SGM G-Profile Turbo

By: Mike Wood

It's been quite a few years since I looked at an SGM fixture, and a lot has changed. Originally an Italian company, SGM is now based in Denmark, and all products are designed and manufactured there under the auspices of Peter Johansen, the founder of Martin Professional. SGM has also recognized, and striven to fill, a specific niche in the automated lighting market for weather-resistant units designed for use outdoors. These days, all new products that the company produces are rated either IP65 or IP66 and aimed at outdoor use.

This is an interesting direction for SGM to take. On the one hand, the market for IP65 automated lighting isn't that large at the moment (although I'm sure SGM is trying to change that), but, on the other hand, SGM is one of the very few companies addressing it. This gives it a niche position in an increasingly standardized world. Additionally, the sealed unit, protected against dust, also gives protection against theatrical fog and dirt in indoor permanent installations.

Figure 1: Fixture as tested.

This month, I'm looking at the SGM G-Profile Turbo, one of the "G" series of LED-based automated lights. As always, I'll work through the unit, from light source to output, measuring everything possible and giving you the results in a way that I hope allows you to judge its suitability for your own use.

The weatherproof nature of the G-Profile Turbo means a few changes to my process. Unfortunately, I'm not set up to test the waterproof ability in any meaningful way. I could spray a hose on it, but that proves very little. It's how a fixture performs after six months on the side of a building that really matters. The sealed nature of the system also made some of my usual testing tricky. However, let's get on with it. All tests were run on a single unit provided to me by SGM and run at 118V, 60Hz (Figure 1).

Perhaps I should start by quickly recapping what IP65 (the rating of the G-Profile Turbo) means. Firstly, "IP" stands for "International Protection," often called "Ingress Protection" instead, and is the symbol for internationally agreed-upon protection types and levels. This is followed by two numbers, in this case 65. The first number, 6, shows the protection level against physical contact and dust. Level 6 is the highest rating and means "full protection against penetration of dust. Complete contact penetration." The second number, 5, is the level of water protection. Level 5 means, "Water projected by a nozzle against the luminaire from any direction shall have no harmful effect (hosed water)." There are higher levels that cover protection against heavy seas, temporary submersion, and continuous submersion. IP65 is sometimes called "dust-tight and protected against water from a nozzle." This all means that the product is rated for outdoor use and should survive normal rain as well as overzealous employees with hoses. It's not rated for submersion or for heavy seas, where water is constantly bashing against the unit.

Light source

The G-Profile Turbo uses an LED array with emitters in three colors: red, lime, and blue. The choice of lime, instead of the more usual green, makes good sense. Lime is a phosphor-converted color with a blue LED pump that produces a broad green spectrum tailored to match the response of the human eye. It's very efficient and gives you a lot of light. A standard RGB mix is always lacking in green energy, which is why it always appears pink when you run all channels to

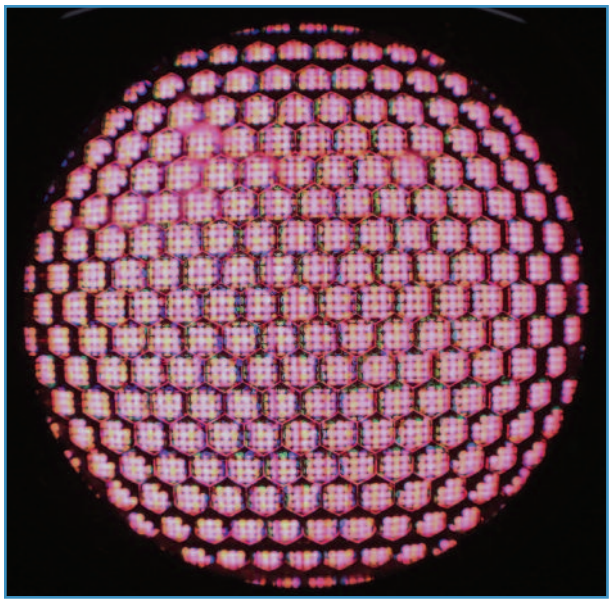

Figure 2: LED array.

