Coemar Stage Lite LED

By: Mike Wood

Fig. 1 - Fixture as tested

Fig. 2 - LED lines

Fig. 3 - LED line movement

Fig. 4 - LED lines and gears

It's been well over a year since we looked at a product from Coemar, and it's definitely time to look at one of the company's new offerings. I was wondering which one to review when I saw this product—the Stage Lite LED—had just been launched at Prolight + Sound in Frankfurt, and I was intrigued by the possibilities. It's a novel concept, as you often get from Coemar—but how does it perform? I've also not tested a linear LED cyc flood in this series of reviews before, and I've had to rethink some of my testing procedures to get the data you need for this kind of device. I've still stuck to the philosophy of measuring everything I can, but the presentation has changed slightly to reflect the type of unit.

Figure 1 shows a view of the Stage Lite LED as supplied to me by the U.S. distributor, Inner Circle Distribution. At first glance, it looks like a simple linear LED-based cyc flood with three strips of LEDs. Well, that's what it is, but there's a twist: Each of those three LED strips can independently pivot about its longitudinal axis, and that tilt movement is controlled through three stepper motors and three DMX512 channels. Thus you can angle the three strips (or lines, as Coemar calls them) independently to alter the beam output angle and distribution—the theory being that you can emulate both symmetric and asymmetric floods by realigning the lines. It's an interesting concept, and potentially turns a simple LED batten into something a little more exciting.

However, I'm getting ahead of myself; let's start at the beginning and work our way through the unit.

Light source and optics

The Stage Lite LED contains 96 LEDs, with 32 on each of the three LED lines. The LEDs are in four colors—red, green, blue, and white—and thus there are eight sets of those four on each line. The LEDs are 1W devices, so the total is approximately a 96W unit. That's not a huge output, but when you consider that this can be used as an outdoor IP65-rated fixture (the Stage Lite LED can be configured either as an IP20 indoor unit or as an IP65 weatherproof one), it could well be adequate for its intended use as an architectural (or architainment) wall washer.

The 96 LEDs are split into two controllable zones—left and right—and each half has its own independent color mixing and control. For all my tests, I measured the output of a single zone, as this is analogous to a cell in a regular cyc unit. For the total output, you need to allow for the two zones or cells. Figure 2 shows a closer view of one of the zones, with its three lines of LEDs. You can also see in Figure 2 that each line of LEDs is mounted on its own chassis and heatsink assembly, and it's this entire assembly that rotates to give the beam angle control. Figure 3 shows the Stage Lite LED with its lines in two different sets of positions. Each line

can be independently tilted through a broad range of angles. In practice, the useful tilt range is limited by the cutoff of the light by the neighboring line or the outer chassis. This angle varies, depending on the position of those neighboring lines, but the average is about a 90° range, so, effectively, you can tilt any line to any angle you need.

Figures 4 and 5 show in greater detail how the lines tilt through a large rubber gear on the end of each line, meshing with a similar gear on a standard stepper motor.

Each of the LEDs is fitted with an asymmetric TIR lens to give a very broad distribution of 62° horizontally, but a much narrower 23° vertically, allowing the three lines to be kept separate or blended as desired (Figure 6). Coemar also offers other optional lens angles. According to Coemar, this is done by removing the chassis from the housing and then changing out modular lens strips that encompass one line at a time. Unfortunately, I wasn't able to test this to see how the other lenses perform. As mentioned before with LED-based luminaires, TIR (or total internal reflection) lenses are by far the most efficient at capturing that 180° spray of light from the LED die and collating it into a narrow beam. The other benefit of using reflection—rather than refraction—for collation is that it is always achromatic; that is, it affects all colors exactly the same. This is much easier to deal with than refractive lenses, where different colors are affected differently, thus requiring special achromatic lens combinations to avoid red/blue rings around the beam. Often, the reflection from the TIR is the only process—calling them lenses is perhaps a misnomer, as they are really reflectors; however, in this case, the lens is actually a hybrid—the light capture portion uses the TIR, whereas the asymmetry of output producing the strongly oval shaped beam is produced by the linear refractive lens array molded into the top of the lens clearly visible in Figure 6. The output from a single color and single line is shown in Figure 7. (Note: It is extremely difficult to show the subtlety of a luminaire's output distribution in a photograph, so I usually avoid doing it; however, I felt it was important to try here, because of the extreme asymmetry of the beam. Please take Figure 7 as purely an indication of beam shape and don't try to read anything to do with smoothness or brightness from my inadequate photograph.)

