



# inCamera® 4.0 User Guide

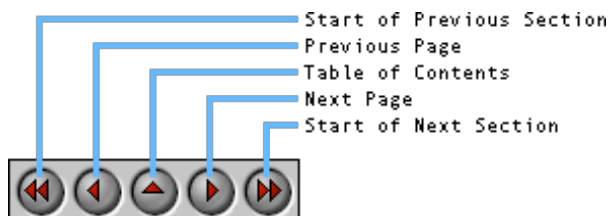
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In addition to providing direct links from the table of contents above, we have also provided a small navigation control to allow you to select pages in the User Guide:



**Note:** This HTML User Guide is cross-platform. That is, if you view it with a browser running on a Windows computer, the User Guide describes the Windows version of inCamera. Conversely, if you view it with a browser on a Macintosh, the Guide describes the Macintosh version. The differences are primarily related to the user interface appearance, but there are a few differences in the text also.



You are now running a **Windows** browser.

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# 1. Introduction

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inCamera is a digital camera and scanner profiling plug-in for Adobe Photoshop 5 6 7 or CS. With it you can create high quality ICC device profiles for any RGB digital camera or scanner.

Digital camera profiles are made using either the GretagMacbeth ColorChecker® chart, the ColorChecker DC chart or the ColorChecker SG chart. A new profile must be made each time the lighting changes, so when profiling digital cameras, inCamera is best suited for studio photography, where several pictures will be taken under the same lighting setup.

inCamera also creates scanner profiles using the IT8.7/1, IT8.7/2 or HutchColor HCT scanner targets, which are available for most photographic color transparency and print materials. Note that since these targets are not available for color negative films, scanner profiles cannot generally be made for such media. However, the clever photographer can circumvent this limitation in certain situations by using inCamera in a special way — a topic that will be discussed in a [later section](#) of this user guide.

An overview of the entire process is:

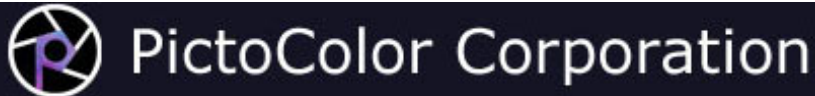
1. Select the appropriate chart and reference file.
2. Capture the chart with your scanner or digital camera.
3. Open the captured image in Photoshop and use inCamera to make the ICC profile.
4. Use this ICC profile by assigning it to other images that were captured on the same device and in the same manner as the chart image.



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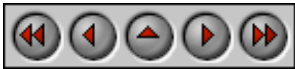
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## 2. Installation

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### Installation

inCamera is a plug-in. That means it cannot be run on your computer by itself. Instead, it must be run from within another program (called a *host* program) that has been specifically designed to support Adobe Photoshop Filter plug-ins. Because of the somewhat unusual characteristics of plug-in software, the installation process involves two steps:

- **Running the Installer Program** The installer places the plug-in and its support files onto your hard drive.
- **Copying the Plug-in File** The plug-in file created in the above step must then be copied (or installed) into the host program.

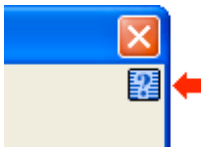
Detailed installation instructions may be found online [here](#).

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### Help

In addition to this **User Guide**, help is available from several other sources:

1. **Built-in Help** may be found by clicking on inCamera's Help button.



The Help button displays general information about using the plug-in.

2. Our **Frequently Asked Questions** site contains answers to many common problems. You will find this at [www.pictocolor.com/faq/](http://www.pictocolor.com/faq/).
3. **Technical Support** is available via e-mail at [Contact Us](#).



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## 3. About the Charts








inCamera makes use of different types of color *charts* (sometimes called *targets*) to make a profile.

The industry standard IT8 chart and the HutchColor HCT chart are intended for use with film scanners. (Actually there are two IT8 charts for scanners: IT8.7/1 for transparency scanners and IT8.7/2 for reflective scanners. Since these two are very similar to each other, we will collectively refer to them as just IT8.) Do not use an IT8 chart to profile a digital camera — you will likely get color errors in even basic colors, like neutrals.

The ColorChecker chart (containing 24 patches) or the newer ColorChecker DC (containing 240 patches) and ColorChecker SG (containing 140 patches) charts are intended primarily for digital cameras, although they may also be used to profile scanners which will be used for scanning non-photographic originals.

**Note on scanning color negative film:** There are certain situations (for example, school portrait photography) where profiling can be brought to bear on an "untouchable" area of color management: color negative film. If you shoot a frame containing one of the ColorChecker charts, followed by your "normal" images, the processed film can be scanned by a color negative film scanner, producing positive RGB digital images. You may then build a "digital camera" profile from the image of the ColorChecker, and apply this profile to all other images shot at that same time.

Here is a table that summarizes the various recommended uses of the different chart types:

Chart	Digital Camera	Scanner
 ColorChecker	Yes	For scanning non-photographic originals or color negative films
 ColorChecker DC	Yes	For scanning non-photographic originals or color negative films
 ColorChecker SG	Yes	For scanning non-photographic originals or color negative films
 IT8	Not recommended	For scanning photographic positive originals
 HCT	Not recommended	For scanning photographic positive originals

For each chart, there is a *reference file* which contains colorimetric values for each of the chart's color patches.

The following pages will provide more detailed information about each of the chart types:

[ColorChecker Chart](#) 

[ColorChecker DC Chart](#) 

[ColorChecker SG Chart](#) 

[IT8 Chart](#) 

[HCT Chart](#) 



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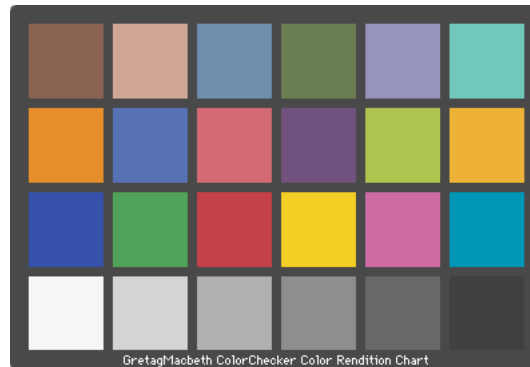
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### 3a. About the Charts: ColorChecker



#### Chart Description



The ColorChecker chart is made up of 24 color patches, arranged as four rows of six colors. The bottom row consists of six colors that are nominally neutral whose tones are approximately evenly distributed, visually speaking. Note that the "black" patch of the chart (lower right corner) is not really black, but rather, is a dark gray.

The third row from the top has some fairly saturated colors including primary colors (Blue, Green, Red) and secondary colors (Yellow, Magenta, Cyan).

The top row has a few "memory colors," such as skin tones, foliage and sky blue.

#### Reference File

GretagMacbeth (the manufacturer of the ColorChecker chart) does not include a reference file with this chart, and when inCamera was first released, there was not a universally accepted format for such a file. So lacking a standard, we chose to use the same format that GretagMacbeth was using for the data reference files that they shipped with the ColorChecker DC chart. Using this format, we created a reference file for a typical ColorChecker chart and have included it in the inCamera product installation. That file is named `ColorCheckerRefFile.txt`.

More recently, GretagMacbeth has made a spectral data reference file for the ColorChecker chart available. It is named `ColorChecker 24.txt`, and we have included it in the inCamera installation package as well. inCamera now supports these spectral data reference files, and it also supports the older reference files that contain XYZ and Lab data.

You should use one of the included files in all cases except those where you have both the means and desire to create a custom reference file yourself. If you use the spectral reference file (`ColorChecker 24.txt`), you will also be able to specify your [light source](#).

#### Power Users Only: Custom Data Reference Files

If you wish to make a custom reference file, it must be in the same file format as either `ColorCheckerRefFile.txt` or `ColorChecker 24.txt`. The contents of `ColorCheckerRefFile.txt` are shown here:

```
Date: 3/1/2001 Time: 09:53
LGOROWLENGTH 4
BEGIN_DATA_FORMAT
Sample_Name XYZ_X   XYZ_Y   XYZ_Z   Lab_L   Lab_a   Lab_b
END_DATA_FORMAT
BEGIN_DATA
A1   11.48   9.88   4.67   37.63   14.85   15.64
A2   39.11  30.25   4.12   61.87   34.51   60.58
A3    7.30   5.73  23.07  28.72   18.78  -53.73
A4   86.77  90.01  74.18  96.00    0.01    0.00
B1   39.66  35.93  19.88  66.47   16.39   17.68
B2   12.13  11.22  27.98  39.95    9.40  -43.06
B3   14.79  23.12   7.34  55.20  -39.20  33.44
B4   56.98  59.11  48.71  81.35    0.00    0.00
C1   17.02  18.60  25.88  50.22   -4.91  -21.76
C2   30.16  19.82  10.24  51.63   47.92  16.81
C3   22.04  12.40   3.70  41.84   56.41  28.65
C4   34.90  36.20  29.83  66.67    0.02    0.01
D1   10.79  13.30   5.37  43.21  -14.26  21.61
D2    8.59   6.59  10.93  30.85   21.37  -21.21
```



```

D3  59.45  59.69  7.70  81.67  4.61  77.64
D4  19.09  19.80  16.32  51.61  0.02  0.00
E1  24.60  23.40  33.67  55.48  9.04  -25.16
E2  35.14  43.91  8.73  72.17  -22.85  57.39
E3  30.63  19.70  22.50  51.50  50.26  -13.37
E4  8.68  9.00  7.42  35.98  0.04  -0.01
F1  30.82  41.85  34.83  70.77  -32.13  -0.49
F2  49.94  44.85  6.32  72.79  18.87  68.12
F3  13.04  18.38  29.81  49.95  -27.61  -28.80
F4  2.99  3.10  2.55  20.44  0.03  0.04
END_DATA

```

The patch measurements follow the BEGIN\_DATA line and are presented as seven items per row. The first is the identifier indicating the column (A through F) and the row (1 through 4). The next three items are numbers representing the XYZ values for the patch (relative to the CIE 2° standard observer and the CIE D50 reference illuminant). The last three items are the numbers representing the CIE Lab values for the color. For example, the ColorChecker "White" patch (lower left corner of the chart) has the identifier of A4 (first column, fourth row), XYZ value of (86.77, 90.01, 74.18) and Lab value of (96.00, 0.01, 0.00).

The contents of ColorChecker 24.txt are shown here:

```

LGOROWLENGTH 4
CREATED "2/5/2004" # Time: 18:16
INSTRUMENTATION "Unknown"
MEASUREMENT_SOURCE "Illumination=Unknown ObserverAngle=Unknown WhiteBase=Abs Filter=Unknown"
ILLUMINATION_NAME "D50"
OBSERVER_ANGLE "2"
KEYWORD "SampleID"
KEYWORD "SAMPLE_NAME"
NUMBER_OF_FIELDS 38
BEGIN_DATA_FORMAT
SampleID SAMPLE_NAME nm380 nm390 nm400 nm410 nm420 nm430 nm440 nm450 nm460 nm470 nm480 nm490 nm500 nm510 nm520
END_DATA_FORMAT
NUMBER_OF_SETS 24
BEGIN_DATA
1 A1 0.0479 0.0553 0.0610 0.0626 0.0619 0.0616 0.0614 0.0615 0.0618 0.0619 0.0618 0.0622 0.0638 0.0696 0.0767 0.0801 0.0801
2 A2 0.0520 0.0540 0.0530 0.0534 0.0529 0.0528 0.0532 0.0542 0.0557 0.0573 0.0597 0.0628 0.0683 0.0902 0.1268 0.1559 0.1559
3 A3 0.0511 0.0605 0.0779 0.1280 0.1986 0.2481 0.2830 0.3058 0.3006 0.2716 0.2291 0.1813 0.1349 0.0962 0.0710 0.0536 0.0479
4 A4 0.1267 0.2179 0.4164 0.6780 0.8397 0.8911 0.9035 0.9092 0.9154 0.9180 0.9194 0.9225 0.9209 0.9212 0.9242 0.9227 0.9227
5 B1 0.0962 0.1328 0.1706 0.1877 0.1903 0.1923 0.1971 0.2064 0.2245 0.2535 0.2922 0.3274 0.3473 0.3489 0.3224 0.2835 0.2619
6 B2 0.0988 0.1506 0.2227 0.2834 0.3316 0.3701 0.3999 0.4146 0.4075 0.3781 0.3280 0.2680 0.2112 0.1660 0.1366 0.1162 0.1010
7 B3 0.0531 0.0559 0.0566 0.0576 0.0575 0.0586 0.0606 0.0652 0.0745 0.0932 0.1270 0.1771 0.2424 0.3154 0.3470 0.3392 0.3320
8 B4 0.1166 0.1987 0.3599 0.5193 0.5784 0.5910 0.5960 0.5988 0.6002 0.5984 0.5965 0.5966 0.5947 0.5954 0.5987 0.5983 0.5983
9 C1 0.1053 0.1633 0.2518 0.3163 0.3325 0.3355 0.3349 0.3294 0.3199 0.3055 0.3294 0.3199 0.3055 0.2863 0.2737 0.2612 0.2378
10 C2 0.0865 0.1099 0.1303 0.1352 0.1332 0.1310 0.1294 0.1275 0.1244 0.1194 0.1136 0.1083 0.1027 0.0974 0.0936 0.0914 0.0909
11 C3 0.0478 0.0474 0.0470 0.0461 0.0459 0.0453 0.0449 0.0447 0.0445 0.0437 0.0427 0.0421 0.0417 0.0412 0.0412 0.0413 0.0413
12 C4 0.1074 0.1704 0.2705 0.3409 0.3601 0.3655 0.3698 0.3724 0.3733 0.3715 0.3692 0.3689 0.3673 0.3684 0.3711 0.3714 0.3714
13 D1 0.0477 0.0507 0.0527 0.0537 0.0544 0.0563 0.0584 0.0601 0.0611 0.0619 0.0634 0.0659 0.0721 0.0958 0.1386 0.1748 0.1810
14 D2 0.0854 0.1240 0.1696 0.1955 0.1970 0.1849 0.1651 0.1430 0.1213 0.1020 0.0868 0.0750 0.0655 0.0599 0.0567 0.0533 0.0505
15 D3 0.0476 0.0488 0.0496 0.0499 0.0496 0.0506 0.0526 0.0567 0.0652 0.0813 0.1110 0.1556 0.2211 0.3353 0.4692 0.5703 0.6200
16 D4 0.0912 0.1253 0.1599 0.1778 0.1820 0.1853 0.1886 0.1904 0.1903 0.1884 0.1869 0.1866 0.1856 0.1864 0.1883 0.1886 0.1886
17 E1 0.1092 0.1802 0.2996 0.3941 0.4244 0.4329 0.4357 0.4336 0.4247 0.4070 0.3817 0.3492 0.3113 0.2787 0.2532 0.2293 0.2120
18 E2 0.0556 0.0605 0.0646 0.0653 0.0661 0.0676 0.0708 0.0765 0.0867 0.1044 0.1344 0.1818 0.2574 0.3757 0.4837 0.5446 0.5619
19 E3 0.1112 0.1763 0.2824 0.3552 0.3693 0.3612 0.3407 0.3130 0.2832 0.2539 0.2230 0.1935 0.1700 0.1499 0.1288 0.1088 0.1010
20 E4 0.0657 0.0764 0.0858 0.0898 0.0911 0.0918 0.0929 0.0933 0.0927 0.0918 0.0910 0.0906 0.0898 0.0898 0.0905 0.0904 0.0904
21 F1 0.1095 0.1696 0.2524 0.3074 0.3279 0.3427 0.3592 0.3839 0.4231 0.4733 0.5243 0.5676 0.5908 0.5959 0.5870 0.5648 0.5340
22 F2 0.0544 0.0604 0.0627 0.0637 0.0638 0.0638 0.0646 0.0646 0.0655 0.0668 0.0680 0.0696 0.0725 0.0813 0.1221 0.2118 0.3215 0.4040
23 F3 0.0813 0.1282 0.1940 0.2456 0.2693 0.2921 0.3237 0.3611 0.4029 0.4439 0.4654 0.4621 0.4342 0.3895 0.3417 0.2903 0.2440
24 F4 0.0286 0.0290 0.0297 0.0305 0.0312 0.0310 0.0314 0.0315 0.0316 0.0315 0.0315 0.0313 0.0309 0.0310 0.0313 0.0313 0.0313
END_DATA