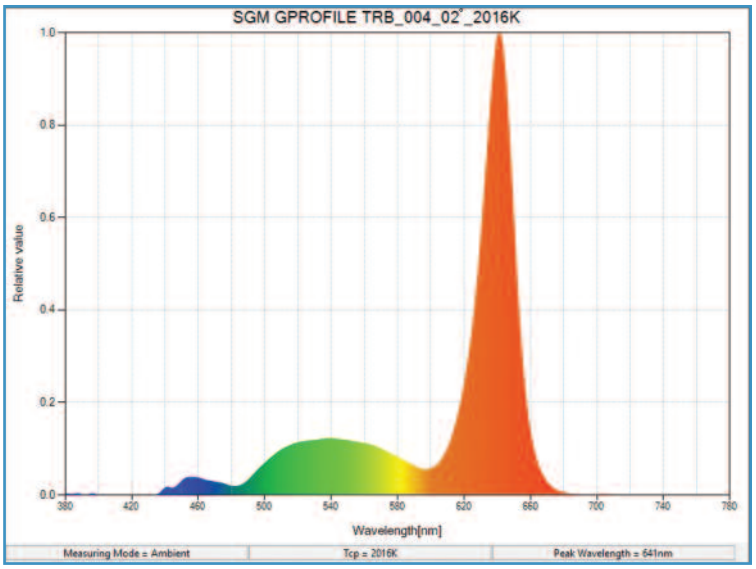

Figure 3: 2,000K.

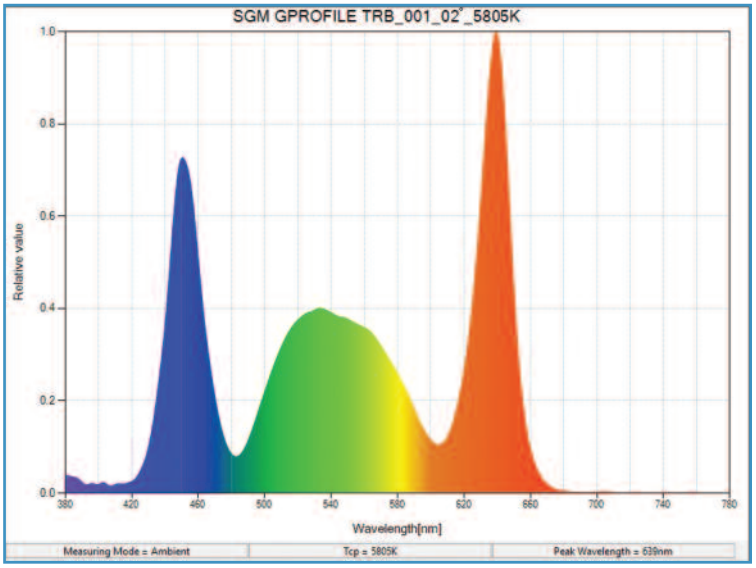

Figure 4: 5,800K.

full; using lime instead of green helps fills in that gap. The only disadvantage of using lime is that you can't get a truly saturated green. Arguably, we never use green much in our industry, anyway, but SGM has thought of that and provided a special color filter that can be brought in to trim the lime output and produce a more saturated green; more of that later. The array is topped with a fly-eye lens array to integrate the colors before going through the gate. Figure 2 shows what I could see of the LEDs and lens array from looking through the front, as I wasn't easily able to dismantle the sealed light engine component of the fixture.

The LEDs are mounted and thermally connected to large heat sink arrays on the rear of the unit. Two fans pull air in at the top and bottom, across the heat sinks, and out again at the rear and sides. As this is a sealed unit, there is no direct air path from outside to inside, and all cooling comes from conduction through the heat sink.

