Robe ROBIN DL7S Profile

By: Mike Wood

Figure 1: Fixture as tested.

LED-based automated spot luminaires are a real thing now. Yes, I know they've been available for a number of years, but most of them didn't have the punch to work on anything but small rigs. This month, I'm testing one of the newest entries into that market: the Robe ROBIN DL7S Profile.

This has to be one of the largest LED-based moving lights I've tested. The Robin DL7S tips the scales at 80lb and has every innovation and feature that Robe's busy R&D department has thought of over the last few years, including framing shutters. But never mind the mechanical features: The main claim to fame of the DL7S has to be the use of seven colors of LED to provide a broader spectrum of color mixing.

As far as I'm aware, there's nothing else quite like the DL7S on the market right now, so comparisons are tricky. Nevertheless, as always, I've tried to test and measure everything I can, from power input to light output, and report the raw data so you have information to help you decide for yourself.

The results presented here are based on the testing, with the fixture operating on a nominal 120V 60Hz supply, of a single Robin DL7S Profile unit supplied to me by Robe (Figure 1). The unit is self-adjusting for supply voltage and will run on any voltage from 100-240V, 50/60Hz.

Light source

As with its four-color predecessor, the Robin DLS Profile, the DL7S uses a sealed, "black-box" light engine. The major change, as already mentioned, is that Robe's engineers worked to squeeze in three more colors, for a total of seven. Robe lists the colors as red, green, blue, amber, cyan, light green, and Congo blue. I suspect the light green is actually a lime and the Congo blue is really a deep or royal blue. (A true Congo blue has red in the output as well as the deep blue). The trick with using this many colors is to homogenize the outputs into a single beam and avoid colored shadows or the colored dot "M&Ms" in the lens. The crossed dichroics and fly-eye lens system in the DL7S light engine do a good job of this, squeezing the homogenized light down into the 25mm aperture of a moving light, albeit with some inevitable lost light. Robe's literature states that it is an 800W LED engine; however, in practice with real color mixes, I was pulling around 650W on average. Because it's a sealed black box, I can't tell you precisely which emitters it uses and how many of each; we'll just have to measure the output and see if we like what it does. Figure 2 shows the output of the light engine with some of the LED drivers below it. (The entire assembly is kept cool by an array of heat pipes, large finned heat sinks, and two fans mounted on top and bottom of the heat sink. These components can be seen in Figure 3. The thermal image in Figure 4 shows

Figure 2: LED engine and driver.

Figure 3: Head side 1.

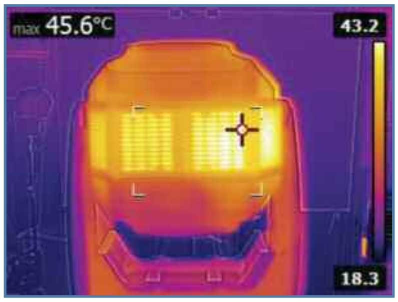

Figure 4: Thermal.

the rear of the unit where the heat is exhausted.

There's no hot mirror, of course, as LEDs produce very little IR in their output, so we immediately move into the various optical modules.

Dimming and strobe

As you would expect, intensity control is done electronically with the DL7S. Most functions are 16-bit resolution, including the color controls. Figure 5 shows the dimming curve in its default setting. Dimming was very smooth, with no visible steps, even down at low-dim levels. You also have the option to set the DL7S in tungsten-emulation mode, where it adds simulated thermal delay to the dimming to match the fade curves of incandescent lamps. It also introduces red-shift to the dimming in this mode, so the output warms as the lamp is dimmed. The PWM waveform was interesting; it looks like Robe uses a couple of frequencies of PWM, one superimposed on top of the other. The fundamental is 300Hz—the same as I measured with the Robe Robin DLS—but there looks to be a higher frequency 1,200Hz component on top of that, which is introduced as you dim down. I don't know how that will look on a video camera, but it looked a little strange on my iPhone camera—often a very difficult test to pass, as iPhone cameras use slow-scan rolling-shutter CMOS detectors. Strobe range is adjustable from 0.3Hz — 19Hz.