```

The patch measurements follow the BEGIN\_DATA line, one per line. Each line begins with the data line number, followed by an identifier indicating the column (A through F) and the row (1 through 4), which is followed by the spectral measurement data for the patch. Each measurement consists of 36 numbers, which represent the spectral responses from 380 through 730 nm at 10 nm intervals.

Your measuring instrument may have come with software that can create a file in one of these formats. If not, the easiest way to make a custom reference file that can be used with inCamera, is to copy the file that is included with inCamera, and then edit it with any text editor that can save plain (unformatted) text files.

You will notice that your ColorChecker chart comes with a printed data sheet containing color information about the chart. Please note that the chromaticity coordinates (x, y) for the colors are provided relative to the CIE standard C illuminant, while ICC profiles and Adobe Photoshop both use CIE standard D50 illuminant. This means you cannot use the printed values without first accounting for the reference illuminant difference. Furthermore, the data sheet also contains RGB values for the patches. These values are completely meaningless and should not be used for any purpose whatever.



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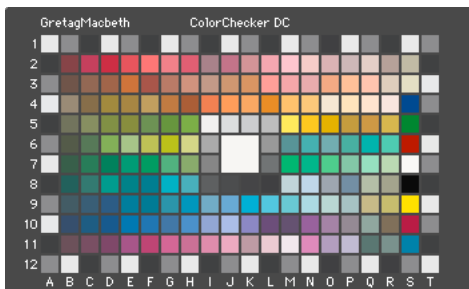
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### 3b. About the Charts: ColorChecker DC



#### Chart Description



The ColorChecker DC chart has a large white patch in the center, immediately surrounded by a set of various neutral gray patches. These are used for global color balance and tone reproduction purposes. The center patch is very helpful to the photographer in determining the proper exposure of the chart (a topic that will be discussed in the next chapter).

The patches around the outer edge of the chart allow you to judge the uniformity of illumination of the chart (a topic that is discussed further [here](#)). If you see that the lighting is not even across the chart, you are advised to correct this problem before proceeding to make the profile.

Colors S4 through S11 have a glossy surface finish, and because of that, they can represent more extreme colors which extend the "knowable" color range of the profile. However, many photographers feel that this gloss can pick up unwanted reflections, thereby polluting the color of the patch, resulting in an inferior profile. Other photographers are comfortable setting up the shot in such a way as to avoid these reflections. Since there is no consensus on this matter, inCamera may instructed to either include or exclude the glossy colors when the profile is made.

#### Reference File

ColorChecker DC charts are available in two forms: batch measured and custom measured. In either case, a reference file for the chart is provided with the chart. Use this file with inCamera. Your reference file may or may not contain spectral data. Older reference files did not, but GretagMacbeth (the manufacturer of the ColorChecker DC chart) has recently made spectral reference files available. inCamera will work with either kind of reference file, but you can specify your [light source](#) only when using spectral reference files. The inCamera installation package includes a spectral reference file from GretagMacbeth named `ColorChecker DC.txt`.

#### Power Users Only: Custom Data Reference Files

If you wish to make a custom reference file, it must be in one of the two following formats.

The beginning and ending of `ColorChecker DC.txt` (an example of the spectral format) is shown here:

```

LGOROWLENGTH 12
CREATED "12/15/2003" # Time: 15:08
INSTRUMENTATION "SpectroScanT"
MEASUREMENT_SOURCE "Illumination=D50 ObserverAngle=2° WhiteBase=Abs Filter=No"
ILLUMINATION_NAME "D50"
OBSERVER_ANGLE "2"
KEYWORD "SampleID"
KEYWORD "SAMPLE_NAME"
NUMBER_OF_FIELDS 38
BEGIN_DATA_FORMAT
SampleID SAMPLE_NAME nm380 nm390 nm400 nm410 nm420 nm430 nm440 nm450 nm460 nm470 nm480 nm490 nm500 nm510 nm520
END_DATA_FORMAT
NUMBER_OF_SETS 240
BEGIN_DATA
1 A1 0.1406 0.1994 0.3760 0.6298 0.7718 0.8014 0.8049 0.8056 0.8058 0.8039 0.8021 0.8011 0.7984 0.7961 0.7957 0.7937 0.7920
2 A2 0.0312 0.0347 0.0339 0.0344 0.0343 0.0342 0.0344 0.0340 0.0335 0.0334 0.0330 0.0329 0.0325 0.0322 0.0321 0.0317 0.0313
3 A3 0.0903 0.1232 0.1674 0.1900 0.1937 0.1984 0.2021 0.2036 0.2036 0.2016 0.2005 0.2000 0.1994 0.1998 0.2005 0.2006 0.2006
4 A4 0.1383 0.2016 0.3787 0.6342 0.7773 0.8066 0.8101 0.8111 0.8105 0.8088 0.8067 0.8056 0.8028 0.8005 0.8001 0.7982 0.7979
5 A5 0.0313 0.0342 0.0340 0.0342 0.0342 0.0341 0.0342 0.0339 0.0335 0.0336 0.0331 0.0329 0.0326 0.0323 0.0321 0.0319 0.0319
6 A6 0.0898 0.1256 0.1694 0.1908 0.1958 0.1996 0.2034 0.2050 0.2047 0.2031 0.2017 0.2012 0.2008 0.2009 0.2015 0.2016 0.2016
7 A7 0.1428 0.2073 0.3863 0.6390 0.7783 0.8072 0.8105 0.8121 0.8114 0.8100 0.8081 0.8071 0.8041 0.8021 0.8015 0.7999 0.7999
8 A8 0.0312 0.0338 0.0342 0.0347 0.0346 0.0347 0.0344 0.0343 0.0341 0.0337 0.0335 0.0333 0.0329 0.0327 0.0325 0.0322 0.0322
9 A9 0.0879 0.1256 0.1684 0.1901 0.1957 0.1994 0.2030 0.2055 0.2047 0.2032 0.2020 0.2014 0.2012 0.2013 0.2021 0.2024 0.2024
10 A10 0.1354 0.1959 0.3716 0.6268 0.7736 0.8048 0.8090 0.8100 0.8096 0.8078 0.8062 0.8049 0.8022 0.7999 0.7993 0.7976 0.7976
    
```

```

11    A11    0.0353  0.0320  0.0347  0.0343  0.0341  0.0344  0.0342  0.0339  0.0335  0.0335  0.0331  0.0331  0.0325  0.0323  0.0323  0.0320  0.03
12    A12    0.0901  0.1242  0.1667  0.1886  0.1940  0.1974  0.2014  0.2031  0.2025  0.2013  0.2000  0.1994  0.1991  0.1991  0.1999  0.2000  0.20
13    B1     0.0898  0.1243  0.1665  0.1889  0.1937  0.1978  0.2015  0.2037  0.2030  0.2016  0.2005  0.1999  0.1997  0.1999  0.2006  0.2009  0.20
14    B2     0.0479  0.0472  0.0461  0.0449  0.0443  0.0440  0.0434  0.0431  0.0422  0.0414  0.0407  0.0401  0.0396  0.0394  0.0394  0.0396  0.04
...
227   S11    0.0462  0.0722  0.1166  0.1527  0.1681  0.1895  0.2217  0.2611  0.3035  0.3575  0.3910  0.3916  0.3599  0.3069  0.2448  0.1849  0.13
228   S12    0.0887  0.1230  0.1669  0.1891  0.1944  0.1987  0.2021  0.2040  0.2033  0.2021  0.2009  0.2000  0.1999  0.2000  0.2008  0.2009  0.20
229   T1     0.0915  0.1247  0.1685  0.1901  0.1951  0.1993  0.2031  0.2051  0.2046  0.2029  0.2017  0.2010  0.2008  0.2010  0.2017  0.2018  0.20
230   T2     0.0341  0.0342  0.0349  0.0354  0.0353  0.0353  0.0351  0.0350  0.0346  0.0344  0.0342  0.0338  0.0337  0.0333  0.0332  0.0330  0.03
231   T3     0.1387  0.1983  0.3765  0.6319  0.7749  0.8055  0.8086  0.8093  0.8091  0.8073  0.8054  0.8045  0.8018  0.7996  0.7993  0.7975  0.79
232   T4     0.0874  0.1217  0.1663  0.1883  0.1932  0.1974  0.2009  0.2031  0.2026  0.2011  0.1998  0.1992  0.1991  0.1991  0.2000  0.2000  0.20
233   T5     0.0316  0.0324  0.0337  0.0339  0.0333  0.0339  0.0336  0.0334  0.0333  0.0331  0.0330  0.0325  0.0323  0.0320  0.0319  0.0316  0.03
234   T6     0.1401  0.1988  0.3761  0.6303  0.7736  0.8040  0.8074  0.8085  0.8079  0.8065  0.8046  0.8039  0.8011  0.7986  0.7981  0.7964  0.79
235   T7     0.0888  0.1224  0.1669  0.1883  0.1936  0.1978  0.2014  0.2035  0.2029  0.2016  0.2002  0.1997  0.1994  0.1997  0.2004  0.2007  0.20
236   T8     0.0310  0.0334  0.0334  0.0333  0.0331  0.0332  0.0331  0.0328  0.0326  0.0326  0.0324  0.0319  0.0318  0.0315  0.0313  0.0311  0.03
237   T9     0.1352  0.1973  0.3741  0.6292  0.7720  0.8021  0.8057  0.8065  0.8068  0.8054  0.8034  0.8030  0.8004  0.7983  0.7980  0.7963  0.79
238   T10    0.0890  0.1239  0.1684  0.1894  0.1949  0.1991  0.2026  0.2046  0.2038  0.2027  0.2014  0.2009  0.2006  0.2008  0.2015  0.2017  0.20
239   T11    0.0312  0.0325  0.0339  0.0338  0.0341  0.0342  0.0342  0.0341  0.0338  0.0336  0.0333  0.0328  0.0327  0.0323  0.0322  0.0320  0.03
240   T12    0.1389  0.1988  0.3755  0.6293  0.7715  0.8018  0.8054  0.8059  0.8059  0.8042  0.8025  0.8017  0.7988  0.7967  0.7964  0.7947  0.79
END_DATA

```

The patch measurements follow the `BEGIN_DATA` line, one per line. Each line begins with the data line number, followed by an identifier indicating the column (A through T) and the row (1 through 12), which is followed by the spectral measurement data for the patch. Each measurement consists of 36 numbers, which represent the spectral responses from 380 through 730 nm at 10 nm intervals.