Color

As already mentioned, the G-Profile Turbo is effectively an RGB color-mixing unit, but with lime substituted for green. As well as a higher output, using lime also improves the color mixing in pastels and gives better color rendering. SGM provides normal RGB control as well as a dedicated white control channel, which provides a range of whites with color temperatures ranging from around 2,000K up to over 10,000K. Figures 3 and 4 show a couple of examples of the spectra: Figure 3 is at a low, warm, color temperature of 2,000K, while Figure 4 shows the output at a daylight color temperature around 5,800K, the default for the unit. In both cases, but particularly in the cooler color temperature, you can see the broad central peak from the lime emitter.

I mentioned earlier that the G-Profile Turbo has an extra dichroic filter to sharpen up that lime to a deeper green. Figures 5 and 6 show you the results. Figure 5 shows the spectrum and color point for the lime LED (with just a little red LED). The peak is broad, and thus unsaturated, as can be clearly seen on the CIE chart. Figure 6, however, shows the same data but with the filter added. This trims off the yellow wavelengths, leaving a much narrower spike around 530nm. This is a green more similar to a standard green LED. The operator can choose to allow the fixture to control this filter automatically, bringing it in when deep greens are called for, or you can control it yourself with a fourth color channel. In my tests, I let the fixture control it.

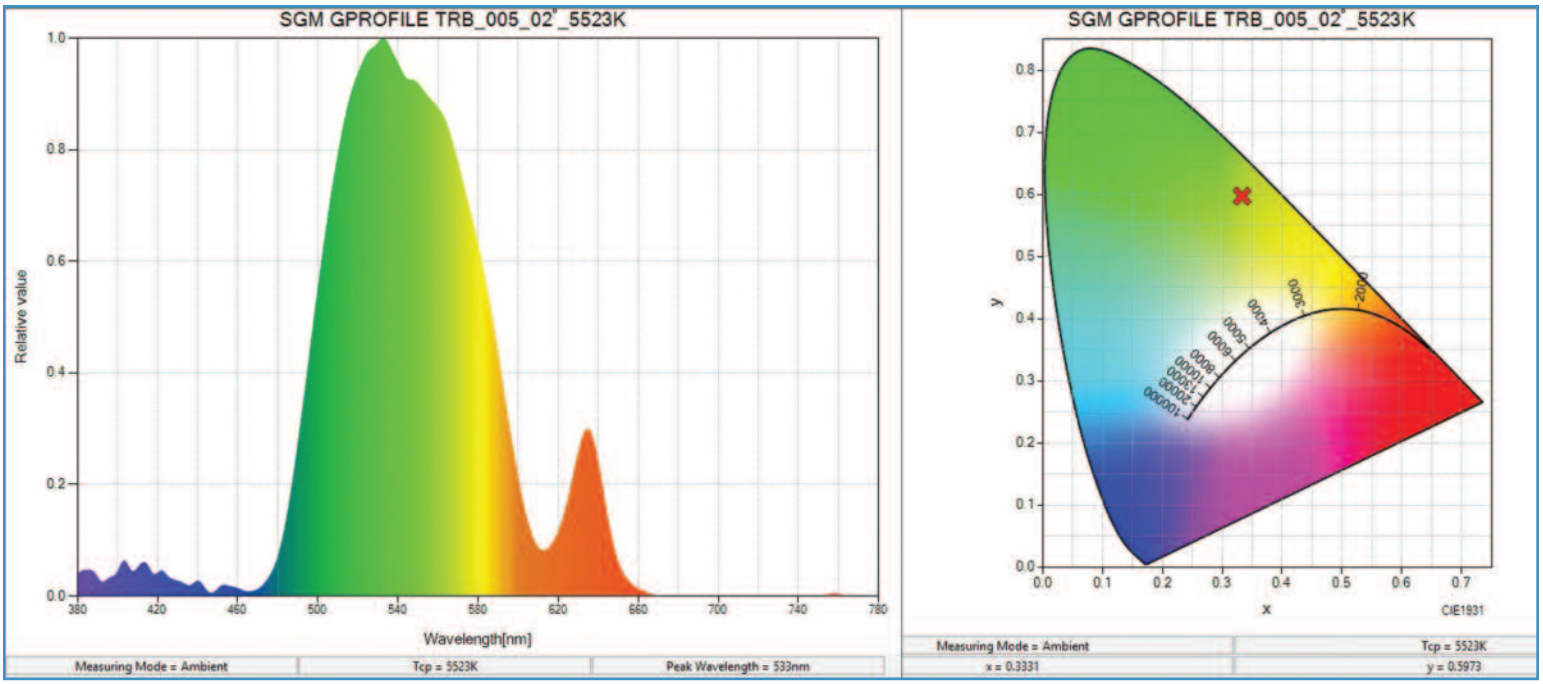

Figure 5: Lime green.

