Chauvet Professional Maverick Silens 2 Profile

By: Mike Wood

Figure 1: Fixture as tested.

The standard moving light product—if there is such a thing—has become a hybrid profile spot fixture with a white light LED engine and dichroic color mixing. Every manufacturer has its version and, it has to be said, they can all be very similar—particularly as many manufacturers' products use a light engine from the same manufacturer, Appotronics, or a close clone. This isn't altogether a new situation; back when we were using MSR discharge lamps (remember those days?), everyone used the same lamp. The difference now is that an LED light engine is more than just a lamp; a light engine defines a light exit size and includes all the primary optics, so the options for customization are more limited. This means that as well as manufacturers sharing a lamp type, they also share aperture size, focal length, and a slew of other optical characteristics that make product differentiation extremely difficult.

This month, we are looking at a product that tries, albeit in a small way, to break out of that mold: the Chauvet Professional Maverick Silens 2 Profile. Does it use an optical system similar to an Appotronics light engine? Yes, but it has been made specifically for Chauvet and has some tweaks. Most significantly, perhaps, the unit's light engine runs with no cooling fans, so it runs as silently as Chauvet can make it. I want to take a look and see what this means for the product and, as usual, will run through it from LEDs to output.

This review is based on my tests of a single Maverick Silens 2 Profile supplied to me by Chauvet. All tests were run on a nominal 115V 60Hz supply; however, the unit is rated to run on voltages from 100-240V 50/60Hz (Figure 1).

Light source

As mentioned, the light source in the Maverick Silens 2 Profile is a custom unit made for Chauvet. It uses a familiar structure—an array of white LEDs driving into an array of collimating lenses followed by twin tandem fly-eye arrays for mixing—but has some modifications. The primary one is the inclusion in the center of the array of a small group of red, green, and blue LEDs surrounded by a sea of white. Figure 2 shows the view backwards down the optics with the RGB array clearly visible in the center. As I understand it, these are used primarily for Duv/hue/green-magenta control, rather than for coloring the beam. I'm sure they also help with color rendering. Other than the RGB LEDs, the main difference in the engine is that, by building its own unit,

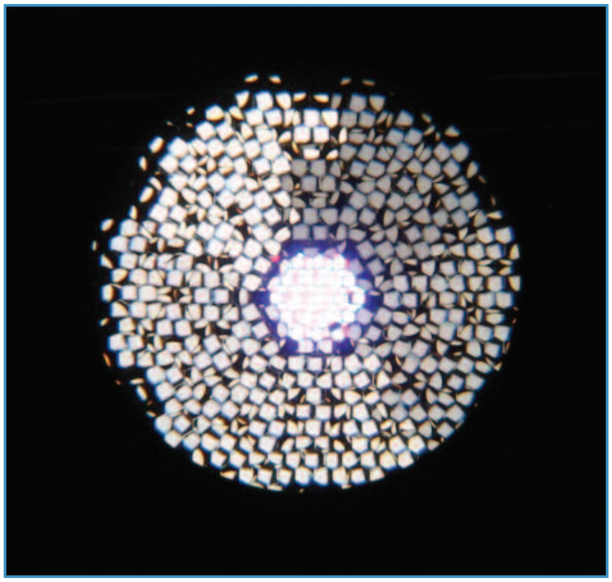

Figure 2: LED array.

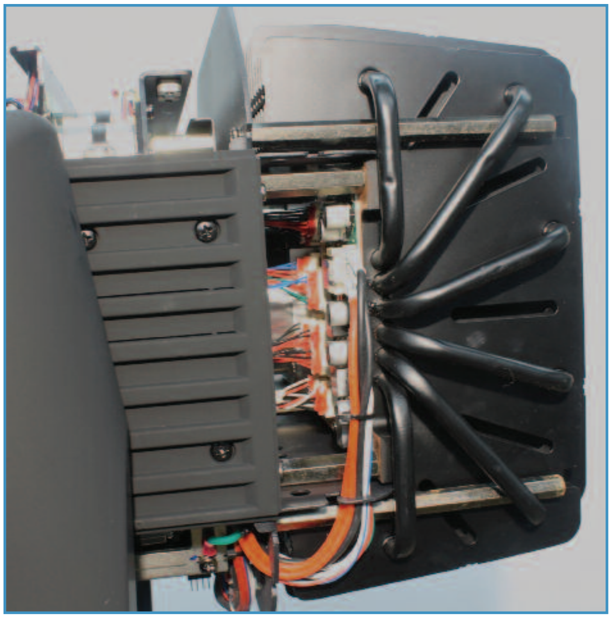

Figure 3: LED array and heat sink.

Chauvet was able to choose some of those optical parameters mentioned earlier. The unit deals with the heat generated in the usual way, with heat pipes and a large ambient air-cooled heat sink as shown in Figure 3. There are no fans, so it is the size and efficiency of the heat sink that ultimately controls the power of the unit.

