The Robe Robin BMFL Spot

By: Mike Wood

Figure 1: Fixture as tested.

In the last few years, I've gotten so used to small packages with LED luminaires that it comes as a nice surprise when a real road case arrives in the workshop. This month, a carrier brought me such a case, containing a Robe Robin BMFL Spot. This is Robe's most recent offering in the no-holds-barred, all-singing, all-dancing automated spot luminaire category. That being said, even these large, high-output units have gotten smaller, and, with only a little struggle, I was able to get it out of the road case and on my bench single-handed. At 36kg (80lb), this is a manageable unit for a 1,700W light.

Robe maintains that BMFL stands for "bright multi-functional luminaire." That may well be true, but I suspect the acronym came before the explanation. For whatever reason it is called the BMFL, the proof of the pudding comes down to its performance. There's no shortage of competitive luminaires on the market, so how did the Robe BMFL perform in the tests?

As always, I've tried to test and measure everything I can, from power input to light output, reporting the raw data so you have information to help you make your own determination.

The results presented here are based on the testing, with the fixture operating on a nominal 230V 60Hz supply, of a single Robin BMFL Spot unit supplied to me by Robe in the US (Figure 1).

Lamp and lamp access

The BMFL uses the Osram Lok-it! HTI 1700/PS lamp. As I understand it, this is the same as the 1500 lamp that has now been uprated to run at 1,700W with full 750-hour life. It uses a bayonet-lock version of the PGJ28 base, which is replaced from the rear of the unit through the back of the lamp holder, then twisted slightly to lock in place. Figure 2 shows the lamp change. Note that the lamp as fitted is branded Robe, but I understand this is a standard Osram lamp rated at 140,000 lumens nominal output at 6,000K from a 5.8mm arc. The BMFL is capable of running this lamp at various powers, including 1,500W; however, I ran it at the full 1,700W for all my tests. We've seen this same lamp upgrade from a number of manufacturers; the power rating of HID lamps is always nominal, and is as much based on the ability to cool the lamp as anything else. It's perfectly reasonable to increase the power as long as the conditions, particularly envelope and pinch temperatures, remain correct.

Figure 2: Lamp change.

To ensure this cooling, the lamp is enclosed in a separately ventilated sealed lamphouse structure, capped with a usual hot mirror. This lamphouse uses temperature sensors and dedicated fans to keep the lamp operating at its optimal point.

There are a lot of optical modules in the BMFL, so I'll work through them logically from the rear of the fixture to the output lens.

Dimmer and strobe shutters

Figure 3 shows a view of the dimmer shutters immediately in front of the lamphouse exit aperture. Visible within that aperture are the hot mirror that closes off the lamphouse, and the ducting behind it that channels cooling air to the top pinch of the lamp. The dimmer flags have a finger pattern cut into them, and each has a small piece of glass diffusion material fixed over the inner end of those fingers. These help to smooth out the dimming at the bottom end and prevent any objectionable vignetting or irising of the beam. There's also more homogenization further down the optical train that assists with this. I believe that the mechanical dimmer and electronic dimming of the lamp power supply work together to provide the final output.

Overall, the result is very good; the dimming is smooth and even, with very little evidence of beam artifacts, and

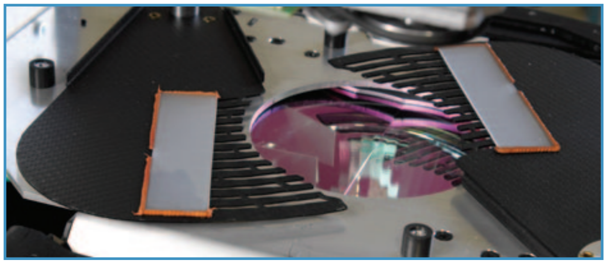

Figure 3: Dimmer flags.

