APERTURA

Panorama 82° Eyepieces

WARNING: Never look directly at the Sun with the naked eye or with this optic. Permanent, irreversible eye damage can result.

The Apertura Panorama eyepieces are a highly corrected wide field eyepiece on par with some of the most well regarded eyepieces in astronomy today. Available in a range of focal lengths, these versatile eyepieces have an 82° apparent field of view (AFOV). The Panorama eyepieces match exceptionally well with SCTs, Dobsonians, Refractors, and many other types of telescopes. The fold up eyecups make for comfortable viewing and the eye relief accommodates most observers, comparable to other 82 degree eyepieces on the market. Unlike most eyepieces, the Panorama utilizes a durable stainless steel eyepiece barrel. They are fully multicoated with anti-reflection coatings. These coatings allow for improved image brightness and better contrast. This document shares not only the technical specifications of these eyepieces, but also shares a wealth of information to help further your astronomical journey.

The manual covers the following topics:

- Specifications
- Apparent Field of View
- True Field of View
- Exit Pupil
- Use of Filters

Specifications

Focal Length (mm)	Barrel size (in)	Eye Relief (mm)	Eye Lens Diameter (mm)	Field Stop Diameter (mm)	Advertised AFOV	Lens Structure (#Elements / #Groups)	Length w/ Eyecup Collapsed (mm)	Maximum Width (mm)	Weight
28	2	18	27	40	82	6/4	119	73	1lb 11oz
21	2	15	21	29.3	82	6/4	98	60	1lb 2.5oz
16	1.25	12	21	21.24	82	7/4	85	45	7.2oz
13	1.25	12	21	18.5	82	7/4	90	45	7.6oz
10	1.25	12	17	14.2	82	7/4	78	45	7.8oz
7	1.25	12	17	11.3	82	7/4	83	45	6.7oz
4	1.25	12	17	5.6	82	7/4	92	45	6.6oz

Apparent Field of View (AFOV)

An eyepiece's apparent field of view can be thought of as the window you look through. The larger the apparent field of view degree, the larger the window. Let’s say, for example, you have an eyepiece with a 50° apparent field of view. With this eyepiece, you’ll likely be able to see the entirety of the object you are viewing through your telescope. Now, swap out the 50° eyepiece for another with the same focal length but with a wider, 82° apparent field of view. Because the focal length is the same, the magnification is the same, and so the celestial object will be the same size. However, with the wider 82° apparent field of view, you can see more space around the object. This wider view allows for a better perspective and increases observation satisfaction.

An example of this increased satisfaction can be illustrated when viewing star clusters. Instead of just seeing a field densely filled with stars, you can see a dense ball of stars at the center and how the sky is darker with sparser stars around the cluster. Now you know, without a doubt, that you are viewing a big and beautiful open star cluster. This is the beauty of a wide field eyepiece.

True Field of View (TFOV)

The actual section of the sky that can be seen though your telescope and eyepiece is called the True Field of View. This differs from apparent field of view because it is only concerned with the actual patch of sky that can be seen.

If two eyepieces have the same focal length, but one has a wider apparent field of view, it will also have a wider true field of view. Though, this is only true if the two eyepieces being compared have the same exact focal length. Two eyepieces with differing focal lengths and different fields of view can have the same true field of view. For example:

- A 25mm Plossl with a 53° AFOV in a 8” SCT will show a 0.66° TFOV.

- A 16 mm Panorama eyepiece with a 82° AFOV in the same telescope will show a 0.66° TFOV.

Both eyepieces in the above example show exactly the same patch of sky, but offer different experiences and different performance.

The measure of TFOV is useful when determining if you will be able to see the entirety of an object. As an example, when viewing the entirety of the Moon, more than a 0.5° field of view is desirable since the Moon is about 0.52° when viewed from the Earth. If we consider that we want a little more room around the object to view the edges comfortably and allow for any tracking inaccuracies of the mount, a 0.6° to 1° TFOV might be preferred.

Calculate the True Field of View
The formula to calculate True Field of View is fairly straightforward: First, divide the telescope's focal length (mm) by the eyepiece focal length (mm), which will give you the combination of magnification for the telescope and eyepiece, and then divide the eyepiece's Apparent Field of View (82° for the Panorama line of eyepieces) by the combined magnification. An example of the formula is shown below:

- Eyepiece AFOV / (Telescope Focal Length / Eyepiece Focal Length)

Let's try this out with a couple different 20 mm eyepieces and an 8" Schmidt–Cassegrain Telescope (SCT). The focal length of the telescope is 2,000 mm. The focal length of our eyepiece is 20 mm.

- 2,000 / 20 = 100

So, this combination is 100x magnification. A simple 20 mm Plossl or Kelner eyepiece might have a 50° AFOV. Divide that by the 100x magnification.

- 50 / 100 = 0.50°

The simple 20 mm eyepiece with its 50° AFOV in combination with the 8" SCT provides a 0.5° true field of view, which is just a bit smaller than the size of the Moon.

