Chapter 7

Color Management

7. Colour Management

This chapter describes the concept of colour management, how to set up the appropriate settings in SilverFast, and how to calibrate your scanner to get precise colours.

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7.1 Colour Management

Introduction

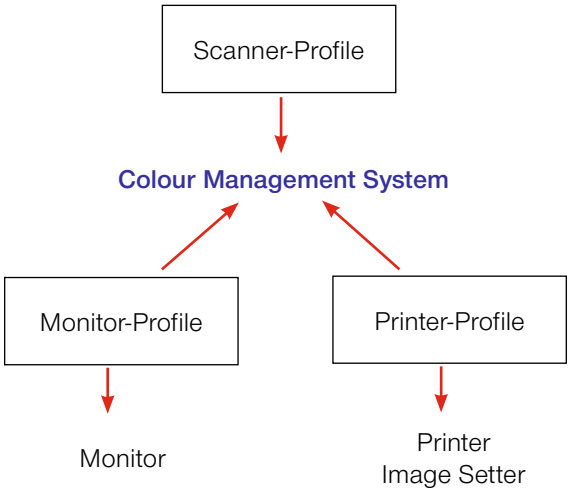
In the past getting professional results with colour reproduction was only achieved by highly educated professionals. There have been two major reasons for this:

1. Devices for colour reproduction demanded high investments
2. Operation of devices was complicated - complex Know-How was necessary.

Luckily the above mentioned reasons are not valid any more today, because the devices needed as, scanner, PC, printer have become affordable for almost everyone. Also operation has become easy with intelligent software and colour management matured.

Objective of Colour Management System (CMS)

Professional workflow without colour management is not conceivable any more today. To save time and money it is desired to see the result of the final scan on the monitor or printer already on the preview. Since every input- and output-device has its own colour gamut, one cannot assume colours to be consistent.



What is an ICC Profile?
An ICC profile characterizes the colour space behaviour of a device. An ICC profile is a data file and will be used to calibrate the device.

What is IT8?
IT8 is an industry standard test-form designed to measure the performance of input devices and generate ICC profiles.

This is where a CMS becomes relevant. A dedicated ICC profile has to be generated for every input- and output device describing their colour space behaviour. Within the workflow the colour management System compares two profiles, that of the data sender, i.e. a scanners, with that of the data receiver, i.e. a monitor, and calculates a relation for the conversion, which will translate the image data into the right colour impression.

Objective of the *SilverFast* Colour Management

SilverFast differs from the majority of scan software by its functional power. With reference to colour management *SilverFast* offers three significant functions:

1. **Automatic Matching with Photoshop**

   The high level of integration of *SilverFast*'s architecture into the Adobe Photoshop 5 architecture, assures matching of the *SilverFast* preview with the final result in Photoshop. This is a very important highlight of *SilverFast*, because only this function makes sure that the user can predetermine (and control) his final result from the *SilverFast* preview.

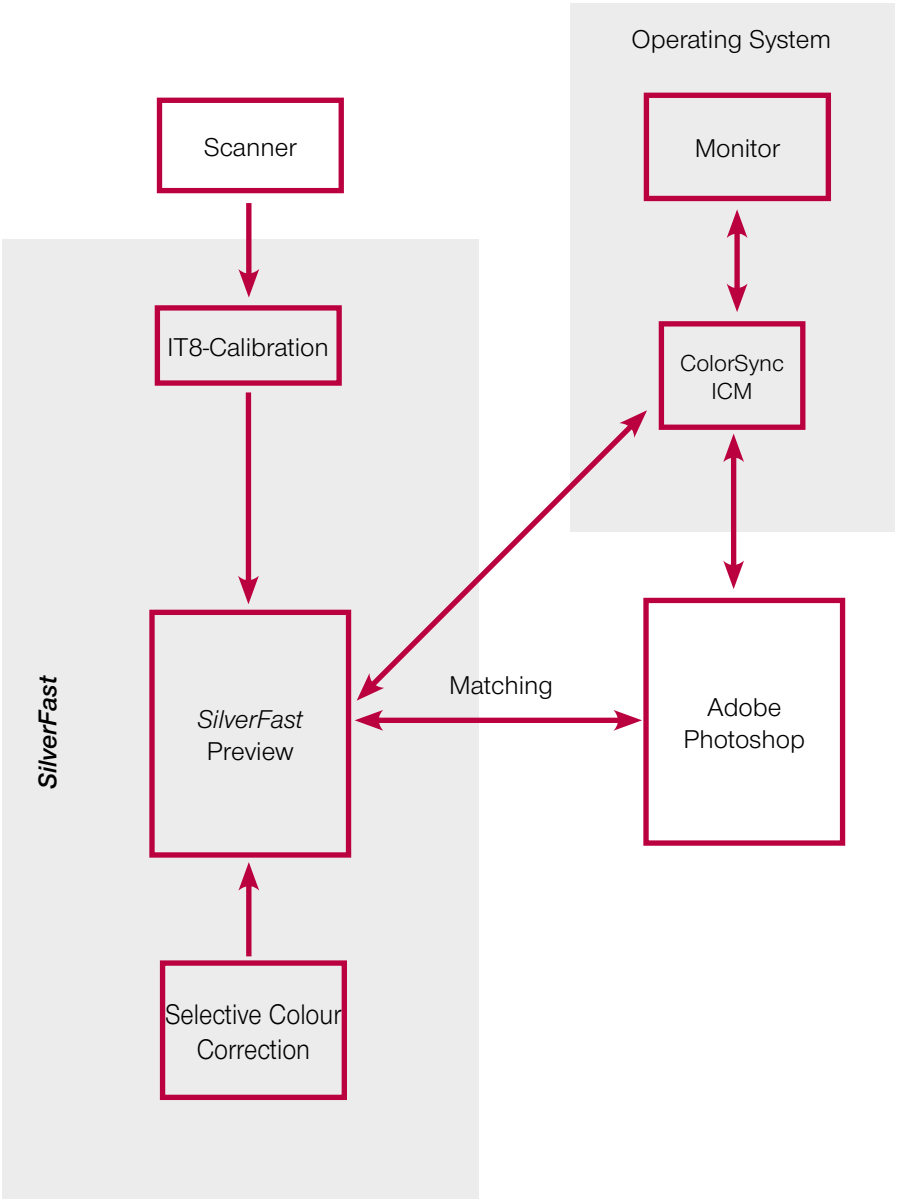
2. **Safe IT8 Calibration (optional) with ICC Profiler**

   With *SilverFast Ai* you can create a dedicated ICC profile for your scanner so your scanner can be used within the colour management workflow. *LaserSoft Imaging AG* offers (optional) IT8 calibration for all full versions of *SilverFast*.

   SilverFast's IT8 calibration is integrated into the *SilverFast* application in such a way excluding any possible mis-operation.

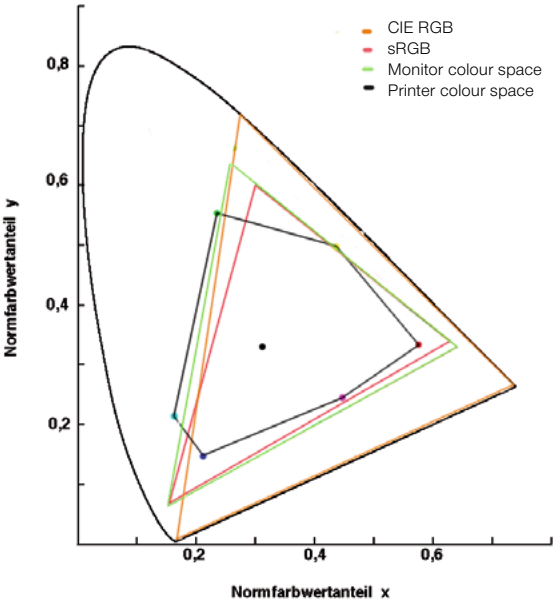
3. **Individual Colour Control with Selective Colour Correction**

   SilverFast's selective colour correction enables the user to change individual colours independently on the *SilverFast* preview. Controlling the colours of the final result at a very professional level without trial and error and integrated with the colour management, is a real boon for any level of user.


Operating System
Scanner
Monitor
IT8-Calibration
ColorSync
ICM
SilverFast
SilverFast
Preview
Matching
Adobe
Photoshop
Selective Colour
Correction

Note!
Do not select sRGB as your default colour space in Photoshop if you intend to do colour reproduction with printing.

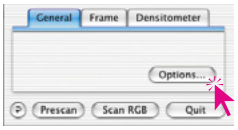
Obviously there are limits to the ability to display the same data on different devices the same way. The different colour spaces have varying dimensions, i.e. displaying different amount of colours. Also the colour shades they can display are varying. This is resulting in colour deviations from the conversion. The colour space “sRGB”, which Photoshop offers as a default colour in its set up is very small, so that even the small colour space of a printer will not be properly rendered. sRGB colour space is still big enough for any monitor Monitor making sRGB a suitable colour space for the internet. For any documents containing images, which have to be printed, sRGB is not suitable. Use Apple RGB or Adobe RGB instead.



Comparing the colour spaces
*Shown is a projection of the colour spaces on to a surface. The „curved triangle” represents the L*a*b* colour space, which contains all visible colours.*

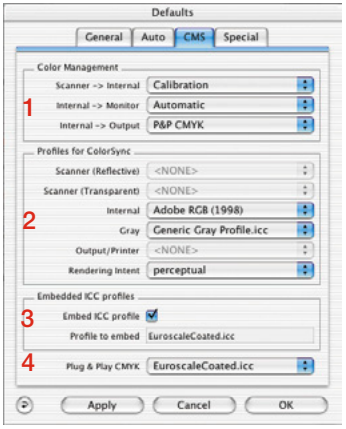
SilverFast offers different possibilities for work flow integration. On the system level under ColorSync (Mac) or ICM (Windows98/2000/XP), or in with integration into the application - in general as realized with Photoshop. CMYK output can already on the preview be checked by *SilverFast*’s softproof function.