Color

The Maverick Silens 2 Profile has its major optical components mounted on three plug-in removable modules. The first module in the optical train, right after the light engine, is for color mixing; the second is for color and gobo wheels; and the last is for framing. For color mixing, Chauvet uses the familiar "pair-of-curtains" style system in which each of the four sets of graded dichroic colors (cyan, magenta, yellow, and CTO) come in as two linear flags, one from each side of the beam. This two-sided approach, as opposed to a single wheel or flag, produces a much more even color across the beam. Figure 4 shows the overall layout of this module. By the way, this photograph also shows two interesting features. Firstly, the homing for the color mixing uses micro switches, which is absolutely fine, just something I've not seen for a while. Secondly, the color-mixing module, like all the modules, uses a large D-type connector to provide power and data. This is a technique that another manufacturer has used for a very long time. The industry is split on the connections for removable modules like these, as to whether to use a solution such as the D-type, in which the module plugs itself in as it is inserted, or to use flying leads with circuit board connectors. It's not a real product differentiator, but just differing engineering techniques.

I measured the output from the color-mixing system as shown in the chart below. Chauvet has gone for very saturated colors in the mixing flags. At first glance, this seems a slightly unusual choice in a unit that is aimed at theatre use. I suspect, however, that, primarily because of the relay/condenser lens that immediately follows the CMY flags and helps with the homogenization, the color mixing is smooth and produces good pastels at the bottom end with very little evidence of banding, so maybe it was a good choice by Chauvet. The center image in Figure 6 shows a mixed lavender. One pleasing note is that there is very little color breakup when a gobo is soft focused, a problem you see in many automated spots with white LED engines and color mixing.

COLOR MIXING

Color	Cyan	Magenta	Yellow	Red	Green	Blue	CTO
Transmission	25%	4.1%	67%	3.2%	6.5%	0.4%	40%

When inserted fully, the CTO flags reduced color temperature from a native 6,437K down to a CCT of 2,612K. I measured all the flags as taking a maximum of 0.8 seconds to move from one end to the other.

That's it for the first module; the rest of the color system is on the second module but first we go through that extra

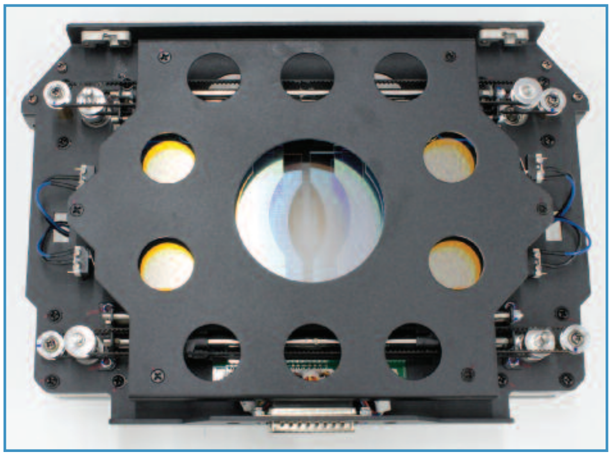

Figure 4: Color mixing.

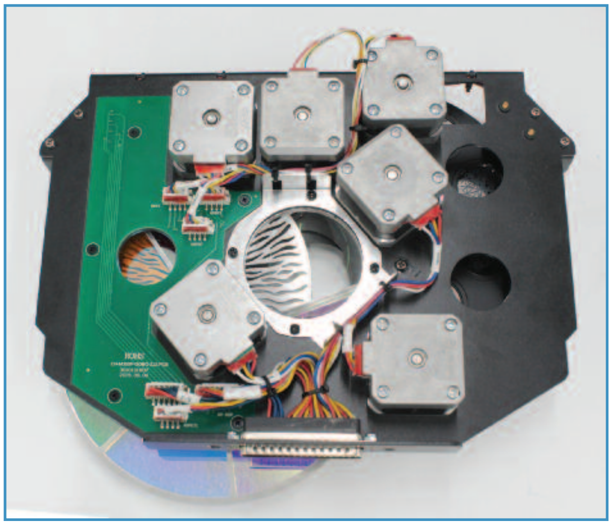

Figure 5: Color and gobo module front.

relay lens on the front of the color wheel and gobo wheel module, visible in Figure 5. Next in line is the fixed color wheel with six fixed frameless trapezoidal dichroic colors plus an open hole.

FIXED COLOR WHEEL

Color	Red	Orange	Dark Green	Cyan	Congo Blue	UV
Transmission	3.5%	53%	20%	17%	1.0%	0.9%

The transmission of, for example, the fixed red filter is very similar to that of the mixed red, showing they have similar saturations (but not necessarily the same hue). The edgeless colors on the fixed wheel provide good half colors. The right-hand image in Figure 6 shows an example of one of those positions. Color-change speed was good, with very smooth transitions and slow wheel rotations possible. (A general point about the Maverick Silens 2 Profile is that the speeds of many functions are relatively slow; this is in line with trying to remain as silent as possible and emphasizes its target theatrical market.)

