Vari-Lite VL5LED WASH

By Mike Wood

Figure 1: Fixture as tested.

Way back in June of 2004, David Barbour and I put together the idea of doing these in-depth reviews in this magazine and, later, in *Light & Sound International*. The brief was to measure products rather than take the datasheet's word for it. That was 16 years ago, and, in that time, I've tested around 100 lights. In fact, I think that this review is number 100! It's hard to be precise, as a couple didn't get published, and others where the publication order got juggled. Even if this isn't precisely number 100, then it ought to be. Why? Well, the very first product I tested was the Vari-Lite VL1000 and, this month, I'm looking at the company's new VL5LED WASH. It seems appropriate that Vari-Lite, one of the founders of the automated light industry, should get this spot. It's serendipitous, as another company had to drop out and Vari-Lite stepped in to fill the gap.

I'm also pleased to be reviewing another additive color-mixing luminaire. Those of you who've read me before won't be surprised that I believe additive mixing is the way of the future. For the moment, getting fundamental brightness in white light is still tough with additive mixing from LEDs, but we'll get there.

The VL5LED Wash is a natural development of the original, iconic Vari-Lite VL5, introduced in 1992. Vari-Lite has kept the same appearance, with the radial frost vanes and a similar form factor. But everything behind those vanes is new, bearing no resemblance to the VL5: Six colors of LEDs and a second set of blade LEDs replace the original single tungsten halogen incandescent lamp. How does it perform, and is it a true replacement for the original? Let's dig in.

The results presented here are based on the testing of a single unit supplied to me by Vari-Lite, with the fixture operating on a nominal 120V 60Hz supply (Figure 1).

Light source and cooling

The VL5LED Wash uses a variant of the relatively new Osram LED Engin LZ7 LED package. Figure 2 shows the ceramic package. This is an extremely compact assembly, with seven LEDs that can dissipate a total of 60W if you keep it cool. The seven LEDs comprise two phosphor-converted limes (the two yellow dies in the figure), a phosphor-converted amber (the orange die on the right), and individual dies for red, green, blue, and cyan. It's a versatile arrangement that gives good punch in white and pastels from the twin limes, and a good range of saturated colors. The broad spectrum also helps with color rendering and skin tones. A

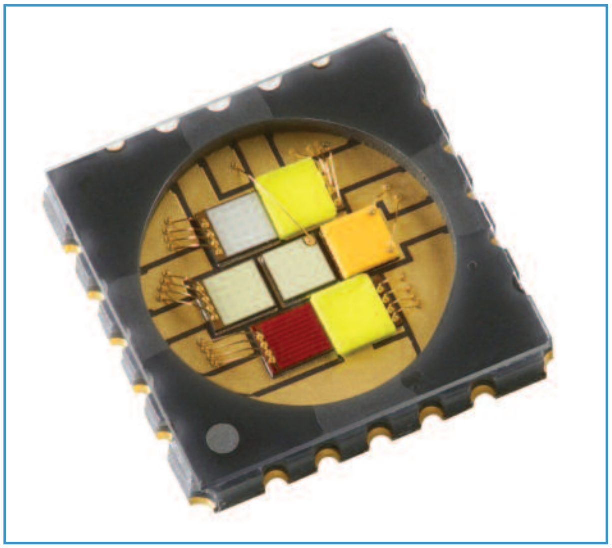

Figure 2: LED package.

number of LED manufacturers are introducing these high-density packages and they show great promise given their small size, low etendue, and high power. Although not used for this in the VL5LED Wash, small sources are just what

Figure 3: LED and light pipe.

one needs for image projection.

The VL5LED Wash uses eighteen LZ7 packages, each capped with a long TIR light pipe to mix the colors. Figure 3 shows one die with its associated light pipe; notice that the end of the light pipe that meets the LED is square, to match the top of the package. The other end of that same light pipe is hexagonal and has a fixed primary optic. The transition from square to octagonal cross-section along the length of the pipe further helps to homogenize the light and produces an output beam that is an even mix of the seven input colors. Most importantly, it also means that the final output beam is much closer to the desired circular shape than the original square.

