



# Douglas Photo Calculator

**Version 4.0.0 for iOS and Android**

© Douglas Software 2007-2018

# Contents

Introduction.....	1
Upgrade Information.....	1
Installation .....	2
Running the App .....	3
Example Calculations .....	5
Photographic Definitions .....	8

## Introduction

This software contains features that will enable photographers to make more effective use of their photographic equipment.

The examples are intended to guide the user how to make best use of the programme at the same time as solving potential photographic problems.

What we have attempted to do is to put them in a way that is a practical and effective means of solving photographic equations without the user having to worry about any calculations or formula. These calculations are not suitable for any photographic extremes, such as using a telephoto lens in the extreme close-up range to achieve a long working distance or reversing a wide angle lens on extension tubes to photograph in the macro range.

When it comes to lenses manufacturers tend to round the figures. For example, a lens may actually be 147mm, but the manufacturer will call it a 150mm lens. This means that any calculations may not agree exactly with those quoted by the manufacturer.

For details of some of the camera formats supported by this software see:

<https://www.photo-software.com/depth-of-field-and-hyperfocal-distance-calculator-cameras/>

If your camera is not on the list, and you are unaware of the sensor that it uses, please have a look at this site for the information:

<https://www.dpreview.com/products/cameras/>

or you can email us: [support@photo-software.com](mailto:support@photo-software.com)

## Upgrade Information V4.0.0

The list of sensors has been revised and includes more digital backs as well as Super 16mm.

All the documentation has been revised.

A number of errors on the **Home** screen have been corrected as follows:

Firstly, when trying to change **Language** in the menu from English there was a message about Resolution. This has been corrected.

Secondly, when selecting **Resolution** and changing from 4 lines per mm a correction has been made to the resulting message.

In so far as the **Work** screen is involved the **Man(ual)** option has been replaced by **+/-** which we think is more appropriate but this does not apply to **Circle of Confusion** where the choices are still between **Auto** and **Manual**.

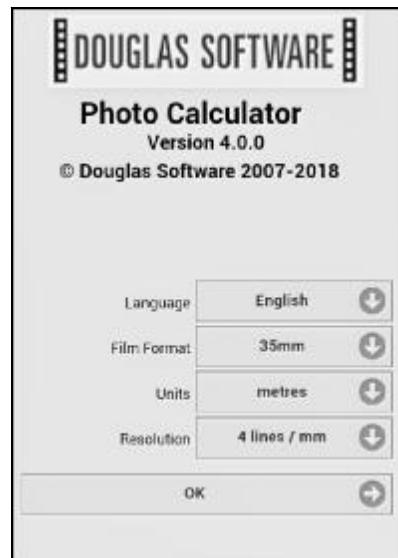
When selecting **Manual Circle of Confusion** the Resolution was moved to the left which is more pronounced with the iPad and larger Android devices.

This has been corrected.

Once again with regard to the **Work** screen when selecting **Resolution** the resulting message has been corrected as in the **Home** screen.

The 6 lines/mm option for **Resolution** has been deleted.

# Installation



As you can see, there are four options, namely the language, film format, units of measurement and resolution that you can select from this screen.

**Language:** This can be either English, French, Italian, German or Spanish.

**Film Format:** There is a large choice of digital and conventional film formats as well as digital backs.

**Units:** This can be either metres or feet.

**Resolution:** The choice here refers to the resolution that can be accommodated by the user's eyes.

It is generally accepted that a circle of confusion of 0.033mm is acceptable for a 35mm camera. If you select 4 lines per mm this equates to a circle of confusion of 0.0333mm and represents the average individual as well as the standard used by camera/lens manufacturers.

Users should not change the default of 4 lines per mm without the necessary technical knowledge.