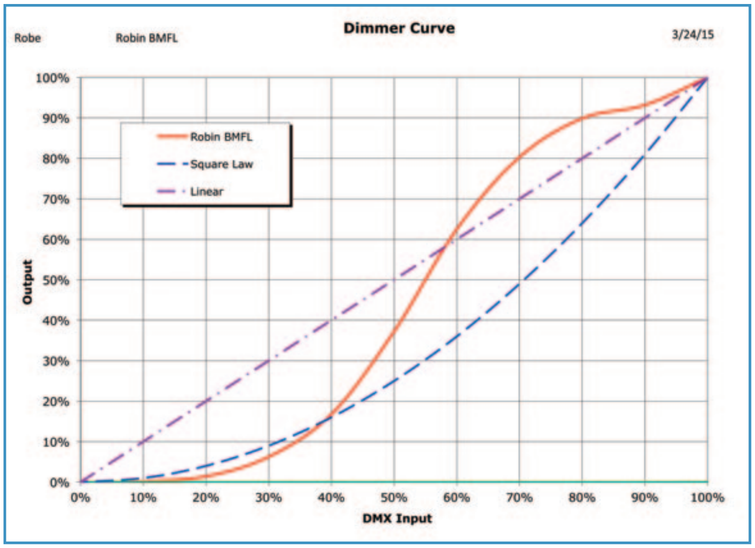

Figure 4: Dimmer law.

there is only some slight vignetting visible at the very bottom end. Figure 4 shows the default dimming curve when run via DMX512; this curve plots light output versus dimmer channel level. The curve is a slightly odd shape—more like a theatrical S-curve than anything else—but there were no discontinuities or steps, so it's very usable. The BMFL fades abruptly to black when the dimmer is taken below 1%.

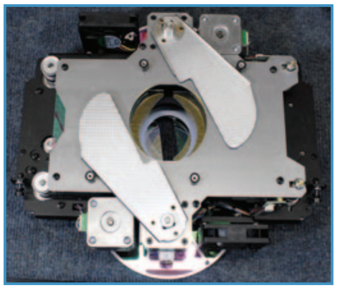

Figure 5: Shutters and color.

Strobe is accomplished through a second pair of blades that are mounted on the input side of the removable color module shown in Figure 5. There's nothing complex here, just a simple pair of flags, each with its own stepper motor, providing a mechanical shutter that I measured, providing up to 11.7Hz strobes. This range is extended up to 20Hz through an electronic strobe from the lamp power supply.

Color systems

The BMFL has both CMY color mixing and color wheels. First in the optical train are the color-mixing flags, visible through the aperture in Figure 5. These are arranged as four sets (cyan, magenta, yellow, and CTO) each comprising two finger-etched dichroic filters, running on their own linear racks and opening and closing across the beam like a pair of curtains. This seems to be the method many automated luminaire manufacturers have moved to from the earlier rotating wheels. Although it's more complex, a pair of opposed flags takes up less physical space and is more controllable than a single wheel with the same usable surface area. Color mixing from this system is very smooth, with only a small amount of color fringing around the beam edges when trying to mix the very tricky aqua and lavender that are my usual torture tests for color-mixing systems. In my opinion, having worked with dichroic color-mixing systems for a very long time, those two colors, along with amber, are what discrete color wheels were invented for.

COLOR MIXING

Color	Cyan	Magenta	Yellow	Red	Green	Blue
Transmission	30%	13%	48%	7.2%	4.8%	3.8%
Color change speed – worst case				0.2 sec		

The CTO wheel smoothly adjusted the color temperature from 2,750K up to the native 6,643K when fully out of the beam. There is not very much deep red in the lamp spectrum (a problem common to most short-arc HID lamps), which explains the relatively low output in red. That having been said, the appearance of the reds is good.

