SA International

A Guide to the Flexi Color Profiler

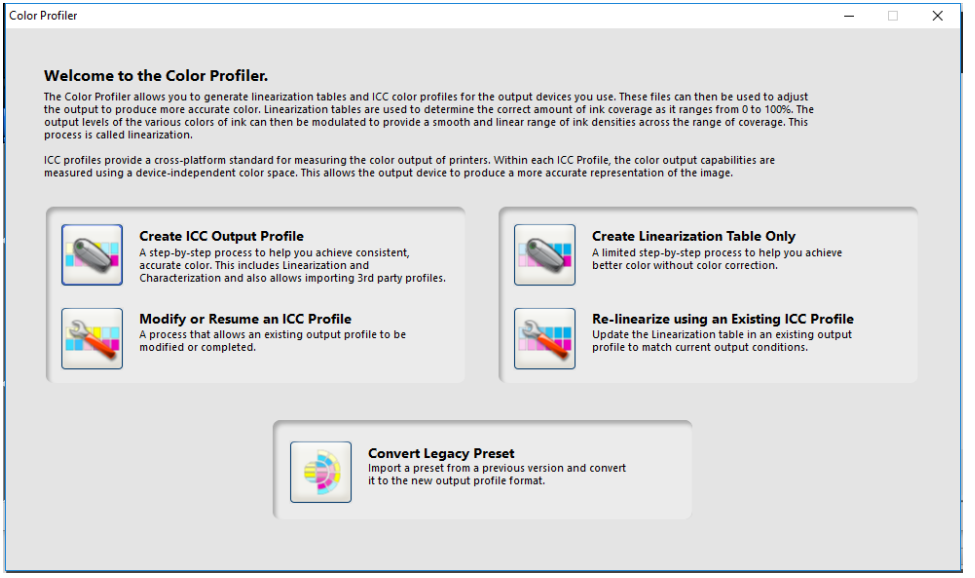
1.1. Introduction to Color Profiler

You can complete several actions from the Color Profiler home screen. Using the Color Profiler, you can generate ICC profiles and linearization tables for the output devices you use. You can use these files to adjust the output to produce more accurate print jobs.

ICC profiles provide a cross-platform standard for measuring the color output of printers. Within each ICC Profile, the color output capabilities of a specific printer on a specific medium using a specific color mode are measured using a device-independent color space. Once an ICC profile has been generated, you can adjust the output of an image within the color space mapped out in the ICC profile. This allows the output device to produce a more accurate representation of the image.

Linearization is a process by which output values are corrected to match input values. For instance, a file contains a color that is 10% cyan, but when printed appears much darker than expected, closer to 25% cyan. Performing linearization will determine the correct output values so that when printed, 10% cyan more closely matches the 10% cyan in the file being printed.

At minimum, you should create linearization files and ICC profiles for each combination of ink type and media that an output device supports.



1.2. Creating a New ICC Profile

1.2.1. Before you Begin making an ICC Profile

Before you print test swatches, consider the following factors to maximize the quality of your color calibration:

Ink	Each printer is designed with specific kinds of ink; therefore you should use the manufacturer-recommended inks. Also, make sure the inks are filled and properly primed as instructed by the manufacturer.
Media	Media is the most important part of the ink and media interaction. This interaction between the ink and media coating affects every aspect of print quality, including color accuracy, vividness and durability, as well as the sharpness of your print. If the ink and media are not properly matched, potential problems include bleeding and smearing.
Resolution	Resolution measures the number of dots per inch printed by the printer. Changing the resolution affects the dot placement and the amount of ink laid down on the media by the printer.
Environment	Humidity and temperature affect the drying time for a print, which affects the ink and media interaction. A longer drying time can cause ink bleeding or intentional ink mixing.
Print mode	For the best results, calibrate using the printer's highest quality print mode. Using the quality mode will reduce banding.
Print heads	Print heads should be properly primed and all nozzles should be firing. The heads also need to be in alignment. Consult the printer manufacturer's documentation for instructions.
Measuring Device	The spectrophotometer, colorimeter needs to be calibrated properly for white points and black points. See your device's documentation for calibration instructions.

1.2.2. Characterization

Characterization determines the color characteristics of your printer.

Before you start measuring, "Calibrate your measurement device:" on page 11 again.

