

EFI Fiery™ XF / proServer Version 6.1

Fiery Wide Format Products

VUTEK LINEARIZATION FIERY XF / FIERY PROSERVER 6.1



Purpose of this document

This documentation will guide you through the process of creating a linearization and profile for your EFI VUTEk printer. It will also provide hints on how to achieve specific compromises between gamut size and ink saving.

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A brief history of VUTEk linearizations

When Fiery XF first started supporting EFI VUTEk printers in version 3, the same standard Fiery XF linearization was used as for any other printer.

Later a dedicated Advanced VUTEk linearization was added with "Advanced" color modes for extended control of ink limiting and light/norm ink builds. It was implemented in parallel to the standard linearization, so that, for example, the "CMYK" color mode used the standard linearization, whereas "CMYK, Advanced" used the Advanced VUTEk linearization.

Later still, all new EFI VUTEk printer drivers used only the Advanced VUTEk linearization, and the standard linearization was dropped altogether for these printers.

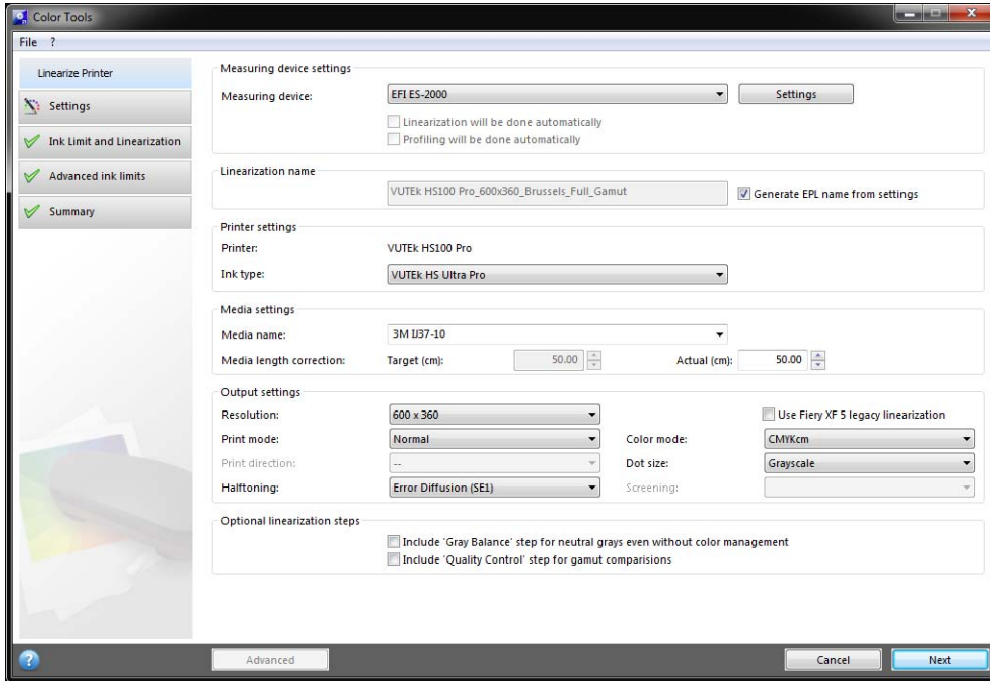
Although the amount of control the 9-step Advanced VUTEk linearization wizard provided to customers was far superior to the standard linearization, the complexity and time it took to complete a linearization was increased as well.

Fiery XF 6.1 has a completely new VUTEk linearization for the standard color modes (e.g "CMYK"). The wizard provides the same amount of control as the Advanced VUTEk linearization, but requires only 4 steps (+ 2 optional steps). This greatly reduces the complexity and time required to create a new linearization and, due to carefully chosen default values, even allows color novices to achieve excellent results quickly.

The Advanced VUTEk linearization of former versions (5.x / 6.0.x) is still available, in addition to the new VUTEk linearization wizard, and can be activated through a dedicated check box in the "Settings" step. It has been retained only for legacy reasons, and there should not actually be any reason to use it, as the new VUTEk linearization wizard is far superior!

VUTEk linearization wizard

Step 1: Settings



- Purpose of this step
 - The "Settings" step allows you to define the basic parameters of your linearization, such as the resolution, color mode, dot size and halftoning method.

- Measuring devices

It is recommended that you use one of the following measuring devices / measurement modes:

Measuring device	Comments
ES-2000, M2	<ul style="list-style-type: none"> • UVCut • Dual-pass measurements • Supports any media
ES-2000, M0	<ul style="list-style-type: none"> • Single-pass measurements • Supports any media without optical brightener
ES-1000, M2	<ul style="list-style-type: none"> • UVCut • Single-pass measurements • Supports any media
ES-1000, M0	<ul style="list-style-type: none"> • Single-pass measurements • Supports any media without optical brightener
iSis, M2 / M0	<ul style="list-style-type: none"> • Automated measurement • Does not support thick materials or textiles

Although you can use any other supported measuring device as well, it is recommended that you check the measurement consistency on your media to prevent unwanted side effects.

- **Use Fiery XF 5 legacy linearization**

By default this check box is unchecked. Selecting it will switch the new VUTEk linearization wizard back to the old legacy Advanced VUTEk linearization wizard with 9 steps.

It is highly recommended that you leave this check box unchecked as the new VUTEk linearization introduced with Fiery XF / Fiery proServer 6.1 is easier, faster and achieves superior results.

- **Halftoning**

The halftoning method SE2 has been reintroduced. Select the halftoning method that is most suitable for your purpose.

Halftoning method	Comments
Error Diffusion (SE1)	Recommended for "fixed dot". Sharpest results on small fonts and fine contour lines.
Stochastic Screening (SE2)	Recommended for "grayscale". Faster processing time than SE1. Potentially smoother results in gradations and full tones.

