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DTS Synergy 5 Profile

By: Mike Wood

Figure 1: Fixture as tested.

It's been a few years since I looked at a DTS product—the DTS MAX, back in 2013. That's not the fault of the company, which hasn't stopped making lights in Italy; however, it isn't as well-known as other manufacturers in North America, where I live. This is the first DTS LED product that I've reviewed.

This month, we are looking at the DTS Synergy 5 Profile, a white LED-based automated profile spot. Although the field of white-LED-with-dichroic spots is pretty busy at the moment, many of them are very similar internally. They aren't in any way identical, but they use the same basic layout and systems. It's interesting then to look at a DTS product, which enters the market by a somewhat different route. Designed and manufactured in Italy, it has certain differences in concept and design specifics from the majority of similar products. Whether these are good or bad I leave for you to decide. I'll try and point them out, and what you might see as a result, as we go along.

Everything I report here is based on tests of a single Synergy 5 Profile unit supplied to me by DTS for this review. All tests were run on a nominal 115V 60Hz supply (tests run at 119V); however, the unit is rated to run on voltages from 100-277V 50/60Hz (Figure 1). As I always do, the tests reported below step through the unit, from light source to output lens, measuring as much as I can.

Light source

The Synergy 5 Profile uses an Appotronics SUL420 white LED light engine, the style of LED engine that most manufacturers are using at the moment. Appotronics and other Chinese manufacturers making almost identical products seem to have the monopoly on light engines for automated lighting spots at the moment. Appotronics has done an excellent job designing engines that are well-homogenized and with optics that can direct that light through the tiny gate sizes used by automated units. Figure 2 shows the

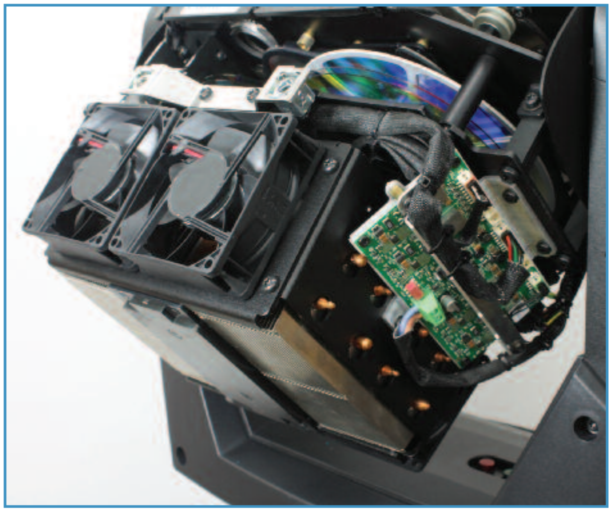

Figure 2: Heat sink and fans.

entire engine with its associated heat pipes, heat sink, and fans. The 420W, 7,000K white light engine has the usual Appotronics fly-eye lens optical system directing the light towards the gate. This part of the design is, so far, familiar and fairly standard for current products.

Modules

Before we get too far into the specifics of the design, a word or two about the modules in the head of the Synergy 5 Profile: Yes, the product is modular; there are two main modules, which can be easily removed, containing most of the optical effects systems. However, DTS has left a couple of things out of the modules and kept them directly chassis-mounted—in particular, the color mixing at the back. The manufacturer has also reduced the number of optical effects from what might be thought of as the norm: One gobo wheel and the deliberate lack of an iris are the most obvious. My guess is that one major design specification driving both these decisions was to make the Synergy 5 as small as possible. DTS has certainly compressed the optical chain to as short a length as possible, and this, I'm sure, drove decisions about modules. This is one of the differences I mentioned earlier.

