SilverFast® Resolution Target (USAF 1951)

Content

web address:
www.SilverFast.com/sf/Resolution-Target

USAF 1951
Made by LaserSoft Imaging

SilverFast® Resolution Target (USAF 1951)

1. Introduction

The new SilverFast® Resolution Target by LaserSoft Imaging® is a useful tool to get the best actual usable resolution from your scanner as easily as possible. As a second important application, the Target helps you find the optimum sharpness settings for a chosen resolution. You can also find the best compromise for your scanner between high resolution and sharpness and determine which parts of your flatbed scanner are scanned particularly sharply or blurry. The SilverFast Resolution Target is equally well suited for film and flatbed scanners with transmissive unit.

2. Resolution of a Scanner

2.1 dpi, what exactly is that?

One of the most important parameters for describing the quality of a scanner is its resolution. Resolution is a measure of the accuracy with which an image can be recorded; it is expressed in dpi (dots per inch). The higher the resolution of a scanner, the more image details the scanner can detect, and the better you can, for example, enlarge the image later. A scanner with a resolution of 1200 dpi can thus theoretically detect 1200 different points per inch (2.54 cm).
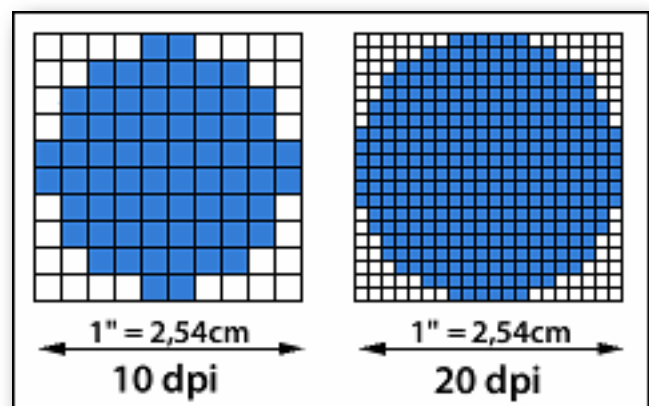
2.2 How a scanner is structured

Both flatbed and film scanners generally record the image of the original line by line using one-dimensional CCD sensors (charge-coupled device). These light-sensitive components consist of many photocells arranged in a row. Each photocell can detect brightness values and generate pixels from them. The more densely the CCD sensor is populated with individual photocells, the higher the resolution across the width. Lengthwise, a stepper motor is used to move the CCD sensor line by line across the original. The fineness of the steps this motor can take thus determines the lengthwise resolution.

The horizontal and vertical resolutions of a scanner, therefore, aren't necessarily the same. Usually the horizontal resolution, that is, the resolution of the CCD sensor, is lower. It should also be noted that a CCD sensor built into a flatbed scanner can resolve an original much less precisely than the same CCD sensor in a film scanner. The reason for this is the different width for originals of about 20 cm for flatbed scanners and only about 3.5 cm for film scanners, both of which are projected onto the width of the sensor by lenses.

2.3 Sharpness at high Resolution

The optical system of a scanner is somewhat more complicated than the description in 2.2. To record a scan original, the light in a flatbed scanner travels roughly the following path. From the light source, it passes through a sheet of glass onto the original, is reflected, then passes back through the glass into a system of several mirrors, which finally direct it into a lens rod. The light is then separated using color filters or a prism into the primary colors of red, green, and blue, which are then detected by the CCD sensor. To ensure that the rays of light are always the same length, the scanning head with its light source, along with the mirror system and the lens with the CCD sensor, are all moved. Small errors in this delicate system, particularly at very high resolutions, can lead to slightly blurry images.

The complex optical system is also responsible for the fact that scanning is not equally sharp at all points on the flat bed of the scanner. A high resolution scan can be very sharp exactly in the center of the flat bed, but simultaneously have significant blurriness at the edges.

2.4 Higher Resolution using Interpolation?

Interpolation is a process used during scanning that increases the resolution of a scan using a computer algorithm. To do this, additional pixels are subsequently inserted between the pixels recorded by the scanner that are mathematically calculated with special algorithms. Interpolation can give the impression of higher resolution, but at the cost of the image's sharpness. These processes, however, are never able to gain additional information, that is, to add image details or to increase the actual optical resolution of a scanner.

Notice: Please assure to not use any interpolated resolution when scanning the SilverFast Resolution Target.