- **Optional steps**

The Fiery XF / Fiery proServer 6.1 VUTEk linearization provides two optional steps:

- *Include "Gray Balance" step for neutral grays even without color management*
- *Include "Quality Control" step for gamut comparisons*

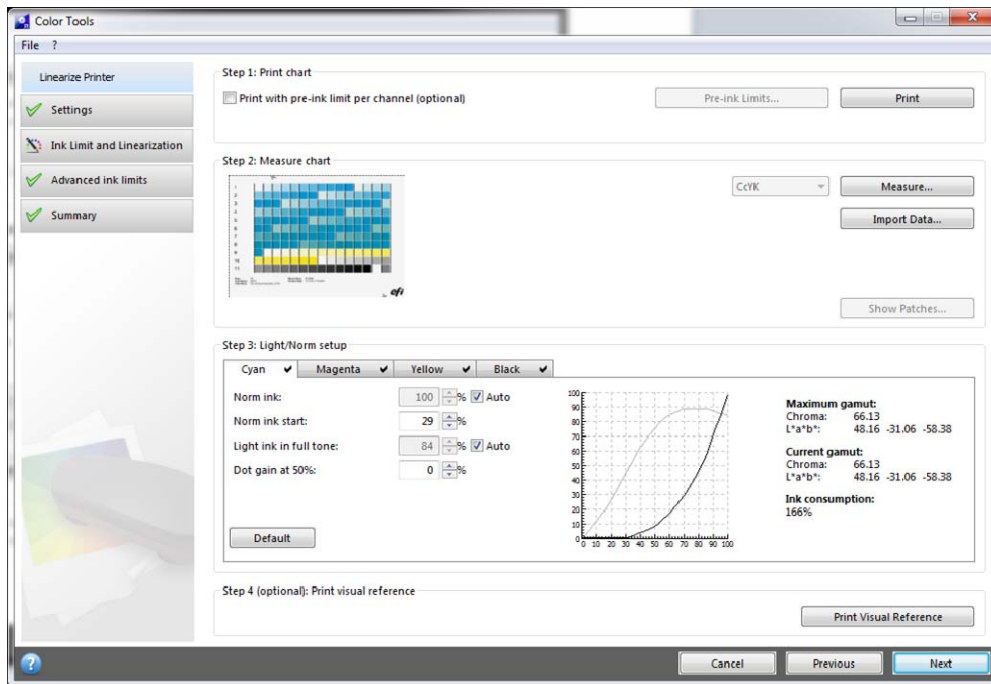
Select the "Gray Balance" step if you want the linearization to balance the C, M and Y curves in such a way that they produce neutral grays even before the ICC profile is created. This step was introduced to help Color Profiler Suite achieve more neutral grays, but is typically no longer needed due to the updated linearization curve algorithms in Fiery XF 6.1.

It is recommended that you leave this check box unchecked.

Select the "Quality Control" step if you want to evaluate and/or compare the resulting gamut of your linearization before creating a profile (e.g. to change parameters before you decide to print the profiling target). By selecting this step, you can evaluate the gamut and optionally compare it to reference profiles such as GRACoL or ISOcoatedV2 or any custom profile (e.g. one of another EFI VUTEk printer) that you load.

Only select this check box if you want to evaluate the gamut.

Step 2: Light norm ink build

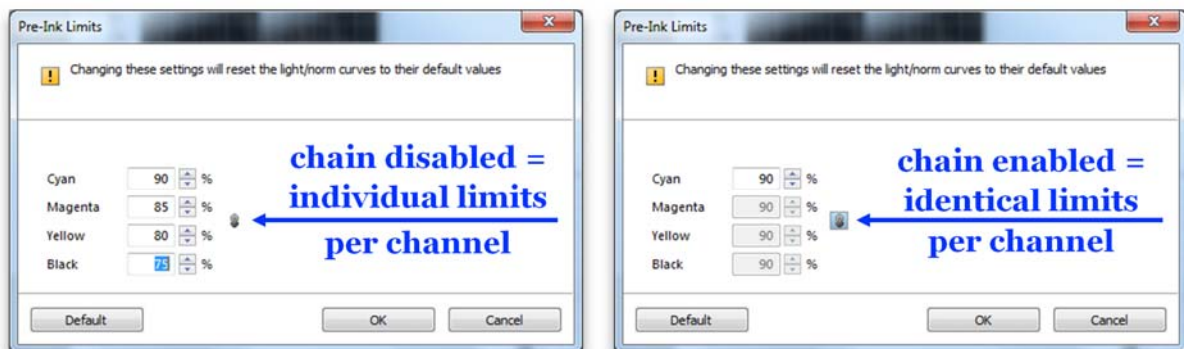


➤ Purpose of this step

- The "Ink limit and Linearization" step will help you to build the light/norm ink curves (or just norm ink curves for a color mode without light ink) for your linearization.
- Defining the behavior of light and norm ink linearization curves and ink limits is important for the gamut size and/or ink savings you may want to target.

The check box "Print with pre-ink limit per channel (optional)" is optional and allows you to define pre-ink limits before you start the linearization.

Clicking the chain icon allows you to influence all ink limits at the same time.



Pre-ink limits are only useful if your printer/media combination cannot handle the full amount of inks, and bleeding, mottling or drastic ink thickness effects can be seen on your primary color gradations.

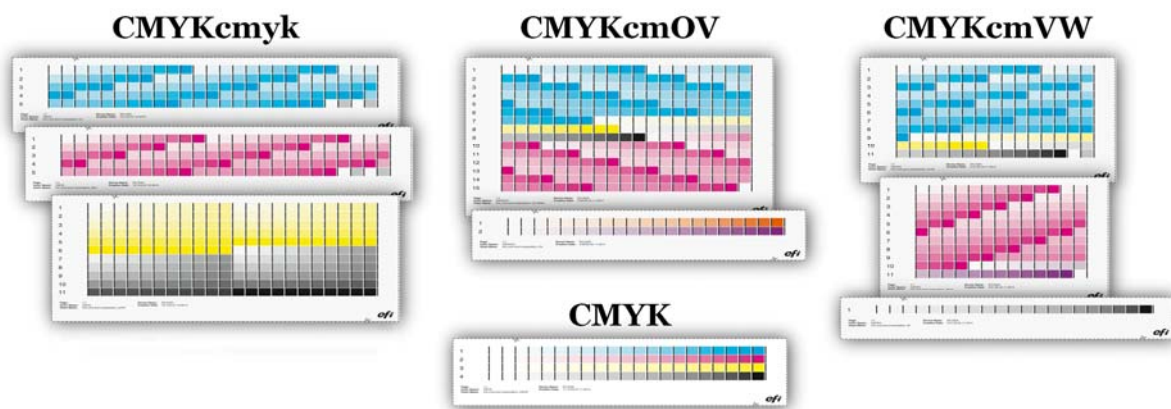
Important:

Pre-ink limits have been applied to all 1000 dpi resolutions so that the default gamut of 1000 dpi will match the gamut of 600dpi! This behavior was requested by many of users and allows you to align easily the color of 600 dpi and 1000 dpi resolution modes.

However, if you want to use the full gamut capabilities of the 1000 dpi mode (e.g. for backlit applications), reset all pre-ink limits for the 1000 dpi resolution to 100%!

If in doubt, leave this check box unchecked, as applying pre-ink limits to your channel(s) may noticeably reduce the gamut you can achieve with the linearization.

Print and measure the newly designed light/norm charts.



Small check marks appear next to the channel name on each tab if measurement data is present.

Use the displayed values for Chroma and $L^*a^*b^*$ on the right side of the Color Tools window to evaluate the "Maximum gamut" you can achieve with the current combination of printer, media and ink and compare it with the "Current gamut" you will achieve based on the settings you have chosen.

