PixelRange PixelSmart

By Mike Wood

James Thomas Engineering has a longstanding reputation for making solid, reliable products, which the company has tried to carry through into the PixelRange brand of LED lighting units. Certainly, PixelRange LED luminaires have become well-known as workhorses, and are most commonly seen in rental and staging projects. The product we are looking at this time is the new PixelSmart, which was introduced at PLASA and LDI last fall. At first glance, it looks like a standard PAR 64-sized LED unit, but there's more to it, in both light sources and possibilities, than meets the eye (Figure 1). As always, I base the review on a single sample of the unit supplied to me by the manufacturer. I work my way through the unit, presenting measurements of all relevant parameters, so that you have some independent data to form your own opinions. Those parameters vary somewhat from luminaire type to luminaire type, but, I hope, are always useful.

Figure 1: Fixture as tested

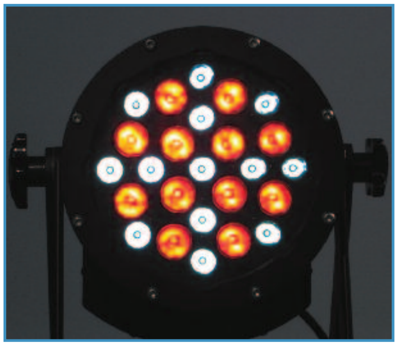

Figure 2: LED layout

Figure 3: Five colors

The PixelSmart is a little hard to classify. As I mentioned, at first glance it looks like a regular PAR-sized LED-based luminaire. Dig a little deeper into the specification and it's clear it is more than that. Looking at the basics, the PixelSmart has 12 LED arrays, each with red, green, blue, and white emitters in a single package with a common optic. It also has 13 additional single white LEDs with a different, narrower beam angle. Finally, you get to choose to either control all of these LEDs together as an RGBW+W luminaire, or take control of every one independently so you can do pixel-mapping. The PixelSmart is an interesting combination of a wash light with multiple LED beam angles and a pixel-mapped effects light. For these tests, the PixelRange was operated from a nominal 115V 60Hz supply (varied from 117V – 120V during testing), although the unit is fitted with an autosensing universal power supply input that is rated from 90V to 264V AC.

Light source and optics

In detail, the PixelRange PixelSmart uses 12 Cree XLamp MC-E Quad LEDs, fitted with RGBW emitters, and 13 Cree XLamp XP-G white LEDs. Cree rates all these dies as having 70% lumen maintenance after 50,000 hours, as long as the temperature is kept within specification. In the specific unit supplied to me, all the whites, both in the RGBW array and the individual LEDs, were cool whites, but PixelRange tells me that it also offers the unit with a warm white option for the 13 individual white LEDs.

Both the RGBW arrays and individual white LEDs are fitted with TIR (total internal reflection) collimating optics. Interestingly, PixelRange has chosen these to be different beam angles, with the individual white LEDs much narrower than the RGBW. You get an interesting combination in which the wider beam can be colored with the RGBW array—and then you superimpose a white beam in the center from the white LEDs.

The TIR optics homogenize the four-color RGBW arrays well; the resultant light beam appears in a single color, with no colored shadows or beam artifacts. Figure 2 shows the LED layout and Figure 3 shows the five native colors from the unit—red, green, blue, and white from the arrays, and the 13 separate white emitters interspersed between the arrays.