Coemar has chosen slightly less extreme colors for the LEDs, particularly in the selection of a 475nm blue, which I

Fig. 5 - Tilt motors

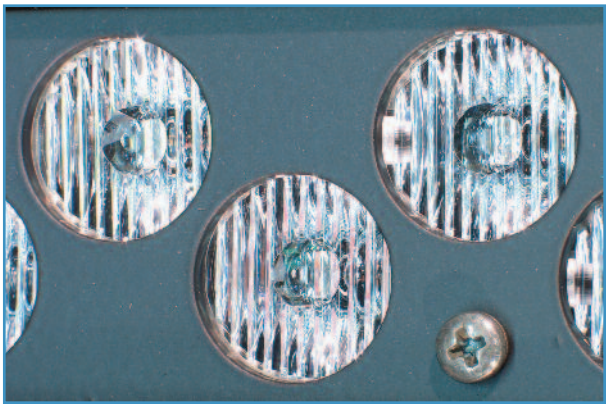

Fig. 6 - Lenses

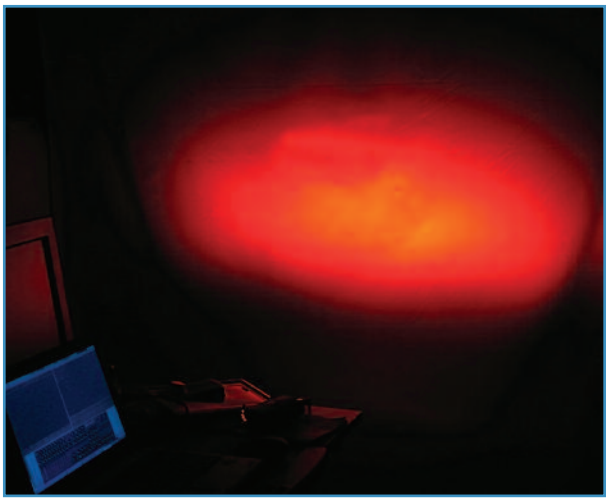

Fig. 7 - Single line

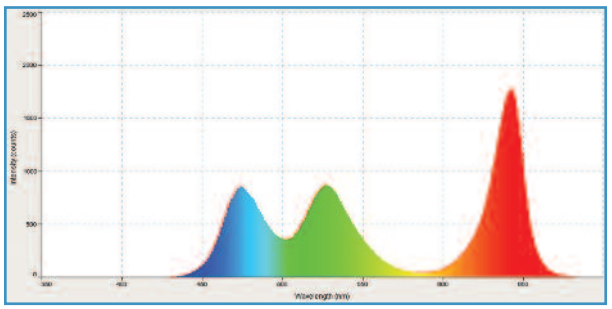

Fig. 8 - Spectrum RGB LEDs only

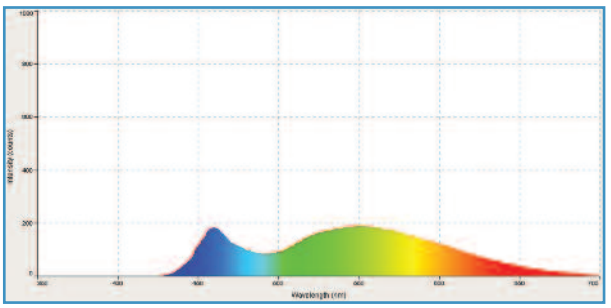

Fig. 9 - Spectrum White LED only

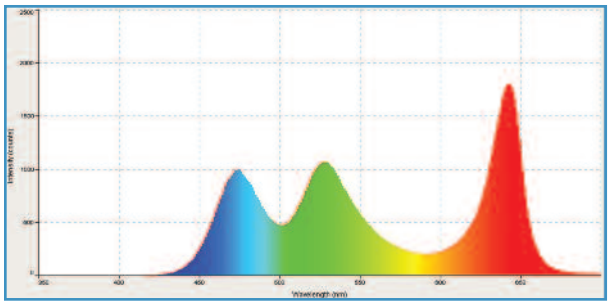

Fig. 10 - Spectrum with all LEDs at full

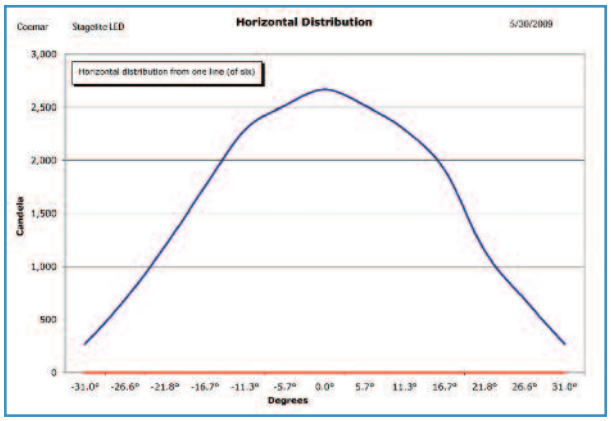

Fig. 11 - Horizontal distribution

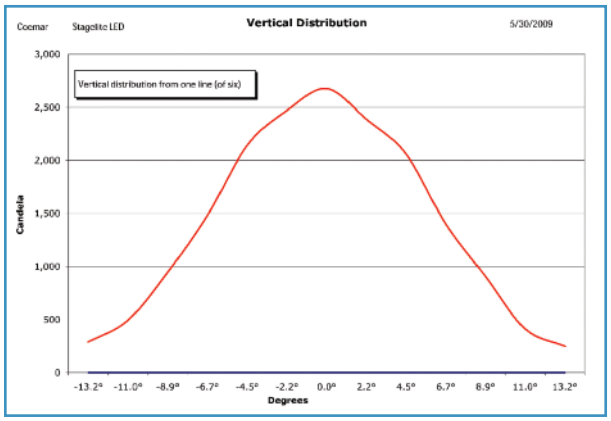

Fig. 12 - Vertical distribution

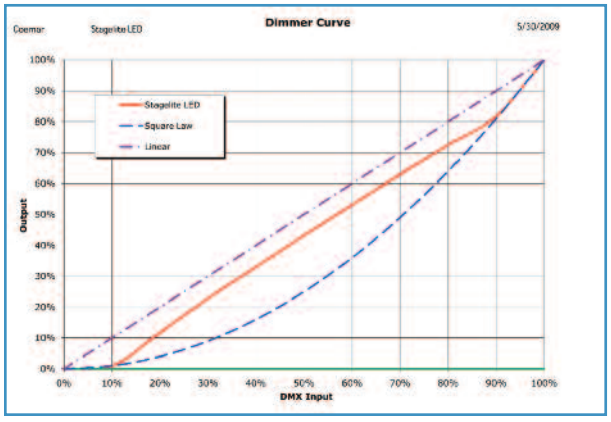

Fig. 13 - Dimmer curve

think suits its intended use and will improve the perceived output. Figure 8 shows the spectrum of the RGB emitters, while Figure 9 shows the white on its own. Note the narrow blue peak in the white LED's output—this is the underlying "pump" color from the blue LED die that excites the yellow phosphor coating, giving the second very broad peak. The net result is something that looks white to the eye. The vast majority of white LEDs available today use this technique. Figure 10 shows the output spectrum with all four LEDs running. Note the difference between Figures 8 and 10—the addition of the white is subtle, but it fills in the gaps between the individual color emitters, particularly between the green and the red, and provides broad band output.

Output