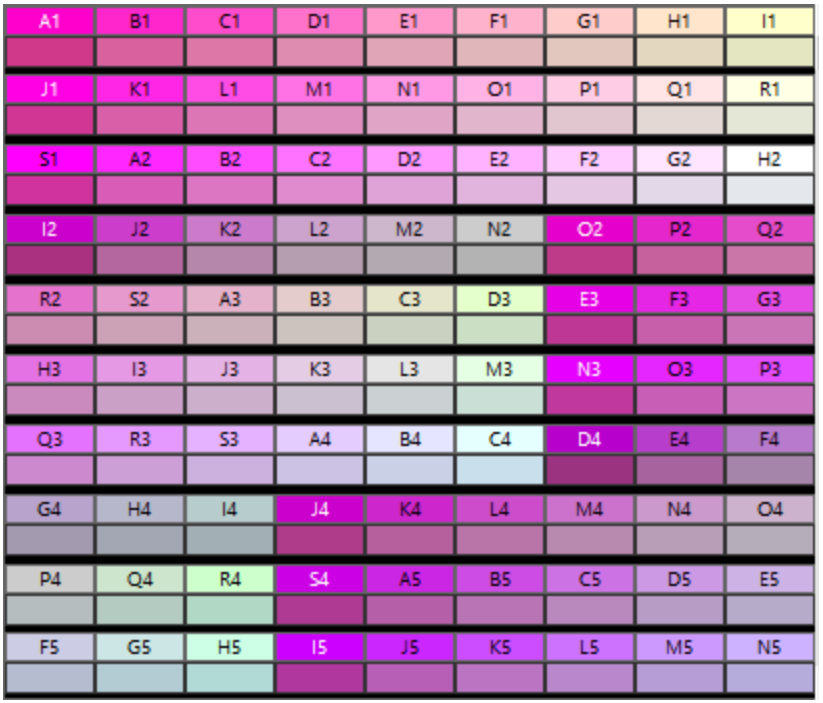
1.2.2.1. Print and Measure a characterization chart

» From Target Setup, select a **Style.**

» If your color mode is CMYK or CMYK+ light inks, your options will be ECI2002, IT8.7 and TC3.5. The more swatches you print and measure, the more accurate your icc profile will be.

- If your color mode has additional process colors, such as Orange, Green, Red, Violet, only a special chart for your specific combination of inks will be available.

- Select a **Size** : this refers to the page size. Your characterization chart can be spread over multiple A4 pages. If Full is selected, the chart will be printed in one big page.
- Click the **Measure** button to measure the swatches with your measuring device.
- After you measure the swatches, check to see that the measured swatches line up with the target swatches.



- If you need to remeasure swatches:
  - To remeasure the entire target, click the Measure button.
  - To remeasure a swatch sheet, select a swatch and click the Remeasure one sheet button.
  - To remeasure a swatch strip, select a swatch in the strip that you want to remeasure and click the Remeasure one strip button.

- To remeasure a single swatch, select the swatch and click Remeasure one swatch button.
- Depending on the type of measurement device you use, the choices for remeasuring may be limited.

- Click **Next** to continue

1.2.2.2. Importing Measurement Data

Import measurement data from another Flexi ICC Profile by clicking Measurement Data.

> The color modes of the current ICC Profile and any imported measurement data must match.

1.2.2.3. Importing a 3rd party profile

It is possible to generate an ICC profile using both Color Profiler and a third party color profiling application such as Xrite or ProfilerMaker.

Color Profiler is used to determine the ink limits, linearization data and multi-ink limits, and to output the target for the fourth step, the creation of the ICC profile. The third party software is then used to measure the target and generate the ICC profile.

This profile can be imported in the characterization step by clicking the 3rd party ICC button.

Note that a preview of measurement data will not be available for imported profiles.

1.2.3. ICC Generation

In this final step, parameters for black generation, size and compensations can be set before generating the icc profile.

Black Generation

In theory, cyan, magenta and yellow mixed together should produce black. In practice, mixing CMY together produces a muddy dark gray or brown. In addition, CMY black tends to over-saturate the print medium, because it requires coverage from all three inks.

The solution is to use the CMYK color model, which adds a true black that replaces CMY. The CMYK model reduces over-saturation, produces better blacks, and requires less ink.