Output

Because the beam angles of the RGBW arrays and the individual white emitters are so different, it doesn't really make sense to measure the output with both of them on at the same time. The result would be a very strange beam profile with a very intense central hot spot from the narrower angled white LEDs. Instead, I measured the output and beam angles for the array and solo white LEDs separately. Figure 4 shows the measurements of the RGBW array, which produced 3,090 lumens across a field angle of 44°. The output was very smooth and symmetrical, as can be seen from the chart, and should blend nicely if you have multiple adjacent

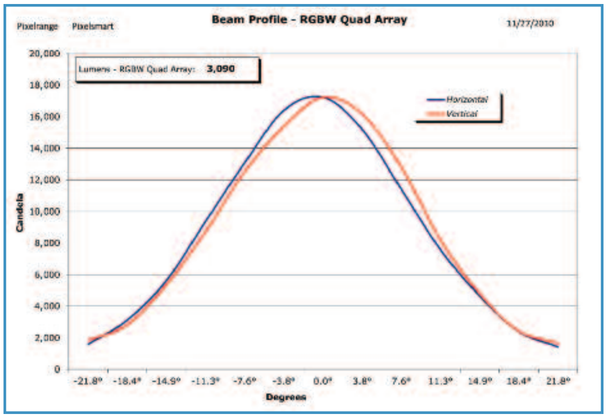

Figure 4: Output from RGBW array

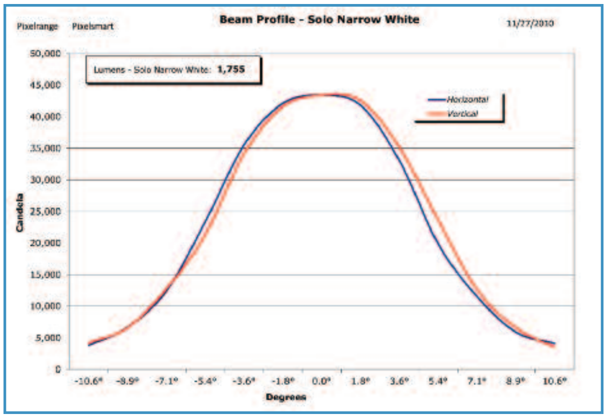

Figure 5: Output from solo white

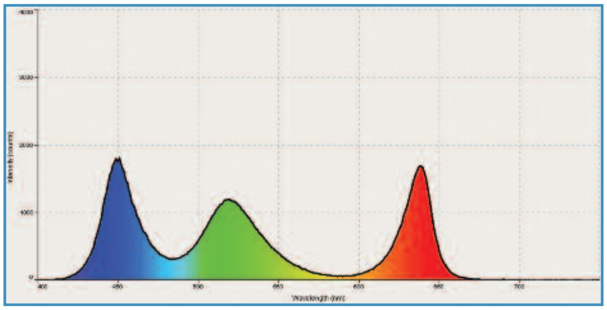

Figure 6: Spectrum - RGB

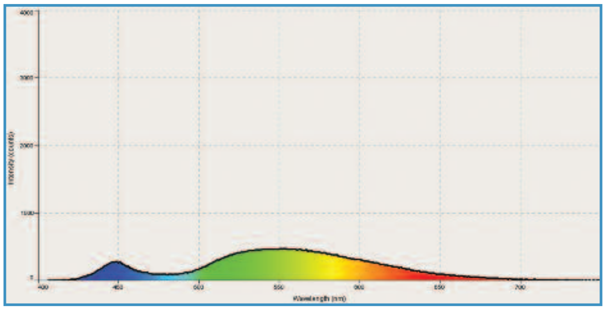

Figure 7: Spectrum - array white

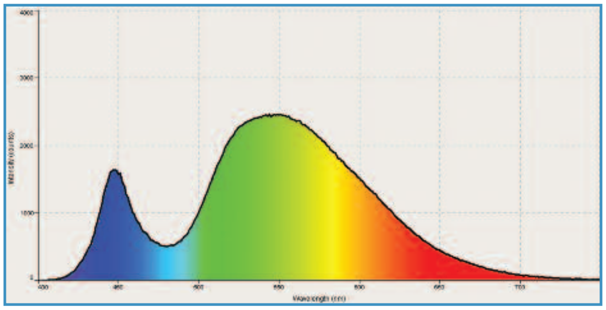

Figure 8: Spectrum - solo white

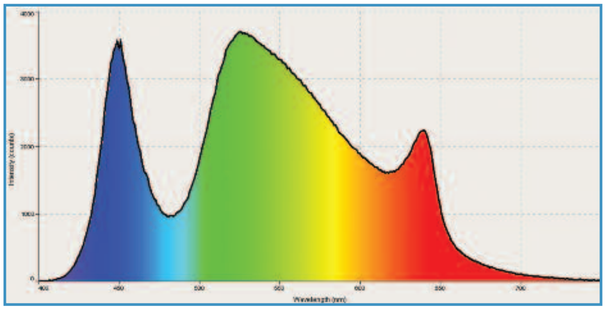

Figure 9: Spectrum - all channels

units. The solo white results are shown in Figure 5; here we have 1,755 lumens across a field angle of 21°, just under half that of the array. Again, the distribution was smooth—with quite a flat top to the profile—and should blend well. Note, however, that, because of the two differing angles, you wouldn't be able to blend both the RGBW array and the solo whites across adjacent units simultaneously, and would instead have to choose the spacing to suit one or the other.

Efficacies in white were measured at 21.3 lum/W for the RGBW array and 40 lum/W for the solo white LED. These are normal values, with RGB mixed whites typically about half the efficacy of phosphor whites.