Immediately after the color-mix system are the two fixed color wheels (Figure 6). The two wheels are very similar, in that they both contain six trapezoidal dichroic filters and an open position, but one wheel (the upper in Figure 6) has the colors fixed while the other (lower) has replaceable colors held in place through a central clip. The thin spokes between the colors are narrow and didn't interfere with half colors as shown in Figure 7.

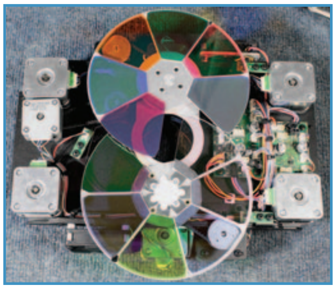

Figure 6: Color wheels.

Figure 7: Half color.

COLOR WHEEL 1

Color	Red	Blue	Orange	Green	Magenta	UV/Congo
Transmission	3.6%	12%	16%	21%	20%	1.5%

COLOR WHEEL 2

Color	Pink	Lavender	Light Green	CTB	Minus Green	Minus 0.5 Green
Transmission	35%	29%	48%	67%	58%	68%

COLOR WHEEL SPEED

Color change speed – adjacent	0.1 sec
Color change speed – worst case	0.2 sec
Maximum wheel spin speed	0.47 sec/rev = 127 rpm
Minimum wheel spin speed	123 sec/rev = 0.49 rpm

Color wheel movement was impressively quick for relatively large filters, making for snappy changes.

Next, we come to the imaging section of the BMFL, containing the animation, gobo wheels, and iris. I wasn't able to remove this module as easily as I did the color module, without dismantling more of the unit, so my photographs are taken with the module in situ. Figure 8 shows an overview of the entire module.

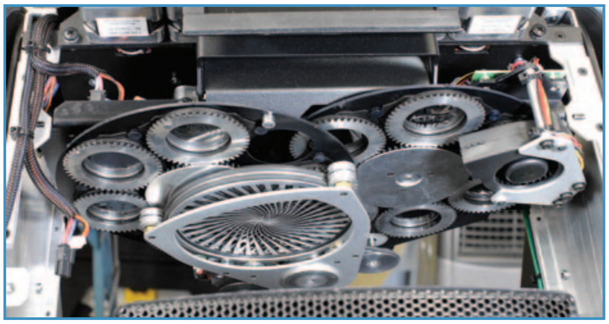

Figure 8: Imaging module.

Animation wheels

The BMFL uses two concentric parallel animation wheels that move in and out of the beam as a single unit. The wheel pair can be positioned anywhere across the beam, and each of the two wheels can be independently rotated. The two wheels can be rotated in the same or opposing directions. Pulling focus through these and onto the adjacent gobos provides some very interesting effects. Figure 9

Figure 9: Animation wheels.

shows a close-up shot of the pair of wheels in position across the beam. Figure 10 shows the appearance when close to the focal point (which isn't how you would normally use them).

It took approximately 0.5 seconds to insert or remove the wheels. Once in place, they can each be rotated at speeds from a maximum of 10 sec/rev (6rpm) down to an extremely slow speed of 1,440 sec/rev (0.04rpm or 2.4 revolutions per hour). The effects possible with this system are many and varied, particularly when coupled with the prisms and gobos. As well as allowing the programmer full access to each of the wheels to program their own effects, Robe provides a set of pre-programmed macros for the animation wheels that showcase some of the possible results.

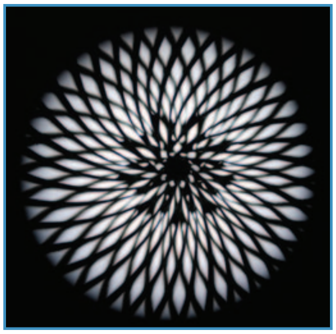

Figure 10: Animation wheel effect.

Gobo wheels

The BMFL has two rotating gobo wheels, each of which has six replaceable glass gobos and an open slot. Figure 11 shows a gobo being removed in its carrier. Interestingly, the gobos on one wheel have black colored backs, while those on the other wheel are white. I presume this is to serve the dual purposes of heat protection (white) and prevention of hall-of-mirror image effects (black).

