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Elation Professional Satura Spot LED PRO

By: Mike Wood

Fig. 1: Fixture as tested.

We are seeing more and more LED-based spotlights with full feature sets, including gobos, prisms, and effects. It's an interesting development. They aren't yet really any more efficient or less expensive than the HID units they compete with, but the appeal of the LED sources remains. Their claimed longevity and lack of heat in the beam are clearly attractive. (The total heat produced is still about the same as an HID lamp; it's just all in the unit, not in the beam). LEDs also have the advantage of no restrike time and instant lamp control. Whatever the reason for the switch, it's a trend that is here to stay, and the days of the smaller HID lamp for anything other than ultra-narrow beam projectors are numbered. To that end, there are now a number of suppliers of LED light engines designed for this task. They take care of the basic LED collimation and homogenization optics and provide a black-box component for the luminaire manufacturer to deal with in the same way they would have previously done with an HID or incandescent lamp. This month, we are looking at the Elation Professional Satura Spot LED PRO. This is a nominal 300W RGBW unit that looks to compete in the same market space with what would have been a 250W HID unit a year or so ago. Elation is well-known for having a large portfolio of products across a broad range of types, and they've been pushing those products upmarket in the last few years, competing with the more entrenched players. How does the Satura Spot LED PRO perform in that market? I've followed my usual approach and measured—in as objective a manner as I can—all the operational parameters of a standard production unit supplied to me by Elation (Figure 1).

Light source

The Satura Spot LED PRO uses a 300W RGBW LED light engine. As mentioned above, I recognized this as being an assembly from one of the OEM manufacturers of light engines. It's used by a few other companies in our industry and produces a well-homogenized and even beam. The technology inside uses a pair of crossed dichroic reflectors to combine the four different colors of LEDs into a single beam that is output through a fly-eye lens. Figure 2 shows a portion of a view back through the system showing the LED arrays and the hexagonal lens facets. The light engine is supplied as a single component complete with heat sinks and heat pipes, but the luminaire manufacturer has the responsibility of cooling those heat sinks and providing all electronic drive circuitry. Again, it's very similar to using an HID lamp with integral reflector. The lamp comes optically ready to go, but it's up to the integrator to provide the cooling and control. Elation has utilized four thermostatically controlled fans, two each at top and bottom, to cool the engine. I found that these rarely came on to any significant level when using two or three LED channels but ran at what sounded like full speed when all four channels were used (Figure 3).

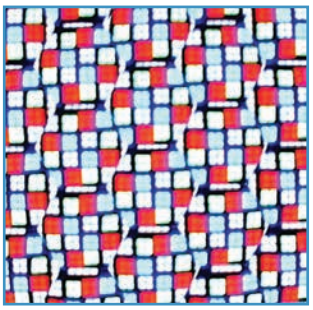

Fig. 2: LED arrays.

Fig. 3: LED module cooling.

Strobe and dimmer

One big advantage of LEDs over HID is that all dimming and strobing can be done through direct lamp control with no mechanical shutters or dimmers required. Elation has done a nice job of dimming, with Figure 4 showing the measured curve. This matches a standard square law curve very closely. The dimming was visibly very smooth for all except the very bottom of the dim curve where some steps are visible. Similarly, color mixes remained constant apart from the very bottom end. The PWM frequency of the emitters is 300Hz, which is perhaps a little slow for some applications and may cause banding on CMOS camera sensors. As expected, the Satura Spot LED PRO offers a dedicated strobe channel, which I measured as offering speeds ranging from 0.7Hz – 30Hz as well as ramps and snaps.

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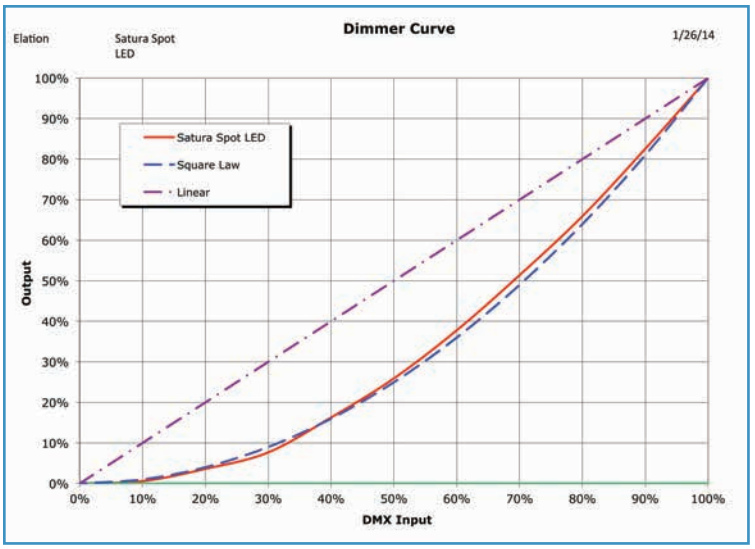

Fig. 4: Dimmer curve.