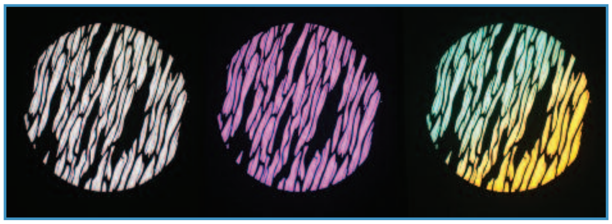

Figure 6: Focus, color, half-color.

COLOR SYSTEMS

Color change speed – adjacent	0.3 sec
Color change speed – worst case	0.6 sec
Maximum wheel spin speed	1.12 sec/rev = 53.6 rpm
Minimum wheel spin speed	146 sec/rev = 0.4 rpm
Color mix speed – worst case	0.8 sec

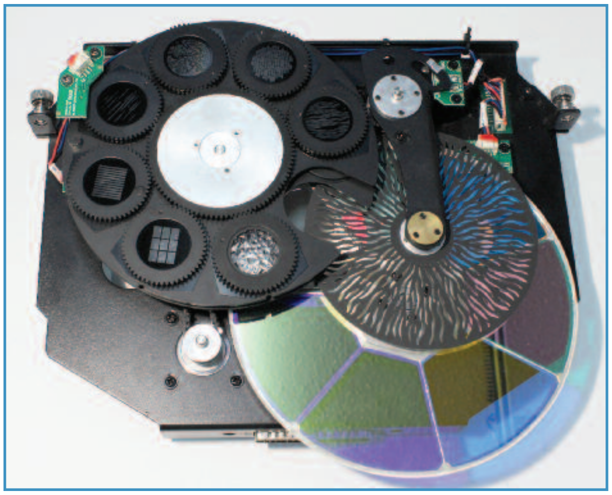

Figure 7: Color and gobo module rear.

Imaging effects

Turn the second optical module shown in Figure 5 over and we have the two gobo wheels and the animation wheel (Figure 7). The fixed and rotating gobo wheels run on concentric shafts on the left of Figure 7, with the animation wheel coming in on an arm from the right.

Moving through the system in the direction of light travel, first in line is the animation wheel. This has a breakup pattern that can be overlaid over either of the two gobo wheels. It can be moved across the beam in one second and then rotated at varying speeds. The angle of the pattern across the beam is fixed.

Next come the two gobo wheels. These are very similar, apart from the rotation function, and use the same size gobos. The fixed wheel has eight gobos plus an open hole while the rotating wheel has seven gobos. Because the module removes so easily, the gobos are very simple to change out.

ROTATING GOBO SPEEDS

Gobo change speed – adjacent	0.4 sec
Gobo change speed – worst case	0.8 sec
Maximum gobo spin speed	0.6 sec/rev = 100 rpm
Minimum gobo spin speed	Very, very slow…
Maximum wheel spin speed	2.6 sec/rev = 23 rpm
Minimum wheel spin speed	648 sec/rev = 0.1 rpm

FIXED GOBO SPEEDS

Gobo change speed – adjacent	0.4 sec
Gobo change speed – worst case	0.9 sec
Maximum wheel spin speed	1.1 sec/rev = 56 rpm
Minimum wheel spin speed	333 sec/rev = 0.2 rpm

Positioning and rotation of both wheels was quick and smooth, with a good range of rotation speeds down to an extremely slow, almost stationary, rotation for the rotating gobo. There are occasional hesitations in movement at very slow speeds, but nothing you would notice from normal viewing distances. The rotating wheel showed very little bounce when changing direction and no overshoot on indexing. I measured the accuracy as 0.05° of hysteresis error which equates to 0.2" at a throw of 20' (8mm at 10m). Both wheels use a quick-path algorithm to minimize change times.

Focus quality on all gobos was extremely good, with excellent edge-to-center difference and almost no color fringing. Figure 8 shows an example of the gobo morph effect from the fixed wheel (left) to rotating wheel (right). Figure 9 shows the gobo change mechanism and the very small size of the gobos.

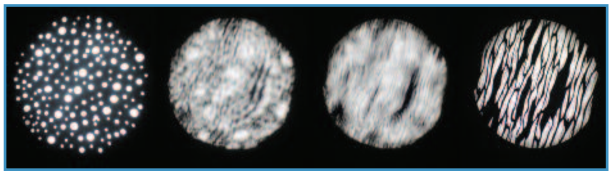

Figure 8: Gobo morph.