Figure 11: Gobo change.

ROTATING GOBO SPEEDS

Gobo change speed – adjacent	0.3 sec
Gobo change speed – worst case	0.5 sec
Maximum gobo spin speed	0.3 sec/rev = 196 rpm
Minimum gobo spin speed	414 sec/rev = 0.15 rpm
Maximum wheel spin speed	0.7 sec/rev = 81 rpm
Minimum wheel spin speed	152 sec/rev = 0.4 rpm

Rotation and indexing were smooth on both wheels, with a good range of rotation speeds. Movement was clean when changing direction, with very little hysteresis. I measured the accuracy at an excellent 0.06° of hysteresis error which equates to 0.3" at a throw of 20' (10mm at 10m). All wheels use a quick-path algorithm to minimize change times.

Figure 12 shows the typical focus quality achievable from the two wheels, with very acceptable edge-to-

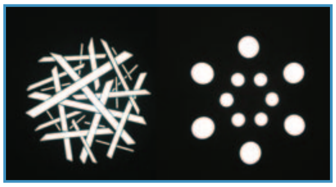

Figure 12: Gobo focus.

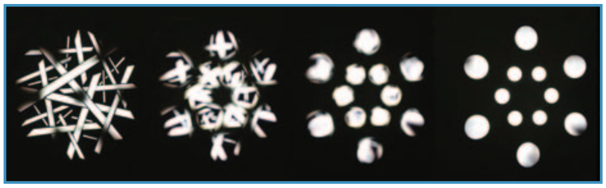

Figure 13: Gobo morph.

center difference (just visible on the left image), almost no color fringing, and a little keystone distortion (just visible on the right image). Figure 13 shows the effect of pulling focus to morph from one gobo wheel to the other, using the same two images.

Iris

The last imaging component is the iris. The fully closed iris reduces the aperture to 14% of its full size, which gives equivalent field angles of 0.8° at minimum zoom and 7.5° at maximum zoom. I measured the opening/closing time at around 0.2 seconds.

Frost and prism

The final optical elements in the BMFL are the projection lenses and frost and prism systems. There are the usual three lens groups, the first two of which move and provide zoom and focus, while the last is fixed as the large output lens. The BMFL has two prisms and two separate frost filters, all of which can be inserted between lens groups one and two. Figure 14 shows one of the frost flags and one of the prisms as examples.

Figure 14: Frost and prisms.

Looking at the prisms first, the BMFL offers a six-facet linear prism and a six-facet pyramid prism. Although they are on separate mechanisms, these occupy the same slot, so only one at a time can be inserted. Once in place, the prisms can be rotated and indexed. Figure 15 shows the effects and image separation of the two prisms when applied to a single small aperture. Prism insertion or removal took approximately 0.3 seconds;

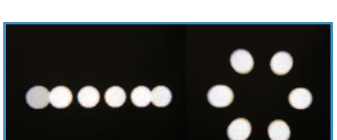

Figure 15: Prism effects.

once in place, they can be rotated at speeds varying from 0.35 sec/rev (171rpm) down to 330 sec/rev (0.18rpm).

As mentioned, there are two separate frost flags: light, and medium frost. Either one or both of the filters can be inserted at the same time to give a combined heavy frost effect. I don't think I've seen a system like this before. Each flag offers variable frost up to its individual maximum frost. Insertion or removal of either of the frost filters took 0.3 seconds. There's not much more to say, other than that the options provided for frost in the BMFL are many and varied.

Lenses and output

Finally, we come to the part you've been waiting for, the output. How much light did the BMFL produce? We've already mentioned the three lens groups that provide zoom and focus. I measured zoom as taking 0.8 seconds to move end to end, while focus took 0.6 seconds, both quite quick.

