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SGM Giotto Synthesis

by Mike Wood


Fig. 1


Fig. 2: Power supplies


Fig. 3: Lamp and retainer


Fig. 4: Head with modules

We are looking at a new offering from a supplier who has been around a long time but whose name isn't perhaps as well known as it should be. The company is SGM, from Italy, and the product is their new Giotto Synthesis.

SGM has been in the lighting business for over 25 years, manufacturing moving lights for much of that time. The Synthesis is the latest incarnation of the "Giotto" line of fixtures; the Giotto 400 is possibly the most well-known of these, but I would hazard a guess that the Synthesis will soon take that crown. Synthesis is conventional in some of its design but has a number of novel and interesting features that bear further investigation. The general standard of construction and quality in this sector of the market is so high that you have to do something special to stand out and the Synthesis has some tricks up its sleeve that attempt to do just that.

This review, as usual, will work through the fixture from lamp to output lens, presenting the data as measured. The specific fixture was a standard unit supplied by Techni-Lux Inc., the U.S. distributor for SGM (Fig 1: Unit as tested). As always, I measure what I see with no tweaks allowed—each measurement is taken a number of times and an average value reported to try and minimize error.

Synthesis is a universal-voltage fixture fitted with auto-sensing supplies rated from 90-245V at 50/60Hz for both the electronics and the lamp (Fig 2: Power supplies.) For these tests, the fixture was run at 118V, 60Hz. The lamp power supply and ignitor provide hot-restrike capabilities for the unit, as evidenced by the large size of the lamp feeder cables.

Lamp

The Synthesis uses a single-ended 700W Osram HTI 700 SE lamp. It is available in both 5,600K and 7,000K versions, with the 5,600K lamp being used for these tests (Fig 3: Lamp and retainer). Lamp changing is straightforward; the rear lamp adjustment plate removes completely by loosening four captive screws; the entire assembly pulls out for access to the lamp. This should be no problem when hanging in a truss.

Light collection and heat management is conventional, using a faceted elliptical cold mirror reflector and hot mirror assembly with associated local cooling fans in a sealed "hot" compartment. All of this performed well; temperatures everywhere in the unit were very low and the lamp showed none of the tell-tale signs of over temperature running.The maximum temperature recorded on the outside of the fixture was 84°C on the rear of the lamp plate.

Modules

The Synthesis' method of construction deserves a mention, as SGM has clearly put a lot of work into this aspect of the design.The entire optical train, with its associated electronics, is mounted on three individually removable modules roughly breaking down as CMYK, Imaging, and Effects/Optics. These are extremely easy to remove via a single electrical connection and either two or four captive quarter turn fasteners. A number of manufacturers have claimed that their fixtures are modular—but this is the first one I've seen where that is completely and literally true. If you take all three modules out—the work of