These values provide reliable feedback if you want to achieve a certain compromise between ink saving and gamut size.

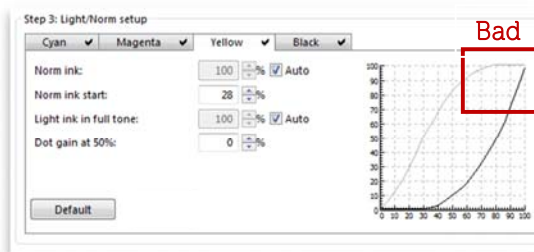
The "*Ink consumption*" value represents the approximate amount of ink used for the reproduction of a gradient from 0% to 100% of the selected input channel, taking the shape of the light- and norm ink and the pre-ink-limits into account.

- 100% is equivalent to an unlinearized input channel using norm ink only.
- 200% is equivalent to an unlinearized input channel using a combination of light ink and norm ink (= 100% light ink unlinearized + 100% norm ink unlinearized)."

The default values of the VUTEk linearization will automatically aim for the biggest possible gamut size. You can always return to the default settings by clicking "Default" on each ink channel tab.

The following controls are available if you require advanced controls:

- **Norm ink**
 - If the "Auto" check box is selected, the VUTEk linearization automatically determines the amount of norm ink that is used to achieve the biggest possible gamut for this channel.
 - Clearing "Auto" allows you to overwrite this value manually.
 - Note that the value (e.g. "85%") is the maximum amount of norm ink you allow the VUTEk linearization to use – it is not an absolute value. In other words, a setting of "85%" would allow the VUTEk linearization to use "up to 85%" norm ink. If the analysis of the measurement data shows that the maximum gamut could be achieved at 79%, then the VUTEk linearization will choose a value of 79%. Evaluate the curve to the right to see how much norm ink is used. The dark colored curve is the norm ink curve.
- **Norm ink start**
 - The ideal starting point of the norm ink curve is automatically determined by the VUTEk linearization.
 - You can review the color gradients on the "Visual Reference" chart, which you can print by clicking the appropriate button at the bottom of the Color Tools window. If necessary, you can change the transition point at which norm ink is added (e.g. because the bigger norm dots are kicking in too strongly), you can overwrite the default value.
 - The "Norm ink start" value can also be used to save ink. By letting norm ink start sooner (lower values) you reduce the amount of light ink overall, but it may lead to grainy results.
 - If you change the "Norm ink start", make sure you avoid "flat curves":

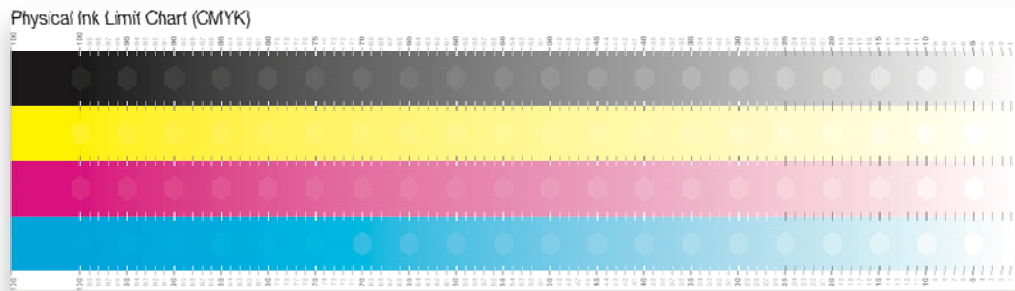


- If in doubt, do not change the default value!

- **Light ink in full tone**
 - If the "Auto" check box is selected, the VUTEk linearization automatically determines the amount of light ink in the full tone to achieve the biggest possible gamut for the channel.
 - Clearing "Auto" allows you to overwrite this value manually.
 - Note that the value (e.g. "50%") is the maximum amount of light ink you allow the VUTEk linearization to use in the full tone – it is not an absolute value. In other words, a setting of "50%" would allow the VUTEk linearization to use "up to 50%" norm ink. If the analysis of the measurement data shows that the maximum gamut could be achieved at 10%, then the VUTEk linearization will choose a value of 10%.
 - You can use this setting to achieve a targeted compromise between maximum gamut (typically a greater amount of light ink the full tone) and ink saving. You can force the linearization not to use any light ink in the full tone at all by entering 0%.

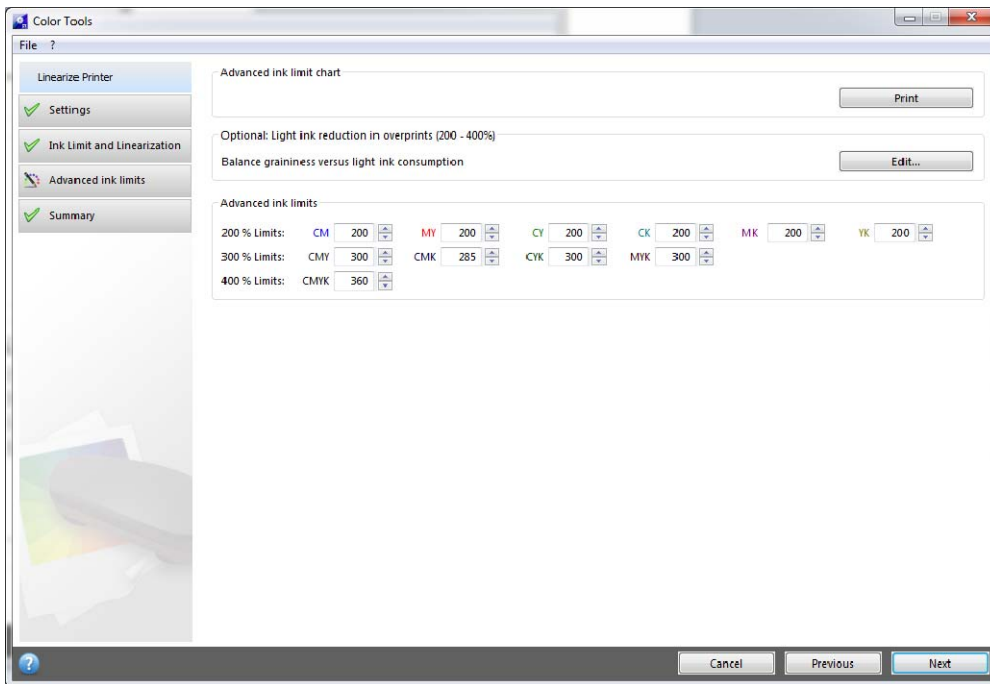
- **Dot gain at 50%**
 - The dot gain setting allows you to influence the C, M, Y and K curves individually if you want to add a certain dot gain to the linearized state.
 - This can be useful in certain situations but, in general, it is recommended that you leave the value at 0%.

