# The Martin MAC 700 Profile

by Mike Wood

**This month, we're looking at Martin's MAC 700 Profile. This fixture has attracted a great deal of publicity in the last few months. Does the reality live up to the advertising?**

Fig 1

Fig 2: Lamp and holder

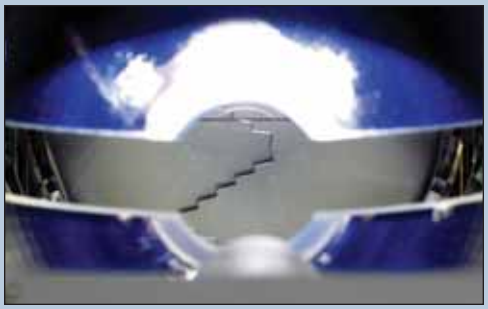

Fig 3: Reflector and dimmer

Fig 4: Dimmer mechanism

The Mac 700 is the latest incarnation of reduced-size fixtures, which the recent generation of short-arc metal halide lamps has made possible. It enjoys many of the same features as its larger sibling, the MAC 2000, and indeed claims to have very nearly the same light output. All this in a 700W package that's only the size of the current 400W MAC 550, or a last generation 575W unit.

I must admit to being a fan of these ultra-short arc lamps. The optical efficiencies they give you are well worth their finicky cooling requirements. Add in a big reduction in fixture heat issues and they present a compelling case (Figure 1: Unit as tested).

As usual, we'll start with the lamp and work through the fixture to the output lens, while presenting measurements in as objective a manner as possible. As in previous reviews these results are based on the testing of one specific unit which, hopefully, is typical of the product.

This fixture shares many design concepts and, indeed, components with the Mac 550 (see *LSA*, June 2005). There are definitely some improvements in the Mac 700 though. In particular the optical focus quality and vignetting seemed to me to be improved.

The Mac 700 is fitted with auto-sensing power supplies for both lamp and electronics and can be run on voltages between 100-130V or between 200-250V. Slightly unusually, you have to change the fuse size to switch between the 100-130V and 200-350V ranges: 6.3A for 230V and 15A for 115V. I'm betting that, in reality, once that 15A fuse goes in there, it never comes out! For these tests, the fixture was run at 119V, 60Hz.

## Lamp

The Mac 700 continues Martin's use of Osram lamps; in this case, it's the HTI 700 W/D4/75 double ended discharge lamp, rated at 7,380K color temperature. This is a short-arc lamp in Osram's 'SharXS' family. As with other similar Martin , the lamp is mounted on a lampholder plate, which is retained by four quarter-turn fasteners; once released, it swings down for lamp access. The lamp change is simple—it's a "snap-in" lamp, requiring no tools with all parts remaining captive (Fig. 2: Lamp and holder)

There are lots of fans to keep everything cool, but everything is well-controlled for speed and I saw no evidence of lamp or fixture overheating. Everything ran very cool during all tests.

Figure 3 shows a close-up looking through the lamp slot in the faceted cold-mirror reflector towards the dimmer shutter whose teeth can be clearly seen (Fig. 3: Reflector and dimmer flags.) Martin has this basic design nailed down and the beam quality is excellent even with the large

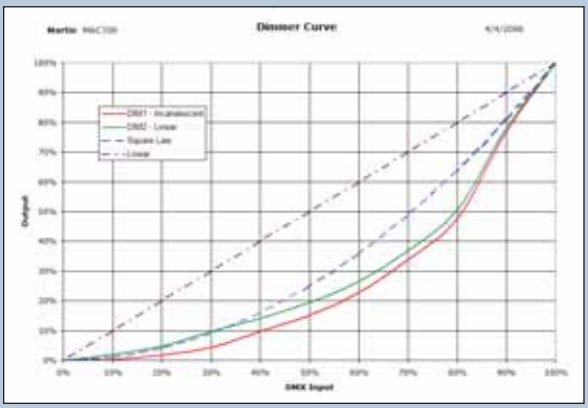


Fig 5: Dimmer curves

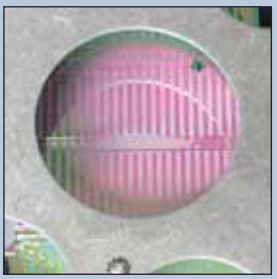

Fig 5a: Mixing flags

Fig 6: Mixed colors

slot to accommodate the double-ended lamp.

