TMB Super Monocentrics

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Available from	APM Telescope Germany
	Astronomics
Price	$195.00

In July, 2003, just in time for the Mars apparition, TMB Optical released a new line of TMB Super Monocentric eyepieces intended to be outstanding planetary eyepieces, perhaps the best ever made.

Initially priced at $200 each (soon to go up, I'm told), they are premium eyepieces promising premium views.

The designer of the monocentrics, Thomas Back, is deservedly respected for designing a line of apochromatic telescopes that are as good as the best in the world, comparing favorably in reviews with telescopes from Astro-Physics and Takahashi. His partner, Markus Ludes of APM Germany, works with optical companies in Russia to make the TMB objective lenses, and found a Zeiss subcontractor in Germany to make the TMB Super Monocentric eyepieces.

This review takes a look at how well TMB has achieved its goal. I have no connection with TMB Optical or APM, and purchased the eyepieces from TMB at the regular price.

Everything old is new again

The monocentric is actually an old eyepiece design developed in the 1880's. A version was sold by Zeiss as an astronomical eyepiece until the mid-1950's. The eyepiece consists of a single triplet lens with all the curved lens surfaces having their centers of curvature at the same point. Its virtue, in a word, is surfaces. The fewer air-to-glass surfaces in an eyepiece (monos have the minimum of two), the less light is scattered by the coatings. This increases the ability to see low-contrast surface features on planets

Thomas Back's contribution to the evolution of the monocentric design was to use modern high index of refraction Schott glass that would allow correction of some of the aberrations associated with using conventional glass and permit a wider corrected apparent field of view. In addition, working with a Zeiss subcontractor to manufacture the eyepieces, he was able to use some of the best polishing equipment and the finest optical coatings available to further reduce scatter and increase image contrast.

But there's a catch. The price of maximizing contrast is a reduced apparent field of view. The old Steinheil and Zeiss monos, as well as the more recent Intes monos, all have about a 30-degree AFOV. Even with the high index glass used by TMB, so do the TMB Super Monocentrics.

TMB vs. Germany and Japan (and the U.S., too)

I compared a set of the new TMB Super Monocentrics with what are generally considered the top planetary eyepieces ever made from Germany and Japan, the Zeiss 1.25" orthoscopic eyepieces and the Pentax SMC .965" orthoscopics. Both of these have not been manufactured for several years and are expensive and difficult to find (particularly the Zeiss), so for the TMB Super Monos to even match their performance would make the monos a worthy and much-desired addition to the astronomy hobby. Two more fine eyepieces were serendipitously added to the review as well.

TMB Super Mono	Zeiss 1.25Ortho	Pentax SMC Ortho	Other

10mm	10mm	9mm	9mm Nagler T6
8mm	-	7mm	-
6mm	6mm	6mm	6mm Radian
5mm	-	5mm	-
4mm	4mm	-	-

The eyepieces were tested in three telescopes that cover a modest range of focal lengths and f-ratios.

	Focal length	**f-ratio**
Takahashi Sky 90, 90mm apochromatic refractor with 1.6x Extender-Q	800mm	8.9
10dobsonian, optics by Mike Spooner	1380mm	5.6
15Discovery dobsonian	1900mm	5

Besides overall image quality, I had other questions, too. For instance, rather annoying ghost images have been seen by other reviewers in testing the Zeiss and Intes monocentrics on bright objects. Vignetting has also been a problem with previous monocentric designs, resulting in a darker image at the edge of the field of view. Do TMB Super Monos have these problems?

I also wanted to know if the TMB Super Monos are only useful on planets or whether they are useful for viewing other objects.

