The GLP impression Spot One

By Mike Wood

Figure 1: Fixture as tested

This is the first appearance in this column of a product from GLP. Well-known in Europe as a manufacturer of automated lighting, GLP has not been so well-known in the US. I can recall seeing my first GLP product, the 360° rotating Patend Light, many years ago at a PLASA Show. It was an impressive debut. Since then, GLP has gone on to manufacture a range of automated lighting products, most of them in more conventional stylings, including the impression Spot One. This will be the first RGB color-mixing automated spot luminaire to be reviewed here, so it was particularly interesting for me to see how it performed. There are already many RGB LED-based wash lights on the market, but making LED optics work with a spot image-projection luminaire is a complex matter, particularly with the small gobo sizes typical of automated units. How does the impression Spot One perform and how does it compare with automated lights using more conventional sources? Hopefully, this review will help provide you with basic data to help you determine if it is likely to be useful to you.

In these reviews, I start at the light source and work my way through to the output lenses, reporting what I see and what I measure as I go. That was the strategy followed here, with all reported results based on the measurement of a single unit sent to me by GLP. (Figure 1) I always state this to make it clear that I don't measure a number of units and average them, although that would be a better technique. Time and logistics don't allow that luxury.

All tests were run with the fixture operating on a nominal 115V 60Hz supply. However, the impression Spot One specification allows operation on supplies rated between 100-240 VAC, 50/60Hz, with automatic voltage selection through the switched mode power supplies.

Light source

As stated above, I start with the light source; however, in the case of the impression Spot One, that's not entirely possible. The Spot One uses an integrated light engine from Appotronics, which is supplied and installed as a "black box" component. Figures 2 and 3 show views from both sides of the light engine. You can see that cooling is the predominant visible feature, with an array of pipes leading heat to a large finned heat sink surrounding the engine. In turn, that heat sink is surmounted by two large cooling fans. We can't really take this component apart to see what's going on inside. The specification for the engine states that it is a 400W RGB LED chipset with a rated lifetime of 20,000 hours. The manufacturer and type of LEDs is not revealed.

However, we do know how the three colors are combined, and this is an interesting aspect of the design that is worth briefly discussing. The three color arrays of LEDs are arranged with green at the rear of the engine, and red and blue on either side, facing inwards towards each other. The three beams are combined into a single integrated output beam through the use of twin crossed dichroic filters, somewhat like the beam splitters used in projectors or video cameras. This system is designed to make the three RGB light sources behave optically as if they were a single light source, with all emitters superimposed on top of each other. Figure 4 is a drawing from Appotronics, which shows what I believe to be the system used here with the crossed dichroics and a fly-

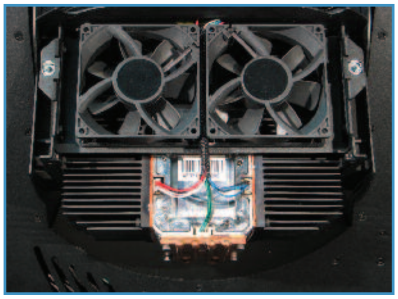

Figure 2: LED source and cooling

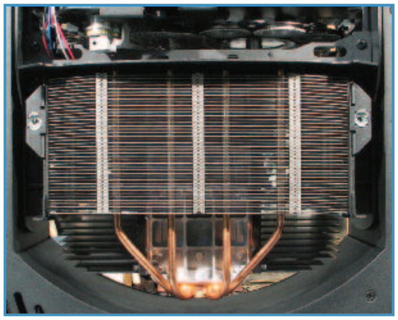

Figure 3: Heat pipes and heat sink

eye output lens. The system certainly seems to work, as there was almost no color fringing in the output beam and no colored shadows.

As far as I can tell, the Appotronics light engine has no user-replaceable components, and is designed to be replaced as a single unit.

Strobe and dimmer

While we are looking at the LED engine, this is perhaps a good place to talk about strobing and dimming. As this is an LED product, both functions are completely electronic. The impression Spot One offers the user a range of dimming curves; I went with the default one as supplied, which is described as an ELog curve. This gave the dimming curve shown in Figure 5. Dimming was smooth and just about stepless until it got down to 5%, when it snapped to zero. That first step—where you go from completely off to on at the lowest possible level—is always a concern with LEDs; you don't have the filament heating to help smooth it out. I also found that there was a slight visible color shift towards the green when dimmed below 30%. The unit has a dedicated strobe channel with the normal varied strobe options, including ramp and snap strobes. I measured a possible strobe range of 1Hz to 24Hz.