Color

The first system in the optical chain is the color mixing. It uses four graded dichroic color wheels, the usual CMY plus a CTO wheel (Figure 3). Again, this is a change from the current norm. Many manufacturers seem to have moved to curtain-type systems with two filters per color, one from each side. However, wheels have their advantages. They are easier to move quickly, and the mechanisms are simpler. They also make it simpler to get colors closer to each other. Both systems have issues with uniformity to some extent: The linear systems vary from edge to center, while wheel systems vary from top to bottom. (Another one of those differences…) In practice, I found the Synergy 5 Profile's color mixing to be smooth and acceptably even. I saw some aberrations as the edge of the filter came in, but nothing out of the ordinary. One place where I think it works a little better than curtain systems—and I don't really know why—is the color fringing around the edges of images when using defocused gobos. Just about every white LED-based spot has this problem, some more than others, but the Synergy 5 Profile seems to have reduced the problem a little.

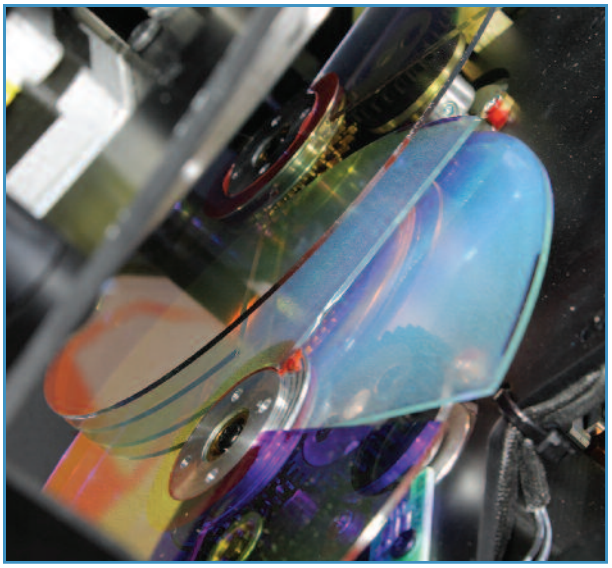

Figure 3: Color-mixing wheels.

I measured the output from the color-mixing system as follows. The colors are well-saturated, and I was able to mix good, even tones. As mentioned above, there was some slight color difference between the top and bottom of the beam with pastel mixes such as aquas and lavenders.

COLOR MIXING

Color	Cyan	Magenta	Yellow	Red	Green	Blue	CTO
Transmission	21%	4.7%	75%	4.0%	5.6%	0.7%	59%

When inserted fully, the CTO wheel reduced color temperature from a native 7,144K down to 3,403K.

Next in line is the fixed color wheel. This has six fixed trapezoidal dichroic colors, including a high CRI filter and an open hole. This wheel is clearly visible when the rear module is removed, as shown in Figure 4.

FIXED COLOR WHEEL

Color	Red	Blue	Green	Amber	Lavender	CRI
Transmission	2.0%	0.3%	7.1%	55%	14%	56%

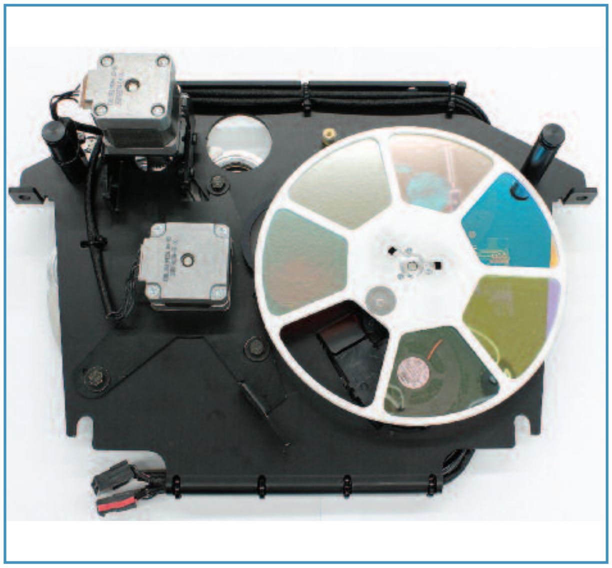

Figure 4: Color wheel.