The objects tested

- A test with an artificial star examined sharpness, coma and astigmatism across the field.
- The moon provided a view of high contrast surface features, sharpness, and a test for ghost images.
- Mars was the most available planet and provided a test for resolving low-contrast surface features plus a test for ghost images.
- M13 and the Double Cluster provided an opportunity to see if the monocentrics were helpful in resolving dim stars in the globular and improving the view in the open cluster.
- The Dumbbell nebula and the Ring nebula tested whether the monos resolved more detail or helped these dim fuzzies stand out from the background sky.
- The double stars Polaris and the double-double in Lyra were compared for cleanness of the split and the star images.

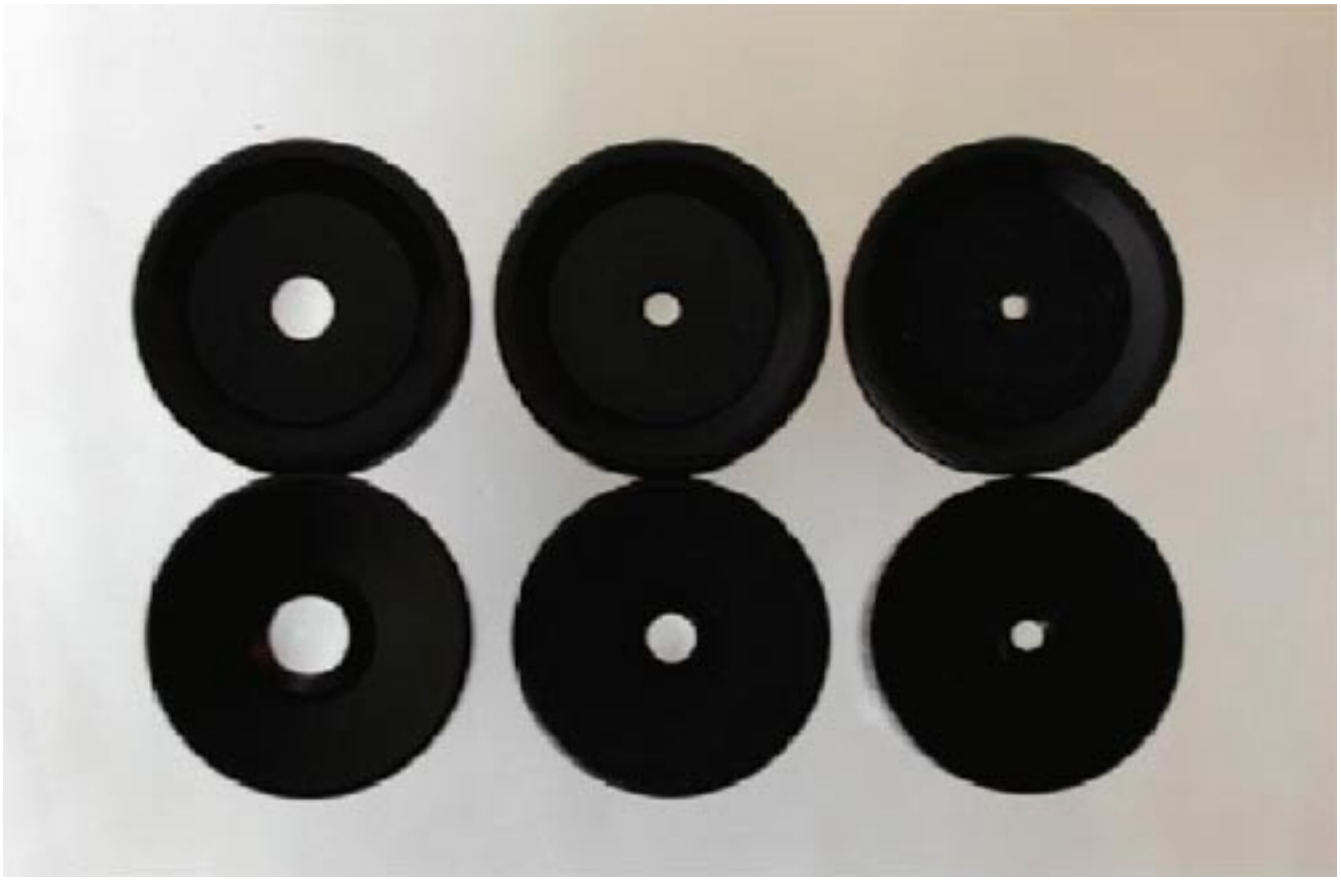
But before all that, I took a good look at them indoors.