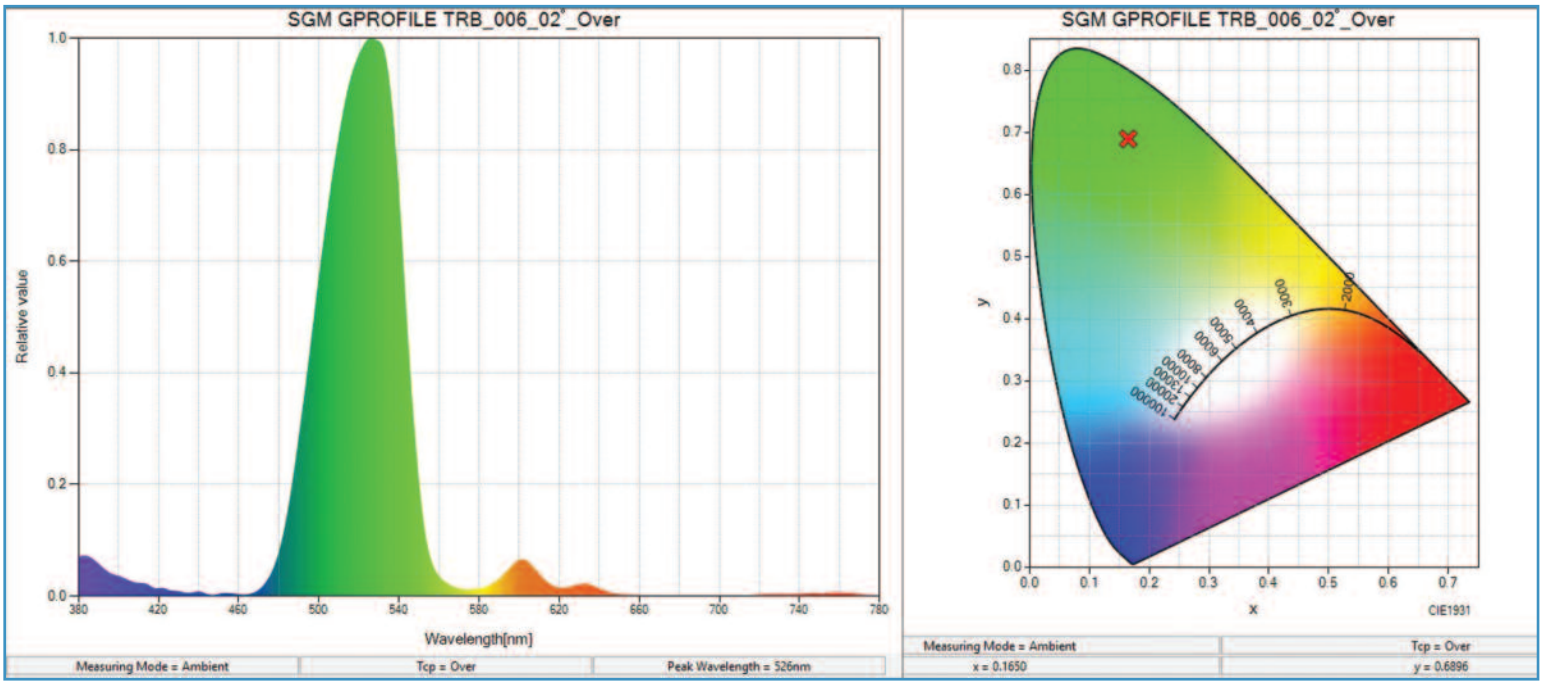

Figure 6: True green.