The CRI filter raised the native Ra value from 74 to 91, while also reducing light output to 56% and dropping the color temperature to 5,900K. These CRI enhancers are very close to a normal minus-green filter and work by reducing the green content coming from the phosphor on the LED. White LEDs are usually weak in red output, so the way to balance things up is to reduce the other colors to match the red.

Transitions between colors are good, with no black bar, and the possibility of half colors, albeit somewhat soft. Figure 5 shows an example. I suggest using the color wheel

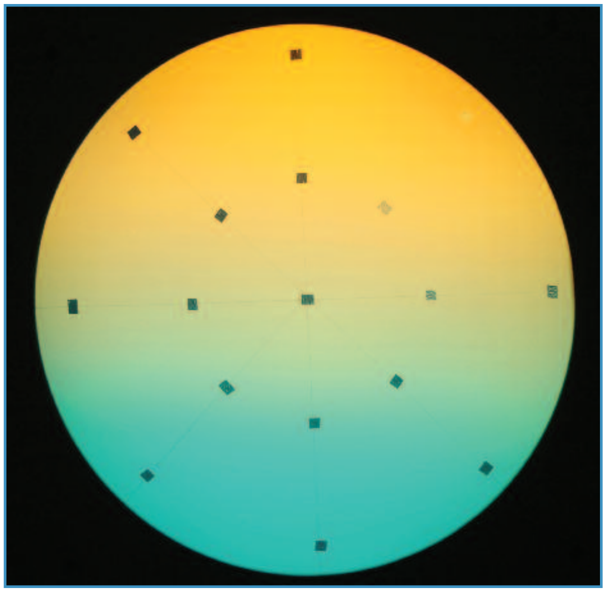

Figure 5: Half color.

in proportional mode rather than the built-in indexed half-colors; that way, you can tune them to get the result you want. It's very often true that the best result with a half-color is not when the mix is exactly halfway. The dominant color often needs dialing back a little. Color-change speeds were good, with very smooth transitions and extremely slow wheel rotations possible. The slowest speed on the wheel rotation is so slow that I didn't attempt to measure it. If I did, I'd need a calendar rather than a stopwatch!

COLOR SYSTEMS

Color change speed – adjacent	0.3 sec
Color change speed – worst case	0.7 sec
Color mix speed – worst case	0.5 sec

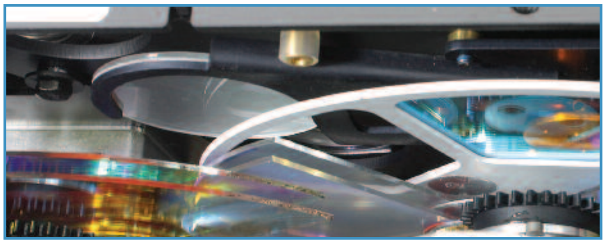

Figure 6: Homogenizing filter.

Lastly on this side of the first module is a homogenizing filter (DTS calls it a "soften filter"), which flattens the field and improves the color mix homogeneity at the loss of about 17% output. You can see it just behind the wheel on the left in Figure 4 and better in Figure 6.

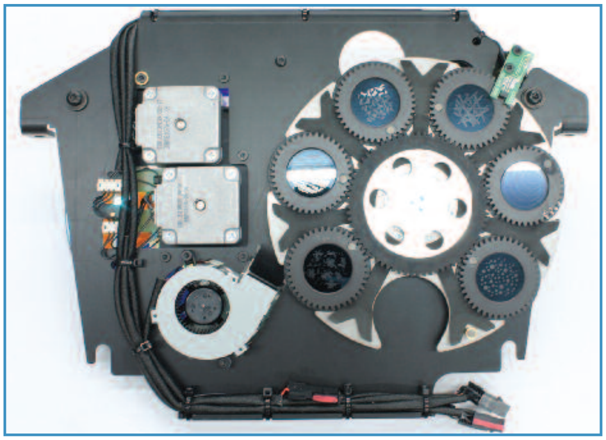

Figure 7: Gobo wheel.