As mentioned above, the lamp power supply is electronic and fully power factor-corrected (measured power factor was 0.99) giving flicker-free square wave operation. The lamp supply is mounted in the unit top-box while the ignitor is mounted in the front of the head near the lenses, keeping the high voltage cables short and the electronics cool.

## Dimmer and Strobe

Next in the optical train is an angled hot mirror (hot mirrors are usually angled to avoid infinite "hall of mirrors" reflection problems) and the dimmer/shutter mechanism. This assembly comprises two flags each with rectangular teeth. Each flag is driven by its own stepper motor (Fig. 4: Dimmer mechanism).

The Mac 700 software menu gives you two options for the dimmer curve. You can select between a linear dim mode and a mode designed to more closely match the characteristics of incandescent lamps. Figure 5 shows both curves as well as true hypothetical linear and square law curves for comparison (Fig. 5: Dimmer curves).

As we've seen with other Martin fixtures using this system, there really isn't much difference between the two curves. Both are too steep at the top end and drop below both the incandescent 'square law' and linear curves. The Mac 700's dimming is smooth across the range apart from the very bottom end. The DIM2 linear curve looks better overall to my eye. (Note: This is the opposite of what I recommended for the Mac 550, where the DIM1 incandescent curve looked better).

Strobing was quick and precise with a measured range of 2Hz - 10Hz.

## Color systems

The Mac 700 has full CMY color mixing, using three "pairs of curtains" of etched dichroic glass plates running on linear tracks. A number of manufacturers have moved over from the once ubiquitous wheels to use this system—t's compact and gives good results. Having two filters mounted like this for each color allows the overlap to be used as part of the mixing, thus effectively doubling the travel length. Figure 5 shows the pattern etched into the Magenta flags (Fig. 5A: Mixing flags).

Color homogeneity was excellent and it coped well with my usual tough test colors—lavender and amber (Fig. 6 - mixed colors). The only time I saw any issues was when trying to mix some pale blues, where there was a faint magenta hotspot in the beam center and slight evidence of horizontal tiger stripes from the etch pattern.

**Color mixing**

| Color | Cyan | Magenta | Yellow | Red | Green | Blue |
|---|---|---|---|---|---|---|
| Transmission | 42% | 14% | 53% | 7% | 7% | 5% |

| | |
|---|---|
| Color change speed - worst case | 0.7 sec |

Martin seems to have chosen the mixing dichroics to maximize output in the warmer colors. The red output is higher than other fixtures measured but, it has to be said, it's not a very deep color, more of a pinky red than a primary.

This mix system is the final component on the rear module—the color wheel and gobo wheels are mounted in the front module.

The Mac 700 has a single color wheel with eight replaceable colors plus open aperture. This uses Martin's now familiar trapezoidal filters which are connected to the hub with a molded snap-in clip (Fig. 7: Color filter). It's an elegant mechanism with the trapezoidal shape minimizing any transition between colors as you rotate the wheel (Fig. 8: Half colors).

**Color Wheel**

| Color | Red | Green | Blue | Pink | Orange | Minus Green | CTB | CTO |
|---|---|---|---|---|---|---|---|---|
| Transmission | 6% | 15% | 47% | 37% | 28% | 79% | 64% | 68% |

The standard colors include a good selection of color correction/modifying filters along with a good deep red to enhance the CMY system.