Fig. 5: Color and dimmer module

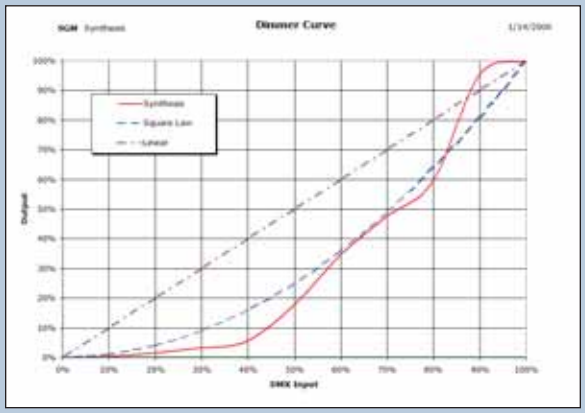

Fig. 6: Dimmer curve

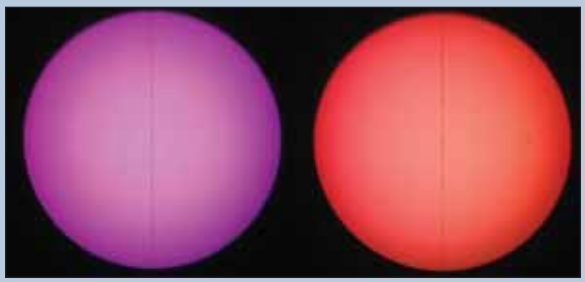

Fig. 7: Lavender and peach color mixing

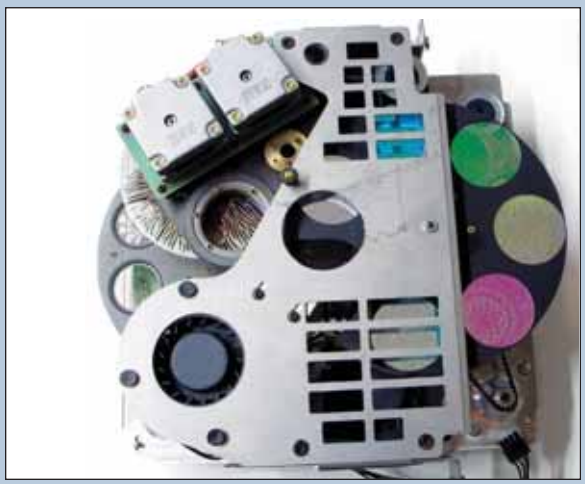

Fig. 8: Image module

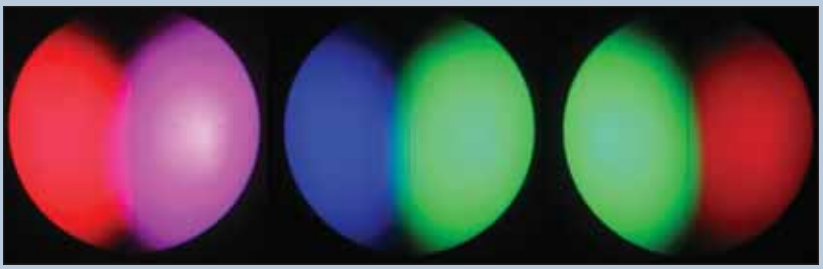

Fig. 9: Half colors

no more than three minutes—then there is pretty much nothing left in the head, just a support chassis, some wiring, and the lamp. Anyone servicing this fixture is going to like this (Fig 4: Head with modules).

I'm going to break the rest of this review down by these modules, detailing the functions that are present in each one along with their associated measurements and parameters.

Module 1 - CMYK

(Fig. 5: Color and dimmer module) The first module contains six pretty-much-identical pairs of glass curtain flags—one pair each of cyan, magenta, yellow, and CTO dichroics plus a coated and etched glass dimmer, and a frosted glass pair used for homogenization. Figure 5 shows the module with the homogenization glass visible in the aperture. Each of these six sets operates like a pair of curtains, with a motor-and-belt assembly moving the appropriate pairs of filters into the beam from opposite sides. The CMY, CTO, and dimmer filters have graded etching in the coatings to smooth out any visible transitions.

Dimmer

The dimmer flags are made like big glass gobos; in each case, a gradient pattern is etched into an aluminum coating on the glass with homogenization flags to help smooth everything out. Although they look like frost flags, they are placed before the gobos in the optical train and smooth the dimmer curve rather than diffusing the image. The resultant dimmer is excellent, with pretty much no strange aberrations or distortions visible in the beam.

The dimmer curve is good and is relatively close to a standard square law curve (Fig. 6: Dimmer curve). You can see some slight steps on the dim curve, which I believe are where the system transitions from one dimming mode to another. First, the edges of the dimming glass come in, then the etched gradient, and finally the homogenization glass and the full overlap of the two "curtains." In practice, these steps are not really visible in the output and the effect is one of smooth, continuous dimming over pretty much the whole range. SGM has clearly put a lot of effort into this excellent dimming system. The system also offers the increasingly common feature of reducing the lamp power after the system goes into blackout to reduce heat buildup. This system is automatic and invisible to the user with the fixture power reducing down to 630W from the full 980W five seconds after blackout. Recovery from this mode is instantaneous as soon as the dimmer is opened again.

Color mixing

The unit's color mixing is not quite as smooth as the dimmer—clearly, SGM doesn't want to lose light output by bringing in the homogenization filter when mixing colors—but is still very acceptable, with only minor color fringing visible in the pastels. (Fig. 7: Lavender and peach color mixing). The flags are perhaps a little slow in their movement, with a change from white to a fully saturated color taking 1.4 seconds.