I measured the output from the color system as follows. The colors mix well, with very little colored edging and no visible colored shadows.

Color	Red	Green	Blue
Transmission	23%	44%	39%

Imaging effects

First in line after the green color filter are the effect wheel and main gobo wheel. The effect wheel is a single large metal pattern mounted before the main gobo wheel. This can be inserted and removed by the user to give texture to the main gobo. The effects wheel in the unit I had was

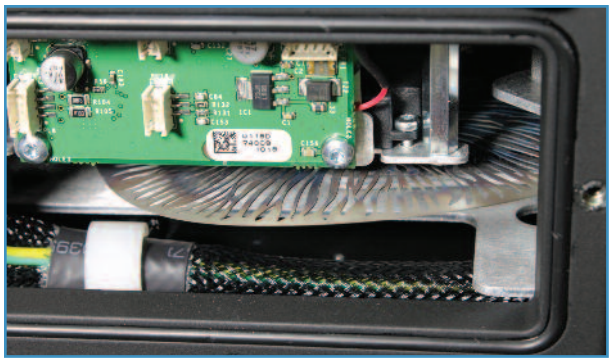

Figure 7: Effects wheel hatch.

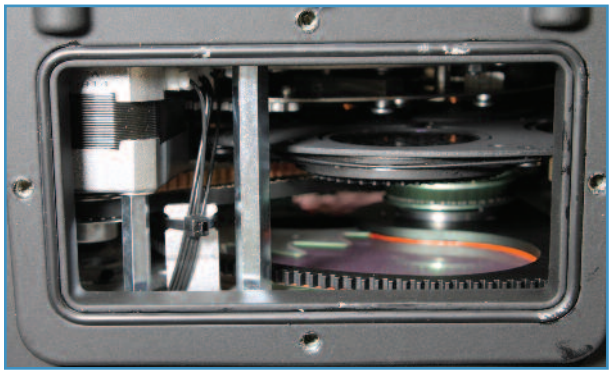

Figure 8: Gobo wheel hatch.

somewhat distorted and warped from heat and I wasn't able to pull it into focus, so the results it produced were minimal. Figure 7 shows the effects wheel with the photo taken through one of two small sealed access hatches in the body of the luminaire. Next is the gobo itself. This has five indexable rotating glass gobos plus open hole. Gobos can be changed through a second small hatch on the other side of the unit. Figure 8 shows that hatch; the gobo wheel is at the top, and, at the bottom, you can also see the green dichroic filter discussed earlier.

ROTATING GOBO	
Gobo change speed – adjacent	0.6 sec
Gobo change speed – worst case	1.0 sec
Maximum gobo spin speed	0.6 sec/rev = 100 rpm
Minimum gobo spin speed	380 sec/rev = 0.16 rpm
Maximum wheel spin speed	1.2 sec/rev = 50 rpm
Minimum wheel spin speed	68 sec/rev = 0.9 rpm

Positioning and rotation of both wheels was relatively smooth, with a good range of rotation speeds. The rotating wheel showed some bounce but very little hysteresis. The wheel uses a quick-path algorithm to minimize change times. I did see some odd jumps in gobo rotation when rotating the entire gobo wheel, which, I think, need addressing in the firmware.

Focus quality on all gobos was good, with acceptable edge-to-center difference and very little color fringing.

Framing

The G-Profile Turbo offers a full four-blade framing system. Each blade has two motors—one for insertion, and one for angle—and the entire module can then be rotated. Each blade can be inserted to cover about 60% of the beam; however, the range of angle adjustment is very limited when fully inserted. Maximum angle adjustment of about 30° is when the blade is only partially inserted. This limitation is not uncommon in automated framing systems. The entire framing mechanism can be rotated by +/-45°. I measured a maximum of 1.2 seconds to move a blade into position across the beam.

Iris

This is a standard iris system, mounted next to the framing. I measured the opening/closing time of the iris at 0.3 seconds. The fully closed iris reduces the aperture size to 44% of its full size, which gives equivalent field angles of 3.9° at minimum zoom and 16.4° at maximum zoom.