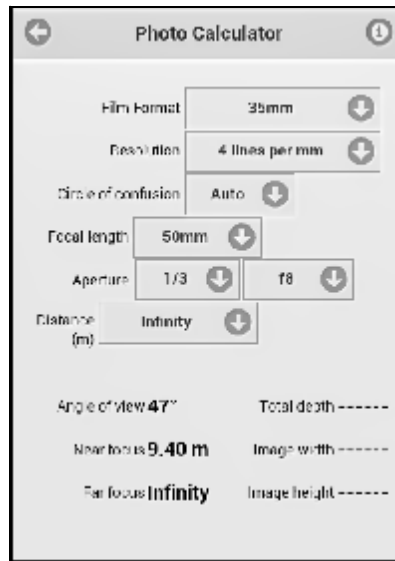
For other formats the circle of confusion is automatically adjusted to take the format into account.

For more on the subject of Resolution see **Photographic Definitions** on page 8.

Please note that any changes you make to the above will be saved.

## Running the App

The picture below shows how the work screen will look initially:



The options you can select are:

**Film Format:** This can be selected from a list of digital and conventional film formats as well as digital backs. When you select a format the software selects a lens that is the standard lens (or as close to as possible) for that particular format.

**Resolution:** This figure can be between 3 and 5 lines per mm with a default of 4 lines per mm. *The default of 4 lines per mm should not be changed without the necessary technical knowledge.* For more on the subject of Resolution see Circle of Confusion in **Photographic Definitions** on page 8.

**Circle of confusion:** The **Auto** option is based the formula set out in **Photographic Definitions** on page 8.

The **Manual** option allows you to enter a figure of your own choice. This figure can only be between certain limits dependant upon the selected film format.

For the 35mm format, for example, you can select a circle of confusion between 0.0159mm and 0.0638mm.

The majority of users will only need the Auto option.

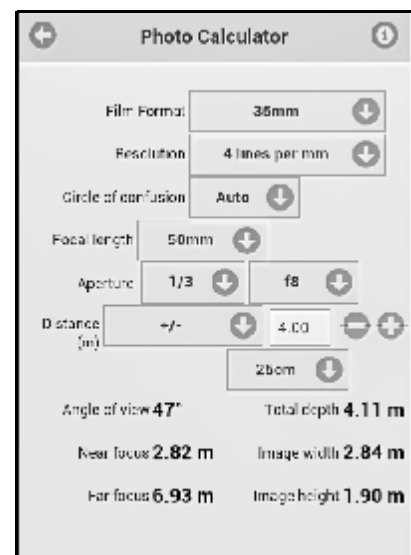
**Focal length:** The figure that you can select here depends upon the film format that you have selected. For example, selecting the 35mm film format would select an initial focal length of 50mm. The +/- option allows you to scroll through the list of focal lengths that are appropriate to the selected film format and you are limited to a lens with an angle of view of between 1° and 175°.

You cannot, for example, select a 3000mm lens for the 35mm format.

**Aperture:** You can select any aperture between f/1 and f/90 in 1/3 or 1/2 stop steps, with 1/3 stop being the default.

**Distance:** This can be either infinity, the hyperfocal distance or a figure of your own up to 100m/330ft.

When you select the +/- option, you will see a button marked **25cm (or 12in)** appear below the distance button as can be seen in the picture here.



The software will increment distances, which in this example are metric, by the amount shown in the highlighted button which in this example is the default 25cm/12in button.

To change to either the 5cm/2in figure or 1m/36in figure just click on the current button and make the choice from the selection that appears in a new window as can be seen below:



The initial +/- focusing distance is calculated as being half the hyperfocal distance figure with a standard lens rounded to the nearest whole number.

The minimum focusing distance is based up the standard focal length of the selected film format. For example, a 35mm camera has a standard focal length of 50mm and the minimum focusing distance would be taken as 25cm/10".

When entering feet this can either be in decimal or feet and inches.

For example, both 2'6 and 2.5 would be the same.

The results of your calculations will be calculated automatically by the software with the exception of when the Manual option has been selected for Circle of Confusion. At such time a small C will appear. You should click on this to perform the calculations.

*Please note that none of the parameters on this screen can be saved. The language, film format, units of measurement and resolution have to be saved from the main screen.*

The results of any calculations are as follows:

**Angle of view:** The angle of view of the focal length of the selected lens and film format. See **Example Calculations** on page 5 to see how to make use of this feature.