At the end of all those optics, I measured the BMFL as providing a zoom range with field angles ranging from 5.5° – 53°, or roughly 10:1. The output when run at 1,700W in

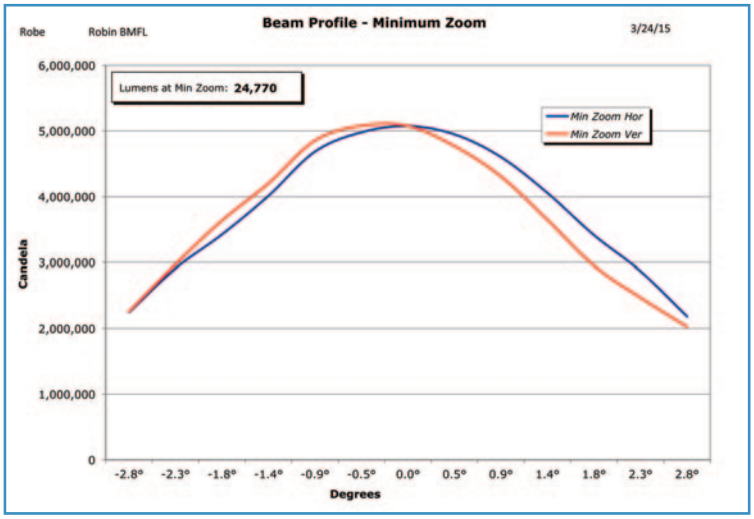

Figure 16: Beam profile - minimum.

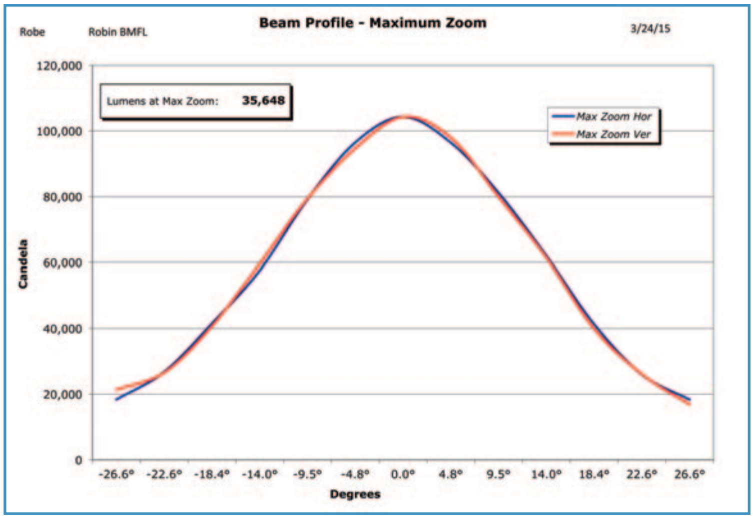

Figure 17: Beam profile - maximum.

wide angle was 35,600 lumens, while in narrow angle it gave 24,800 lumens (Figures 16 and 17). (Robe tells me there is a position near to wide, but not at full wide, where it achieves the rated 40,000 lumens, but I didn't have the time to seek that out to confirm it.) Dropping the power to 1,500W reduced these figures to approximately 84% of those values.

Pan and tilt

I measured the pan-and-tilt range of the BMFL at 540° and 270°, respectively. A full-range 540° pan move took 3.5 seconds to complete, while a more typical 180° move finished in 1.9 seconds. Tilt took 2.3 seconds for a full 270° move and the same 1.9 seconds for 180°. All movements were very smooth, with very little bounce and no visible steppiness. I measured hysteresis on pan at 0.05°, equivalent to 0.2" at 20' (9mm at 10m), while tilt hysteresis was 0.03°, equivalent to 0.1" at 20' (5mm at 10m). These are excellent figures for a large fixture. Robe is using accelerometers, providing motion stabilization of the pan-and-tilt axes, which likely explains these results. Both axes also have optical encoders to reset position if the unit is knocked.