“Print visual reference” allows you to review your settings by evaluating the primary color gradations in a chart similar to the one illustrated below, e.g. for the CMYKOV color mode. The chart below is for CMYK:



Proceed to “**Linearizing white ink**” if you want to learn about how to linearize white ink.

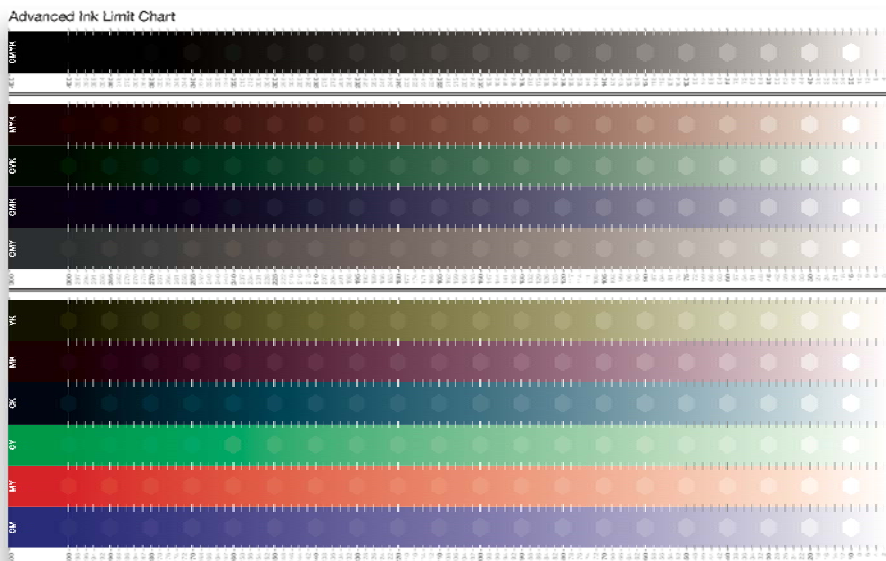
Step 3: Advanced ink limits



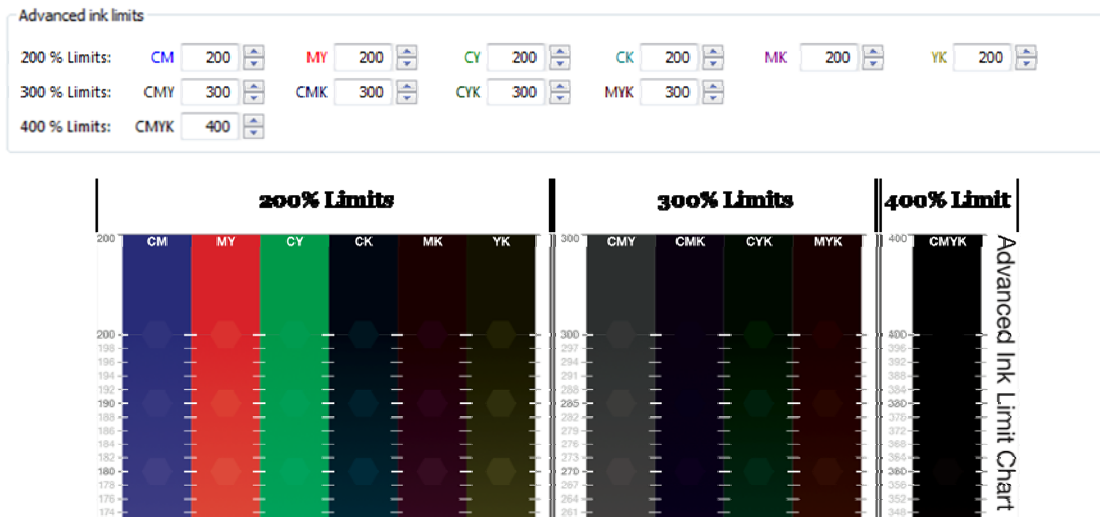
➤ Purpose of this step

- The "Advanced ink limit" step allows you to set 200%, 300% and/or 400% ink limits.
- Its main target is to cut off gamut areas that are not needed or that can potentially cause issues for profiling.

In this step, start with printing the "Advanced ink limit" chart. The step is optional, but highly recommended.



Note that the ink limits shown from left to right in the Color Tools window are shown on the chart from bottom to top!



Evaluate the chart to identify any need for 200%, 300% and/or 400% ink limiting.

Search for over-inking, inversions, graininess, mottling, ink stacking issues and/or lack of detail.



The Advanced ink limit chart has hexagon shapes on it. Each hexagon has a 5% lower ink coverage than its surrounding area. For example, the 90% hexagon has an ink coverage of 85%. If you can see a hexagon it means that the linearization shows a tonal difference between the two ink coverages. This is the targeted behavior.

If one or more hexagons are not visible, you should consider applying ink limits to cut off the area with no tonal differences. If, for example, you can see the hexagon for the 360% CMYK limit, but the one at 380% is not visible, consider applying a CMYK ink limit of 360-370%.

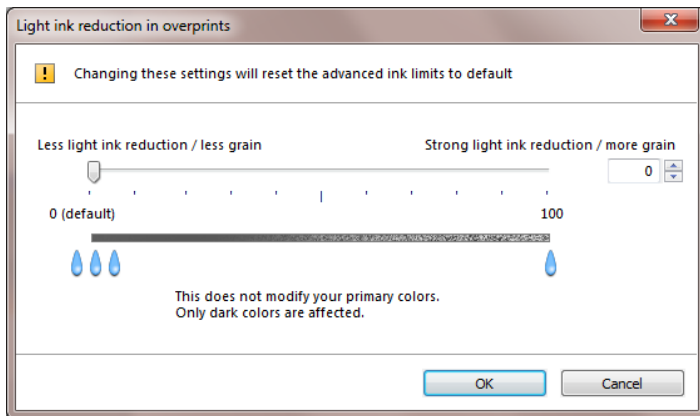
Any ink limit that you enter is based on absolute values.

Example: If you apply a 180% ink limit to "CM" (Cyan + Magenta) and then reprint the "Advanced ink limit" chart, the 200% CM area on the chart will be printed with 180% coverage, i.e. 90% Cyan and 90% Magenta. Note that the description on the chart does not dynamically change.

The following procedure is recommended:

- Print the "Advanced ink limit" chart.
- Visually evaluate it.
- Apply ink limits, if necessary.
- Click "Next" without reprinting the chart or doing any further iterations, as this is typically not necessary.