Here's where the data reported differs slightly from previous reviews. It isn't as appropriate to report total lumens for such an asymmetric beam pattern as it is for regular circular beams. You can't learn as much from it, and it doesn't tell you how the unit will perform in its intended wall washing role. What is more important here is the output at any particular distance; thus, I'm reporting separately the output in candela in both the horizontal and vertical planes. Figure 11 shows the horizontal distribution, while Figure 12 shows the vertical. The Stage Lite LED has good, smooth blending distribution in both axes, and it should be possible to blend adjacent units into the continuous, single output needed for washing applications. In my test, I blended together the three lines into a single vertical beam, using the adjustable tilt on each line, and it was very easy to get a continuous output. One caveat: You can't adjust the intensity of each line independently, so the output was inevitably brighter at the bottom of the beam, where it was closer to the cyc than at the top—perhaps Coemar might consider adding individual line intensity control as well as, or instead of, individual zone control in a future revision; it would add a lot to the usability of the luminaire, I think. Another way of dealing with that now would be to use slightly wider angle optics on the bottom row than the other two. (Note: Coemar informed me after I wrote the review that it can provide a set of 50° lenses for the bottom row to deal with this problem.) Note that the curves and figures presented are from a single line of emitters from one of the two zones—if you were to overlay lines, you could multiply up these figures accordingly.