The beginning and ending of a reference file in the non-spectral format is shown here:

```

Date: 3/27/2000 Time: 19:04
LGOROWLENGTH 12
BEGIN_DATA_FORMAT
Sample_Name XYZ_X XYZ_Y XYZ_Z Lab_L Lab_a Lab_b
END_DATA_FORMAT
BEGIN_DATA
A1 74.79 77.56 64.46 90.58 0.01 -0.46
A2 3.08 3.19 2.77 20.8 0.05 -1.05
A3 18.98 19.71 16.53 51.51 -0.15 -0.64
A4 74.57 77.34 64.38 90.48 -0.01 -0.55
A5 3.1 3.21 2.78 20.87 0.03 -1.07
A6 18.88 19.62 16.44 51.4 -0.15 -0.62
A7 74.65 77.43 64.37 90.52 -0.03 -0.47
A8 3.05 3.16 2.74 20.69 0.03 -1.06
A9 18.86 19.59 16.42 51.37 -0.15 -0.63
A10 74.33 77.13 64.18 90.38 -0.07 -0.53
A11 3.05 3.16 2.74 20.68 0.06 -1.07
A12 18.94 19.67 16.48 51.46 -0.14 -0.6
B1 18.98 19.71 16.53 51.51 -0.15 -0.63
B2 9.28 6.32 3.27 30.2 29.98 11.49
...
S10 17.03 7.57 3.05 33.07 69 17.97
S11 6.56 11.29 24.29 40.07 -37.61 -36.38
S12 18.91 19.64 16.46 51.43 -0.15 -0.61
T1 18.91 19.64 16.46 51.43 -0.15 -0.62
T2 3.05 3.16 2.73 20.67 0.06 -1.02
T3 74.38 77.15 64.2 90.39 -0.01 -0.54
T4 18.94 19.68 16.48 51.47 -0.15 -0.6
T5 3.12 3.24 2.79 20.97 0.02 -0.96
T6 74.2 76.97 63.98 90.31 -0.03 -0.46
T7 18.87 19.61 16.43 51.39 -0.16 -0.62
T8 3.04 3.16 2.73 20.66 0.02 -1.04
T9 74.41 77.19 64.05 90.41 -0.03 -0.36
T10 18.9 19.63 16.46 51.42 -0.15 -0.62
T11 3.09 3.2 2.78 20.82 0.05 -1.1
T12 74.57 77.32 64.19 90.47 0.03 -0.39
END_DATA

```

The patch measurements follow the `BEGIN_DATA` line and are presented as seven items per line. The first is the identifier indicating the column (A through F) and the row (1 through 4). The next three items are numbers representing the XYZ values for the patch (relative to the CIE 2° standard observer and the CIE D50 reference illuminant). The last three items are the numbers representing the CIE Lab values for the color.

Your measuring instrument may have come with software that can create a file in one of these formats. If not, the easiest way to make a custom reference file that can be used with inCamera, is to copy the file that is included with inCamera, and then edit it with any text editor that can save plain (unformatted) text files.



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### 3c. About the Charts: ColorChecker SG



#### Chart Description



The ColorChecker SG (Semi Gloss) chart was designed specifically for digital photography. It is made up of 140 color patches, including the 24 colors from the original ColorChecker chart.

The patches around the outer edge of the chart allow you to judge the uniformity of illumination of the chart (a topic that is discussed further [here](#)). If you see that the lighting is not even across the chart, you are advised to correct this problem before proceeding to make the profile.

#### Reference File

GretagMacbeth (the manufacturer of the ColorChecker SG chart) does not include a reference file with the chart, but they do provide one which is included in the inCamera installation package. That file is named `Digital ColorChecker SG.txt`.

You should use that reference file, unless you have both the means and desire to create a custom reference file yourself.

#### Power Users Only: Custom Data Reference Files

If you wish to make a custom reference file, it must be in the following format.

The beginning and ending of `Digital ColorChecker SG.txt` is shown here:

```

LGOROWLENGTH      10
CREATED "3/24/2004" # Time: 20:14
INSTRUMENTATION  "eye-one"
MEASUREMENT_SOURCE  "WhiteBase=Absolute Filter=No"
ILLUMINATION_NAME  "D50"
OBSERVER_ANGLE    "2"
KEYWORD "SampleID"
KEYWORD "SAMPLE_NAME"
NUMBER_OF_FIELDS  41
BEGIN_DATA_FORMAT
SampleID          SAMPLE_NAME      RGB_R    RGB_G    RGB_B    nm380    nm390    nm400    nm410    nm420    nm430    nm440    nm450    nm460    nm470    nm480    nm490
END_DATA_FORMAT
NUMBER_OF_SETS    140
BEGIN_DATA
1      A1      242.81  244.08  241.52  0.1365  0.2349  0.4385  0.6837  0.8452  0.9077  0.9231  0.9273  0.9322  0.9335  0.9337  0.9350  0.9345  0.9345
2      A2      25.95   26.52   26.99   0.0088  0.0083  0.0086  0.0085  0.0085  0.0084  0.0086  0.0084  0.0084  0.0085  0.0085  0.0085  0.0084  0.0084
3      A3      110.21  110.29  109.97  0.0658  0.1060  0.1522  0.1777  0.1851  0.1885  0.1918  0.1935  0.1938  0.1925  0.1915  0.1912  0.1910  0.1910
4      A4      242.53  244.27  241.88  0.1415  0.2396  0.4435  0.6895  0.8521  0.9147  0.9298  0.9340  0.9384  0.9397  0.9396  0.9407  0.9400  0.9399
5      A5      24.73   25.51   26.40   0.0089  0.0089  0.0089  0.0090  0.0089  0.0089  0.0088  0.0089  0.0090  0.0089  0.0088  0.0089  0.0088  0.0088
6      A6      110.61  110.76  110.51  0.0660  0.1066  0.1532  0.1784  0.1860  0.1895  0.1926  0.1943  0.1945  0.1931  0.1921  0.1918  0.1915  0.1915
7      A7      243.04  244.49  241.86  0.1423  0.2401  0.4435  0.6883  0.8499  0.9121  0.9274  0.9317  0.9364  0.9380  0.9384  0.9394  0.9388  0.9388
8      A8      26.01   26.57   27.21   0.0093  0.0097  0.0092  0.0091  0.0092  0.0090  0.0089  0.0090  0.0091  0.0090  0.0089  0.0089  0.0089  0.0089
9      A9      110.54  110.61  110.33  0.0663  0.1056  0.1512  0.1759  0.1831  0.1865  0.1896  0.1911  0.1913  0.1902  0.1891  0.1888  0.1887  0.1887
10     A10     243.16  244.24  241.41  0.1415  0.2399  0.4433  0.6890  0.8516  0.9141  0.9293  0.9335  0.9382  0.9397  0.9399  0.9414  0.9409  0.9409
11     B1      110.29  110.49  110.26  0.0650  0.1055  0.1507  0.1758  0.1829  0.1860  0.1891  0.1905  0.1908  0.1895  0.1885  0.1880  0.1877  0.1877
12     B2      134.54  19.42   86.41   0.0627  0.0963  0.1412  0.1637  0.1669  0.1574  0.1391  0.1183  0.0990  0.0827  0.0673  0.0541  0.0451  0.0399
13     B3      167.60  121.04  172.35  0.0915  0.1731  0.3193  0.4417  0.4867  0.4917  0.4822  0.4655  0.4455  0.4216  0.3916  0.3584  0.3286  0.3000

```

```

...
128 M8 188.60 173.10 -2.27 0.0143 0.0143 0.0141 0.0140 0.0143 0.0152 0.0173 0.0214 0.0296 0.0449 0.0693 0.1019 0.1471 0.22
129 M9 70.32 36.09 24.98 0.0094 0.0106 0.0109 0.0110 0.0109 0.0108 0.0109 0.0109 0.0109 0.0112 0.0115 0.0119 0.0123 0.01
130 M10 110.68 110.74 110.35 0.0652 0.1051 0.1516 0.1772 0.1841 0.1875 0.1905 0.1921 0.1925 0.1913 0.1901 0.1897 0.1895 0.19
131 N1 242.47 243.85 241.14 0.1372 0.2361 0.4404 0.6859 0.8478 0.9099 0.9254 0.9296 0.9339 0.9353 0.9355 0.9367 0.9359 0.93
132 N2 110.63 110.82 110.59 0.0667 0.1063 0.1522 0.1770 0.1843 0.1875 0.1906 0.1922 0.1925 0.1914 0.1903 0.1899 0.1898 0.19
133 N3 24.47 24.76 25.40 0.0101 0.0102 0.0101 0.0102 0.0101 0.0099 0.0098 0.0099 0.0098 0.0097 0.0097 0.0097 0.0095 0.00
134 N4 243.10 244.83 242.39 0.1406 0.2391 0.4430 0.6889 0.8508 0.9129 0.9280 0.9320 0.9365 0.9380 0.9379 0.9390 0.9383 0.93
135 N5 110.60 110.83 110.56 0.0655 0.1052 0.1509 0.1759 0.1832 0.1866 0.1897 0.1912 0.1915 0.1903 0.1893 0.1887 0.1886 0.18
136 N6 24.99 25.62 26.18 0.0098 0.0099 0.0099 0.0101 0.0100 0.0097 0.0099 0.0099 0.0099 0.0099 0.0098 0.0097 0.0097 0.00
137 N7 243.42 245.01 242.48 0.1432 0.2408 0.4445 0.6896 0.8506 0.9126 0.9275 0.9320 0.9364 0.9381 0.9383 0.9397 0.9392 0.93
138 N8 110.67 110.79 110.54 0.0652 0.1050 0.1512 0.1766 0.1839 0.1871 0.1903 0.1918 0.1920 0.1910 0.1898 0.1894 0.1893 0.18
139 N9 24.05 24.48 25.05 0.0100 0.0100 0.0096 0.0092 0.0091 0.0091 0.0092 0.0091 0.0092 0.0091 0.0090 0.0089 0.0089 0.00
140 N10 243.17 244.71 242.06 0.1427 0.2403 0.4441 0.6904 0.8530 0.9151 0.9301 0.9343 0.9385 0.9399 0.9400 0.9414 0.9407 0.94
END_DATA

```

The patch measurements follow the `BEGIN_DATA` line, one per line. Each line begins with the data line number, followed by an identifier indicating the column (A through N) and the row (1 through 10), which is followed by the spectral measurement data for the patch. Each measurement consists of 36 numbers, which represent the spectral responses from 380 through 730 nm at 10 nm intervals.

Your measuring instrument may have come with software that can create a file in this format. If not, the easiest way to make a custom reference file that can be used with inCamera, is to copy the file that is included with inCamera, and then edit it with any text editor that can save plain (unformatted) text files.



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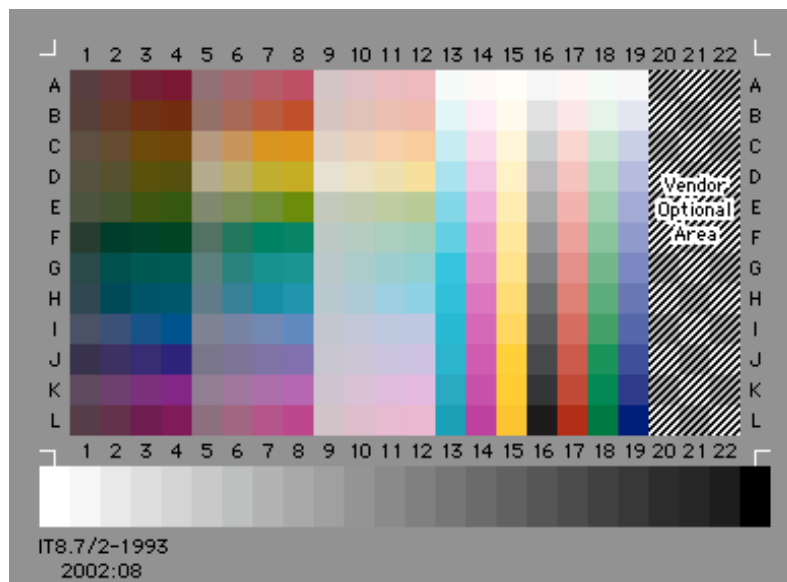
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## 3d. About the Charts: IT8



### Chart Description



IT8 charts are made by the major film manufacturers (e.g. Kodak, Agfa, Fuji). They are generally available on each of the manufacturers' main film families, both transparency and print. IT8 charts are not available for color negative film.

The IT8 chart has between 252 and 288 color patches, arranged in twelve rows (A through L) and 22 columns (1 through 22), along with a nominally neutral scale across the bottom.

The three columns at the far right (patches A20 through L22) represent the *Vendor Optional Area*, which the chart manufacturer is free to use in any manner it wishes. This area is typically used for additional color patches, a photograph, or a combination of the two.

In the very bottom left of the chart you will find a date code in YYYY:MM format. This gives the year and month that the chart was manufactured and is used to identify the proper reference file for the particular chart.

### Reference File

Reference files for the IT8 are provided by the chart manufacturer, either on disk with the chart, or online at some central repository.

## Kodak Reference Files

Reference files for Kodak IT8 charts may be found on Kodak's FTP site at <ftp://ftp.kodak.com/gastds/Q60DATA/>. (Note that logging onto this site is sometimes slow, so be patient.) At this site, you will find reference files in different folders, according to the chart media type:

Folder Name	Media Type
E1-Data	4 × 5 inch Ektachrome Transparency
E3-Data	35mm Ektachrome Transparency
K3-Data	35mm Kodachrome Transparency
R1-Data	5 × 7 inch Ektacolor Print

Select the folder corresponding to the media type of your IT8 chart. In that folder you will find every reference file ever made for Kodak targets. How do you find the one you need? That is where the manufacturing date is used (found in the lower left corner of the physical chart). Kodak has a file naming convention where the first two characters correspond to the media type (E1, E3, K3 or R1 as shown in the above table) followed by the four-digit year and two-digit month manufacturing code. Kodak reference files always have a ".Q60" file name extension.

Let's use the chart at the top of this page as an example. It is a 5 × 7 inch Ektacolor chart (i.e. a photographic print). Therefore, its media type code is R1. Its manufacturing date is 2002:08. So the reference file we are looking for will be found in directory R1-Data and will have the file name R1200208.Q60.

## Reference Files From Other Manufacturers

Unfortunately, other film manufacturers have not organized their reference files as nicely as Kodak has. If you do not have the reference file for your chart, you should contact the source from which it was purchased and hopefully they can help you locate the file.