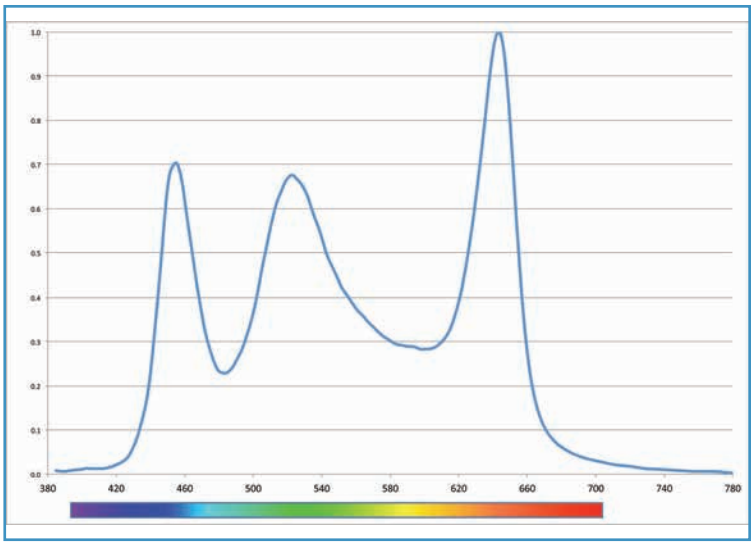

Fig. 5: Spectrum all emitters on.

Color system

This is an RGBW LED unit, so all color control is through additive mixing of the LED channels. Elation provides both native individual control of these four channels as well as a color channel that allows quick selection of standard colors and color effects such as rainbow chases. Included on that channel are six standard whites at different color temperatures. I measured these as follows.

Rated Color Temp	Measured Color Temp	Measured CRI
2,700K	2,616K	62
3,200K	3,047K	67
4,300K	4,151K	75
5,600K	5,531K	85
6,500K	6,576K	84
8,000K	8,607K	82

Figure 5 shows the spectrum from the Satura Spot LED PRO when all four emitter channels are run at full power. The chart below shows the measured output of all colors compared to the full output. Not unsurprisingly, the majority of the light output is coming from the white emitters.

COLOR OUTPUT

Color	Red	Blue	Green	Yellow	Magenta	Cyan	White
Transmission	9.0%	3.4%	9.0%	38%	13%	33%	62%

Color change speed from the LEDs was, of course, effectively instant. As mentioned earlier, the Satura Spot LED PRO offers a color macro channel with rainbow chases and other color effects. In all cases, the color fades were smooth.

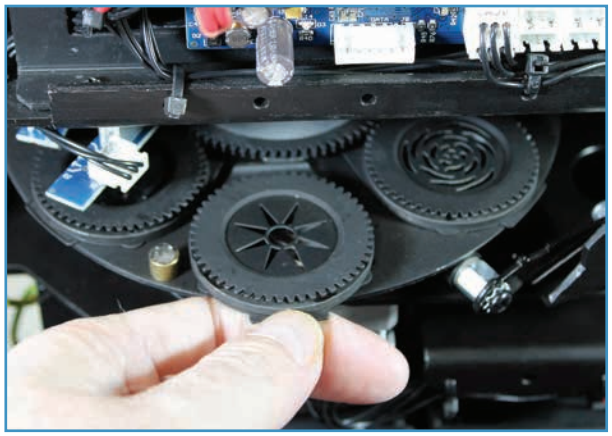

Fig. 6: Gobo change.

Gobos

Next in the optical train are two gobo wheels: a rotating wheel with six changeable patterns plus open hole and a fixed wheel with seven non-changeable patterns plus open cut into a single wheel. Patterns on the rotating wheel use a cartridge snap-in system as shown in Figure 6 and are easy to switch out. Figure 7 shows a rotating gobo in its cartridge while Figure 8 shows a view of the fixed gobo wheel and the operating arm for the iris.

Fig. 7: Gobo.

Fig. 8: Fixed gobo and iris.