Note: As always with LEDs, I had a problem with measuring the output of the blue LED, because light meters vary so much at this end of the spectrum. I'm reporting the output from the light meter I own that seems to best match my eye. However, you should know that I have another light meter that can hardly see this blue at all! With blue LEDs, don't trust the light meter—trust your eyes.

With RGBW in the array all at full, the output was a pinky white, too far off the black body line to get a correlated color temperature. By reducing red and blue, I was able to get a reading around 6,600K at a level about 20% lower in lumens.

Figures 6 through 9 show measured spectra of the various options. Figure 6 is the RGB spectra from the array, with the white emitter turned off for clarity. You can see the three peaks from the colors at 450nm (blue), 520nm (green), and 635nm (red), with the green being the lowest output. This explains the pinky white when all channels are at full. Figure 7 shows the white from the array, while Figure 8

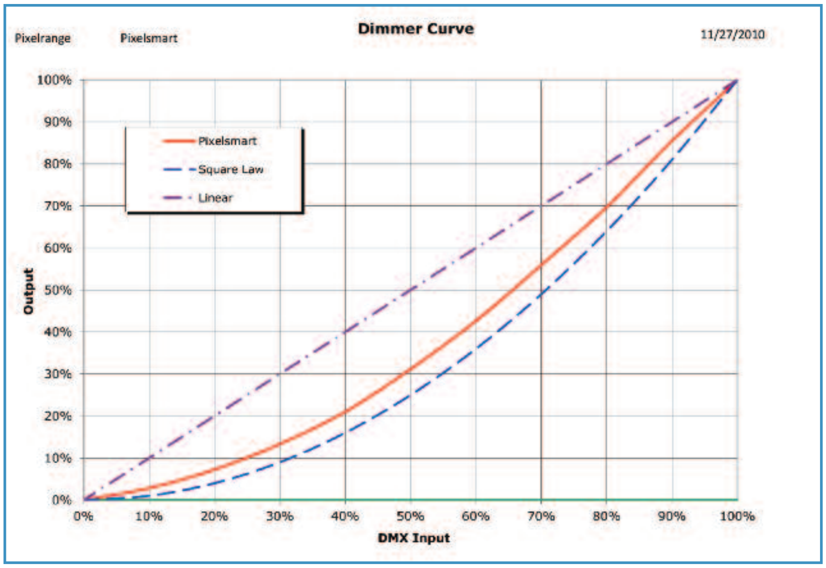

Figure 10: Dimmer curve

Figure 11: Individually addressable

Figure 12: Connections

Figure 13: Display and menu

shows the solo white. Both whites use a blue pump LED at just under 450nm with a broad yellow/green phosphor centered at around 540nm. The solo white appears so much brighter in the spectra because of its narrower beam angle. Finally, Figure 9 shows the spectrum with all channels running. This shows good broadband coverage at most wavelengths, but with a big dip in the cyan. Again, these are typical results for RGBW systems.

