How to Determine the Magnification of any Telescope

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The magnification of any telescope is controlled by the eyepiece being used and can be calculated by dividing the focal length of the telescope by the focal length of the eyepiece.

For example; the Meade ETX80 Observer which has a 400mm focal length, with the included 26mm and 9.7mm eyepieces, magnification would be 15x power using the 26mm eyepiece (400 / 26) or 41x power with the 9.7mm eyepiece (400 / 9.7). Most telescopes, have interchangeable eyepieces so the telescope can be used at low, medium, or high magnification.

High Magnification Eyepieces

Keep in mind that the smaller the number on the eyepiece (shorter focal length in millimetres), the higher the magnification. Higher magnifications do however always cause the image to lose sharpness. The lower powers will always be sharper due to the effects of Earth's atmosphere.

Barlow Lenses

Barlow lenses are rated by their magnification factors, commonly 2x or 3x. For instance, a 2x Barlow used on the ETX80 Observer with 400mm focal length and a 26mm eyepiece would calculate to a total magnification of 30x (400 / 26 multiplied by 2).

Telescope Maximum Magnification

As a general rule, telescopes with larger apertures can achieve higher useful magnifications which lead to better views. All Meade telescopes are

able to view the same celestial and terrestrial objects. These telescopes can be used to view galaxies, bright nebulae, the Moon and the planets.

However, the clarity of viewing these objects will depend on various factors including:

- Location
- Light pollution
- Weather
- Time of Day
- Telescope optical design
- Collimation of the optics
- Quality of the eyepieces
- Magnification

Useful Maximum Magnification

Under good British viewing conditions from a dark site the maximum useful magnification can be roughly estimated by the aperture of the telescope and its optical design.

Short Focal Length Telescopes

A short focal length achromatic refractor such as the ETX80 is capable of 30x per inch of aperture. E.g. 80mm is equal to 3.15 inches. Therefore, the maximum useful magnification is 3.15 inches x 30 = 94.5. That's approximately 95 times magnification.

It is possible to increase the magnification beyond this level but as the magnification increases the viewing object will become softer and less detailed.

Newtonian reflector telescopes are also cable of approximately 30 times useful magnification per inch of aperture.

Longer Focal Length Telescopes

The Meade ETX90 and ETX125 telescope are based on the Maksutov optical design with longer focal lengths and a higher degree of optical correction. This allows the magnification to increase by up to 40 times per inch of aperture. For example; the EXT125 has an aperture of 127mm or 5 inches. Therefore, the maximum useful magnification is 5 inches x 40 = 200 times.

Advanced Coma Free (ACF) Telescopes

Meade telescopes with Advanced Coma Free (ACF) optics such as the LS, LX90 series among others are capable of 40 times magnification per inch of aperture. For example, the LX90 8” ACF model is capable of 320 times magnification (8 inches x 40 times per inch of aperture).

Apochromatic Refracting Telescopes

Apochromatic refractor telescopes utilize ED (extra low dispersion) glass to achieve high magnifications for their size. This is especially the case with ED apochromats (APO) with three lenses or more.

The Meade Series 6000 apochromatic refractors are capable of 80 times magnification per inch of aperture. The 115mm model is capable of 360 times magnification (4.5 inches x 40 times per inch of aperture).

Summary

As mentioned earlier in this article there are many factors that determine the maximum useful magnification of any telescope. The examples mentioned above should be used only as a guide.