# Robe ROBIN 300 Plasma Spot

By: Mike Wood

We have a new light source this month. Over the years, I've reviewed luminaires with incandescent, HID, and LED sources—but this is the first opportunity I've had to take a close look at a plasma lamp. A couple of manufacturers are using them, but, at the moment, Robe is one of a very few using them in automated lights. The ROBIN 300 Plasma comes in both spot and wash versions; in this review, I'm taking a close look at the spot unit.

As always, we will follow the optical system from lamp to output, providing measurements of those parameters that may help you to determine if this is a useful product for your arsenal. The readings are based on the measurements taken from a single sample of the luminaire provided to me by the manufacturer, so they may not necessarily be representative of the full production line. Enough of the preamble; how did the Robe Robin 300 Plasma Spot perform?

From the outside, the Robin 300 Plasma Spot looks just like a regular 250W HID lamp product, and I'm sure Robe started the design based on that premise. It is rated for self-switching operation on any voltage from 100V to 240V at 50 or 60Hz. For all these tests, it was run at a nominal 120V, 60Hz (Figure 1).

Figure 1: Fixture as tested

## Lamp

The plasma lamp is where this gets interesting. The Robin 300 Plasma Spot uses the LiFi ENT 31-02 lamp from Luxim. LiFi stands for "light fidelity," and, I assume, refers to the broader and more continuous spectrum that the plasma lamp produces compared to a regular HID lamp. Actually, LiFi and HID lamps have quite a lot in common, and the word "plasma" is perhaps a little misleading; both use a quartz capsule and both emit light from a plasma of superheated gases formed within the quartz envelope. These gases are a vaporized mix of various rare earths and other materials chosen for the mix of spectral lines and light output they produce when in the plasma state. The difference between the lamp types comes in the way that plasma is created and the physical structure of the quartz envelope. In the HID lamps we are familiar with, the plasma is created by an electrical arc struck between two electrodes enclosed within the envelope; in the LiFi lamp, there are no electrodes, and the plasma is formed by passing a high-intensity radio frequency (RF) or microwave field through the envelope. In both cases, the result is a large amount of energy in a small space, resulting in very high temperatures, vaporization of the chemicals, and the formation of a plasma. The absence of electrodes is a big plus for the LIFF—electrodes, and the seals and pinches where they enter the quartz envelope, constitute a weak spot in normal HID lamps, and represent one of the primary sources of eventual failure when the seals break down. The need to keep the pinches cool and separated from the heat also means that the quartz envelope has to be relatively large. In the LiFi lamp, however, there are no electrodes, so the envelope is continuous and unbroken without the weak points. Accordingly, it can be a lot smaller and can run at higher pressures, which helps with broadening the spectral lines. The net result is a very small source, with a 10,000-hour life and a more complete spectrum. Figure 2 shows the output spectrum from the Robin 300 Plasma Spot—note that this was measured at the output of the luminaire after it has travelled through all the optics and lenses within the luminaire, so it will likely be slightly different than the raw lamp spectrum. Even though it is still fairly spiky, the spectrum is almost continuous, with just a couple of missing narrow frequency bands around 420nm and 450nm. This provides a published CRI of 94, which is very acceptable.

The small lamp capsule is enclosed within a module that both directs the microwave energy and provides a heat sink to cool the lamp (Fig. 3). You can also see the large, heavily shielded, coax cable leading into the bottom of the module. The other end of that cable connects to the lamp power supply and its associated cooling system, shown in Figure 4. It's good to keep this cable as short as possible, so the supply is mounted right next to the lamp and above the first optical components. Figure 5 shows a more general view.

As you can see, a couple of fans are mounted directly on the power supply heat sink, with more at the back of the unit for cooling the lamp heat sink. All of these are thermostatically controlled, and appeared to perform as desired, with the unit remaining acceptably cool to the touch during use. The lamp is almost hot-restrike, and only needs a few seconds to cool before it will strike again. I measured about one minute between powering down and the lamp coming back up after cycling power. Once struck, it takes about 30 seconds to a minute to reach full output.

Normally at this point in these reviews, we'd talk about how easy or not it is to change the lamp and how to adjust it, but the Robin 300 Plasma Spot offers neither of those functions as part of normal user maintenance. The LiFi lamp is rated at 10,000 hours life to an L50 point (the point at which an average lamp will have 50% of the output of a new one), and the lamp capsule is already pre-aligned in its module. To change the lamp means switching out the complete lamp module shown in Figure 3, which I, of course, tried—both out of curiosity and to take the photos. It's not a difficult task, but it's definitely something you would do on the bench, with a full set of tools, rather than in the rig, as quite a lot of disassembly is required.