The GCR settings determine when and to what extent CMY will be replaced by black (K). The higher the GCR is set, the more CMY black is replaced with K black.

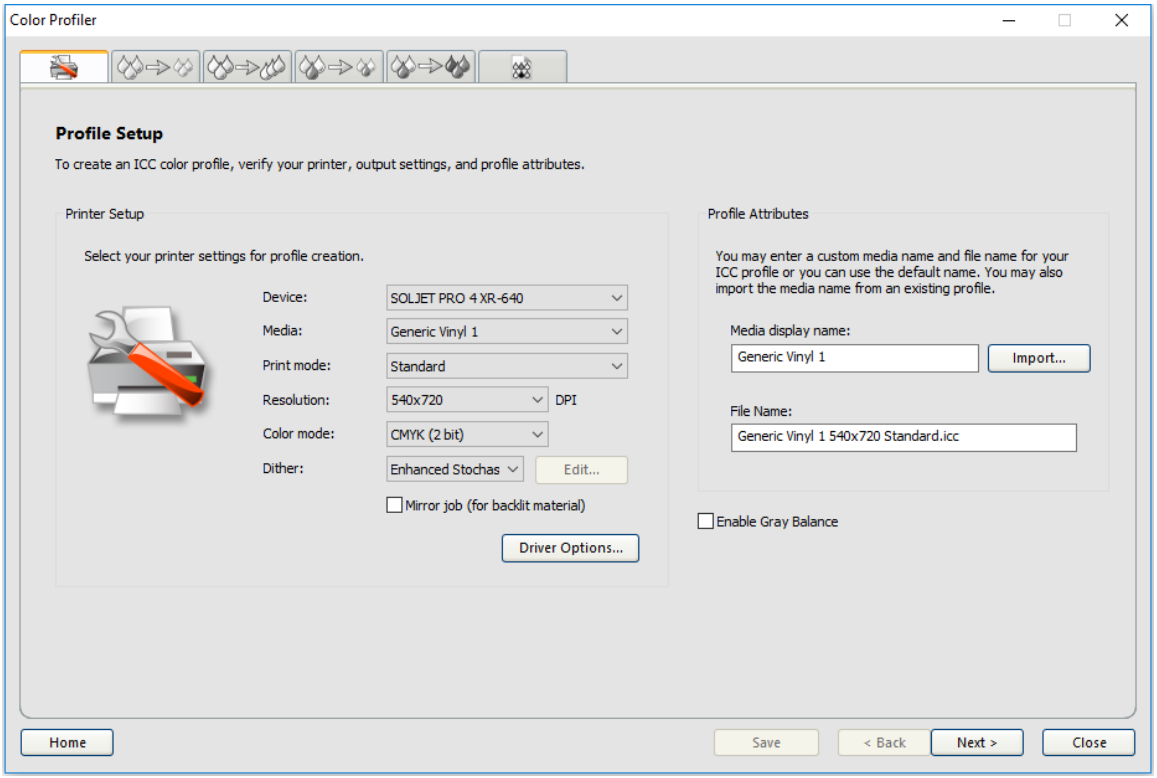
UCR based curves

Under color removal is a process of eliminating overlapping yellow, magenta, and cyan that would have added to a dark neutral (black) and replacing them with black ink only

	GCR based curves	With Gray Component Replacement CMY values that add to grey all along the tone scale can be replaced with black ink. (In contrast : UCR only adds black to the CMY equivalent of what would have printed as a grey or near-grey)
	MaxK / MuchK	These curves try to use as much K as possible and only at high saturation levels CMY components are added to create a higher density black.
	MinK	This curve uses as little of the K ink as possible. CMY components are used to make up the grays for as long as possible and only at higher saturation levels K is added to create a higher density black.
Black Start	This determines at which percentage of gray the black (K) channel begins to replace CMY.	
Black Width	A low Black Width value only generates black in the neutral areas. High values also generate black in the colorful shadows.	
Total Ink	This is a sum of the ink limit values for all process inks combined.	
Profile Size	Size of the LUTs (Lookup Tables) in the profile. The size has an impact on the precision of the profile and its calculation time. It has no impact on the processing time using the profile.	
ICC Version	Even though v4 has been in the market for a while, a lot of input profiles are still v2.1. The rule with icc version is that it is best to have the same version across your work flow. If your input profiles are 2.1, choose 2.1 for the output profiles.	
UV brightener compensation	Some media have a coating applied to make them look whiter - this is very common with fabrics. This coating is called an Optical Brightener. Optical, because the coating is actually a very light blue but our human eyes pick up on this color as white. Measurement devices, however, see the blue for what it is. This option compensates for the difference between what the measurement device and the human eye perceive.	
Chroma Adjustment		
	Additional adjustment for backlit application	