Eighteen 60W packages mean there's a lot of heat to get rid of: around 1,000W, the same as the original VL5! As shown in Figure 4, the LED circuit board is mounted to large copper and aluminum heat plates that, in turn, are thermally linked through heat pipes to a finned heat sink assembly. Two large fans draw air through these fins; additional, smaller fans on the rear of the unit provide cooling for electronics (Figure 4).

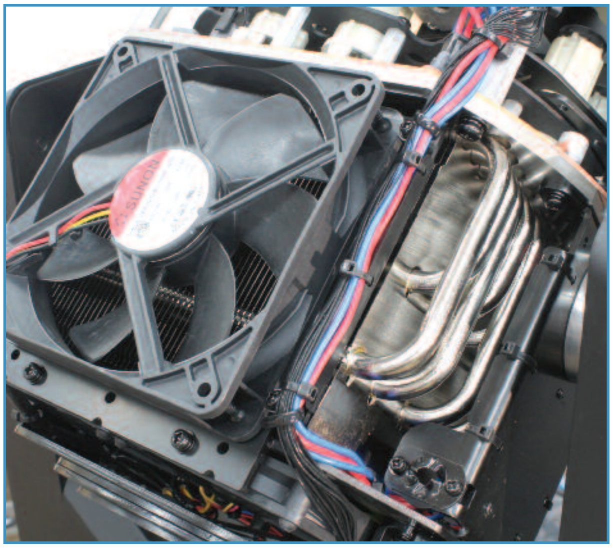

Figure 4: Cooling.

Color systems

As this is an additive color unit, the LEDs are the color in VL5LED Wash. Although you can control the six channels of colored LEDs independently (Vari-Lite calls it "open-source color control") and do your own color mixing, the company recommends using one of its SmartColor modes, in which you use normal CMY control and the fixture figures out the best mix for the requested color. Most of the time, this is the best way to go with LED fixtures that use more than four colors and is the method I used for my testing. If you mix colors yourself, you will almost inevitably get a version of the color that is lacking in output; it's not always intuitive which mix is the best. SmartColor mode gives you CMY (or RGB) control plus dedicated channels for color temperature and green shift (Duv). Going through the normal CMY color mixing as if this were a subtractive color luminaire gave me the following measurements. In all cases, the colors were smoothly and cleanly mixed across the beam.

COLOR MIXING

Color	Cyan	Magenta	Yellow	Red	Green	Blue
Output as percentage of open white	10%	8.5%	73%	6.5%	16%	3.3%

The VL5LED Wash also provides a virtual color wheel channel from which you can directly select a wide range of standard premixed colors and effects and also mix and store your own custom colors. The color temperature channel allows a range of whites from a measured 1,790K up to 10,180K (nominally 1,800K to 10,000K). I measured the parameters of some of the whites at standard color temperatures as follows.

Nominal	Color Temperature, K	Output	TM 30 Rf, Rg	Duv
10000K	10180	100%	88, 103	0.0022
6500K	6548	98%	85, 105	0.0016
5600K	5667	96%	83, 105	0.0023
4500K	4540	90%	82, 105	-0.0015
3200K	3162	68%	78, 108	-0.0047
1800K	2607	31%	78, 116	-0.0032

Figure 5 shows a typical TM30 graphic, for 5,600K. In all cases, the mixed whites show slight oversaturation on the green-magenta axis, with slight undersaturation along cyan-red. With an Rf in the 80s and Rg just over 100, the light should be pleasing to the eye, although oversaturation in red would likely look better than in green. Preference testing shows that we like a little boost in the red.

Additionally, to get a feel for the broad coverage of the six emitters, Figures 6 and 7 show the spectral power distribution when set to 6,500K and 3,200K, respectively.