Color systems

The impression Spot One is an RGB LED unit, so all colors are achieved by additive color mixing from the three primaries. As well as the raw red, green, and blue control channels, GLP also provides a single color channel, giving quick access to a dozen premixed colors, rainbow effects, and various color temperatures of white. In addition, there is a color temperature channel, which can be overlaid on top of any other color selection to simulate a white source from 3,200K to 7,200K. Figure 6 shows the output spectrum when all three color channels are at full output; this gives the highest output

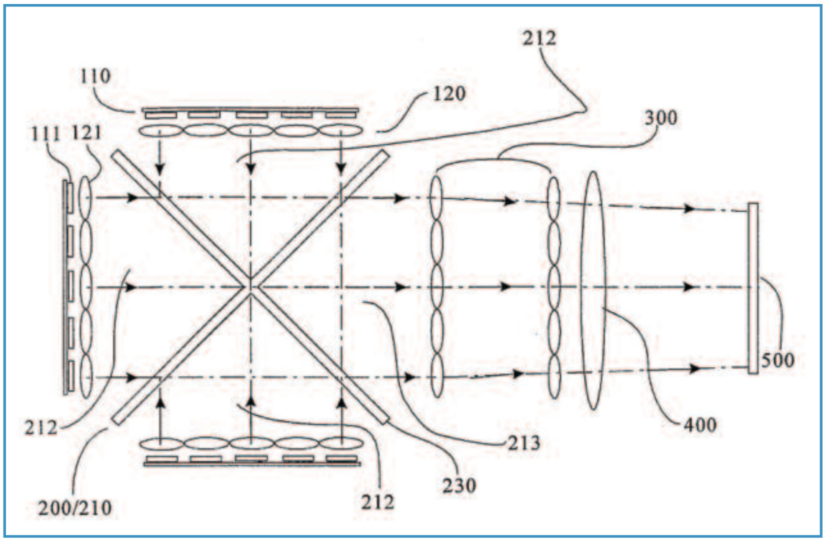

Figure 4: Light engine

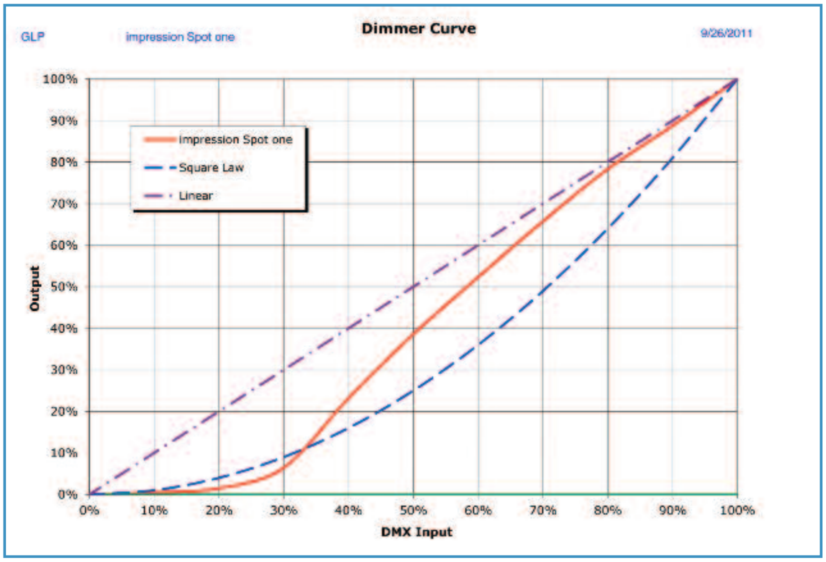

Figure 5: Dimmer curve

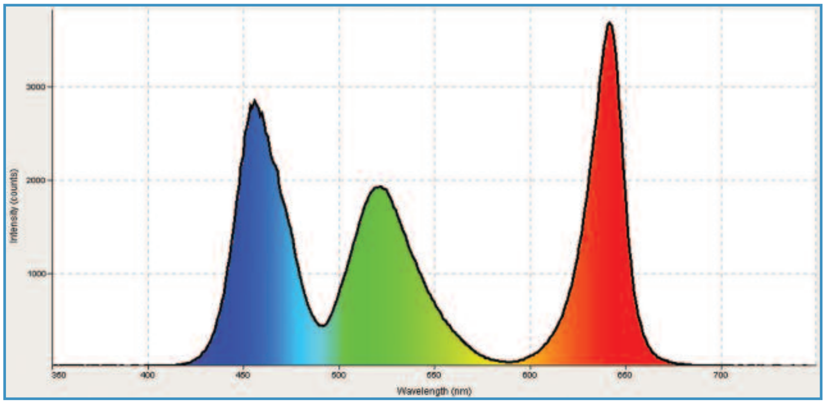

Figure 6: Spectrum - all channels full

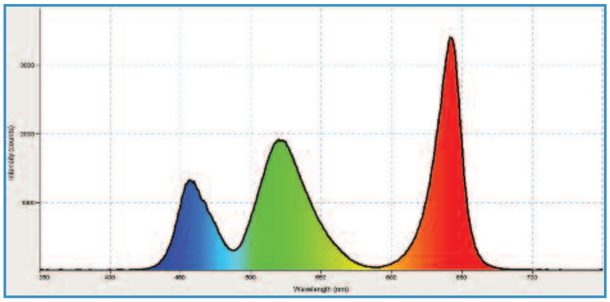

Figure 7: Spectrum - 7,500K

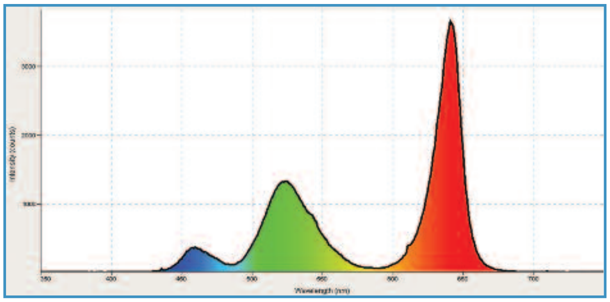

Figure 8: Spectrum - 3,00K

but, as is often the case with RGB units, the output is a little lacking in green, and thus is pinkish rather than white. Figure 7 shows the spectrum when the output mix is adjusted to produce a 7,500K white, and Figure 8 shows it at a 3,200K white. Output was reduced to 75% of the full RGB output when producing a 7,500K white, 68% at 5,600K, and 50% at 3,200K. As with all RGB LED units, the color system is additive, so the output in deeply saturated colors isn't reduced as much as it is with subtractive filters.

COLOR MIXING

Color	Cyan	Magenta	Yellow	Red	Green	Blue
Transmission	56%	39%	55%	19%	36%	19%

