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Zoom 7000

Features

- Working distance 5″ to infinity.
- Parfocal over entire zoom range.
- Highest mag. 1.1X at 5″ (at camera).

The Zoom 7000 is a close-focusing macro video lens with a working distance of 5 inches to infinity. This versatile lens is compatible with cameras 2/3″ or smaller and is specifically designed for use in applications where objects over 1″ in diameter must be imaged. It offers unsurpassed clarity and parfocal zoom capabilities over the entire zoom range.

The Zoom 7000 is ideal for quality assurance, biomedical imaging, or assembly applications where an easy-to-view, sharp and true-to-life magnified image of your product can mean the difference between a shippable, top-quality end product and a costly manufacturing failure.

The Zoom 7000 offers a 6:1 zoom ratio or a 6X magnification power over a focal range of 18 mm to 108 mm. It comes with a close-up lens for imaging at distances from 5″ to 12″. When the close-up lens is removed, the working distance extends from 24″ to infinity. Focus and aperture control are standard Zoom 7000 features. Navitar also offers an 18-108 mm Bayonet Mount Zoom Lens (3CCD Camera) (1-11898) or a Zoom 7000 locking sleeve (1-11736).

Example

Object size = 100mm x 50mm

Camera format = 2/3″

Criteria: All edges should be visible at low magnification and high magnification should show the object at maximum magnification.

Looking at the chart below, a 10″ working distance would allow a 108 mm wide object to be imaged into a 2/3″ camera. Therefore, something slightly less than 10″ would do for an object 100mm wide and would provide maximum magnification at high zoom.

Zoom 7000 Field of View

W.D.	2/3" High Mag.		2/3" Low Mag.		1/2" High Mag.		1/2" Low Mag.		1/3" High Mag.		1/3" Low Mag.		1/4" High Mag.		1/4" Low Mag.	
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
5"	8	6	48	36	5.8	4.4	35	26.3	4.3	3.2	25.9	19.4	2.9	2.2	17.5	13.2
6"	10	7.5	60	45	7.3	5.5	43.8	32.9	5.4	4.1	32.4	24.3	3.7	2.8	21.9	16.5
7"	12	9	72	54	8.7	6.6	52.6	39.4	6.5	4.9	38.9	29.2	4.4	3.3	26.3	19.7
8"	14	10.5	84	63	10.2	7.7	61.3	46	7.6	5.7	45.5	34	5.1	3.9	30.7	23.0
9"	16	12	96	72	11.7	8.8	70.1	52.6	8.6	6.5	51.8	38.9	5.9	4.4	35.1	26.3
10"	18	13.5	108	81	13.1	9.9	78.8	59.1	9.7	7.3	58.3	43.7	6.6	5.0	39.4	29.6
11"	20	15	120	90	14.6	11	87.6	65.7	10.8	8.1	64.8	48.6	7.3	5.5	43.8	32.9
12"	22	16.5	132	99	16.1	12	96.4	72.3	11.9	8.9	71.3	53.5	8.1	6.0	48.2	36.2
With Close-up Lens Removed																
2'	42	30	252	180	30.7	21.9	184	131.4	22.7	21.1	136.1	97.2	15.4	11.0	92.0	65.7
2'6"	54	39	324	234	39.4	28.5	236.5	170.8	29.2	25.9	175	126.4	19.7	14.3	118.3	85.4
3'	66	48	396	288	48.2	35	289.1	210.2	35.6	25.9	213.8	155.5	24.1	17.5	144.6	105.1
3'6"	78	57	468	342	56.9	41.6	341.6	249.7	42.1	30.8	252.7	184.7	28.5	20.8	170.8	124.9
4'	90	66	540	396	65.7	48.2	394.2	289.1	48.6	35.6	291.6	213.8	32.9	24.1	197.1	144.6

Taken from 2/3", 1/2", 1/3" & 1/4" camera monitor systems with an approximate 10% overfill. All dimensions are in mm. Zoom adjustment comes with locking screw. Iris and Focus adjustment can be modified for locking screw upon request.

Understanding Focal Length and F/Number

Video lenses can be classified into three categories according to focal length: standard, wide angle and telephoto. Focal length is the distance between the camera sensor and the center of the lens. The greater the focal length, the larger the image will appear. Therefore, the greater the focal length, the more the lens becomes telephoto in application.

Standard Lens
A standard lens doesn't change the size of the object being viewed.

Wide Angle Lens
A wide angle lens provides a wider field of view and therefore a smaller image of the object being viewed than a standard lens.

Telephoto Lens
A telephoto lens produces a larger image of a distant object. The longer the focal length, the larger the object will appear.

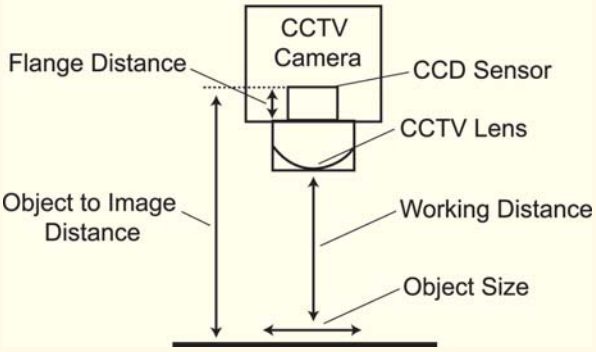
The f/number is an indication of the brightness of the lens. It is the measurement of the ratio between the focal length and the diameter of the entrance pupil (where the light enters the lens). The f/number is directly proportional to the focal length and inversely proportional to the effective diameter of the lens. It determines the amount of light reaching the camera sensor. The smaller the value, the larger the opening and the brighter the image produced by the lens.