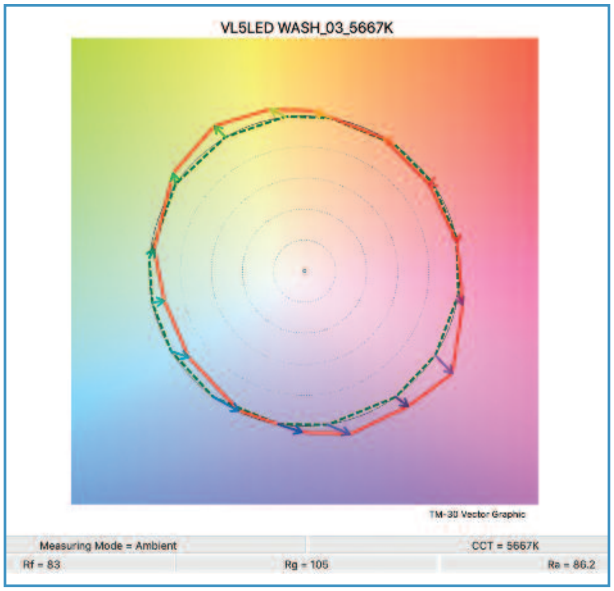

Figure 5: TM30 at 5600K

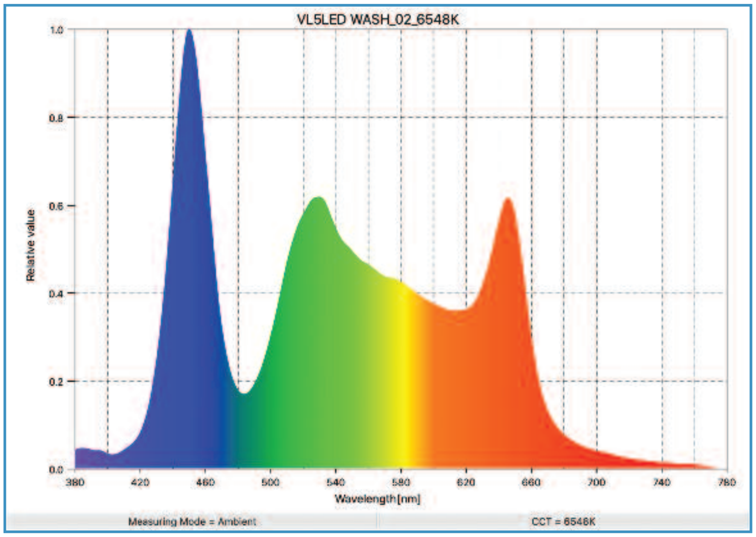

Figure 6: SPD at 6,500K.

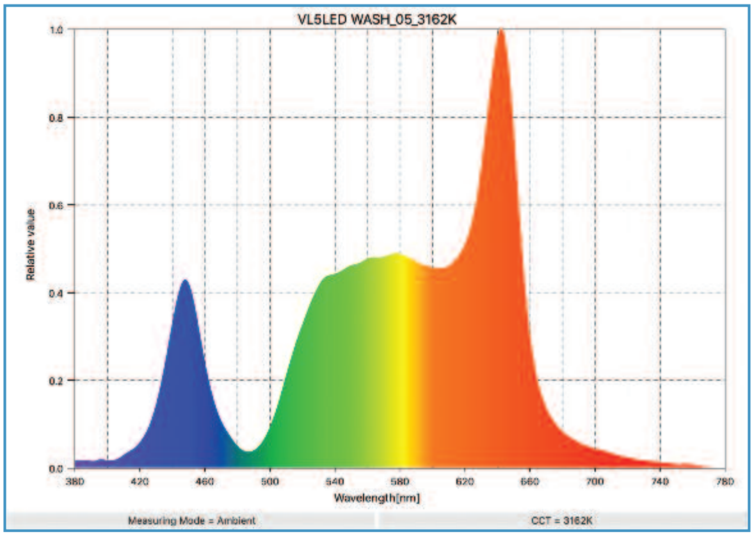

Figure 7: SPD at 3,200K.