Color systems

Robe offers the option to control the color-mixing system through standard RGB or CMY controls as well as providing, in one of the operating modes, direct access to each of the seven LED channels. I'd recommend, unless you have a real need to get your hands dirty, letting the fixture do the color mixing and sticking to RGB or CMY. There's also a virtual color wheel channel, which gives instant access to about 90 pre-mixed colors, 66 of which are chosen to match popular gel colors. The user can also pre-program 10 user colors, which are then accessible through this same channel.

As with the DLS, Robe calibrates a range of whites with color temperatures ranging from 2,700K to 8,000K. I measured these using a Sekonic C7000 spectrometer-based meter as follows:

	Color Temperature, K	Output
8000K	7950	100%
6600K	6308	95%
5600K	5471	90%
4200K	4054	80%
3200K	3083	69%
2700K	2607	62%

The final column above shows how light output reduces as you lower the color temperature.

Figures 6 and 7 show the measured spectra at nominal 3,200K and 8,500K. Six out of the seven colors are clearly visible as peaks; only cyan is hiding, presumably underneath the broad lime peak.

The color system has a great many options. As well as the already-mentioned tungsten-emulation mode, you can choose to run with color calibration on or off and, most significantly, choose whether the white mixes are optimized for output or for their color-rendering ability. I ran the unit in the CRI 70 mode, which was how it was delivered and this seems like a good compromise between output and rendering. It is possible to select CRI modes all the way up to 90+, but, inevitably, the output suffers as you increase the rendering. Figure 8 shows an information screen on the unit, showing the specific mode I was using. As an example, using 8,500K white light in CRI 70 mode as the baseline.

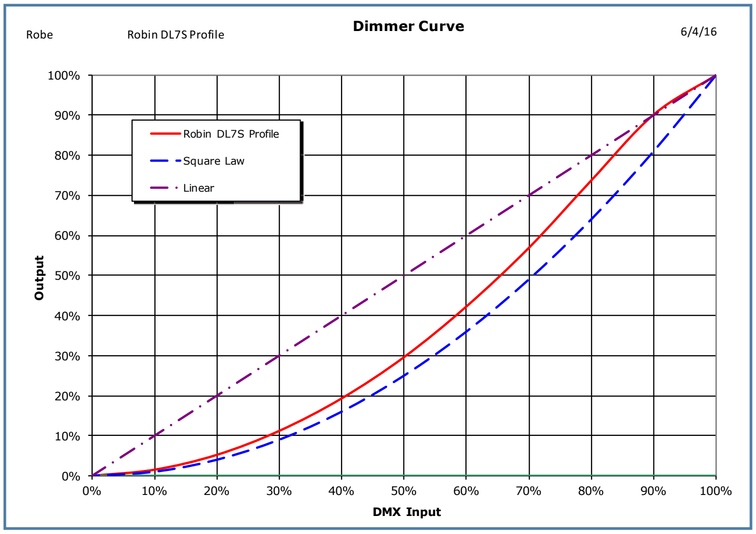

Figure 5: Dimmer curve.

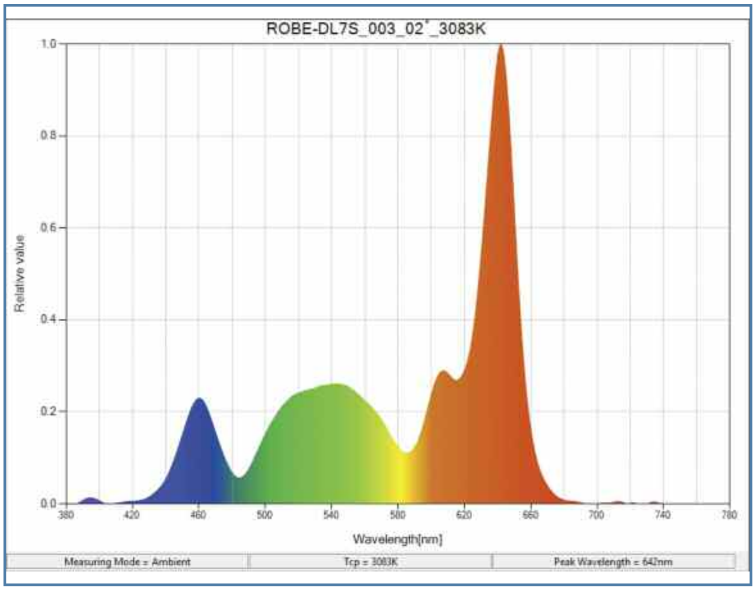

Figure 6: Spectrum at 3,200K.