Figure 9: Gobo change.

Framing

Moving on to the final module with framing and an iris, Figure 10 shows the front of the module with a clear view of the four independent framing blades, each driven by two motors in a five-bar linkage arrangement. Each blade can be tilted approximately 18° in each direction at the center of

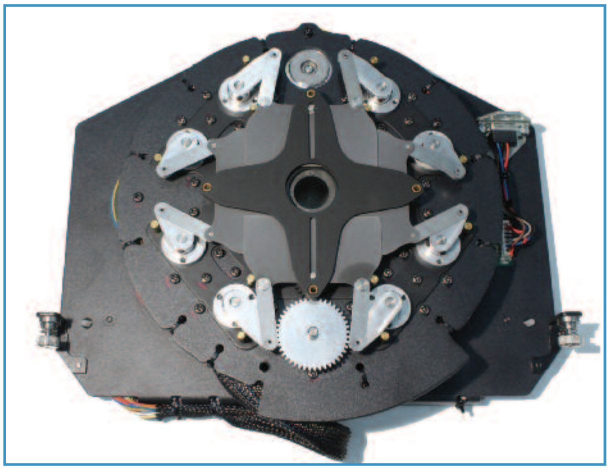

Figure 10: Shutter front.

the beam and is capable of traveling fully across the beam. Figure 11 shows the possible tilt range for a single blade. This is with both opposing blades inserted and titled to their maximum angles. The possible tilt angle varies a little at different insertions and is greater for lower insertion amounts. The entire four-blade assembly can then be

Figure 11: Maximum shutter angle.

rotated by +/- 64° (128° in total). This system, like many similar automated framing systems using this type of linkage, has its advantages and disadvantages. An advantage of the Maverick Silens 2 Profile system is that each blade can travel all the way

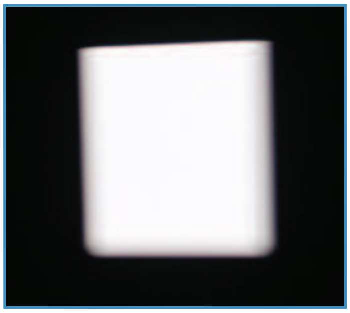

Figure 12: Shutter focus.

across the beam, while a disadvantage is the limited tilt angle of each blade that would make framing at oblique angles difficult. The blades are also quite widely separated, resulting in a noticeable focus difference between blades. Figure 12 shows a square made with four shutters with the system focused on the top blade.

Iris

On the other side of the framing is the iris, as shown in Figure 13. You can also see in this photograph the large gear and belt used to rotate the framing system and the motor driver boards for the ten motors in this module, eight for framing blades, one for framing rotation, and one for the iris. I measured the opening/closing time of the iris at a fairly slow one second. The fully closed iris reduces the aperture size to 14% of its full size, which gives equivalent field angles of 0.8° at minimum zoom and 5.7° at maximum zoom.

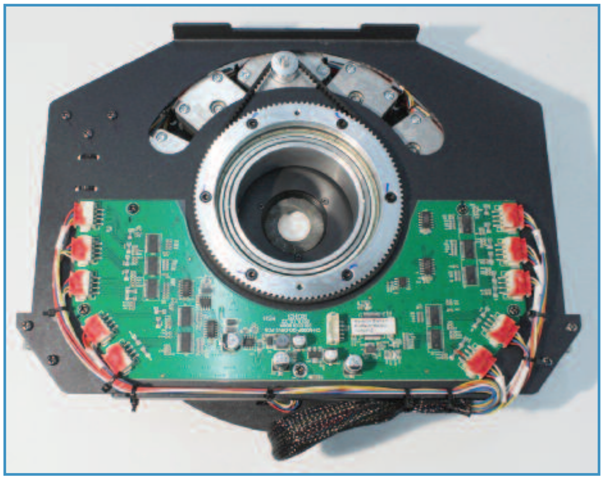

Figure 13: Shutter rear.

Prism and frost systems

The Maverick Silens 2 Profile has a single five-facet prism, mounted on the rear of, and traveling with, the focus lens (lens group one). It can be inserted across the beam in around 2.5 seconds and then rotated at speeds varying from 0.7 sec/rev (91rpm) down to 360 sec/rev (0.17rpm). I would note that the insertion time is slow because, depending on where the lenses are at that moment, the unit may have to move them out of the way to provide space for the prism. As the overriding design factor of the unit is low noise and moving lenses is noisy, this is done relatively slowly. Figure 14 shows the prism and frost flags mounted on the rear of the focus lens.

Figure 14: Frost and prism.