Gobo

The opposite side of this first module contains the single rotating gobo wheel and its fan (Figure 7). This has six rotating, indexing gobos plus an open hole. The gobos are mounted in snap-in cartridges to make for a quick, easy change. Figure 8 shows one of the rotating gobos.

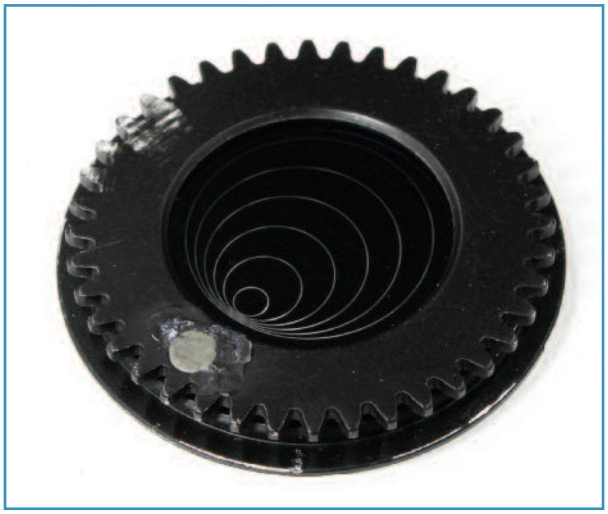

Figure 8: Gobo.

ROTATING GOBO

Gobo change speed – adjacent	0.3 sec
Gobo change speed – worst case	0.6 sec
Maximum gobo spin speed	0.43 sec/rev = 139 rpm
Minimum gobo spin speed	656 sec/rev = 0.09 rpm
Maximum wheel spin speed	2.72 sec/rev = 22 rpm
Minimum wheel spin speed	273 sec/rev = 0.2 rpm

Positioning and rotation of the gobo wheel was quick and smooth, with a good range of rotation speeds and almost no bounce when changing direction. Both color and gobo wheels use a quick-path algorithm to minimize change times.

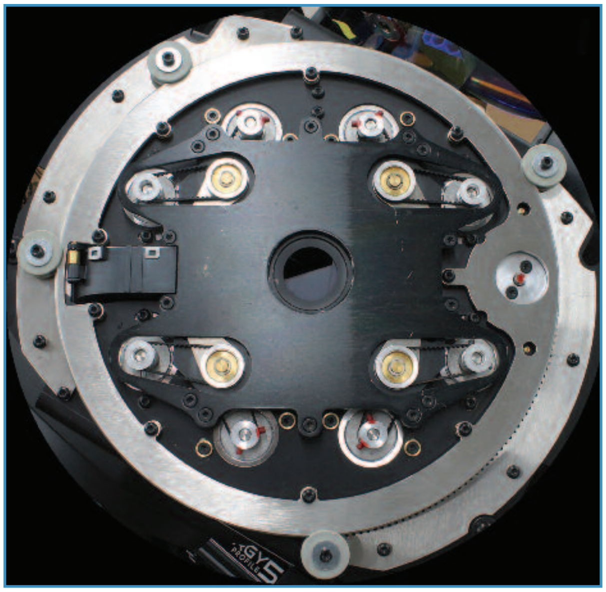

Figure 9: Framing shutters.

Framing

The second module contains just the framing system. Here is another place where we see a different path taken by DTS. Typical framing systems today use systems of levers and bars to move the blades, but DTS instead uses pulleys and belts (Figure 9). The motion they get with this system is very different—not good, not bad, just different. On the plus side, it's possible to close every blade fully across the beam, which is something not many systems can do. However, you can only do this when the blade is perpendicular to the axis. As soon as you angle the blade at all, the range of movement reduces significantly and, at a full angle

Figure 10: Maximum frame angle across center.

of about 20°, the blade cannot be moved out of the far half of the field. Figure 10 shows the maximum angle that can be achieved across the center of the beam. Note that the blade cannot move out when at this angle, only further in. To remove the blade back out, the angle must be reduced. The Synergy 5 Profile framing system has a very different range of motion than other, competitive, systems. Make sure you try it out to see if it does what you need, as the motion isn't intuitive. Finally, the entire framing mechanism can also be rotated by +/-45°.

