THE BURGESS 24MM MODIFIED ERFLE & 10MM ULTRAMONO

by: *William A. Paolini, October 12, 2018*

Fig 1. The Burgess 24mm Modified Erfle (left) and 10mm Ultra Mono (right) with their supplied bolt cases. Credit: Author.

1. OVERVIEW

The Burgess 24mm Modified Erfle and 10mm Ultra Monocentric eyepieces are relatively new offerings from Burgess Optical. The Ultra Monocentric has been long promised so nice to see it finally coming to fruition.

Marketing for the Modified Erfle lists: Classic 5 element 3 group Erfle design modified by using high index glass and splitting one of the doublet groups into 2 singlets to improve edge performance, fully broadband coated, and fully baffled barrel with a 26mm field stop.

Marketing for the Ultra Monocentric lists: high contrast, fully baffled barrel, glass elements having very high transmission characteristics from 400-700nm, broadband multicoatings for optimal color balance and transmission, a 5.5mm field stop, and compared to the traditional monocentric design a: 30% increase in field of view, 70% reduction in field curvature, and 80% increase in eye relief.

Focal Length (mm)	AFOV (degrees)	AFOV *Measured* (degrees)	Eye Relief (mm)	Eye Relief *Measured* usable/design (mm)	Eye Lens Diameter *Measured* (mm)	Optics Elements/Groups (count)	Barrel Size (in)
10	35	31	16	4.8 / 6.8	8.7	3/1	1.25
24	67-70	61	18	9.5 / 17.5	30	5/4*	1.25

Fig 2. Eyepiece Data. “Measured” values by author, others obtained from Burgess Optical website. Credit: Author.
* - based on the marketing where they say the Erfle Design was modified by separating a doublet into two singlets, from this I infer that the eyepiece probably has 5 elements in 4 groups.

Note in the table above that some bench test measures for eye relief varied significantly from marketed data. The optical eye relief for the 10mm Ultra Mono, which is the measure of the eye relief from the top center of the eye lens, was only 6.8mm instead of the advertised 16mm. Even though this eye relief is much less than marketed, the eyepiece still felt comfortable when viewing (most likely due to the combination of the strongly convex eye lens, relatively large eye lens, flared eye guard design, and small Apparent Field of View (AFOV). For the 24mm Modified Erfle the optical eye relief was closer to the marketed value, however since the eye lens was so deeply inset into the housing the usable eye relief was only 9.5mm above the top housing with the eye guard folded down. AFOV measures were arrived at by bench test measurements, then confirmed visually against other similar AFOV eyepieces, and also with star drift timing. Marketed and measured AFOV for the 10mm Ultra Mono was fairly close, but for the 24mm Modified Erfle the AFOV was a solid 61° so fairly short of the marketed 67° to 70°. Contacting Burgess Optical they informed me that they would be adjusting the marketing of these eyepieces to better reflect the eye relief values as tested. They also mentioned plans to offer a version of the 24mm Modified Erfle where the lens is not so deeply inset so that the eyepiece could be used effectively when wearing eyeglasses. For this version though, the eye guard height is optimized for use without eyeglasses.

2. Physical Characteristics

Both eyepieces present a nice build quality. The diamond rubber grip panel on the Modified Erfle made it very easy to grip confidently while the dual rubber rings on the Ultra Mono housing similarly provided a nice tactile addition to this smaller eyepiece. Both eyepieces have fold down eye guards, very mild tapers on the barrels instead of undercuts, and barrels threaded for filters. The eye guards are not overly thick rubber but are not thin and flimsy either. Eye guards on both eyepieces stay solidly in place. Both eyepieces felt nice in the hand and showed a pleasingly nice build quality. The 10mm Ultra Mono was very light, as I expected. The 24mm Modified Erfle had a good heft to it, heavier than I expected.

Fig 3. The eye lenses of the Burgess 24mm Modified Erfle (left) and 10mm Ultra Mono (right). Credit: Author.