Finally, mounted next to the prism and also traveling back and forth with the focus lens are the frost flags. There are two flags, which are progressively inserted together across the beam to provide a variable effect. Figure 15 shows the frost levels achievable on a gobo. As you can see in the image, at lower insertion levels the frost filter acts as a contrast reducer rather than a frost but starts to diffuse the beam at the upper end of the range. Overall, it's a good result. (Those who read this column regularly will know of my dislike for frost systems that don't actually frost…)

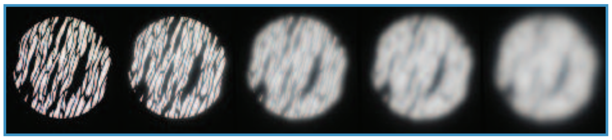

Figure 15: Frost.

Lenses and output

As with just about every spot system I've reviewed for the last ten years, the Maverick Silens 2 Proflie lens system is a typical three-group zoom, with the front group fixed as the output lens and the other two groups moving to provide zoom and focus control. Zoom took 2.4 seconds to run from maximum to minimum while focus took two seconds from end to end.

I measured the output of the Maverick Silens 2 Profile at 7,600 lumens across a field angle of 41.1° at the wide-angle end of zoom, ramping down to 5,400 lumens at a narrow angle of 5.8°. The field is extremely flat at all positions, as can be seen in the beam profiles in Figures 16 and 17. These measurements are field lumens (output within the

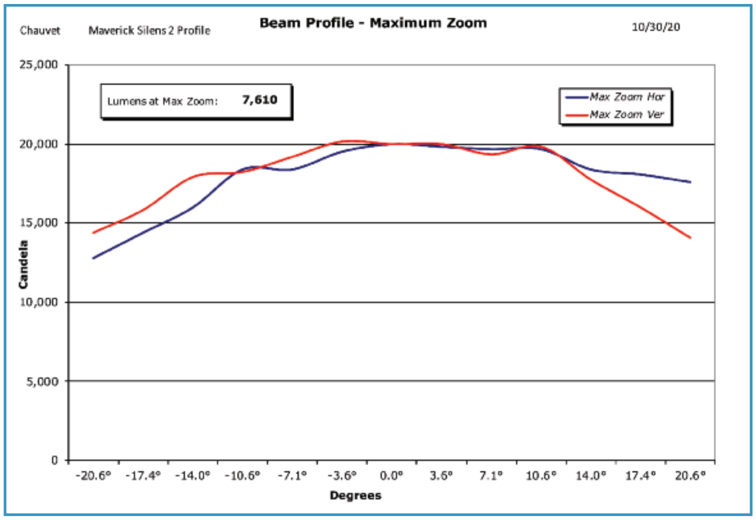

Figure 16: Output maximum zoom.

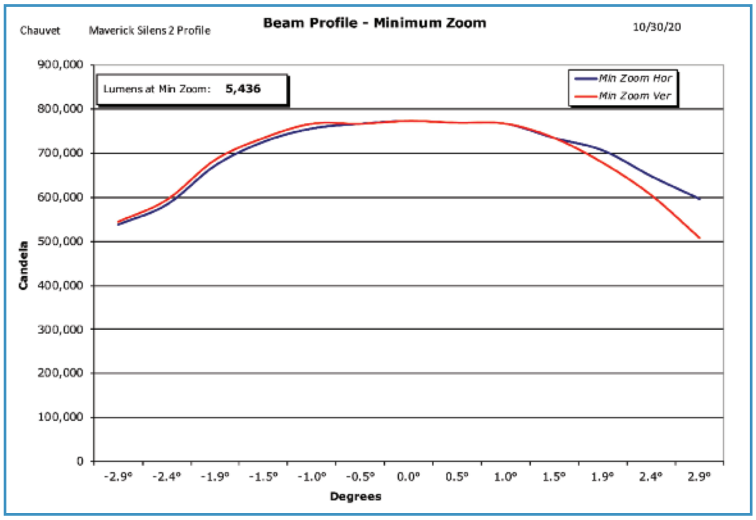

Figure 17: Output minimum zoom.

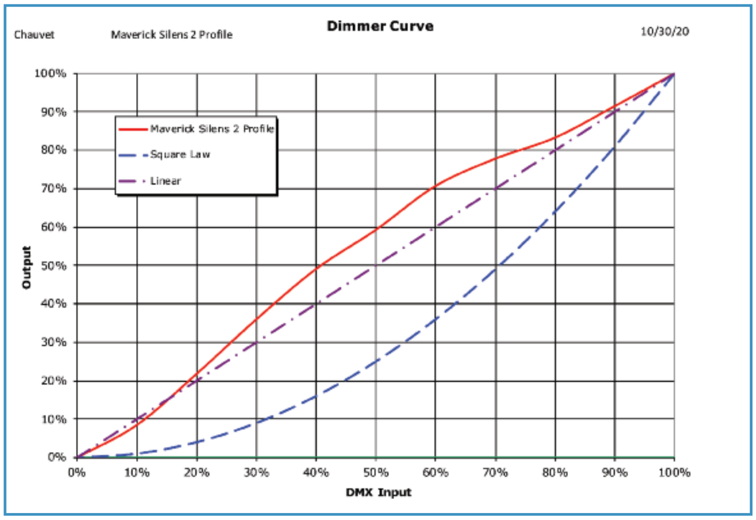

Figure 18: Dimmer curve.