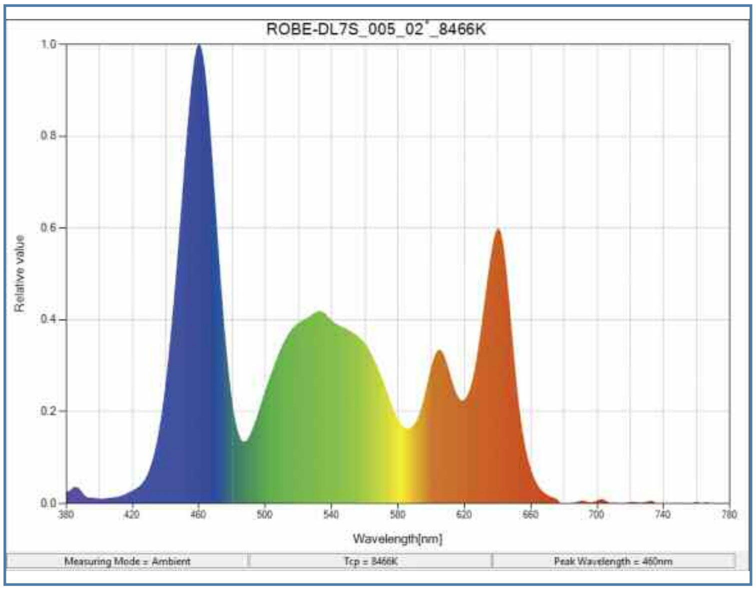

Figure 7: Spectrum at 8,500K.

Switching to "maximize intensity" mode gave an extra 10% output while, conversely, running in "CRI 90" mode dropped the output by 30%. I like having the choice—many times you need good color rendering, but not always. When running at 3,200K in CRI 70 mode, I measured the CRI at 68 and the TM-30 values as an Rf of 80 and an Rg of 111. (Note: As you will see in my other reviews, I'm switching over to using TM-30 instead of CRI. It is a much better color rendering metric for discontinuous light sources like LEDs. The two different parameters Rf and Rg represent the color fidelity and the gamut index respectively. Rf tells you how faithfully the light reproduces colors on a 0-100 scale that you can use in much the same way as you did CRI. Rg tells you whether the light tends to over- or undersaturate colors and can, as in this case, go above or below 100. I strongly recommend you switch to using TM-30 as well, and ask your suppliers for the data. Stop using CRI—it's useless with LEDs! (Read my article in the Fall 2015 issue of *Protocol* magazine for more information on TM-30.)

Figure 8: Color parameters.

Just to give you an idea of the color mixing, I've included the usual table of outputs for various standard colors. Note that these are not the outputs of single emitters, but rather the output when producing the specified color using one of the colors on the virtual color wheel. The light engine homogenizes the colors extremely well; there was an even color across the beam, with no visible colored shadows.

COLOR MIXING

Color	Red	Amber	Green	Magenta	Blue	UV
Output	15%	13%	24%	32%	8.1%	0.9%

Now we move into the imaging portion of the optical train. The DL7S has all major optical components mounted on three easily removable modules. Working from the back, there is a gobo module, framing module, and lens module. I'll cover each in turn.

Gobo module

Figures 9 and 10 show both sides of the gobo module. There is no need to remove the module to change gobos on either wheel; I just did so for the photographs. First in line is the animation wheel. This uses a large breakup-pattern gobo that can be adjusted for coverage angle and rotation and took 0.3 seconds to insert or remove.

