

Canon

BINOCULARS

TECHNOLOGY GUIDE



15X50 IS
ALL WEATHER



18X50 IS
ALL WEATHER



12X36 IS



10X30 IS

Profile



Image Stabilizer switch: To activate the image stabilizer.

Eyepiece barrel: To adjust the spacing of the eyepieces to the spacing of your eyes.

Diopter adjustment rings: To adjust the diopters to your own eyesight.

Focusing ring: To adjust the focus.

Eyepiece lens: Enlarges the object refracted from the objective lens. It consists of three groups of 5 lenses.

Eye cups: Protect the eyes from shock and harmful rays.

Doublet field-flattener: Makes the images sharp throughout the field of view. This consists of two lenses.

Erecting prisms: Corrects the inverted image.

Vari-Angle Prism: System which stabilizes the image, using Canon's unique optical technology.

Objective lens: Pulls in the image of a distant object.

How to Use the Binoculars

- 1) Look through the binoculars with both eyes, and adjust them for the spacing of your own eyes (with the IS series, use the eyepiece barrels). The instrument is correctly adjusted once both views merge into one circle.



Remembering the readings of the diopters will be convenient to adjust the binoculars after someone else has used them.

Next, adjust the diopter adjustment rings to your eyesight. This is an important step, as each person has different eyesight.

- 2) With your right eye closed, look through the left eyepiece with your left eye. Using the focusing ring, adjust the focus on an object.
- 3) Now, close your left eye and look through the right eyepiece. If the object is in focus, the diopter was adjusted correctly. Otherwise, use the right diopter adjustment ring to readjust the focusing.
- 4) By adjusting the focusing ring each time you look at an object, the diopters will also automatically focus.

Please note that eye spacing and diopter adjustment is different for each person. Another person would have to adjust the eye spacing and diopters again.

- **For eyeglass wearers**

If you look through the binoculars while wearing eyeglasses, your eyes will be further away from the eyepieces, and scenes will gradually shade off at the edges. To prevent this, use the foldaway rubber eyepiece rings if available.



With the IS series, you can simply lengthen the eye cups by squeezing the edges of the eye cups.

Q1 What Types of Binoculars Are There?

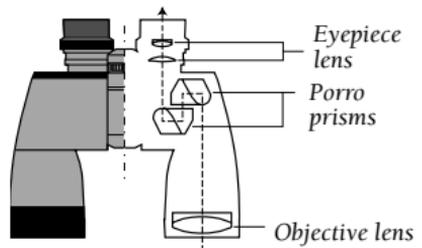
The first binoculars were invented about 400 years ago. There are now several hundred different models of binoculars manufactured and sold throughout the world. Although the concept of seeing a magnified image with your own eyes has not changed, there are two distinctly different types of binoculars: prism binoculars and Galileo binoculars.

• Prism Binoculars

The majority of binoculars sold today use convex lenses for both the objective lens and eyepiece lens. They are called prism binoculars, because prisms are used to “correct” the inverted image.

1) Porro Prisms (Fig. 1)

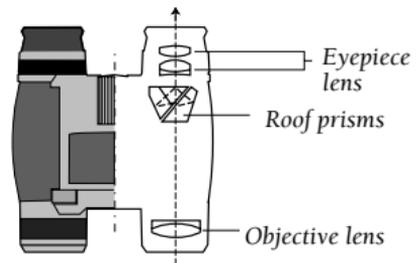
Because of the porro prisms, the light passing through forms a “Z” shape before reaching the eye.



(Fig. 1)

2) Roof Prisms (Fig. 2)

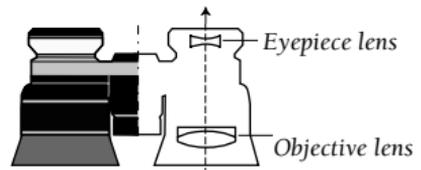
When using roof-shaped prisms, called Roof (or Dach: meaning roof in German) prisms, the light passes through in a straight line, which makes it possible to design compact binoculars.