The CMS Dialogue

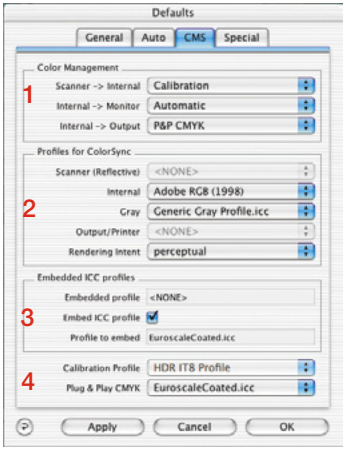


Clicking on the “Options...“ button in the ”General“ palette brings you to the basic settings dialogue. Among others you will find the CMS card, where you can adjust the colour management settings.

The “CMS” Palette has Four Different Sections



CMS palette in SilverFast Ai



CMS palette in SilverFast HDR

1. **Colour Management**

   Here you can define whether and how *SilverFast* will communicate with its imaging functions and the different devices (scanner, digital camera, monitor, printer).

2. **Profiles for ColorSync (ICM)**

   In case you have chosen ColorSync (Windows: ICM) as your preferred colour management system, you have to define the in- and output profiles for the different devices here.

3. **Embedded ICC Profiles**

   Here you will define whether *SilverFast* will embed a profile into the output data in order to render colours on another output device correctly at a later instant.

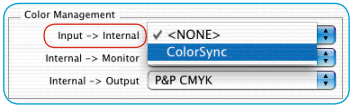
   The name of the embedded profile in the current image is also displayed in ***SilverFast HDR...***, *-**DC**...*

4. **Plug&Play CMYK**

   When using P&P CMYK you have to chose a separation ICC (CMYK) output profile to seperate your images for the printer.

1. Colour Management

Scanner –> Internal

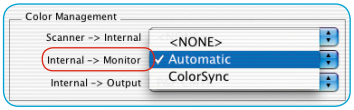


Here you define how your scanner's colour space will be matched to your system. You decide whether the original scan will be transferred to the imaging application with accurate colours.

<NONE>: You renounce matching of the scanner colour space to the colour space of the imaging software. Colours on the monitor may deviate from the image sample.

ColorSync / ICM: You decide to integrate the scanner into the operating system's colour management. By selecting the right ICC profile images will be scanned colour-exact. With *SilverFast*'s IT8 calibration you can generate a profile describing your scanner (your scanner's colour gamut).

Internal --> Monitor



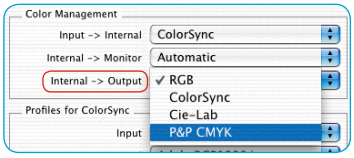
Here you define whether and how the monitor is matched to your system. You have to make sure that the work flow is consistent with the colour settings in your imaging application (e.g. Photoshop).

<NONE>: Data will be passed on to the monitor without any matching. You do omit colour management. Specially with Photoshop 5 it is very likely, that the *SilverFast* preview will deviate significantly from the results in Photoshop.

Automatic: You rely on Photoshop to do the matching to your monitor. It is advised, to set the same colour space (e.g. Adobe RGB) under "Profiles for ColorSync (ICM)" in the field "internal", you have defined inside Photoshop. Otherwise the colour of the scan data could deviate. Since the Twain-standard does not support such functions, it is not available with the *SilverFast* Twain-module!

ColorSync / ICM: You are integrating the monitor into the OS's colour management. The appropriate ICC profile for your monitor will be required. More sophisticated monitors get one supplied on disk or CD, if not, you might get it through the internet from the manufacturers web site, last resort would be to create one with a spectro-photometer. Adobe Photoshop 5 enables you to do your own monitor calibration (ICC profile). For this, utilise the installed Photoshop tool „Adobe gamma" or, as a professional solution, use respective measurement tools.

Internal –>Output



Here you can define what type of data the printer will get from ***SilverFast***. Data to be transferred to the imaging application (e.g. Photoshop), can be in different formats. CMYK- and RGB-files can have profiles embedded, so the data will be matched to the printer's colour space accordingly.

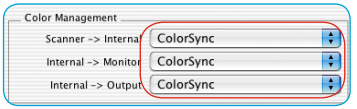
RGB: You can output data in RGB-data format. This setting is recommended for users having no Postscript- but other printers or have no printer ICC profile, or for those using their scans merely for internet- or multimedia projects.

ColorSync /ICM: You are integrating your printer into the OS's colour management. The appropriate ICC profile for your printer will be required.

Lab CIE-L*a*b* is a device-independent colour space, representing all visible colours. Colour differences are not rendered very detailed, and many colours cannot be displayed on a monitor (see also graphic in introduction: the "curved rectangle" represents Lab).

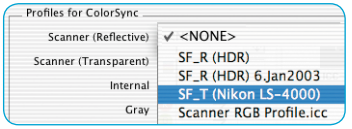
P&P CMYK: High quality system to get CMYK data directly from the 4-colour separation built into ***SilverFast***. To get precise colours it is vital to select the same CMYK colour space in Photoshop, (defined by the same ICC profile), as in *SilverFast*.

2. Profiles for ColorSync (ICM)

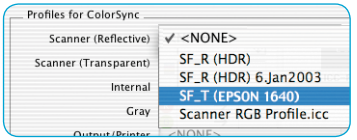


Only when you have chosen ColorSync (ICM) for colour management, you will have to select under “ColorSync profiles” the appropriate profiles for your device here. Exception is with the menu option “Internal ---> Monitor” which has to have an ICC profile allocated to under “Internal”.

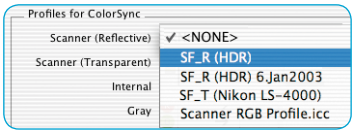
Scanner (Reflective), Scanner (Transparency)



Film scanner
Only then option “Scanner (Transparency)” is available



Flatbed scanner with transparency unit
Both options are available here: “Scanner (transparency)” as well as “Scanner (reflective)”

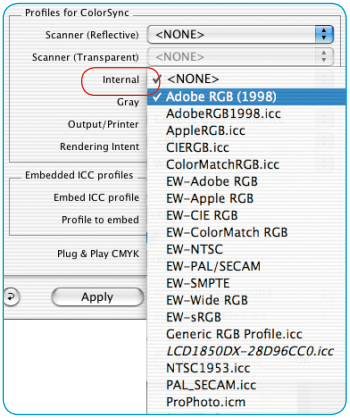


Flatbed scanner without transparency unit as well as SilverFastHDR, -DC, - PhotoCD.
Again, only one option is available: “Scanner (reflective)”

Here you allocate the appropriate (input) scanner profiles, which you have created with *SilverFast* or you have received from the scanner manufacturer. The profiles generated by *SilverFast* have the following naming convention:

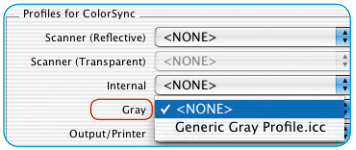
SF_R (Scanner name) or SF_T (Scanner name)

Where the “R” stands for reflective, and the “T” for transparency. In brackets after these again are the scanner names.
Profiles of hardware manufacturer do not follow standard structure. You will mostly find the name of the device where the file-suffix is „.icc” or „.icm”, does not have any significance, since the internal format is fully compatible.



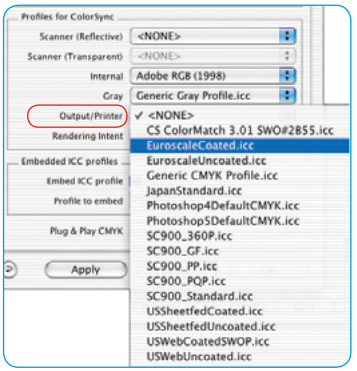
Internal

The internal colour space is independent from any device connected and is defined by a profile. This defines the colour matching foundation the colour management is building upon.. For the majority of users it is advised to select the monitor colour space in order to unburden the computer.
Once you have selected Internal --> Monitor ColorSync (ICM) you have to define the internal colour space by a profile you can select freely. In case you have chosen “Automatic” under “Internal”, select the profile of the application’s internal colour space. The Photoshop plug-in leaves the monitor matching to Photoshop.



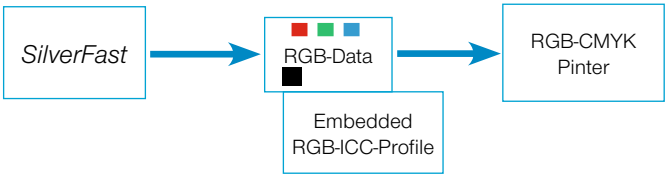
Grey

Here you can select a grey profile for greyscale scans, which can also be embedded into the image file.

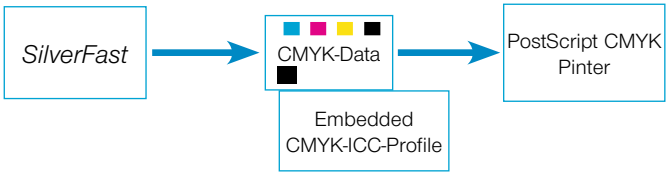


Output/Printer

The integration of the printer into the colour management is the highlight, but also the part inducing the most difficulties. The scanner's colour space and the monitor's are the same in principle – RGB – there may be small differences in size, and the related white points are shifted against each other. The printer behaves differently: the output is not only depending on the inks but also on the paper stock - how is the paper white, how is the paper absorbency. All this information has to be considered by the profile. The modern inkjet printers are equipped with drivers, which generally take these issues into account, but they can not so well be integrated with ColorSync .
After having chosen Internal-->Output ColorSync (ICM) under colour management, you have to select the output profile of your printer or imagesetter here. This profile can be embedded into the file at your request.

