Tips For Choosing Industrial Lens

The process of choosing a industrial lens is the process to confirm every parameters of the lens gradually. As a imaging device, Lenses are usually used to work with the cameras and machine vision lights to constitute a complete machine vision system. Therefore, the choice of lenses should take the whole system into consideration. Generally, the following aspects is what you may need to consider when choosing industrial lenses:

Focal Length

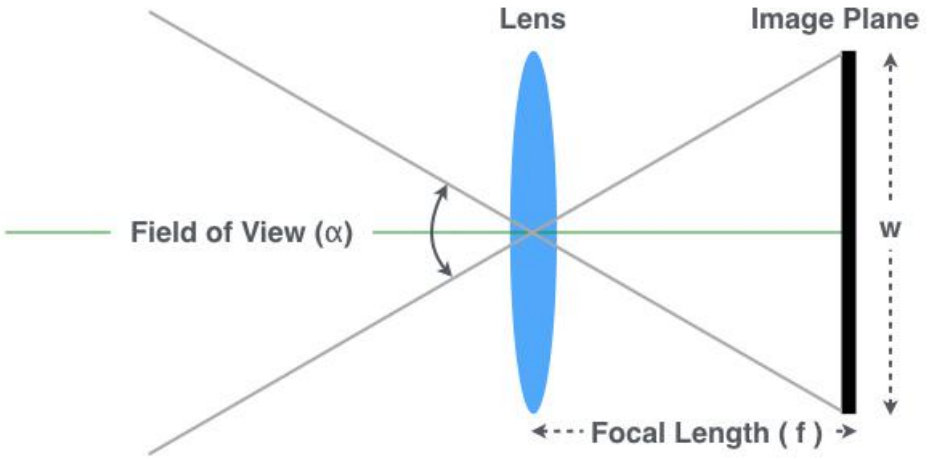
Generally, focal length is the easy prat to make sure when choosing a right lens. Firstly, choose varifocal lenses when it needs to change the magnification in the imaging process, otherwise use a fixed focal length.

The magnification represents the relationship between the size of the image and that of the object:

$$Magnification = \frac{Size\ of\ image}{Size\ of\ object}$$

For example; the length of a screw is 5cm and the resulting image should be 5 mm, the magnification is therefore 0.1. If, however, the screw size is only 0.5 mm and is to be represented by an image of 5 mm, the magnification is 10.

Magnification also depends on the working distance. The more distant the object the smaller the image. Thus, the use of the parameter magnification only makes sense if we know the working distance at the same time. It seems like not so pratical for our everyday life. So there are another parameter which describes a lens more clearly. That is the focal length.



$$Focal\ Length = \frac{Working\ distance * Size\ of\ image}{Size\ of\ object + Size\ of\ image}$$

Special Requirements

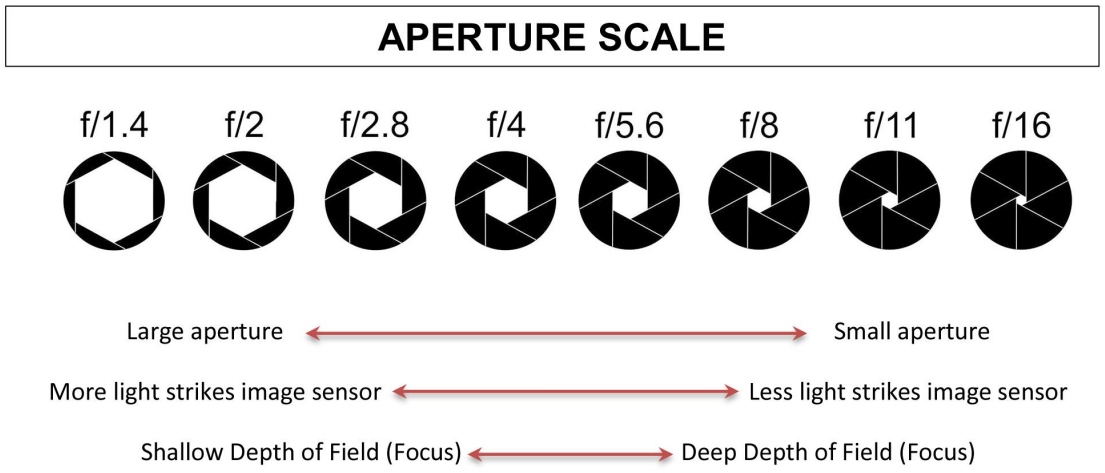
Firstly, you need to take all the special requirements of the application into consideration, if there are. For example, it requires measurement function or not; it requires telecentric lense or not; it requires a large imaging DOF or not. Commonly, the depth of field(DOF) often gets ignored, but it is the thing that every imaging system should take into consideration.

DOF&Aperture

In reality, our eyes do not register a small blurred spot as being blurred. This tolerance of our eyes is the basis for the effect called "depth of field". In the case of camera sensor, the size of the pixel can be defined as a blurred spot. For example, the pixel size of our Mars series cameras is 4.8 * 4.8μm.

The camera lens aperture, or more specifically, the size of the lens aperture opening determines the amount of light that reaches the camera's image sensor.