(Fig. 2)

• Galileo Binoculars (Fig. 3)

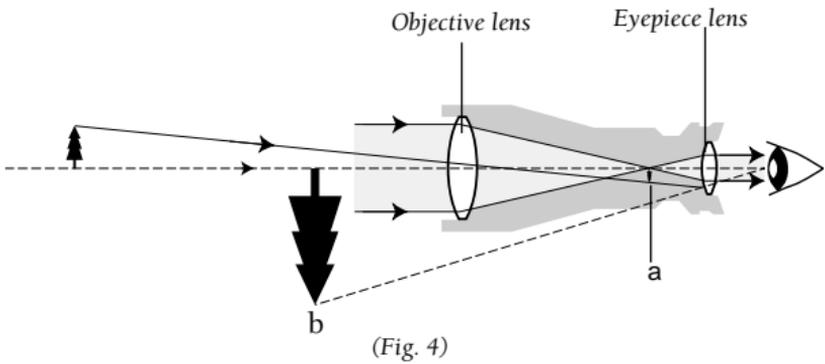
The concept used in the telescopes made by Galileo Galilei in the 17th Century is used in these binoculars. Because concave lenses are used for the eyepiece lenses, prisms are not needed to correct the images. Also known as opera glasses, this type is used for looking at objects not too far away.



(Fig. 3)

Q2 Why Are the Images Magnified?

Basically binoculars are made up of the objective lenses for long focal points, and the eyepiece lens, for short focal points. The light from each to the two objective lenses which forms the image of an object (Fig 4-a), passes through the barrel and hits the eyepiece lens, which enlarges the image (Fig 4-b).



Create a telescope using two camera lenses

Attach a wide-angle lens to a telephoto lens. Without shifting the optical axis, look through from the back of the lens and adjust the distance between the two lenses. You will eventually see a sharp inverted image.

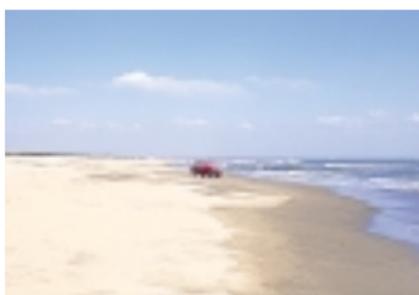
This is the basic structure of a telescope. Put two of these side by side and you have a pair of binoculars. In addition, the longer the focal point of the telephoto lens and the shorter the focal point of the wide-angle lens, the more the image will be magnified. It is also possible to achieve focus by adjusting the distance between the two lenses. It's very simple.



Tested with the EF 300 mm f/4L and EF 24 mm f/2.8, the outcome was pretty obvious.

Q3 What Is Magnification?

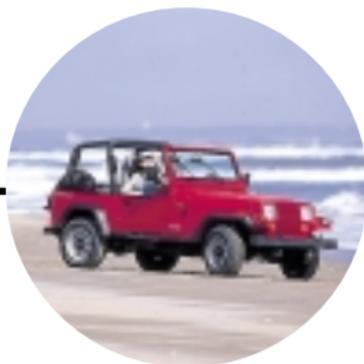
Magnification refers to the ratio of the size as seen with the naked eye and size obtained with the binoculars. For example, if a pair of binoculars has 10x magnification, an object will be enlarged 10 times. In other words, something 100 meters away will look 10 meters away through the binoculars.



A car 100 meters away with the naked eye.



A car 10 meters away with the naked eye.



With a 10x magnification binoculars, a car 100 meters away will seem as if it were 10 meters away.

Magnification and focal length

A 1,000 mm telephoto lens for a camera will provide five times higher magnification than a 200 mm lens. The same applies to binoculars, in that an object is enlarged five times more with 20x magnification binoculars than with 4x magnification binoculars. The only difference is that, while a telephoto lens must be wide enough to magnify the image for the fairly wide aperture of the camera, binoculars need only magnify the image for the relatively smaller iris of the human eye. Say for example you have 12x magnification binoculars. To get the same enlarged image using a 35 mm Single lens reflex camera, you would need to use a 700~800 mm telephoto lens.

Q4 Why Is the Image Easier to See When Enlarged?

How clearly the binoculars let you distinguish details is called their resolving power. Because the unit area of conic vision cells in the retina of a human eye is low, no physical training will be able to increase, up to a point, the resolving power. The only way to increase it is to look through a good pair of binoculars. If you use 10x magnification binoculars, you will have 10x more resolving power than normal.