10% field angle) taken after running the unit at full power for at least 30 minutes. Due to the fanless ambient cooling system, the unit shows significant output droop as it warms up. Over the first 30 minutes, after turning on at full power, the output dropped to around 68% of that at turn-on. There are operational modes that allow you to proactively reduce the output so that it remains more constant.

Dimming was extremely smooth across the whole range, with no visible artefacts at any level. Figure 17 shows the profile when set to a linear curve. The default PWM rate is a very high and admirable 40kHz, which should be excellent for use with video cameras. The LEDs can be strobed as well, of course, I measured the maximum strobe rate as 28Hz. The Maverick Silens 2 Proflie also offers red shift in dimming to match the dimming of an incandescent lamp more closely.

This is where I looked at the spectral output of the unit, taking a look at what the hue (Duv, or green-magenta) shift channel did by using the central RGB LEDs. Figures 19 and 20 show the spectral output of the native beam and with full CTO, respectively. In both cases, the spectrum is full, with no real gaps. I measured the color rendering of the native 6,437K beam with a TM-30-18 Rf of 91 and an Rg of 95.8. With full CTO inserted, the 2,612K beam had a TM-30-18 Rf of 93 and an Rg of 93.4—all very respectable. The hue channel moved the Duv of the native beam from -0.0016 to -0.0047 while the CCT changed from 6,230K to 6,458K (either side of the native 6,437K). It's not a huge change in Duv, and always on the magenta side of the black-body line. Figure 21 shows those central RGB LEDs as the hue channel is moved from full magenta to full green.

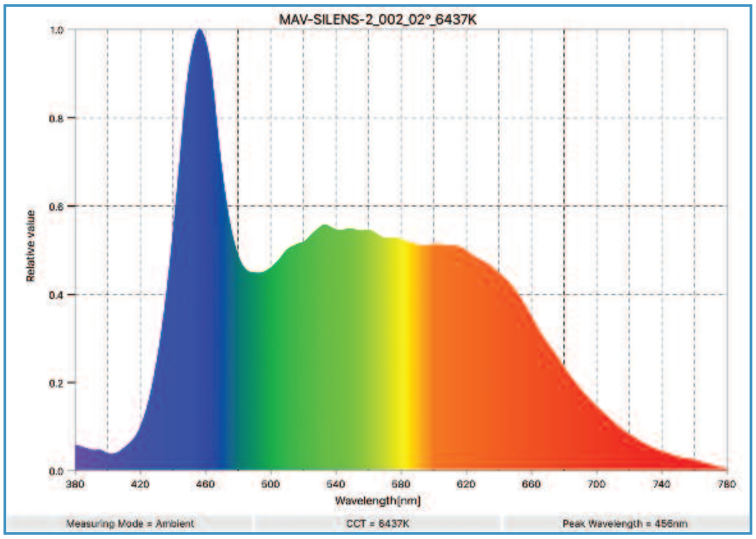

Figure 19: Spectral output - native - 6,437K

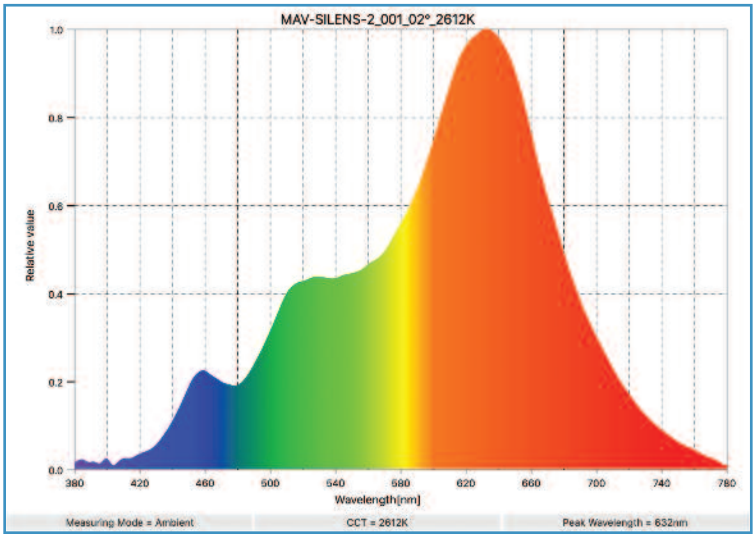

Figure 20: Spectral output - CTO - 6,437K

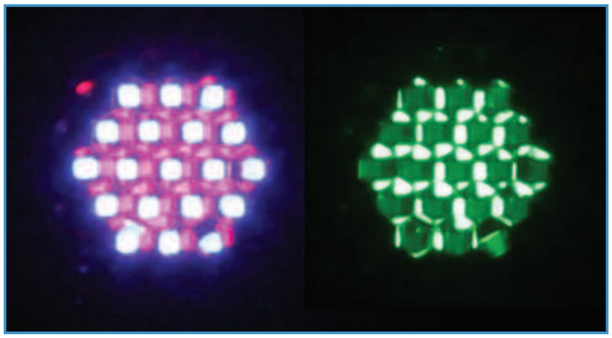
Figure 21: Center RGB LEDs.