At the dining room table

Removing them from their black textured boxes, the TMB Super Monos seemed like solid, high quality eyepieces with excellent fit and finish. The chrome barrels have an inset to keep them more secure in the focuser. The insides of the barrels are threaded for standard filters and painted a very deep flat black. I ordered the optional wood display case for the set, but it didn't arrive in time for this review.

Setting these fairly small 1.25" eyepieces side by side, the first thing I noticed was that they were all the same size. This is unusual in an eyepiece set, and means that the Super Monos aren't parfocal – they don't come to focus at the same position. In practice, I discovered later that this wasn't much of a problem. The 10mm mono focuses about 3mm farther out than the 4mm in my Sky 90, with the others interspersed in between. As you increase power, you also focus in on the subject, which seems quite natural. The actual focus position for the shorter focal length Super Monos is about the same as for the Zeiss orthos.

Another obvious thing about them is that they're colorful, more colorful than the other eyepieces in my case. There is a different colored metal band – red, gold, green, purple, light blue – with white lettering around the top of each eyepiece. Whatever your esthetic judgment of this design element might be (I kind of like it), there's a practical issue. The white letters are hard to read against some of the backgrounds, particularly for the 8mm eyepiece with white letters on gold. It's worse under a red light while observing. Only the 6mm (green) and 4mm (light blue) are easy to read under red, and the 8mm verges on impossible. By comparison, the focal lengths of the Zeiss and Pentax orthos are white on black, easy to read in almost all situations.



The lens opening that we see is smaller than that of an ortho (see the photo above for a lens opening comparison between the 10mm, 6mm and 4mm TMB Super Monos and Zeiss orthos; the monos are on top). For the 10mm mono, the lens is only about 7mm across, and by the time you get to the 4mm, the lens opening is tiny, only about 2mm. This looks and sounds much worse than it is since the eye relief for the monos is excellent, about 80% of the focal length, and the apparent field of view helps by being only 30 degrees. So it's easy to see the entire field, even with the 4mm. I've had more difficulty with the eye relief on short focal length plossls.

Focal length	**Eye Relief**
10mm	8.0mm
8mm	6.4mm
6mm	4.8mm

5mm	4.0mm
4mm	3.2mm

The tops of the eyepieces are broad and flat with a black matte finish, and are circled by a slightly elevated rubber ring that blocks light even further. There is far less intrusion of light into the edge of one's field of view than there is with the Pentax and Zeiss orthos. A higher rubber eye guard is offered as an option, but it's not really needed for the 10 and 8mm eyepieces and actually constricts the field of view for the 6, 5 and 4mm eyepieces (and it's already small enough!). Longer focal lengths are on the way, however, and the high eye guard might still prove to be useful.

The final dining room table test was looking at light throughput by holding the test eyepieces up to a brightly illuminated white piece of paper. The Pentax orthos won this contest by a nose. The Zeiss orthos and TMB monos tied at being just barely dimmer, but still bright. This was a somewhat surprising result since the monos are billed as having 99% light transmission, and may have something to do with the design of the two types of eyepieces.

Quality control was an issue with the first run of TMB Super Monos. In the rush to get the eyepieces into observers'hands before the Mars apparition, a small number (five or so, by Thomas's best estimate) were inadvertently sent out with optical defects producing chromatic aberration at the edge. Many more were shipped with irregular bumps on the field stop that interfere with the view. All of them were shipped with top caps that don't fit (the bottom caps are fine). The 4mm eyepiece shipped to me had a slightly out of round field stop, and the rest were ok.