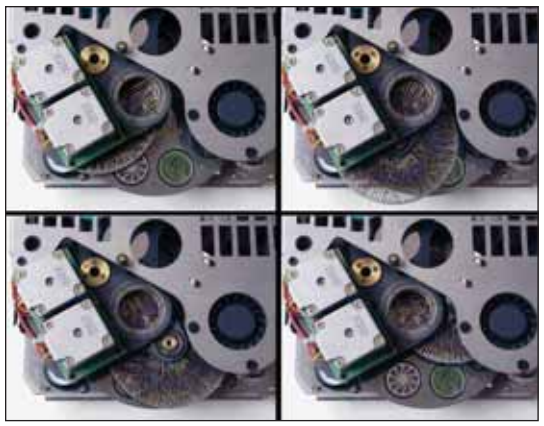

Fig. 10: Animation wheel motion

Fig. 11: Animation wheel output

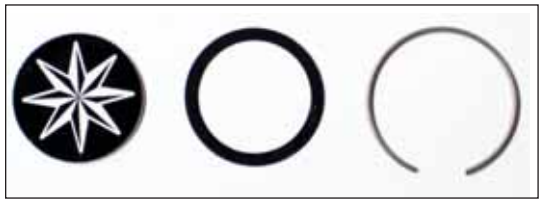

Fig. 12: Gobo

Color mixing

Color	Cyan	Magenta	Yellow	Red	Green	Blue
Transmission	46%	12%	51%	5%	9%	6%

Color change speed – end to end	1.4 sec

Module 2 - Imaging

The next module (Fig. 8: Image module) mostly contains imaging effects—gobo wheels, iris, and the new animation wheel—however, it also has the fixed color wheel, which is the next item in the optical train. (Note: it's usually best to have all color systems before the imaging components, such as gobos, to avoid the color system introducing any aberrations in the final image.)

Color wheel

The unit has a conventional fixed color wheel with six colors plus an open hole. The dichroic filters are sandwiched between two metal wheels and are easily changed by slightly separating the two discs and sliding the colors out. The filters are close enough together to provide reasonable half-color effects (Fig. 9: Half colors).

Color Wheel

Color	Red	Green	Blue	Pink	Amber	UV
Transmission	2%	40%	9%	35%	17%	0.1%

Transition speeds are reasonable—it's a fairly large wheel, not blisteringly fast, but acceptable. This helps make up for the slightly sluggish color mixing. The wheel provides quick-path operation and a good range of rotation "rainbow" effects.

Color Wheel

Color change speed – adjacent	0.3 sec
Color change speed – worst case	0.75 sec (quick-path enabled)
Maximum wheel spin speed	0.9 sec/rev = 64 rpm
Minimum wheel spin speed	409 sec/rev = 0.15 rpm

Animation wheel

We've seen a number of animation or graphics wheels recently in moving lights, but with Synthesis, SGM has taken a slightly different approach to the concept. As with others, the Synthesis system allows the insertion into the beam of a large-diameter gobo or effect. Only a portion of that gobo is visible in the aperture, so the effect, as the wheel is rotated, is of a somewhat linear motion across the beam. What's different about Synthesis is that the center of rotation of this large gobo may be set anywhere in a full 360° circle, so the linear motion can be in any direction. The mechanism SGM has designed to achieve this is very flexible, with the user being given full freedom to index the rotation axis and then to index or spin the wheel around that axis. However, the space needed to give us that freedom comes with a consequent restriction in the size of the wheel. Thus it is more apparent than with other systems that we are seeing a large diameter rotation and not true linear motion. Figure 10 shows the animation wheel in four different positions and Figure 11 shows the resultant output in the projected beam. As is so often the case with engineering design, an improvement in one area loses you something in another and you strive to achieve the best compromise (Fig 10: Animation wheel motion; Fig 11: Animation wheel output).

Measured operation times were 1.3 seconds to insert or remove the animation wheel and, once inserted, the wheel has a range of spin speeds selectable from

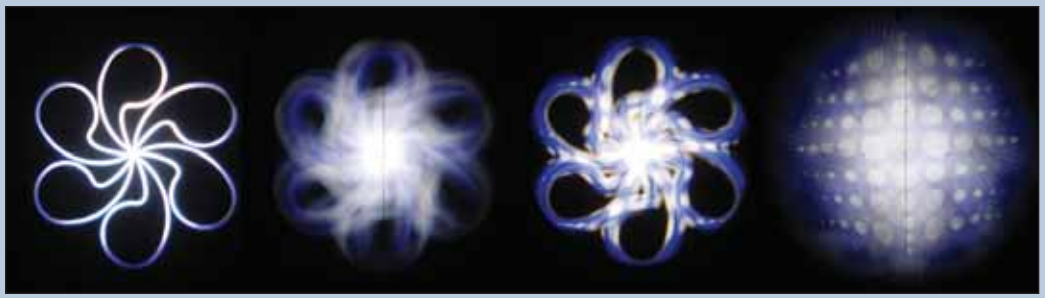

Fig. 13: Morphing effects

Fig. 14: Effects and optics module

0.28-30rpm.