The impression Spot One has excellent blue output—often a weak area—and the range of color mixing is as you would expect from an RGB unit. There are very good saturated colors, but it's a little tricky to mix good pastels and near whites. There's nothing unusual or different here. However, the very best thing about RGB LEDs in an automated spot unit is the speed of color change. Instantaneous color snaps—from any color to any other—are what effect LEDs are all about. We've now gotten used to having that in wash units, but it's exciting all over again to see it with tight beams and gobo projection, too.

Effect wheel

Now, back to physical optical devices rather than electronics; first in line, after the light engine, is the effect wheel. This is a now-familiar device using a large, oversized gobo pattern disc that can be moved across the beam at an angle of 45°; when rotated, it produces a linear movement effect across the beam. As you move the wheel in and out of the beam, you can produce movements that are vertical, horizontal, or anywhere in between. There is a single, changeable pattern on the wheel. Figure 9 shows the wheel in two positions as it moves from outside the beam, to producing a vertical movement. It took 0.6 seconds to move the wheel completely across the beam, and, once in place, it can be rotated over a large range of speeds. I measured the fastest rotation speed at around 33rpm, while the slowest was so slow that I couldn't really measure it!

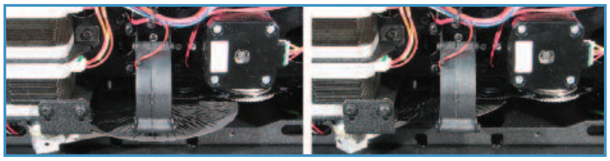

Figure 9: Effects wheel

Gobo wheels

The Spot One has two rotating gobo wheels, which are pretty much identical. Each has seven replaceable patterns plus the open hole, and each uses the same "snap-in" cartridge system to replace patterns. Access to change patterns is very easy; Figure 10 shows a gobo carrier partly removed, while Figure 11 shows the front and rear of the gobo carriers. Both metal and glass gobos are used, as well as breakup glass.