2.5 Summary of Resolution

The data sheets for modern scanners often show amazingly high resolutions for the devices. CCD sensors and the fine mechanisms of the stepper motors are nowadays so accurate that they permit these resolutions. However, there are a series of factors that mean that the user can only directly utilize these resolutions in the rarest of cases.

As described above, interpolated resolution cannot be seen as a usable optical resolution. The often larger resolution of the stepper motor should not be confused with that of the CCD sensor, and the complex optics within the device can cause blurriness during the scan at the resolution limit, particularly at the edges of the image. The entire technically available resolution can therefore usually not be used, but only a significantly lower figure.

So how high is the resolution that is actually usable for the user? It is precisely to answer this question that LaserSoft Imaging developed the SilverFast Resolution Target. You can also find the optimum SilverFast sharpness settings for every resolution.

3. SilverFast® Resolution Target (USAF 1951)

3.1 Overview
Based on the USAF-1951 standard, LaserSoft Imaging developed the SilverFast Resolution Target to make the actually usable resolution of a scanner measurable. This is a transparent scan original, which is suitable for either film or flatbed scanners with transmissive unit.

The structure and elements of the Resolution Target are defined to an American military standard. On the target there are smaller and smaller elements, each consisting of black bars of precisely defined width and spacing. These individual elements are numbered and organized into groups on the Resolution Target. The smallest of these elements for which the scanner can just differentiate between two bars, for which the intervening space is thus barely still detectable, can be indicative of the usable resolution of the scanner.
The Resolution Target can also be used to make statements about the sharpness at different resolutions, in order to find the optimum resolution for scanning and to differentiate the sharpness at different points in the scanned area of a flatbed scanner.

3.2 The Structure of the Resolution Target in Detail
The SilverFast Resolution Target is a transparent test target, framed in a 35 mm small image format.

On the target there is a series of elements consisting of three horizontal bars and three vertical bars, each with white gaps between them. A figure next to each element (marked in green in the illustration below) numbers it. Six elements form a group that is numbered with the figure above it (marked in blue).
For example, as seen in the illustration, the fifth element of the first group is marked in red.
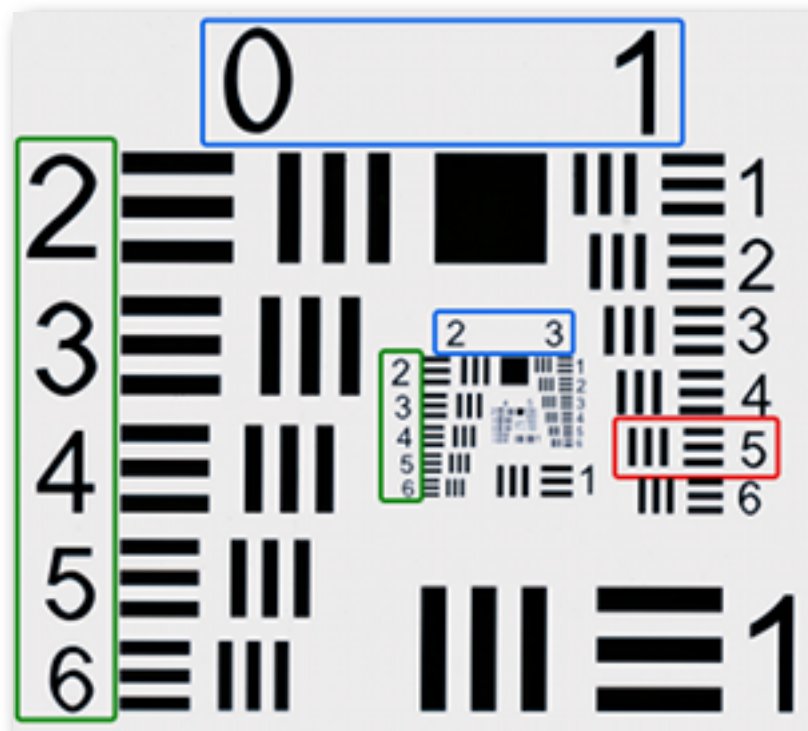
4. Usage of the SilverFast Resolution Target

4.1 General Guidelines for using the Resolution Target
For using the Resolution Target efficiently and successfully some details and settings have to be respected.

SilverFast remembers many settings that you may have made in previous scanning processes, even across a restart of the software. To ensure that no interfering parameters are selected, it is recommended to reset these settings before using the Resolution Target. Therefore, please click on the shown button, that you will find in the vertical button bar of the large preview window. Click „Yes" in the dialog window that pops up.