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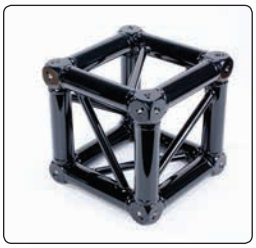

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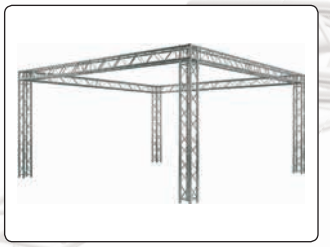

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Gobo change time, adjacent apertures	0.3sec
Gobo change time, max (Gobo 0 to 4)	0.6sec
Maximum gobo rotate speed	0.77sec/rev = 78rpm
Minimum gobo rotate speed	19sec/rev = 3.2rpm
Maximum wheel spin speed	1.7sec/rev = 36rpm
Minimum wheel spin speed	32sec/rev = 1.9rpm

STATIC GOBO WHEEL

Gobo change time – adjacent apertures	0.2sec
Gobo change time – max (Gobo 0 – 7)	0.4sec
Maximum wheel spin speed	0.9sec/rev = 67rpm
Minimum wheel spin speed	73sec/rev = 0.8rpm

Both wheels use quick-path algorithms to minimize the time to make a change. Positioning accuracy and rotation smoothness of the gobos was good. At the very lowest wheel rotation speeds, there is some evidence of speed hunting but nothing objectionable. I measured hysteresis on the rotating gobo at 0.25° of error, which equates to about 1.1" at a 20' throw (44mm at 10m).

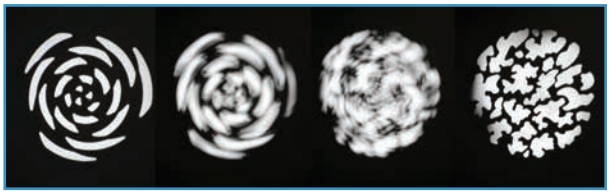

Fig. 9: Gobo morph.

Focus quality on both wheels from the optical system was excellent. It is also possible to perform a morph between the two wheels by pulling focus. Figure 9 shows the appearance of a morph from the rotating gobo (left) to the fixed gobo (right).

Iris

The Satura Spot LED PRO iris reduced the beam size to 13.6% of the full beam, and I measured opening and closing times at around one second. The optical system is fast, so it isn't really possible to iris on a gobo. There are very few units that have optical systems capable of that feat these days; it's usually a design choice between light output and focus depth of field. You just can't get the physical gobos and iris close enough together with the fast systems everyone is using.

Prism and frost

Prism and frost are next in line, and both are attached to, and travel with, the zoom lens carriage. Figure 10 shows a view of the three-facet prism when it's swung out of the beam. I measured insertion/removal time at approximately one second. Once inserted, the prism can be indexed or

rotated at speeds varying from 0.2rpm to 100rpm. Figure 11 shows the image separation at full zoom. There is a macro channel that provides a range of pre-programmed prism and gobo combination effects.

Right next to the prism is the frost flag. This is a flag that can be inserted or removed in 0.4 seconds and provides a non-variable (in or out) frost effect (Figure 12).

Fig. 10: Prism.

Fig. 11: Prism separation.

Fig. 12: Frost.

Output and lenses

The Satura Spot LED PRO contains the usual three-group lens system: two moving groups providing zoom and focus and a fixed final output lens group. I measured the output with all emitters at full at 4,497lm at a wide angle of 35° ramping down to 3,349lm at 11.7° at the narrow end. That's very close to a 3:1 zoom range. As mentioned, this is the output with all emitters at full, which is a very high color temperature. For comparison, the outputs when set to the color temperatures provided on the color control channel were as follows.

Color Temperature	Measured Output %
2,700K	45%
3,200K	55%
4,300K	76%
5,600K	98%
6,500K	98%
8,000K	98%

As we've seen with other LED spot units, the beam distribution is very smooth and flat with good beam homogeneity. Figure 13 shows an example of the field from a mixed magenta output. Figures 14 and 15 show the beam profiles at maximum and minimum zoom.

Fig. 13: Field.