ROTATING GOBO SPEEDS

Gobo change speed – adjacent	0.2 sec
Gobo change speed – worst case	0.6 sec
Maximum gobo spin speed	0.4 sec/rev = 150 rpm
Minimum gobo spin speed	368 sec/rev = 0.16 rpm
Maximum wheel spin speed	0.53 sec/rev = 113 rpm
Minimum wheel spin speed	352 sec/rev = 0.2 rpm

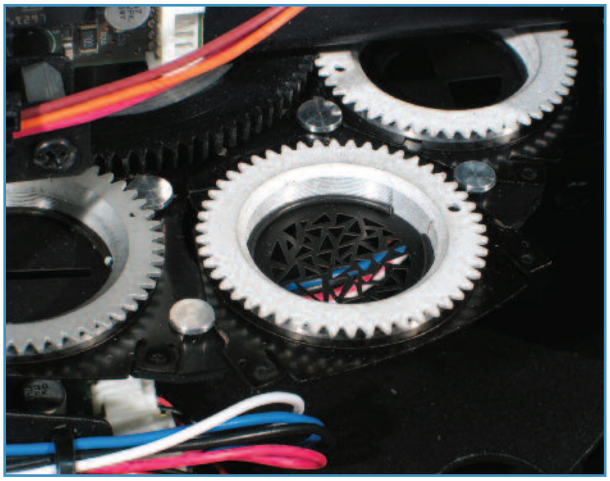

Figure 10: Gobo change

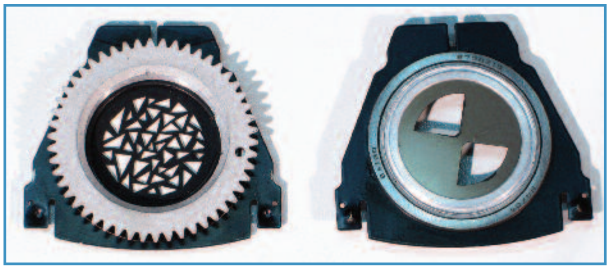

Figure 11: Gobo carriers

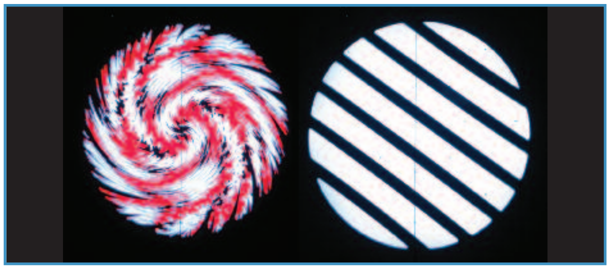

Figure 12: Image quality

The Spot One has an excellent range of rotation speeds for both the individual gobos and the wheel itself, and all moves use quick path algorithms to minimize movement times. Rotation itself is very smooth, with almost imperceptible hysteresis on positioning. I measured the total error at 0.02°, which is equivalent to just 0.1" at a throw of 20'. The focus quality and sharpness of gobo projection is very good; there is a small amount of color fringing, but I think that's from chromatic aberration in the lenses, not from the RGB homogenization. Spherical aberration creating edge-to-center focus difference is visible but minimal. Figure 12 shows two of the projected images. The fly-eye optical system at the output of the light engine creates some interesting patterns around the gobos if you deliberately take them a long way out of focus—I can see someone using that in a show!

Iris

The impression Spot One has a standard iris, mounted immediately after the two gobo wheels. The fully closed iris reduces the aperture size to 16% of its full size, which gives equivalent field angles of 1.6° at minimum zoom and 4.2° at maximum zoom. I measured the opening and closing time at around 0.2 second. The focus difference between the gobos and the iris is quite large, so it isn't possible to crisply iris in on a gobo—one or the other can be in focus, not both.