The manufacturer has been informed of the problems and has promised to correct them on future runs. Thomas and Markus will also replace any eyepiece that's defective because of a manufacturing flaw, and will be sending out better caps. I have been impressed with the willingness of Thomas and Markus to address these issues directly and completely. If you're reading this before you order a TMB Super Mono, you more than likely won't have a problem

Test #1: The moon

I had planned to do the artificial star test first, but the sky was clear for about two hours the night I received the Super Monos and I started off with the moon. In the five nights after receiving the eyepieces, the sky was clear enough for observing on three. All I can say is that with so many Super Monos being delivered at about the same time, the astronomy weather gods must have been busy making cloudy skies elsewhere.

The moon was the only astronomical object I tested all of the eyepieces on. The other objects were

viewed with an eyepiece of an appropriate power. Keep in mind that all test results depend not only on the eyepiece but on the telescope. In this case, the telescope was a perfectly collimated Sky 90 at f8.9 with the Extender-Q.

The 10mm mono tied with the 10mm Zeiss for sharpness and texture detail, with the 9mm Pentax barely a half a step back. However, the shorter the focal length, the more the advantage shifted to the monos. At 6mm, the TMB barely edged out both the Zeiss and the Pentax in clarity of the view. At 5mm, the TMB was clearly ahead of the Pentax. By 4mm, the moon was crisper to my eye in the TMB than the Zeiss and gave more of a sense of actually looking at the moon's surface.

As for off-axis sharpness, the 10mm mono was maximally sharp up until a bit over two-thirds of the way from the center of the field, at which point a barely noticeable softness in the image began and continued to the edge. This was similar to the performance of the 10mm Zeiss, but slightly inferior to the 9mm Pentax, which had no detectable deterioration of sharpness to my eye until 80% of the way from the axis to the edge of the field. Again, the shorter focal length monos (and orthos) were sharper across more of the field. Both the 5mm and 4mm mono appeared sharp to the edge of the field.

In none of the TMB Super Monocentrics did I see a problem with ghost images on the moon or any other object. Also, there was no visible dimming of the image toward the edge of the field.

Test #2: The artificial star

In order to have a more controlled environment to compare the test eyepieces, I built an artificial star out of $20 worth of equipment from Radio Shack, a piece of foil with a tiny pinhole, some scraps of Baltic birch plywood, and a cardboard box. The Sky 90 at f8.9 was set up with focal length extenders for straight through viewing about 35 feet away, and easily brought the star into focus with all the test eyepieces.

The two basic tests consisted of looking at the artificial star in focus and the two-diffraction-rings-unfocused image of the artificial star across the entire field of the eyepiece. With the star in focus, I was looking for coma or loss of focus, and with the unfocused diffraction rings I was testing for astigmatism. I thought it was fair to compare eyepieces with different apparent fields of view.

The percentages in the chart indicate the maximum distance from the center of the field that the airy disk and diffraction rings were perfect, so higher numbers are better. Please keep in mind that beyond the zone of perfection,the images are still pretty darn good. These are all excellent eyepieces. But it did seem that the TMB Super Monos had better edge correction than the others. Also, it is clear from both the moon and the artificial star tests that the edge views tend to become better at shorter focal lengths.

Focal length (mm)	**TMB Super Mono**	**Zeiss 1.25Ortho**	**Pentax SMC Ortho**

10	75%	65%	9mm: 65%
8	80%	-	7mm: 50%
6	90%	75%	65%
5	95%	-	80%
4	100%	90%	-

As anticipated, the artificial star was more sensitive at detecting distortions in the field of view, even those that didn't significantly affect my view of the moon. However, some people may see those distortions with more sensitive eyes or in better viewing conditions. Similarly, other observing equipment may make them more obvious or less obvious.

Test #3: Planets (ok, just Mars)

My viewing buddy Tony gave me a call the third night after the Super Monos arrived to see if we could go look at Mars at a reasonably dark site near him. After two weeks of rain, the weather decided to cooperate yet again for a second night of testing. In addition to my 10Spooner dob and Sky 90, he brought a 15" Discovery dob.