The eye lens on the Modified Erfle is inset deeply into the housing. As a result, most of its eye relief is not usable. However, it still felt comfortable in use and was used most often with the eye guard in the up position. The eye guard is easily removed if desired.

The Ultra Mono had much shorter eye relief, and was measured to be well short of the marketed value. Still, it did not feel uncomfortably close in use as does my 5mm XO eyepiece. In use the Ultra Mono felt fairly comfortable and typically the raised eye guard would just lightly touching my face when observing to see the entire field of view. The eye guard is easily removed if desired.

Fig 4. Field lens and barrel interiors of the Burgess 24mm Modified Erfle (left) and 10mm Ultra Mono (right). Credit: Author.

Insides of the barrels for both eyepieces, looking at the eye lens, revealed no flat black paint. The interiors were naturally black from the anodization, but still showed a shine (there was no flare or glare noticed during field observations). The threading grooves extended all the way up the barrels to serve as micro-baffling.

Neither eyepiece came with end caps, however each came with a bolt case. The bolt case for the 24mm Modified Erfle was the standard variety. The 10mm Ultra Mono's bolt case appeared custom fit the eyepiece, and it came in a nicer than typical box with custom foam cutout fitting the contours of the bolt case.

3. Field Test

Location

Field testing took place over several months in a Yellow Zone in rural Virginia where the Sky Quality Meter readings generally range between 20.5 to 21.2 mag/arcsec^2 on Moonless nights (the Milky Way is fully visible). Outdoor temperatures during field testing (August and September) was not cold and did not vary appreciably from the indoor temperatures.

PROCESS

Multiple frequent observation sessions were conducted over the course of 8 weeks to assess the eyepieces. All outcomes were recorded at the time of occurrence at the telescope using a voice recorder. Each performance test was generally replicated multiple times, and in multiple telescopes to ensure consistency and accuracy. When results were compiled if there were any discrepancies or conflicting test results, then those tests were redone until the root cause of the initial discrepancy was discovered. Any test related to assessment of perceived contrast, brightness, and background field of view uniformity was only conducted on Moonless nights of darkest skies.

EQUIPMENT

Testing was accomplished in the Lunt/APM 152 f/8 ED-Apochromatic (Apo) refractor, the Takahashi TSA-102 f/8 Super Apo refractor, the Vixen 81s f/7.7 Apo refractor, and the Celestron Onyx 80mm f/6.25 Apo refractor. Diagonals used were the Baader Zeiss 2" Prism, Baader Zeiss 1.25" Prism, and the Baader BBHS 2" Silver Mirror diagonal. A Tele Vue 2x Barlow was used to compare the 10mm Ultra Mono with the Pentax 5mm XO, and the Tele Vue 2.5x Powermate was used to compare the 24mm Modified Erfle to the Pentax 10mm XW. A 25mm Agena 60° Star Guider eyepiece was also used to compare against the 24mm Modified Erfle.

OBSERVED CELESTIAL OBJECTS

A range of different celestial object types were observed to assess the general performance of the eyepieces across a broad range of targets. Objects observed included, among others:

24mm Modified Erfle Targets:

- The Moon
- Stars: Vega
- Multiple Stars: Albireo, Double Double
- Nebulas: M16 Eagle Nebula, M17 Swan Nebula, M57 Ring Nebula
- Open Clusters: M11 Wild Duck Cluster
- Globular Clusters: M22
- Other: M24 Sagittarius Star Cloud

10mm Ultra Mono Targets:

- The Moon
- Planets: Mars, Jupiter, Saturn
- Stars: Vega
- Multiple Stars: Albireo, Double Double

Fig 5: A comparative view of the Burgess eyepieces with the Agena 25mm StarGuider & Pentax 5mm XO. Credit: Author.

FIELD OBSERVATIONS 24MM MODIFIED ERFLE

The field stop appeared sharp and distinct when viewing with the 24 Modified Erfle. Eye relief was also comfortable; although not generous, due to how deeply the eye lens was inset into the housing. Eye relief was such that it was matched the rubber eye guard height -- I could see the entire AFOV when the eye guard was just lightly touching my face and blocking out any extraneous light sources. At no time did flare or ghosting occur while observing, even with bright magnitude 0 Vega.