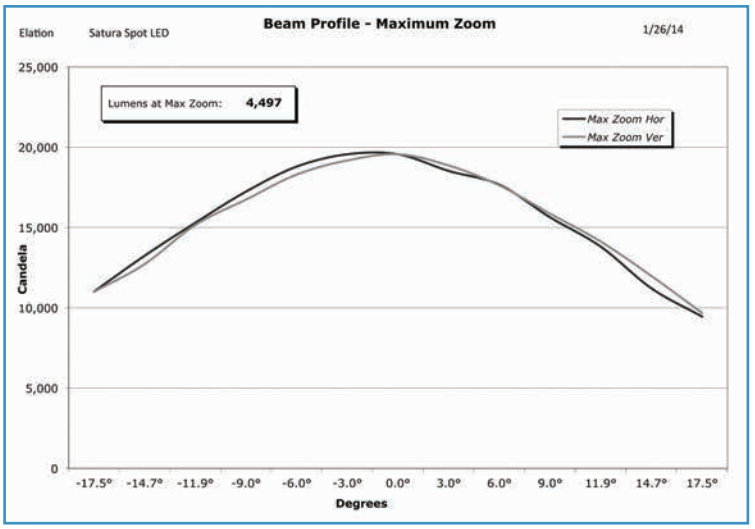

Fig. 14: Maximum zoom.

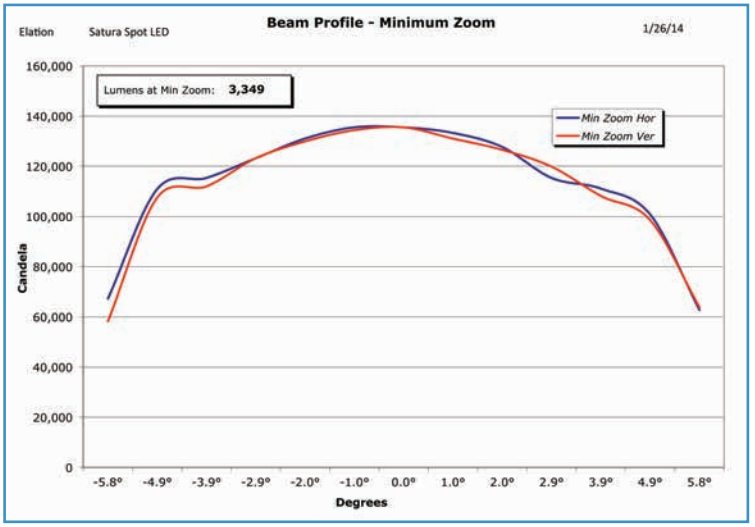

Fig. 15: Minimum zoom.

I measured zoom at 0.6 seconds from end to end, while focus took 0.7 seconds.

Pan and tilt

I measured the movement range of the Satura Spot LED PRO as 540° in pan and 250° in tilt. Pan time over that angle was measured at six seconds with four seconds for 180°. In tilt, the figures were five seconds for 250° and five seconds for 180°. Both pan and tilt have optical encoders to reposition the fixture if it is knocked out of place. Figure 16 shows one of the yoke arms with the tilt driver and encoder. As is usual these days, the pan motor is in the other yoke arm (as opposed to in the top box, which is often where the pan drive was situated in earlier units).

The unit uses the same algorithm as I've seen in other

Elation units I've tested. This has move acceleration profiling, which results in a strong early deceleration into the final position. This type of algorithm is good at reducing bounce and overshoot and is typically quite accurate in its final positioning, with the compromise that movement can be slower.

I measured the repeatability accuracy for pan at 0.25°, which is 1.1" at a 20' throw (44mm at 10m) with tilt slightly better at 0.15° (0.6" at 20' or 26mm at 10m).

Noise

Noise levels are all driven by the four LED cooling fans, which are very apparent when running at full speed. Only the zoom and focus were noticeable above the fan noise. The levels reported here are all taken with the unit running at full power on all emitters after reaching thermal equilibrium.

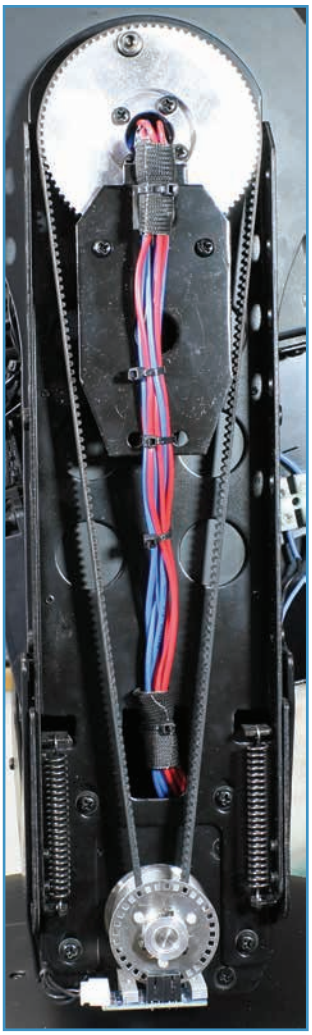

Fig. 16: Yoke arm.