I first looked at Mars in the Sky 90 around 11:00 p.m. with the 6mm TMB, Zeiss and Pentax eyepieces (133x). Mars was still roiling in the atmosphere, but the southern polar cap was visible and faint blue surface features appeared and disappeared with changes in seeing. Later around 1:30 a.m. the image improved considerably, and it was clear that the 6mm Super Mono gave a slightly cleaner and steadier view of surface features than the 6mm Zeiss and Pentax, although there was little difference in contrast at this aperture and power. Bumping up the power with 4mm TMB and Zeiss eyepieces (200x) lowered contrast for both but resulted in a slight relative improvement in contrast for the TMB over the Zeiss.

A similar late evening comparison was made with the 6mm TMB and Zeiss eyepieces in the 10" Spooner dob (230x). The additional aperture revealed significantly more detail and resulted in a substantial increase in contrast for both eyepieces. Again, there wasn't much to choose between them, although I thought the Super Mono gave a slightly better view at the best moments of seeing. The power was then raised slightly in comparing the 5mm TMB and Pentax (276x). This was pushing it in the seeing. Still, there were moments when it was justified, and the TMB gave a view of the planet's surface

that seemed more realistic.

The ultimate comparo came at the end of the evening between the 6mm TMB and Zeiss and Tony's 6mm Radian in the 15" Discovery f5 dob (317x). The extra aperture again increased the contrast and detail of the image, and the seeing at the time of the test justified the power. Despite the Radian being of a completely different design, it clearly belonged in the comparison. It was very sharp, as good as or maybe even better than the TMB and with a much more comfortable AFOV. But the mono's advantage in contrast gave it a slightly better image. Remembering the TMB's contrast in the 10" dob, the Radian's contrast was about what I'd imagine the mono's contrast to be in a 12" or 13" scope. The Zeiss again seemed maybe a hair less crisp than the TMB.

Keep in mind that the differences between the three main test eyepieces are not something you'd necessarily walk across an observing field at a star party to see. As Tony said when casually comparing Mars with the Zeiss ortho and the TMB mono, I don't see much of a difference. Which, of course, was high praise for the mono.

Test #4: Star clusters

M13 is a favorite target, and I was glad for the opportunity to revisit it on the third night of viewing. Compared with the 10mm Zeiss in the Spooner 10" dob, the image was a bit crisper in the 10mm TMB and perhaps a bit brighter in the 9mm Pentax to my eye call it a tie between those two. I also liked seeing more space around the image with the Pentax.

In viewing the double cluster, the constraints of the narrow field with the Super Mono became obvious. Extended objects reveal the mono's tradeoff between contrast and AFOV they simply don't fit in the narrow field easily at high power, and the loss of field was a greater disadvantage than the gain in contrast. In short, a 9mm Nagler T6 gave the most pleasing view of the Double Cluster to my eye in the Sky 90.

Test #5: Dim fuzzies

I also examined the Dumbbell nebula with the 10mm Super Mono, 10mm Zeiss ortho and 9mm Pentax ortho in the Sky 90. It was not significantly different in any eyepiece dim fuzzytruly applied. The Dumbbell has essentially no structure visible with such a small telescope. In the 10" Spooner dob, the added brightness of the image allowed the nebula to stand out very slightly better from the background with the 10mm Super Mono, but again it was hard to choose between the three eyepieces.

However, the Ring nebula was a different story. With the 15" Discovery dob, the Ring with the 10mm Super Mono was significantly more distinct and interesting to view than with the 10mm Zeiss or 9mm Pentax. This observation was confirmed on the final night of viewing with the 10" Spooner. There was a more distinct shape to the nebula, and it seemed to stand out more from the background.