Using the f/7.7 and f/8 refractors, magnitude 0 Vega remained tight across 70% of the AFOV, with just a minor about of Field Curvature (FC) starting to show at about 50% from center. At the 70% from center position FC was dominant and astigmatism also came into play. However, if I refocused the star point the astigmatism was mild enough at the 70% from center point so as not to be distracting. Past the 70% from center mark, the stars were deformed more than I liked for very bright stars. For stars dimmer than magnitude 0, which is of course the vast majority of stars, these aberrations were less noticeable so that on most star fields I felt maybe up to 80% or even more of the field of view looked acceptable.

Overall I felt the central 70% or so of the AFOV of the Modified Erfle was pleasing for all observing circumstances in my f/8 scopes. In the 81mm Vixen Apo the magnification produced with the 24 Modified Erfle was 26x. In the 102mm TSA the magnification was 34x. In the 152mm Lunt/APM it was 50x.

Moving to my 80mm F/6.25 Apo I expected the off-axis performance to look worse due to the faster focal ratio. Surprisingly I found that behavior in this scope assessed the same, with star points being pleasingly rendered for general observing in the central 70% of the field of view. In the 80mm Celestron Onyx Apo the magnification produced with the 24 Modified Erfle was 21x.

Using the 24mm Modified Erfle with either the Tele Vue 2x Barlow or the 2.5x Powermate, star points were clean and tight to the field stop. With the 2.5x Powermate the effective focal length of the 24mm Modified Erfle was 9.6x so I compared its view against the Pentax 10mm XW. Views through either the 10mm XW or 24mm Modified Erfle with 2.5x Powermate were very pleasing and both showed well for general or casual observing. However, the XW is a top-tier premium eyepiece and was, as expected, more refined in multiple ways: higher perceived contrast to the view with a darker background field of view, nebula and stars visually appeared more contrasted and with more "presence", more generous 20mm fixed focal length, wider 70° AFOV, sealed construction, adjustable eye guard, and premium build. So it was somewhat unfair comparing the Erfle to such a premium eyepiece, but the bottom line was that the view through the Erfle with the Tele Vue 2x Barlow was still aesthetic, engaging, and in my opinion quite acceptable by any standard.

When I was finished testing and just observed for enjoyment with the 24mm Modified Erfle, I found it was quite enjoyable using the lower magnification of the 24mm Modified Erfle to find and initially view the many targets in the vicinity of Sagittarius, then add the 2.5x Powermate to zoom in for closer inspections. So this single eyepiece supplemented with the 2.5x Powermate I found was a nice very minimalist combination for observing. I found it interesting that this 10mm and 24mm combination was the same offered as standard equipment with many new telescopes. I have never liked that combination with new telescope standard equipment, and found it interesting that I did like the combination, as in this case, when the eyepieces were more refined in eye relief, AFOV, and clarity.

Comparing the 24mm Modified Erfle to the Agena Astro 25mm StarGuider (same eyepiece as the Astro-Tech Paradigm Duel-ED and other brandings), a few differences popped out between the two. The StarGuider showed off-axis stars as tighter and better defined, with stars out to 85% from center being nice and tight in my f/7.7 and f/8 Apos. Overall less field curvature was showing in the StarGuider than in the Modified Erfle as well. As a result, the far off-axis star field appeared richer because of the better off-axis correction through the StarGuider than with the Modified Erfle. Eye relief was more comfortable in the StarGuider and the adjustable eye guard was handy.

Examining the background field of view uniformity, the 25mm StarGuider showed some edge of field brightening whereas the 24mm Modified Erfle showed markedly less in extent and brightness (just very dimly nearest the field stop). Scatter in both the Modified Erfle and StarGuider looked about the same, so no advantage was readily apparent for either one. Eye relief felt more comfortable with the StarGuider, although at times the exit pupil would be more difficult to maintain in the StarGuider.