With the naked eye, you will not be able to read text past a certain distance, but with the binoculars, because the resolving power is increased, you will be able to read it.

Image quality and resolving power

Not all binoculars will provide the magnification ratio and resolving power indicated on the instrument. When there is too much aberration, there is not enough resolving power. No matter how superior the binoculars may be, the resolving power will decrease because of image shake. The larger the magnification ratio, the more the hands will shake that image. In general, binoculars with magnification of over 10x are not recommended for hand-held use.

To eliminate this problem, Canon has adopted its superior optical technologies gained in developing camera lenses. In addition to using the doublet field-flattener, UD lens and aspherical lenses to achieve ideal resolving power, Canon has used its own original image-stabilization technology (in the IS series), which greatly controls hand shake. It is because of these technologies that with Canon's binoculars, each feather on a bird's wing comes in crisp and clear.



A sharper image—right down to the bird's wings.



Because of lens aberration, the entire image appears blurry.

Q5 Why Are There Different Fields of View for Different Binoculars?

The optical structure of each model of binoculars is different, so even if the magnification rating is the same, how much view the pair of binoculars can pull in will differ. The width of the view you can see through the binoculars is called the field of view. For bird watching in a large forest, using a wider field of view will be more useful.

1) Real field of view

This is the view through the binoculars (Fig. 5-a), and it is measured from the center of the objective lens and expressed in degrees (angle). The lower the magnification the binoculars have, the wider the real field of view—and the higher the magnification, the narrower the field of view. Because of this, it is hard to compare the real field of view of binoculars with that of binoculars of different magnification rating.

2) Apparent field of view

This is the value of the real field of view multiplied by the magnification (Fig. 5-b). For example, if 10x magnification binoculars have a 5x real field of view, the apparent field of view will be 50°. This value represents the field of view which you will see looking through the binoculars. It is comparable even among binoculars of different magnification. In general, if the apparent field of view is more than 65°, it is considered a wide field of view.

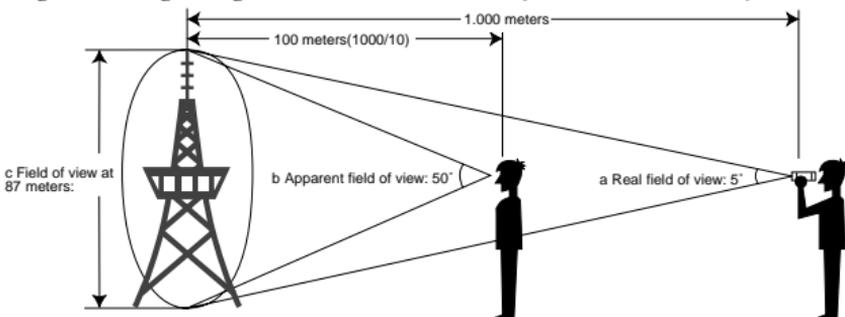
$$\text{Apparent field of view} = \text{Magnification} \times \text{Real field of view}$$

3) Field of view at 1.000 meters

The field of view, measured in meters, which you can see 1.000 meters in front of you.

$$\text{Field of view at 1.000 meters} = 1.000 \times 2 \times \tan\left(\frac{\text{Real field of view}}{2}\right) \text{ [m.]}$$

(Fig. 5) Looking through 10x/5° binoculars at a subject 1,000 meters away



(Fig. 5)



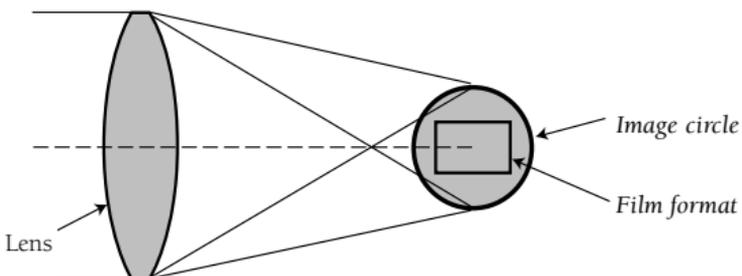
Wide field of view



Narrow field of view

Field of view and image circle

Film for 35-mm cameras has a set standard format (24 x 36 mm), and if the focal distance is the same, generally the angle of the lens will not change. However, the field of view is larger than the film, and the part of the view which is larger than the film is called the image circle (Fig. 6). The field of view for binoculars is usually everything inside the perimeter of the image circle.