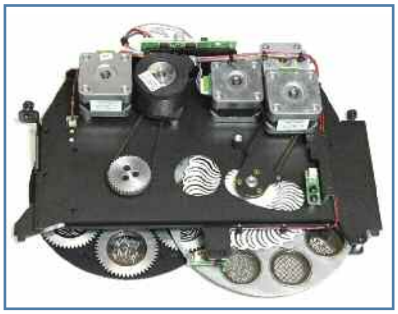

Figure 9: Gobo module 1.

Figure 10: Gobo module 2.

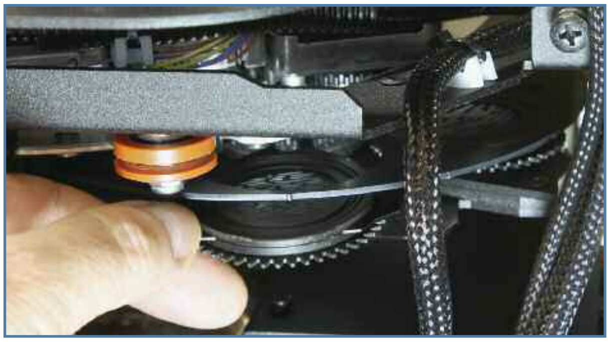

Figure 11: Gobo change.

In addition to allowing the programmer full access to the animation wheel to program his or her own effects, Robe provides a set of pre-programmed macros for the animation wheel and gobos combined that showcase some of the possible results.

Immediately after this is the rotating gobo wheel, which has six replaceable glass gobos and an open slot. Figure 11 shows a gobo being replaced into the snap-and-lock wheel in its carrier.

ROTATING GOBO SPEEDS

Gobo change speed – adjacent	0.2 sec
Gobo change speed – worst case	0.5 sec
Maximum gobo spin speed	0.3 sec/rev = 191 rpm
Minimum gobo spin speed	1276 sec/rev = 0.05 rpm
Maximum wheel spin speed	0.7 sec/rev = 82 rpm
Minimum wheel spin speed	212 sec/rev = 0.3 rpm

Rotation and indexing were very smooth, with a good range of rotation speeds. Movement was clean when changing direction, with very little hysteresis. I measured the accuracy at an excellent 0.02° of hysteresis error which equates to 0.1" at a throw of 20'. All wheels use a quick-path algorithm to minimize change times. The fixed gobo wheel has eight replaceable gobos plus open.

FIXED GOBO SPEEDS

Gobo change speed – adjacent	0.5 sec
Gobo change speed – worst case	0.5 sec
Maximum wheel spin speed	0.7 sec/rev = 82 rpm

Figure 12 shows the effect of pulling focus to morph from one gobo wheel to the other. This image also shows the focus quality on the static gobo (left) and rotating gobo (right). Both are very good, with very little color-fringing. The static gobo shows a little pincushion distortion in wide angles.

Figure 12: Gobo morph.

Framing module

Figure 13: Framing module.

Figure 13 shows the framing module, which also contains the iris. Clearly visible are all ten motors—eight for the individual shutter blades, one (black gear top right) to rotate the entire framing assembly, and, finally, the iris motor at the bottom left. Each shutter blade has approximately +/- 25° of rotation and can move in to cover about 60% of the beam. The entire assembly can then be rotated a further +/- 45°. The blades move very quickly, about 0.1 second from fully open to fully closed, so they can be used for a dynamic effect as well as framing. Rotation was a little slower, at 0.9 second from a full 90°. The shutter cuts were nice and straight; I saw very little evidence of pincushion or barrel distortion. (See my review of the Robin DLS in the January 2013 issue for more details on the framing shutter construction.)

Last, but not least, is the iris. The fully closed 14-blade iris reduces the aperture to 17% of its full size, which gives equivalent field angles of 1.2° at minimum zoom and 6.2° at maximum zoom. I measured the opening/closing time at around 0.3 second.

Lens module

Figure 14: Lens module.