Lenses and output

We've already covered most of the optical system when discussing the LEDs and their light pipes. The remaining component is a movable array of output lenses, one per light pipe, which move axially to alter the beam angle of the system. Figure 8 shows a portion of that lens array, which is molded in a single piece. Three small stepper motors move it back and forth to change the field angle from approximately 12° to 49°. The output at wide angle was 10,200lm, ramping down to 7,800lm at narrow angle. (Note: This was measured with the fixture in SmartColor mode and set to

Figure 8: Zoom lenses.

the highest white color temperature, 10,000K. I'm sure output would be higher if all emitters were set to full.)

The VL5LED Wash output distribution was very good and smooth, with a flat-topped beam and straight sloping sides. This is the kind of blending distribution you would more typically expect to see from a Fresnel and should work well on camera. Figures 9 and 10 show the wide and narrow beams, respectively. (In North America, flat-topped beams are more often seen in TV and film production, while theatre more typically uses luminaires with curved cosine distributions. There is no real reason why they shouldn't cross over in usage more than they do; it's just become the norm. Europe has a more even usage pattern.)

The zoom lens array took 1.3 seconds to travel end-to-end. There is slight evidence of the octagonal output at narrow angle, but I couldn't really see it at the wide end.

Dimming and strobe

Dimming was extremely smooth and followed the standard square law very well. (Other curves are available through a DMX control channel.) I didn't see any jumps or steps in slow fades to black (Figure 11). I measured the standard PWM rate at 1.5kHz but this is adjustable up to 25kHz. Strobing of the LEDs is variable up to 19Hz.

I measured the thermal droop from cold switch on; the VL5LED Wash drops to 87% of its initial output over 10 minutes when run at full output white with fans in standard mode.

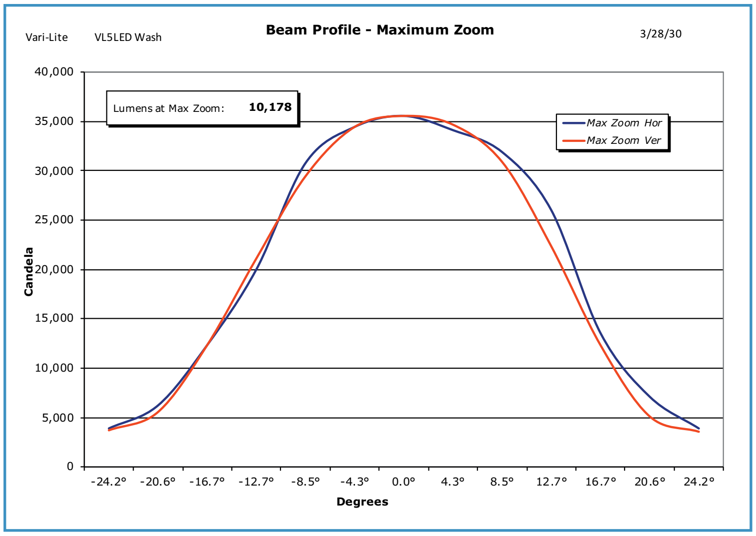

Figure 9: Output at wide angle.