(Fig. 6)

Q6 Why Are Some Binoculars Brighter Than Others?

Brightness varies from one model of binoculars to another. Brightness varies with the price and size of the binoculars. There are many degrees of brightness according to one's needs.

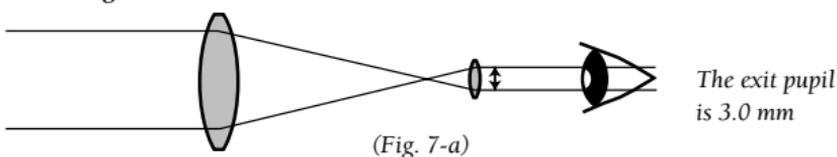
1) Exit pupil

The bright circle visible when the eyepiece lens array is viewed about 10 inches away from the eyes is called the exit pupil. The diameter, measured in millimeters, is called pupil aperture. The larger the exit pupil, the brighter an image the binoculars make, and the brightness is expressed by the square of the aperture of the exit pupil.

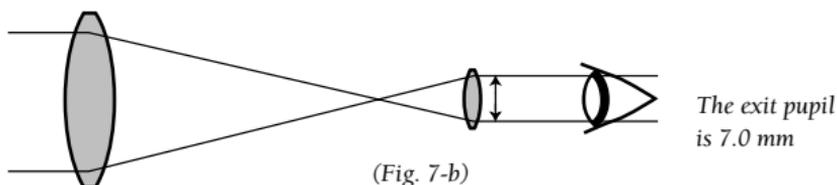
Human pupils are about 2-3 mm at most (Fig. 7-a) when bright, and the binoculars' exit pupils should be about 3 mm. At night, our pupils dilate to about 7 mm (Fig. 7-b), so it is desirable to have binoculars with large exit pupils if they will be used at night.

However, the disadvantage is that such binoculars tend to be big and heavy.

When bright



When dark



2) Available Aperture of the Objective Lens

The diameter of the objective lens which the light passes through is called the available aperture of the objective lens. If the magnification is the same, the larger the available aperture of objective lens, the brighter image seen through the binoculars. This is the same effect as when a telephoto lens has a very large lens diameter. The relationship of the three is:

$$\text{Aperture of Exit Pupil} = \frac{\text{Available Aperture of Objective Lens}}{\text{Magnification}}$$

3) Twilight Coefficient

Watching a bird from a distance at night, you would use a 300 mm f/2.8 instead of a 50 mm f/1.4 lens, even if the brightness were cut in half. The amount of gradation which the human eyes can see is very large, and with experience, will be able to distinguish between the colors. In this way, although the eyes may be weaker when bright, the higher the magnification (resolving power), the more detail the eyes will be able to distinguish. A simple calculation rule:

$$\text{Twilight Coefficient} = \sqrt{\text{Magnification} \times \text{Available Aperture of Objective Lens}}$$

(the brightness is limited to a certain point)

For example, if you compare the brightest binoculars for general use, those of 7x50 (exit pupil: 7.1 mm) and 12x36 (exit pupil: 3.0 mm), the binoculars of 7x50 are brighter. But with the twilight coefficient:

$$\sqrt{7 \times 50} = 18.7$$

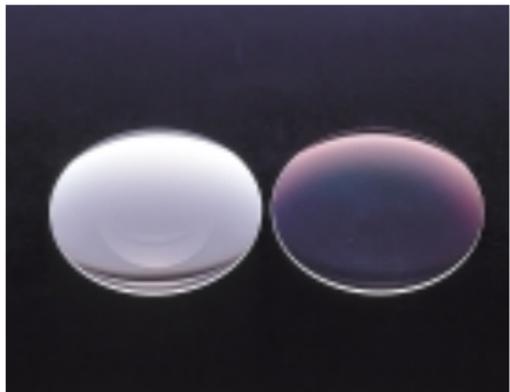
$$\sqrt{12 \times 36} = 20.8$$

As a result, using 12x36 binoculars at night will provide more detail.