Rotating gobo wheels

The Synthesis has two, essentially identical, rotating gobo/effects wheels. Each has eight changeable patterns plus an open position and each uses exactly the same mechanism and construction. Gobo 1 is supplied with eight patterns while Gobo 2 comes with five patterns and three break-up glasses. All gobos are changeable through a "snap-in" retainer (Fig. 12: Gobo). Remove the module first and they are fairly easy to change, although you need to make sure that you don't snap them out too vigorously and watch the retainer fly across the workshop, as I did the first time I tried it. A little practice soon makes perfect and I eventually found the retainer.

Rotating Gobos (Gobo 1 and Gobo 2)

Gobo change time, adjacent apertures	0.3 sec
Gobo change time, max (Gobo 0 to 4)	1.1 sec (quick path)
Maximum gobo rotate speed	1.2 sec/rev = 50 rpm
Minimum gobo rotate speed	1020 sec/rev = 0.1 rpm
Maximum wheel spin speed	6 sec/rev = 10 rpm
Minimum wheel spin speed	26 sec/rev = 2.3 rpm

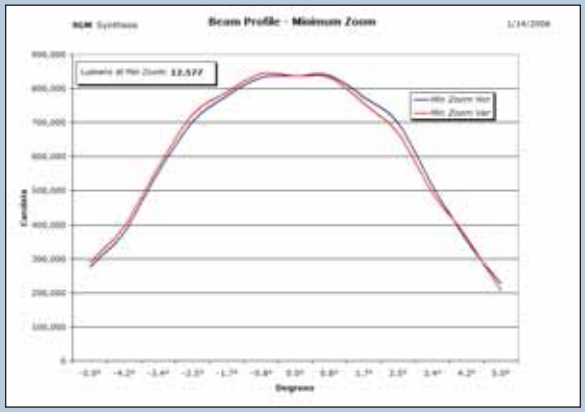

Fig. 15: Output at narrow angle

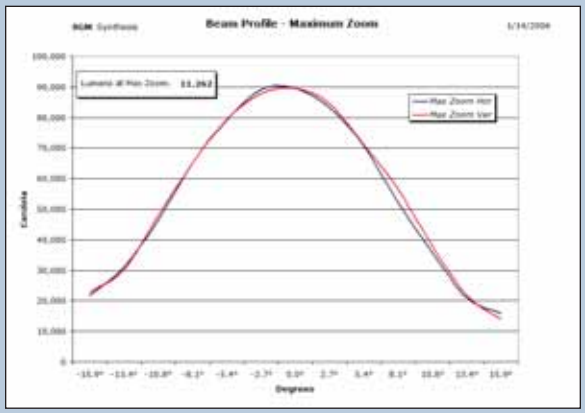

Fig. 16: Output at wide angle

Indexing accuracy was reasonable, with a measured hysteresis error of around 0.28° or approximately 1.2" at a 20' throw. This hysteresis was visible as a slight “jump” in the image when reversing the direction of gobo rotation, as the gobo moves from one side of its bearing to the other.

A couple of operational points bear mention. First, when you change from one gobo to another, the Synthesis software does not synchronize the wheel and gobo-rotate motors. This means that gobos “roll” into the gate rather than "slide." I know some designers like the look of this and some don't; either way it's something to be aware of. Second, both wheels offer a “shake” mode, which uses wheel rotate rather than the more normal gobo rotate. The effect is of a side-to-side shake rather than a rotational shimmy.

The optics allow for good overlaying and morphing between the two gobo wheels—Figure 13 shows examples of the results you can achieve (Fig 13: Morphing effects).

Iris

The final effect in this module is the iris. This reduces the beam size to 24% of the full size when fully closed, i.e., 2.5° when at minimum beam angle and 7.8° when at maximum beam angle. To move from fully open to fully closed takes 0.2 seconds.

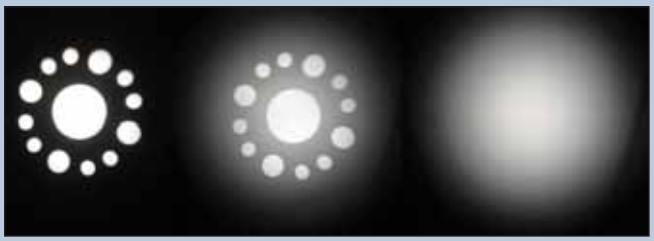

Fig. 17: Variable Frost

Fig. 18: Prism

Module 3 - Effects/optics

The final module (Fig. 14: Effects and optics module) contains the zoom and focus lenses along with prism, variable frost effects, and the strobe flags.