Dimming

I recall being impressed with the dimming the last time I tested a PixelRange luminaire, and the PixelSmart lives up to that expectation. PixelSmart uses a very high PWM frequency—I measured it at 7.8kH—so that flicker shouldn't be a problem for any user or TV camera. The luminaire offers optional modes for dimming, including a raw eight-bit mode called Fine, which is really only needed for high-speed strobing or pixel-mapping modes (of which more in a moment) and, my personal favorite, Tungsten mode, which provides very smooth interpolated dimming with a superimposed thermal lag emulating a tungsten filament lamp. In all cases, the dimmer curve itself was excellent, very smooth and falling close to a square law. You can see the measured curve in Figure 10.

Color system

Color mixing was as you would expect from an RGBW unit—a little limited in some colors, but strong in saturates. The white helps with color rendering, but the high color temperature still makes it less than ideal for skin tones—however, that's not really what the PixelSmart is for. The chart below shows the output in the major colors from the RGBW array.

COLOR MIXING

Color	Red	Green	Blue	White
Output	14%	30%	34%	30%

Note that the total adds up to 108%, more than the full output. There is some ramping of power as temperature rises with all the channels turned on. It is often the case with LED luminaires that the whole is less than the sum of its parts…

This is perhaps a good place to mention the operating modes of the PixelSmart. In all the above tests, I operated it as a wash luminaire in five-channel mode, one channel for each of the five colors. However, you can select discrete mode operation, where every LED in the unit can be addressed and accessed independently. You have 48 channels for the 4 x 12 RGBW arrays plus 13 channels for the solo whites, making 61 channels in total. Couple that with some pixel-mapping software from a lighting desk or media server and you have full control over every pixel. Figure 11 shows a very simple example where I programmed stripes of colors on the unit. Additionally, there are programmable chase modes, accessible through DMX control, which leverage this facility.

Noise

The PixelSmart has a couple of fans—a large one, which cools the power supplies and driver electronics, and a second, smaller one, which cools the LED heat sink. After leaving the unit running at full power for a couple of hours so it reached maximum temperature, I measured the noise output at 37.5dBA at 1m with a background ambient less than 35dBA at 1m.