On open clusters, globular clusters, and nebula, such as Messier 11 the Wild Duck, Messier 17 the Swan, and Messier 22, both the Modified Erfle and StarGuider showed these targets quite similarly with no real distinctions between them

Adding the 2.5x Powermate to both eyepieces did not my change impressions. However, the off-axis of the 24mm Modified Erfle cleaned up completely with the 2.5x Powermate whereas the 25mm StarGuider still showed some aberrations in the stars in the far off-axis.

Finally, the rectilinear distortion in the Modified Erfle is extremely low. When placed in a daytime spotter scope straight lines in the off-axis, even right up to the field stop, stayed straight. I then wondered how the true field of view (TFOV) might differ in this eyepiece compared to something like an Explore Scientific 24mm 68° or a Tele Vue 24mm Panoptic, both of which have a significant amount of rectilinear distortion. Having an Explore Scientific 24mm 68° on hand I compared it to the Burgess 24mm Modified Erfle and discovered that the TFOV of both the 61° Modified Erfle and the 68° Explore Scientific were almost exactly identical! So although the Modified Erfle visually shows a smaller AFOV, its TFOV is almost exactly the same as the wider Explore Scientific 68° with its added rectilinear distortion to maintain more controlled off-axis star points.

FIELD OBSERVATIONS 10MM ULTRA MONO

The field stop appeared sharp and distinct when viewing with the 10mm Ultra Mono. However, as received my unit had slight damage to the field stop. As a result, the field stop showed two small indents instead of being perfectly circular. This small irregularity in the field stop, presumably from improper insertion of a spanner wrench during assembly, was minor and had no effect on function and I found generally went unnoticed during observing.

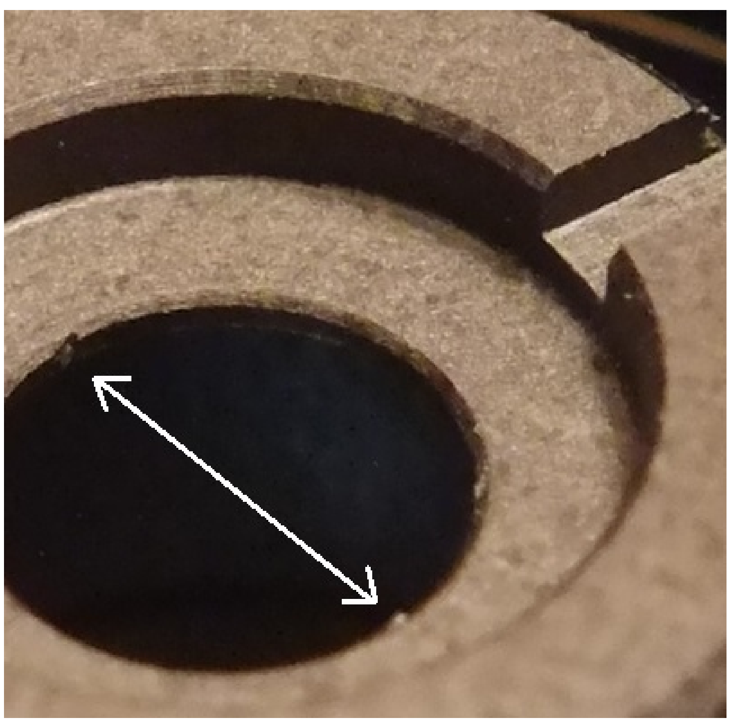

Fig 6: Slight divots damage on the field stop presumably from assembly. Credit: Author.

Eye relief was fairly comfortable, although not nearly as generous as the 16mm value presented in the marketing. Instead, I measured it at 6.8mm optically, with 4.8mm of eye relief usable above the top housing with the eye guard folded down. Although the eye relief was fairly short, overall it did not come across as feeling tight. In use, the eye relief matched the rubber eye guard height; I could see the entire AFOV when the eye guard was just lightly touching my face and blocking all extraneous light sources. At no time did flare or ghosting occur while observing, even with bright magnitude 0 Vega.