Lenses and output

Synthesis uses a three-group optical system, with other components interspersed between the lenses. First in the optical train is the movable focus lens group, followed by the frost, strobe, and prism systems. Finally, you have the movable zoom lens group and the fixed objective group. All three lens groups use two lens elements and appear to be configured as air-spaced achromatic doublets. Focus and objective are positive lenses while zoom is a negative lens.

Optical performance was good throughout the zoom range and there was almost no visible chromatic and spherical aberration. It's very pleasing to see that lens quality has universally seen major improvement in moving lights over the last few years. Focus speed end to end was one second and zooming from full narrow to full wide took 1.5 seconds. Interestingly, SGM offers a “fine focus” channel, allowing you 16-bit control of the focus channel—a good idea in principle, but I have to admit I could see no visible effect of changing this channel! The only other issue I saw was a slight focus difference between the top and bottom of the gobo, suggesting that the gobo wheel was not completely perpendicular to the optical axis. This effect was very minor and likely not visible in normal use.

The optics produced a measured field angle range of 10°-32° or just over 3:1. Output was very respectable for a 700W system with 12,577 lumens measured at narrow angle and 11,262 lumens at wide. (Fig. 15: Output at narrow angle; Fig. 16: Output at wide angle) This compares extremely well with competitive 700W units.

Frost

As mentioned above, the frost, strobe, and prism systems are located in between the focus and zoom lenses. First up is the variable frost. This position in between the lenses really works well for the frost; output from the twin flags was smooth and clean all the way from zero to full frost (Fig: 17: Variable frost). The amount of time to open or close the flags was 0.3 seconds. You might know from earlier reviews that I'm a big fan of variable frost if it's done well, and Synthesis does it well.

Strobe

Nothing unusual here—a good, solid, twin-flag strobe system with a measured range of 1-10Hz, its position in the optical train makes for a particularly effective strobe with no evidence of “irising.” One slight oddity is that the strobe is not fully variable but instead has 14 fixed speeds over the range. I don't think this is a problem and might make it easier to synchronize strobes on separate units. As to other features, you can couple the strobe in with the gobo or color wheel so that the fixture automatically blacks out when changing patterns or colors, and finally the unit has an internal microphone allowing control of the strobe by the bass beat of music.

Prism/Beam expander

Synthesis offers two effects flags, which can be inserted at this point. Although they are on separate arms they share the same physical space (and DMX channel) so only one can be inserted at a time. The first of these is a single, four-facet, rotating prism, which offers reasonable image separation and good focus (Fig. 18: Prism). The supplied prism can be changed if you need another style.

Effects Flags

Prism change time	0.4 sec
Beam expander insertion time	0.4 sec
Maximum prism spin speed	0.4 sec/rev = 150 rpm
Minimum prism spin speed	164 sec/rev = 0.37 rpm

The effect on the other flag is described by SGM as a "beam expander" and consists of a single frosted lens. To my mind, calling this a beam expander is slightly misleading. It does expand the beam, but it frosts it out completely, so no imaging is possible with it inserted. For occasional use of Synthesis as a wash fixture, this could be useful; it produces a similar effect to frosting out the open beam, but slightly wider. It also has the same significant output reduction as frost so, again, it makes a great occasional effect but is no substitute for a real wash light. (Note: SGM informed me that other optional lenses will be supplied with the unit, which the user may install on this flag—this will include a narrow-angle lens and a fresnel style lens. I was not able to test these lenses at this time.)

Pan and Tilt

Pan and tilt had smooth movement at most speeds (see below) with a range of 535° on pan and 270° on tilt. Movement speed was acceptable with a full-range 535° move taking 5.75 seconds and a 180° move taking 3.2 seconds. The comparable figures for tilt are 3.5 seconds for the full 270° and 3.1 seconds for a 180° move.

Positional accuracy and hysteresis were excellent, at 0.14° for pan and 0.07° for tilt. That equates to 0.6" and 0.3" at a 20' throw. There is some settling bounce on stopping, but it is better than many units.