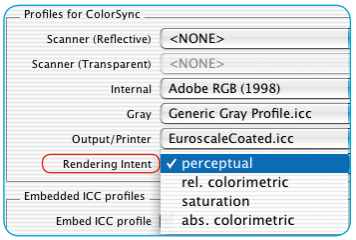


Profile-Embedding with Output on Non-PostScript-Printer



Profile-Embedding with Output on PostScript-Printer

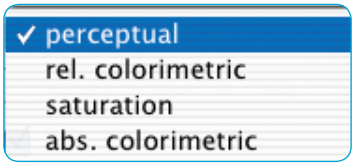
“Rendering intent” for ICC-Profiles



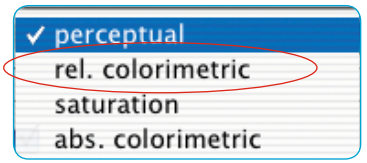
“Profiles for ColorSync (ICM)” now has an additional popup menu in the “CMS” tab of the “Options...” dialogue. Now *SilverFast*’s “Rendering Intent”, which can be utilized for all ColorSync / ICM operations, can be switched on.
A differentiation of the Rendering Intent for various operations (i.e., input, monitor and output matching) is not possible.
Prior to this, *SilverFast* has utilized the Rendering Intent which was preset in the profile, thus generally “Perceptual Match.”
Instead of this default setting, one of the three other Rendering Intents supported by ColorSync / ICM, such as “relative colourimetric,” “saturation” and “absolute colourimetric” can be chosen.
In comparison, the effect, when choosing “absolute aolourimetric” appears to be the most similar to prior behaviour, because of the differences of the Media white points that appear here.
Image data, which has been produced from computer graphics or from renderings might require adaption of the Rendering Intent.

Rendering Intents

1. Perceptual

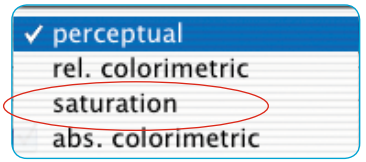


Relative colourimetry is used. A reproduction which provides a perceptual or pleasing appearance. This general means both in- and out-of-gamut colours are modified from their colourimetric representation.
Example usage would be for scanned images.



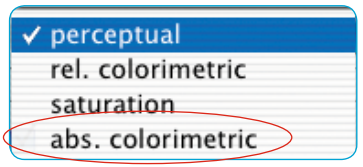
2. Relative Colourimetric

Relative colourimetry is used. For reflection print this means that “y” of paper (paper white) is taken to be “1”. All colourimetric measurements are normalized based on the paper‘s colourimetry. A colourimetric reproduction is provided for in-gamut colours. Out-of-gamut colours are mapped to the border of the reproducible gamut. This has the advantage of providing a larger effective gamut so that bright colours will more likely to be in-gamut. It has the disadvantage of sacrificing exact colour matches for printers with different paper white points.
Example usage would be for spot colours where a colour reproduction relative to the paper‘s white is desired.



3. Saturation

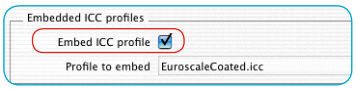
Saturation relative colourimetry is used. A reproduction in which saturation is emphasized. In-gamut colours may or may not be colourimetric.
Example usage would be for business graphics where saturation is the most important attribute of colour.



4. Absolute Colourimetric

Absolute colourimetry is used. For reflection print this means that “y” (paper white) of printed paper is less than “1”. A colourimetric reproduction is provided for in-gamut colours. Out-of-gamut colours are mapped to the border of the reproducible gamut. This has the advantage of providing exact colour matches from printer to printer. It has the disadvantage of causing colours with “y” values between the paper‘s white and “1” to be out-of-gamut.
Example usage would be for spot colours where an exact colour reproduction is desired.

3. Embedded ICC Profiles



Nowadays, digital images are transferred in various channels onto different computers. To assure the rendering of colours to be true without knowing from where they came and how they have been processed, images get a profile attached which will assure a basis for the colour reproduction process.
If you want to embed the ICC profile into the data, you have to check this field accordingly. You will automatically see which profile will be embedded.
There are four possible origins for an ICC profile:

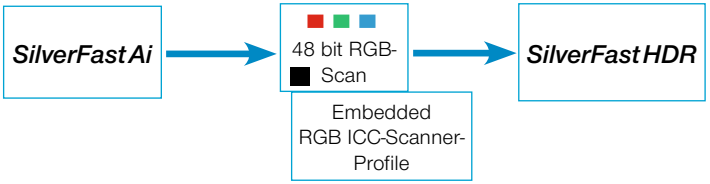
1. When selecting RGB in the section colour management under Internal->Output the profile originates from the field Profiles for ColorSync --> Internal (e.g. Adobe RGB).

2. When selecting ColorSync (ICM) under Internal-->Output, the profile originates from the field Output/Printer in the field “Profiles for ColorSync”. (e.g. “Euroscale coated.icc).

3. If “P&P CMYK” is selected, it is the profile that was chosen under “Plug&Play CMYK”.

4. When scanning in 48 bit mode and having selected the scanner-profile under “Profiles for ColorSync”, the scanner profile will be embedded into the file.

Working in 48 bit mode?
SilverFastAi can embed a scanner profile (which describes the deviation of the scanner) into the Tiff data during the output of 48 bit data. The scanner deviations can then automatically be corrected during later processing with SilverFastHDR.



Embedding a Scanner-Profile into the 48bit RGB-File

4. Plug&Play CMYK

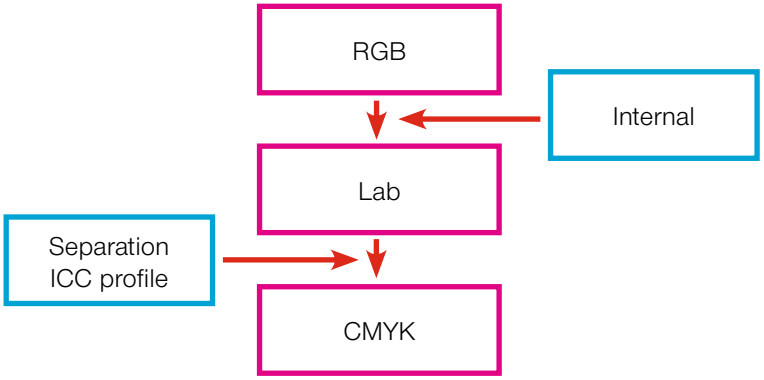
Scanning with Colour Separation

LaserSoft Imaging AG has developed a new solution for high-end separation through Plug&Play CMYK. A new and revolutionary technique solved the problem of separation because the CMYK preview always used to look too different from the final result. Not so with ***SilverFast***!
The following diagram explains the functionality of the new separation:

1. RGB data is internally calculated to the hardware independent Lab colour space. Monitor settings are taken into account. The monitor should therefore always be adjusted properly (see below).

2. By using ***SilverFast separation*** as well as the Photoshop separation profiles with help of the ICC profile, we calculate via the Lab format into CMYK.

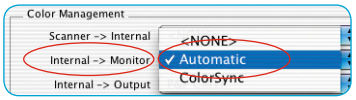
SilverFast Plug&Play Separation



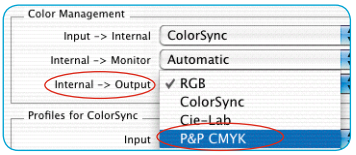
CMYK Output with Colour Management

Plug&Play CMYK Separation

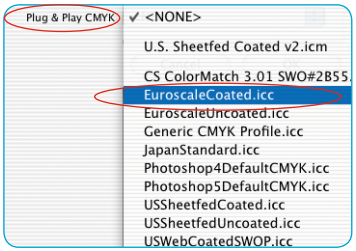
In order to activate the P&P CMYK separation, proceed as follows: Select Internal->Output" "P&P CMYK" under the ***SilverFast*** colour management dialogue. Under "Plug&Play CMYK" at the bottom of the dialogue, select the appropriate profile.
The ICC-CMYK output profile can by chosen at the base of the CMS dialogue.
Make sure you have loaded the same profile in Photoshop under "Colour Settings -->CMYK setup".



Selection of monitor setting

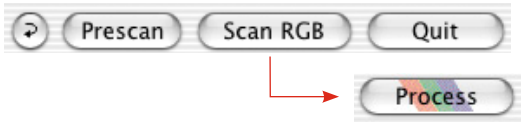


Selection of P+P CMYK



Selection of same profile or separation table

When leaving the "Options..." dialogue, the button "Scan RGB" will now show "Scan CMYK".



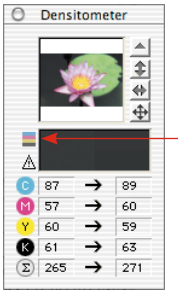
You may also switch ***SilverFast*** from RGB to CMYK by keeping the "CRTL" key pressed and click on the "Scan" button. A small popup window will appear in which the choice can be made. (refer also "Permanent softproof" Pages 87 and 191) If you have not selected a separation table or ICC profile previously , the selection will be grey and cannot be activated.