These measurements were done with all emitters on full, which produced a white with a very acceptable color temperature of 6,400K. The white LED on its own has a much higher color temperature, which I measured at 8,000K. Color homogenization was reasonable—with separate emitters, there were inevitably colored shadows; however, when using it as a cyc wash, this isn't likely to be a problem.

Dimming

The Stage Lite LED's dimming performance is a mixed bag, with a good dim curve, poor smoothness, and excellent PWM control. The dimming curve is shown in Figure 13; it

falls halfway between a square law and linear dimming, and gave a good feel to the dimming. However, the dimming itself is the weakest point of the Stage Lite LED, and showed LED steppiness over a wide range, with DMX512 steps clearly visible in slow fades below 40% brightness. On the plus side, Coemar gives the user exceptional control over the PWM frequency. The native speed is 600Hz; however, through a control channel you can select PWM frequencies in 500Hz steps from 1,000Hz all the way up to a very fast 5,000Hz. I've not come across a fixture with such a fast PWM frequency before, and I would expect it to give the "flicker-free" performance that Coemar claims. 5,000Hz is well above the frequencies that can cause problems with television cameras—even HD cameras with narrow shutter angles should be okay. There is a direct relationship between PWM frequency and the number of bits you can allocate to dimming, and I suspect that Coemar decided that a high PWM frequency was more important than the smoothest dimming for this unit.

Color system

As previously mentioned, the Stage Lite LED uses RGB-plus-white dimming, so it is able to give a good range of colors. The addition of white really helps with making good pastel mixes and improves color rendering. An RGB mix is not so good on skin tones, but that isn't the intended use of this luminaire.

The individual LED frequencies are red: 643nm, green: 528nm, and blue: 475nm.

Color Mixing - Percentage of Full RGBW Output

Color	Red	Green	Blue	White	Magenta	Cyan	Yellow
Output	20%	18%	23%	19%	45%	39%	38%

Noise

No fans means no noise. Within its IP65 housing, I couldn't detect any noise from electronics or power supplies, so the Stage Lite LED is effectively completely silent when running and stationary. There is very slight noise at around 40dbA at 1m from the tilt motors when running quickly, but they can be made to be silent by running them slowly.

Electronics and control

The Stage Lite LED contains two power supplies, one for the electronics and control and the other for the LED drivers. Both supplies are auto-ranging, with 90-250V 50/60Hz operation. Figure 14 shows a rear view of the electronic chassis after sliding it out of the unit and Figures 15 and 16 show close-up views of the power supplies and LED/motor driver areas respectively. The power supplies are standard off-the-shelf units from well-known manufacturers and should perform reliably. The unit consumed 152W at a power factor of 0.97 when run with all channels at full with a supply voltage of 115V, 60Hz.

The Stage Lite LED provides both five-pin and three-pin XLR connectors for DMX512 input and output, as well as a comprehensive menu system using a four-character, seven-segment display allowing the configuration of many parameters and interrogation of system. Figure 17 shows a view of the control and connections panel. When used in IP65 mode, this panel is sealed; Coemar supplies a remote control unit—the DR 1—to allow remote addressing and configuration of the unit.