I did, however, see a problem with an unpleasant jerky motion at very slow speeds (one minute or slower moves). This was very noticeable and was present with and without using the MSpeed channel. It looks to me as if the motor is going in and out of its “park” state between each micro step in the middle of the move, creating a noticeable jerk each time. SGM may be able to address this with a firmware upgrade.

Both pan and tilt have the now-customary locks for transit. A nice touch is that these are fitted with solenoids and automatically disengage as soon as power is applied. This means no cursing that you have to climb the truss to remove locks (Fig. 19: Tilt lock and solenoid).

Noise

Synthesis is, on the whole, a very quiet fixture. Pan has a resonance at top speed, the prism has a slight “clunk” as it comes in, and the color-

mix system is noisier than you would expect. These can all be pretty much controlled in critical situations by careful choice of speeds.

Sound Levels in Normal Mode

Ambient	<35 dBA
Stationary	47 dBA at 1m
Homing/Initialization	59 dBA at 1m
Pan	56 dBA at 1m
Tilt	49 dBA at 1m
Color	54 dBA at 1m
Animation Wheel	48 dBA at 1m
Prisms / Effects	49 dBA at 1m
Gobo rotate	47 dBA at 1m
Zoom	49 dBA at 1m
Focus	48 dBA at 1m
Strobe	50 dBA at 1m

Electrical parameters

Power consumption at 118V, 60Hz

	Current, RMS	Power, W	Power Factor
Initializing	9.5A	1,120W	0.97
Normal running – stationary	8.3A	980W	0.98
Normal running – all moving	9.0A	1,070W	0.98

Homing/Initialization time

The results: 42 seconds from a cold start and 40 seconds when fixture is powered up and reset command sent

Electronics and control

Synthesis has many features in its electronics, DMX512 protocol, and menuing system—everything you would expect—plus a few more, I suspect. Noteworthy is the provision of an internal rechargeable battery, which allows the user to set menu parameters without powering up the fixture. This is the second fixture we've seen this feature in and I suspect it's not the last.

The unit offers a number of ways to control it: DMX512, of course, but there is also an RJ45 connector ready for ACN and SGM says that the DMX512 port will support RDM as soon as it is released. Finally, and most unusually, Synthesis has built-in wireless DMX. As I'm sure you know, there is no standard for wireless DMX, with every manufacturer using different and incompatible systems. I understand from Techni-Lux that Synthesis uses the system manufactured by Wireless Solutions in Sweden, which runs on the 2.4GHz frequency band and uses its own proprietary protocol. This is an FHSS system as compared with the DSSS system used in 802.11b “Wi-Fi” and, as such, should offer better noise immunity.

I didn't test the wireless system, partly because I didn't have a transmitter but mainly because I don't think my test would be adequate and could be misleading. I've tested the Wireless Solutions

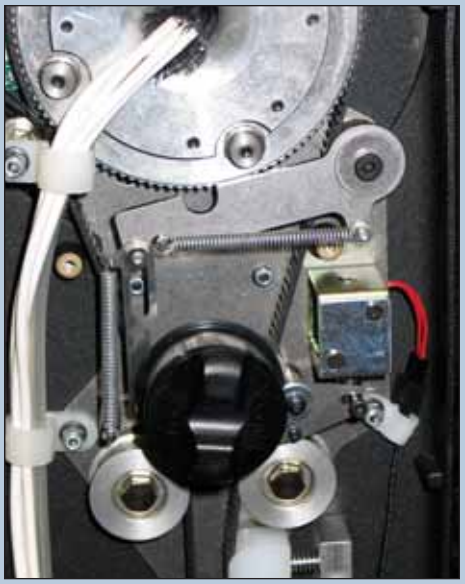

Fig. 19: Tilt lock and solenoid

system before and found it to work as well as any, with all the pros and cons of any wireless system. However, a lab bench test is not appropriate for a wireless link; just because it works in my shop at my location doesn't mean it would work for you at yours. If this feature is important for your installation, then I recommend you test this yourself in the real rig in the real building with all the other interfering radio sources around to be sure that it works as you need it. In this case, I'm confident that your mileage will vary. Moving lights can be particularly susceptible to glitches, dropouts, or missing data in the DMX 512 stream.

As I said at the beginning of this review, Synthesis is SGM's latest offering in the well-known Giotto range. Will it take the crown away from the well known Giotto 400? The decision is yours to make. As usual, I leave you to draw your own conclusions and hope this review helps you make that decision.

Mike Wood provides technical and intellectual property consulting services to the entertainment technology industry. He can be contacted at mike@mikewoodconsulting.com.