RGB-CMYK Toggling
Under Windows press right Mouse-button

Softproof - CMYK Simulation
"Alt"-command and click into preview

CMYK Colour Simulation on the Preview (CMYK Softproof)

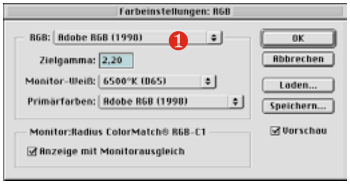
When the scan button shows "Scan CMYK" , you can switch the preview to CMYK simulation by clicking the softproof button within the densitometer window.

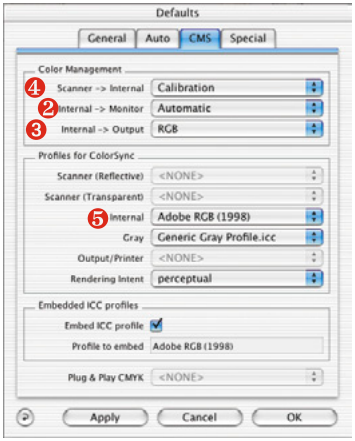


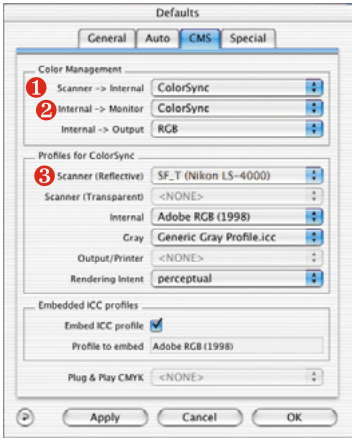
Button for switching on / off the softproof function

Example Settings *SilverFast*/Photoshop 5.02

Following is a selection of example settings for the ***SilverFast*** CMS dialogue with reference to Photoshop 5.02:





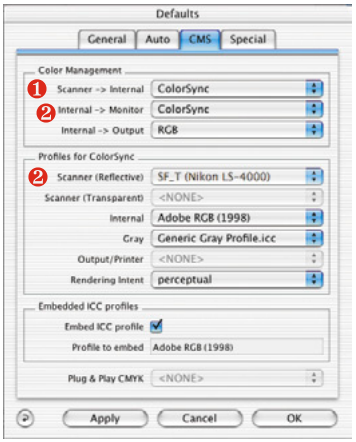


RGB Output under Photoshop without Colour Management

Under „Photoshop File/Colour Settings/ RGB Setup" you have selected e.g.: ❶ Adobe RGB as your working colour space. An ICC profile for this colour space should be exported, so you can select it later in *SilverFast*. To do this, you can save the settings with „save" into the ICC folder of the operating system.
Now bring up *SilverFast* (from the Photoshop "Import" menu).
Go to "CMS" under "Options..." in the *SilverFast* main dialogue.
In "Colour management" select ❷ "Automatic" under "Internal --> Monitor". Select ❸ "RGB" under "Internal --> Output". In this case select ❹ <NONE> or "Calibration" under "Scanner->Internal". You can only use Calibration with *SilverFast*'s own IT8 calibration. In this example we left it at <NONE>.
Select ❺ Adobe RGB under "Internal" in section "Profiles for ColorSync" as the RGB profile, which you have selected previously in Photoshop.

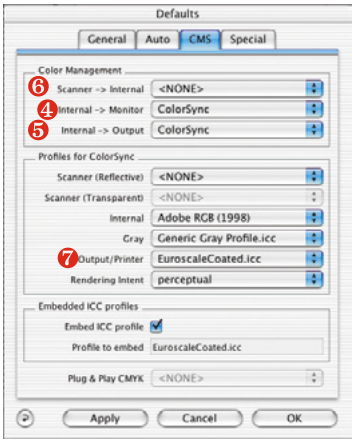
RGB-Output with Colour Management

You have selected an RGB colour space (e.g.: Adobe RGB) under "Photoshop /Colour Settings/ RGB Setup". For this you should have an ICC profile defining this colour space in which you can select later in the *SilverFast* CMS dialogue under "Profiles for ColorSync / ICM" - "Internal". (If you do not have this profile, use "save" to save the profile into the System's profile folder.)
Now bring up *SilverFast* (from "Import menu") .
Go to "CMS" under "Options..." in the *SilverFast*'s main dialogue.
Select ❶ "ColorSync"(ICM) in the "Colour management" section under Internal -> Monitor and Internal --> Output. Scanner-->Internal is also set to ❷ "ColorSync" (ICM) in our example. This is only possible, if you have a Scanner ICC profile - either from *SilverFast*'s IT8 calibration, or supplied from the scanner manufacturer. The profiles of the hardware manufacturer are not very accurate, since they are more generalized instead of scanner specific.



Select the scanner profiles ❸ (reflective/transparency) of your scanner in section “Profiles for ColorSync” and under Output/Printer your printer profile. Select the profile of the internal system colour space under “Internal”. *SilverFast* assumes your image application supports complete colour management . Please check for this feature in the manual of your software manufacturer.

CMYK-Output with Colour Management (CMS Separation)

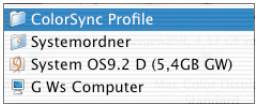


You have selected a CMYK colour space under “Photoshop / CMYK setup”. For this you should have an ICC profile you can select later in *SilverFast*. If not, you can save the settings with “save” into the System profile folder.
Now bring up *SilverFast* (from the “Import” menu).
Under “Options...” go to “CMS” in the *SilverFast* main dialogue.
Under the section “Colour management” select ❹ ”ColorSync” under Internal--> Monitor and ❺ ”ColorSync” under Internal --> Output.
Under Scanner--> Internal in our example it is again ❼ <NONE>.
In the section “Profiles for ColorSync” select the same CMYK profile under – Output/Printer, which you have allocated in Photoshop.
Under Internal, select the profile of the internal system colour space.

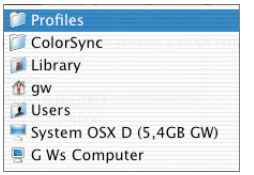
How to save Profiles from Photoshop 5.02

Go to “File”, Colour Settings: RGB Setup. In this dialogue you can prepare your own settings and “Save...” them. Make sure, the profile goes into the right folder, so the System and *SilverFast* can access (load) it.

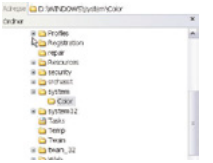
The path to save it into using **MacOS 9** is «..:System folder: ColorSync Profiles» and to save the file into.



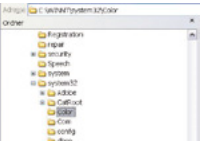
The path to save it into using **MacOSX** is: «...: user : *user-identification* : Library : ColorSync : Profiles ...».

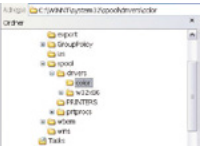


The path to save it into using **Win98** is: «C:/Windows/System/Colors»
Note: Profiles in *SilverFast* have a different name from the file name!



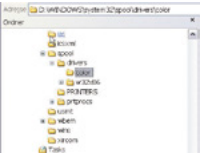
The path to save it into using **Windows 2000** is: «C:/WinNT/System32/Color»
or
«C:/WinNT/System32/Spool/Drivers/Color»





Attention!
Under Windows profile descriptions do not correspond to profile name. To make sure you do not unvolentarily select profiles you do not want, move those profiles temporarily out of the Windows / System Colour directly into a new directory (folder).

The path to save it into using **Windows XP** is: «C:/Windows/System32/Color»
or
«C:/Windows/System32/Spool/Drivers/Color»

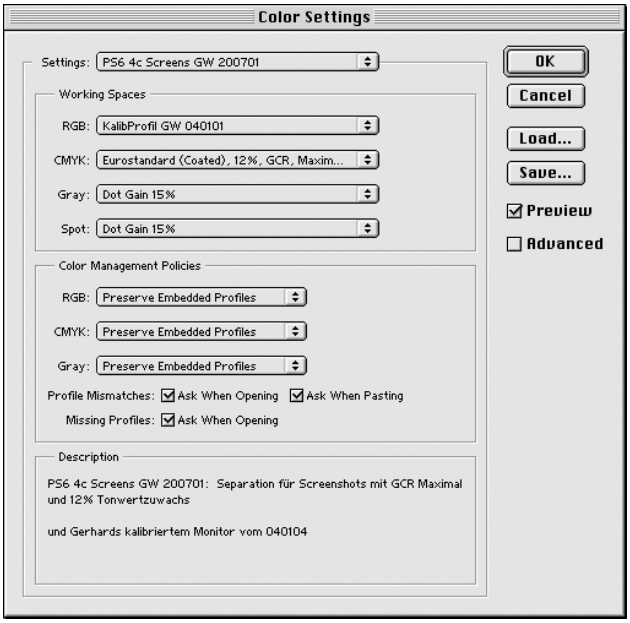


Example Settings SilverFast / Photoshop 6

In ADOBE Photoshop 6 all colour settings have been integrated into one menu under “Colour Settings”. It seems more complicated on first look but has become clearer structured in reality.

Once set up, you can save all as one setting and if required exchange with other settings.

Please carefully read the corresponding pages in your Photoshop manual.



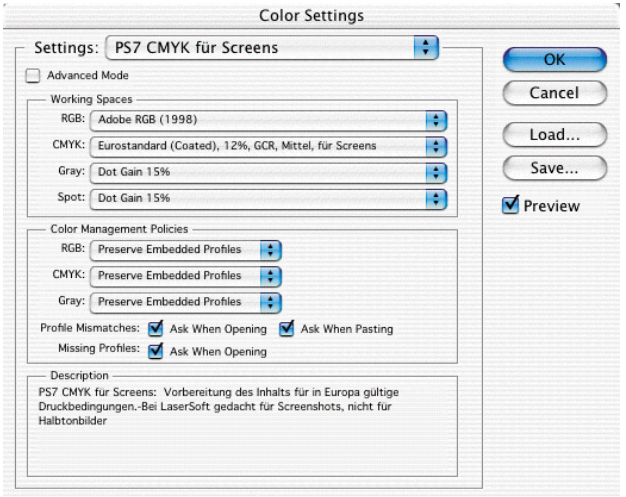
Example Settings *SilverFast* / Photoshop 7

In ADOBE Photoshop 7 all colour settings have been integrated into one menu under “Colour Settings”. It seems more complicated on first look but has become clearer structured in reality.