Fig. 14 - Electronic chassis

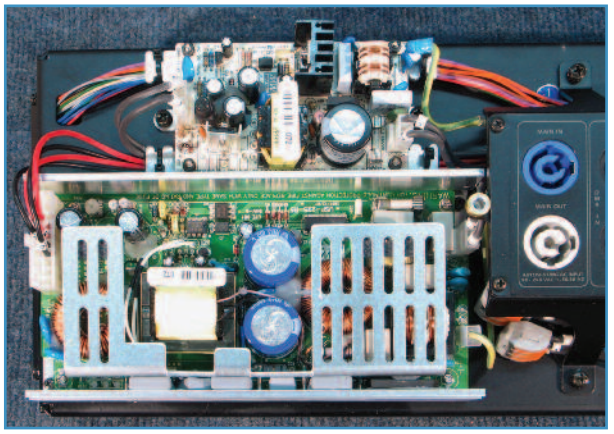

Fig. 15 - Power supplies

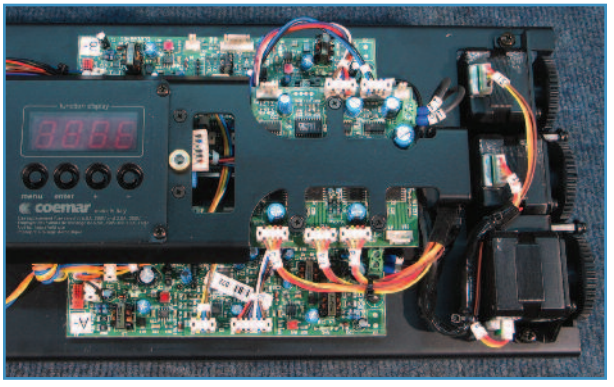

Fig. 16 - LED and motor drivers

Fig. 17 - Display

Fig. 18 - Profile view

The three tilt motors are mechanically homed, so initialization takes a while—in my tests, it took 38 seconds from a cold power up to be ready for use, and a slightly shorter 31 seconds when a reset command was sent on the DMX512 control channel. The LEDs were re-energized when homing before the tilt movement had finished, so make sure to black the unit out before homing it live. As already mentioned, the DMX512 protocol allows individual RGBW control of each half of the unit independently as well as the tilt angles for the three lines. In addition, there are channels providing a good range of special strobe functions and a range of pre-programmed macros for "instant" effect.

Finally, there are, of course, three DMX512 channels to control the tilt movement of the three lines. The movement of these was very quick, and you can pivot any line from top to bottom of the visible range in less than 0.5 second. They were also capable of slower smooth movement, and I can envisage that overlapping sweeps with the three lines could be an interesting dynamic effect.

Construction

The Stage Lite LED has a very interesting shape, particularly the profile (Figure 18), with the top and bottom curved to allow more room for the tilt movement. The unit supplied was an IP65-rated outdoor unit, so the whole operating chassis is enclosed in an outer enclosure of extruded aluminum with a sealed glass front panel. The constructional design is elegant, and the whole chassis can be easily slid out from the enclosure by removing one end cap and its associated sealing gaskets. Figure 19 shows the chassis being removed. This process is very simple, and maintenance of the luminaire should be straightforward. IP65 rating means that the fixture is fully protected against physical object insertion, including dust and dirt, and is also protected against low-powered water jets from any angle. I have no means to test for IP65 compliance, so I cannot comment on the efficacy of the enclosure. Coemar tells me that, for full IP65 rating, the unit has an extra cover fitted over the connections and menu plate. However, a consequence of IP65, and the subsequent lack of external ventilation and fans, is the need for good internal thermal management. Each LED line has its own integral heat sink which, of course, has to rotate with the line as the tilt angle is adjusted. This leads to a cylindrical design to maximize surface area while minimizing the physical space occupied by the heat sink so that the lines can be close together. Figure 20 shows a close-up of two lines, with one of them rotated to show the heat sink on the rear. Each line is only consuming 32W, so this simple system works well, and simple convection within the enclosure transfers the heat from the internal heat sinks to the external aluminum housing. I ran the Stage Lite LED for extended periods over many hours and, although the outside casing got up to 42°, the unit ran with no thermal problems. At its maximum temperature, the output dropped by about 17% from the cold level. All LED units lose output with temperature, so this is not unusual.

Fig. 19 - Removing chassis


Fig. 20 - Heat sink

Conclusions

The Coemar Stage Lite LED is an intriguing unit. The intended use would appear to be as an adjustable wall-washer or cyc light; however, the lack of individual control of the LED lines is a little limiting to that adjustability. On the other hand, I can envisage using this unit as an overhead light curtain and using the sweeping of the beams as an effect—perhaps that's really what Coemar intended? Whatever the intended use, perhaps it strikes a chord with you and would work in your application? If so, then I hope the information provided here is of some help in allowing you to make that decision. As always, I encourage you to use this document solely as a guide and to test the fixture for yourself and trust your eyes instead—it's your decision.

Mike Wood provides technical and intellectual property consulting services to the entertainment technology industry. He can be contacted at mike@mikewoodconsulting.com