

First Telescope Basic Guide – Part 2

What type of telescope should I buy?

A good all-round beginner's telescope is a Newtonian reflector (below). It's a simple design and is relatively cheap for the size of mirror you'll get for your money – ideal if you're just starting out.

A Newtonian reflector with a 6-inch (150mm) mirror will give you good views of the brighter galaxies and nebulae, and should also perform well when you train it on the Moon and planets.

But what about the other types of telescope? Well, refractors are perhaps the most recognisable of all designs. They use a series of lenses to bring what you're looking at to focus at the eyepiece end of the tube, and are great for observing the Moon or rich star clusters.

There's also the Dobsonian, which is a type of reflector that has a simple mount and because of that, often has a much larger mirror for its price. As this collects more light it will let you see dimmer object's, so it's a great choice if you want to see faint galaxies and nebulae.

Finally, there are the catadioptric telescopes that use a combination of corrector lenses and mirrors. Their compact size makes them relatively portable and their high focal ratios mean that they're ideal for lunar and planetary observing.

What do all the numbers on a telescope mean?

When you're buying a car you want to know how fast it can go, how big the boot is and how many miles per gallon you'll get. A telescope is no different, so let's look at some of the specifications you'll need to know.

The first important spec is the size of the telescope's front lens or main mirror – its 'aperture', which is measured in millimetres today, but is often given in the more traditional inches. The bigger a telescope's mirror or lens, the more light can be captured and the brighter distant celestial objects will appear.

The quality of the lenses is also very important. Before you buy, ask to have a look through it in daylight at a distant object. When it's in focus, a telescope with quality lenses should show clear crisp edges to objects in its field of view.

You'll also encounter the 'f number', which is the focal ratio of the scope – the focal length divided by the aperture. The higher the focal ratio, the narrower the field of view that you see in the eyepiece. So, if you want to study small features on the Moon, then a scope with a high focal ratio is for you.

You'll sometimes hear people referring to a telescope's focal ratio as its speed. Scopes with low focal ratios, like f/5, are said to be fast, while high focal ratios like f/10 are slow.

Finally, don't be fooled by claims of massive magnification – that's not the measure of a good telescope. Even poor telescopes can magnify things many times.

What is the mount for?

The mount is the most important part of the telescope. A telescope with superb optics will always be let down by a poor-quality mount: if you can't keep the optics stable, your view of the night sky will be completely ruined, so make sure that the mount is sturdy. The heavier the mount is the better it will be, because it will be a solid platform for the telescope to rest on.

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However, its weight has obviously got to be offset by how portable you want your telescope to be. It shouldn't have any flimsy plastic parts and it should never flex or wobble noticeably.

There are two main types of mount that you'll come across: the Altaz and the equatorial. Altaz stands for altitude and azimuth, and is the simplest of all mounts. The telescope moves on a base parallel to the ground, up and down (in altitude) and left and right (in azimuth).

The equatorial mount is different and more complex to use. One of its axes is tilted to your latitude, your position on the Earth north or south of the equator, and the other is parallel to the celestial equator, like Earth's equator but in the sky.

It moves in units of right ascension and declination, which are similar to longitude and latitude but mapped onto an imaginary sphere on the sky.

Most Newtonians come on an equatorial mount, and they're really good for astronomy because you only need to adjust one axis, the right ascension one, to keep track of an object in the sky as it moves through the night. With an altaz mount (right), you'd need to adjust both axes to keep one object in view for any longer than a few seconds.

What's the little telescope on top of the big one?

That's the finder scope. It has a wider field of view than the main telescope, with crosshairs over it, so you can find things and aim the main scope much more easily.

Before observing you'll need to align the main telescope and the finder scope. In the daytime, point the main telescope at a distant object like a telegraph pole. Be careful not to look at the Sun or you could damage your eyes.

Centre the top of the telegraph pole in the main eyepiece and then adjust the little screws around the finder scope, one by one, to centre the top of the pole in the crosshairs. Once done, you'll be able to point at something with the finder scope and it will appear in the main eyepiece.

How much money should I spend?

A good Newtonian on a sturdy equatorial mount costs around £200 in the UK, while a good refractor costs around £300. A 6-inch Dobsonian can cost as little as £155. What's most important is that you buy from a well-respected astronomical dealer. Never go over your allowed budget.

Avoid the cheap, poor-quality models you sometimes see in mail order catalogues or in high street stores.

I've unpacked the scope – how do I set it up?

For detailed instructions on your own make of telescope, it's best to have a good read of the manual, but here are a few tips.

Set up the tripod and mount arrangement first, and make sure any leg screws are screwed in and secure enough to take the weight of the telescope.

If you have an equatorial mount make sure that the 'north' leg is indeed pointing north. Then put the telescope tube on the mount.

Check that the tube is secured firmly with the tube ring screws and that it can't slip out of them. If you're setting up a Newtonian, position the telescope tube in the rings so that you can easily look into the eyepiece –it's best to have it parallel to the ground or slightly above parallel.

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And remember, it'll help if you balance the telescope and counterweights before observing.

What is the eyepiece for?

Most telescopes will have one or two eyepieces included in the price. They come in two standard barrel sizes to fit into the telescope focuser – 2-inch or 1.25-inch – and have several optical designs such as Plössl, Nagler or orthoscopic.

The number on the eyepiece is its focal length, measured in millimetres. The smaller the number, the greater the magnification it will give when used.

Two good quality eyepieces with a small (10mm) and a larger (20-40mm) focal length will provide you with a decent range of magnifications to get you started.

However, if you had to choose just one eyepiece, get a 20mm Plössl. Only use or buy eyepieces that have glass lenses, because plastic lenses will almost always disappoint.

Should I get a computerised Go-To scope?

Go-To telescopes come with an in-built computer and handset that, once set up correctly, automatically aim the telescope and track an object. Although this is helpful, we'd recommend that you get a scope without Go-To as your first-time buy.

If you aren't familiar with using a telescope, setting up a scope without Go-To is much easier. A non-Go-To is also much cheaper and will be a gentler introduction to how telescopes work.

How do I align my equatorial mount?

First, check that the north leg of the tripod is pointing roughly north, or simply make sure that the polar axis itself is pointing north. You then tilt the polar axis (the one that moves in right ascension) to the angle of your latitude – your position in degrees north or south of the equator. There will be a graduated scale on the side of the mount head to help you do this, as shown in the image on the left.

The polar axis should now be pointing roughly towards Polaris, which is in Ursa Minor. Check this by looking along the axis, or through the finderscope. For simply observing the night sky this setup is fine and you can now rotate the right ascension (polar) axis with the motion of the stars.

More advanced equatorial mounts include a polar scope, fitted inside the polar axis, that allows for a far more accurate alignment.

To use it, set up your telescope as above and when you look into the polar scope you'll see a diagram on a reticule inside the eyepiece and the star Polaris. You should now align the diagram with the polar axis itself.

Point the crosshairs in the reticule so they are on Polaris. Now unlock the polar axis and rotate it. If Polaris doesn't move, your reticule and polar axis are already aligned and you don't need to adjust it. If it does shift, adjust the alignment of your polar scope until it doesn't move when you rotate the axis.

The final step is to offset Polaris using the reticule so that the polar scope is pointing at the north celestial pole, which is a very short way from Polaris. To do this, tweak the altitude and azimuth knobs on the mount until Polaris is in the correct position in the polar scope's reticule. See your manual for exact details.