**Near Focus:** The nearest part of the subject that is in focus.

**Far Focus:** The furthest part of the subject that is in focus.

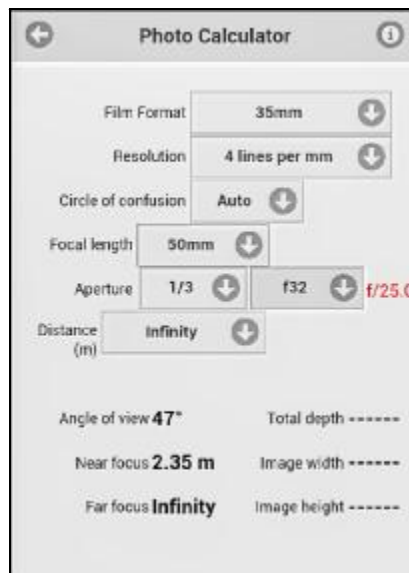
**Total Depth:** The distance between the near and far focus.

**Image Width:** The width of the area covered by this lens and focus combination.

**Image Height:** The height of the area covered by this lens and focus combination.

A feature allows the calculation of an aperture that could be affected by diffraction.

Whenever you see an aperture marked in red next to the selected aperture as follows:



it means that the selected aperture may cause an unacceptable loss of sharpness and shows what this software calculates to be the smallest aperture (largest number) that gives an acceptably sharp 20.5cm x 25.5cm/8in x 10in print.

If you stop down more whilst still requiring a sharp print you will be limited to a reduced print size.

For more information on this subject see **Diffraction** in **Photographic Definitions** on page 9.

## Example Calculations

**1.** What is the depth of field with a 35mm camera with a 100mm lens at a distance of 2 metres, at an aperture of f/8 with a Resolution of 4 lines per mm?

1. Select the 35mm film format
2. Select 4 lines/mm for Resolution
3. Select a focal length of 100mm.
4. Select an aperture of f/8.
5. Select the Man(ual) option for Distance.
6. Select the 1m button from the three choices that can be found by clicking on the 25cm button which is just below the +/- Distance as follows:



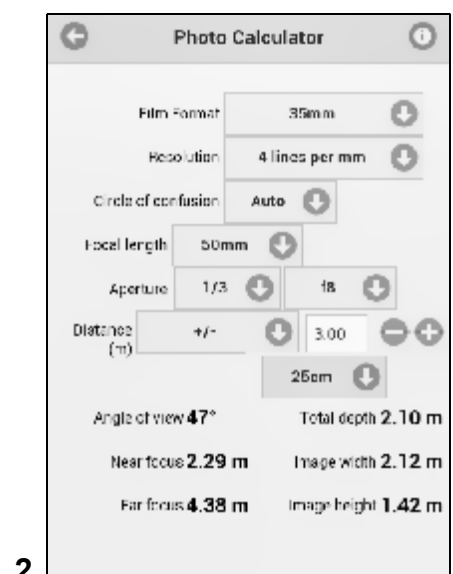
7. Click on the - button until the distance is 2m.



**2.** With our 35mm camera, we have a subject that is 4 metres wide, and are restricted to being no more than 3 metres away, what lens would be required to cover the subject?

1. Select the 35mm film format.
2. Select a focal length of 50mm.
3. Select a distance of 3 metres.

You will see that the width covered with a 50mm lens at 3m is 2.12 metres as shown here.



4. Select +/- option for the focal length and reduce the figure until such time that you see that a focal length of 26mm covers a width of 4.12 metres as in the picture here.



We may not have a 26mm lens so a 25mm lens will do.

