons. However, it's your job, not mine, to weigh the arguments for your specific situation. As ever, I've tried to give you the raw facts and figures to help you make a decision but, ultimately, that decision must be yours.

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