I measured a maximum of 0.5 seconds to move a blade into position across the beam. This is a quick movement for framing.

Prism and frost systems

The Synergy 5 Profile has two prisms and a frost flag. The frost flag is attached to the back of the second lens group and travels with it. The prisms, on the other hand, are fixed to the chassis, and the DMX protocol gives you the option to either insert them between the two moving lens groups or in front of the second group, just behind the output lens. This gives you two options for the spread produced by the prism. You don't get full control over zoom when the prisms are used, but you do get these two choices. One or both prisms can be inserted and rotated separately or together, so as to give a combined effect. As supplied, the first prism is a 24-facet circular prism arranged as an outer ring of 16 facets and an inner ring of eight facets, while the second prism is a linear six facet. Figure 11 shows both prisms.

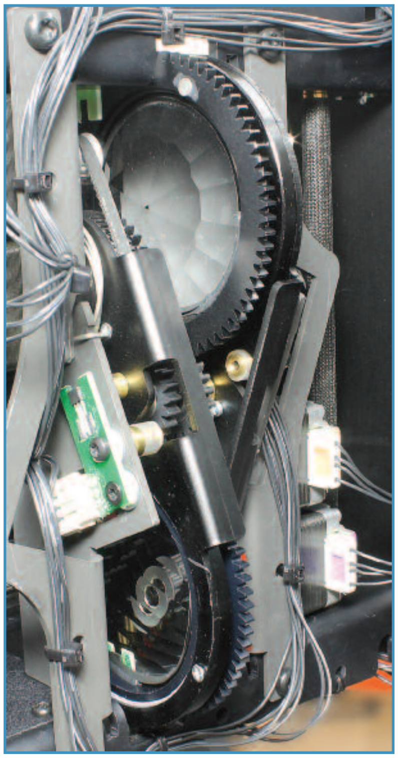

Figure 11: Prisms.

Either prism can be inserted or removed in 1.8 seconds. It takes a while, as the lenses have to move out of the way first. Once in place, they can be rotated at speeds varying from 336 sec/rev (0.18rpm) up to 0.42 sec/rev (143rpm). DTS provides various macros to control these prisms, both

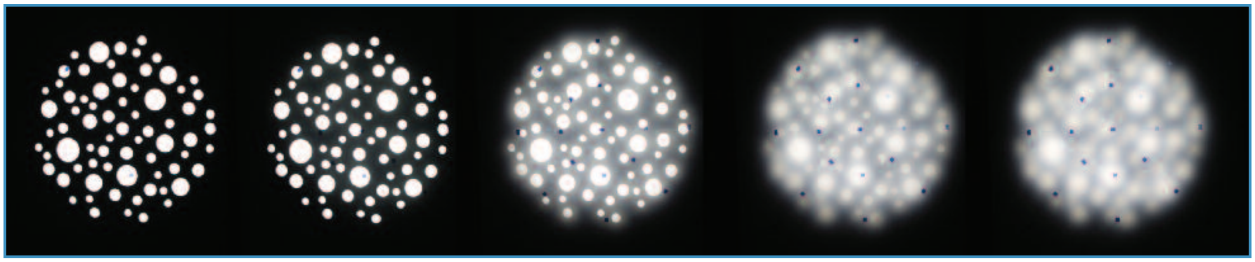

Figure 12: Frost effect.

on their own and in conjunction with the gobo wheel and color mixing to produce a range of dynamic effects similar to those you might see with an animation wheel.