Let's perform this exercise again but with the 21 mm Apertura Panorama. The focal length of our 8" Schmidt–Cassegrain Telescope (SCT) is 2,000 mm. The focal length of our eyepiece is 21 mm.

- 2000/20 = 95

This combination is 95x magnification, just about the same as the other 20 mm eyepiece. The Apertura 21mm Panorama eyepiece has an 82° AFOV. Divide that by the 95x magnification.

- 82/95= 0.86°

86° TFOV is much larger than the 50° TFOV of the Plossl eyepiece, and at a very similar magnification. This helps to demonstrate the benefits of a wider AFOV.

Exit Pupil

The exit pupil is the size of the light beam leaving the eyepiece when used with a specific telescope. Knowing the exit pupil size created by your telescope and eyepiece combination is important in order to maximize the viewing experience.

Larger exit pupils will illuminate more eye receptors and allow for more available light from the telescope into the eye, which results in a brighter view. Additionally, larger exit pupils are accompanied by lower magnifications, which further concentrates the available light into a smaller area, allowing the eye to possibly pick up on fainter structures.

Smaller exit pupils and higher magnifications will often provide a darker sky background and some observers find this to be especially useful when viewing galaxies or when viewing from locations that might not be as dark as normally preferred.

A low magnification, large exit pupil eyepiece is often good for use with nebula filters like the Apertura UHC. Keep in mind that the average human eye can only dilate to 7 mm, and this dilation shrinks with age and can only happen at the darkest of observing sites after 30 minutes or more in total darkness. Because of this, a 3 mm-6 mm exit pupil might be the largest you would ever need when using filters. With an SCT, the 28 mm Panorama would most closely match. With an f/6 Dobsonian, the 21 mm or 28 mm Panorama could work.

An exit pupil of 2 mm to 3 mm generally works for most. With an f/10 SCT, this would be the 21 mm or 28 mm Panorama eyepiece.With an f/6 Dobsonian, you might choose the 13 mm or 16 mm Panorama. This would be a good place to start for general deep sky viewing.

For double star or planetary observing, an 1 mm-2 mm exit pupil is a good start. With an SCT, this could be the 10 mm, 13 mm, or 16 mm eyepiece. Some double star observers prefer as low as 0.5mm, but defects in the eye can become visible at the extreme low ranges.

To calculate the exit pupil of a specific telescope and eyepiece combination, there are two methods. We’ll share the simple method here.

Take the focal length of the eyepiece and divide it by the focal ratio of the telescope. Using a 28mm Panorama eyepiece in an f/10 SCT:

- 28mm / 10 = 2.8 mm exit pupil

The benefit of longer eye relief and room for corrective glasses is especially apparent with longer focal length eyepieces which produce larger exit pupils. If an observer has astigmatism, the lower magnifications and larger exit pupil sizes can cause the astigmatism to become much more apparent. So being able to wear corrective eyeglasses at lower magnifications is important. With more mild astigmatism or at moderate magnifications, eyeglasses are generally not required and so, less relief is necessary.

Using Filters

Blocking certain types of light and allowing other types to pass through almost unaltered increases contrast, meaning astronomical filters can enhance a viewing experience. Light pollution is an example of a type of undesirable light. Emissions from nebulae are an example of desired light. Filters do not enhance or multiply light; they simply block undesired light.

The Apertura UHC filters are a great option for enhancing nebulae without dimming the view too much. It can make planetary nebulae like the Ring Nebula and Dumbbell Nebula stand out against a black backdrop, even in mildly light polluted skies. The UHC allows OIII and Hydrogen Beta light to pass through. A less aggressive option would be a filter like the Apertura Moon and Skyglow filter. This filter will provide a brighter view than the UHC, but perhaps with less contrast.

Colored filters like those found in the Apertura 1.25" Lunar & Planetary Filter Set can also be used to enhance the view of any object, though they are primarily used when viewing planets. By swapping out different colored filters, different features on the planet's surface can become more apparent.

Variable polarizing filters such as the Apertura 1.25" and 2” Variable Polarizing filters are useful when viewing the Moon because they work to dim the view by varying degrees, allowing you to tune the intensity to what is most comfortable to the observer.

Installing Filters

To install filters on the Apertura Panorama eyepieces, choose the correct filter size for your eyepiece. Eyepieces with 1.25” barrels require a 1.25” filter. Eyepieces with 2” barrels require a 2” filter. If your telescope has a 2” focuser, it will require a 2” to 1.25” adapter (sometimes included with the telescope).

First, remove the eyepiece from the telescope. Invert the eyepiece so the bottom of the barrel is visible. Without touching the filter glass, gently start to thread the filter into the bottom of the eyepiece. Insert the eyepiece back into the telescope and readjust the focus.

Never view the Sun without proper safety equipment and procedures!

Warranty

The Apertura Absolute Warranty provides two years of coverage against product defects. After the initial two-year warranty expires, this product qualifies for Apertura's Three-Year Accident Replacement Program. In addition, the Apertura Absolute Warranty is transferable! It is important to keep your original receipt and the product's original boxes and packaging, should you need to make a claim.