The final optical elements in the DL7S are the frost and prism systems and lenses, as shown in Figure 14. There are the usual three lens groups, the first two of which move and provide zoom and focus, while the last element is fixed as the large-output lens. The DL7S has a single, five-facet, rotating and indexable prism and a replaceable variable frost filter, both of which are inserted between lens groups one and two. This requires a little lens-juggling by the system when frost or prism is requested at some zoom/focus settings. Figure 15 shows the frost flag and prism arm. Both prism and frost insertion and removal took about 0.3 second if no lenses were in the way, a little longer if lenses had to be moved. Once in place the prism was able to be rotated at speeds ranging from 0.25rpm to 150rpm.

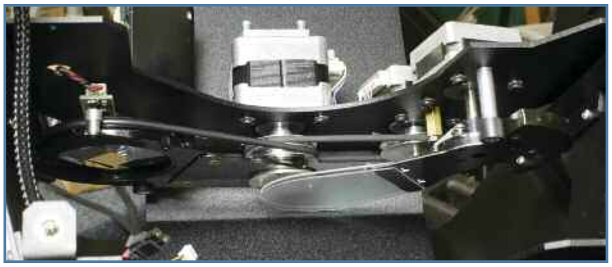

Figure 15: Frost and prism.

Output

As mentioned above I tested the unit at 8,500K in CRI 70 mode and, with those settings, I measured the output in open at 7,400 lumens at a wide field angle of 37°, ramping down to 5,030 lumens at a 7° field angle. As can be seen in Figures 16 and 17, the beam distribution is extremely flat and smooth. You will need to increase or reduce these figures to suit the color temperature and CRI mode you operate in.

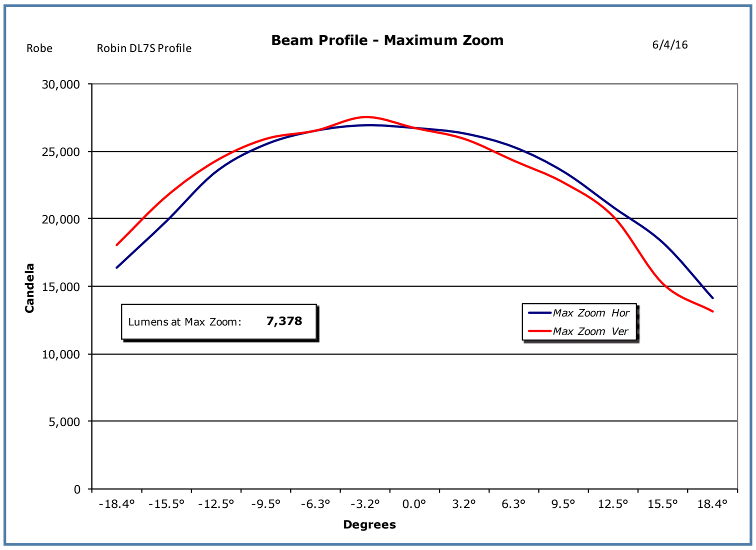

Figure 16: Output at maximum zoom.

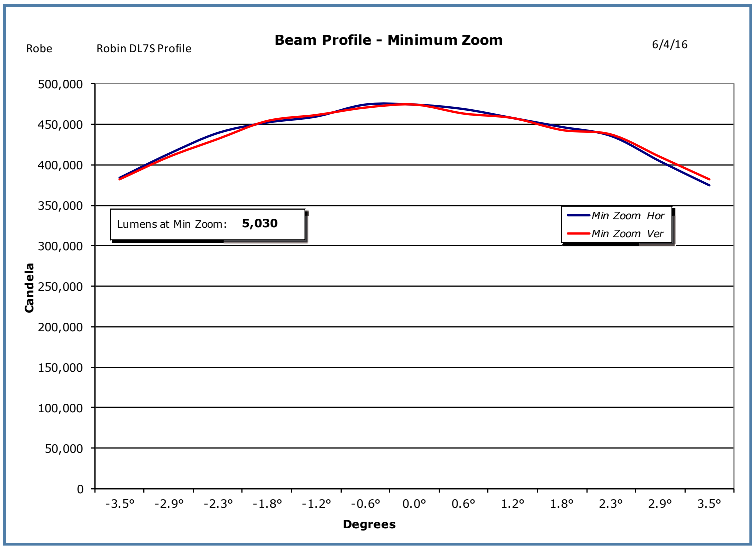

Figure 17: Output at minimum zoom.

