

Application Note- CCTV
SI No. 01/2008

How to Calculate Focal Length

One common question which each sales guy would have faced from the customer is 'What should be the focal length of the lens if the object is X mtr far?'

If such a question is asked to me, my initial reply will be 'you may use any lens for viewing objects at any distance'. However I will add certain conditions also to it. If a proper lens is not used, you will not be able to identify the object clearly. Also whatever information you get from the object you should be satisfied with it.

As we cannot give such replies to our customers, we need to understand what is the calculation involved in clarifying this query.

The formula used for calculating focal length is

$$f = v \times (D/V) \text{ or } f = h \times (D/H) \text{ where}$$

f – focal length in mm

v – vertical multiplier

V – Vertical field of view

h – horizontal multiplier

H – Horizontal field of view

D- Distance of the object from the lens

By looking at the formula, we can understand that we need to know the approximate size of object we want to see.

v & h are constant values which depend on the camera format. See the table below for their values

Camera Format	1 inch	2/3 inch	1/2 inch	1/3 inch	1/4 inch
v	9.6	6.6	4.8	3.6	2.7
h	12.8	8.8	6.4	4.8	3.6

Let us work out an example. Suppose we need to see an object which is around 8 m far and camera format is 1/3". If the height of object is around 3 m, focal length required will be

$$f = 3.6 \times (8/3) = 9.6\text{mm}$$

Similarly if the width of the object is known we can calculate the focal length by involving equation involving horizontal multiplier.