Frost is a single flag with a serrated edge that can be inserted across the beam. As is often the case with these systems when partially inserted, the effect is that of a contrast reducer, not a frost. It acts as a true frost with softened edges only when fully inserted. Figure 12 shows the effect on a sharply focused gobo image as the flag is inserted.

Lenses and output

This is a place where DTS is more conventional and the Synergy 5 uses the typical three-lens group zoom with the front group fixed as the output lens and the others moving to provide zoom and focus control. Zoom took 0.7 seconds to run from maximum to minimum while focus took 0.4 seconds from end to end (Figure 13). These lens movements are very quick and would help using zoom as an effect in its own right.

I measured the output of the Synergy 5 Profile when on open aperture with no homogenizing or CRI filters at 12,000 lumens at 39.6° at the wide-angle end of zoom, ramping down to 10,200 lumens at the narrow angle of 7.2°. The field flatness remained fairly constant as the zoom angle changed and can be seen in the beam profiles shown in Figures 14 and 15. As I always do, these measurements were taken after running the unit at full power for at least 30 minutes to account for any warm-up droop. Droop on the Synergy was fairly low: Over the first ten minutes after turning on at full power, the output dropped by 8%.

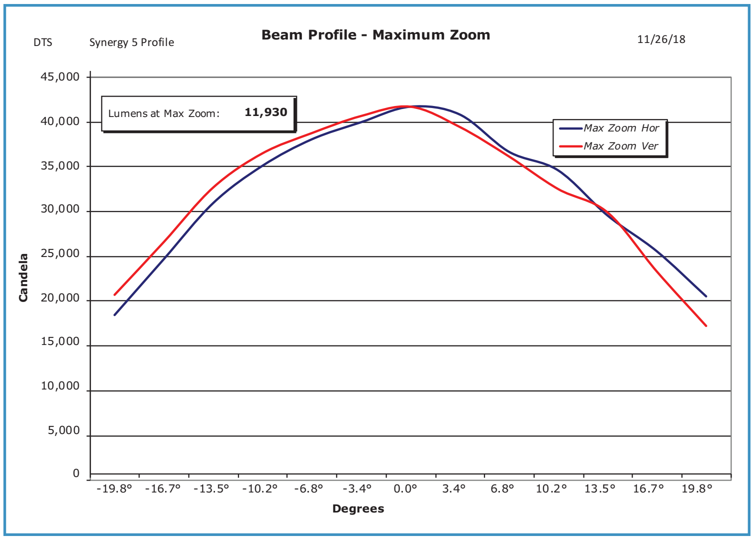

Figure 14: Maximum zoom.

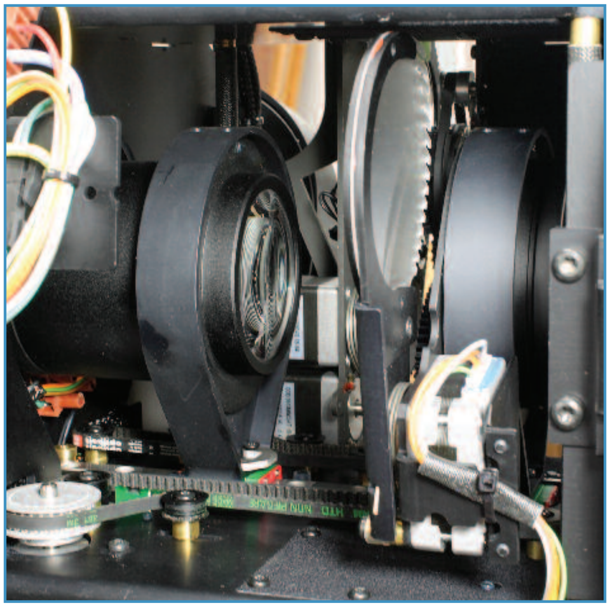

Figure 13: Lenses and frost.