As the LiFi lamp is surrounded by the microwave source, it's more difficult to customize the optics than usual, and there is no large reflector and hot mirror. Instead, the lamp module has a deep metal elliptical reflector at its output that feeds into the rest of the optics, which you can see in Figure 3, mounted above the quartz envelope.

## Color mixing and dimmer

Immediately after the reflector are the color mixing and dimmer flags. There are five etched flags—four for color (cyan, magenta, yellow, and CTO) and one for the dimmer. Each has a familiar finger pattern etched through a dichroic coating to give variable color saturation. As I understand it, the dimming flag and electronics work together to dim the lamp. The result is visually very smooth, even though the actual curve is a little unusual (Fig. 6). The curve roughly follows a square law and dims with no visible beam artifacts or patterning.

**Color mixing**

| Color | Cyan | Magenta | Yellow | Red | Green | Blue |
|---|---|---|---|---|---|---|
| **Transmission** | 25% | 6.6% | 79% | 6% | 9% | 0.7% |

| | |
|---|---|
| **Color change speed – worst case** | 0.2 sec |

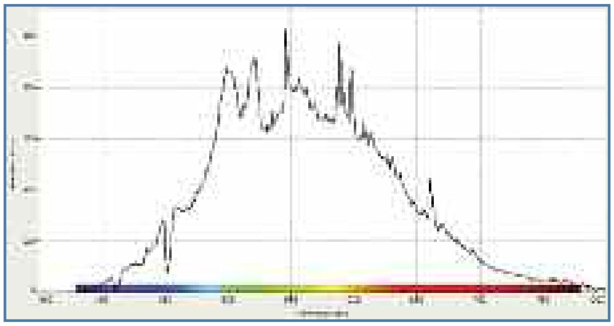
Figure 2: Lamp spectrum


Figure 3: Lamp module


Figure 4: Power supply and waveguide


Figure 5: Microwave power supply

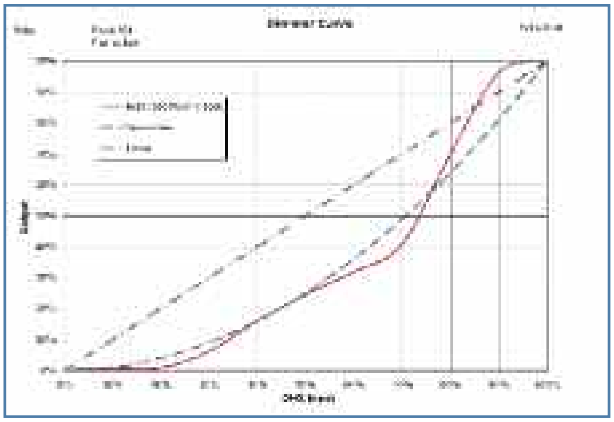

Figure 6: Dimmer curve

Figure 7: Color filters

Figure 8: Color wheel

The chosen colors give a good range of mixed colors, with the saturated magenta giving good deep blues. The speed of change was excellent, with the color-mix system providing almost as quick a snap change as the color wheel. Mixed red was slightly amber—as they often are with discharge lamp sources—but the improved red output of the LiFi lamp must help here.

Next in the chain is something you don't normally see in luminaires. After the flags comes a hollow, hexagonal cross-section light tube, about 5cm long and 2cm across, made of reflective aluminum. The light enters this tube, and is reflected back and forth within it before exiting. Presumably, this reflection within the light tube serves to integrate and homogenize the color mixing and dimming evenly across the entire beam. It seems to do a good job, as the color mixing was very even across the beam, with little or no center/edge variation and no banding.

## Strobe

The strobe shutter flag is mounted across the exit aperture of the hexagonal light tube. The aperture is so small that, at this point, the flag can be small and thus move quickly, with a range of 0.3Hz up to 15Hz.

## Color wheel

The color wheel contains seven interchangeable pie-shaped dichroic filters retained through a magnetic lock system to the hub. Figure 7 shows two sample colors, with the magnet clearly visible on the yellow filter; Figure 8 shows a view of the wheel with one of the magnet-locating holes. Changing colors is very simple; they just drop into place.