No changes were made to Photoshop 6. The same presets may be used.

Once set up, you can save all as one setting and if required exchange with other settings.

Please carefully read the corresponding pages in your Photoshop manual.



7.2 Calibration of your Scanner using *SilverFast* IT8 Calibration

IT8 calibration button, will open the IT8 dialogue.

IT8 button coloured = calibration is active.

IT8 button grey = calibration is disabled.

The IT8 button is NOT visible when this function is not activated in the software!

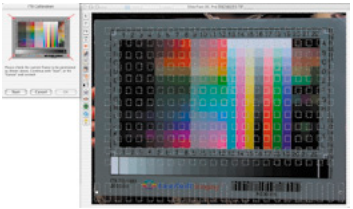
SilverFast Ai for some high-end devices features a professional tool for calibration and generation of input ICC profiles. The calibration can be made for reflective and transparency positive originals. The calibration is NOT applicable to negative originals.
The IT8 calibration is an additional function in the ***SilverFast*** software. It is usually an option to the software and therefore has to be activated separately. In certain ***SilverFast*** versions - for selected scanners - this function is active by default. In cases where this function must be activated separately, a second CD Rom is required for this procedure - the "***SilverFast*** Feature-CD".
The separate activation procedure is described in chapter "SilverFast Feature-CD".
SilverFast has made the process of IT8 calibration very convenient – all steps are performed automatically by the software, just follow the instructions outlined below.

1. Position the IT8 Reference Chart on your Scanner Bed.

Make sure that the original is positioned inside the scan area of the scan bed. Avoid positioning on areas at the rim of the scanner bed, with some scanners this areas must be kept clear for hardware calibration. The orientation of the IT8 target should be as shown on the left.

2. Click "Prescan" (the Scanner performs a Prescan).

3. Click the button "Calibration"

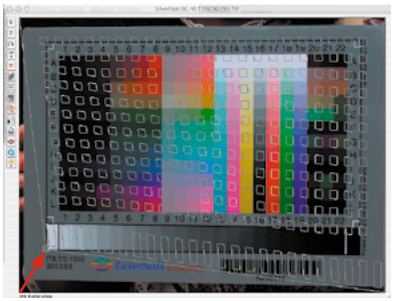


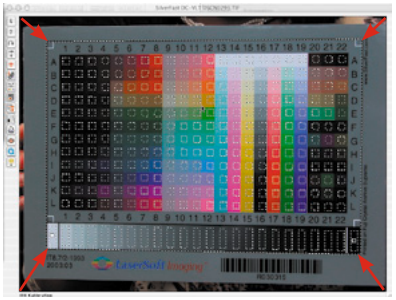
4. The Window "IT8 Calibration" pops up

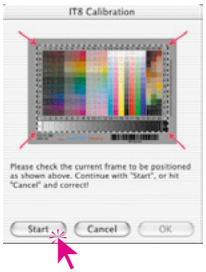
The preview window and the grid will open.

By clicking into the IT8 image of the dialogue window, the grid is reset to its standard position.

Position the grid in such a way, that all edges are precisely covering the IT8 target.







5. Start the Calibration

If the frame is correctly set up, the calibration can commence by clicking the “Start” button.

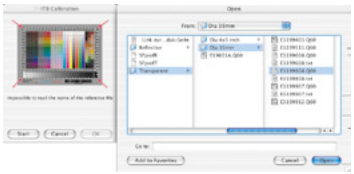
SilverFast will now search for the respective reference file for the chosen IT8 target.

6. Identifying the IT8 target and Searching for the Correct Reference Data File.

6a. *SilverFast* Locates the Reference Data File on Its Own

This usually happens very quickly and runs automatically; the IT8 target is identified by the barcode on its front. ***SilverFast*** then searches for the respective reference data file, and then launches the calibration.

6b.*SilverFast* cannot find the Reference Data File



The automatic search is started within the installed folder for reference files. In case no matching data file is found, ***SilverFast*** will make an internet connection to the ***LaserSoft Imaging*** homepage, and search for the data file there. The reference file will quickly be loaded (size 20 to 30kB). The calibration will then be commenced.

In case no matching reference file is found, an options dialogue is opened. This may occur if the user has chosen a non ***LaserSoft Imaging*** IT8 target which does not contain barcodes. In this case, please locate the matching reference file manually.

Attention! Each reference data file contains exact information about the IT8 target. This means that for each IT8 target there is only one matching reference file. Not matching the exact targets and reference files will lead to a wrong calibration and false results.

Make sure your reference file (text file) corresponds to the production charge of your IT8 calibration target (when in doubt, ask target manufacturer)!

SilverFast software usually installs some known reference files automatically inside the “IT8 Reference” folder, a subfolder of the ***SivlerFast*** folder.

In case the reference file is not installed, you will find more filed on the ***SilverFast*** installation CD, as well as on out website:

http://silverfast.com/download/it8calibration-en.html

Reference files for original KODAK reference targets (image) can be found here:
ftp://FTP.Kodak.com/GASTDS/Q60DATA/

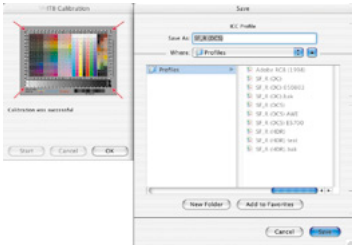
You can easily identify your reference file by its file name. That name is either a so-called “charge number” or a production date printed either directly on the calibration target or on its protective sleeve or below the barcode.

Note!
When using IT8 calibration make sure you are only using targets with the correct reference data of the appropriate film manufacturer (e.g. Kodak, Agfa, Fuji).

For calibration in reflective mode, please make sure to select the corresponding reference file for reflective targets. The same applies for transparency calibration accordingly.

Confirm your choice with a click on the “Open” button.

7. Saving the ICC Profile



After the calibration has been completed you will get the message “Calibration has been successful”.

You’ll then have the option to save the result of the calibration as an ICC profile for system-wide colour management. Name and location of the profile can be selected by the user.

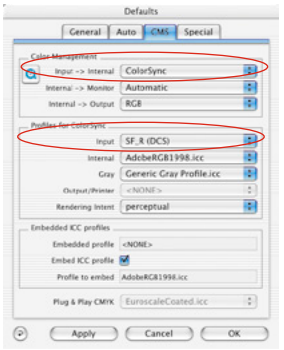
Close the dialogue window by clicking “OK”. A new prescan will be launched simultaneously to update the preview.

If the name of the profile just exists you are asked for replacing the just existing older profile.

8. Calibration is now Active.

The IT8 calibration button is now coloured and not longer grey.

Attention!



For a subsequent activation of the calibration, please choose the following colour management settings:
Choose the option “ColorSync” (Windows “ICM”) in the “Scanner-> internal” menu.
After this, choose the correct calibration profiles for both transparent and reflective images.
After clicking the “OK” box of the CMS dialogue, the IT8 calibration is activated.

Differences in Calibration Between a Scanner and a Digital Camera

When calibrating a digital camera, several factor have to be taken into account.

The great advantage of scanners is that they work with almost constant conditions: it has an almost constant light source, a fixed colour temperature and a constant distance between the object and the sensor, as well as an absolute array between object and sensor.

This is completely different with digital cameras! Nothing is really constant or standardised, leaving the camera much more flexible and therewith hard to calculate.

An IT8 calibration can be performed but, strictly speaking, lasts only as long as no changes are made to the surrounding factors.

These conditions are generally only found in photo studios , Tabletop or during repro photography. They are strongly variable when working with changing light conditions, outdoor photography, etc.

Each deviation of the factors makes the calibration work for only one single photo. If a light source is moved in a photo studio, a new calibration-photo is to be made. In order to do this, simply place a suitable IT8 target on a prepared stand into the photo to be taken, and capture the IT8 target in the photo. Then remove the target from the set, and re-shoot the photograph. By this method, two photos are taken, first one for calibration and after that the actual photograph. Professionals know the procedure with grey card tests – the objective is the same with the steps described here.

Sequence of IT8 calibration

A summarized run through the calibration process in the ***SilverFast*** software.

1. Place the IT8 target into scanner and align the target

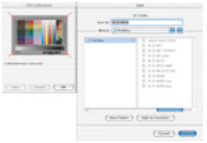
2. Initiate a prescan

3. Click once on IT8 calibration button (a dialogue opens).

4. In preview window, position the grid exactly over the IT8 target

5. Click once on “Start“ button
(if a dialogue opens: browse to location of corresponding IT8 reference file and select it. Confirm selection by clicking the “Open“ button.)

6. The IT8 calibration process itself runs automatically.
The IT8 dialogue window informs you about the progress of the calibration process.



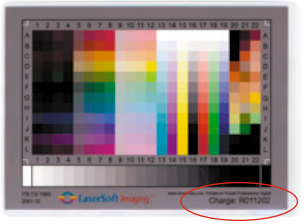
7. Save the result of the calibration as ICC profile for system-wide colour management.

8. The IT8 calibration process is completed and automatically set active.

Examples Where to Find the Production Charge Number on IT8 Targets of Different Manufacturers.

LaserSoft Imaging target
35mm, transparent,
charge number is on slide mount.