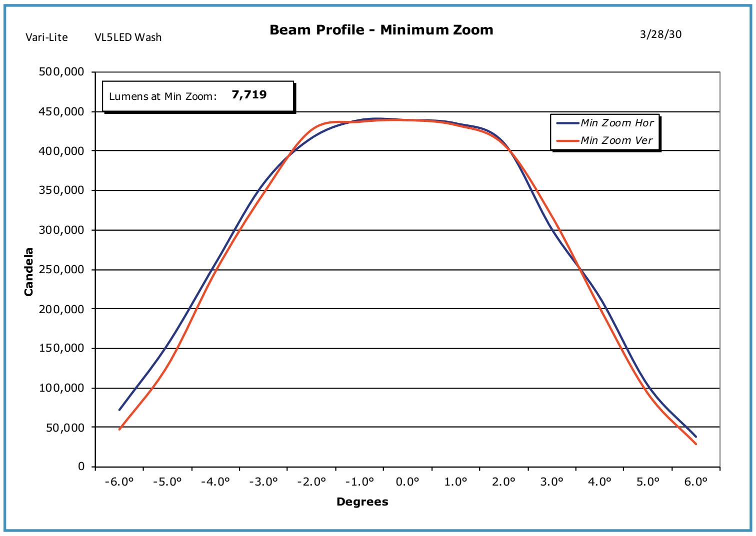

Figure 10: Output at narrow angle.

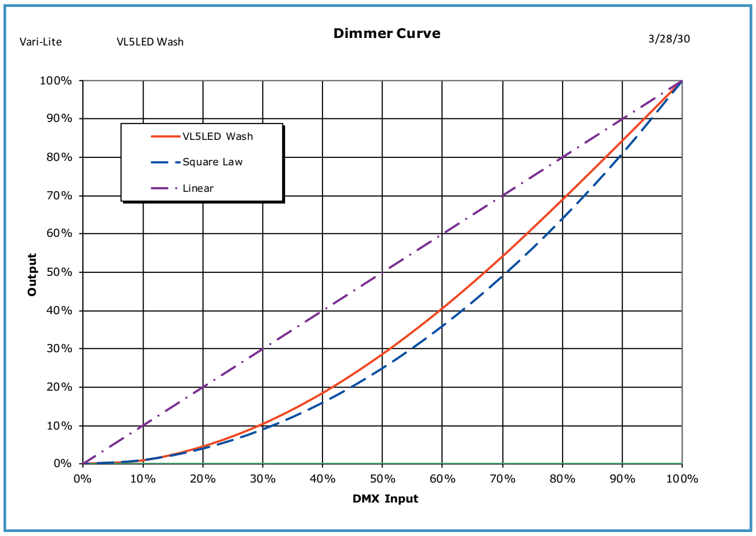

Figure 11: Dimmer curve.

Frost and effects

The VL5LED Wash uses the familiar Vari-Lite-style radial vane system for applying frost across the beam. The effect is not quite the same as with a regular optical system, but it works well. A second set of small RGB LEDs, placed around the front ring of the unit, is designed to light up the vanes and provide some color contrast for in-camera shots. Figure 12 shows a close-up of those LEDs, one per blade, next to the pivot points for the vanes. A separate color-control channel allows you to select predefined colors for the ring or to run color macros.

Figure 12: Frost vanes and LED ring.

Figure 13: Narrow LEDs.

Figure 13 shows the unit in various colors at narrow angle (and with the brightness turned way down so I could photograph the LEDs), revealing the 18 emitters and how they line up with the frost vanes when turned parallel to the beam. Figure 14 shows two different combinations with the unit in wide angle and the frost vanes across the beam. I've

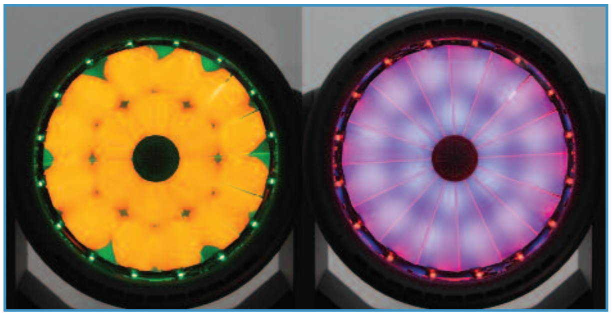

Figure 14: Frost and second LED ring.

also set the outer ring lights in contrasting colors.