Color change speed was good, crisp and definite.

**Color Wheel**

| | |
|---|---|
| Color change speed - adjacent | 0.1 sec |
| Color change speed - worst case | 0.4 sec |
| Maximum wheel spin speed | 0.58 sec/rev = 103 rpm |
| Minimum wheel spin speed | 256 sec/rev = 0.23 rpm |

Fig 7: Color filter

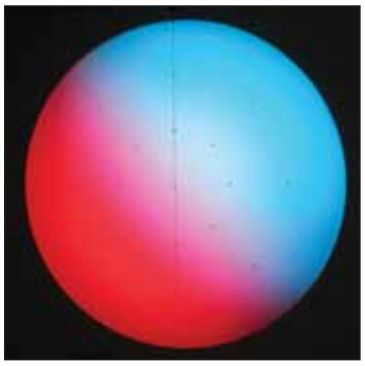

Fig 8: Half colors

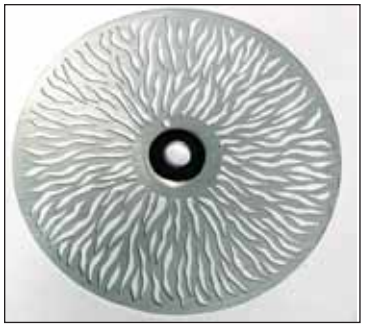

Fig 9: Animation wheel

Fig 10: Animation wheel effect

Fig 11: Rotating gobo

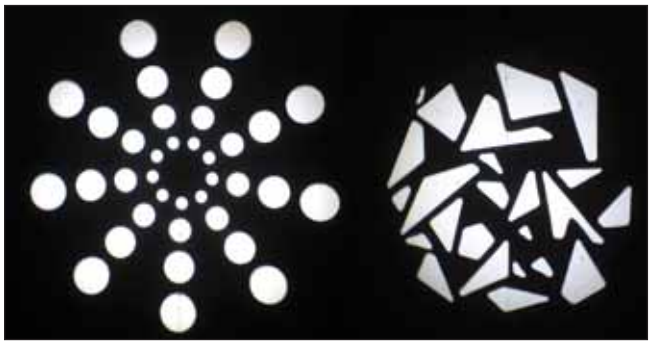

Fig 12: Focus quality

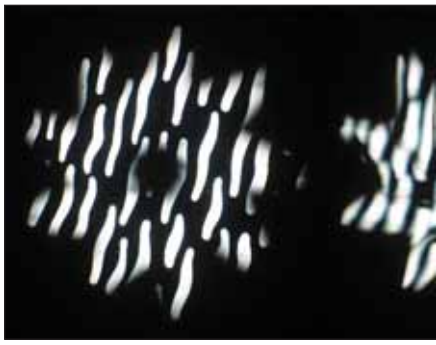

Fig 13: Morph sequence

It is possible to select whether the wheel always takes a quick path to go from color to color for the quickest possible change (used in the measurements above) or, if you don't like the white flash, you can choose a mode where it always rotates in the appropriate direction to avoid the open white position.

## Animation wheel

Immediately after the color wheel comes the first projected effect—the gobo animation wheel. This is becoming a standard feature for the Mac range. Mounted on a magnetic hub—so it's easy to change—is a single replaceable large metal pattern which can be inserted into the beam and then rotated. (Fig. 9: Animation wheel) The mechanism is offset by 45° to allow any effective angle of movement from vertical to horizontal (Fig. 10: Animation wheel effect). Designed to be used in conjunction with an appropriate gobo and color, this wheel gives an effect similar to that produced by water ripple or fire effects in theatrical projectors. Rotation of this wheel was smoother than I've seen in some other fixtures. It takes a fairly lengthy 2.8 seconds to insert or remove this wheel and the insertion is very visible so you might want to do it with the fixture blacked out. The fixture is supplied with one disc as standard, but Martin makes a range of replacement patterned disks. One slight issue with the magnetic hub is that, in removing and replacing the disk, it is very easy to bend the aluminum. In fact the unit supplied for test had a slightly warped disk—this leads to a slight focus shift as the wheel is rotated through the optical plane. Not an issue if the wheel is run out of focus, which I would expect to be the norm.