1.2.4. ICC Profile Setup

- Click **Create ICC Output Profile** in the Color Profiler application to start a new profile.
- Configure the settings for your ICC profile in the Profile Setup step



Device	The printer for which you are creating an ICC Profile.
Media	The media list provided by the device driver.
Print mode	The device's print mode.
Resolution	Select the resolution that will be used for the profile.

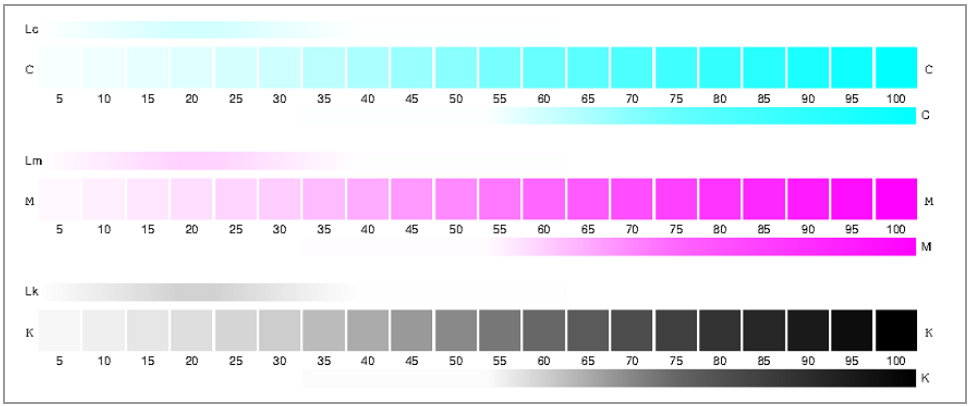
Color mode	The color mode that will be profiled (CMYK, CMYKLcLm, RGB, etc.)
Dither	The pattern in which the individual dots that make an image are applied to the media.
Edit	This button only becomes available when dither Angled Screen is selected and allows to change parameters for Angled Screen such as Frequency and Angle.
Mirror job (for backlit material)	Check this if the material will be backlit by a light box when scanned. All swatches will be printed mirrored.
Driver Options	The settings related to the selected output device. The options displayed may vary depending on your output device.
Media display name	The name of the media that will be displayed in Job Properties. This can be used to add custom media names to the media list.
Import	Click to import a media name from an existing ICC Profile.
File name	The name of the resulting ICC profile when clicking Save or Generate.
	To create a duplicate of an ICC profile, change the name before making other changes and re-generate. This allows you to make a new profile based on an existing one.
Enable Gray Balance	Check this only if the profile you are creating will be used mostly for Grayscale printing. If the profile will be mostly used for color printing, leave this box unchecked.

» Click **Next** to continue to the next step.