Light ink reduction in overprints



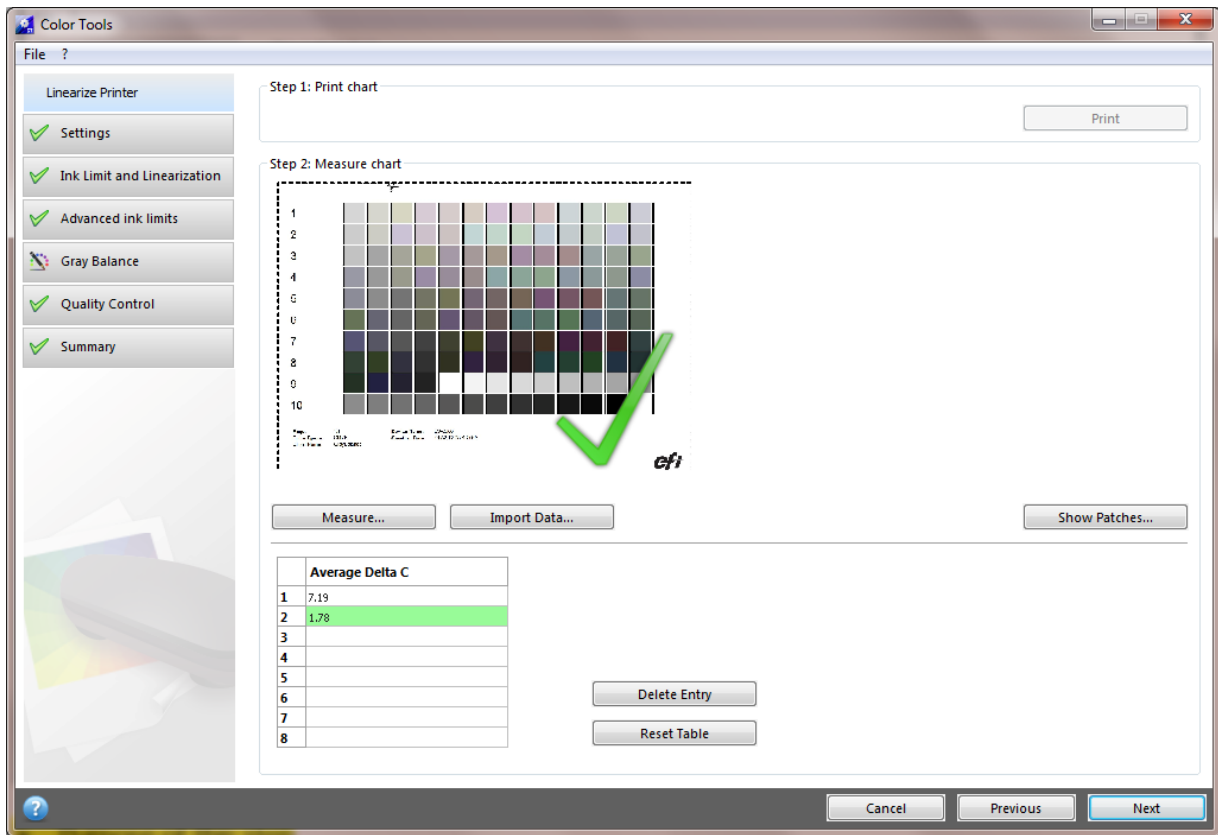
"Light ink reduction in overprints" allows you to reduce dynamically the amount of light ink in overprints, i.e. in areas with more than one color full tone.

It is recommended that you leave the value at "0" (default value).

Increasing the value reduces the percentage of light ink, which leads to a certain amount of ink saving, but at the risk of inversion effects, i.e. gradations that should become increasingly darker suddenly show lighter areas.

Be careful when changing this setting and visually evaluate the "Advanced Ink Limit" chart.

Optional step: Gray balance



➤ Purpose of this step

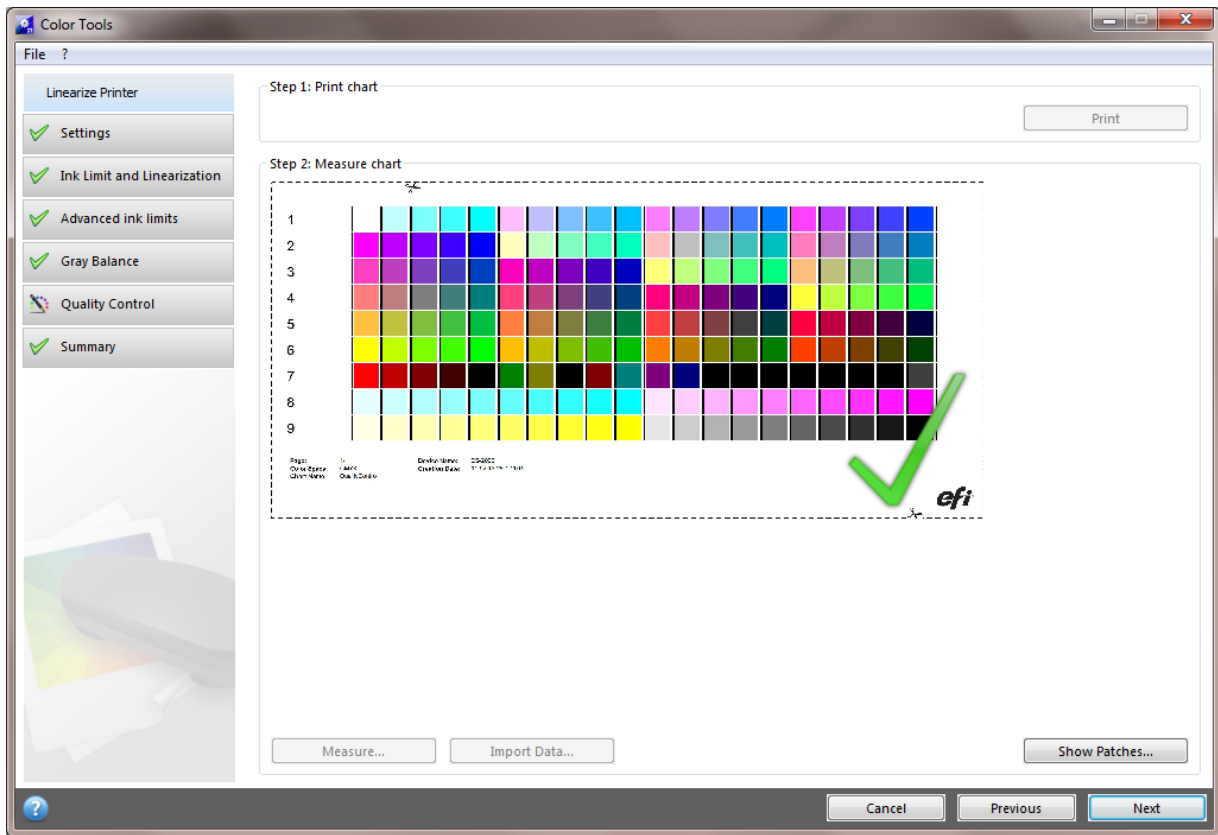
- The optional “Gray balance” step allows you to align the C, M and Y curves to a neutral gray.
- Typically the 3-dimensional lookup tables of the ICC profile generation will take care of the reproduction of neutral grays, but aligning C, M and Y beforehand can make the job easier for the profiler, especially when smaller charts are used.