**3.** What is the hyperfocal distance with my 35mm camera with a 50mm lens at apertures of f/8 and f/5.6?

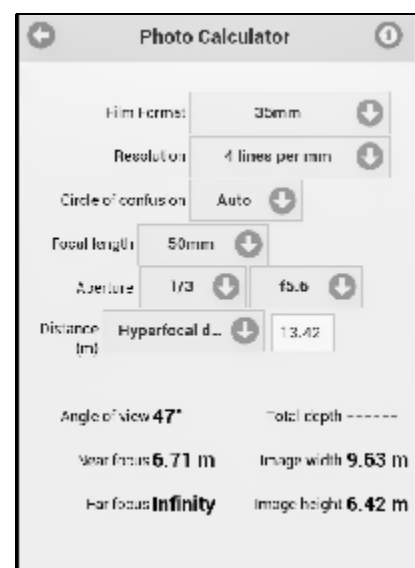
1. Select the 35mm film format
2. Select an aperture of f/8.
3. Select Hyperf(ocal distance) from the Distance drop down menu which calculates a figure of 9.40 metres.



Now:

Select an aperture of f/5.6.

The hyperfocal distance at this aperture is seen as 13.42 metres as in this picture.





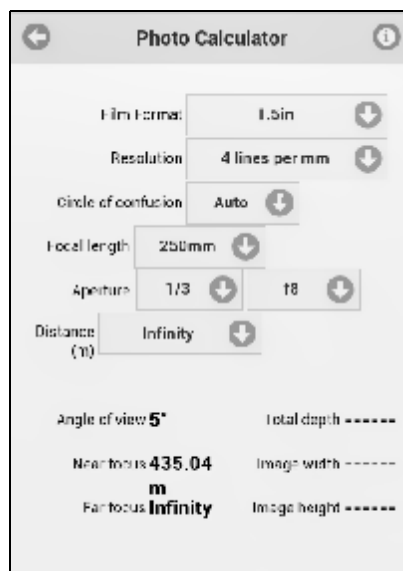
**4.** In so far as **Angle of View** calculations are concerned let us work out what lens would be required for a camera with a 1.5in sensor that is the equivalent to a 500mm lens on a 35mm camera.

1. Select the 35mm film format and a 500mm lens from the focal length drop down list and you will see that the Angle of View is 5° as is shown here:



2. Now select the 1.5in sensor and the 500m focal length from the dropdown list from which you will see that the Angle of View is 3°, but we are looking for an Angle of View of 5°.

*Please bear in mind here that by going to a smaller format that the focal length will be a smaller figure whereas had we been going to a larger format the new focal length would be a larger figure.* Keep reducing the focal length by an amount of 50mm (to save clicking on the down button all the time) until such time that the focal length is 250mm as is shown here when we see that a 250mm lens for the 1.5inch format is equivalent to a 500mm lens to a camera with a 35mm sensor.



Many optical calculations can be covered by this software. Please contact us with any queries that you might have.

# Photographic Definitions

## Angle of View

In still photography this is defined as "the angle subtended at the lens by the diagonal of the film format."

The focal length of a lens also determines the angle of view of the lens as used in conjunction with a given film format size.

To give an example, a 35mm camera with a 50mm lens will have an angle of view of around 45 degrees.

A 6 x 6cm format camera would require a lens of about 90mm to give the same angle of view and a digital camera with a sensor size of about 23.5 x 15.6mm (APS-C) would require a lens of about 30mm.

## Circle of Confusion

The circle of confusion can be described as a point on the final print that appears in focus to the average human eye when that print is viewed from the required distance.

Providing that the circles of confusion are small enough, the eye will accept them as points, and the image will be acceptably sharp.

The maximum permissible circle of confusion depends upon the viewer's eyesight and the distance from the print.

For normal viewing this distance is assumed to be 25 cm/10 in which equates to the diagonal of a 20.5cm x 25.5cm/8" x 10" print and it is generally accepted that the individual can distinguish at least 4 lines per mm which would represent a dot size of 0.25mm.

With this software you find that the resolution can be set between 3 and 6 lines per mm with a default of 4 lines per mm which should not be changed without the necessary technical knowledge.

The circle of confusion is calculated by this software from the amount that the image has to be enlarged to a 20.5cm x 25.5cm/8" x 10" print.

For example, a 35mm image has to be enlarged 7.516 times, whereas a Nikon DX has to be enlarged some 12 times and a 20.5cm x 25.5cm/8" x 10" negative does not have to be enlarged at all.

So for a 35mm camera and 4 lines per mm the calculations are as follows:

Circle of Confusion =  $0.25/7.516 = 0.0333\text{mm}$

The resolution of the image does not change with the size of a print but it does for a closer or farther viewing distance.