Pan and tilt

The Maverick Silens 2 Profile has 540° of pan and 270° of tilt movement. I measured pan speed over the full travel at 4.1 seconds and 2.2 seconds for 180°. In tilt, the figures were 2.8 seconds for the full 270° and the same 2.2 seconds for 180°. Movement on both axes was smooth, with reasonable hysteresis and just a little overshoot/return at the end of a move, particularly on pan. Pan showed 0.19° of hysteresis, which is 0.8" at a throw of 20' (33mm at 10m). Tilt was tighter, with 0.05°, 0.2" at 20' (8mm at 10m).

Noise

It's in the name. Low noise is what the "Silens" is all about. The measured levels were fairly close to my noise floor, so take that into account. The Maverick Silens 2 Profile is certainly extremely quiet; it also has a further user-selectable mode that reduces movement speeds further and drops noise level from these figures. When the unit was stationary, I could hear the stepper motors chattering slightly with their park current, but at a very low level.

SOUND LEVELS

Ambient	<35 dBA at 1m
Stationary	36.2 dBA at 1m
Homing/Initialization	52.3 dBA at 1m
Pan	43.6 dBA at 1m
Tilt	42.5 dBA at 1m
Color	37.5 dBA at 1m

Zoom	38.8 dBA at 1m
Focus	43.5 dBA at 1m
Frost	36.2 dBA at 1m
Gobo	39.5 dBA at 1m
Gobo Rotate	37.2 dBA at 1m
Prism	38.2 dBA at 1m
Animation Wheel	36.8 dBA at 1m
Framing	38.4 dBA at 1m

Homing/initialization time

I measured the Maverick Silens 2 Profile as taking 36 seconds to complete a full initialization from either power up or a DMX reset command. The reset is badly behaved in that the LEDs fade up again before the unit has reached its final position.

Power, electronics, control, and construction

In my setup, the power consumption of the Maverick Silens 2 Profile was 4.5A with the LEDs at full and no motor movement. In detail, this was 540W, 541VA with a power factor of 0.99. Quiescent load with LEDs extinguished was 0.73A, 88W, 90 VA, power factor of 0.97.

Figure 22 shows the head with all modules in place, a neat, clean construction. Figure 23 shows the module bay with the three modules removed. In this shot, you can clearly see the lens at the output of the LED light engine. The modules are very easy to remove for maintenance, just two thumb screws on each. Figure 24 shows the yoke arms with the pan and tilt motors along with their drivers.

Figures 25 and 26 show the color menu display system

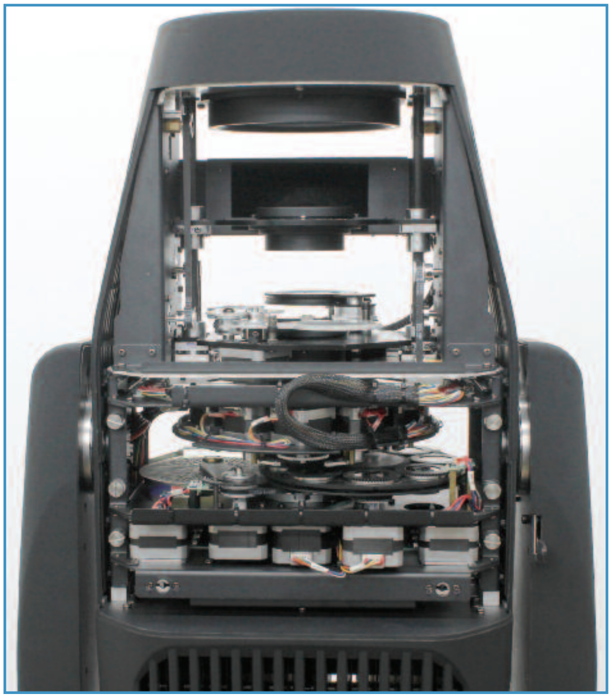

Figure 22: Head.

