Martin By Harman MAC Encore Performance

By: Mike Wood

Figure 1: Fixture as tested.

Continuing the recent theme of testing products using technology where I got my predictions all wrong, this month we look at another white LED-based fixture using dichroic filters for color. This time it's the Martin by Harman MAC Encore Performance. This is a profile unit with framing aimed at the theatrical side of the business.

Although the styling of the unit is somewhat different, the Mac Encore Performance clearly owes a lot of its heritage to the Mac Viper Performance. The internal design is very similar, and some modules, particularly the framing, look almost identical to its ancestor.

The big difference is, of course, in the light source: white LEDs versus a short-arc HID lamp. How does the Encore stand up against its big brother, and the many competitive LED products in the market place? If you are in the market for a Martin framing fixture, should you be looking at LEDs rather than arc lamps? I've tried to help you with that decision by measuring all that I can.

The results presented here are based on the testing of a single unit supplied to me by Martin, with the fixture operating on a nominal 115V 60Hz supply (Figure 1). Note: The Mac Encore is available in both high (CLD) and low (WRM) color temperature versions. Martin sent me both in a dual road case; however, this article is based on tests of the high color temperature (CLD) unit only.

Light source

The Mac Encore Performance CLD uses 36 cool white LEDs arranged in three concentric circles with six, 12, and 18 LEDs respectively. Each of the 36 LEDs is capped with its own primary optic, shaped and angled to direct the light through the gate. Figure 2 shows the view through the front lens back into the LEDs. These 36 LEDs are merged into a single beam at the gate. Martin states that the LED array consumes 468W, which is 13W per emitter. The waste heat generated by this array is pulled back into a large finned heat sink with two sets of fans, one set on the left and the other on the right, drawing cooling air sideways across the back. Figure 3 shows a photo, but, as most of it is enclosed, it's a little hard to see. The fans on the right-hand side blow air from the outside world, while those on the left spin in the opposite direction and pull the heat-

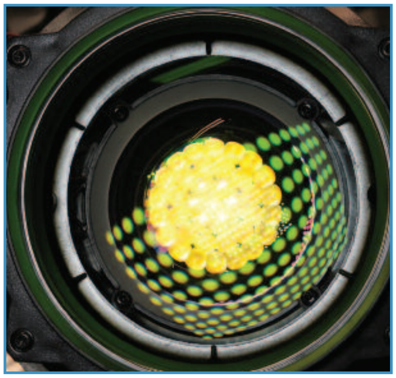

Figure 2: LED array.

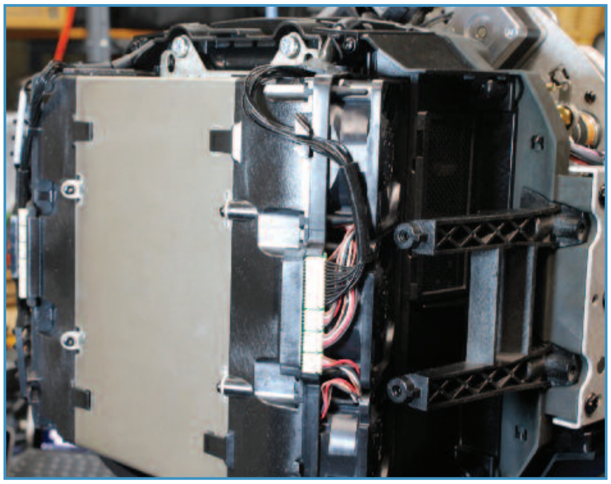

Figure 3: Cooling system.

ed air out and through exhaust vents. The heat sink itself is sealed in the center.

Color systems

Most of the optical components are mounted in a single, removable optical module. This contains color mixing, color wheel, gobo, animation wheel, framing, and iris.

The Encore has both CMY color mixing and a color wheel. The color mixing uses four sets of linear flags (cyan, magenta, yellow, and CTO), with etched finger patterns, as can be seen in Figure 4.