Proceed as follows:

- Print the chart.
- Measure the chart.
- Review the resulting “Average Delta C”.
 - “Average Delta C” is a unit that describes the average chromatic difference of the gray gradation.
 - The higher the value, the stronger a color cast of gray.
 - You should target an “Average Delta C” value of “2” or less.
- If further optimizations are possible (as indicated by an arrow in Color Tools window), repeat the process of printing and measuring until you reach a value of “2” or less.
- If the “Average Delta C” value increases in one step instead of decreasing, you can ignore that iteration step. Click on the iteration step that yields the best (lowest) result and click “Next”.

Note: You can skip this step altogether, even if you selected it in the “Settings” window, by just clicking “Next”.

Optional step: Quality Control



➤ Purpose of this step

- The optional "Quality Control" step captures the "color foundation" of your linearization by measuring representative color patches.
- Capturing this measurement data is very useful if you want to evaluate/compare gamut sizes before you proceed with profiling. However, it is not mandatory.

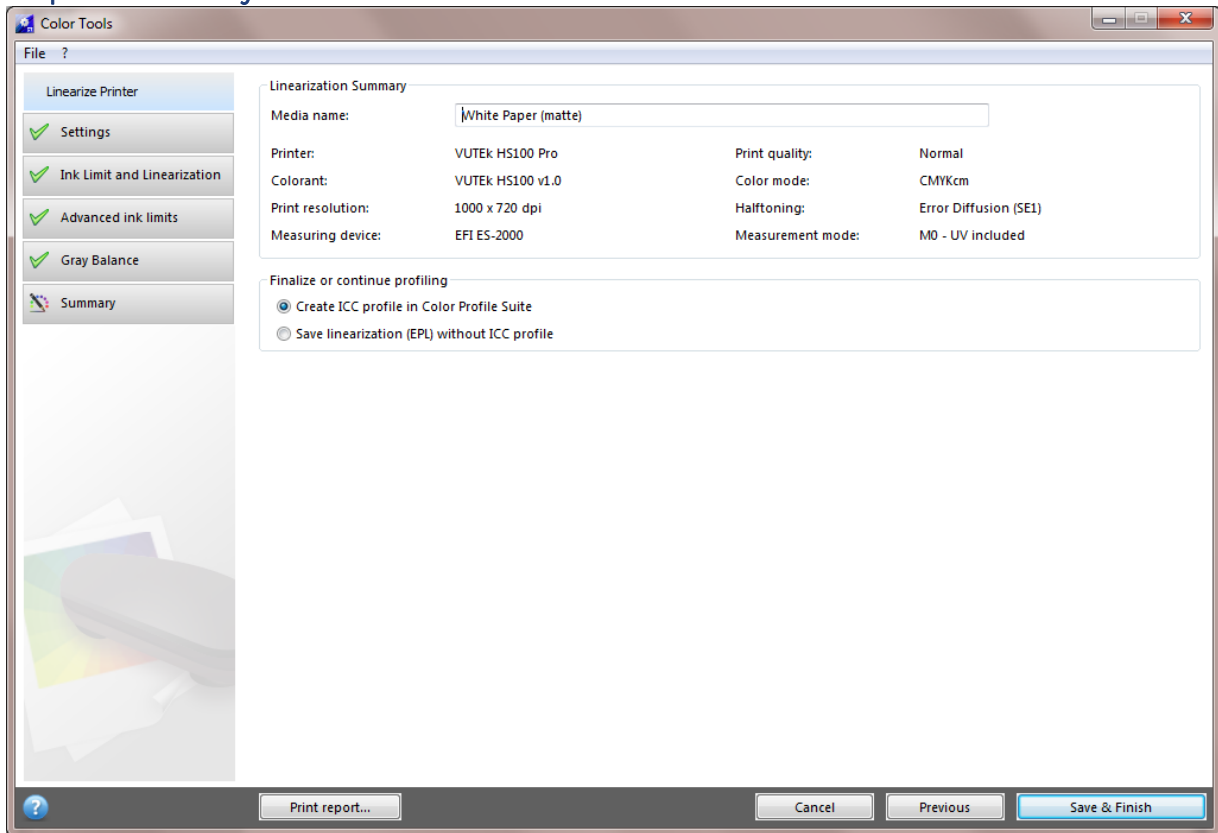
The measurement values can be used to compare the gamut achieved by the linearization in the "Summary" step.

Print and measure the "Quality Control" chart.

No further interaction is required in this step as the Quality Control chart measurement data is just used to unlock functionality in the "Summary" step.

Note: You can skip the "Quality Control" step, by returning to the "Settings" window and clearing the appropriate check box. The linearization steps you have already completed are not lost.