LaserSoft Imaging target
4x5 inch, transparent,
sticker on the protective sleeve.



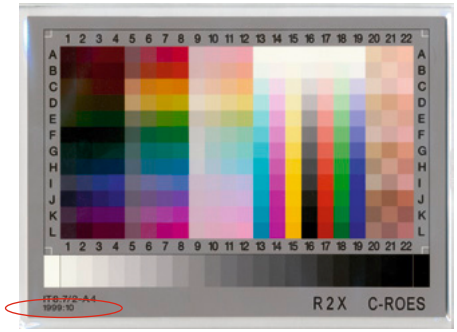
LaserSoft Imaging target
5x7 inch, reflective,
written directly on the target
- bottom right.

Kodak target
35mm, transparent,
reference is date printed directly on the target and also on the slide mount.

LaserSoft Imaging target
DIN A4, reflective,
printed directly on the target
- bottom right.

C-ROES target
35mm, transparent,
reference is date printed directly on the target

C-ROES target
DIN A4, reflective,
printed directly on the target
- bottom left.



Non-calibrated Scan

Calibrated Scan (IT8 Calibration)

Chapter 7.3 Addendum

7.3 Addendum

The following chapter introduces into basic scanning concepts and why a good scanner usually has more than 8 bits per colour.

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Scan concept
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Need for more than 256 levels of grey 441
Screening 442
Calculating the scan resolution 443
Which „resolution“ does ***SilverFast*** indicate? 444-445
Optimizing scanner resolution for inkjet printers 446-447
Selective colour correction 448
Colour model relations 449
Keyboard shortcuts Mac and PC 450-454

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7.5 Glossary **471-491**

Scanning Concepts

What is a brilliant image? Do I really need very high resolution? What is interpolated resolution?

Imaging has been an abstract science which was practised by well trained professionals. Now with the advent of low price PCs, scanners, printers and digital cameras imaging has become a mass phenomenon.

It is exciting to see how this technology is impacting and changing economy and society. It seems that in an information society imaging is becoming the premier tool to convey ideas and compact messages.

This recognition emphasises the importance to learn more and become familiar with the basic imaging concepts. It will help you to realise your visions and ideas much more quickly!

So for your own advantage do study the following pages carefully!

Scan resolution (dpi)

Some important definitions are clarified here. They form the vital basics of image reproduction theory.

Input Resolution

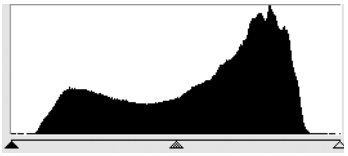
Resolution is a common expression that refers to the number of finest elements of an image or pixels (pixel is an artificial word made of picture and element), which a sensor, for instance a scanner, can record or distinguish. The unit of measure is in general „dpi“ = dots per inch or „dpcm“ = dots per cm. The higher the resolution, the greater the number of pixels can be scanned.

Optical Resolution / Interpolated Resolution

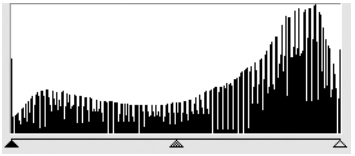
The optical resolution is also called physical resolution. It de-fines how many lines or points per inch or cm the CCD and optics of the scanner can clearly distinguish. This can be seen when two lines, being very close to each other, can still be seen as two different lines and not as one.
Interpolated resolution is mathematical resolution which, as we will see later, is only important for line art scans, not for greyscale scans. It is calculated via hardware or software.

Greyscale

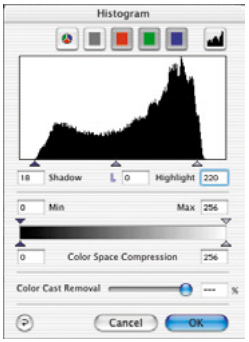
Greyscales are of very high importance for scanning technology because, in order to reproduce a greyscale image, the scanner has to sense every single image point with a certain depth of data in order to reproduce the different levels of grey correctly. A good scanner should be sufficient to distinguish 256 levels of grey (8 bit), but as we will see on the next page, this is not enough. The scanner should distinguish more than 256 levels of grey internally.



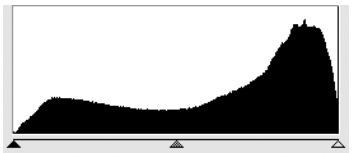
1. Histogram without spreading in Photoshop



2. Histogram with spreading in Photoshop



3. Histogram in SilverFast with automatic optimisation



4. Histogram after scan with SilverFast and 10 bit

Need for More than 256 Levels of Grey

Images are rarely ideal. Furthermore, the scanner itself can deviate (in itself) while scanning images. Adjusting the highlight–shadow values of an image on a prescan lets a scanner with an internal 10- to 8 bit transformation expand the reduced tonal range (fig. 1) to a full range of 256 levels of grey. By expanding a reduced tonal range with only 8-bit transformation, gaps in the tonal scale are produced where grey values are missing. Detail and sharpness of the image are lost or reduced. This can also happen when the transformation-algorithm from 10- to 8-bits is not optimised. The gaps in the histogram (fig. 2) also called spikes, become clearly visible.
Through an optimised transformation of the expansion of tonal values with 10- or 12-bits in *SilverFast*, the end result, that is to say, the final scan displays a gapless distribution of grey levels across the entire greyscale (see fig. 4).

The correct adjustment of highlight and shadow, for instance which values on the prescan become white and which become black, has a strong influence on the quality of a reproduction. *SilverFast* helps locate the brightest and darkest points in two ways: First, the densitometer can be set to CMY% and, by moving across the prescan, indicates where the brightest and darkest points are. Second, the highlight / shadow tool displays the brightest point when the “Ctrl” key is pressed, and the darkest when the “Alt” key is pressed (together with the “Command” key on Mac and the “Alt” key on PC, respectively). For displaying the brightest and the darkest point of the image on the prescan in combination with the highlight/shadow tool, click and hold the white or black square respectively.

Show brightest point

Show darkest point

Thus, the end points are easily set onto the correct spots in ***SilverFast*** (fig. 3).

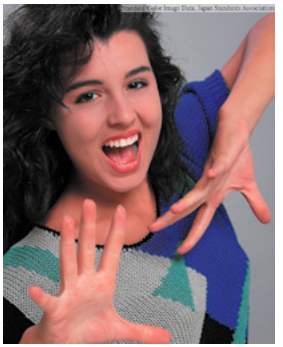


Fig. 1

Fig. 2

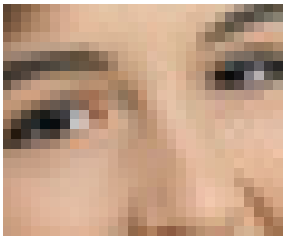
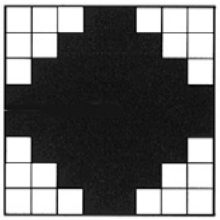


Fig. 3

Fig. 4

Screen Resolution (lpi)

In order to reproduce different shades of grey, the printing technology uses the screening technology. A dot matrix is the most economical way to produce shades of grey.



Screening Matrix
of an image point simulating grey through single image setter dots

An image dot from the scanner is transformed into a screening matrix (in general a 16x16 Matrix). If a screening dot is black, up to 256 image-setter pixels can be set in a screening cell. In a screen of 152 lpi there are 152 screening dots in a line. The unit of measure lpi (lines per inch) is often confused with printer resolution. The unit of measure for printer resolution is generally dpi (In some countries, lpcm (lines per centimetre) is the unit of measure for the image setter´s resolution as well as for the screening frequency). Once again the units of measure:

Printer resolution: **dpi / dpcm (lpcm)**
Screening resolution: **lpi / lpcm**

The images on the left show the effects of different scanner and screening resolution. Image 1 shows a normal scan with 220 dpi printed on a laser printer with 120 lpi. Image 2 shows an enlargement of a selection. Image 3 shows a scan with very low resolution (under 72 dpi) printed with 120 lpi. Image 4 shows a scan from image 2 printed with a line screen of only 20 lpi.

Calculating the Scan Resolution

The best possible scanning resolution is very important and should be well thought out “the more the better” does not always hold true!

High scan resolution

High scan resolution is important only in line art scans. It should be between 800 to 1000 dpi depending on the printer resolution.

To Clarity:
Shades of greyscale images are converted into dots made of a 16x16 matrix when imaged on to an image setter. Ideally, a screening dot contains 256 individual pixels. When a photograph is scanned and printed onto a 150 line screen, each greyscale dot is converted into a 16x16 matrix. An image setter with a resolution of 2540 dpi is just capable of imaging such screening dots.
Since there are losses in the process of analog-digital conversion, an additional Q-factor (Q for Quality) is introduced. This factor is generally 1.4, and, with exception, 2.0.
As a result, the following formula for the calculation of the ideal scan resolution may be used:

Scan resolution = output screen x 1.4 x scale-factor

For Example:
The scan resolution for a 150 line screen with a 1:1 scaling-factor has to be calculated.

Scan resolution = 150 x 1.4 x 1 = 210 dpi

Automatic Calculation of Optimal Scan Resolution in SilverFast.
The calculation of optimal scan resolution results in maximum quality, less memory load and faster processing. For this very reason the automatic calculation of optimal scan resolution was integrated into SilverFast. Having chosen the quality factor of 1.5, you only have to input the desired output line screen (150 line screen) and the required output size. SilverFast automatically sets the optimal scan resolution for you.

The resulting file size for an A4 page for black and white greyscale is 5.77 MB, for colour 17.3 MB.
300 dpi would roughly double the file size. This shows the importance of setting the optimal resolution since memory requirements and processing time increase dramatically.