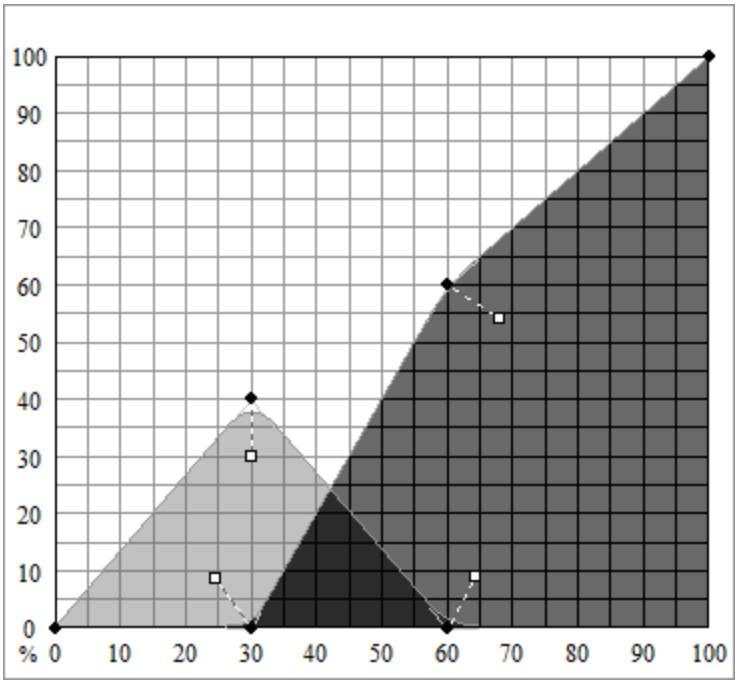
1.2.5. Ink Split

The Ink Split dialog allows you to set the points at which light or medium colored inks will be used instead of normal "dark" inks. This provides a greater number of light-colored shades, and reduces banding in light-colored areas. Ink split is only used when a color mode that includes light such as CMYKLcLm is selected.

» To print an Ink Split test, click the Print Ink Split Test button.



Each shade of ink is represented by a curve plotted on the chart. The chart illustrates the amount of each shade of ink that will be output in order to provide a certain amount of coverage. The range of coverage that can be specified in the image (0% to 100%) is plotted on the X-axis, and the corresponding coverage of each shade of ink is plotted on the Y-axis.



- Look at the critical area where both inks are used. This can be seen on the Ink Split Test where the swatch increments have color bars above and below, and on the curve where the colors overlap. Each color patch in these areas should be darker than the previous swatch increment and look like a smooth gradient. The amount of change between swatch increments will be corrected in Linearization.
- Adjust the curve using the handles.
  - Drag the colored round control points to move the curve
  - Drag the white square control points to change the smoothness of the curve at the control point
  - Click on the curve to add a new control point
- Repeat this step for all channels
- Print the Ink Split Verification to check the results.
- Click **Next** to continue.

If you have already completed this step in other icc profiles for the ink / media combination, you can use **Import** to import those settings from the other profile. Color profiler will read those settings and apply them to your new profile.

1.2.6. Linearization

Linearization determines what the output levels of each color need to be in order to produce linear ink coverage at levels ranging from 0 to 100% coverage.

To linearize the color channels:

1.2.6.1. Calibrate your measurement device:

» Select the type of measuring device and the port that connects it to your computer.

Not all devices support calibration from Color Profiler. If the Calibrate button is disabled, you should calibrate your device using the software provided with it before using it with Color Profiler.

» If desired, click **Settings** to set advanced settings for the measuring device. Note that only the Setting supported by your device will be available.

Illuminant	The light source currently used by the device.
Observer	The observer angle.
Status	The status currently used by your spectrophotometer.
	If you are unsure which status to use, we recommend using Status A (Automatic). This status will be uniform across all spectrophotometers.
Samples	The number of samples that will be taken of each swatch in a test pattern for automated measuring devices.
Spacing	The amount of spacing between the samples, expressed as a percentage of the width of the swatch. This field is disabled when only 1 sample is specified.The approximate position of the specified samples is displayed in the square below.

» Click Calibrate and follow the on-screen instructions.

1.2.6.2. Print and Measure the Linearization Chart

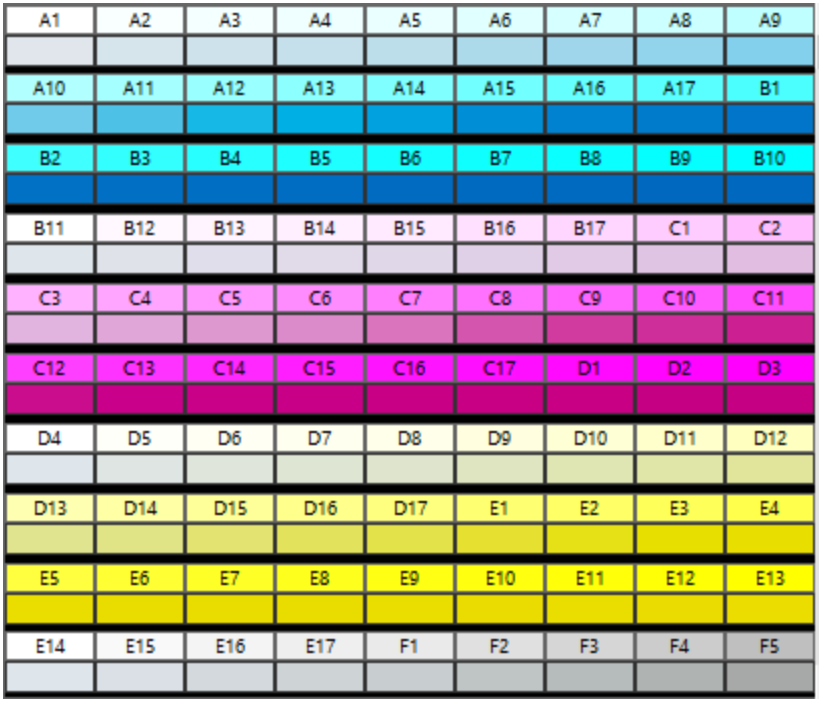
» Select an **Increment size**. The smaller the % increment, the larger the number of swatches that will be required in the target.