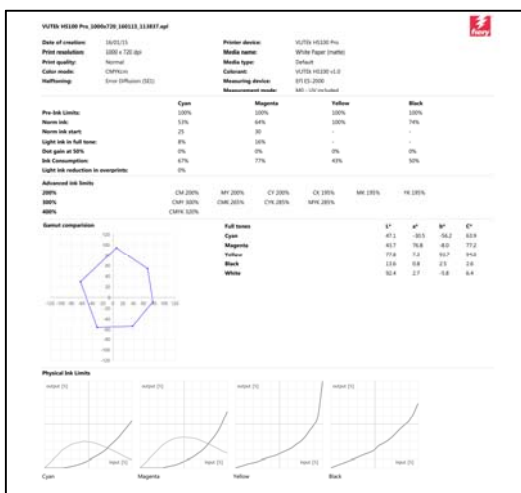
Step 4: Summary



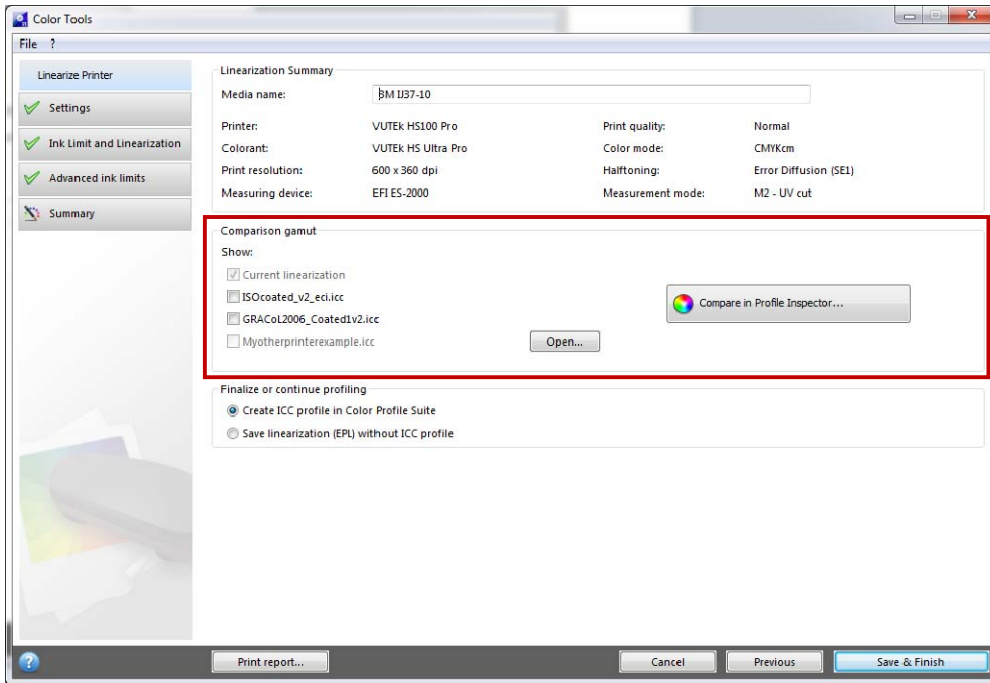
➤ Purpose of this step

- The "Summary" step displays the most important settings of your linearization. You can also change the "Media name" in this step if you want to.

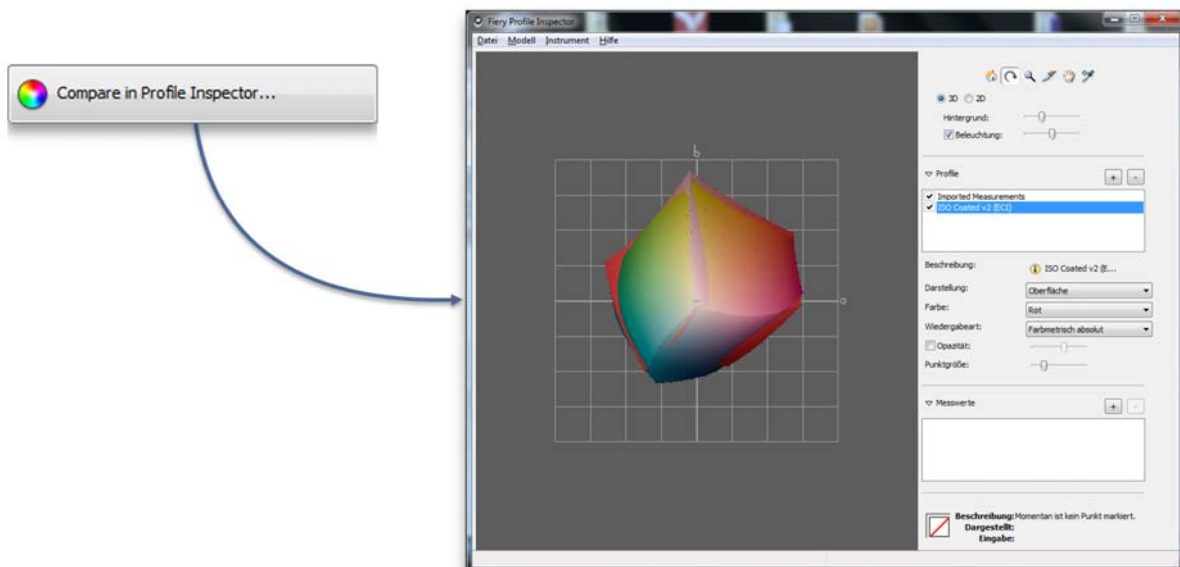
You can display an HTML report that summarizes all linearization settings, by clicking "Print report" at the bottom of the Color Tools window.



If you have printed and measured the "Quality Control" chart, the "Comparison gamut" section is available:



It allows you to evaluate or compare the gamut of your linearization with one of the standard reference color spaces and/or any custom ICC profile. Click "Compare in Profiler Inspector" to start Fiery Profile Inspector:



This can be useful if you want to ensure that the gamut is large enough before you proceed with profiling in Color Profiler Suite.

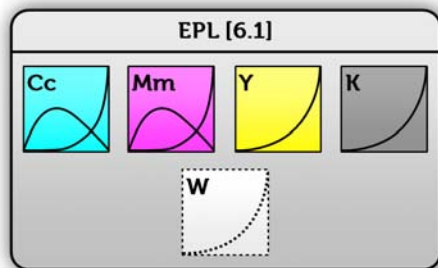
Linearizing white ink

➤ Purpose of a "white ink linearization"

- White ink, if not linearized, shows very noticeable dot gain when printed. This is not an issue for full tones, but the effect can be clearly seen whenever white is printed in gradations.
- Linearizing the white channel just like any other ink channel leads to smooth gradations where the input percentage is the same as the output percentage.

Fiery XF 6.1 actually supports two different ways to create a white linearization.

The recommended path to a white linearization

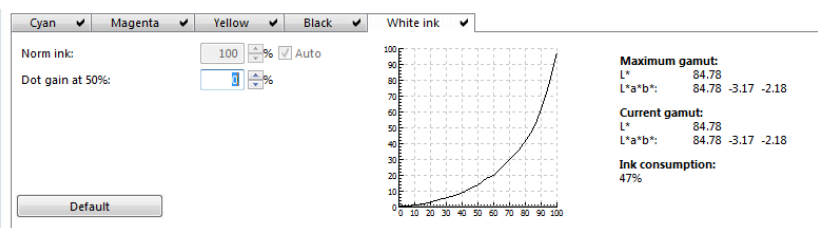


- Any linearization (EPL) created for a printer driver *without* "White" in its name automatically includes a generic white linearization for the specific combination of ink type, ink head technology, printer resolution and dot size.
- If you apply such a linearization to an EFI VUTEk printer driver *with* "White" in its name, the generic linearization is applied to the white ink channel to ensure that you achieve smooth results.
- Based on experience, the generic white ink linearization makes it mostly unnecessary to create a custom white ink linearization. However, in some cases, a custom white linearization will lead to even smoother results.
- Note: Remove all VCC and CxF files that were created specifically for white ink from your workflow to make sure that they do not interfere with the generic white ink linearization.
- Note: If you open a linearization with a generic white ink linearization in Color Tools for a printer driver *with* "White" in its name, you cannot see the white ink curve as it is applied under the surface and is completely invisible to users.