Lenses and output

The optical system in the Spot One is a standard three-group layout, in which Groups One and Two move to provide zoom and focus, and Group Three is the fixed output lens. The first two lens groups are located immediately after

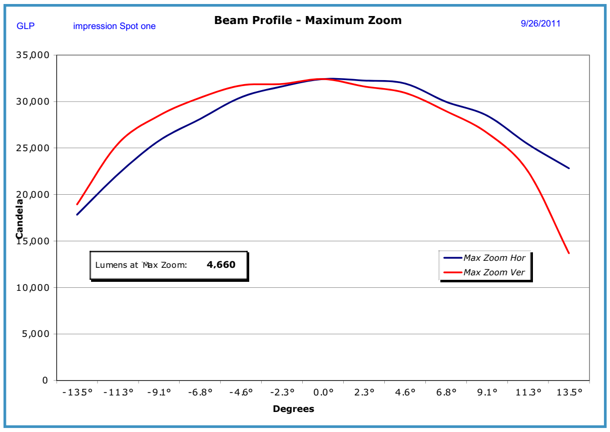

Figure 13: Beam profile maximum zoom

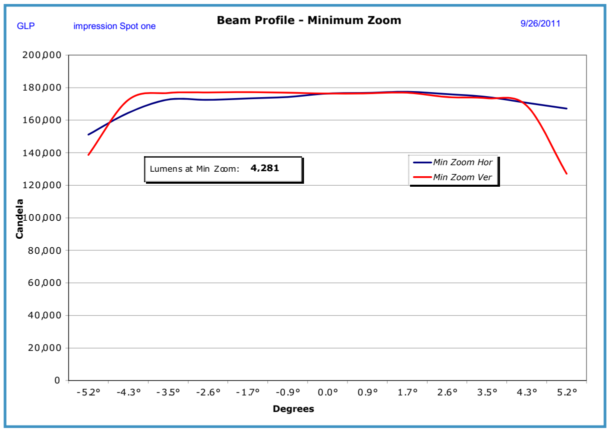

Figure 14: Beam profile minimum zoom

the iris and before the prism. I measured the output from the complete system when running at full power on all three RGB LEDs at 4,660 field lumens at its wide angle position of 27°, dropping slightly to 4,281 lumens at the narrow angle position of 10.4°. (See the color section above for corrections to apply to these figures to get true white output.) The field in all cases was extremely flat, particularly so at the narrow end, which is excellent for image projection and aerials, although perhaps a little too flat for blending between adjacent units (Figures 13 and 14). Figure 15 shows the zoom and focus lenses in operation with their associated belt drives. The time for the zoom to move from narrow to wide was 1.2 seconds, while a full-range focus change took 0.5 second.

Prism

Sandwiched in between lens Groups Two and Three is a removable three-facet prism. The mechanism for moving this into position is a little different from those I've seen before. Instead of sliding in from the side, the entire prism mechanism pivots in from the top of the unit up and over lens Group Two (which has to move out of the way to allow the prism room to

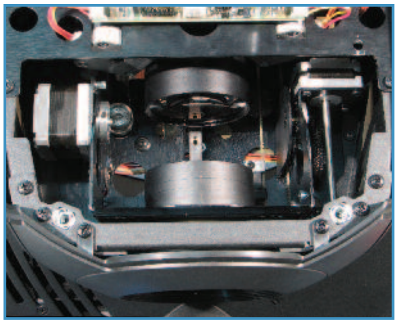

Figure 15: Zoom and focus lenses

maneuver). Figure 16 shows the sequence as the prism drops into position over around 1.1 seconds. Once in place, the prism can be rotated in both directions at speeds ranging from 113rpm down to 0.13rpm. Adjusting the zoom channel allows you to alter the separation of the three images, from separated to about 40% overlapping.

Pan and tilt

The impression Spot One has a pan range of 630° and a tilt range of 270°. A

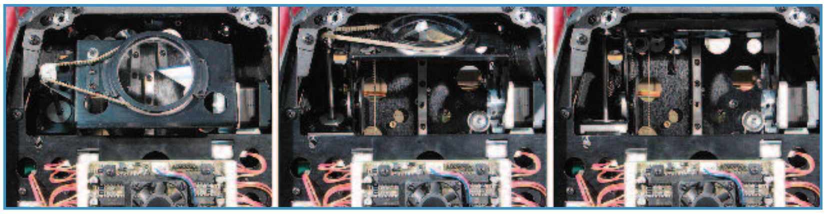

Figure 16: Prism operation

full-range 630° pan move took five seconds to complete, while a more typical 180° move finished in 3.5 seconds. Tilt took 3.5 seconds for a full 270° move, and three seconds for the 180°.