Prism and frost systems

The G-Profile Turbo provides prism and variable frost effects. Both systems are mounted on the rear of lens group 1, between it and lens group 2, and travel back and forth with it. The prism is a four-facet device that can be inserted or removed in 0.5 seconds. Once in position, it can be rotated at speeds varying from 159sec/rev (0.38rpm) up to 0.8sec/rev (74rpm). Image separation from the prism is fairly small.

The frost flag produces a smooth effect as it is inserted. Initially, it behaves as a contrast reducer but, as it reaches full insertion, behaves more like a true frost where the edges are diffused. The frost flag took 0.7 seconds to insert or remove.

Lenses and output

Figure 9 shows the prism and frost in place between the two movable lens groups of the G-Profile Turbo. You can see how the rear lens moves taking the frost and prism with it.

This is the usual three-lens-group system. The final output group doesn't move and, in fact, is fixed into the front of

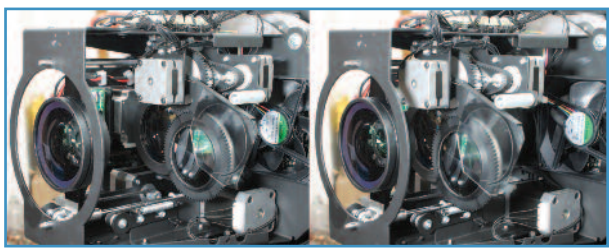

Figure 9: Lens movement.

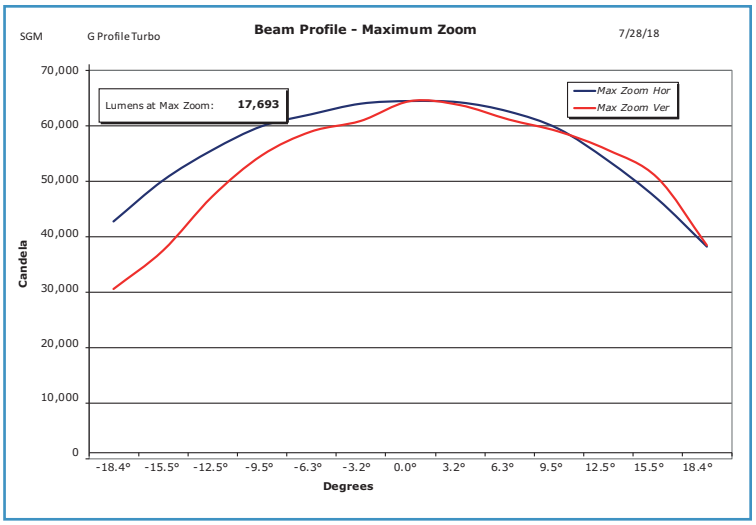

Figure 10: Maximum zoom.

the removable fixture cowl. Zoom took one second to run from maximum to minimum; focus took 1.1 seconds from end to end.

How about the output? I measured the G-Profile Turbo as producing 17,690 lumens at 37° when in wide angle, ramping down to 12,250 lumens at 8.7° when fully zoome in. The beam was very flat at all beam angles. Figures 10 and 11 show the beam profile at maximum and minimum zoom respectively. *Note: These readings were taken with the fixture at its operating temperature, in raw mode, with all color channels at full.*

The G-Profile Turbo showed very little output droop; it only dropped by 5% over 15 minutes when run at full power. Dimming control was excellent, very smooth and, in the default dimmer mode, precisely following the standard square law (Figure 12). As it came out of the road case, I measured the PWM rate at 712Hz; however, this is adjustable through a control channel function and can be set at much higher frequencies. Electronic strobe of the LEDs is variable up to 12Hz.

Pan and tilt

The G-Profile Turbo has the normal movement ranges of 540° for pan and 270° for tilt. I measured pan speed over the full travel at 5.75 seconds and 3.2 seconds for 180°. For tilt, the figures were 3.7 seconds for the full 270° and three seconds for 180°. The weatherproof construction means this is a big, heavy unit. This definitely introduces some bounce and wobble in the movement. Hysteresis, however, after the fixture comes to a final halt, is minimal at around 0.1" at a throw of 20'.