The optional path to a white linearization

- If you create an EPL for an EFI VUTEk printer by choosing a printer driver *with* "White" in its name, the "Ink limit and linearization" step will also print a white ink chart.
- Click "Print" and open the RTLs on the VUI.
- Do the following steps if you want to print white ink on a black media:

- o Right-click each RTL file and create a multilayer job.
- o For all charts (except the file with "Ink Limit and Linearization_**W**" chart in its name):
 - Under "Colors", clear "White" for the top layer in the image.
 - For the bottom layer, select "White Flood".
 - You can improve the ink coverage, if required, by adding a second white layer. To do so, select three layers on the Multilayer panel. Then, select "White Flood" for the middle and bottom layers.
- o For the white linearization chart (the file with "Ink Limit and Linearization_**W**" in its name):
 - Under "Colors", select "White From Image" for the bottom layer.
 - Make sure that "White" is cleared for the top layer.
 - You can improve the ink coverage, if required, by adding a second white layer. To do so, select three layers on the Multilayer panel. Then, for the middle layer, click "Select Image", and browse to the RTL file that was used to create the multi-layer job. When the image has been loaded, under "Colors", clear all colors for the middle layer, except white.
- o In general, use the print options of each (multi-layer) job to set the smoothing level, and margins, etc. Use the interlace mode "Double strike" to increase the ink density, if needed. As this setting has a high impact on the output color, it is recommended that you include "double strike" in the name of the base linearization file. Multi-layer jobs cannot be grouped together into a layout, so you must print them separately.
- Print and measure all ink limit and linearization charts until you see a check mark on the "White" ink tab, indicating that measurement data is available.
- When it has been measured, the linearization curve for the white ink channel is calculated and displayed.
- Note that the "Norm ink" setting cannot be edited. It is automatically set to 100% as there is no need to apply ink limits to the white channel. However, you can apply a pre-ink limit to the white ink channel if you absolutely want to limit it, although this is not recommended.
- It is recommended that you leave the "Dot gain at 50%" setting on the "White ink" tab at "0%".



- **Important:** Custom white ink linearizations are currently not supported for transparent material. Please stick to the "recommended" path to a white linearization for transparent materials and use our generic white linearization.

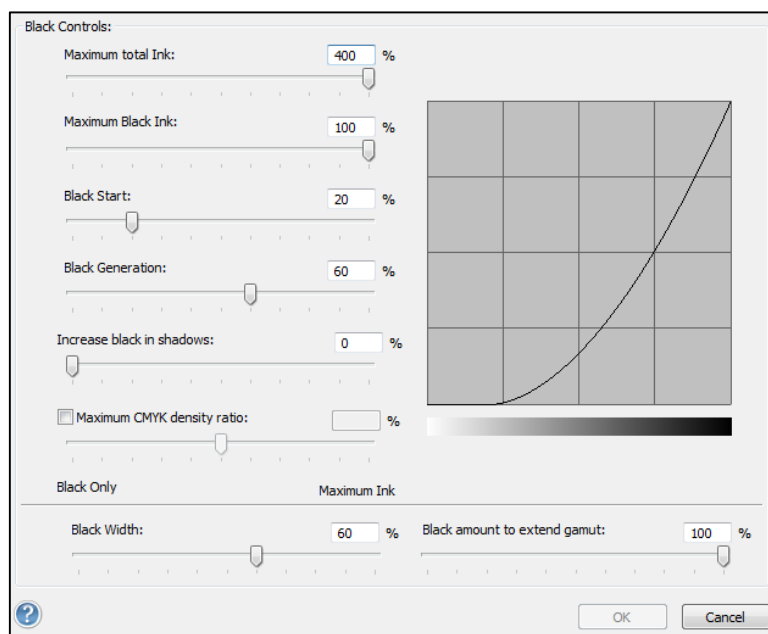
Creating a Media Profile

➤ Purpose of the "Profiling" wizard

- The "Profiling" wizard guides you through the steps required to create an ICC profile for your VUTEk linearization.

IT8.7/4 is the recommended profiling chart to use. Smaller charts may also produce good results, as well reducing the measurement effort, but the IT8.7/4 includes enough patches to characterize any gamut shape and is the best choice overall.

The black generation settings below are recommended for EFI VUTEk printers:



- **Maximum total ink** – always keep this at 400%.
- **Maximum black ink** – always keep this at 100%.
- **Black start** – ~30-35% for 4-color printers; ~20-25% for 8-color printers
- **Black generation** – 60% recommended. (Higher values help with ink saving, but at the expense of higher graininess.)
- **Increase black in shadows** – always keep this at 0%.
- **Maximum CMYK density ratio** – it is recommended that you leave this setting unchecked. (A setting of 0% would use black only for the darkest point, whereas a setting of 100% would use 400% CMYK for the darkest point.)
- **Black width** – always keep this at 60%. (Higher values help with ink saving, but at the expense of higher graininess.)
- **Black amount to extend gamut** – always keep this at 100%.

Hints on saving ink

The following settings will help you to achieve a specific compromise between gamut size, graininess and ink saving.

Note that ink saving is very application-dependant. Saving ink at the expense of smoothness may be perfectly fine for an outdoor advertisement viewed from a typical distance of 3-5 m, but less aggressive ink saving might be more appropriate for an indoor advertisement and a viewing distance of 50 cm.

Recommended linearization tools for ink saving:

Step	Feature/setting	Ink saving potential	Risk	Recommended for ink saving?
Ink Limit and Linearization	Lower "Norm ink"	Medium	Loss of gamut	No
Ink Limit and Linearization	Lower "Norm ink start"	High	Increased graininess	Yes
Ink Limit and Linearization	Lower "Light ink in full tone"	High	Loss of gamut, increased graininess	Yes
Advanced ink limits	Lower "200%, 300% and/or 400%" limits	Low	Loss of gamut, inversions	No
Advanced ink limits	Increase "Light ink reduction"	Low	Graininess, inversions	No
Advanced ink limits	Increase "Light ink reduction in overprints"	Low	Inversions	No

Recommended profiling settings for ink saving:

Step	Feature/setting	Ink saving potential	Risk	Recommended for ink saving
Black Controls	Lower "Maximum total ink"	High	Loss of gamut	No!!!
Black Controls	Lower "Black start"	Medium	Graininess	Yes
Black Controls	Increase "Black Generation"	High	Graininess	Yes
Black Controls	Lower "Maximum CMYK density ratio"	High	Lighter shadow areas	Yes

Compatibility

Note that Fiery XF 6.1 EPLs cannot be used in Fiery XF 6.0 or earlier versions!