Whatever application you want to scan the Resolution Target for, please do always choose the option "48 Bit HDR Color" in the „Frame" tab of the main dialog.

Please do no changes to the other parameters here, they automatically have the correct values.

One exception is the setting of the resolution at which the Resolution Target will be scanned. Use the slider at the bottom of the "Frame" dialogue to adjust it. It is especially important to make a right choice here.

If the slider is pushed to the far right to the highest value, an **interpolated resolution** is selected, which is not suitable for scanning the Resolution Target (cp. 2.4).

In the picture, the slider is at the next to last position. This corresponds to the **maximum optical resolution**, which the manufacturer has specified for your scanner. To determine the actual usable optical resolution, you should use that resolution.

For other applications of the Resolution Target proposals for appropriate resolutions are made in the respective instructions.

Please do not activate the iSRD and Multi-Exposure functions. Otherwise, these SilverFast Software functions could affect the measurement of the hardware.
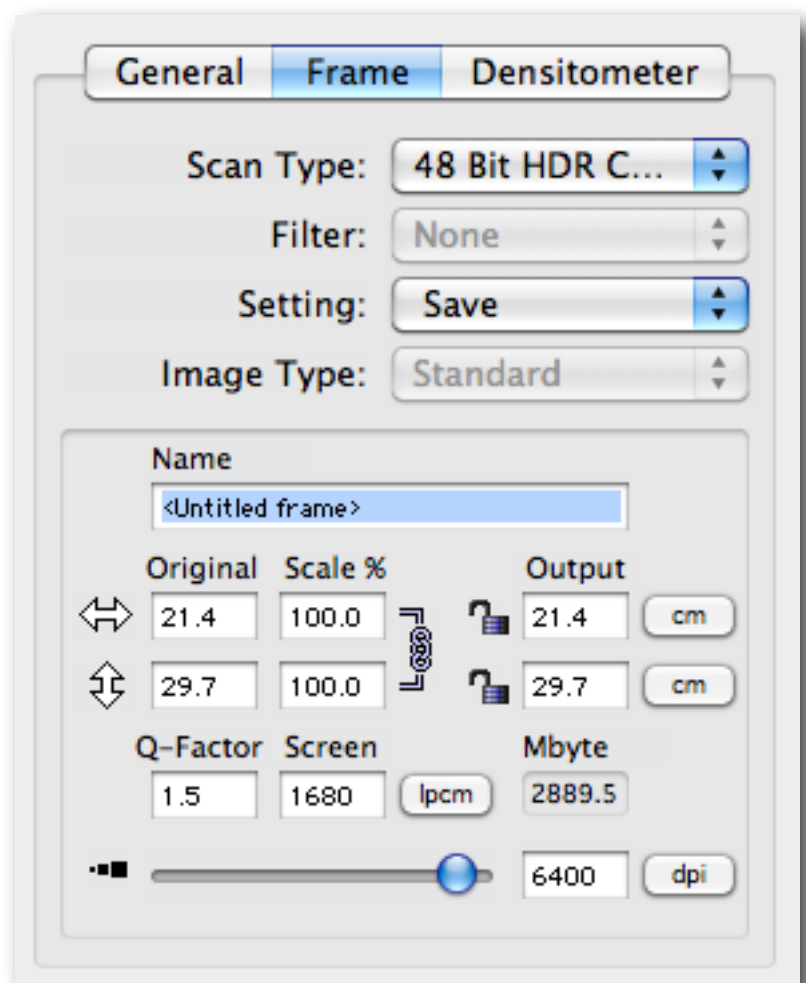
4.2 Determining the highest actual usable Resolution

