The Elation Impression

By: Mike Wood

Fig. 1: Unit as tested

Fig. 2: LED array

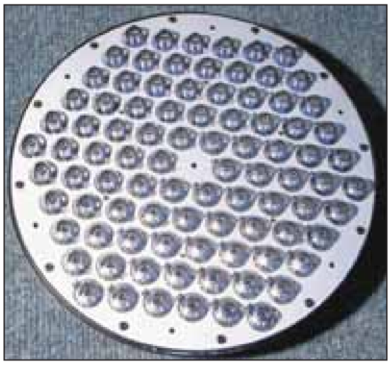

Fig. 3: Rear of lens array

Fig. 4: LED array without lenses

The Elation Impression is the second LED fixture to be reviewed in this series; I want to thank the readers who wrote after the first review, making suggestions for areas to consider when looking at LED-based units. However, apart from the use of LEDs as a light source, the Elation Impression is very different from the previously tested luminaire, the Martin Stagebar 54. The latter is a static linear flood unit, while the Impression is a moving-head wash light. As such, it enters a very busy market segment.

The packaging, form factor, and marketing of the Impression position it head-on against conventional automated wash lights. (It may seem slightly strange to use the word conventional to mean automated luminaires, but, in this context, I mean those using HID lamps sources.) How does it stand up in that arena? Can you replace your 575W HID wash units with 270W of LEDs?

With this intent, we should test this unit exactly the same way we'd test any color-changing automated wash light—so let's start, as usual, with the light source and see where that gets us.

The Impression is fitted with a universal power supply rated from 100-240V 50/60Hz, and, for these tests, the luminaire was run from a nominal 115V 60Hz supply (Figure 1.)

Light source

The light sources are obvious and can be clearly seen in Figure 2. Ninety Luxeon K2 LEDs—30 each of red, green, and blue—provide the output. Philips' Lumileds Luxeon range currently seems to be the most prevalent LED used in entertainment luminaires. I suspect this is partly because of the packaging available. Choosing an LED is not just about choosing the die; in fact, that's a minor part of the story. Just as critical is the way the die is packaged, including the power distribution, heat management, and optical assemblies. With Luxeon, Lumileds offer manufacturers a one-stop shopping system to answer these questions. Whether this is the best solution remains to be seen as the market matures, but it's certainly a route many companies are choosing for now. The Luxeon K2 packages are rated for 50,000 hours (perhaps more at reduced output), so lamp change is neither a concern nor an option. Interestingly, although Elation has chosen the standard red and green LEDs, they've decided to go with Royal Blue, rather than regular blue, for the Impression. More on this choice, and its implications, later in the color section.

The large diecast-heat-sink-and-fan combination on the rear of the head provides all the LED cooling. I ran the unit for many hours and this never exceeded 60°C, which is warm, but not hot, to the touch.

Optics

The 90 LEDS are arranged in a honeycomb pattern, with even and equal distribution of the three colors. What you see in Figure 2, though, is not the LEDs themselves, but an array of plastic lenses, one for each LED. These use a combination of refractive and TIR (total internal reflection) optics to constrain the very wide Lambertian output of the LED die into a usable beam. Think of them as 90 individual condenser lenses. Perhaps I should discuss Lambertian distribution, as it's a word that's going to come up more and more in the literature of LEDs. Basically, it's a distribution where the light behaves as if emitted equally in all directions from everywhere on a flat surface. This means that it has the same apparent brightness (or luminance) when viewed from any angle. The net result is an emitter with an extremely high field angle that we need to capture and control. It's not always the ideal light source distribution for the kind of luminaires we use, but it's the way LEDs are, so we have to live with it! As the LED is mounted on a substrate with electrical connections and heat sink, we don't usually have the option of positioning a reflector behind it; instead, we have to use a lens mounted as close as possible, maybe even surrounding the chip, to try and capture that light.

All this is what goes on in the Impression and other units using K2 emitters. If we remove the lenses and take a look at the rear of the lens array (Figure 3), you can see the pocket on the back of each lens, which fits over the LEDs and tries to capture every last lumen. Figure 4 shows the LED array with the lenses removed, with the LEDs mounted on their heat-conducting substrate.

Elation offers two different lens arrays. The unit as supplied came fitted with the standard array, which I measured at a 24° field angle. However, the company also supplied me with an alternate array, which was a little wider at 36°.