Brightness and Lens Reflection

Even with binoculars with the same exit pupil, the brightness may not always be the same. This is due to the amount of light reflected by the lens. With uncoated lenses, about 8% of incident light is reflected. The more light is reflected, the lower the brightness of the images will be, in addition to a decrease in image quality.

In order to prevent the incident light from being reflected, Canon uses a “super spectra” coating, which has been highly praised for its efficacy with Canon’s EF lenses. Canon also coats the prisms as well to ensure bright and clear images.



Left: lens not coated. Right: lens coated. The lens on the left looks white because light is reflected.

Q7 How Can I Tell the Difference in Image Quality?

The ideal binoculars are ones that make you forget you are looking through binoculars. If you purchase a pair with a wide field of view, and the image quality is superior (enough that there isn't much difference from looking with the naked eye), you will have many enjoyable hours of use. Some people have the misconception that because they only concentrate on the middle of the lens, even if the outer part is blurred, it really will not matter. Normally, the retina projects aberration-free images, so when you view blurred images, the brain tries to disregard them. If you consciously try to reject the blurred images for a long period of time, there is a chance that you will become very tired and even sick. It is very hard to determine the image quality with just a spec sheet. The easiest and surest way is to actually look through the binoculars. Please keep the following points in mind when purchasing binoculars.

1) Do you see only one image or two?

Binoculars use two lenses parallel to each other. However, if alignment during manufacture is not perfect, or owing to shock during transport, the lenses may become just a bit off. If that happens, you will see two images. Even if you get the binoculars fixed, the lenses will tend to slip with just a slight jolt. Such binoculars are not recommended.

2) Is the image sharp enough?

Make sure that the lettering on a sign or the thin branches on trees are crystal clear (See comparative photos "Resolving Power" on page 7). Also, make sure that the lights at night and the stars are not blurred and the shapes are not distorted (photo a). It may be difficult to know how clear the image is by looking through only one pair of binoculars. Try looking through several, and you will be able to tell the difference.

a: Comatic aberration



The image around the light source is blurred.

b: Chromatic aberration



The highlight part looks pink.

c: Discoloration



There is a yellow tint on the image.

3) Does it seem as though the colors are running together? How about discoloration?

When you look at a white object, a rainbow-type ring appears. Called chromatic aberration, the image quality usually decreases, and occurs with binoculars with larger apertures and higher magnification (photo b). Also, because of the coating and different lenses used for the binoculars, the colors may change. Point the binoculars at a white image and check to see how white the image is (photo c).

In order to prevent discoloration, Canon has adopted the UD lens (15X50 IS ALL WEATHER, 18X50 IS ALL WEATHER) from the EF lens series, which is known for its superior optical technology. In addition, with the “super spectra” coating, we guarantee bright and clear images (photo d).

4) Is the entire image clear?

There are more binoculars with a wide field of view to meet the demands of consumers. However, there are cases where the binoculars were “forced” to have a wider field of view, which causes the image quality around the edge of the lens to decrease. When this happens, most of the time it is caused by curvature of the field. Point the binoculars at a wall, focus on something simple, and check if you can see clearly all round (photo e). If the curvature of the field is large, the edges will be blurred. It is not recommended to purchase such binoculars.

To greatly decrease the curvature of the field, Canon uses a field-flattener lens and an aspherical lens. With Canon binoculars, you will have beautiful image quality all round.

5) Is the image distorted?

When looking through the binoculars, there are times when the perpendicular lines of windows of a building or bricks seem warped around the edge of the lens (photo f). This is called distortion. When the distortion is great, not only will the entire object seem distorted, but when you move the binoculars, it will seem as if the object were flowing, making it very hard to see. Canon uses high-precision aspherical lenses to correct the distortion.

d: Contrast



The colors are not vivid and look dull.

e: Curvature of the field



The image around the light source is blurred.

f: Distortion



The building is slanted, and has a spool-shaped effect.