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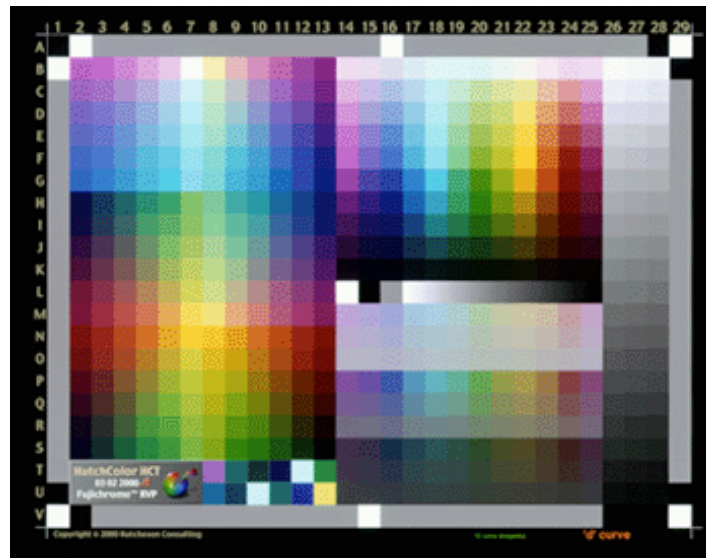
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## 3e. About the Charts: HCT

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### Chart Description



The HutchColor HCT is a target from Hutcheson Consulting, available in a number of formats for both transparency and print. It contains over 500 discrete color patches arranged in 22 rows (A through V) and 29 columns (1 through 29), including a 63-step gray scale. More information about the HCT is available at [http://www.hutchcolor.com/HCT\\_overview.htm](http://www.hutchcolor.com/HCT_overview.htm).

---

### Reference File

Reference files may be found on the CD that is included with the target, and are also available online at [http://www.hutchcolor.com/HCT\\_data.htm](http://www.hutchcolor.com/HCT_data.htm).

Each HCT is identified by a 4-digit serial number, either printed on a sticker, scratched in the film border, or printed on the frame (35mm). In the case of 35mm targets, which are produced in small batches, you should use the reference file whose two code numbers define a range that includes your serial number. For example, if you have 35mm target number 6195, you should use reference file number '6190-6219'. The other targets are all individually measured, so there is one unique reference file for your particular target. You must use the reference file with exactly the same number as your target.



If you are unable to find your reference file on the CD, your target was measured after the CD was produced. All reference files are available [online](#).



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## 4. Capturing the Chart

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Creating a profile begins with capturing a digital image of the test chart. Since this capture will eventually result in a profile which describes the raw behavior of the device, it is important that no other profile be part of this capture. Therefore, you must disable any ICC profile that may affect the color behavior of the device. Otherwise, you will be profiling on top of another profile — a recipe for failure.

Most capture programs (which control digital cameras and scanners) have many controls that affect the digitized image. This is especially true on higher-end devices. These controls may be called such things as gamma, brightness, contrast or curves. In theory, a profile can handle any settings you choose (as long as you are consistent), but what you may not realize is that some settings might provide better "raw material" for profile building and production image capture than others. How do you determine what settings might be best? That is what you will learn in the following pages:

[ColorChecker Chart](#) 

[ColorChecker DC Chart](#) 

[ColorChecker SG Chart](#) 

[IT8 Chart](#) 

[HCT Chart](#) 



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## 4a. Capturing the Chart: ColorChecker

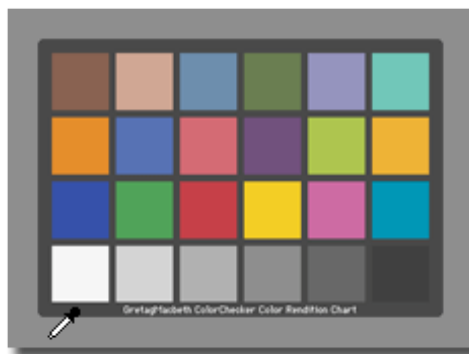


In conventional, film based photography, exposure is often determined by using an 18% gray card, from which a light meter measures an "average" brightness of the scene. If there are any very bright objects in the scene, their detail is compressed (but usually still retained) due to the gentle roll-off of film's characteristic curve. (A card that reflects 18% of the incident light provides a shade of gray that appears to the eye to be halfway between pure white and pure black — a phenomenon caused by the nonlinear response of the human visual system.)

Digital photography is different. The solid state sensors in the camera produce progressively more output as the amount of light increases, right up to the point that they reach their limit, where they abruptly "hit the wall" or saturate. There is no gentle roll-off as is seen with film. Therefore, proper exposure for digital photography is usually determined by looking at white instead of gray.

When photographing the ColorChecker chart, here is a checklist of things to consider:

1. Make sure that the chart is evenly illuminated. A good way to do this is to fasten the ColorChecker chart onto the center of a gray card which is a couple inches larger than the chart. This produces an even gray "frame" around the outer edge of the chart.



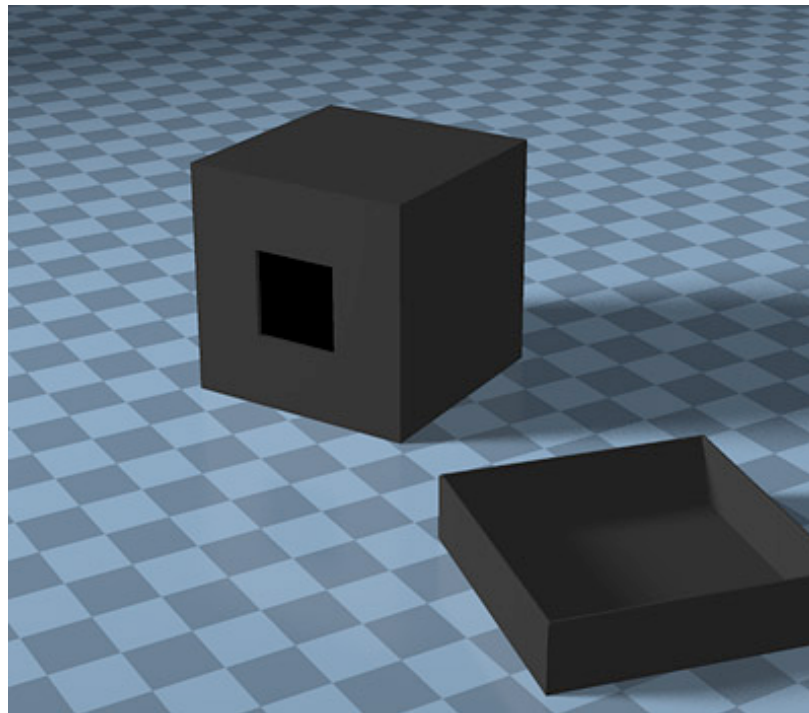
The RGB values of this frame should be fairly consistent as you examine them at various locations on the frame. If the illumination is uneven, adjust your lighting before proceeding to make the profile.

2. Adjust the exposure and balance so that the ColorChecker "White" patch has an RGB value of about 243. Be absolutely certain that its value is less than 255!
3. If your camera control software has curves or other controls, adjust them to strive for these "ideal" values for the neutral patches:



It is not critical that these exact values be achieved, the point is to use them as a guide. If you are capturing more than 8-bits per channel, you do not need to strive for the above values — just capture the raw data.

- Note that the ColorChecker "Black" patch is not black at all, but only a dark gray. A **very common mistake** is assuming this patch to be black and shooting the chart so that its RGB values are close to zero. Don't do that!
- Include a light trap in the scene, if possible. A light trap is a small, closed box which is painted flat black inside and out, having a square hole cut into the center of one of the box faces. A good size is a cube measuring about four inches on a side with the hole measuring about one and one-half inches. The idea is that any light entering the hole will be trapped inside the box and not escape. So in a photograph of the light trap, the RGB value for the hole should be close to zero. The use of a light trap will also underscore the significant difference between a real black (the light trap) and the ColorChecker "Black." Here is a picture of a light trap (with its cover removed):



If you want to go to the extra trouble, line the inside of the box with [light absorbing blackout material](#), and make a cover for the hole for when the box is not in use.

- When capturing your real pictures under these same lighting conditions, you may need to adjust the camera exposure slightly on an image-by-image basis so that the brightest white object in the scene does not saturate. The adjustment should be in exposure only, that is, nothing affecting the color balance.



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make whatever adjustments might be necessary to eliminate unwanted reflections in these patches, as seen from the camera's vantage point.

5. Note that patch L8 is not black, but rather is a dark gray. A very common mistake is assuming this patch to be black and shooting the chart so that its RGB values are close to zero.
6. Include a light trap in the scene, if possible. The RGB value for the hole in the light trap should be close to zero. (Light traps are discussed on the [previous page](#) of this User Guide.)
7. When capturing your real pictures under these same lighting conditions, you may need to adjust the camera exposure slightly on an image-by-image basis so that the brightest white object in the scene does not saturate. The adjustment should be in exposure only, that is, nothing affecting the color balance.



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## 4c. Capturing the Chart: ColorChecker SG



If you haven't already done so, be sure to read the previous page on [capturing the ColorChecker chart](#) because much of the information presented there is also relevant for the ColorChecker SG chart.

When photographing the ColorChecker SG chart, here is a checklist of things to consider:

1. Make sure that the chart is evenly illuminated. Use the patches found around the outer edge of the chart to do this. inCamera's [Check Capture](#) feature can assist you with this. If the illumination is uneven, adjust your lighting before proceeding to make the profile.
2. Adjust the exposure and balance so that patch E5 has an RGB value of about 243. Be absolutely certain that its value is less than 255!
3. Note that patches J5 and E6 are not black, but rather dark grays. A very common mistake is shooting the chart so that the RGB values of these dark patches are close to zero. Instead, if your camera control software has curves or other controls, try to adjust them so that patch J5 has an RGB value of about 38 and E6 has an RGB value of about 23.



It is not critical that these exact values be achieved, the point is to use them as a guide. The most important thing is to avoid any values that "hit the wall" in any of the color channels. In other words, you should not have pixels in the chart whose R, G or B values are either 0 or 255.

4. Include a light trap in the scene, if possible. The RGB value for the hole in the light trap should be close to zero. (Light traps are discussed [here](#).)
5. When capturing your real pictures under these same lighting conditions, you may need to adjust the camera exposure slightly on an image-by-image basis so that the brightest white object in the scene does not



saturate. The adjustment should be in exposure only, that is, nothing affecting the color balance.



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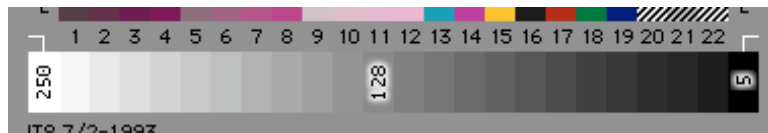
## 4d. Capturing the Chart: IT8

---



When scanning the IT8 chart, here is a checklist of things to consider:

1. Adjust the white point of the scanner so that the white patch has an RGB value of about 250. Be absolutely certain that its value is less than 255!
2. If your scanner control software has curves or other controls, adjust them to strive for these "ideal" values for the grayscale patches:



It is not critical that these exact values be achieved, the point is to use them as a guide. If you are capturing more than 8-bits per channel, you do not need to strive for the above values — just capture the raw data.

3. No matter how you adjust the scanner, make sure that there is a difference in RGB values between neighboring patches on the grayscale. This is more important than achieving the ideal target values shown above.
4. When scanning your real pictures under these same scanning conditions, you may wish to adjust the scanner white point slightly on an image-by-image basis so that the brightest white object in the image does not saturate.



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## 4e. Capturing the Chart: HCT

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When scanning the HCT chart, here is a checklist of things to consider:

1. Adjust the white point of the scanner so that the whitest patch in the chart has an RGB value of about 250. Be absolutely certain that its value is less than 255!
2. If your scanner control software has curves or other controls, make sure that there is a difference in RGB values between neighboring patches on the grayscale.
3. When scanning your real pictures under these same scanning conditions, you may wish to adjust the scanner white point slightly on an image-by-image basis so that the brightest white object in the image does not saturate.
4. The CD that is included with the HCT target contains additional advice on how to set up your scanner to get the best possible results with the target.



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## 5. Creating the Profile

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Once your chart has been properly captured with your scanner or digital camera, you are ready to use inCamera to create the profile. This process involves several steps, as described in this chapter.

- [Opening the Image](#) This describes how the chart image must be opened in Photoshop in preparation for making a profile.
- [Selecting the Chart](#) This describes how to select the proper chart type and its reference file.
- [Adjusting the Grid](#) This describes how to position the overlay grid.
- [Checking the Chart image](#) This describes a way to check how the quality of your chart image may affect the quality of the resulting profile.