Using the f/7.7 and f/8 refractors, magnitude 0 Vega showed tightly rendered across 50% of the AFOV. At the 50% from the center of the field of view in the 10mm Ultra Mono is when Field Curvature (FC) began presenting. Moving Vega to 75% from center, both astigmatism and FC were dominant. In that range between 50% to 75% from center, if the telescope was refocused to eliminate the FC, the star point of Vega was fairly acceptable until it got closer to the 75% point when astigmatism became more significant.

For my planetary tests with the 10mm Ultra Mono I used it with a Tele Vue 2x Barlow attached. This was more appropriate so that the resulting magnification with my refractors would be sufficient for assessing planetary performance. In addition, with the Tele Vue 2x Barlow I could then directly compare the Ultra Mono with the very well respected Pentax 5mm XO planetary eyepiece. I did not consider this an unfair comparison as the XO's design is 5 elements in 3 groups, whereas the Ultra Mono together with the Tele Vue 2x Barlow is a similar minimum glass configuration together having 5 elements in 2 groups.

Using the Tele Vue 2x Barlow with the 10mm Ultra Mono changed things significantly. Now star points were nicely sharp across 80% of the AFOV with the eyepiece operating at an effective focal length of 5mm. Past the 80% point from center astigmatism was only mildly presenting. This larger and more controlled on-axis, along with the shorter effective focal length, made the Ultra Mono quite nice for planetary observing. In this configuration it was producing 240x in the Lunt/APM 152mm Apo, 163x in the TSA-102 S.Apo, and 125x in the Vixen 81s Apo.

Planets showed a wealth of details using the 10mm Ultra Mono with Tele Vue 2x Barlow. Eye relief also felt comfortable, unlike the overly close eye relief of the Pentax 5mm XO or of a 5mm TMB Supermonocentric. Jupiter showed a wealth of detail, contrast, and color. Observations revealed six and more belts, irregular structure on the boarders of the North and South Equatorial belts, structure and shading within these larger belts, nice steel-blue shading and striations in the polar regions, starkly portrayed moon transits, and a very prominent and starkly white band below the South Equatorial Belt.

Saturn similarly showed nicely, with structural details visible within some of the belts. The more blue hues of the north polar region was distinctive and the darker hues of the north polar hexagon was readily visible. Shadows of the planet across the rings was jet-black and sharply etched, as was the Cassini Division. A, B, and C rings all clearly shown and when using the 152mm Apo the Enke Minima also clearly present. Overall outstanding visual contrast and crisply rendered planetary features were observed using the 10mm Ultra Mono with the Tele Vue 2x Barlow.

Mars, like Jupiter and Saturn provided a multitude of “eye candy” using the 10mm Ultra Mono with the Tele Vue 2x Barlow in the three Apos. For some of these observations I added the Vernonscope #30 magenta filter stacked with the Baader Contrast Booster as I found this combination allowed me to cut through some of the obscuring global dust storm on Mars during the observations. The south polar region was very nice and bright white with a darker rim along its edge that was very deep and distinctly etched. There was an ethereal white swatch at the north polar region as well. Even with the dust storm obscuring many of the Martian details, Syrtis Major was still showing nicely with well defined boarders. More ethereal in nature but still there to observe were: Mare Erythraeum, Acidalia Planitia, Mare Serpentis, Sinus Meridiani, and Sinus Sabaeus. These were very faintly visible without the added filtration, and much easier to detect with the stacked filters in place.

When I compared how the Ultra Mono and Tele Vue 2x performed against the 5mm XO and 5mm XW without any additional filtration, most of the Martian features described were difficult to see in the 5mm XW, with only the white of the south polar region viewing well. All the lower contrast features on Mars were much easier to see and showed with more detail in the 10mm Ultra Mono with Tele Vue 2x compared to the Pentax 5mm XW. The Ultra Mono was actually keeping pace with what the venerable 5mm XO was showing, and showing some features just a little better with more visually contrasted features using the Ultra Mono. This was also the case when the pair was compared on Jupiter as well.