## Gobos

The Mac 700 has two gobo wheels—the first contains six rotating gobos and the second nine static gobos. All are easily changed; the static gobos slide under spring clips, while the rotating gobo has cartridges which snap completely out of the wheel (Fig. 11: Rotating gobo). As with everything in the head, access to the gobo wheels is straightforward; remove the injection molded head covers by releasing four quarter-turn fasteners and let it dangle on its safety cable while you work inside. If you have a lot of gobos to change you can always remove the whole module, which is very straightforward and makes changing gobos much easier.

**Rotating Gobos (Gobo 1)**

| | |
|---|---|
| Gobo change time, adjacent apertures | 0.2 sec |
| Gobo change time, max (Gobo 0 to 3) | 0.5 sec |
| Maximum gobo rotate speed | 0.4 sec/rev = 140 rpm |
| Minimum gobo rotate speed | 347 sec/rev = 0.17 rpm |
| Maximum wheel spin speed | 1.15 sec/rev = 52 rpm |
| Minimum wheel spin speed | 150 sec/rev = 0.4 rpm |

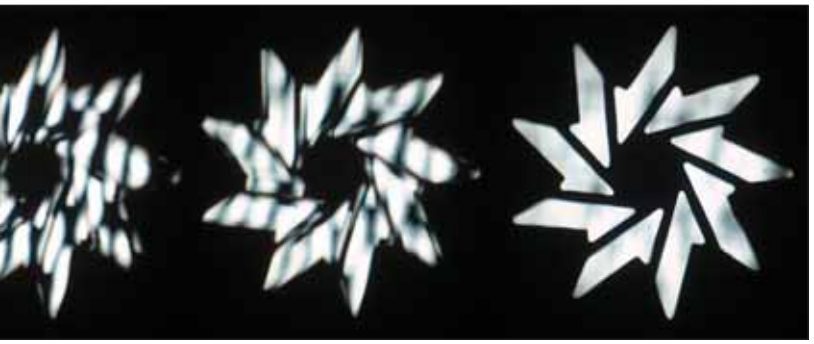

Fig 14: Prism effect

Indexing and wheel positioning accuracy on the rotating gobos was really excellent. Measured hysteresis error was around 0.04°, which is less than 0.25" at a 20' throw.

**Static Gobo (Gobo 2)**

| | |
|---|---|
| Gobo change time, adjacent apertures | 0.2 sec |
| Gobo change time, max (Gobo 0 to 4) | 0.4 sec |
| Maximum wheel spin speed | 0.4 sec/rev = 150 rpm |
| Minimum wheel spin speed | 52 sec/rev = 1.15 rpm |

All three wheels had excellent center/edge focus as shown (Fig. 12: Focus quality) and, aided by the small diameter optical system, are widely spaced enough to give good morphing effects. The only mild annoyance I found was that it is not possible to focus on the gobo animation wheel when working at the narrowest zoom angles. That's likely not a big problem, as this wheel is typically used well out of focus anyway. Figure 13 shows a morph sequence between Gobo 1 and Gobo 2. (Fig. 13: Morph sequence).

## Iris

The Mac 700 has a standard multi-leaf iris capable of reducing the beam size to 21% of the full size when fully closed—i.e., 3.2° when at minimum beam angle and 6.4° when at maximum beam angle. Movement time from open to fully closed was measured at 0.4 seconds.