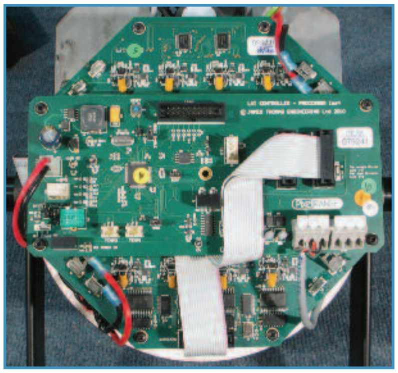

Figure 14: Control and LED driver boards

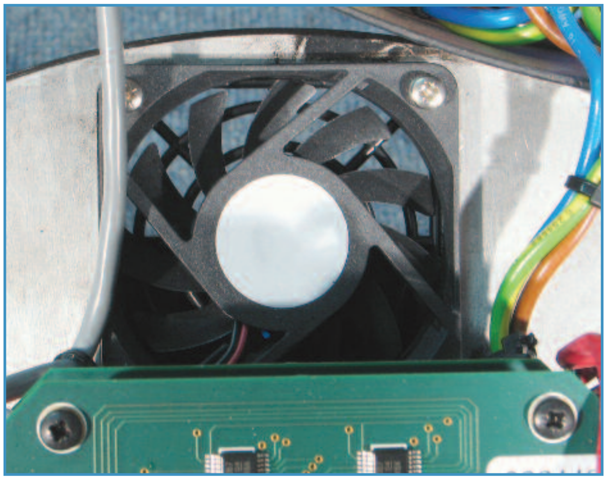

Figure 15: Electronics fan

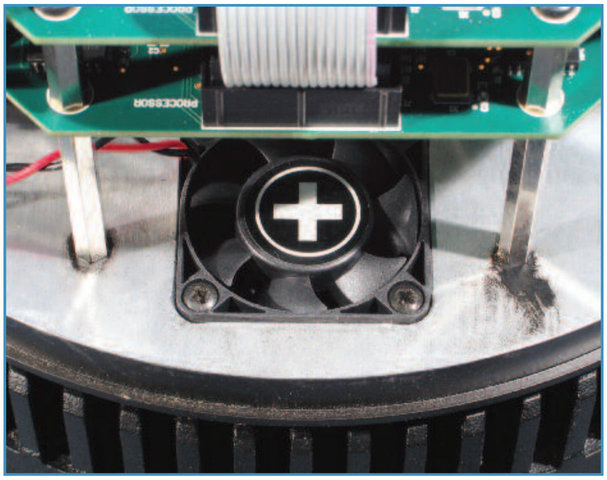

Figure 16: Heat sink fan

Electrical parameters

The PixelSmart uses an internal, fully power-factor-corrected, auto-ranging (90V – 264 50/60Hz) power supply.

POWER CONSUMPTION AS TESTED AT 119V

	Current, Power	Power Factor
Quiescent Load	0.12A, 5W	0.4
All LEDs illuminated	1.57A, 185W	1.0

Initialization time from power up to output was 1.5 seconds

Electronics and control

The PixelSmart uses the increasingly common Neutrik PowerCon connectors for mains power and has both in and out connectors for daisy-chaining power. Figure 12 shows the main connection plate. Control and access to setup and options are through a conventional LED display and four-button menu system, as shown in Figure 13.

Inside the unit there are three circuit boards stacked on top of the power supply. Two of them appear to be four-channel drive boards, one being used for three colors and the other for two in this configuration. Figure 14 shows a top view of this stack, with the smaller input and processor board on top of the two driver boards.

As previously mentioned, there are two fans in the PixelSmart—one for the electronics and one for the heat sink. Figures 15 and 16 show the fans, with one mounted on either side of the main circuit boards. The menu and display board is mounted inside the plastic cover, as shown in Figure 17. All boards look simple to remove and replace, if necessary.

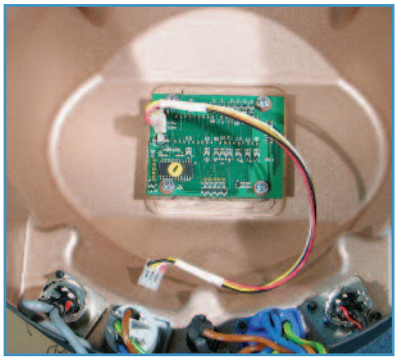

Figure 17: Inside head cover

Construction

Construction was very neat; the unit feels solid and sturdy. LED units are always a little heavier than you expect, because of all that aluminum in the heat sinks. The PixelSmart is no exception, weighing in at a chunky 19lbs. In appearance, the PixelSmart resembles a PAR unit and is fitted with a double yoke often seen on those luminaires. This allows the unit to be rigged or used as a floor stand.

The front of the unit looks to be sealed for weatherproofing, although PixelRange doesn't claim any particular IP rating in the product's literature. As such, disassembly of the LED module, with all its seals and gaskets, wasn't something I wanted to attempt. The rest of the unit, though was easy to disassemble, and servicing it should be straightforward.

Conclusions

The PixelSmart is an interesting product: Part wash light from the RGBW array, part PAR from the narrower angle solo white LEDs, and part display device when run pixel mapped. Does that combination appeal to you for your next show? I hope I've provided the data to help you decide—but, as always, it's up to you.

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