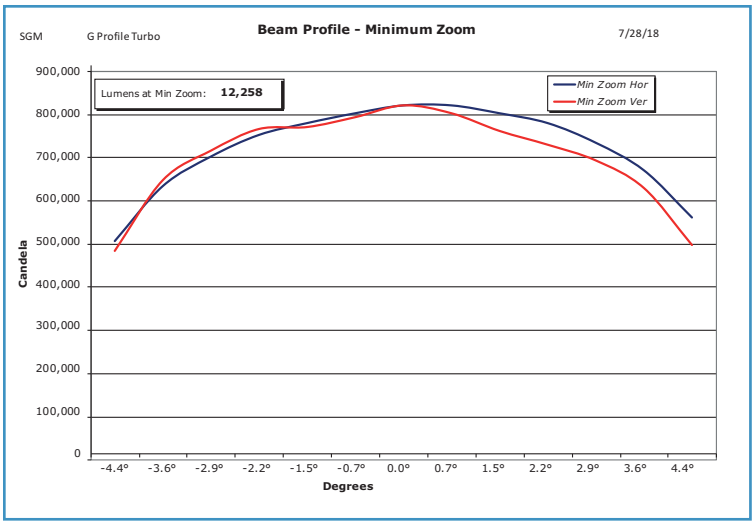

Figure 11: Minimum zoom.

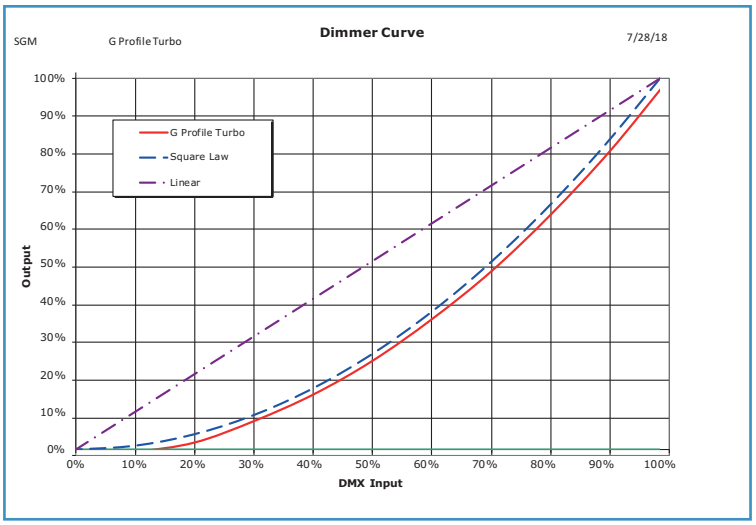

Figure 12: Dimmer curve.

Noise

This is an outdoor unit, with large external fans to keep it cool, so it's not surprising that the noise levels in standard mode are quite high to match. Most other functions are quieter than the fans. The exceptions being pan, tilt, and focus. I also tested "silent" fan mode, where the unit runs the fans at a much slower speed, ramping the LED output down as necessary. In this mode, the stationary noise reduced down to 45.7dBA at 1m, with a corresponding reduction in light output of about 10%. This was in an ambient temperature of 23° C.

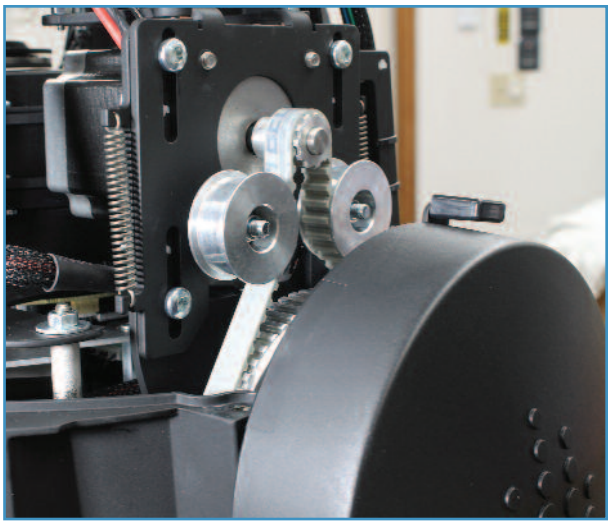

Figure 13: Tilt mechanism.