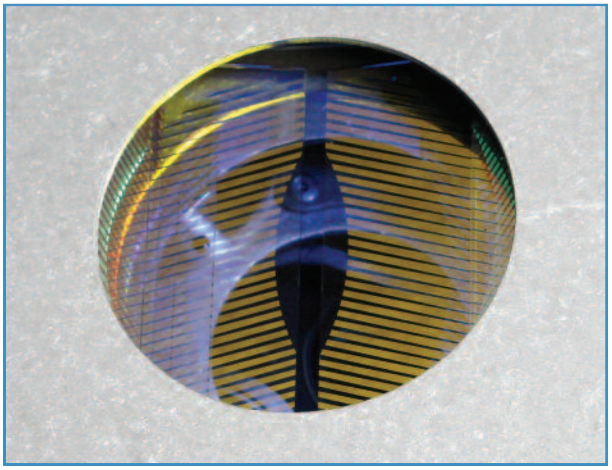
Figure 4: Color flags.

Immediately after the flags is a homogenizing filter on a flag arm, which can be moved across the beam, using a command on the control channel. I saw very little difference with the homogenizing filter in or out, other than the inevitable light loss, so I wonder what this was intended for. The Viper used a similar filter, so perhaps that's why it's there. I don't think the Encore needs it: the color mixing is smooth without it. I ran all tests with this out of the beam.

With no gobo, or a sharply focused gobo, the color mixing is very smooth and even. You do start to see some color fringing when there is an unfocused edge in the beam, for example with a defocused gobo as shown in Figure 5, or when trying to use framing on top of a gobo. This fringing shows up on vertical edges only. Martin isn't the only one to suffer from this, I've seen it on other white LED-based spot units when using dichroic color mixing. I believe it's a problem exacerbated by the large source size of multiple LEDS as compared to an optically friendly, single tiny arc, and it's extremely difficult to design an optical system to hide it.

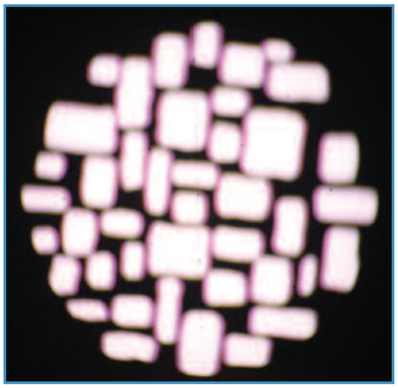
Figure 5: Color fringing.

COLOR MIXING

Color	Cyan	Magenta	Yellow	Red	Green	Blue
Transmission	19%	7.0%	87%	6.4%	8.8%	0.43%
Color change speed – worst case			0.6 sec			

Martin uses less saturated color mixing colors in the Encore than it did in the Viper, particularly the magenta. This is presumably to better suit the theatrical audience.

The CTO flags dropped the color temperature from the native 6,049K down to 2,421K when fully inserted across the beam, with a corresponding drop in output to 39% of the original (Figures 6 and 7). As to color rendering in white light, TM-30 and CRI are in a range around the mid-to-high 80s.

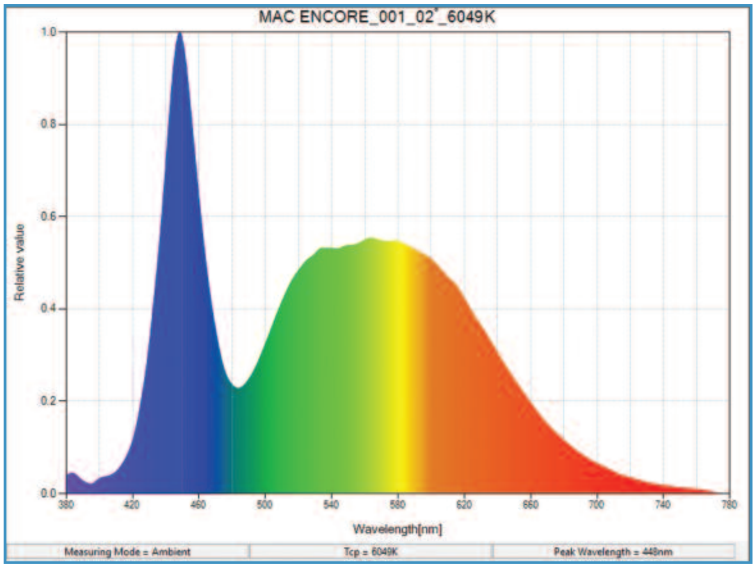

Figure 6: Spectrum in open white.