## Prism

As with the Mac 550 the 700 features a three-facet prism sited between the zoom and focus lens groups. To allow access for this prism as it is brought into the beam the system may need to move the zoom lens out of the way and then replace it once the prism is in place. I assume that this positioning gives optimal image separation in the optical system. The only downside with this mode of operation is that you get a visible image change as the lens moves just before the prism comes in and again just after it is removed (Fig. 14:  Prism effect).

**Prism**

| | |
|---|---|
| Prism in/out time | 1.1 sec |
| Maximum prism spin speed | 1 sec/rev = 60 rpm |
| Minimum prism spin speed | 56 sec/rev = 1.07 rpm |

## Lenses and output

The Mac 700 uses a three group optical system: Lens Groups One and Two provide focus and zoom functions, while the final group is the static front lens (Fig. 15: Optical system). Performance is excellent, with almost no chromatic or spherical aberration and high efficiency. Lens movement time from end to end was 1.5 seconds for zoom and 2.6 seconds for focus.

Looking at the all important output measured, field angle range was 15°-30°, with total lumens ranging from 14,440 at narrow angle to 14,550 at wide. This stands up well even in comparison with much larger 1,200W units (Fig. 16: Output at narrow angle; Fig. 17: Output at wide angle).

The Mac 700 also offers the user the option of running the lamp in a reduced power mode where it is run down at 400W. This mode can be accessed through menus or the DMX control

Fig 15: Optical system

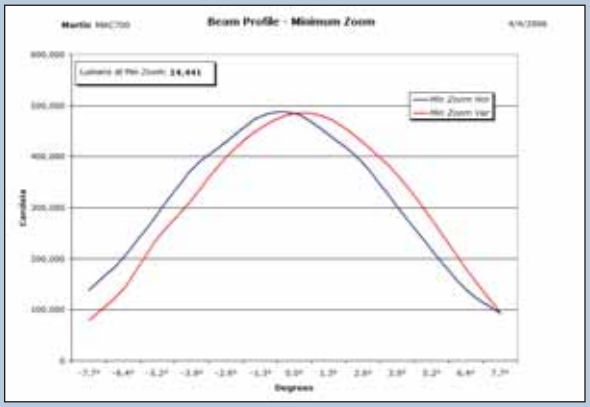


Fig 16: output at narrow angle

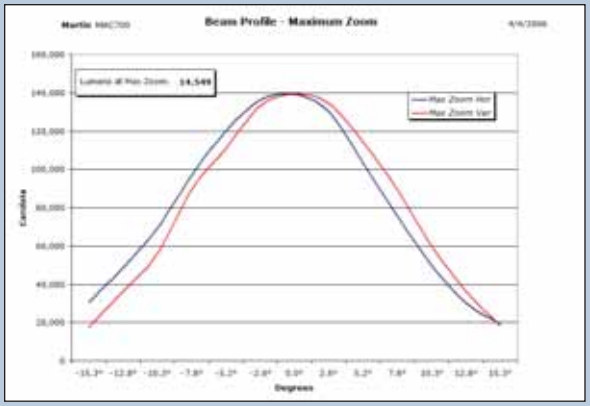


Fig 17: Output at wide range

channel. When in this mode, I measured the output to be 49% of full, 700W, power. The lamp automatically enters this reduced power mode when the shutter is closed for a period of time, jumping instantaneously back up to 700W when the shutter reopens.

## Pan and tilt

The Mac 700 has standard pan and tilt ranges of 540° and 240° respectively. With the 'Studio' (quiet) mode turned off, a full range pan move took five seconds and a more typical 180° move took three seconds. Tilt took 3.3 sec for a full 240° move and 2.8 sec for 180°.

Positional repeatability on pan and tilt was 0.11° and 0.04° respectively—that's around 0.5" of pan error with a 20' throw. Martin has done a good job at coping with settling bounce with this very tight mechanical system—I complained about this with the Mac 550, but the Mac 700 is much better—no more than 0.5" of bounce as compared to the 2-3" I measured with the Mac 550. My only issue with the Mac 700 in this regard was with a slight jerky movement in pan when using very slow movement times (greater than 100 seconds for a 90° move). This was present when tested both with and without vector mode.