The quality of the movement was very good, with no steppiness visible. The accuracy of positioning was excellent, with a measured hysteresis of 0.05° on both pan and tilt. That's equivalent to 0.2" at 20'. The slight downside of such a stiff system with no hysteresis is that, instead, you get quite a lot of bounce on final positioning, particularly on pan. This is an eternal engineering dilemma for automated light designers; we want a trio of results that are difficult to achieve concurrently—high speed movement, accuracy in final position, and very little bounce. You can pick any two out of the three, but getting them all at the same time is very tough. Both pan and tilt axes have encoders and will correct position errors if blocked or knocked. Figure 17 shows the tilt motor in the yoke.

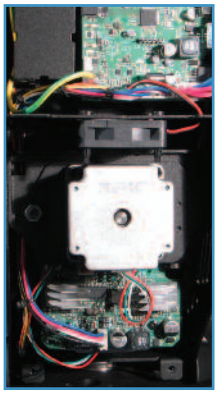

Figure 17: Tilt motor

Noise

	SOUND LEVELS
	Normal Mode
Ambient	<35 dBA at 1m
Stationary	45.0 dBA at 1m
Homing/Initialization	50.4 dBA at 1m
Pan	47.8 dBA at 1m
Tilt	50.3 dBA at 1m
Effect	46.2 dBA at 1m
Gobo	46.3 dBA at 1m
Gobo rotate	47.5 dBA at 1m
Zoom	52.9 dBA at 1m
Focus	50.7 dBA at 1m
Prism	52.9 dBA at 1m

With the firmware supplied, the zoom lens was the noisiest function on the Spot One (the prism shows the same result, as it has to move the zoom lens out of the way). The stationary noise figure reported is with the LEDs and their associated fans running after 30 minutes of use at full power.

Figure 18: Connections

Electrical parameters and homing/ initialization time

POWER CONSUMPTION AT 115V, 60HZ

	Current, RMS	Power, W	VAR, VA	Power Factor
Quiescent (LEDs off)	0.93A	110W	113VA	0.97
LEDs at full	4.66A	536W	536VA	1.00

Initialization took around 51 seconds either from a cold start or from a DMX512 reset command. Homing is badly behaved, in that the fixture dims up the LEDs before pan and tilt have finished moving to their final position. (GLP tells me that this has been addressed in more recent versions of the firmware.)

Construction

The Spot One seems to be a well-built unit. As mentioned above, the LED engine is not user-serviceable, but the gobo and effect systems are all readily accessible for maintenance. The design is almost top-box-free; there is just a small circular area where the connections and power supplies are situated.

Everything else is in the yoke arms or the head. Getting into the head is simple—four quarter-turn captive screws on each side release the covers exposing all the systems. Overall, it's an elegant looking unit.

Electronics and control

Figure 18 shows one side of the connections housing with the power and both five-pin and three-pin XLR DMX512 input connectors. There is also space for an Ethernet port, unused in the unit supplied. The other side of the unit has the corresponding DMX512 output ports, along with the power switch and fuse (Figure 18). The color LCD and touch panel menu system is mounted on one of the yoke arms (Figure 19). It provides access to all the usual configuration and service functions. A nice touch is the graphic, which displays as the unit boots, showing the status of the sub-systems as they each initialize. Electronics are distributed throughout the unit with power supplies in the base of the yoke (Figure 20) and motor drivers in the head (Figure 21).

Figure 19: Menu system

Figure 20: Power supplies in yoke

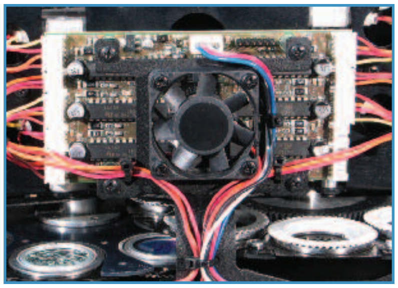

Figure 21: Motor drivers

There it is, the GLP impression Spot One, an RGB LED automated spot luminaire. It's the first RGB spot to be reviewed here, but I'm sure not the last. Has GLP managed to make a unit that suits your needs? As always, you get to decide.

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