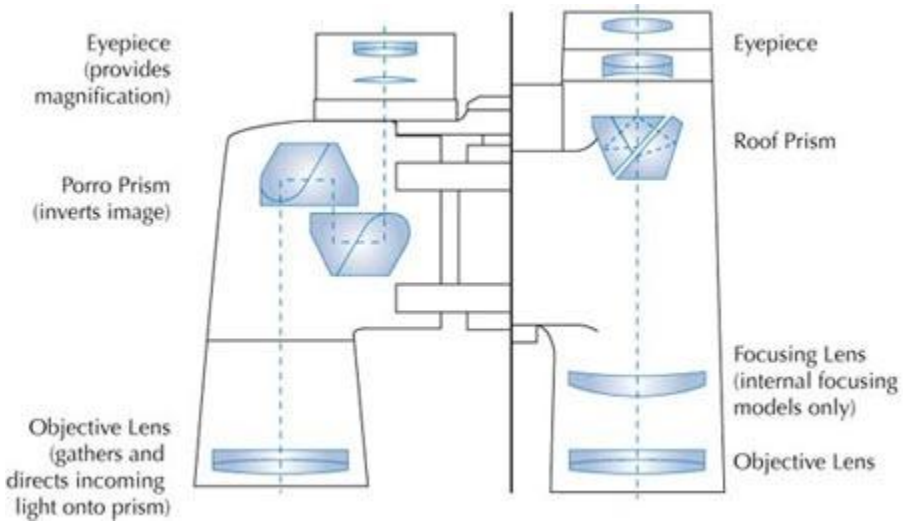
BINOCULARS

Binoculars are a pair of identical telescopes mounted side-by-side and aligned to point in the same direction which allows the user to use both eyes when viewing distant objects. Using both eyes significantly increases the user's perceived visual acuity (resolution) and gives the user a three-dimensional image.



Types of Binoculars

Porro-prism binoculars. These binoculars are wide, with the objective lenses widely separated and offset from the eyepieces. The wider spacing of the objectives gives a better sensation of depth.

Roof-prism binoculars. These binoculars are narrower and more compact than Porros, with the objective lenses in line with the eyepieces.

Porro-prisms produce a brighter image than roof-prisms of the same magnification, objective size, and optical quality because of 12-15% increased light transmission. Porros are more likely to need periodic realignment than roof-prisms.

Optical Parameters of Binoculars

Magnification. The focal length of the objective divided by the focal length of the eye piece gives the magnification power of the binoculars. For example, the 7 in a 7 x 35 binoculars means that the image appears 7 times closer than it actually is (not 7 times larger). A larger magnification leads to a smaller field of view. Most binoculars used for bird watching are 7-10x magnification.

Objective Diameter or Aperture. The diameter of the objective determines how much light can be gathered and how bright the image will be. Typically, binoculars are categorized by the magnification times the objective diameter (i.e., 7 x 50).

Field of View. This is the area seen through the binoculars, usually notated by how many feet (meters) in width will be seen at 1,000 yards (meters) or an angular value of how many degrees can be viewed. Most values are between 5-10 degrees or 260-520 feet.

Exit Pupil. Binoculars concentrate the light gathered by the objective into a beam – exit pupil – whose diameter is the objective diameter divided by the magnification; generally values are between 4 and 8. For example, the exit pupil of 7 x 35 binoculars is 35/7=5. Ideally, the exit pupil should be equal or slightly smaller than the pupil of your dark adapted eye. The pupils of young adults are about 7 mm, those of older adults are about 5 mm.

Eye Relief. This is the distance behind the eye piece at which the image is in focus. The distance the observer must position their eyes behind the eyepiece in order to see an image. This value is particularly important for eye glass wearers.

Close Focus Distance. The closest point that the binoculars can focus on; varies from 1-30 meters.

Focus and Adjustment.

Independent Focus. The two telescopes that make up the binoculars are focused independently.

Central Focus. The two telescopes that make up the binoculars are focused together using a central focusing wheel.

Diopter Focus. The two telescopes can be further adjusted to compensate for differences between the viewer's eyes. After this adjustment is made, the two telescopes can be focused together.

Interpupillary Distance. The two telescopes can be adjusted to accommodate viewers with different eye separation; most are optimized for the typical 56 mm interpupillary distance of adults, but range from 60-72 mm.

Zoom Binoculars. These binoculars are intended to give the user the flexibility of having a single pair of binoculars with a range of magnification. They are not recommended because they have fragile optics, a narrow field of view and reduced brightness.

Image Stabilizing. These binoculars have battery powered gyroscopes or inertial detectors to reduce the amount of image shaking when high magnification is used.

Alignment. Well aligned binoculars should produce a single circular, apparently 3-dimensional image.

Range Finding. These binoculars have a range finding scale (reticle) superimposed on the view. This allows the distance to the object to be estimated if the height of the object is known (or estimable).

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