With the SilverFast scan software and the new Resolution Target (USAF 1951) you can determine right away, which resolution to best use with your scanner.
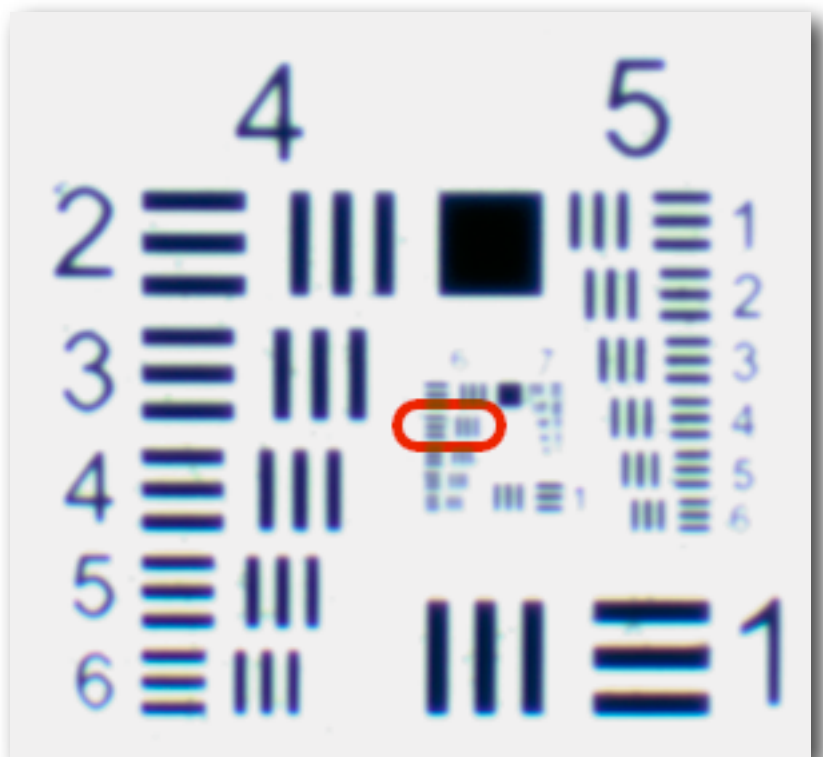Please follow these 5 simple step:

1. Place the Resolution Target in a slide holder in the center of your scanner's flatbed or in your film scanner.

2. Start your SilverFast scan software and do a transmissive raw-scan (48bit HDR) with the **maximum optical resolution** - therefore please always choose the next to last step of the resolution slider. (The last step chooses **an interpolated resolution**, which is inappropriate for this task.) You should not activate iSRD or Multi-Exposure.

3. Save your scan as a TIFF-file and open it in your Imaging software (SilverFast DC Pro or HDR). In order not to change the results it is important not to do any image manipulation such as rotation, etc.

4. Set the view to 100% (original view) and look for that element, where you can just differentiate two adjacent bars with your eyes, so you can just still recognize the white gaps.

Notice: Many scanners have different resolutions in vertical and horizontal direction. For measuring those independently, the Resolution Target has horizontal and vertical oriented bars.

5. Read the element's number and group affiliation and determine the resolution of your scanner with this element and group numbers from the table under 4.6.

Example: The 3rd element of group 6 is marked in the sample picture, since the black bars of the 4th element cannot be differentiated against the white background. From the table we can determine a resolution of approximately 4096 dpi for the actual scanner.

4.3 Definition of the optimum Sharpness Adjustments for a chosen Resolution
Images can be scanned for various applications. Therefore, varying scan resolutions are used, each having an optimum sharpness adjustment. Using the Resolution Target you can figure out the optimum basic sharpness adjustments for SilverFast and your scanner for any chosen resolution as follows:

1. Place the Resolution Target in a slide holder in the center of your scanner's flatbed or in your film scanner.

2. Start your SilverFast scan software and do a transmissive raw-scan (48bit HDR) with that optical resolution you like to figure out the sharpness adjustments for. The last step of the resolution slider chooses **an interpolated resolution**, which is inappropriate for this task. You should not activate iSRD or Multi-Exposure.

3. Save your scan as a TIFF-file and open it in your Imaging software (SilverFast DC Pro or HDR). In order not to change the results it is important not to do any image manipulation such as rotation, etc.

4. Look up the value that comes closest to the resolution you have chosen in the table under 4.6. Take the relating element and group number to identify this element on the Resolution Target (cp. 3.2).

5. Set the view to 100% (original view) and have a look at the identified element. Use the sliders at the SilverFast sharpness dialog to display the element as sharp as possible.

6. The sharpness adjustments figured out this way are the ideal basic settings for your scanner for future use with the chosen resolution. Based on this basic settings any possible unsharpness of an original is easily compensated.

Example: Assumed you would like to scan with a resolution of 1200 dpi. As the closest value in the table under 4.6 you will find 1149. The 4. element of the 4. group is related to this value. Identify this element on the 1200 dpi scan of the Resolution Target you have made and adjust the sharpness sliders in a way the element is as sharp as possible. The sharpness adjustments you figured out this way can be used for scanning with your scanner at 1200 dpi as basic settings in future.