Output

Measuring the output was interesting; it led me into an area of theoretical photometry that I hadn't intended to explore. However, I know this is going to come up again, and it's something everyone should understand. As you may know, the definitions of light output are all based on the theoretical response of the "standard" human eye. Photometric light measurements (lumens, lux, foot-candles) are not based on some physically definable and measurable standard; instead, they are based on statistical surveys of what you and I can see. For example, a light can emit as much energy as you want in the infrared end of the spectrum, but, if we can't see it with our eyes, then, by definition, it has zero light output. That infrared source has a power output measurable in watts but no light output measurable in lumens.

The internationally approved and agreed eye-response curve is one created by the CIE, dating back to 1924. All light meters are supposed to follow this curve. Here's the problem: The Royal Blue used in the Impression is so deep that it falls out of this curve—so it officially has very little output. However, looking at the unit, we know this is wrong—these Royal Blue emitters are really bright! What's going on? Well, the 1924 CIE curve is incorrect, just flat-out wrong, at the short wavelengths of blues and violets. It is now acknowledged to underestimate the human eye's ability to see these colors by as much as a factor of 10.

All light meters are supposed to match this CIE curve, so I had a problem in that my light meter couldn't see it. I had to go back to basics, measure the spectral output of the unit using a spectrometer, and then apply the published modified CIE curves with the right values for the deep blues to get the results. Depending on what light meter you use to measure this fixture, you will likely get very different readings. My expensive calibrated light meter couldn't see the blue, but my cheap, rough-and-ready one could!

After all this, I came up with a figure of about 4,000 lumens for the Impression in its default white. However, as with all LED-based fixtures, this doesn't tell the whole story. The efficiency of an LED fixture really shows up in mid-level and saturated colors. For example, when outputting a fully saturated red, the Impression still gave 20% of the output in white. By comparison, the transmission of a full saturated red in a dichroic-filter-based conventional unit is typically around 5% of the white level. So, although the Impression doesn't directly compete in open white with a 575W HID lamp wash unit, it does compete very well in