Finally, Figure 15 shows how the frost vane mechanism operates. A single stepper motor rotates a ring that runs around the circumference of the unit. This ring operates 16

Figure 15: Frost ring.

pivot arms that turn each of the individual vanes. The mechanism is much the same as it was in the original VL5 but is now made primarily of plastic instead of the original's metal. Lower temperatures help enormously.

Pan and tilt

I measured the pan and tilt ranges as 540° and 220°, respectively. A full-range 540° pan move took 3.1 seconds to complete, while a more typical 180° move finished in 1.8 seconds. Tilt took 1.8 seconds for a full 220° move and 1.6 seconds for 180°. All movements were very smooth, with very little bounce and no visible steppiness. I measured hysteresis on both pan and tilt at 0.09°, equivalent to 0.4" at 20' (15mm at 10m).

Noise

With the fans set to standard mode, their constant noise is by far the most apparent. Switching to studio mode reduced the base level considerably, but also reduced the output to 57% of that in standard mode.

SOUND LEVELS

	Normal Mode
Ambient	<35 dBA at 1m
Stationary	53.6 dBA at 1m
Homing/Initialization	61.1 dBA at 1m
Pan	53.8 dBA at 1m
Tilt	53.6 dBA at 1m
Zoom	54.8 dBA at 1m

Homing/initialization time

Full initialization took 96 seconds from a cold start and 85 seconds from a DMX512 reset command. The VL5LED Wash's homing is well-behaved in that the fixture fades out smoothly, resets, and keeps the LEDs off before fading up again after all movement is finished.

Power, electronics, control, and construction

The head, with its main systems, can be seen in Figure 16. There's very little that can be serviced, aside from the circuit boards. Access for cleaning is reasonably good. Figure 17 shows both yoke arms with the covers removed; again, disassembly was very easy.

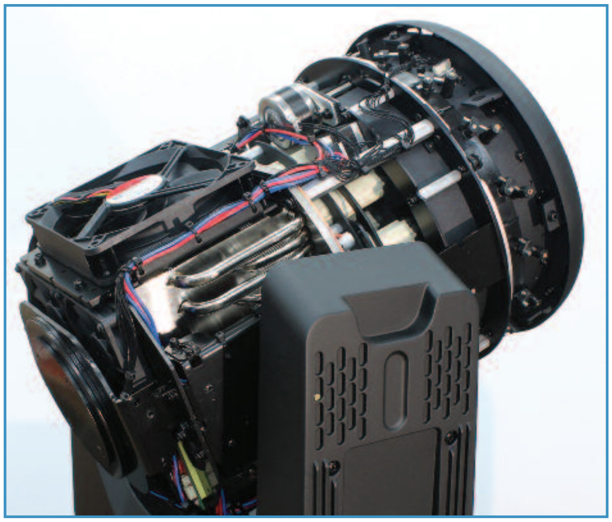

Figure 16: Head.

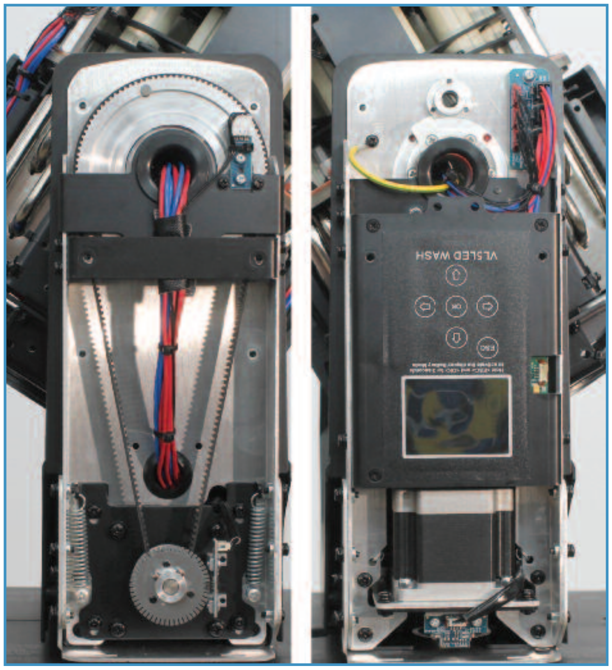

Figure 17: Yoke arms.