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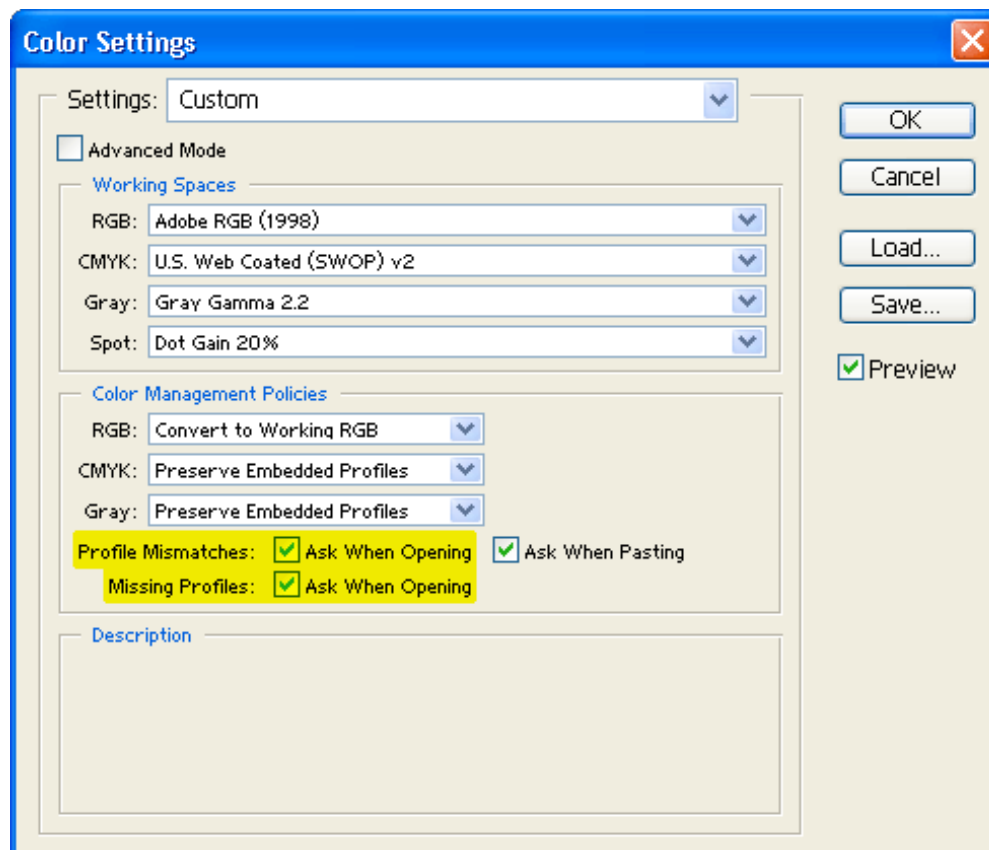
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## 5a. Creating the Profile: Opening the Chart Image



It is very important that your chart image is opened properly in Photoshop, making sure that no color conversion is performed on the pixels of the image. We recommend that you set Photoshop's *Color Settings* dialog as shown here:



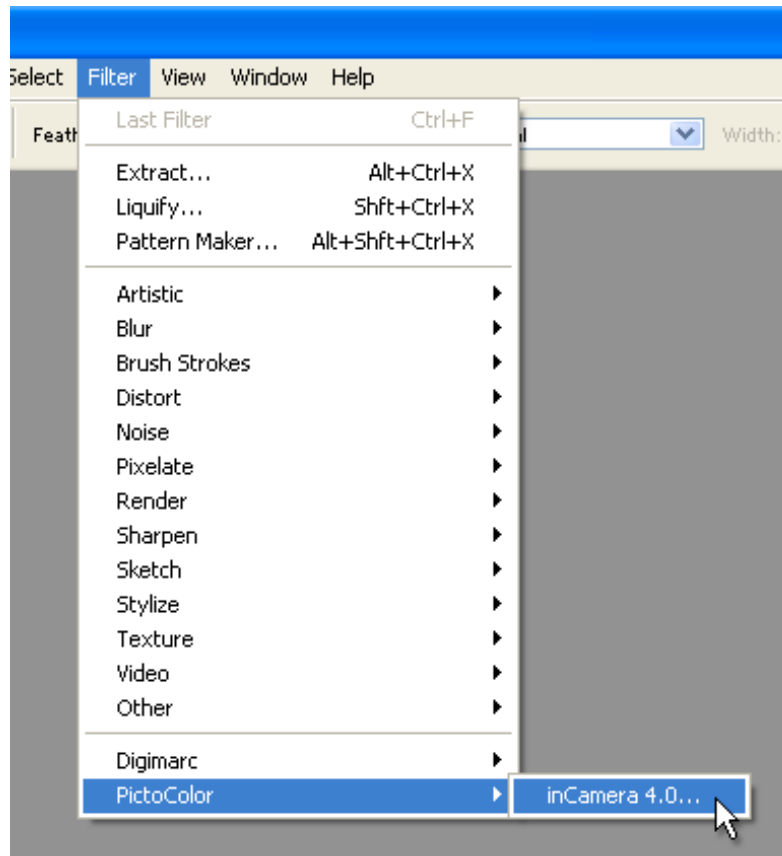
The rationale behind these recommendations will be discussed later in this User Guide. The primary settings that concern us at the moment are the *Profile Mismatches* and *Missing Profiles* items (highlighted in yellow). By checking these checkboxes, you will give yourself the chance to prevent any color conversions when the file is opened — a critically important issue.

When opening the image of your chart, you may or may not be presented with a dialog box, depending on the nature of the image file. Here are the proper responses to any dialogs you may see:

Dialog Type	Proper Selection
Embedded Profile Mismatch	Discard the embedded profile (don't color manage)
Missing Profile	Leave as is (don't color manage)

These responses will guarantee that the pixel values will not be changed in the process of opening the image.

Now you should select the inCamera plug-in from Photoshop's *Filters* menu:



## A Side Note About RAW workflows

If you are working with RAW images from your digital camera, they must be converted to RGB before they can be used with inCamera. Photoshop CS can open RAW image files from many digital cameras. You may also use other conversion programs to convert your RAW files into full color RGB files that Photoshop can open directly. The software that came with your camera should do a good job of this.

inCamera will work with converted RAW files, as long as the conversion process is always held constant (i.e. any parameters that control the conversion are fixed). Make note of the settings that you use to convert the chart image that you use to make a profile, and be sure to use the same settings to convert subsequent images that the profile will be used on.

The following guidelines may help you set some of the possible conversion parameters. If you configure your converter to output linear settings (i.e. the RGB values are linear with respect to intensity, or gamma = 1.0), then

make sure you output a high-bit image (16-bits per channel). If you configure your converter to produce non-linear settings (e.g. gamma = 2.2), then an 8-bit per channel image is probably sufficient. Make sure the output RGB image does not "hit the wall" in any of the color channels. In other words, you should not have many pixels whose R, G or B values are either 0 or 255. If you have a problem with this, you may be able to specify a different destination profile. For example, sRGB is a smaller working space than Adobe RGB, and so the opportunity for clipping is greater. Adobe RGB (1998) is usually a good choice, since it is larger than sRGB, but not gigantic.



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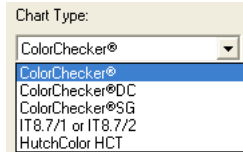
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## 5b. Creating the Profile: Selecting the Chart



### Chart Type

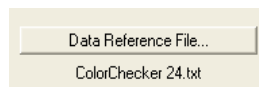
Once inCamera's dialog opens, the first thing you should do is select the proper chart type from the pop-up menu:



These five chart types have already been discussed in some detail, so it shouldn't be too difficult to figure out which one to select.

### Data Reference File

Next, select the proper reference file for your chart:

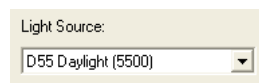


If you are using the standard ColorChecker chart, you do not need to select a reference file, because inCamera has a reference file for that chart "built in." (The built in file does not contain spectral data though, so if you want to specify your light source, you will have to choose a spectral reference file.) The other chart types will require you to locate the proper file. Reference files for each chart type are described in greater detail earlier in this User Guide.

If the file you select is the wrong type or is not the proper format, you will see a Read Error or a Data Format Error message.

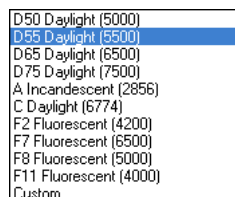
### Light Source

If you are using one of the ColorChecker charts and you have selected a spectral data reference file, you can optimize your profile for your light source. You should select the illuminant that best represents the lighting in your image using the *Light Source* pop-up menu:



The CIE (*Commission Internationale d'Eclairage*) has specified a number of standard illuminants. The D illuminants represent daylight at various color temperatures and are based on actual measurements of daylight. Illuminant A represents incandescent light. Illuminant C is a simulation of average daylight. The F illuminants represent various types of fluorescent illumination. F2 represents a cool white fluorescent lamp, F7 and F8 are broad band (continuous-spectrum) daylight fluorescent lamps, and F11 is a narrow band (line-spectrum) white fluorescent lamp, such as TL84.

Several standard illuminants are built into inCamera, listed with their approximate correlated color temperatures. The lower the color temperature of the light source, the redder the light source and the higher the color temperature, the bluer the light source.



If you choose *Custom...* from the *Light Source* pop-up menu, you will be asked to select a custom illuminant file. Custom illuminant files are described in the following section.

Note that the *Light Source* pop-up menu is not available if your data reference file does not contain spectral data. In that case, the reference file contains XYZ or Lab data that is based on a D50 illuminant. You cannot specify a different light source, but D50 is suitable for many situations.



### Power Users Only: Custom Illuminant Files

Two custom illuminant files are installed with inCamera. The file named `NorthLightCopyLightUV.txt` contains spectral data for a North Light HID copy light with the standard diffuser and optional UF3 UV blocking filter. The file named `NorthLightCopyLight.txt` is for a North Light HID copy light with the standard lenticular diffuser but without the UV filter.

If you have, or can obtain the necessary spectral data about your light source, you can create your own custom illuminant file. If you wish to make a custom illuminant file, it must contain the relative spectral power distribution of the light source, measured from 380 nm to 730 nm at 10 nm intervals. The data may be formatted in several ways.

One example is illustrated by the file named `NorthLightCopyLightUV.txt`. The format of the spectral data is defined by the line following the `BEGIN_DATA_FORMAT` line, which specifies that each line of data contains two fields: `SPECTRAL_NM`, which is an integer wavelength (nm) of an associated data value, followed by `SPECTRAL_RM`, which is the corresponding spectroradiometric data value. The data itself follows the `BEGIN_DATA` line, from 380 through 730 nm at 10 nm intervals, as required. The contents of that file are shown here:

```
# Copy Light w/lens diffuser+UF3
# Copyright ©2004 Robin D. Myers, all rights reserved.
BEGIN_DATA_FORMAT
SPECTRAL_NM      SPECTRAL_RM
END_DATA_FORMAT
#
NUMBER_OF_SETS  36
BEGIN_DATA
380      37.439
390      45.991
400      327.10
410      1644.5
420      3647.1
430      5309.9
440      6127.9
450      6546.9
460      7220.1
470      7467.2
480      7322.8
490      7453.8
500      8276.9
510      8642.7
520      8627.7
530      10730.0
540      12886.0
550      10239.0
560      10692.0
570      11559.0
580      11257.0
590      13151.0
600      15050.0
610      14410.0
620      14053.0
630      14107.0
640      14531.0
650      13402.0
660      11856.0
670      10740.0
680      10152.0
690      8776.6
700      7107.0
710      5879.8
720      5320.9
730      4735.4
END_DATA
```

The file named `NorthLightCopyLight.txt` was generated by SpectraShop, a spectral analysis program. It contains additional information that is ignored by inCamera, but since the required information is included, the file can be read by inCamera. The contents of that file are shown here:

```
BEGIN_RECORD
SPECIMEN_ID1  "Copy Light w/lens diffuser"
SPECIMEN_ID2  ""
SPECIMEN_ID3  ""
MATERIAL      ""
MANUFACTURER  "North Light Products"
SERIAL        ""
PRODUCED      ""
SURFACE       "Matte"
ORIGINATOR    "Robin D. Myers"
CREATED       "24.5.04"
COPYRIGHT     "©2004 Robin D. Myers, all rights reserved."
NOTES        ""
#
INSTRUMENT    "EyeOne"
SPECTRUM_TYPE "Emissive"
FILTER        "Ambient"
GEOMETRY      "d/0"
REFERENCE     "Absolute"
ILLUMINANT    "N/A"
BACKING       "N/A"
NMEASURE      4
```

```

ACQUIRE_NOTES  "Positioned at center of fixture at 5 feet distance."
#
BEGIN_DATA_FORMAT
SPECTRAL_NM      SPECTRAL_RM      SPECTRAL_MIN      SPECTRAL_MAX      SPECTRAL_STDEV
END_DATA_FORMAT
#
NUMBER_OF_SETS  36
BEGIN_DATA
380  7.7725E+2      7.7497E+2      7.8125E+2      2.8321E+0
390  1.5943E+3      1.5909E+3      1.5975E+3      2.8301E+0
400  2.5500E+3      2.5473E+3      2.5561E+3      4.1209E+0
410  3.5938E+3      3.5899E+3      3.5977E+3      3.1689E+0
420  4.7757E+3      4.7723E+3      4.7790E+3      2.9567E+0
430  5.8993E+3      5.8977E+3      5.9029E+3      2.4760E+0
440  6.5438E+3      6.5416E+3      6.5471E+3      2.3973E+0
450  6.9299E+3      6.9258E+3      6.9339E+3      3.3804E+0
460  7.6168E+3      7.6108E+3      7.6257E+3      6.3288E+0
470  7.8704E+3      7.8664E+3      7.8790E+3      5.8855E+0
480  7.7172E+3      7.7123E+3      7.7240E+3      5.6334E+0
490  7.8502E+3      7.8467E+3      7.8573E+3      4.8733E+0
500  8.7162E+3      8.7124E+3      8.7257E+3      6.3452E+0
510  9.0999E+3      9.0943E+3      9.1110E+3      7.5754E+0
520  9.0831E+3      9.0797E+3      9.0900E+3      4.8005E+0
530  1.1311E+4      1.1306E+4      1.1320E+4      6.4211E+0
540  1.3594E+4      1.3590E+4      1.3604E+4      6.6356E+0
550  1.0783E+4      1.0778E+4      1.0791E+4      5.6041E+0
560  1.1260E+4      1.1255E+4      1.1268E+4      5.5479E+0
570  1.2176E+4      1.2168E+4      1.2188E+4      8.8340E+0
580  1.1855E+4      1.1848E+4      1.1866E+4      7.9973E+0
590  1.3874E+4      1.3869E+4      1.3884E+4      7.2020E+0
600  1.5866E+4      1.5861E+4      1.5879E+4      8.9888E+0
610  1.5174E+4      1.5167E+4      1.5183E+4      7.4563E+0
620  1.4800E+4      1.4793E+4      1.4812E+4      8.6302E+0
630  1.4854E+4      1.4848E+4      1.4871E+4      1.0795E+1
640  1.5290E+4      1.5284E+4      1.5301E+4      7.7261E+0
650  1.4087E+4      1.4083E+4      1.4096E+4      5.8558E+0
660  1.2457E+4      1.2449E+4      1.2473E+4      1.1315E+1
670  1.1281E+4      1.1277E+4      1.1290E+4      5.7882E+0
680  1.0673E+4      1.0664E+4      1.0683E+4      7.7113E+0
690  9.2245E+3      9.2156E+3      9.2386E+3      1.0062E+1
700  7.4673E+3      7.4639E+3      7.4698E+3      2.4971E+0
710  6.1848E+3      6.1786E+3      6.1922E+3      6.0046E+0
720  5.5997E+3      5.5979E+3      5.6020E+3      1.9619E+0
730  4.9796E+3      4.9764E+3      4.9846E+3      3.5169E+0
END_DATA
END_RECORD

```

A third possibility is shown here:

```

Date: 5/24/2004 Time: 15:50
ILLUMINATION_NAME  "Emission"
BEGIN_DATA_FORMAT
SampleName nm380      nm390      nm400      nm410      nm420      nm430      nm440      nm450      nm460      nm470      nm480      nm490      nm500      nm510      nm520      nm530      nm540
END_DATA_FORMAT
BEGIN_DATA
My_Light      3.257189      6.165859      19.269892      21.802994      16.533678      39.975159      57.056049      30.274649      30.1
END_DATA

```

This format is similar to the GretagMacbeth ColorChecker spectral reference file format. In this case, the `BEGIN_DATA_FORMAT` section of the file specifies that all of the measurements will be on one line, following the name of the sample. So, a single line of spectral data follows the `BEGIN_DATA` line, and includes the measurements from 380 through 730 nm at 10 nm intervals, as required by inCamera.