**Fixed Color Wheel**

| Color | Deep Red | Deep Blue | Orange | Green | Light Red | Amber | UV |
|---|---|---|---|---|---|---|---|
| Transmission | 2.6% | 1.3% | 37% | 43% | 20% | 57% | 0.2% |

As you can see by the low transmission figures, the deep red and blue are very saturated colors. The reds on this wheel, with the improved red output of the lamp, were much better than the mixed reds, as expected.

The amount of time needed to change between adjacent colors was very snappy, at less than 0.1 second, and the maximum time between colors mounted opposite each other on the wheel was still very quick. All wheels in the unit use a quick path algorithm, so they always take the shortest route between two colors.

**Color Wheel**

| | |
|---|---|
| **Color change speed – adjacent** | <0.1 sec |
| **Color change speed – worst case** | 0.3 sec |
| **Maximum wheel spin speed** | 0.71 sec/rev = 84 rpm |
| **Minimum wheel spin speed** | 175 sec/rev = 0.34 rpm |

Wheel spin and slow color changes are very smooth and are usable live. The frameless colors and optics also allow the Robin 300 Plasma Spot to produce reasonable split colors—albeit, as can be seen in Figure 9, with a visible white band between colors.

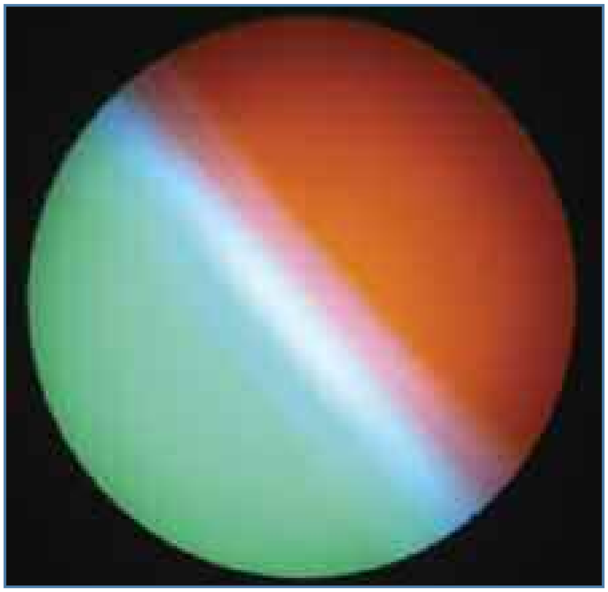

Figure 9: Split colors

## Gobos

Next in line after the static color wheel are a rotating gobo wheel, with seven replaceable patterns, and a static wheel with nine. Their replacement mechanisms are very similar: A long sprung fork on one side of the gobo is inserted with its tangs on either side of a peg on the wheel hub, while the sides are captured under two pins. To remove a gobo, you lift it off the wheel plate slightly and pull outwards.

Figure 10 shows examples for the two gobo types; Figure 11 shows a close-up of the rotating wheel and the retainers.

Figure 10: Gobos

**Rotating Gobo**

| | |
|---|---|
| **Gobo change time, adjacent apertures** | < 0.2 sec |
| **Gobo change time, max (Gobo 0 to 4)** | 0.4 sec |
| **Maximum gobo rotate speed** | 0.24 sec/rev = 250 rpm |
| **Minimum gobo rotate speed** | 288 sec/rev = 0.21 rpm |
| **Maximum wheel spin speed** | 4.5 sec/rev = 13 rpm |
| **Minimum wheel spin speed** | 240 sec/rev = 0.3 rpm |

Figure 11: Rotating gobo wheel

**Static Gobo**

| | |
|---|---|
| **Gobo change speed – adjacent** | <0.1 sec |
| **Gobo change speed – worst case** | 0.4 sec |
| **Maximum wheel spin speed** | 4.5 sec/rev = 13 rpm |
| **Minimum wheel spin speed** | 291 sec/rev = 0.2 rpm |