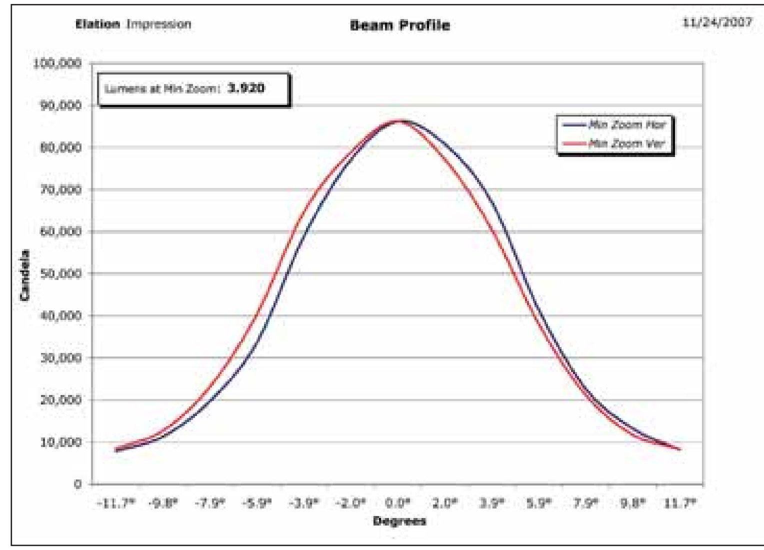

Fig. 5: Beam profile

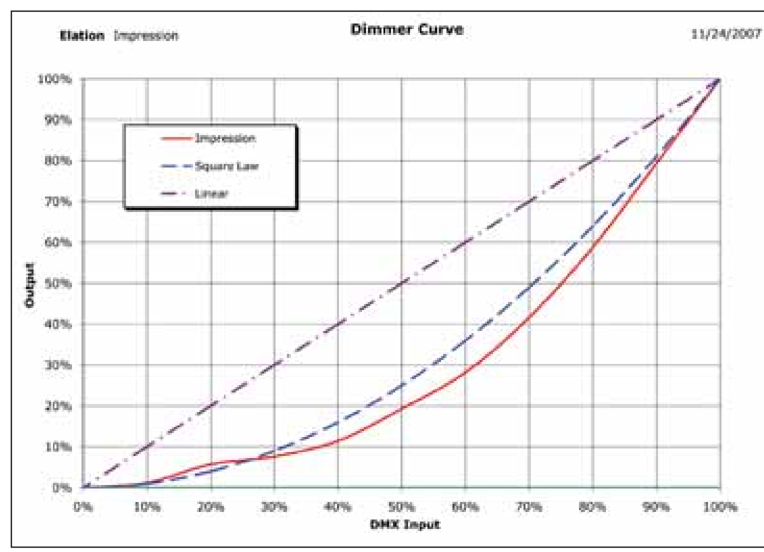

Fig. 6: Dimmer curve

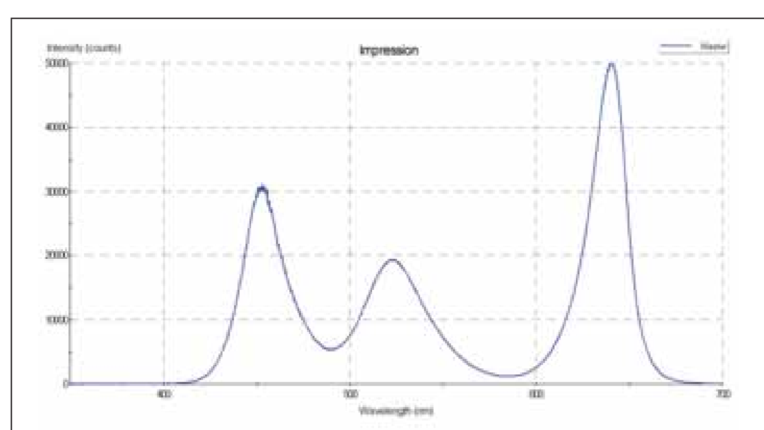

Fig. 7: Output spectrum - cool white

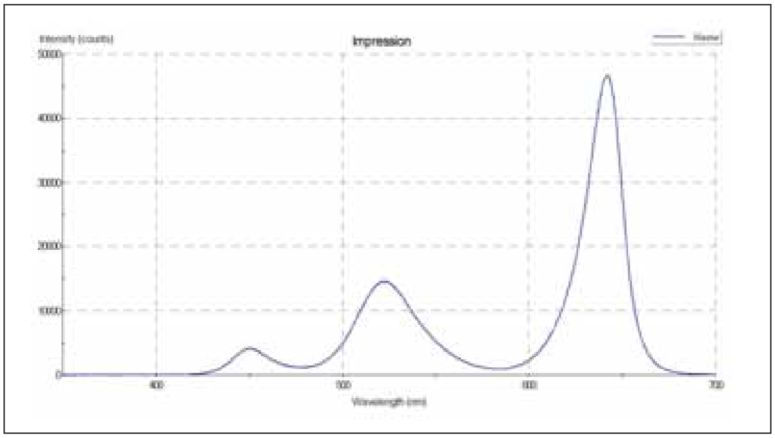

Fig. 8: Output spectrum - warm white

Fig. 9: Tilt encoder and pan gear

Fig. 10: Heat sink

Fig. 11: Electronics

Fig. 12: Display board

Fig. 13: Menu

Fig. 14: Cables and fuse

deeper colors, and may even beat the conventional unit in saturated colors. As expected from the Luxeon optics, the output curves show a smooth, highly symmetrical light distribution (Figure 5).

Dimming

Figure 6 shows the dimming curve; it's an excellently shaped curve, which follows the square law well. As reported before with other fixtures, though, you can see each individual DMX512 step when you execute a slow fade below about 20% intensity. This is going to continue to be an increasing problem as LEDs get brighter and those low light levels become more visible. With a slow (30 seconds or greater) fade in white, it was possible to see some slight color shifts towards red and blue as the unit dimmed down. The unit can be strobed at rates up to 10Hz.

Color system

As mentioned above, a fixture like this is all about color, particularly deeper colors. I imagine that Elation chose the Royal Blue specifically to extend the color gamut down into those deep blues and violets that are tricky to get with color filters. I'm not a huge fan of the pastel ability of any RGB LED systems, but the Impression does as good a job as it can within the possible gamut. Color was slightly uneven across the beam at the paler colors; however, Elation is aware of this and has already made improvements to the unit's optics to combat it. Once you get into any kind of color, this unevenness disappears.

As mentioned above, the light output in deep colors is excellent.

Color Mixing

Color	Cyan	Magenta	Yellow	Red	Green	Blue
Output	77%	67%	51%	20%	31%	49%

As well as RGB color controls, the Impression provides a color-temperature control channel. There is no separate mechanism for this; instead, it matrixes the RGB mixing differently to lower the effective color temperature over a stated range of 7,200-3,200K. With the color temperature channel at 100% (3,200K) the light output drops to about 53% of the full, 7,200K, value.