How to Determine the Lens Focal Length Required

To choose the proper lens for a particular application, the following factors must be considered:

- Field of View - The size of the area to be imaged.
- Working Distance (WD) - Distance from the camera lens to the object or area under surveillance.
- CCD - The size of the camera's image sensor device.
- You must be consistent. If you are measuring the width of your object, then use the horizontal CCD specifications, etc. If you are working in inches, then do your calculations in inches and convert to millimeters at the end.

Distance Diagram



$$FL = \frac{CCD \times WD}{FOV}$$

Consider this example: You have a 1/3″ C-mount CCD camera (4.8 mm horizontal). There is a 12″ (305 mm) distance between the object and the front of the lens. The field of view, or object size, is 2.5″ (64 mm). The conversion factor is 1″ = 25.4 mm (round up).

Calculation in mm:
FL = 4.8 mm x 305 mm / 64 mm
FL = 1464 mm / 64 mm
FL = **23 mm Lens Required**

Calculation in inches:
FL = 0.19″ x 12″ / 2.5″
FL = 2.28″ / 2.5″
FL = 0.912″ x 25.4 mm/inch
FL = **23 mm Lens Required**

Please do not confuse working distance with object to image distance. Working distance is measured from the front of the lens to the object being viewed. Object to image distance is measured from the CCD sensor to the object. To calculate the lens focal length required, you must use working distance.

Optical Characteristics of Video Lenses

Image Size Chart

Image Sensor	Image Circle	Horizontal	Vertical
1/4"	Ø4.0 mm	3.2 mm	2.4 mm
1/3"	Ø6.0 mm	4.8 mm	3.6 mm
1/2"	Ø8.0 mm	6.4 mm	4.8 mm
2/3"	Ø11.0 mm	8.8 mm	6.6 mm
1"	Ø16.0 mm	12.8 mm	9.6 mm

Image Size

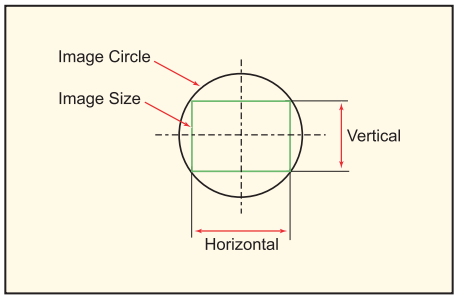
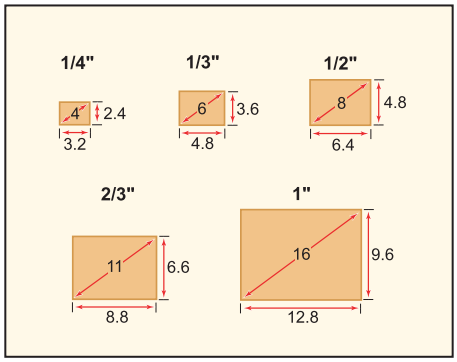


Image Sensor Size (units in mm)



Camera to Monitor Magnification

Camera Format	Monitor Size (diagonal)					
	9"	14"	15"	18"	20"	27"
1/4"	57.2X	88.9X	95.3X	114.3X	127X	171.5X
1/3"	38.1X	59.2X	63.5X	76.2X	84.6X	114.1X
1/2"	28.6X	44.5X	47.6X	57.2X	63.5X	85.7X
2/3"	20.8X	32.3X	34.6X	41.6X	46.2X	62.3X
1"	14.3X	22.2X	23.8X	28.6X	31.8X	42.9X

Image Size

A lens produces images in the form of a circle, called the image circle. In a video camera, the imaging element has a rectangular sensor area (the image size) that detects the image produced within the image circle. The ratio of the length of the horizontal to vertical sides of a video image is called the aspect ratio, which is normally 4:3 (H:V) for a standard video camera.

Relationship Between Angle of View and Image Sensor Size

An important factor to remember is that cameras with different image sensor chip sizes (such as 1/4″, 1/3″, 1/2″, 2/3″ and 1″), using the same focal length lens, will each yield a different field of view.

Lenses designed for a larger image sensor device will work on a new, smaller size camera. However, if a lens designed for a smaller format image sensor device (i.e. 1/3″) is placed on a larger one (i.e. 2/3″), the image on the monitor will have dark corners.

Image sensor sizes are in a ratio of 1:0.69:0.5:0.38:0.25. This means that a 1/2″ format is 50% of a 1″ format, a 1/2″ format is 75% of a 2/3″ format and a 1/3″ format is 75% of a 1/2″ format.

Minimum Object Distance

Minimum object distance (M.O.D.) indicates how close the lens can be placed to the object for shooting. It is measured from the vertex of the front glass of the lens.