Martin has used very much the same mechanical components in both products so the improvement must have come through firmware changes or better fixture balancing (Fig 18: Side view showing tilt).

Martin recommends you use the tracking mode with most modern desks. All my testing was carried out in this mode using the console (Hog 2 PC) for all fade processing. I would agree with this advice. The legacy Vector system in the Mac 700 is for use with older consoles and is now a bit dated. Setting a vector speed via the speed channel in the fixture does exactly what it says—sets a speed and not a time. What this means is that when using vector mode in a normal cue both pan and tilt will move at the same speed. So one axis (whichever has the lesser distance to travel) will get to its target position first, leaving the other one to catch up. The end result is a dog-leg move—a nice diagonal followed by a straight line. My personal preference, if I wanted to use fixture timing, would be for equal time of travel—not equal speed. So, do as Martin recommends, and use the desk for timing not the fixture.

## Noise

Sound levels were fairly constant with the cooling fans providing the bulk of the noise. In regular, high-speed mode the noisiest functions were pan and tilt and the CMY color system, which sound like they have some belt whine. This is normal and not objectionable.

**Fig 18: Side view, showing tilt**

**Sound Levels in Normal Mode**

| | | |
|---|---|---|
| Ambient | <35 dBA at 1m | <35 dBA at 1m |
| Stationary | 54.4 dBA at 1m | 44.5 dBA at 1m |
| Homing/Initialization | 61.2 dBA at 1m | 57.3 dBA at 1m |
| Pan | 65.8 dBA at 1m | 45.3 dBA at 1m |
| Tilt | 64.1 dBA at 1m | 48.6 dBA at 1m |
| Color | 55.8 dBA at 1m | 44.7 dBA at 1m |
| Prism | 54.8 dBA at 1m | 46.3 dBA at 1m |
| Gobo rotate | 54.8 dBA at 1m | 44.6 dBA at 1m |
| Zoom | 54.7 dBA at 1m | 44.8 dBA at 1m |
| Focus | 54.8 dBA at 1m | 44.5 dBA at 1m |
| Strobe | 54.5 dBA at 1m | 44.6 dBA at 1m |
| Animation Disc | 54.9 dBA at 1m | 46.4 dBA at 1m |

The menu system offers a choice of 'Normal' mode and 'Studio' mode for noise levels. The Studio mode reduces fan speeds and limits motor movement speeds. The fans are the noisiest component in the fixture so reducing their speed produced a significant improvement. Total noise with the fixture stationary dropped almost 10dB in Studio mode. I found no annoying resonances.

## Electrical Parameters

**Power consumption at 119V, 60Hz**

| | Current, RMS | Power Factor |
|---|---|---|
| Max when initializing | 8.7A | 0.99 |
| Normal running | 8.5A | 0.99 |

## Homing/initialization time

Initialization took 37 seconds from a cold start and 25 seconds when the fixture is powered up and a reset command is sent. Slightly annoying in this case was that the fixture does not wait until the shutter is fully closed before it starts to home colors and gobos, leading to a short random flash from the unit. Even more annoyingly, at the end of the homing process it re-opens the shutter before pan and tilt have been reset to their final position. Both of these are simple bugs and Martin tells me that they are being addressed for a future software release. For now, make sure you close the shutter before sending that reset.

## Electronics and control

The electronics and menuing system are very comprehensive with many options and settings available in the firmware. As with other fixtures in the Mac range the Mac 700 offers both the standard five-pin XLR and the legacy three-pin XLR for DMX-512.

Well, that's it: the Mac 700 is a very elegant and small package packing a lot of punch. I can see many instances where its size will make it the fixture of choice over its larger 1,200W cousins. Does it have the right features and performance for your application? As usual, I leave you to draw your own conclusions.

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