Pan and tilt

I measured the pan and tilt range of the DL7S at 540° and 270°, respectively. A full-range 540° pan move took 4.6 seconds to complete, while a more typical 180° move finished in 2.7 seconds. Tilt took three seconds for a full 270° move and the same 2.7 seconds for 180°. The pan-and-tilt system uses Robe's Electronic Motion Stabilizer system, which, as I understand it, incorporates accelerometers in the head to close the loop and feed back any vibration and movement to the control system. This results in very smooth precise movement. The DL7S has the best accuracy performance of anything I've measured to date. Pan and tilt moves stop precisely on target with no overshoot, no ringing, and no bounce. Very impressive for such a heavy unit. I measured hysteresis on both pan and tilt at 0.03°, equivalent to 0.1" at 20'.

Noise

The twin cooling fans for the LED light engine provide the primary background noise from the DL7S. As usual, zoom and focus were the noisiest movement functions, followed by the framing shutters when run at fast speed.

SOUND LEVELS

	Normal Mode
Ambient	<35 dBA at 1m
Stationary	48.5 dBA at 1m
Homing/Initialization	55.2 dBA at 1m
Pan	48.7 dBA at 1m
Tilt	54.8 dBA at 1m
Gobo	48.7 dBA at 1m
Gobo rotate	49.6 dBA at 1m
Zoom	55.6 dBA at 1m
Focus	50.1 dBA at 1m
Animation wheel	48.6 dBA at 1m
Iris	48.6 dBA at 1m
Frost	48.6 dBA at 1m
Prism	48.6 dBA at 1m
Framing Shutters	53.3 dBA at 1m

The DL7S also offers a theatre mode in which the fans are run much more slowly and the output is reduced as necessary. In full open white, I measured the stationary noise level at a much reduced 37dBA at 1m (down from 48.5dBA). However, the output was reduced to 45% of its full value. The reduction in output in colors is less. The more saturated the color, the less the reduction in light output.

Homing/initialization time

Full initialization took a very long 105 seconds from either a cold start or a DMX-512 reset command. I'm not sure why homing was so slow. Homing is well behaved in that the fixture fades out smoothly, resets, and keeps its shutter closed before fading up again after all reset movement is finished.

Figure 18: Yoke arm and lock.

Construction

The DL7S is of modular construction, with the vast majority of the head components on the three main modules, all of which are very straightforward and simple to remove—just two captive screws and power and data connectors for each module.

Figure 18 shows one of the two yoke arms, with the main power wires running through past the red and green yoke lock and the tilt mechanism. The other yoke is similar, but contains the data bus and the pan motor.

With no lamp ballast or ignitor, the top box only contains power supplies and the main electronics. Again, construction is very simple.

Electronics and control

The DL7S uses the familiar Robe color touch-screen system. This provides access to a comprehensive array of setup and service functions (Figure 19). This includes RDM, Ethernet protocols, optional wireless DMX using the LumenRadio CRMX system, stand-alone operation, and self-test modes. There is an internal rechargeable battery to power this display and menu when the unit is unpowered, allowing easy setup.

The connector panel on the opposite side of the top box contains Neutrik powerCON TRUE1 power input along with standard five-pin and three-pin DMX-512 connections and an Ethernet port (Figure 20).

I measured power consumption when running at full output in 8,500K open white as 5.43A, 605W, 615VA, a power factor of 0.99. The quiescent load with all LEDs off was 0.9A, 97W, 108VA, power factor of 0.88.

That's it for the Robe Robin DL7S. As I mentioned at the beginning, it's really the use of seven LED colors and the improved color rendering and color mixing that provides that are the main features of this unit. Does your rig have a space waiting for it? You get to decide…

Figure 19: Display.

Figure 20: Connectors.

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