Enhanced	Light and dark swatches print in increments of 2%, while the other swatches print in increments of 5%.
5%	Swatches print in increments of 5%
10%	Swatches print in increments of 10%

» Click **Print Target**.

» Click the **Measure** button to measure the swatches with your measuring device.

» After you measure the swatches, check to see that the measured swatches line up with the target swatches.



- If you need to remeasure swatches:
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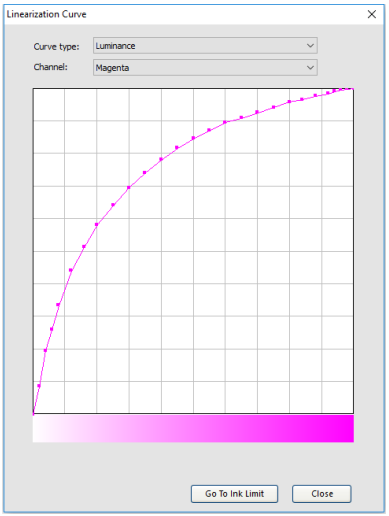
  - To remeasure a single swatch, select the swatch and click Remeasure one swatch button.

Depending on the type of measurement device you use, the choices for remeasuring may be limited.

1.2.6.3. Check the Linearization curve

To see the linearization curve, do one of the following :

- Double click any measurement swatch.
- Click the Linearization curve button 
- The curve should be a relatively smooth arc without any drastic dips, spikes or sections where the curve levels off. An arc containing drastic dips, spikes or level areas is an early indication of measurement errors or improper ink limiting.



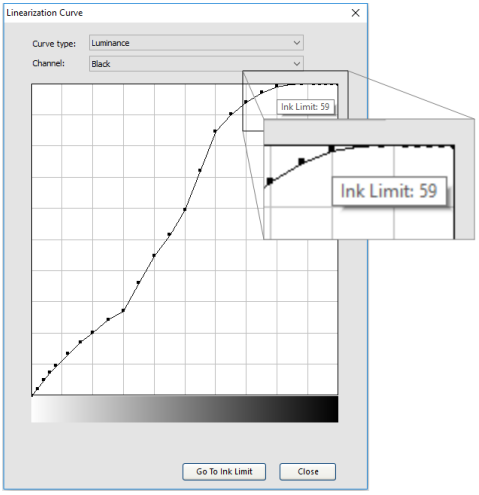
Curve type	Choose a curve type.	
	Delta E	This type of linearization curve is best to look at lighter colors, such as yellow.
	Luminance	This type of linearization curve is best to look at darker colors, such as black, magenta, cyan
Channel	The color channel for which you want to view the Linearization curve.	

» Click **Next** to Continue

You can import linearization measurements from another icc profile generated in Flexi.