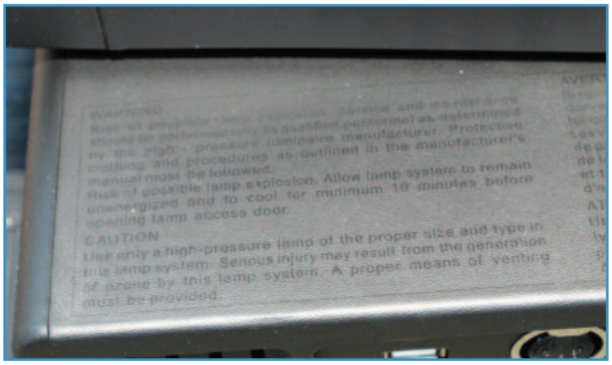

Figure 18: Black on black.

One thing I did notice was the silk-screened warning labels on the top box and control panel are in black ink. Black ink on a black background: It sounds crazy but, actually, it isn't that hard to read, as can be seen in Figure 18. (An off-topic note for those readers who know *The Hitchhiker's Guide to the Galaxy* books by Douglas Adams: This reminds me of Zaphod's line, "Every time you try to operate one of these weird black controls that are labeled in black on a black background, a little black light lights up black to let you know you've done it. What is this? Some kind of galactic hyper-hearse?" I wonder if somebody at Vari-Lite is a fan?)

Figure 19: Display.

The menu-and-control system is mounted in one of the yoke arms (Figure 19). It's a familiar Vari-Lite system, offering the usual functions and setup procedures.

Finally, the top box. All you need here are the connectors: Powercon TRUE1 for power in, five-pin DMX512/RDM, and an RJ45 network connector for sACN or Art-Net (Figure 20). I tested basic RDM functionality and had no problems. Notice again, the black-on-black labels…

In my testing at 120V, 60Hz the power consumption of the Vari-Lite VL5LED Wash was 9.96A with the LEDs at full power, fans running, and no motor movement. That equates to 1179W, 1184VA with a power factor of 0.99 quiescent load with LEDs extinguished was 0.54A, 59W, 66VA, power factor of 0.89. Interestingly, the power consumption is very

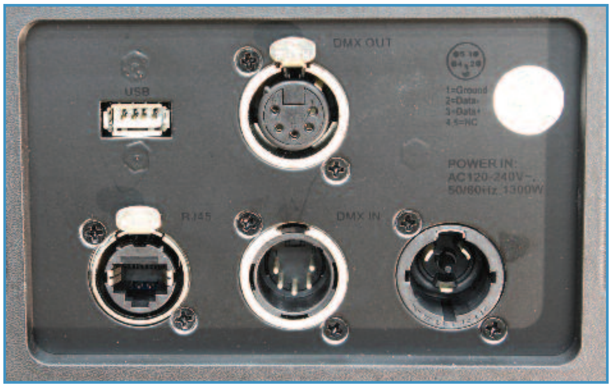

Figure 20: Connectors.

similar to the original VL5, which used a 1,000W lamp. Where the LED version wins in efficiency is in producing colors, when the power consumption drops hugely.

That's about it for the Vari-Lite VL5LED Wash. How does it compare with the original? I'd say the colors are better and richer because of the additive mixing, and the beam is certainly a lot cooler. It also has the LED ring for in-camera eye-candy effects. When our business returns to some semblance of normality in the hopefully not-too-distant future, if this data looks at all interesting, I suggest you get a demo and try it out for yourself.

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