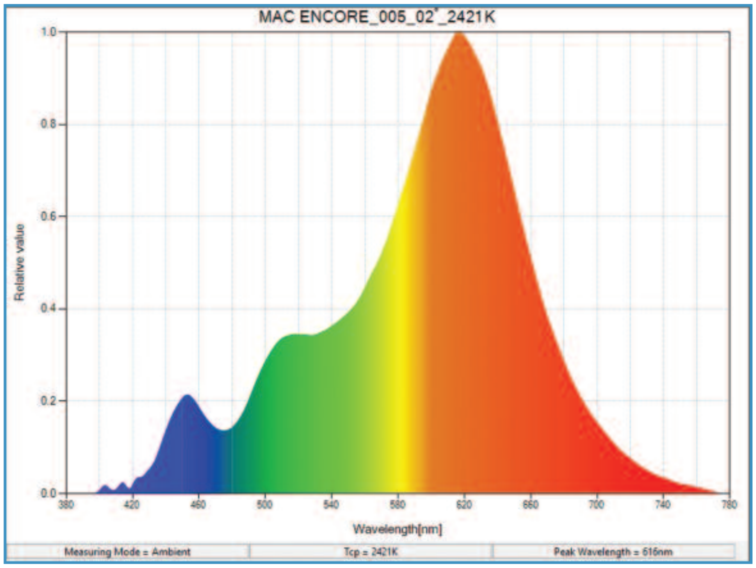

Figure 7: Spectrum with full CTO.

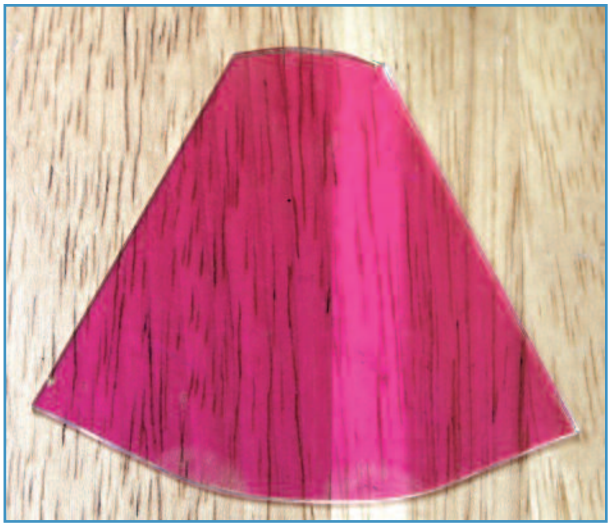

Figure 8: Color filter.

Next in line, after the homogenizing filter, is the color wheel. This has six replaceable colors plus an open hole (Figure 8).

COLOR WHEEL

Color	Blue	Green	Orange	Magenta	Congo	Red
Transmission	4.0%	26%	28%	20%	0.1%	1.5%

COLOR WHEEL SPEED

Color change speed – adjacent	0.4 sec
Color change speed – worst case	0.8 sec
Maximum wheel spin speed	1.25 sec/rev = 48 rpm
Minimum wheel spin speed	120 sec/rev = 0.50 rpm

All color moves are a little slow, compared to moving lights aimed at the concert industry; I'm sure this is to help with noise. The color wheel, with the trapezoidal shaped filters, gives good half-colors and smooth continuous rotation.