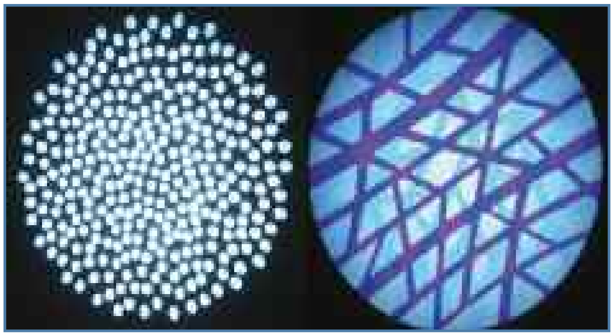

Figure 12: Focus quality

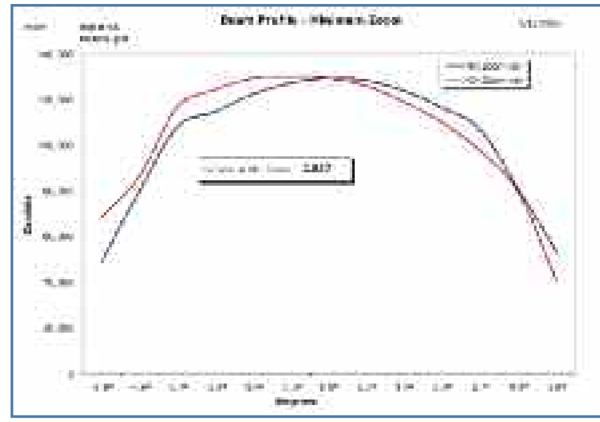


Figure 13: Minimum zoom

The gobo patterns chosen were a little bit too much the same for my personal taste—although nobody ever agrees on gobo selection!—with many of them being break-ups and very few geometrical or other designs. The rotating wheel does contain a break-up glass and colored gobos as well.

Slow rotation movement was very good. Robe has done an excellent job of controlling the stepper motors, with just about no visible jumps or jerks. Positioning accuracy and hysteresis was also good, with a measured error of 0.12°, which is about 0.5'' at a 20' throw.

The optics in the system are too fast to get morphing between the wheels. Figure 12 shows an example of the projected images from the static wheel (left) and the rotating wheel (right).

### Iris

Last, but not least, in the section before the output lenses is the iris. This was capable of taking the beam down to 15% of its full size when fully closed, which equates to a field angle of 1.7° at minimum zoom and 6.1° at maximum zoom. The time from fully open to fully closed was a rapid 0.3 second, which is quick enough to get some good dynamic iris effects.

### Lenses and output

I can't remember the last automated spot luminaire I tested that didn't have a three-group lens system. It's become almost a rule, and the Robin 300 Plasma Spot is no excep-

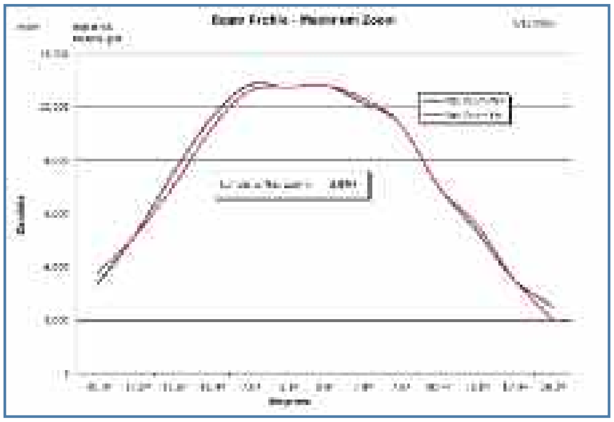

Figure 14: Maximum zoom

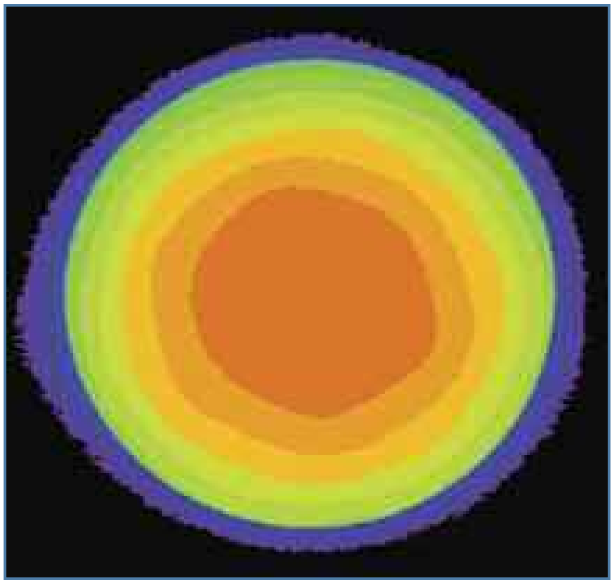

Figure 15: Wide angle field

tion. The rear lens group gives focus control, the center group provides zoom, and the front lens is fixed as the final output. As can be seen in Figure 12, the focus quality was acceptable throughout zoom range, although you can see in the left image that there was some distortion of the image at the outside edge (circles have become ellipses), but nothing that was too unusual. The time for full range movement of the lenses was one second for zoom and 0.8 second for zoom, both of which are about average for a unit of this size.