SOUND LEVELS	
Ambient	<35 dBA at 1m
Stationary	58.5 dBA at 1m
Homing/Initialization	67.5 dBA at 1m
Pan	65.0 dBA at 1m
Tilt	66.2 dBA at 1m
Zoom	59.4 dBA at 1m
Focus	63.1 dBA at 1m
Frost & Prism	58.5 dBA at 1m
Gobo	58.5 dBA at 1m
Gobo Rotate	58.5 dBA at 1m
Shutters	60.3 dBA at 1m
Effects Wheel	58.5 dBA at 1m

Homing/initialization time

In my measurements, the G-Profile Turbo took 57 seconds to initialize from power up, and 50 seconds from a DMX reset. The unit is well-behaved in that the LEDs are dimmed out before reset starts and don't fade up again after re-positioning has finished.

Power, electronics, control, and construction

Overriding everything else is, of course, the sealed weatherproof construction. This makes for some differences from typical units. For example, the tilt motor and all gears and bearings are inside the head, not in the yoke arm. Figure 13 shows this mechanism. It has a very short belt and compact construction. Another difference is in the cable routing through the yoke, this is through a sealed tube or conduit inside one of the yoke arms. There is nothing in the other yoke arm, other than the tilt lock system. Figure 14 shows the yoke cabling.

Figure 14: Cabling in yoke.

Main construction is heavy and substantial, with large die castings and plastic moldings. The whole of the LED assembly and imaging components sit in the back of a deep aluminum casting. This has no holes other than the two small access hatches we looked at earlier. This is capped with the front molding, containing the front lens, with the join between them running in a groove around the unit. There was no rubber sealing in this groove, which surprised me a little, but I guess this isn't an underwater unit. There is a secondary shield to the join produced by external head covers, which cover both this seal and the two hatches. As I mentioned earlier, I didn't test the weatherproof ability. That needs a long-term test to be of any use. As well as the usual Gore-Tex filters, SGM units have their own proprietary active dehumidification system. Again. I can't speak to how well it works, as the effectiveness of such a system would only show up in a long-term test.

With the 118V 60Hz supply I was using, and running in default 5,600K white, the G-Profile Turbo took 5.7A when running at full output and allowed to warm up and reach stability. This equates to 661W, with a power factor of 0.99. The quiescent load with the unit powered up but no LEDs on was 1.04A, 67W, power factor 0.53. When running in Raw mode with all channels at full the power consumption increased to 960W.

Other than the external construction, layout is very much more conventional. The motor drive boards are distributed throughout the unit head. Connection details are different, again because of the need for weatherproofing. There is a single power connector, a Neutrik True1 on the side of the top box (Figure 15). DMX-512 connections are

Figure 15: Connector.

Figure 16: DMX connectors.

Figure 17: Display and menu.

through flying leads, one clipped into each of the two top box handles. (Figure 16). Wireless DMX through a LumenRadio system is also offered. I tested RDM using a City Theatrical DMXCat and was able to get diagnostic data as well as setting parameters.

The display and menu system, Figure 17, is more conventional. Apart from the sealed buttons this looks and behaves in the way you would expect. The menu system provides access to the usual setup and diagnostic functions.

Conclusion

It's important, I think, to look at the SGM G-Profile Turbo in its intended use case, that is as an outdoor waterproof unit, and not to directly compare it with indoor units offering similar functionality. It's a large, heavy unit, driven by the sealing and waterproofing, which inevitably affects its speed and movement. For an outdoor unit on an architectural project, the needs are different than on a rock-and-roll stage. However, I'm not making any final judgments. Those, as always, are up to you.

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