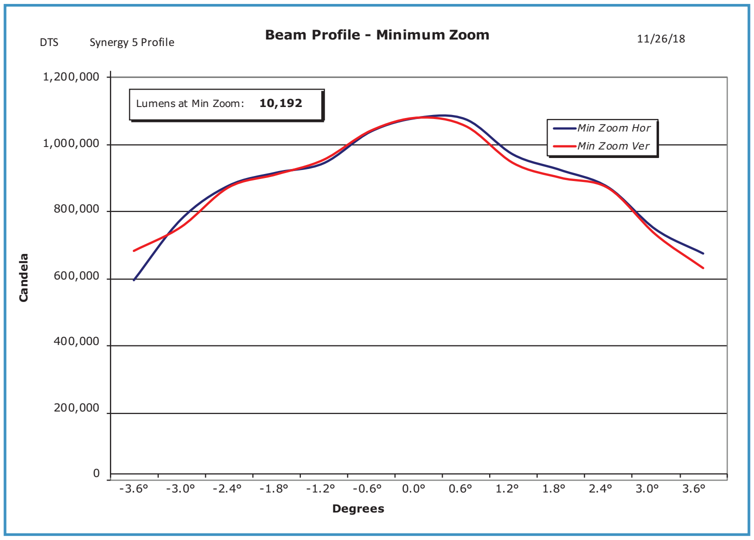

Figure 15: Minimum zoom.

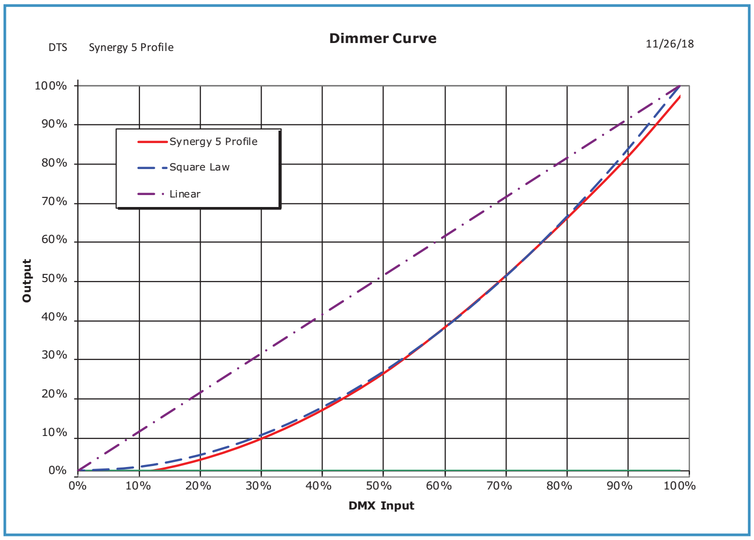

Figure 16: Dimmer curve.

Dimming was smooth and followed a default square law well, with no jerkiness and no artifacts at low dim levels (Figure 16). I measured the standard PWM rate at 610Hz; however, you can vary the PWM rate up to a measured 20kHz through a DMX control channel. Electronic strobe of the LEDs is variable up to a measured 22Hz.

Pan and tilt

The Synergy 5 Profile has 540° of pan and 242° of tilt movement. I measured pan speed over the full travel at 3.5 seconds and two seconds for 180°. In tilt, the figures were 2.1 seconds for the full 242° and 1.9 seconds for 180°.