The smallest size of the Circle of Confusion may be limited by the physical size of the digital sensor elements.

In addition, diffraction (see page opposite) has an effect when very small apertures are used.

With computer monitors it must be remembered that their resolution is less than that of a print so that this must be taken into account when assessing Depth of Field.

Establishing the circle of confusion is the first step in arriving at an estimate as to the performance of a lens in so far as Depth of Field is concerned.

## Depth of Field

Depth of field is the distance between the nearest and furthest parts of the subject that are all in acceptable focus at the same time.

The criteria that affect depth of field are:

1. The aperture of the lens.
2. The focal length of the lens, or the combined lenses if a supplementary lens is added.
3. The distance of the lens from the subject.
4. The circle of confusion.

Control over the depth of field is a vital tool for photographers.

It enables us to emphasize important subjects and suppress unwanted items.

Greatest depth of field occurs when:

1. The aperture is high.
2. The lens is of low focal length.
3. The subject is distant.
4. The circle of confusion is large.

Although it is possible to calculate the depth of field from the Hyperfocal distance, the resultant figures are not as accurate as the longer formula which this programme uses.

The advantage of calculations using the Hyperfocal distance is that they are much easier to do on a pocket calculator.

The depth of field values shown by this software are measured in distances from the film/sensor plane to the front and rear limits.

The depth of field values for different lens designs, particularly those of telephoto and inverted-telephoto design, will differ slightly because the distance between the object side and the image side principal points will vary accordingly.

If your lens/camera manufacturer has supplied depth of field tables and they do not agree with this programme there can only be one other reason for this and that is that they have been using a different value for the circle of confusion.

Many lenses have Depth of Field scale markings which enables an estimate of Depth of Field to be made.

However these scales are only relevant to the film format for which the lens was designed, and would give erroneous results when using, for example, a lens from a 35mm camera on a camera with a smaller film format.

Any mathematical calculations of depth of field are based upon geometric optics that assume a perfect lens and a perfect film or camera.

Practical experience is the only true guide to the performance of a lens.

Depth of Focus, a term which is often incorrectly used for depth of field, relates to the area behind the lens. It is how far the film/sensor can be moved from the position of accurate focus whilst producing an image of sufficient quality.

## **Hyperfocal distance**

The Hyperfocal distance is the distance from the lens to the nearest part of the subject that is in acceptable focus when the lens is focused upon infinity. If we focus the lens on the Hyperfocal distance then the subject will be in focus from half the Hyperfocal distance to infinity.

The lenses on some cheaper, fixed focus, cameras are designed to be focused on the hyperfocal distance in order to give the greatest depth of field for the average subject.

## **Diffraction**

Diffraction is the name given to phenomena which occur when light passes through a very narrow aperture and arises from light deviating from the rectilinear path.

Because of this phenomenon, the image of a point source by a lens is not a point, but a circle of light of finite diameter, and can therefore limit the total resolution of a photograph.

Usually light travels in straight lines but begins to "diffract" when squeezed through a small hole such as your camera's aperture and is only important when stopping down to obtain depth of field.

It is not affected by the number of pixels that your camera's sensor might have.

This effect has been known to photographers for years, and, for this reason, many lenses for 35mm have minimum values of f/16 or f/22, as performance could be degraded progressively beyond this limit.

With the introduction of digital photography these minimum values have decreased where a smaller size of digital sensor is involved.

For example, based upon the production of an acceptably sharp 20.5cm x 25.5cm/8" x 10" print, the minimum f/stop would be f/25 for a 35mm camera or f/13 for the Olympus 2/3rds sensor which is about half the size of a 35mm frame.



Copyright © Douglas Software 2007-2018

Printing 1.0

## **Douglas Software**

Southgate Chambers  
37/39 Southgate Street  
Winchester  
Hants  
SO23 9EH  
United Kingdom

Tel: 44 (0)1962 851111

Email: [support@photo-software.com](mailto:support@photo-software.com)  
Internet: <https://www.photo-software.com>