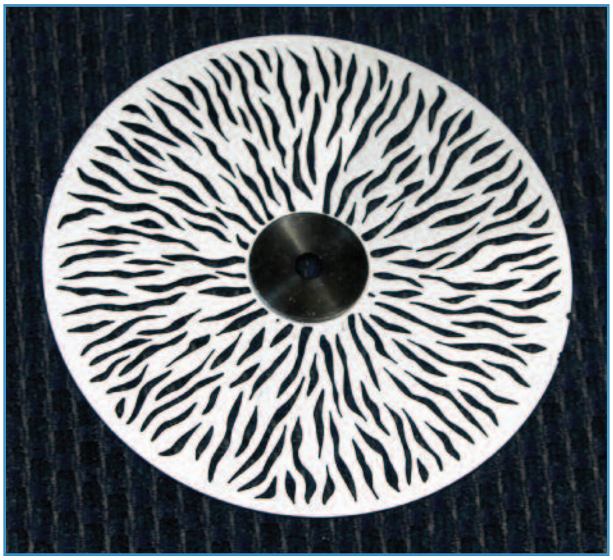

Figure 9: Animatlon wheel.

Animation wheel

The Encore uses Martin's familiar animation wheel running in and out on a 45° track to allow control of the effective rotation center of the wheel from vertical through horizontal. The wheel in the Encore is held in place with a magnetic hub, so it can be replaced with another pattern or with an optional seven-slot fixed gobo wheel. (Note: it's not that easy to get the new wheel into position and locked in, as there is very little room to work; I tried. I recommend changing this on the bench, not in the rig.) The time to insert the wheel was 2.5 seconds, and, once in place, it can be rotated at speeds varying from 0.45 sec/rev (133rpm) down to a glacially slow almost imperceptible speed. Figure 9 shows the wheel out of the unit.

Gobo wheel

The Encore has a single rotating and indexing gobo wheel, containing five gobos plus open hole. Figure 10 shows a gobo removed from the wheel, showing the homing alignment magnet.

Figure 10: Gobo.

ROTATING GOBO SPEEDS

Gobo change speed – adjacent	0.6 sec
Gobo change speed – worst case	1 sec
Maximum gobo spin speed	0.91 sec/rev = 66 rpm
Minimum gobo spin speed	720 sec/rev = 0.08 rpm

Rotation and indexing were smooth, with a good range of rotation speeds. As with the color and animation wheels, change times are slower than with Viper or other concert aimed lights. Positional accuracy is excellent, with a measured hysteresis accuracy of 0.08°, which equates to 0.4" at a throw of 20' (15mm at 10m).

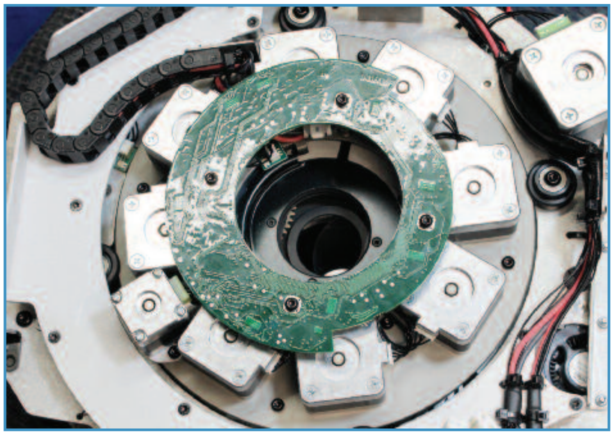

Figure 11: Framing system.

Framing

Immediately after the gobo, and as close to it as possible, is the four-blade framing system. At first glance, this looked to be pretty much identical in construction to the one in the Mac Viper Performance, with the same motors and circular circuit board. Figure 11 shows the layout: Eight motors around the circumference control the edges of each of the four blades, the larger motor outside that ring controls rotation of the entire system, and the small motor tucked in between runs the iris.

Figure 12: LimitatIon of framing.

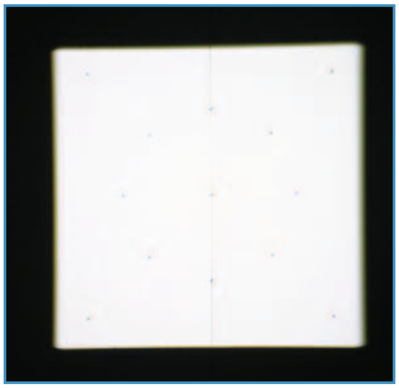

Figure 13: Framing focus.