4.4 Identification of the maximum Resolution with Regard to Image Sharpness

As described under 2.3 scanning at maximum resolution can lead to unsharp images. In this case you can achieve better, sharper results, when choosing a resolution beneath the maximum. The following procedure guides you to figure out an optimum trade-off between high resolution and image sharpness:

1. Place the Resolution Target in a slide holder in the center of your scanner's flatbed or in your film scanner.

2. Start your SilverFast scan software and do several transmissive raw-scans (48bit HDR) with varying optical resolutions. The last step of the resolution slider chooses **an interpolated resolution**, which is inappropriate for this task. You should not activate iSRD or Multi-Exposure. Please write down every scan's resolution, e.g. in the file name.

3. Save these scans as TIFF-files and open them in your Imaging software (SilverFast DC Pro or HDR). In order not to change the results it is important not to do any image manipulation such as rotation, etc..

4. Set the view to 100% (original view) and look on every scan for that element (cp. 3.2), where you can just differentiate two adjacent bars with your eyes, so you can just still recognize the white gaps.

5. Read the elements' numbers and group affiliations and determine the resolutions with the relevant element and group from the table under 4.6.

6. Compare the values achieved from the table. The scan related to the highest value is the sharpest in small image details. The resolution you have written down belonging to this scan is the optimum trade-off between high resolution and image sharpness for your scanner,

Example: Assuming you scan the Resolution Target successively with 1000, 1200 and 1400 dpi and you achieve as smallest sharp elements the 2., 4. and 3. element of group 4. Therefore the table under 4.6 gives the values 912, 1149 and 1024. The highest value 1149 is related to the second scan, which was made with 1200 dpi. This scan is the sharpest in small image details.

4.5 Identification of Differences in Sharpness on the Flatbed

Under 2.3 was explained, that a flatbed scanner's achievable sharpness may vary on different areas of the flatbed. It is advantageous for you to know your scanner's stronger areas especially for scanning small originals. Avoiding the weaker areas allows you to work out more image details sharply. Please proceed as follows:

1. Place the Resolution Target in a slide holder in the center of your scanner's flatbed.

2. Start your SilverFast scan software and do several transmissive raw-scans (48bit HDR) with the **maximum   optical resolution** - therefore please always choose the next to last step of the resolution slider.   (The last step chooses **an interpolated resolution**, which is inappropriate for this task.) You should not activate iSRD or Multi-Exposure. Move the target to another position on the flatbed after each scan and write down the area where it is lying during the scan, e.g. in the file name.

3. Save your scans as a TIFF-files and open them in your Imaging software (SilverFast DC Pro or HDR). In order not to change the results it is important not to do any image manipulation such as rotation, etc.

4. Set the view to 100% (original view) for every scan and look for those elements (cp. 3.2), where you can just differentiate two adjacent bars with your eyes, so you can just still recognize the white gaps.

5. Read the elements' numbers and group affiliations and determine the resolutions with this element and group numbers from the table under 4.6.

6. Compare the values from the table. Scanner areas, where the scanner is able to resolve especially sharp, are related to the higher values.

Example: Assuming you are scanning the Resolution Target successively lying in two opposite corners and exactly in the center of the flatbed. You identify the 2., 2. and 4. element of group 4. From the table under 4.6 you read the values 912, 912 and 1149. The highest value 1149 is related to the third scan, where the target lay in the center. Thus, your scanner produces considerably sharper images in the center in contrast to the corners. Therefore you should place a single photo exactly in the scanner's center.

4.6 Table for Determining the Resolution

The following table provides the actual usable resolution capability of your scanner in dpi. Therefore, please do a scan with the SilverFast Resolution Target as described under 4.1 and use the achieved element and group numbers (cp. 3.2) for consulting the table.

	group 0	group 1	group 2	group 3	group 4	group 5	group 6	group 7
element 1	51	102	203	406	813	1626	3251	6502
element 2	57	114	228	456	912	1825	3649	7299
element 3	64	128	256	512	1024	2048	4096	8193
element 4	72	144	287	575	1149	2299	4598	9196
element 5	81	161	323	645	1290	2580	5161	10322
element 6	91	181	362	724	1448	2896	5793	11586

web address:
www.SilverFast.com/sf/Resolution-Target

USAF 1951
Made by LaserSoft Imaging