The light spectrum shows what's going on with both this and the Royal Blue LED. Figure 7 shows the 7,200K spectrum and Figure 8 the 3,200K spectrum. The peaks of the three LEDs are very apparent and you can see the blue peak is just above 450nm—that's right in the blue/violet area, where the 1924 CIE chart is in error (Figure 7: Output spectrum—cool white; Figure 8: Output spectrum—warm white). It was suggested by a reader that I measure the PWM frequency of LED lights—that's a good idea, as too low a frequency can cause aliasing issues with DMX512 or TV frame rate, as well as peripheral vision strobing. I measured the Impression PWM at 303Hz, which is fast enough to avoid all those concerns.

Pan and tilt

The Elation Impression has very wide pan-and-tilt ranges of 645° and 300° respectively. A full range pan move took 3.5 seconds, while a more typical 180° move finished in a snappy 1.75 seconds. Tilt took 1.4 seconds for a full move and 1.1 seconds for 180°.

Positional repeatability on both pan and tilt was 0.16° and 0.13° respectively—which is around 0.5" of error at a 20' throw. That's very small and completely acceptable for a wash unit.

The pan-and-tilt mechanisms are both built into the unit yoke; there's nothing in the head or the small top box. The light weight means small motors can be used and still keep the movement smooth and accurate. Figure 9 shows the tilt encoder and pan gear at the base of the yoke. Both axes have optical encoders, which provide feedback to reset the position if the unit is knocked or hits an obstruction.

Noise

The Impression has just the two pan-and-tilt motors, but also has a couple of fans in the yoke and on the rear of the heat sink. The rear fan—see Figure 10—was the most obvious from a noise perspective, but pan also had some motor resonances that were very audible at some speeds. The end result is that the unit is quiet, but not silent.

Fig. 15: Yoke arm and display

Sound Levels

	Normal Mode
Ambient	<35 dBA at 1m
Stationary	43.7 dBA at 1m
Homing/Initialization	52.0 dBA at 1m
Pan	53.5 dBA at 1m
Tilt	46.7 dBA at 1m

Electrical parameters

The Impression has an internal, fully power factor-corrected auto-ranging (100 - 24V 50/60Hz) power supply and consumed 3.4A, 400W with a power factor of 0.99 when running with all LEDs at full. The initialization time from power up was 32 seconds, but this time varies depending on the position of the pan-and-tilt axes when power is applied. The time for a DMX512-triggered initialization was around 21 seconds. The unit exhibits the common problem of enabling the output before the homing process is finished, resulting in the light panning/tilting back to its position while illuminated.

Construction

The mechanical construction is attractive, with heavy use of tooled parts in die castings and injection moldings (Figure 16) giving the unit a clean and professional appearance. The photos here show the unit fitted with the floor stand that comes with the fixture, but this is easily removed with two camlock quarter-turn fasteners for mounting on a truss or bar with regular clamps. With a weight of only 16lbs, this is an easy unit to rig. Both yoke arm covers are removed through four screws and, once removed, expose all the main electronics for service access. It also looks like the LED board is easy to replace (see Figure 4), although one would not expect that to be necessary.

Electronics and control

As mentioned earlier, the unit has a very small top box and the majority of the electronics is in the yoke arms. One side has the power supply and LED drivers (Figure 11), while the other has the display and menu system (Figure 12). It's all very easy to access for maintenance.

The Impression uses a very clear back-lit graphical LCD display (Figure 13) which gives access to the usual full range of fixture options and diagnostics. A couple of options are given for DMX512 mappings as well as various stand-alone and preset functions.

The Impression uses a three-pin, rather than a five-pin, XLR connector, so it doesn't fully meet the DMX512 standard. However, when fitted with the necessary adaptor, the protocol implementation seems fine.

Connection is through small panels on the compact top box (Figure 14), including a Powercon for the mains connection.

Conclusions

The Impression is undeniably an elegantly styled unit with good saturated color light output. But is the RGB mixing and pastel/white output enough to compete with HID 575W fixtures? As ever, you get to decide if the Elation Impression is right for you. Given the issues mentioned concerning light meters and LEDs, I would, more than ever, encourage you to try LED-based luminaires in the environment in which they will be operated. There's no substitute for the human eye as a measurement tool. Until we all gain more experience with using LEDs in performance environments, we should work under the assumption that our previous experience may not apply.

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