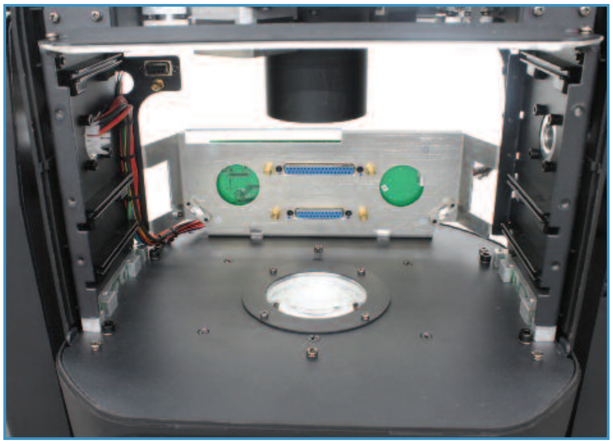

Figure 23: Module bays.

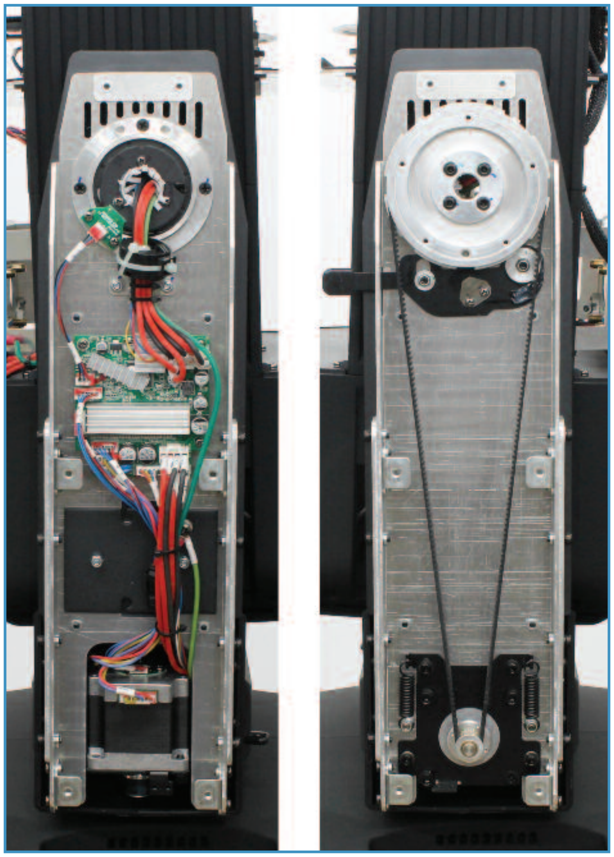

Figure 24: Yoke arms.

Figure 25: Display.

Figure 26: Connectors.

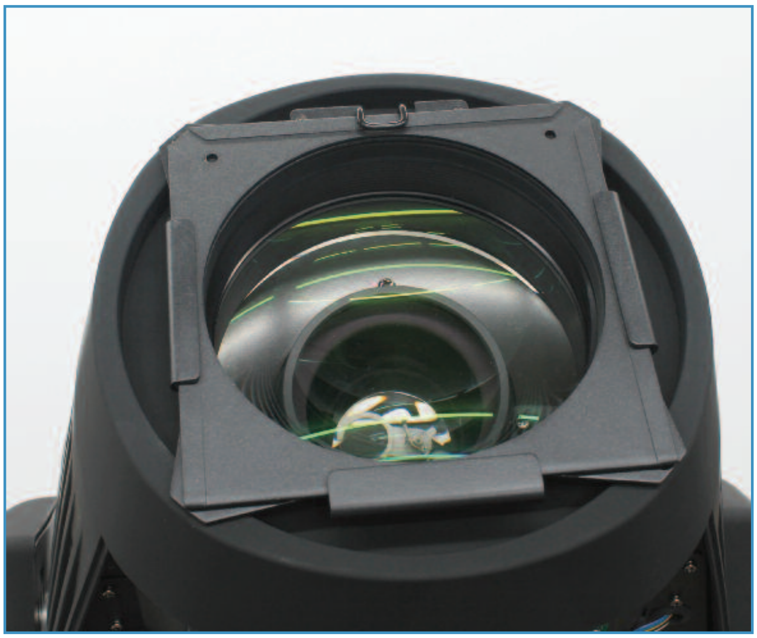

Figure 27: Filter holder.

and the connectors, including DMX512, PowerCon in and out, Ethernet in and out (Art-Net and E1.31-sACN), a folded antenna for wireless DMX, and a USB connection for firmware updates. The unit supports RDM, I tested this with my DMXcat. Oh, and one final feature: There is a color frame position for a filter holder on the front of the unit.

Conclusion

So, that's the Chauvet Professional Maverick Silens 2 Profile, from one end to the other: a fanless LED spot unit with framing aimed at the theatrical market. How did the Maverick Silens 2 Profile compare? Hopefully I've given you some data that will help but, as always, it's your decision that counts.

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