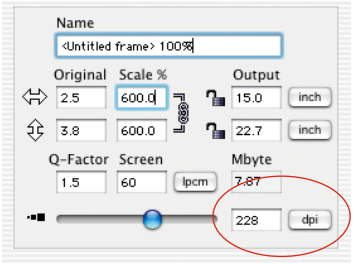
For a 121 line screen for a newspaper and a scale-factor of 50% the calculation is as follows:

Scan resolution = 122 x 1.4 x 0.5 = 85 dpi

If you want to double the image size :

Scan resolution = 122 x 1.4 x 2 = 341 dpi

The images on the right show, what has been explained earlier: that higher image resolution is not significant for better image quality.



Which "Resolution" does *SilverFast* indicate?

In ***SilverFast Ai*** you can monitor three different aspects of scan resolution:

a) **Output Resolution**: Will be continuously displayed. This represents the resolution, which the image will have after the scan, eg. in Photoshop. The value is derived from ***SilverFast's*** integrated formula, which relates quality factor and output-line screen.

b) **Optical Resolution**: Depressing "Ctrl" key will display the optical resolution the scanner is using currently. Every Scanner can only use certain optical resolution increments, depending on the hardware. Eg. 300, 600, 1200 ppi, but not 249 ppi. ***SilverFast Ai*** will always use the next higher hardware resolution, here 300 ppi, and will then interpolate down. This way the full quality is preserved. This way any loss in quality is eliminated .

c) **Interpolated Resolution**: To check whether the scanner does not interpolate "up", you can depress the keys "Ctrl + Shift". Now you can see the internally used, "calculated" or "interpolated" resolution. Here all values are possible such as 249 ppi from our example above.

Be alerted once the second value (with "Ctrl + Shift") is higher than the first value (only with "Ctrl"). This indicates the scanner would interpolate "up" and generate new pixels which are not present in the original image. Moderate interpolation up to 1.3 times max optical resolution puts you on the save side normally, depending on the quality of your scanner, of course.

Generally ***SilverFast*** inhibits “Misuse“ by limiting the max resolution to a factor of 2 or 2.5.

Images with Varying Resolution

100 dpi

200 dpi

300 dpi

400 dpi

Optimum Scan Resolution for Inkjet Printers

In order to print image scans with an inkjet printer without PostScript and without simulation of offset screens, effectively a few points should be observed already before the scan.

Please note: You should scan with reference to file size really needed, i.e. Scan size (file size) should ideally reflect the number of pixels needed for the print. Larger than necessary files only congest the computer system and do not lead to a better printing result! All necessary tools to get to ideal file size are built into ***SilverFast***. There are no complex formulas and no conversions required.

In order to get optimum results it is recommended to do an initial test. With this test you will find the optimum resolution fur the current printer (the printer connected), with relation to a special paper:

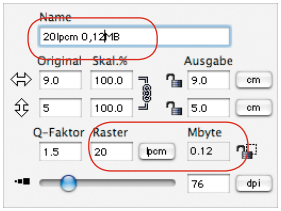
1. In the ***SilverFast*** main dialogue the “Quality factor is to be set“ to 1.5 and “Scaling“ is to be set to 100%.

2. The original to be scanned should be a contrasty slide with lots of details or a similar reflective halftone. do not use printed samples from magazines or books!

3. After the preview scan create a small scan frame (eg. 9x6cm) over an area with significant details.

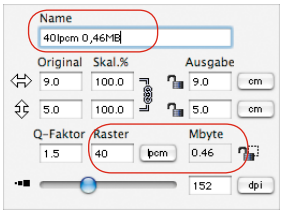
4. The image will be optimized as usual: image auto-adjust, Gradation, colour correction. Under “Filter“ the “Unsharp Masking“, if active should be switched off.

5. In the ***SilverFast*** main dialogue (“Frames“ panel) under “Screen“ input a value of 20 lpcm.
   In the same dialogue input “20 lpcm“ as well as the file size as “Name“ for this scan frame.

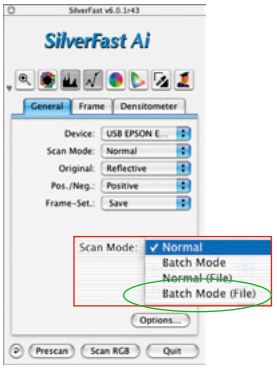


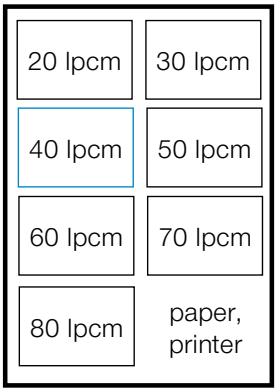
6. While depressing the “Alt“ key and dragging the scan frame will be copied. Position the new scan frame exactly onto the same position as the first frame.

⑦



⑨





Example of positioned test scans on a DIN A4 format sheet.

7. For the new scan frame input “30 lpcm“ under “Screen“. Then input “30 lpcm“ for “name”.

8. Now repeat steps 6 to 7 for the values “40 lpcm“ until “80 lpcm“, with steps of 10 in between.

9. In the main dialogue change to the “General“ panel and select “batch Mode (File)” under “Scan Mode“.

10. Start processing of the seven scan frames with clicking on “Scan Batch“. A dialogue will come up asking you for a destination for the final scans.

11. When the seven scans are done, mount them in a layout-program onto one paper, e.g. letter format. It is important that all scans get exactly the same frame size! Mark each scan frame with the full name of the image file respectively!

12. The test chart can now be printed and evaluated.

13. Evaluation of results:
    Which image, resp. which “screen“, will get the best result with the current paper ?
    Where can you distinguish fine resolution just about?

    What is the optimum screen? Notice how rapidly file size increases with higher line screens!

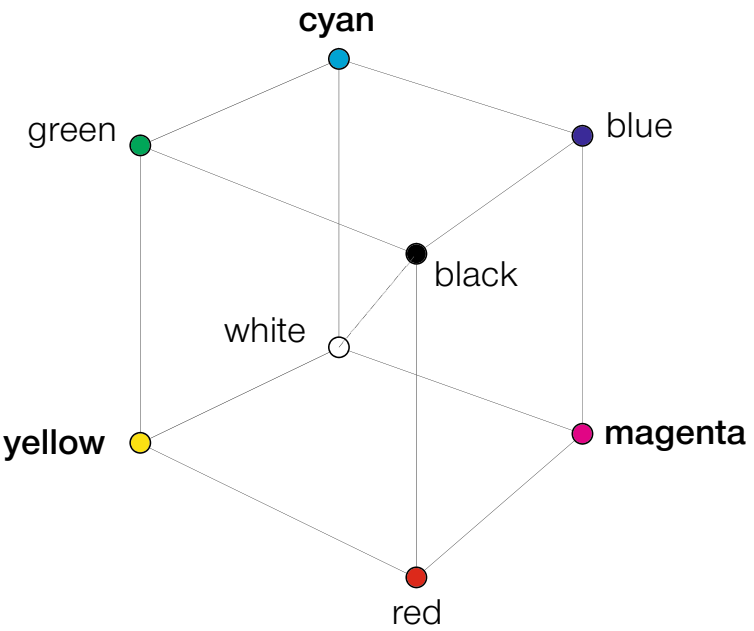
    In reality the limit for recognizing any enhancement in print quality will be between 40 to 50.

    It will be interesting to see the comparison print of the same image file on different paper or other printers.

Selective Colour Correction

Colour in Colour Correction

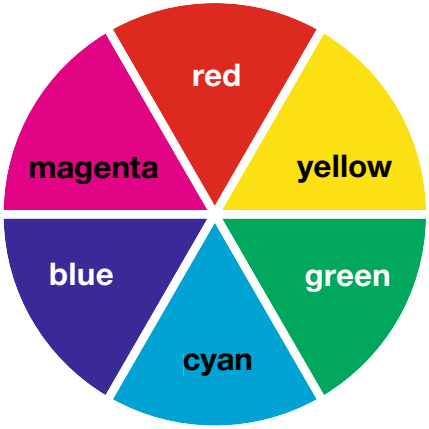
Selective colour correction was developed for high-end scanners, and consists of a changing colours within a colour. The colours red, green, blue, cyan, magenta and yellow are corrected. The cast colour can be reduced and the current colour can be increased. The cast colour of red is cyan, of green is magenta, of blue is yellow.



The diagram above shows the relationship between colours.
The primary colours red, green, and blue have opposite colours as their complementary colours.
The neutral tones between black and white lie on a grey axis.

Colour Model Relations

The following model shows the relation between primary colours and contaminating colours (complementary colours). In the selective colour correction these colours can be increased or decreased.