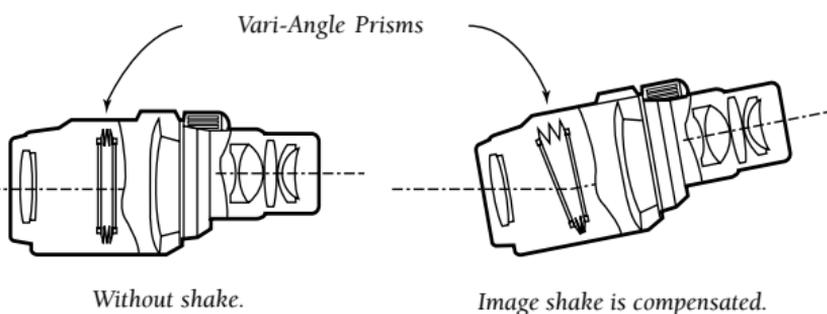
Q8 What Makes Canon's IS series so Unique?

Eliminated "image shake," which was a major problem with binoculars.

Uses the most advanced image stabilizer.

Almost everybody who has ever used binoculars at sporting events or concerts has experienced how much the images shake, and you feel that the binoculars are useless. The main complaint of users has been image shake. The higher the magnification, the larger the image shake. In general, any binoculars with over 10x magnification should not be used for a long time.

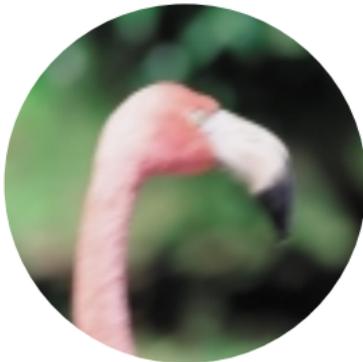
The best solution in the past was to use a tripod. However, tripods are bulky and can't be used everywhere. Even if you need a pair of binoculars of over 10x magnification for bird watching, the most you would want to use since you walk around a lot would be something of 7x or 8x magnification. Canon is the world's first maker to use an active optical image stabilizer for IS series. Because two Vari-Angle Prisms are controlled by a microprocessor, hand shake is eliminated (Fig. 8). As a result, even with over 10x magnification, a tripod is not needed. And they can even be used while viewing from a moving car or train! In addition to the light weight, there is no eye strain to make you tired, so it is possible to use these binoculars for a long time.



(Fig. 8)



With image stabilizer



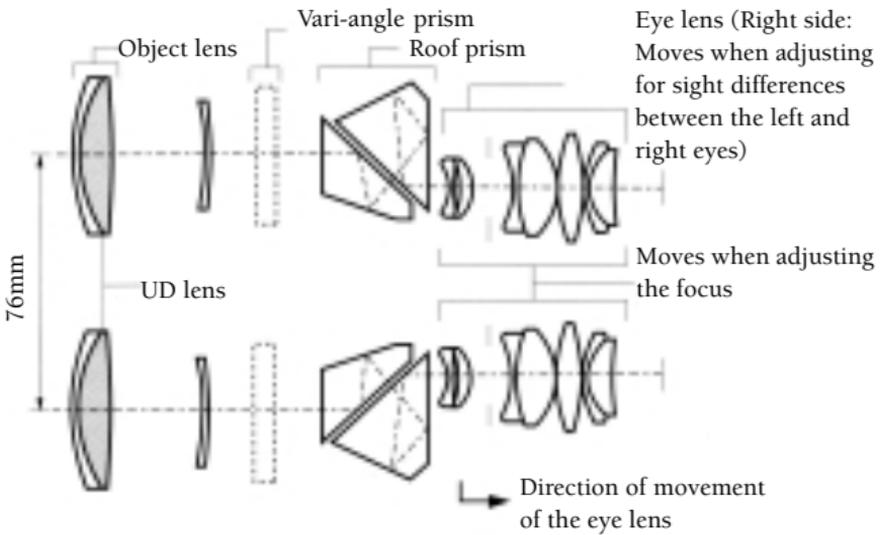
Without image stabilizer



With the image stabilizer on, you are guaranteed stable images even from a moving vehicle.

**Wide field of view, with superior image quality overall.
Uses a doublet field-flattener.**

The image quality around the edges is a very important point to look at when selecting binoculars. If binoculars with inferior image quality are used for an extended period of time, the user will tire easily and may even become sick. The IS series use the world's first doublet field-flattener lens (Fig. 9). This is Canon's exclusive optical design with two field-flattener lenses, lenses which are normally reserved for high-grade binoculars. By using two lenses, Canon has achieved a wide field of view of 67° (12x36 IS, 15x50 IS ALL WEATHER, 18x50 IS ALL WEATHER), with unrivaled sharpness.