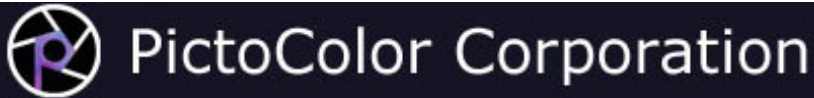
Your measuring instrument may have come with software that can create a file in one of these formats. If not, the easiest way to make a custom illuminant file that can be used with inCamera, is to copy one of the files that is included with inCamera, and then edit it with any text editor that can save plain (unformatted) text files.



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## 5c. Creating the Profile: Adjusting the Grid

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You will now see a grid placed over the image. This grid should be a recognizable facsimile of the chart type you have selected. We will now examine the various tools available for aligning this grid with the image of the chart.

---

### Working with Dark Images

Some captures of the chart may appear very dark, making it difficult to see the locations of the chart patches. This situation is more likely to occur if you have captured a raw, 16-bit image because such images are often captured in "linear mode" which means they have a gamma of 1.0. If the chart image is dark, you may use the *Brighter* checkbox to make it easier to see:

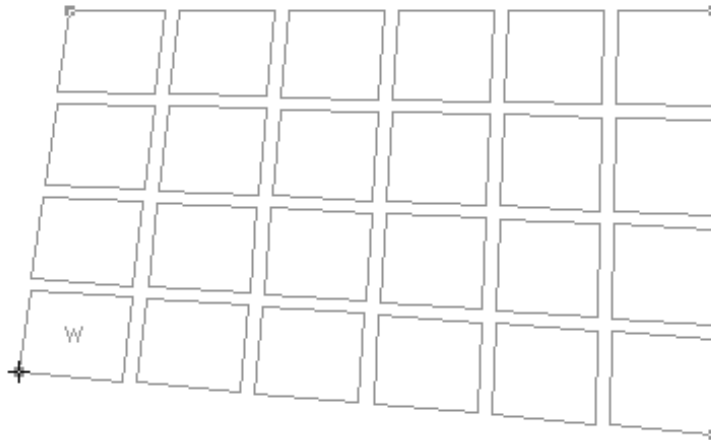


This checkbox is only a visual aid for inCamera's user interface. It **does not** affect the behavior of the profile in any way.

---

### Positioning the Grid

The grid may be dragged as a whole by grabbing its interior and moving. If you grab near one of the four corners, you can drag just that corner.



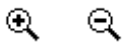
This flexibility allows you to use charts that are captured sideways, upside down or even with some perspective.

Notice that at least one of the grid patches has the letter 'W' drawn on it. Patches marked this way are always to be positioned over white patches of the chart. This convention will be helpful in determining if the grid is upside down or flipped over relative to the chart image. Due to the layout of the ColorChecker SG chart, the white patches alone are not enough to determine the orientation, so that grid also has a 'Y' drawn on a patch which should be positioned over the yellow patch (row 4, column H).

---

## Zooming and Scrolling

You may want to zoom into the image to accurately position the grid. This may be done by holding down the **Alt** key while clicking on the image. This same process is used to zoom back out. The cursor indicates that zooming will occur:



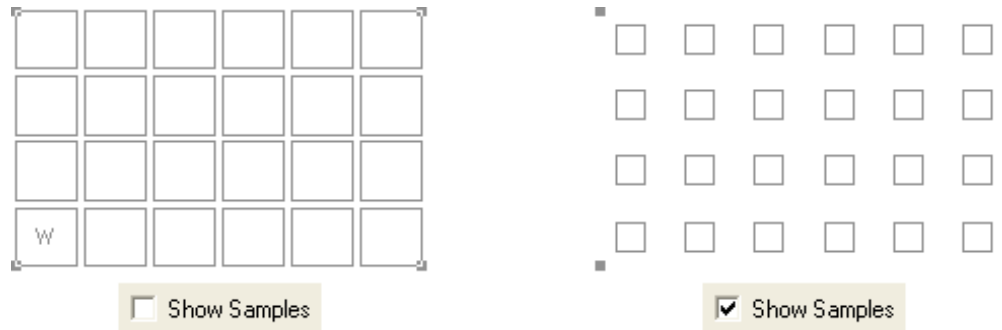
When you are zoomed in, you can scroll the image by holding down the **Ctrl** key while dragging on the image. The cursor will change to this:



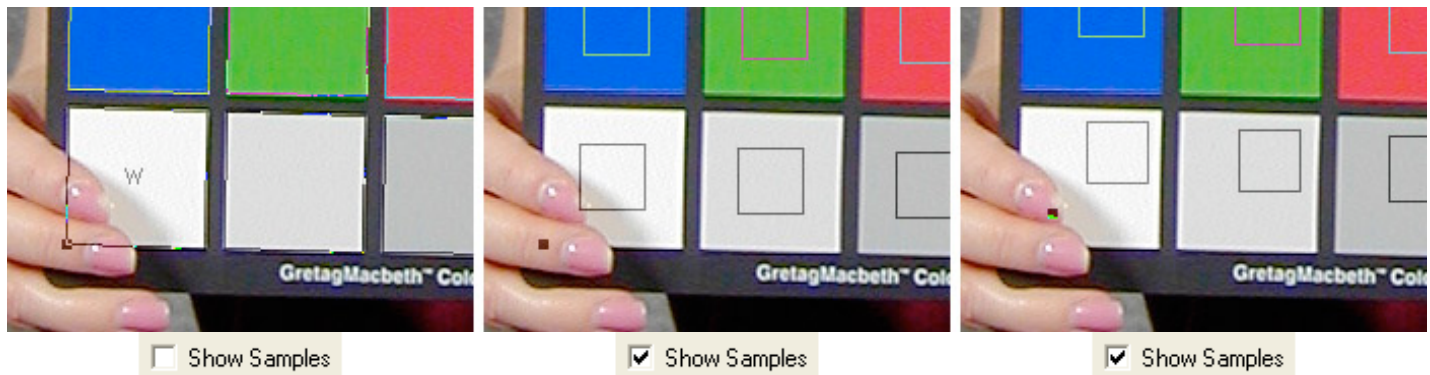
---

## Image Sampling

The grid is used as a reference, guiding the software to the proper places to obtain the patch colors. If you want to see the actual patch areas examined by inCamera, check the *Show Samples* checkbox.



You will see that the grid is replaced with an array of squares. inCamera examines only those pixels that are inside these squares, but it does not use *all* of these pixels. It removes hairs and dust and averages most of the remaining pixels. A situation where the *Show Samples* feature is particularly useful is when part of a patch has been inadvertently covered:

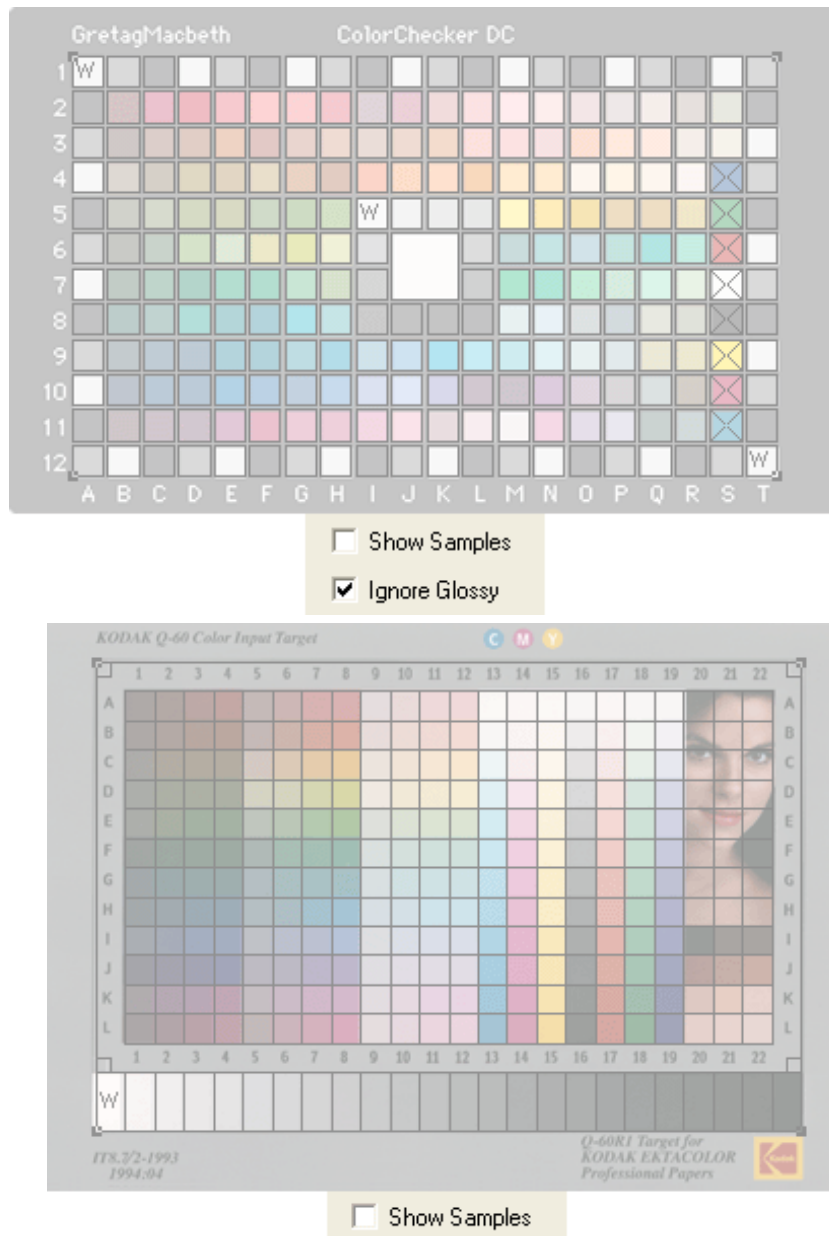


Using the *Show Samples* as a guide, the covered portion may often be avoided without the need to retouch the chart, or even worse, reshoot the chart. As you can see above, the lower left corner of the grid can be repositioned just enough to miss the finger and its shadow.

When *Show Samples* is checked, the sample size may be adjusted using the *Sample Size* slider. The size that is displayed is the width and height in pixels of the sample closest to the center of the grid. The default size is suitable for most situations. Note that it is best to position the grid corners before changing the sample size. Otherwise, you might specify a sample size that will be unattainable based on the resolution of the chart. If that happens, your sample size selection will be changed to the closest possible valid sample size.



The *Show Samples* feature will also indicate portions of the chart that will not be sampled. For example, if you have enabled *Ignore Glossy* when using the ColorChecker DC chart, then the glossy patches of the chart (S4 through S11) will not show sample squares. Similarly, when using Kodak IT8 charts, that portion of the Vendor Optional Area containing the photograph (A20 through H22) will not be sampled.



## A Side Note About Window Sizing

The *Use Largest Window* checkbox indicates how the inCamera window will be sized *the next time the plug-in is run*. A bit of explanation is needed here. Unlike a normal stand-alone application, it is not possible for a plug-in to have a window that may be resized while the plug-in is actually running. So in order to provide a different window size, you must indicate how this should be done *next time*.

Moreover, note that the larger you make inCamera's window, the more memory inCamera needs. So the name of the game is trading window size against available memory. Let's see how this is done.

Use Largest Window

If the *Use Largest Window* checkbox is **unchecked**, the inCamera window will be a fixed size that will fit on a display that meets inCamera's minimum system display requirements (800 × 600 pixels).

If the *Use Largest Window* checkbox is **checked**, the inCamera window will be the largest size that will fit on your display. If under this setup, there is not enough memory for inCamera to run, the window size will be made just enough smaller so that it will run.



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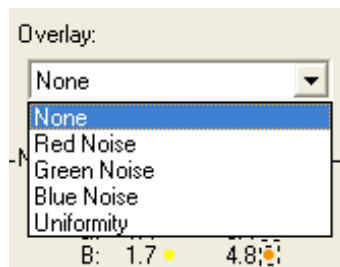
## 5d. Creating the Profile: Checking the Chart Image



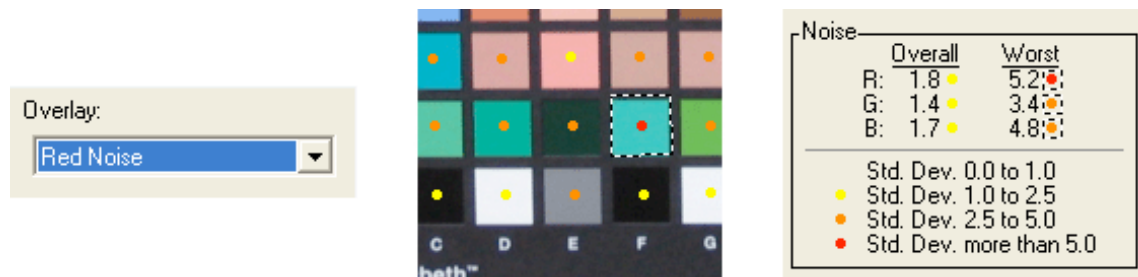
inCamera includes an optional step that allows you to evaluate aspects of the quality of your chart image that could impact the usefulness of the resulting profile. To use this feature, you must first select your chart type, data reference file (including light source, if possible with your reference file), and position the chart template, as described in the preceding sections of this user guide. Then, click on the *Check Capture* button:



Depending on the resolution of your image, there may be a noticeable delay as the image is analyzed. When the analysis is complete, a summary of the results will be displayed numerically and graphically. You can switch from one view to another with the *Overlay* pop-up menu:



The *Noise* panel and overlays provide information about how much noise was found in the chart portion of the image:



Color coded dots appear in the center of each patch in the chart. The lower half of the *Noise* panel defines the color coding. In the upper half of the panel, the *Overall* noise for each channel of the image (red, green and blue) is reported, expressed in the same standard deviation units that the Adobe Photoshop histogram uses. These values represent the average for all of the patches in the chart. The *Worst* noise found in any patch is also reported. To help you quickly locate the patch where the worst noise was detected, it is outlined with a dotted line in the



corresponding overlay.