Contaminating Colours

Contaminating colours are those which lead to a “dirtying” also referred to as a “blackening”. The colours lose their brilliance and tend to grey. The following table shows the relations:

Colour		Contaminating colour
Red	➔	Cyan
Green	➔	Magenta
Blue	➔	Yellow
Cyan	➔	Magenta / Yellow
Magenta	➔	Cyan / Yellow
Yellow	➔	Magenta / Cyan

Keystrokes in *SilverFast*

Action	Macintosh	Windows
Description of keyboard shortcuts and their respective counterparts		
Command	Command-/Apple-Key	–
Alt	Opion-/Alt-Key	Alt-Key
Shift	Shift-Key	Shift-Key
Ctrl	Control-/Ctrl-Key	Control-/Ctrl-Key
Return	Return-/Enter-Key	Return-/Enter-Key
Esc	Escape-/Esc-Key	Escape-/Esc-Key
ScanPilot / ImagePilot		
Apply / Execute current tool	Return	Return
Scroll / Next action	Up and Down arrow	Up and Down arrow
Prescan, scan / Preview, process		
Stop prescan / stop scan	Command+Period	Strg+Period
Switch to other colour space	Ctrl+Click on Scan-/Process-button	Right mouse button+Click on Scan-/Process-button
Zoom	Ctrl+Click&Drag	Ctrl+Click&Drag
Image frames		
Duplicate frame	Alt+Click&Drag	Alt+Click&Drag
Entire Window in one frame	Command+A	Ctrl+A
Delete frame (extended keyboard)	Delete	Delete
Delete frame (normal keyboard)	Alt+Backspace	Delete
Frame reset	Reset-button	Reset-button
Copy settings of one frame into an other frame	Alt+Click on active frame, click then into target frame	Alt+Click into inactive target frame

Action	Macintosh	Windows
Auto-adjust		
Resetting auto-adjust	Alt+click on Auto-adjust button	Alt+Click on Auto-adjust button
Highlight / shadow / midtone tool (HSM-tool)		
Set highlight	Click on white triangle of HSM-tool	
Set midtone	Click on pipette of HSM-tool	
Set shadow	Click on black triangle of HSM-tool	
Multiple attempts with pipette		
Hold down pipette for multiple attempts (only highlight, shadow)	hold down Alt	hold down Alt
Reset highlight / shadow	Alt+Pippette of HSM-tool	
Display brightest point	Click on white square	F6
Display darkest point	Click on black square	F5
Histogram		
Show result histogram	Alt in the histogram dialogue	Alt in the histogram dialogue
Selective colour correction		
Select all colours	Command+A	Ctrl+A
Select additional colour	Shift+Click into prescan	Shift+Click into prescan
Select additional colour column	Shift+Click on LED below column	Shift+Click on LED below column
Show inactive mask area (dialogue must be closed)	F7	F7
Reset		
Reset all parameters	Shift+Click on Reset-button	Shift+Click on Reset-button
Frame reset	Alt+Click on Reset-button	Alt+Click on Reset-button
Undo/Redo last operation	Command+Z	Ctrl+Z

Action	Macintosh	Windows
Opening a dialogue window		
Zoom in preview	Command+1	Ctrl+Alt+1
Image auto-adjust	Command+2	Ctrl+Alt+2
Histogram dialogue	Command+3	Ctrl+Alt+3
Gradation dialogue	Command+4	Ctrl+Alt+4
Global colour correction	Command+5	Ctrl+Alt+5
Selective colour correction	Command+6	Ctrl+Alt+6
Expert dialogue	Command+8	Ctrl+Alt+7
Leave dialogue/Leave SilverFast	ESC or Command+Period	ESC or Ctrl+Period
Start scan / Process image	Return/Enter	Return/Enter
Main dialogue		
Undo/Redo last action	Command+Z	Ctrl+Z
Show current hardware resolution	Ctrl	F5
Show calculated scan resolution	Ctrl+Shift	F6
Masks in *SilverFast SRD*		
Hide mask frame	Ctrl	Ctrl
Shade inactive mask area	Alt+Ctrl	Alt+Ctrl
Reduce mask	Alt	Alt
Extend mask	Shift	Shift
JobManager		
Select all job entries	Command+A	Ctrl+A

Action	Macintosh	Windows
VLT (virtual light table)		
Context menu in album and overview	Ctrl+Click	Right mouse
Preview mode, full screen, fit to screen	Command+Shift+F	Ctrl+Shift+F
Display EXIF infos	Command+I	Ctrl+I
Album, mark all images	Command+A	Ctrl+A
Album, delete image	Command+backspace	Ctrl+backspace
***EP* (extended printing dialogue)**		
Crop opposing edges / corners simultaneously	Shift+Click&Drag	Shift+Click&Dra
SilverFast Launcher		
Terminate	Command+Q	Ctrl+Q

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7.4 Index

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Chapter 7.5 Glossary

7.5 Glossary

A

additive primaries
Red, green, and blue light that produce white light when added together.

ASCII
(American Standard Code for Information Interchange) A standard format for representing data or text in 8-bit chunks.

B

bit
(binary digit) The basic unit of information used by computers. It has two states: on or off.

bitmap
An image made up of a matrix of dots, or pixels.

byte
A unit of information equal to eight bits.

C

calibration
The process of setting equipment to a standard measure.

CCD
(Charge-Coupled Device) A light sensitive electronic chip used by scanners to measure light.

channel
One greyscale scan or one of the three RGB components making up a colour scan.

CLUT
(Colour Look-Up Table) A collection of most-often-used colours stored in a file or the System.

CMYK
(cyan, magenta, yellow, black) The subtractive primaries, also known as the process colours, used for colour printing.

Colour separation
Dividing a colour image into its four CMYK components for printing. (Also refers to the C, M, Y or K film negative from which printing plates are made.)

comp
(comprehensive) A test print used to evaluate layout and design.

compression
The process of decreasing a file size.

contrast
The range between the darkest and lightest areas in an image.

D

daisy-chain
link together sequentially as in linking multiple drives on the SCSI bus.

DCS
(Desktop Colour Separation) A format that contains five Post-Script files for each colour image.

densitometer
A hardware device to measure the amount of light transmitted through film to check the quality of imagesetter output. Also a software feature for measuring the grey and RGB levels of an on-screen image.

dithering
A halftoning process that uses clusters of dots rather than evenly spaced halftone cells.

dot gain

A printing defect in which halftone dots print larger than intended.

dpi

(dots per inch) The unit of measure for a printer's output resolution. Also used for scanner resolution although ppi or spi is more accurate.

dropout colour

A colour that you set the scanner not to recognise.

E

EPS

(Encapsulated PostScript) A file format that can contain both scanned images and PostScript images along with printer information.

gamma

A measure of contrast that affects the midtones of an image.

gamma correction

Application of an algorithm to correct images for the fact that machines and people perceive tonal gradations differently.

G

GCR

GCR (Grey Component Replacement) A technique for reducing the amount of cyan, magenta, and yellow ink in an area and replacing them with black ink.

Greyscale

An image type made up of black, white, and grey pixels. Also, the range of greys in such an image measured in either percent black (0% is white and 100% is black) or grey levels (0 is black and 255 is white).

H

halftone
An image that uses different sized dots to represents light and dark areas.

highlights
The white and nearly white parts of an image.

histogram
A bar graph of the number of pixels for each grey or RGB value in an image. The histogram helps you evaluate the tones in an image.

HSB
(Hue, Saturation, Brightness) A colour model that defines a colour by specifying its hue, saturation, and brightness.

I

imagesetter
A printer that prints computer files at high resolution on photographic paper or film.

interpolation
Mathematical calculation the scanner performs to increase resolution.

J

JPEG
(Joint Photographic Expert Group) A compression algorithm for image files.

K

kilobyte
A unit of memory equal to 1024 bytes.

L

Line art
An image type made up of black and white pixels only.

lpi
(lines per inch) The unit of measure for halftone line screen frequency, or how many halftone cells occur in an inch.

LUT
(Look-Up Table) The table of colours a computer can display at a given time.

M

megabyte
A unit of memory equal to 1024 kilobytes.

memory
Computer hardware that can store information for later retrieval. This term can mean either hard disk memory or RAM memory. See also RAM.

midtones
The range of tones between the shadows and highlights of an image.

moire
Undesirable banding when scanning a halftone image due to the halftone screen interacting with the scanning grid.

O

overprinting
Printing over areas already printed, as opposed to using a knockout.

P

PICT
The native Macintosh file format for images.

pixel
(Picture Element) The smallest point in a scanned image. Line art pixels are black or white, greyscale pixels can be from grey level O to 255, and colour pixels can be from O to 255 for each RGB channel.

Plug-in module
Software that runs from within another application.

posterisation
Visible tonal banding in an image.

ppi
(pixels per inch) The unit of measure for a pixel based image, such as an image displayed on a monitor. Also used for scanner resolution.

prepress
The industry that prepares the film from which printing plates are made.

preview
A low-resolution version of an image that appears in the *Silverfast®Ai* Preview window to help you set the scan area and scanner controls.

proof
A representation of what a final printed piece will look like so that it can be evaluated before the expense of printing.

R

RAM

(Random Access Memory) The short term chip-based memory in a computer that applications load into to run.

RGB

(Red. Green, Blue) The additive primary colours used to display images on a monitor.

S

scan head

The part of the scanner containing fluorescent lamps that passes across an image.

screen frequency

See lpi.

SCSI

An acronym for Small Computer System Interface. An industry standard interface that provides high-speed access to peripheral devices.

SCSI chain

A group of SCSI devices linked to each other through SCSI peripheral interface cables and linked to the SCSI port on the computer through a SCSI system cable.

SCSI ID number

A number assigned to each SCSI device connected to a computer. The Macintosh itself is assigned ID 7. Other devices may use IDs 6 through 0, with 6 indicating the highest priority for communications and 0 the lowest priority.

service bureau

A business that specialises in printing computer files on an imagesetter.

shadows

The black and nearly black tones in an image.

stripping
The traditional process of assembling colour separations and typeset text by hand prior to making printing press plates.

subtractive primaries
The ink colours cyan, magenta, and yellow that add together to make black.

T

terminator
A device used in an SCSI chain to maintain the integrity of the signals passing along the SCSI chain. An SCSI chain should have one terminator at the start and end of the SCSI chain.

TIFF
(Tagged Image File Format) A file format for exchanging files between applications and computers.

trapping
A technique of overlapping abutting colours to compensate for printing press misregistration

U

UCR
(Undercolour Removal) A technique for reducing the amount of magenta, Yellow, and cyan ink in neutral areas of an image and replacing them with an appropriate amount of black ink.

V

virtual memory

A feature of some applications (and System 7) that lets you use hard disk space as RAM.

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