(Fig. 6)

You can enjoy the power and sharp image .

Lightweight and water resistant: Excellent for outdoor use.

The bird that you were following from afar suddenly came close to you. One problem you encounter is the closest focusing distance. In general, the more magnification the binoculars have, the longer the focusing distance. There are plenty of times when you had no choice but to watch with the naked eye, because you couldn't focus in time.

Also, when you are bird watching, you are constantly walking around with a pair of binoculars. For that reason, you would like to carry around something light. 10x30 IS, despite its image stabilizer and full size, weighs only 600 gr. Because a tripod would weigh a couple of pounds, the burden is cut down considerably.

The “15x50 IS ALL WEATHER” and the “18x50 IS ALL WEATHER” are designed with a sealed construction that suits them for outdoor use, even in the heaviest rain conditions. They are built for ALL WEATHER action.

And what's more, because the 12x36 IS is water resistant, you can still use it in a light drizzle. Even if it gets wet, it is still easy to hold, because it is covered by a rubber material.



The ALL WEATHER type is suitable for ALL WEATHER conditions - rain or shine.

Various types and characteristics of image stabilization technology

Presently, there are three makers, including Canon, selling binoculars with image stabilization technology

1) Vari-Angle Prism type

Two sensors detect horizontal and vertical shaking respectively. The two Vari-Angle Prisms in both the left and right telescopes are controlled by a microprocessor to instantly adjust refraction angle of the incoming light. This system is used in Canon's IS Binoculars.

Advantages:

- Compact, light.
- Immediate response after the image stabilizer is activated (the system is activated as soon as the button is pressed).
- Stable image even when panning.

Disadvantage:

- Requires batteries.

2) Gyro type

A high-speed motor-driven gyroscope is attached to a prism. No matter how much the binoculars are shaken, the image will remain stable. This system is used in Fujinon's Stabiscopes S1240 and S1640.

Advantage:

- Extremely resistant to heavy shaking or movement.

Disadvantages:

- One minute delay while the 12,000 rpm motor is starting up.
- Tend to be heavy.
- This system is unable to distinguish between shake and panning; therefore image is not stable when panning.
- Requires batteries.

3) Mechanical type

The prism system is tied-in with the Cardanic Suspension system, which prevents the prisms from moving no matter how much the binoculars are shaken. This system is used in the Zeiss 20x60S Professional.

Advantages:

- No batteries required because of mechanical system.
- Immediate response after the image stabilizer is activated (the system is activated as soon as the button is pressed).

Disadvantages:

- Tend to be heavy.
- This system is unable to distinguish between shake and panning; therefore the image is not stable when panning.

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Choose binoculars according to your needs. You will see a whole new world.

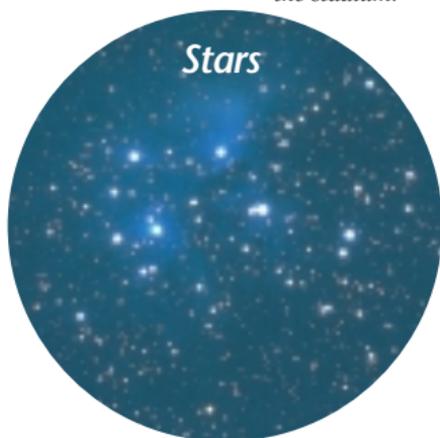
View beautiful scenery or architecture, or museums with the compact 10x25A or 8x22A – they will come in handy on vacations. With the 10x30 IS, you'll be able to see the details of the pencil strokes of sketches or texture of paintings.

You'll be able to watch a parade during your vacation.



Wide-field-of-view-type binoculars will come in handy when watching your favorite athlete play on a large playing field or performer on stage. If you want to see the expressions of the players, the 10x25A is recommended. For extreme close-ups, the image stabilization 12x36 IS, which is easy on the eye, is recommended.

With a good pair of binoculars, you'll feel as if you were in the royal box, no matter how large the stadium.