If these values are high, you may want to consider applying a noise removal filter (such as Adobe Photoshop's Smart Blur) to your images before applying your profile. Otherwise, you may find that although the profile corrects the average color of an area, it also accentuates the noise.

Additional information about *Lighting Uniformity* will be displayed if you are using the ColorChecker SG or the ColorChecker DC chart:



This information can help you determine how uniform the lighting was when the chart was photographed. Each patch in the chart is color coded according to how much the lighting at that patch differed from the lighting at the center of the chart. As the lower half of the information panel indicates, darker patches are represented with shades of blue and lighter patches are represented with shades of red. A perfectly illuminated chart would show all patches as white.

The *Overall* uniformity error is an overall measure of lighting uniformity with respect to the center of the chart. A perfectly illuminated chart would have an overall error of 0.0%, and any lighting imperfections (either lighter or darker) will increase this value. If the overall error is high, you should consider photographing the chart again under more uniform lighting.

If the lighting for any of the patches was darker than the lighting at the center of the chart, information about the *Darkest* lit patch is displayed. Likewise, if the lighting for any patch was lighter than the center, information about the *Lightest* lit patch is displayed. To help you quickly locate these patches, they appear outlined with a dotted line in the *Uniformity* overlay. This information may help you determine what kind of corrections to make to the lighting before photographing the chart again.



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## 6. Saving the Profile

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Although other pages of this User Guide are written to display information relating to just one platform implementation of inCamera (either Windows or Macintosh), this page will describe all platforms. The reason is that some users may wish to create the ICC profiles on one platform and then use them on a different platform. Such a "cross-platform" user must know the rules about ICC profiles on more than one platform, for example, where ICC profiles should be placed, what the file names should be, and so forth. If you are working on only one platform, you may safely read just that section below.

- [Windows](#)
- [Macintosh OS X](#)
- [Macintosh OS 9](#)

**A General Note on Profile Overwriting:** If you overwrite an existing profile when you save a new profile, Photoshop may not be able to use it properly until you restart Photoshop. This is apparently due to profile caching performed by Photoshop. You will not have this problem if you save each new profile under a unique name, in which case Photoshop may make use of it immediately, without restarting.

---

## Windows

### Profile Locations

ICC profiles are located in these standard places on Windows XP:

Location	Purpose
C:\WINDOWS\SYSTEM32\COLOR\	Photoshop 5 looks here.
C:\WINDOWS\SYSTEM32\SPOOL\DRIVERS\COLOR\	Photoshop 6 and later look here.

### Profile Naming

ICC profiles must have the proper file name extension in order to work on Windows. Two suitable extensions are: ".icc" and ".icm".

---

# Macintosh OS X

## Profile Locations

ICC profiles are located in these standard places on OS X:

Location	Purpose
/System/Library/ColorSync/Profiles/	This is where ColorSync stores profiles it uses internally for critical operations, should others be mistakenly lost or damaged. This folder is locked and protected, which normally prevents you from placing ICC profiles here.
/Library/ColorSync/Profiles/	This is the recommended place for applications (like inCamera) to store profiles, and therefore is the default.
/Network/Library/ColorSync/Profiles/	If you are in a network environment and your network administrator has stored profiles on the network for network devices, this is where they will be located.
~/Library/ColorSync/Profiles/	Users can store their own personal profiles in their home directory.

## Profile Naming

There are no naming restrictions for ICC profiles. A file name extension is not needed, but if you choose to use one, Apple recommends ".icc". ICC profiles do not need creator or file type signatures, but if you choose to use them, use 'sync' for the creator signature and 'prof' for the file type signature.

# Macintosh OS 9

## Profile Locations

ICC profiles are located in this standard place on OS 9:

Location	Purpose
System Folder/ColorSync Profiles/	This is the only standard place that ColorSync looks to find ICC profiles.

## Profile Naming

There are no naming restrictions for ICC profiles. A file name extension is not needed, but if you choose to use one, Apple recommends ".icc". ICC profile files must have 'sync' for the creator signature and 'prof' for the file type signature, which inCamera automatically provides. However, if you have transferred an ICC profile from a Windows computer, it will not have these signature assignments. In this case, you may use Apple's Drop•ColorSyncProfile utility to set the proper file signatures. It is available [here](#) (6K).



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## 7. Using the Profile

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Creating a custom input profile is an essential part of successful color management. However, even a great profile, if used incorrectly, will result in failure. Since inCamera creates colorimetrically accurate profiles that conform to ICC specifications, we could technically end this User Guide right here. There are so many different ways that ICC profiles can be used, it would be impossible to describe them in general, much less in any sort of detail that would be useful to anyone.

However, since Adobe Photoshop is so ubiquitous, we will step into Adobe's realm just long enough to describe how inCamera's profiles might be used within that program. Even in Photoshop though, there are many different ways to use profiles. The pages that follow are just our recommendations — those familiar with color management in Photoshop may deviate from these as they wish.

- [Photoshop Setup](#) • This describes a recommended way to set Photoshop up for using input profiles.
- [Opening Images](#) • This describes various methods of making sure your input profile is properly used with your image.
- [Editorial Interpretation](#) • This describes how the science of profiles coexists with the art of photography.



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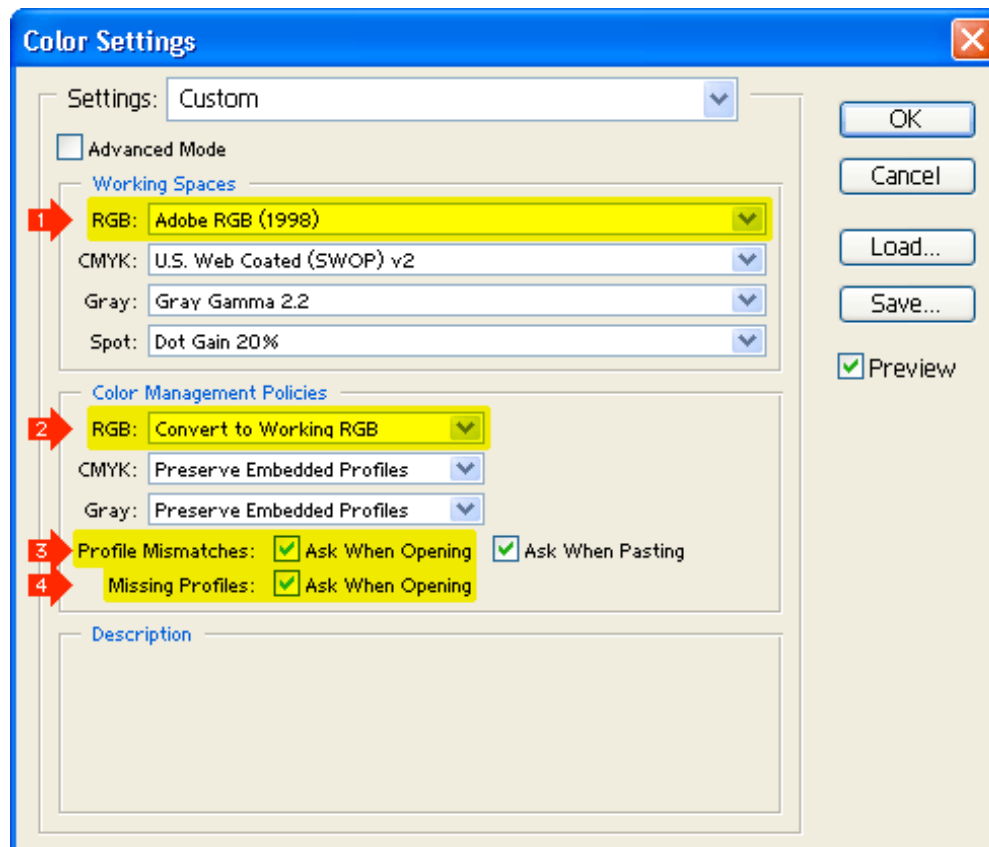
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## 7a. Using the Profile: Photoshop Setup



When working with ICC profiles in Photoshop, it is critical that Photoshop is first set up properly. Here is a recommended setup for Photoshop's *Color Settings* dialog:



Dialog items of particular interest:

1. Select a normal RGB working space, such as Adobe RGB (1998) or sRGB. Do not select your monitor profile!
2. In order to facilitate subsequent color editing, conversion into the RGB working space is recommended.
3. If an image from your camera or scanner has an embedded profile — but the wrong one — this will give you the chance to discard the unwanted profile.
4. If an image from your camera or scanner does not have an embedded profile, this will give you the chance to assign your custom input profile.



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## 7b. Using the Profile: Opening Images

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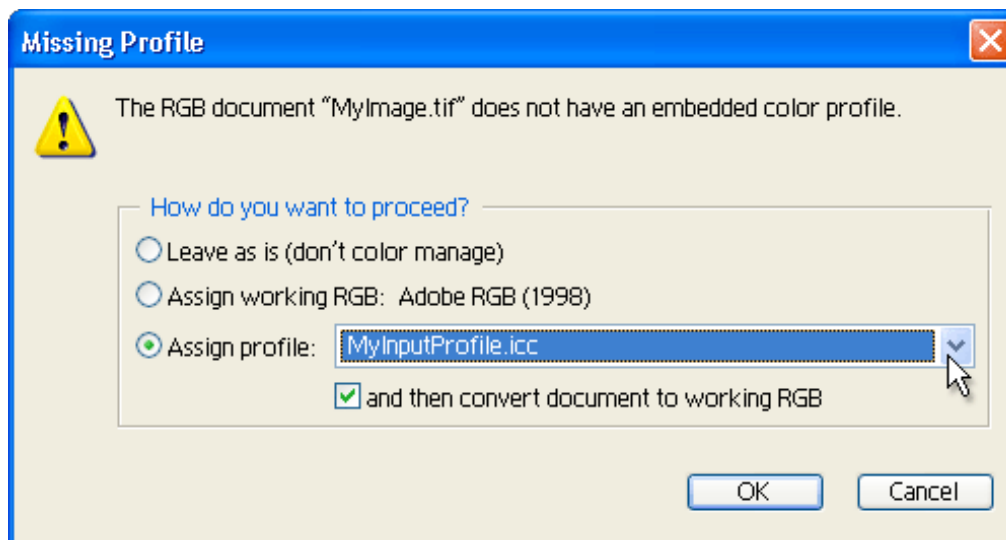
Your custom input profile must somehow be assigned to and/or used with images that come from that scanner or camera. There are several possibilities that may be encountered when opening the image in Photoshop, depending on the particulars of your scanner/camera and its associated software. Each situation requires different treatment. There are basically four possible scenarios, shown here:

Does the image have an embedded profile?

1. [No](#).
  2. Yes, and the embedded profile is
    - a. [your custom input profile](#).
    - b. [the same as your current working space profile](#).
    - c. [some other profile](#).
- 

### 1. Your Digital Camera or Scanner does not embed any profile into the image.

If the image has no embedded profile, then when you open it in Photoshop, you will see this dialog:



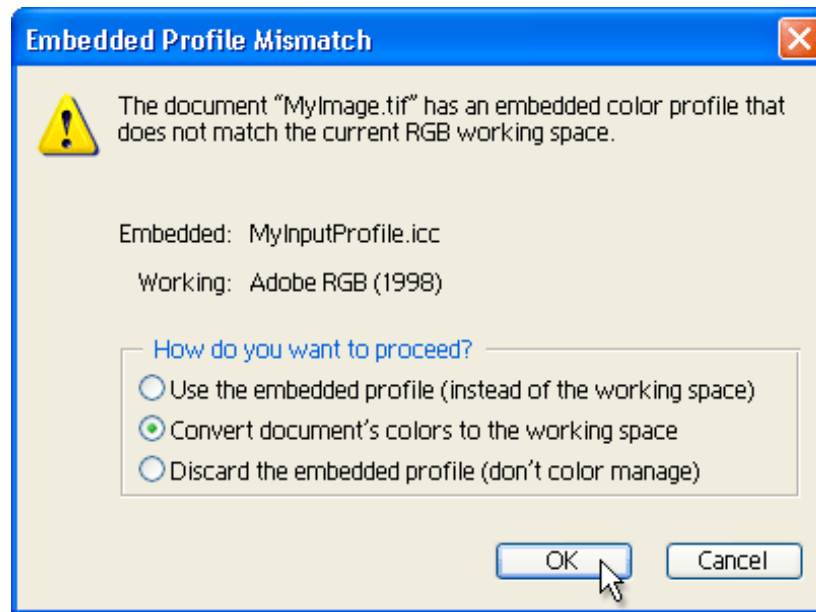
Use the pop-up menu to select the proper custom input profile. It is further recommended that you convert to the working space by using the checkbox as shown above.