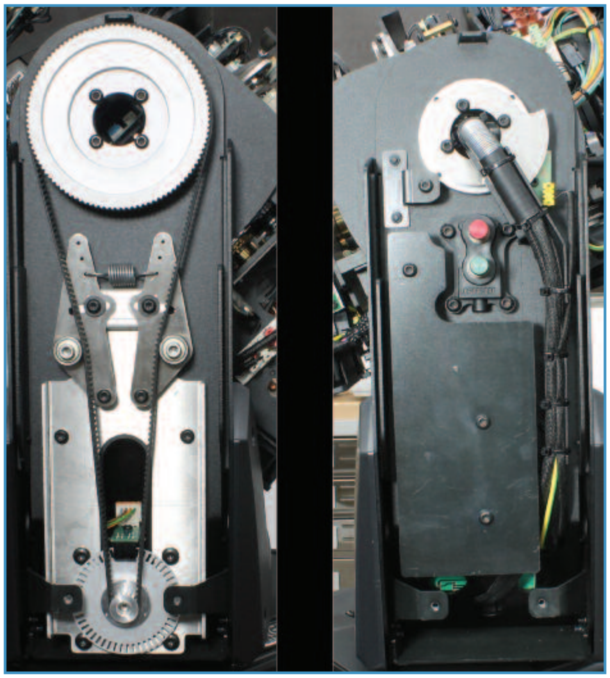

Figure 17: Yoke arms.

Movement on both axes was very smooth, with minimal hysteresis. Pan exhibited 0.03° of hysteresis, which is 0.1" at a throw of 20'. Tilt was a little more, at 0.07°, 0.3" at 20'. Figure 17 shows both yoke arms with the tilt motor system, encoder wheel, and tilt lock system visible.

Noise

Unusually, the color wheels were the noisiest function, although only just. I'd say the Synergy 5 Profile is quieter than average. All readings were taken in the default silent mode for fans. The Synergy also offers standard and auto fan modes. I saw no real difference in light output between these modes in my test conditions; you would likely see more drop-off in silent mode if the ambient temperature were high. In standard mode, the stationary noise level increased to 45.8dBA at 1m.

SOUND LEVELS

Ambient	<35dBA at 1m
Stationary	43.7dBA at 1m
Homing/Initialization	57.3dBA at 1m
Pan	44.0dBA at 1m
Tilt	44.3dBA at 1m
Color	46.8dBA at 1m
Zoom	45.5dBA at 1m
Focus	45.1dBA at 1m
Frost	43.7dBA at 1m
Gobo	44.1dBA at 1m
Gobo Rotate	43.8dBA at 1m
Prism	44.5dBA at 1m
Framing Shutters	43.8dBA at 1m
Framing Rotate	44.4dBA at 1m

Homing/initialization time

I measured the time for a full initialization of the Synergy 5 Profile, from either power up or a DMX reset command, to be 66 seconds. Reset is well-behaved in that the LEDs are dimmed out before reset starts and fade up again after final positioning.

Power, electronics, control, and construction

Running on a 115V 60Hz supply, the Synergy 5 Profile consumed 3.7A when running at full output and allowed to warm up. This equates to 439W with a power factor of 0.99. The quiescent load, with the unit powered up but no LEDs on, was 0.57A, 65W, power factor 0.93.

The Synergy 5 Profile drive electronics are distributed throughout the unit with boards in the yoke arm and head. The head itself has two modules and is very tightly packed. The two modules were very easy to remove for cleaning or maintenance. Power supplies for both electronics and lamp are in the top box.

Figures 18 and 19 show the monochrome graphical LCD display and four-button control menu system and the set of connectors. The menu system is comprehensive and provides access to the usual fixture setup and maintenance functions. The Synergy 5 Profile uses a True1 connector for power in and provides both three-pin and five-pin XLR connectors for DMX512 data along with RJ45 in for sACN and Art-Net. I tested and confirmed the RDM functionality using a City Theatrical DMXcat and was able to change system parameters, control the unit, and access temperature data and other parameters.

I already mentioned the prism macro channel, but the Synergy 5 Profile also offers other macro channels—in particular for the framing system and a gel color emulation channel for the color mixing.

Conclusion

Well, that's about it for the DTS Synergy 5 Profile. As I said at the start, it has some differences from its competition and I leave it to you to determine if they suit you or not. Most noticeably different is the framing system; it definitely has some plus points as well as some oddities. You would definitely need to try it out! As always, I've given you some facts and figures, but it's your decision as to whether or not the D.T.S. Synergy 5 Profile will work for you.

Figure 18: Display.

Figure 19: Connections.

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