SOUND LEVELS

	Normal Mode
Ambient	<35dBA at 1m
Stationary	46.4dBA at 1m
Homing/Initialization	55.6dBA at 1m
Pan	47.7dBA at 1m
Tilt	47.6dBA at 1m
Frost/Prism	47.0dBA at 1m
Gobo	47.0dBA at 1m
Gobo rotate	47.0dBA at 1m
Zoom	51.3dBA at 1m
Focus	51.4dBA at 1m

Electrical parameters and homing/initialization time

The Satura Spot LED PRO is rated for auto-switching operation on 100 – 240V, 50/60Hz. For these tests, it was run on a nominal 115V, 60Hz supply and measured as follows.

POWER CONSUMPTION AT NOMINAL 115V, 60HZ				
	Current, RMS	Power, W	VAR, VA	Power Factor
Quiescent (LEDs off)	0.87A	96W	103VA	0.92
LEDs at full	3.54A	422W	429VA	0.98

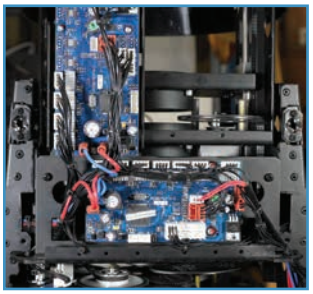

Fig. 17: Head electronics.

Fig. 18: Top box.

Fig. 19: Display.

Fig. 20: Connections.

Initialization took 53 seconds from a cold start and 40 seconds from a DMX-512 reset command. Homing is badly behaved in that the fixture fades up before pan and tilt have finished moving to their final positions.

Electronics and control

The electronics of the Satura Spot LED PRO are distributed throughout the unit with motor drive boards mounted in the head. Figure 17 shows a view of the driver boards. Figure 16 shows one yoke arm that contains the pan motor and associated electronics. Finally, the top box contains all power supplies as well as the menu and main control electronics (Figure 18). The Satura Spot LED PRO is partly modular in its construction and not too cramped (this is a larger unit than some), so it should be relatively easy to maintain.

In common with other recent Elation products, there is a full-color LCD display providing menu and control functions. This offers all the normal DMX-512 configuration functionality along with stand-alone, programming, and maintenance options and has battery power so that you can set options while the unit is in the road case. The Satura Spot LED PRO also comes with wireless DMX built-in using the W-DMX format (Figure 19).

The connection panel uses a Neutrik powerCON for power and offers both five-pin DMX-512 XLRs and three-pin XLR connectors for data (Figure 20).

That just about covers everything for the Elation Satura Spot LED PRO, an LED gobo unit with features designed to

A New Tool

This is the first review where I used a new measuring instrument in my toolbox. I've long wanted a portable spectrometer since the unit I currently use, although highly accurate, depends on being connected to a laptop and is slow to set up and calibrate. In the last year or so, we've seen a few of these devices appear on the market, and, having taken a look at them all, I've just purchased an AsenseTek Lighting Passport device. This is a small, battery-powered device, which links through Bluetooth to a phone or tablet and gives you instant readings of the spectrum and other relevant parameters such as x,y color coordinates, CRI, CCT, and so on. If you've read any of my articles in this magazine or *Protocol* on these topics, you will know that I consider a spectrometer essential to properly characterizing LED luminaires. Color meters and regular light meters just can't handle the discontinuous spectra of these devices and often provide widely incorrect data. It's early days for me with this unit, but I compared it to my regular spectrometer for this review, and it all checked out well. Figure 21 shows the spectrometer as I used it for this review. You'll hear more about my experience with this in later reviews, I'm sure (Figure 21).

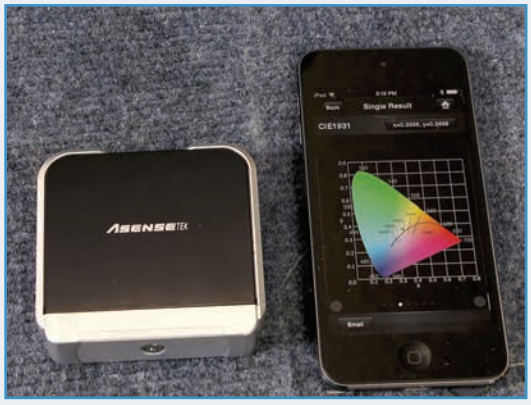

Fig. 21: Spectrometer.

compete head-to-head with 250W HID lamp based units. Is this the unit for you? Well, as always, if it looks interesting, I recommend that you get a demo and try it out in your own venue. I've tried to give you the objective data, but a decision is often made on the subjective items that only you are able to determine.

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