---



## 2a. Your Digital Camera or Scanner is able to embed your custom profile into each image automatically.

If the software that controls your camera or scanner is able to embed your profile into each image, then by all means, do this. When you open the image in Photoshop, you will see this dialog:

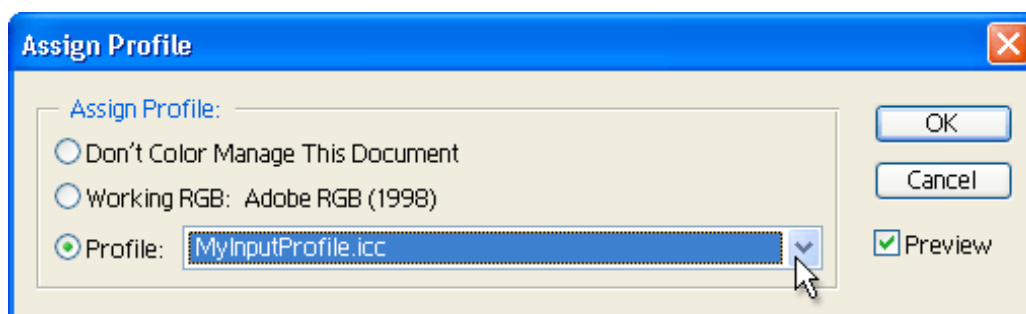


In this case, we recommend that the embedded profile be used to convert the image into your working space, as shown by the selection made above.

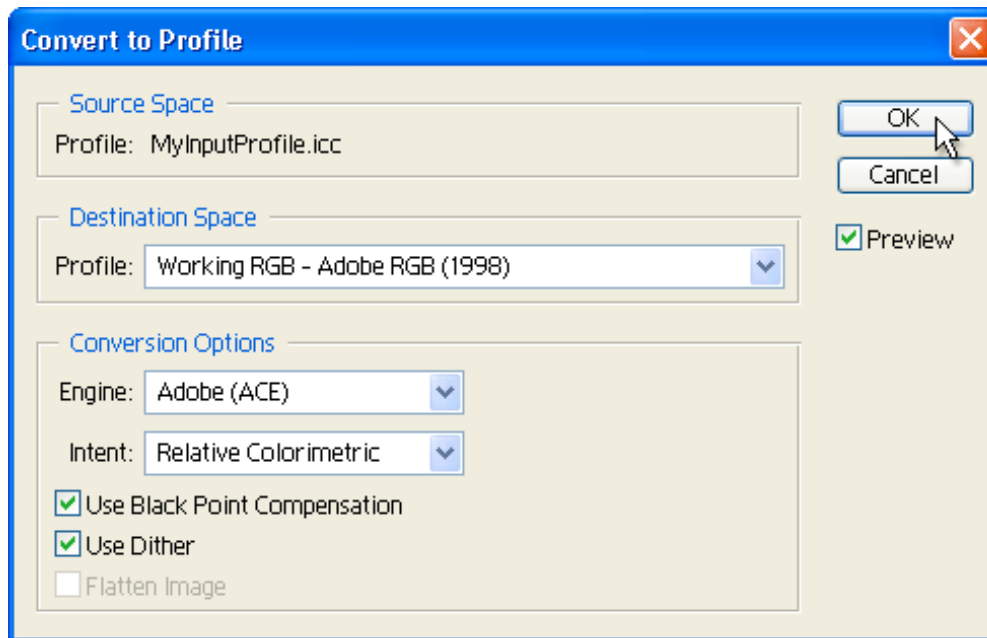
## 2b. Your Digital Camera or Scanner embeds the same working space profile into the image that you have selected in Photoshop.

Some capture software always embeds a generic or standard profile into each image, such as sRGB. If this profile just happens to be the same as the profile you have selected as your RGB working space in Photoshop's *Color Settings* dialog, then the image will open without any intervening warnings or dialogs. But the wrong profile is associated with your image and this must be remedied. Note that this would be a rather unlikely (but nevertheless possible) coincidence. In this case, the incorrect profile must be removed and replaced with the proper one, which involves a couple of steps.

After you have opened the image in Photoshop, you must assign the proper profile by selecting **Image / Mode / Assign Profile...** and then select the custom profile from the pop-up menu:

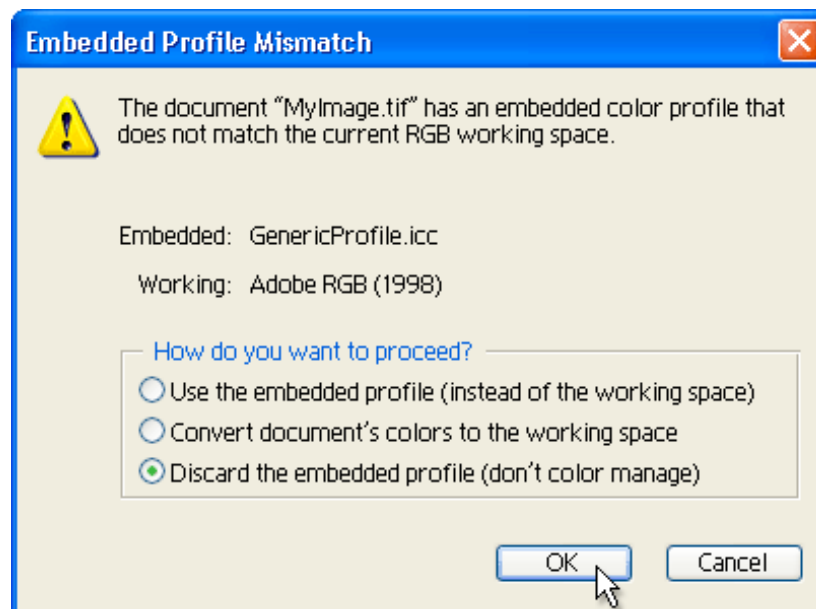


Then you should convert into your RGB working space by selecting **Image / Mode / Convert to Profile...**:

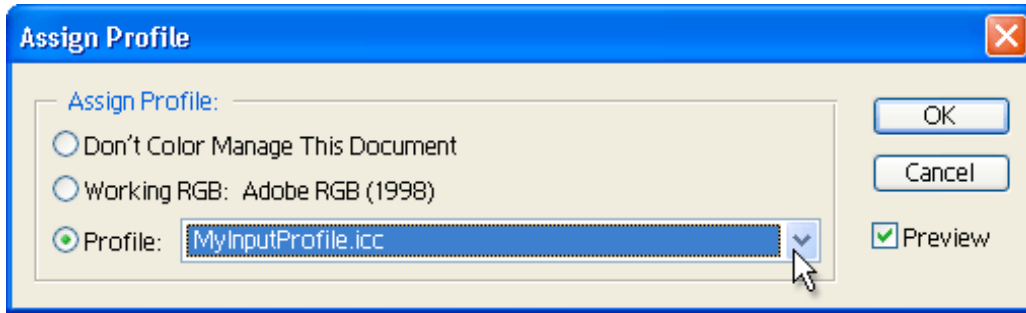


## 2c. Your Digital Camera or Scanner embeds a profile into the image, but not the right one.

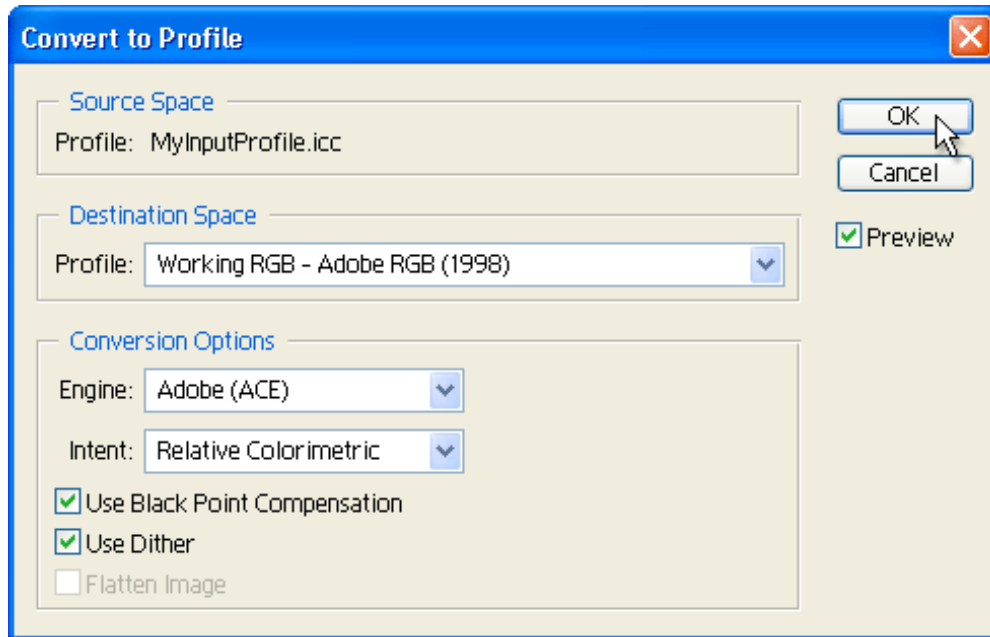
If your capture software has embedded a generic or standard profile into the image (but not the same as your working space), this incorrect profile must be removed and replaced with the proper one, which involves steps similar to the previous situation above. When you open the image in Photoshop, you will get this dialog, which allows you to remove the unwanted embedded profile:



Now you must assign the proper profile by selecting **Image / Mode / Assign Profile...** and then select the custom profile from the pop-up menu:



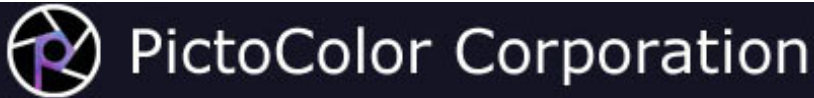
Finally, you should convert into your RGB working space by selecting **Image / Mode / Convert to Profile...**:



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## 7c. Using the Profile: Editorial Interpretation

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inCamera profiles are designed to produce colorimetrically accurate results. That is, all of the color patches on the profile chart are matched to the reference file values with extreme accuracy. However, we fully recognize the fact that many images are intended to produce a certain "feel" or evoke some sort of emotional response in the observer. For example, the appearance of a colorimetrically accurate digital camera image may look a little "flat" when the profile is perfectly matching the colors in the original scene. Therefore, an artistic interpretation of the color is often needed — a color correction which may differ on an image-by-image basis.

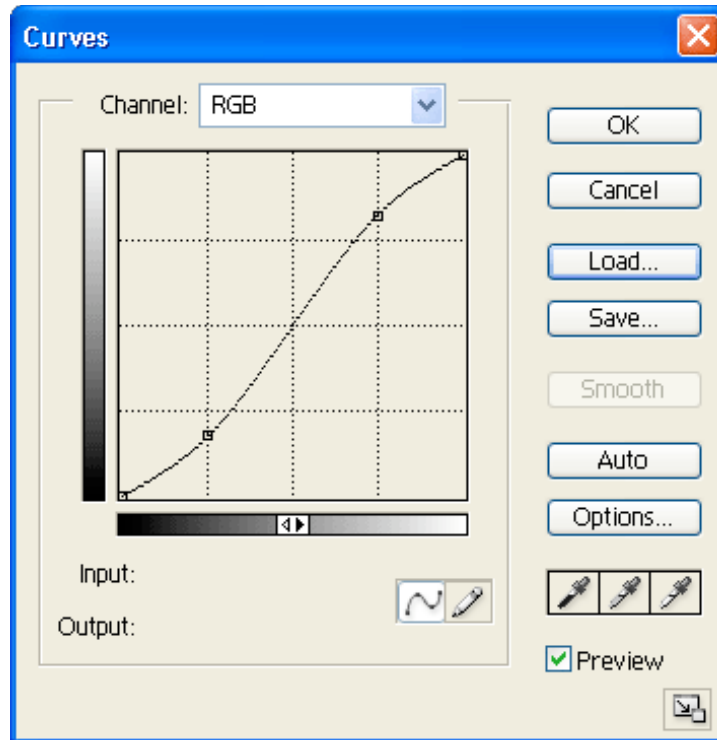
Which leads to the question: If each image must be further color corrected by hand, what is the point of profiling?

For many situations, the profiled image will be perfectly fine as is. For scanners, this is usually the case. Those images requiring adjustment will still benefit from profiling because the profile will always bring the color into a standard color reference, that is, a known starting place. Therefore, a color edit that you might perform on an image from one camera under one lighting setup will do the same thing to an image from a different camera under a different lighting setup.

You can build these adjustments into your inCamera profile using an ICC profile editor, such as PictoColor's [iCorrect EditLab Pro](#).

If you don't have a profile editor, you can also create reusable standard "recipes" using Photoshop's Actions and hot keys to quickly and efficiently perform the adjustments you like.

We have found that a slight "S" shaped curve improves the appearance of many digital camera pictures (use Photoshop's **Image / Adjustments / Curves...** to apply the curve).



**Important:** It is critical that your image be in the RGB working space before applying a curve, and many other color adjustments, which is one reason we recommend that you always convert your image into an RGB working space. Many color correction tools **will not work** if you use an assigned input profile without converting into your working space.

The above curve will take care of the "flatness" seen in many profiled digital camera images. You may adjust the curve shape to suit your preferences, or use other Photoshop tools or third party plug-ins to further express the intent of the image.

## Image Noise

Noise is another concern with digital photography. You can use inCamera's [Check Capture](#) feature to help determine how much noise is in your images. There will likely be more noise in images taken with insufficient illumination, and within an image there will probably be more noise in the shadows than in the highlights. After applying a profile to such an image, this noise may become exaggerated as colors are "pulled" by the profile into their proper positions. To reduce visual defects caused by noise, try to shoot under more intense (or a different type of) lighting. Increase the exposure time if possible to provide more light to the sensor. Noise is often worse in the blue channel, and shooting with tungsten lighting (which has deficient blue light) can exacerbate this particular type of noise. Within Photoshop you can try using a noise removal filter. Even a curve (like the one shown above) can compress shadow detail, thereby suppressing the visual effect of the noise that is found there.



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