The first thing you'll want to do when observing the stars is to pick out the constellations. It's a lot of trouble to lug around a tripod. With the image stabilization 12x36 IS, 15x50 IS ALL WEATHER and 18x50 IS ALL WEATHER it's simple and easy, and you'll be able to shift your view to different parts of the sky quickly. With the 8x32WP, even a star of the ninth magnitude can be clearly seen.

You can see Pleiades (M 45) clearly.

Model	15x50 IS All Weather	18x50 IS All Weather	12x36IS	10x30IS	8x32WP
Magnification (x)	15	18	12	10	8
Obj. Lens Diameter (mm)	50	50	36	30	32
Real Field of View (°)	4.5	3.7	5.6	6.0	7.5
Apparent Field of View (°)	67.0 (wide)	67.0 (wide)	67.0 (wide)	60.0	60.0
Field of View at 1000m (m)	79	65	98	105	131
Exit Pupil (mm)	3.3	2.8	3.0	3.0	4.0
Eye Relief (mm)	15.0 (long eye relief)	15.0 (long eye relief)	15.0 (long eye relief)	14.5	18.0 (long eye relief)
Closest Focus (m)	6	6	3.4	4.2	6
WxHxD (mm)	152x193x81	152x193x81	141x73x169	127x70x150	54.5x136x145
Weight (excl. batteries)	1200	1200	890	600	730
Image Stabilizer	•	•	•	•	-
Field Flatteners Lens	• (double)	• (double)	• (double)	• (double)	• (single)
Aspherical Lens	-	-	-	-	-
UD Lens	•	•	-	-	-
Water Resistant	all weather	all weather	all weather	-	waterproof
	(usable in heavy rain)	(usable in heavy rain)	(usable in light rain)		

The Operating Time for the "Image Shake" Corrective Function in the IS series

Model name	15x50 IS All Weather and 18x50 IS All Weather		12x36 IS		10x30 IS	
Temperature(°F/°C)	77°F/25°C		77°F/25°C		77°F/25°C	
Type of Battery used	14°F/-10°C		14°F/-10°C		14°F/-10°C	
Alkaline battery	2.5 hrs	10 min	1.5 hrs	5 min	4 hrs	20 min
Lithium battery	8 hrs	1.5 hrs	7 hrs	3 hrs	12 hrs	5 hrs

*All the periods of use above are approximate

For veteran bird watchers, the high-magnification, image stabilization IS Binoculars series is best. Because a tripod will not be needed, you will be able to see the minute details of the changes in their feathers with the seasons, and more easily identify species. For the beginner, light, compact 8x22A or 8x23A are recommended.



Easily catch the tension in the athletes' faces.



Catch the details of the bird's movements.

For nature lovers, the waterproof-type 8x32WP or 8x23AWP are recommended. They are perfect for use outdoors because of the antifog structure of the lenses. With the IS Binoculars whale watching will be great!



Among high waves, whales are easily mistaken for crests of waves. Binoculars will be a necessary tool.



Take waterproof binoculars when fishing.

	8x23AWP	8x23A	10x25A	8x22A	7x17FC	5x17FC
	8	8	10	8	7	5
	23	23	25	22	17	17
	6.4	6.4	5.2	6.4	6.5	9.0
	51.2	51.2	51.0	51.0	45.0	45.0
	114	114	105	113	114	157
	2.9	2.9	2.5	2.8	2.4	3.4
ef)	11.0	11.0	11.0	11.0	15.5	16.0
	3	3	3	3	1.5	1.4
	123x106x60	104x100x48	44x66x107	66x107x54	91x60x25	91x60x25
	400	250	310	300	180	180
	-	-	-	-	-	-
	-	-	-	-	-	-
	•	•	•	•	-	-
	-	-	-	-	-	-
	waterproof	-	-	-	-	-

- The "WP" in the model designation is for "Waterproof." "A" indicates the incorporation of an aspherical lens.
- The dimensions apply when the binoculars are in the case.
- Waterproof models are waterproof 1 meter underwater for 5 minutes. These models are not for use under water.



All Canon Binoculars are composed only of environment friendly lead-free optical glass. This special lens design was engineered as part of the corporation's continued concern towards our environment.

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