However, I was wrong: The framing is not identical to the Viper. The blade movement is a little more limited. Each blade can tilt +/- 17° before its back edge starts to become visible. Figure 12 shows the maximum tilt angle of the two side frames, with the curved edge just becoming visible at the bottom of the beam. This effect can be mitigated by either bringing in the adjacent shutters as well, or by rotating the entire framing module, which is capable of +/- 55° adjustment. Each blade can cover about 42% of the beam, taking around one second for full travel.

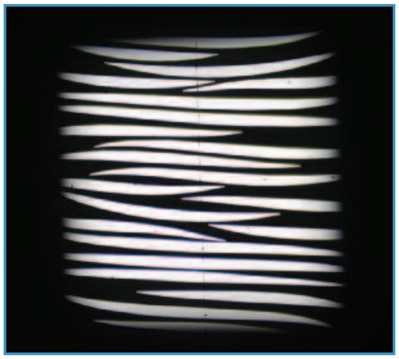

Figure 14: Framed gobo.

The focus across all four shutter blades is excellent. Figure 13 shows the system adjusted so that the bottom blade is in the sharpest focus, with the others progressively getting very slightly softer. Figure 14 shows that same shutter cut on top of a sharply focused gobo.

There is some small barrel distortion bowing visible of the blades caused by spherical aberration at full zoom, but very little.

Iris

Last but not least in this module is the iris. The fully closed iris reduces the aperture to 11% of its full size, which gives equivalent field angles of 1.2° at minimum zoom and 4.3° at maximum zoom. I measured the opening/closing time at around 0.8 seconds.

Frost

As is common in most automated spot luminaires at the moment, the zoom optical system comprises three lens groups: two moving groups and the final, output group, fixed. The frost system is mounted on the rear of the first moving group, and travels back and forward with it. Note: This is nearly always the best place for a frost; most three-lens projection systems of this type have a pupil plane somewhere between groups 1 and 2. All the light passing through any point on that plane is distributed across the entire output field, thus, in theory, giving perfect homogenization for anything placed there.

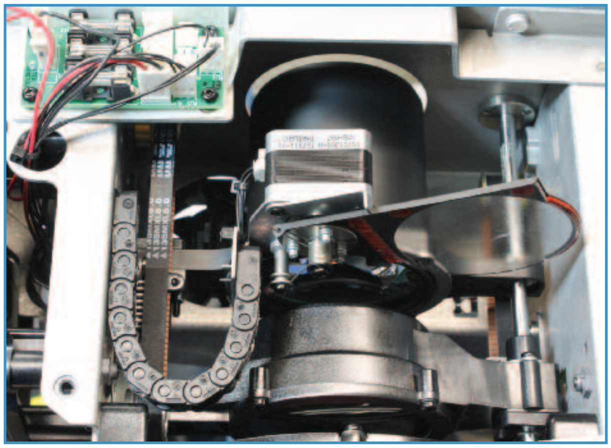

Figure 15: Lenses and frost.

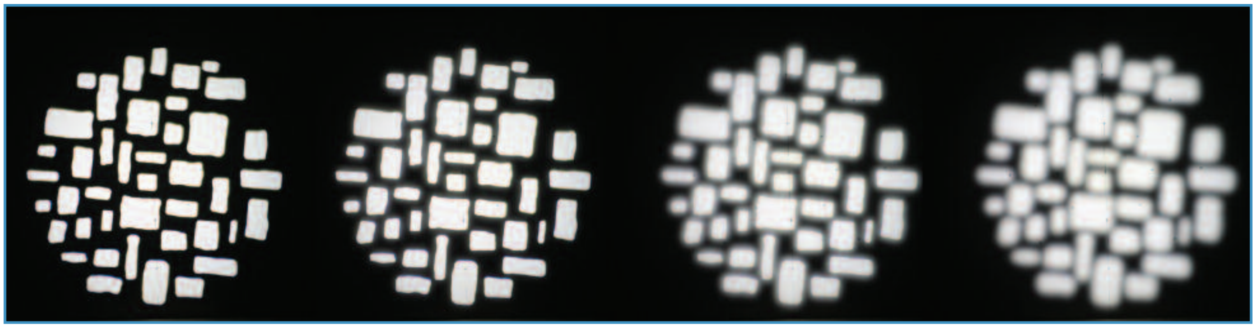

Figure 16: Frost.