The various lens aperture settings are called "F Stops". The aperture settings with the lower F Stop numbers allow more light to reach the image sensor than the settings with the higher F Stop numbers. The following figure descripes the relation between the aperture and DOF.



In practice, it is rarely necessary to calculate depth of field exactly. Depth of field is often a matter of belief rather than a matter of fact. Therefore, it is worth having a closer look at depth of field formula in order to find the corelation:

$$Limits\ of\ DOF = \frac{Working\ distance}{1 \pm Blur\ spot * F\# * \frac{Working\ distance - Focal\ length}{Focal\ Length^2}}$$

So, we can see from the formula, DOF not only has relation with Aperture, also blur spot, working distance and focal length.

In conclusion; depth of field is reliant upon 3 parameters:

Blur spot: The smaller the blur spot, the smaller the depth of field.

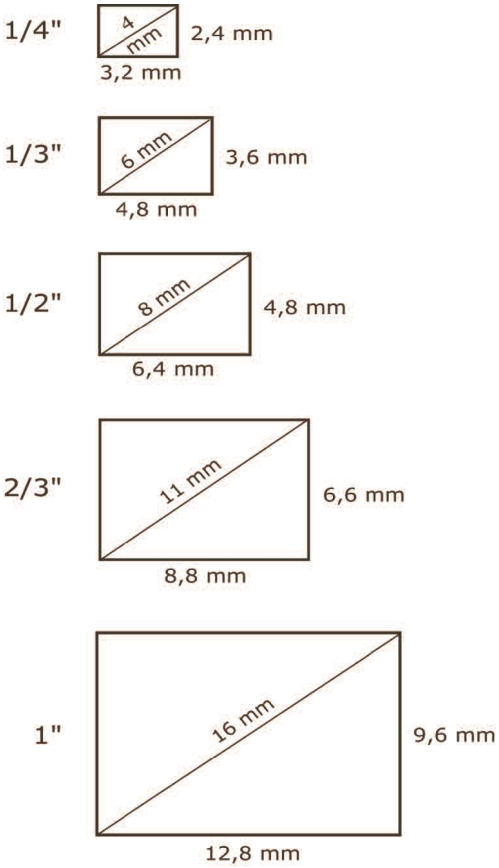
Iris: The smaller the F-stop , the smaller the depth of field.

Working distance: The smaller the working distance, the smaller the depth of field.

Focal length: The larger the focal length, the smaller the depth of field. The relationship is quadratic. Thus, even a small increase of the focal length leads to a considerable decrease of the depth of field.

Image Circle&Image Quality

The image size of the selected lens should be compatible with the sensor size of the camera--Large image size with smaller sensor size, that is, the format of the lens has to be larger than or equal to the format of the CCD. Otherwise, the image quality of the edge field of view could not be guaranteed.



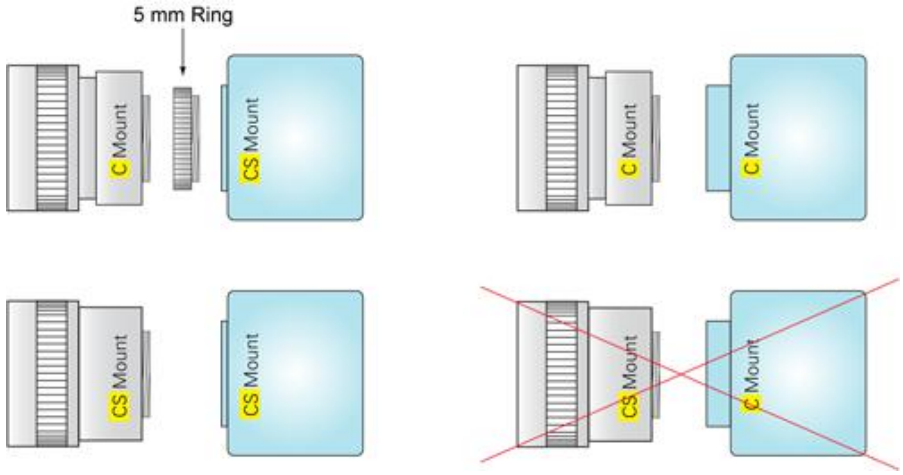
CCD Formats

The image quality mainly focus on two parameters: **MTF** and **Distortion**. In the application of measurement, the distortion should pay more attention.

C&CS Mount

The common types of lens mount found in machine vision are C-mount and CS mount. C-mount or CS-Mount lenses provide a male thread, which mates with a female thread on the camera. The CS

mount version only differs from this in the so-called flange focal distance The flange focal distance is 17.526 millimetres for a C mount and 12.50 for a CS-mount.



Basicly, the above things is what you need to concern when choosing a FA lens for you imaging systems. Also there are other types of lens, such as telecentric lens, which could have a better DOF and low image distortion.

About

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Contact

Hangzhou ContrasTech Co.,Ltd

Add.: No.11, Xiyuan 8th Road West Lake District,
Hangzhou 310030 China
TEL: 86-571-89712238
Fax: 400-8266-163*01460
Web site: www.contrastech.com
E-mail: market@contrastech.com