Turning to targets perhaps not as well suited for such small AFOV designs, I observed some clusters and nebula with the 10mm Ultra Mono, then comparing those view with what the 10mm Pentax XW showed. On Messier 17, the Swan Nebula, details in the structure of the nebula were better visible in the Ultra Mono than in the XW. However, with such a small AFOV I preferred the view through the XW as it provided greater surrounding context making the view overall more aesthetic. My feelings regarding globular clusters between the two eyepieces was similar, so even though the Ultra Mono was showing faintest stars with more authority, the contextual advantage of the wider AFOV of the XW won out for my observing tastes. Double stars however were a little bit of a different story, as their surrounding context is many times not noteworthy. On double stars the 10mm Ultra Mono clearly presented a darker background sky accentuating the view compared to the 10mm XW. Color hue and saturation presented the same between the eyepieces for colorful doubles like Albireo.

4. SUMMARY IMPRESSIONS

Fig 7. Hubble Space Telescope photo of Mars taken when the planet was 50 million miles from Earth on May 12, 2016. Credits: NASA, ESA, the Hubble Heritage Team (STScI/AURA), J. Bell (ASU), and M. Wolff (Space Science Institute).

24MM MODIFIED ERFLE

Overall I enjoyed using the 24mm Modified Erfle. While its off-axis performance was far from perfect, it provided better performance than I expected from an Erfle design showing fairly nice star points out to about 70% from center in my f/6 and f/8 refractors. Its strongest point for me was its flexibility to be a nice one-eyepiece-show when combined with a few Barlows or amplifiers. It performed exceedingly well when used with the 2x Tele Vue Barlow and the 2.5x Powermate showing perfect star points right up to the field stop. The 25mm StarGuider did not show as well under Barlow. At one point I even stacked the Barlow and Powermate and the Modified Erfle still provided excellent views, this time of planets. While I probably would not choose this eyepiece if I was using an f/5 or faster Dobsonian, at more comfortable focal ratios like f/6 and greater I feel it provided an enjoyable view and a lot of flexibility with near perfect performance when used with Barlows and amplifiers to attain higher magnifications. It was disappointing though that the eye lens was inset so far into the housing as this negated its potential to be an eyepiece with very generous eye relief and suitable for eyeglass wearers.

However, Burgess Optical did mention that they plan a version without the deep inset better suited for use with eyeglasses. As it is though, the usable eye relief of the build is not sufficiently generous for eyeglass wearers being only about 9.5mm above the top housing with the eye guard folded down. It is however and effective usable eye relief without eyeglasses as in use the eye guard just touched my face to acquire the entire field of view, at the point where it blocked any external light sources.

10MM ULTRA MONO

Overall, I felt the 10mm Ultra Mono with Tele Vue 2x Barlow showed some of the best performance I have seen on Jupiter, Saturn, and Mars with any eyepiece through my Apochromatic refractors! When I switched out the Barlow for the 2.5x Powermate instead so the 10mm Ultra Mono was operating at an effective 4mm focal length, its planetary performance maintained its excellent showing. The 4mm planetary position in my eyepiece stall has been vacant for many years trying to find a performer suitable to sit alongside my 6mm ZAO-II and 5mm XW. I used to have the 4mm TMB Supermonocentric and felt it outperformed all other contenders including the likes of the 4mm AP-SLP and 4mm ZAO-II. The 4mm TMB Supermonocentric though has the smallest eye lens I've ever seen and its eye relief is too tight for my tastes. Although the 4mm TMB Supermonocentric was an excellent performer I found it was just too uncomfortable in use. This 10mm Ultra Mono when combined with the 2.5x Powermate, with its large eye lens and fairly comfortable eye relief finally provides me with a 4mm equivalent I consider appropriate to sit alongside my other planetary eyepiece, the Pentax 5mm XO an the 6mm ZAO-II. Overall the field test revealed the Burgess 10mm Ultra Mono to be a top-of-class on-axis planetary performer when used with a Barlow or amplifier, and will remain in my collection.