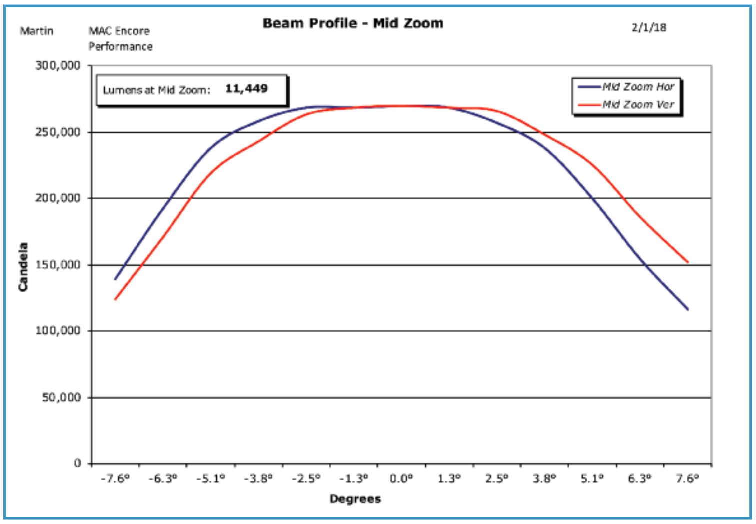

Figure 17: Mid zoom.

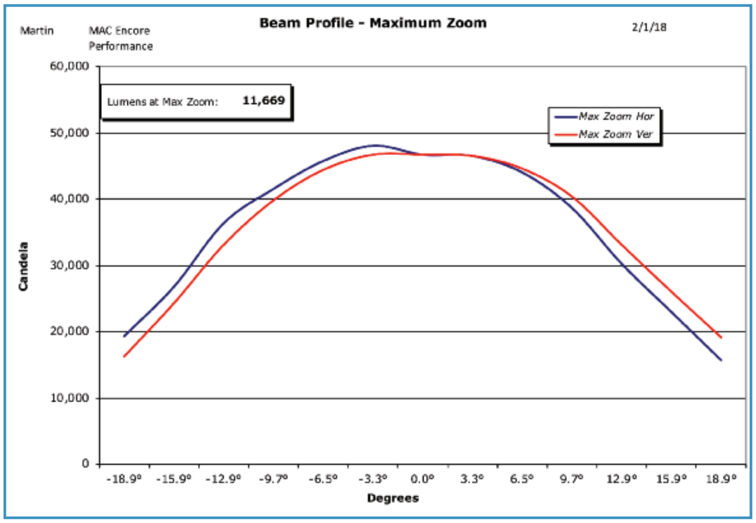

Figure 18: Maximum zoom.

Frost is provided by a single flag (visible between the lenses in Figure 15) and can be positioned in about 0.3 seconds. Figure 16 shows the effect of the frost on a gobo as it moves across the beam. Note that it doesn't provide a true frost effect until fully across the beam. When partly inserted, it reduces the contrast ratio of the image but leaves the gobo edges sharp. Martin offers a heavier frost flag as a user-replaceable alternative to the standard light frost.

Lenses and output

The Mac Encore has an interesting zoom curve. As the zoom gets towards the narrow end, the focus lens runs into the backstop and halts, leaving just the zoom lens to move to finish out the zoom. This means that, for the final few percent of the narrow end of zoom, there is no focus control available. I therefore chose to measure the output at the 15° point, where full focus control was still available, away from the narrowest zoom of 10°, as well as at the wide zoom position.

With this in mind, I measured the zoom range having field angles ranging from 10° to 38°. The output at wide angle was 11,700 lumens, while at 15°, mid-angle, it produced 11,450 lumens. The beam profile looks very good, smooth, with what looks to be a good blending distribution. (Figures 17 and 18). Sharp focus quality is good, with just a little visible chromatic aberration and spherical aberration. Zoom takes 0.8 seconds end to end, while focus is slightly quicker at 0.6 seconds.