The measured zoom range was from a minimum field angle of 11° to a maximum of 40° (3.6:1) with a total lumen output ranging from 2,837 lumens in narrow to 2,667 lumens in wide. These output figures are not the best in class for a 250-sized unit, but that's perhaps the penalty you pay for the extended 10,000-hour life. The field from the optics and that hexagonal homogenizer tube is very flat, as can be seen in Figures 13 and 14, and Figure 15, which shows a false color chart of the wide angle 40° position. The color temperature in open white was measured at 5,100K.

Figure 16: Lenses, frost, and prism

### Prism

The prism and frost systems are mounted between the focus and zoom lenses; this necessitates the lenses automatically separating slightly, to insert them at some focus/zoom combinations. Figure 16 shows the layout. The Robin 300 Plasma Spot has a single rotatable three-facet prism, which gives good image separation from this position in the optics. The time to insert the prism was a maximum of 0.7 second; it could be rotated at speeds varying from 3.3 second/rev (18 rpm) down to 177 second/rev (0.34 rpm).

### Frost

The single frost flag comes in after the prism and just before the zoom lens, with an insertion time of 0.3 second—nothing unusual here.

### Pan and tilt

The full movement range for the Robin 300 Plasma Spot is 540° for pan and 280° for tilt. I measured a full-range pan move at full speed at 3.8 seconds and a more typical 180° move at 2.3 seconds. Tilt took the same 2.3 seconds for 180° and 2.8 seconds for the full range.

Measured hysteresis was excellent, with 0.02° for pan and 0.04° for tilt, which equates to about 0.1'' and 0.2'' respectively at a 20' throw. The smoothness of movement is some of the best I've seen, with almost perfect diagonal moves with very little bounce.

### Noise

As is becoming increasingly common, the noisiest parts of the Robin are the fans. Manufacturers have improved pan-and-tilt systems and reduced motor whine, which leaves fans as the noisiest components.

**Sound Levels**

| | |
|---|---|
| **Ambient** | <35 dBA at 1m |
| **Stationary** | 47.5 dBA at 1m |
| **Homing/initialization** | 56.5 dBA at 1m |
| **Pan** | 48.8 dBA at 1m |
| **Tilt** | 48.3 dBA at 1m |
| **Color** | 47.8 dBA at 1m |
| **Color mix** | 47.8 dBA at 1m |
| **Prism** | 47.9 dBA at 1m |
| **Gobo rotate** | 47.7 dBA at 1m |
| **Gobo select** | 47.5 dBA at 1m |
| **Zoom** | 47.7 dBA at 1m |
| **Focus** | 47.6 dBA at 1m |
| **Strobe** | 47.8 dBA at 1m |
| **Iris** | 48.6 dBA at 1m |

### Electronics and control

Figure 17: Drivers and wheels

Electronics are distributed throughout the unit. The main electronics and power supplies are in the top box; the motor drivers and the lamp supply are in the head, with a serial data link connecting them together. Figure 17 shows motor driver boards in the head; the lamp power supply is illustrated in Figure 4. The Robin 300 Plasma Spot uses the standard Robe touch-screen control panel, which gives quick access to all the usual luminaire functions. I've shown a couple of sample screens in Figure 18; Figure 19 shows the rear of the panel, including the battery supply for the touch screen, which allows setting parameters, such as the DMX 512 address, when the unit is powered down.

The unit offers a comprehensive DMX512 control footprint, with options for timing controls, as well as 16-bit for many functions. As can be seen on the connector panel in Figure 21, the unit also has an RJ45 Ethernet port supporting Art-Net as standard as well as both three-pin and five-pin XLR connectors for DMX512.


Figure 18 - Touch screen

Figure 19 - Electronics

Figure 20: Yoke arm

Initialization of the unit took 44 seconds from a cold start and 27 seconds when sent a "reset" command through DMX512.

### Construction and serviceability

Construction is based around the very familiar chassis-and-module system, with the main optical modules removable for service. I suspect the lamp and lamp supply will get in the way of that somewhat, and will have to be removed first to get at all components, as the large power supply for the LiFi lamp makes the head a little cramped. The components in the top box and yokes are easily accessible after removing the covers (Fig. 20).

That's about it for the Robe Robin 300 Plasma Spot. From the outside, I don't know if you would be aware of the new light source—but I suppose that's what Robe wanted. Does the extended lamp life justify the increased complexity and slightly lower output? As always, I hope I've given you the information to help you decide for yourself.

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Figure 21: Connector panel