Test #6: Double stars

I am not a double star observer, and I defer to my betters on the technical aspects of such observations. I can say that the faint companion of Polaris was easily visible with all three eyepieces in the Sky 90, although the image with direct vision was a bit steadier with the 10mm Super Mono. Viewing the double-double in Lyra, the space between the stars seemed slightly cleaner with the Super Mono and there seemed to be slightly less scatter for the TMB Super Monos over the Zeiss and Pentax.

Miscellaneous observations

The moon observations were made on a humid night, and the Super Monos tended to fog up more rapidly than the orthos. It may be that the low eyecup reduces air circulation slightly as well as excluding extraneous light. This difference only occurred on one night out of three, however, so it may not always be a problem.

In the initial tests, I was never able to see a meaningful darkening of the background sky with the Super Mono compared to the Zeiss or Pentax orthos. This was likely the result of our bright, humid sky in northeast Wisconsin simply washing out subtle differences that might otherwise have been seen. Indeed, several weeks later in northern Ontario, the background sky was just noticeably darker when viewing clusters and nebulae with the Super Monos than with the Pentax orthos (I didn't bring the Zeiss orthos along on the trip).

Barlowing the Super Monos would seem to defeat the purpose of minimizing glass surfaces in the optical train. Nonetheless, a brief observation of the moon using a 10mm Super Mono with a 2.5x Powermate without making a specific comparison to other eyepieces was quite pleasing.

In an undriven dob, the bearings need to be smooth and the vibration damping time quick. At the powers you need to effectively observe planets, the TMB's narrow AFOV means that the image won't be in the eyepiece long. Fortunately, their edge sharpness is good so the entire field is usable. Still, a driven mount would be much preferred.

If you're finding objects by star hopping, use a different eyepiece. Even a similar focal length plossl has almost three times the field of view of the monocentric.

Despite their narrow AFOV, there have been several early reports of people having a great experience with the Super Monos while binoviewing. I would also imagine that these high contrast, low scatter eyepieces would be excellent for solar observing.

In addition to the focal lengths of the eyepieces tested, TMB will soon be releasing 7, 9, 12, 14 and 16mm versions of the Super Monos. They will also be repackaging the non-mono three-element Zeiss 25mm aspheric eyepiece (sold by Markus) so that it matches the TMB mono set, giving the series a high quality low power eyepiece.

Conclusion

If you've always wanted (nay, needed!) a set of Zeiss orthos but didn't have $4000 to spend, the TMB Super Monocentrics may be the answer. At what they do best, viewing planets and the moon, double stars, compact star clusters and nebulae with detailed features, the TMB monos were consistently as good or better than the Zeiss and Pentax orthos. Shorter focal lengths seem to give slightly more advantage than longer focal lengths, and their level of edge correction is better than the Zeiss or Pentax orthos. TMB Super Monos are also designed strategically with more short focal lengths to be true planetary eyepieces.

As for the narrow AFOV, it isn't objectionable if you're viewing an object that's of interest in itself like a planet or planetary nebula. But the monos lose out on larger globulars, open clusters, extended star fields and any object where a wider field at a higher power makes for a better view. They seemed to give no useful advantage in my bright sky on unstructured dim nebulae.

These thoughts are summed up in the chart below, with five stars as the highest rating. Some categories are likely to be more important to you than others. And as the saying goes, your mileage may vary.

Object	**TMB Super Mono**	**Comments**
Planets and moon	*****	Better contrast, more realistic view of surface detail
Double stars	*****	Cleaner separation, less scatter
Planetary or detailed nebulae and galaxies	*****	Better view of structure and detail
Diffuse nebulae and galaxies	**	Little advantage, perhaps may stand out better
Compact and globular clusters	****	Sharp, clean view but may seem constricted by AFOV

Open clusters or star fields	*	Better in eyepieces with wider field of view

The TMB Super Monocentrics are not eyepieces for general viewing. But if you want to add some top quality planetary and special purpose eyepieces to your collection, they're worthy successors to the finest eyepieces of the past.