Dimming was extremely smooth and followed the chosen square law very well. I didn't see any steps or artifacts in slow fades to black (Figure 19). I measured the PWM rate at 3Hz. Strobing of the LEDs is adjustable from 1Hz up to 19Hz.

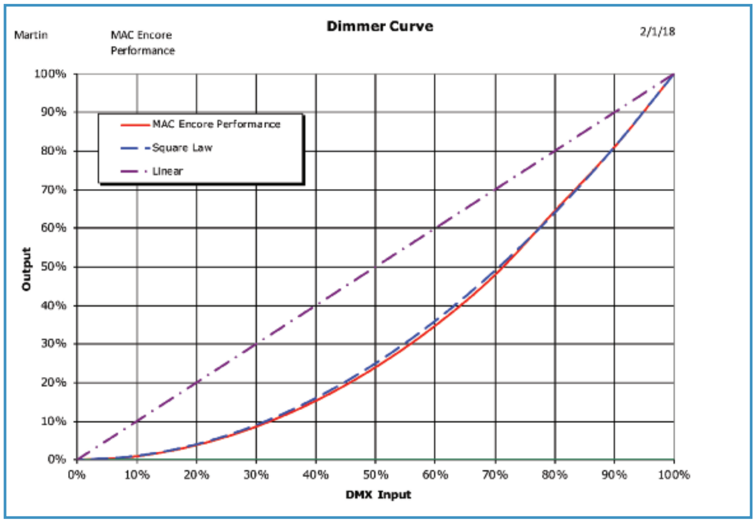

Figure 19: Dimmer curve.

Figure 20: Magnetic encoder.

Pan and tilt

I measured the pan and tilt range of the Mac Encore Performance at 540° and 254° respectively. A full range 540° pan move took 6.2 seconds to complete, while a more typical 180° move finished in 3.2 seconds. Tilt took 3.8 seconds for a full 270° move and 3.2 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 an excellent 0.03°, equivalent to 0.1" at 20' (5mm at 10m). As with the Viper, both axes use the Martin absolute position monitoring system, as shown in Figure 20.

Noise

An interesting mix of results here. As usual, zoom was the noisiest function. In fact, at full speed it was extremely noisy indeed; however, reducing the zoom speed a little makes a significant difference and drops the noise to the level of the other functions. The only other noticeable anomaly was a "tick" as the sliding pan stop was contacted in the center of each pan move.

SOUND LEVELS

	Normal Mode
Ambient	<35 dBA at 1m
Stationary	40.8 dBA at 1m
Homing/Initialization	59.7 dBA at 1m
Pan	47.9 dBA at 1m
Tilt	42.3 dBA at 1m
Color	42.1 dBA at 1m
Gobo	42.9 dBA at 1m
Gobo rotate	41.0 dBA at 1m
Zoom	56.8 dBA at 1m
Focus	42.3 dBA at 1m
Animation wheel	41.3 dBA at 1m
Iris	41.0 dBA at 1m
Frost	40.8 dBA at 1m
Framing Shutters	44.0 dBA at 1m

Homing/initialization time

Full initialization took 60 seconds from either a cold start or a DMX512 reset command. Homing is very well-behaved in that the fixture fades out smoothly, resets, and keeps the LEDs off before fading up again after all reset movement is finished.