EXAMPLES OF BAD LINEARIZATION CURVES AND HOW TO FIX THEM

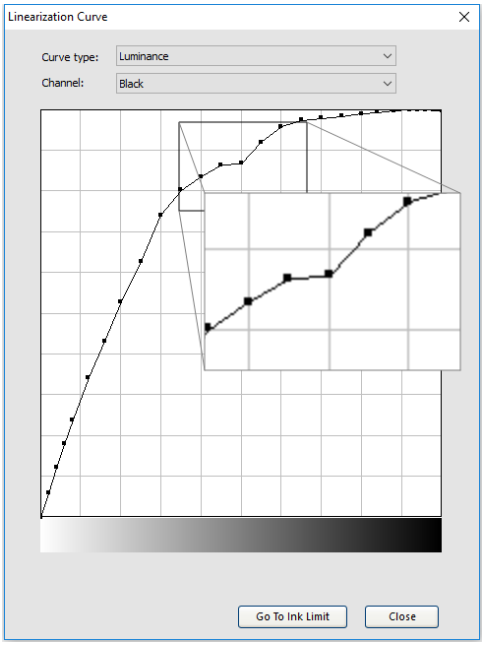
The linearization curve flattens or decreases towards the end



» The reason : Adding more ink does not always result in colors getting darker. There is a point for each printer / ink / media combination where the density of the color stays the same regardless of putting more ink down. For some combinations, putting more ink down actually results in the density dropping.

- To solve this problem :
  - Click on the first dot of the linearization curve where it flattens. This will show you what the ink limit setting for that dot would be.
  - Return to Single Ink Limits and adjust the value of the channel with this number.
  - Continue through the steps and print and measure the linearization chart again.

There is a drop in the middle of the curve



- The most probably reason for this is a bad measurement.
- To solve this problem : measure the linearization chart again. If your spectrophotometer supports it, you can just read this swatch or the strip again.

1.2.7. Multi Ink Limits

Multi-ink limit helps determine the bleed limit of your printer by printing multiple combinations of inks in different ratios.

- Click the **Print Multi-ink Limit** Test button.
- From each row of the print, determine the swatches that are highest on the coverage scale where no bleeding or over-saturation occurs.

Ideal output

Over-saturated swatch

- Enter the swatch values in the Ink Limit field.
- Click **Print Multi-ink Limit Verification** to output a print that includes the changes you made to the Ink Limit values.
- Repeat steps 2 through 4 until a satisfactory set of multi-ink limits has been determined.
- Click **Next.**

1.2.8. Single Ink Limits

The ink limit is the amount of ink a particular type of media is capable of absorbing. Ink limits will vary depending on the selected printer resolution. Higher resolutions dispense more ink, and therefore have more trouble with ink absorption.

- Click the **Print Ink Limit Test** button.
- Examine the test print for over-saturation.

How to check for Over-saturation.

When looking at the test print, you should check the print to see if the swatches are over-saturated. Symptoms include ink bleeding, color mixing and ink that takes an excessive amount of time to dry.

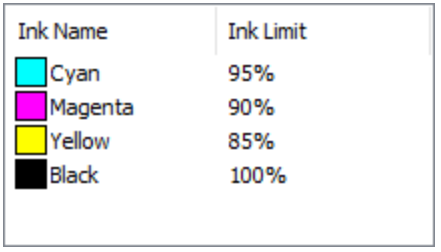
Ideal output

Over-saturated swatch

- For each color channel, do the following:
  - Determine the swatch highest on the coverage scale where over-saturation does not occur.
  - If any swatches are identical to each other, choose the swatch that is lower on the coverage scale to save ink.
- Enter the resulting increments in the Ink Limit field. You can enter any number in between increments. For example, if 85% is too low and 90% is too high, you can enter 87%.
- If your test print looks fine, and the colors do not appear to be over-saturated, continue creating a profile.

You may need to do one or more Ink Limit test prints to determine the appropriate percentages. Be careful not to over-limit the swatches. Over-limiting will reduce the number of viable points with which to produce a profile.

- If the test print is not satisfactory, adjust the Ink Limits for the color channels in use by editing the Ink Limit values.



- Click the **Print Ink Limit Verification** button to print a test with the new Ink Limit values applied.
- Repeat steps 2 through 4 until a satisfactory set of ink limits has been determined.
- Click **Next.**

1.3. Modifying or Resuming an ICC Profile

You can save the creation of an ICC Profile at any point. To save the ICC Profile, click the Save button at the bottom of the window.

To continue creating an ICC Profile at a later time, open the Color Profiler and select Modify or Resume an ICC Profile.

To modify an existing ICC Profile, open the Color Profiler and select Modify or Resume an ICC Profile.

You can change settings in the Profile Setup tab and the ICC Generation tab without affecting other settings. If you change settings in any other tab, you may have to recreate part of the profile.