Noise

As expected with a relatively compact 1,700W unit, the lamp-cooling fan provides the background noise level with most motor functions quieter than the fan noise. As is often the case, zoom and focus were the noisiest movement function. (You might expect pan and tilt to be the noisiest functions, but zoom and focus very often outstrip them. I think it's the rails that the lenses move on that often vibrate, producing high resonant noise levels at some speeds.)

SOUND LEVELS

Normal Mode	
Ambient	<35 dBA at 1m
Stationary	52.5 dBA at 1m
Homing/Initialization	54.0 dBA at 1m
Pan	54.8 dBA at 1m
Tilt	53.9 dBA at 1m
Color	52.5 dBA at 1m
Gobo	52.5 dBA at 1m
Gobo rotate	52.5 dBA at 1m
Zoom	57.3 dBA at 1m
Focus	57.3 dBA at 1m
Strobe	52.5 dBA at 1m
Animation wheel	52.5 dBA at 1m
Iris	52.5 dBA at 1m
Frost	52.5 dBA at 1m
Prism	52.5 dBA at 1m

Homing/initialization time

Full initialization took 58 seconds from either a cold start or a DMX512 reset command. 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. The lamp is cold-restrike and took about two-and-a-half minutes to cool down after being doused before it could be restruck. However, this figure will likely vary and get longer as the lamp ages.

Construction

As I described above, when going through the optical train, the head construction is primarily modular, with the color and imaging modules providing the majority of the moving parts. Data and power is distributed around the unit, with each module having its own motor drivers. This is a common construction for automated lights these days and makes for a very neat assembly. The days of hundreds of black wires running around the head and through the yoke joints are, thankfully, gone. Figure 18 shows one of the yokes, with just the lamp power wires running through past the tilt mechanism and yoke lock. The other yoke is similar, but contains the motor data bus and motor power.

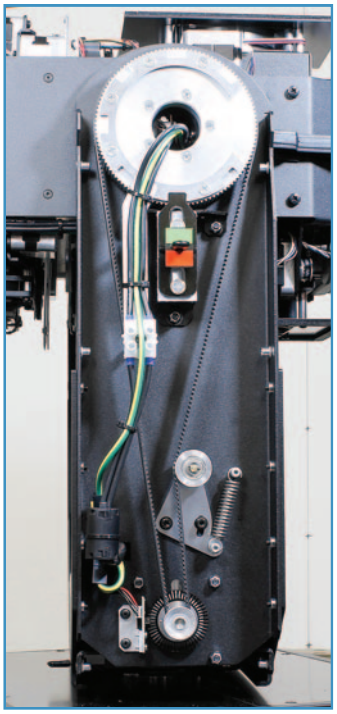

Figure 18: Yoke.

Figure 19 shows the top box with a cover removed, revealing the lamp and main power supplies. A nice attention to detail here is a small spring that lifts up the top box covers when the screws are removed. This saves you struggling to get your fingernails under the cover to lift it out, or

Figure 19: Top box.

Figure 20: Menu.

Figure 21: Connectors.

scratching it by jamming a screwdriver in the gap. The lighting designer won't care about this, but the service tech will.

Electronics and control

The BMFL has the usual Robe color touch-screen system, providing access to a comprehensive array of setup and service functions (Figure 20). This includes RDM, the optional wireless DMX system provided by LumenRadio, stand-alone operation, and self-test modes.

Finally, the connector panel contains Neutrik powerCON power input, along with standard five-pin and three-pin DMX512 connections and a USB socket (next to the display) for diagnostic and service access (Figure 21).

That just about covers it for the Robe Robin BMFL Spot. Good light output and a strong set of features. Does your rig have a space that a BMFL could fill? I've tried to give you the raw facts and figures to help you make a decision, but, ultimately, as always, it's you who gets to decide.

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.