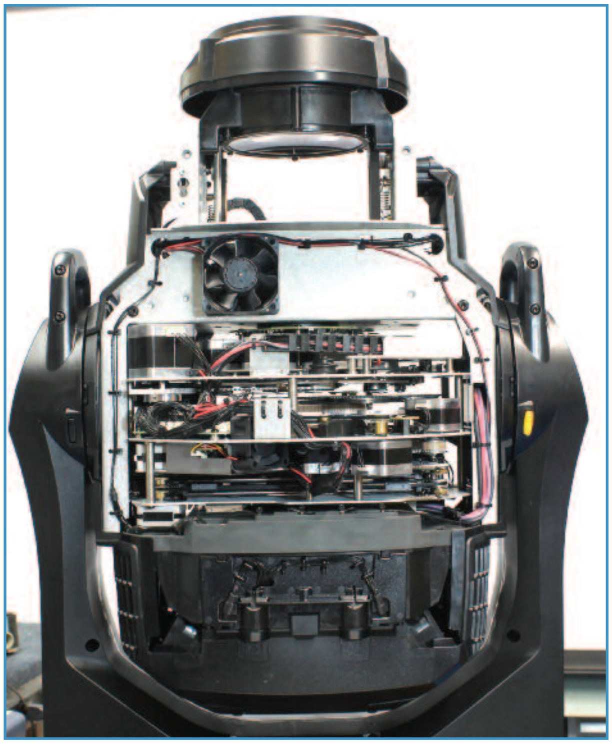

Figure 21: Optical train.

Power, electronics, control, and construction

Figure 21 shows the overall construction of the main optical module. As already mentioned, the entire module can be easily removed for cleaning and maintenance. All fasteners are Torx. Figure 22 shows a yoke arm with the covers off. Both yoke arms share the same double-sided covers, so it's quite a few screws to get them off.

The Encore has the new Martin menuing system for configuration and service, which goes back

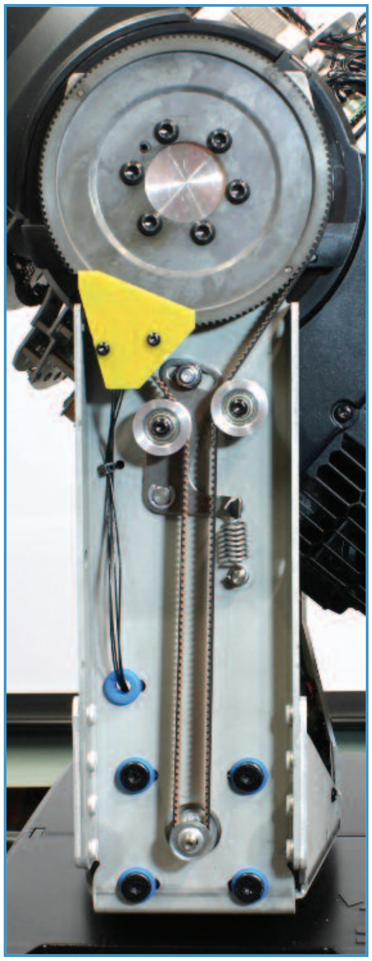

Figure 22: Yoke arm.

Figure 23: Menu.

Figure 24: Connectors.

to a more conventional four-button control rather than the scroll wheel. For connectors, there is a single True1 for power in and a pair of five-pin DMX512s (Figures 23 and 24). The Encore offers full RDM operation for remote setting and troubleshooting, and it all worked well when tested with the City Theatrical DMXcat.

In my setup, the power consumption of the Encore was 4.8A with the LEDs at full and no motor movement. That's 569W, 569VA, with a power factor of 1. Quiescent load with LEDs out was 0.5A, 61W, 61VA, power factor of 0.99.

So, there you have it, the Martin Mac Encore Performance CLD from mains input to light output. I hope I provided you with some useful data that could help you determine if it's a unit you should be testing. There are a number of new fixtures in this area, so it's becoming a busy sector of the marketplace. As I always say, it's you who gets to decide between them.

Connector Issues

Note: This comment has nothing to do with Martin specifically, as many manufacturers have gone to the True1 connector. However, Neutrik recently released a safety bulletin about it, warning that it can be mis-plugged such that the live pin connects with the fixture ground. I tried it, and it's relatively easy to do. As such, I cannot recommend the use of this connector any more. This is a great shame, as the True1 is rated for live dis-connect and I've been encouraging its use in the past. However, I now believe it is safer to use the old blue powerCON and not the True1 on new designs. I believe the True1 has a fundamental design flaw in that the detents are symmetrically arranged, allowing, with some pressure or wear, the connector to be inserted in more than one position. The blue powerCON has asymmetric detents and is much more resistant to misaligning. Let me say again that this is no comment on Martin or the Encore. It's just that this is the first fixture I've reviewed since I found out about this problem.

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