Print Control Wizard

How to Select and Set up Crystal S

Contents

Crystal S screens – benefits and requirements

Benefits

Crystal S is a type of 2nd order stochastic screen with flexo-dedicated advanced highlight technology.

- 2nd order stochastic screening: the screen uses different FM dot sizes for different tonal areas for optimal tone reproduction.
- The screen frequency or perceived screen ruling is higher compared to classic AM screening. Therefore the screen adds sharpness and detail to high resolution content.
- Images with high colour saturation can also benefit from higher frequency screening.
- Because of the advanced highlight technology used in Crystal S screens, highlights print stable without hard edges.

Table 1: print sample caption of high-res image printed with Crystal S 300 16-9 (left) and with Crystal V NP C25-9 (right)

Requirements

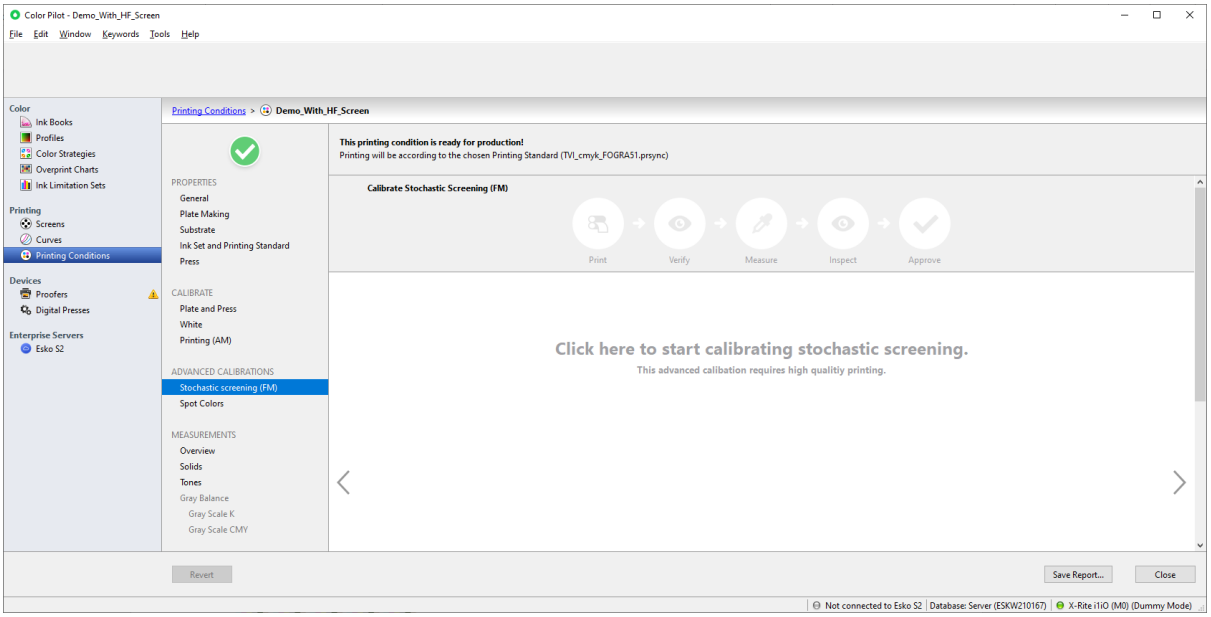
Crystal S screens are high frequency screens and require properly controlled and high-quality platemaking and printing:

- CDI with resolution of 4000ppi
  - For Crystal SQ (Q-Cells as surface screening) you need the CDI Crystal Quartz Edition
  - Crystal S NP do not use surface screening and do not rely on P+ CDI technology
- Exposure: Crystal XPS
- Plate Type: Any XPS certified plate
- Ink + substrate combinations:
  - UV + Paper substrates
  - Water + Paper & Film
- Tape: Soft or Medium Soft
- Anilox: Low volume </= 3.5cm/m2 @ 420lcm or 2.2bcm @ 1100lpi

Setup of Crystal S screen in Print Control Wizard

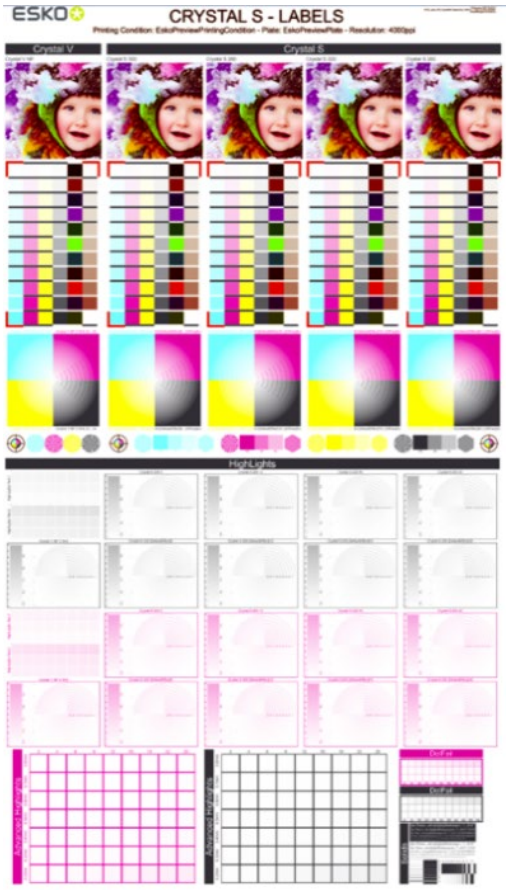
Starting from a finished printing condition

'Print Control Wizard' in Color Pilot also supports creation and setup of Crystal S screens through the 'Stochastic screening (FM)' advanced calibration wizard.
This wizard is only available on existing printing conditions that are successfully calibrated for a Crystal V screen for CMYK (Equinox is not supported yet).
For more information, see the Crystal S section in the Print Control Wizard User guide.



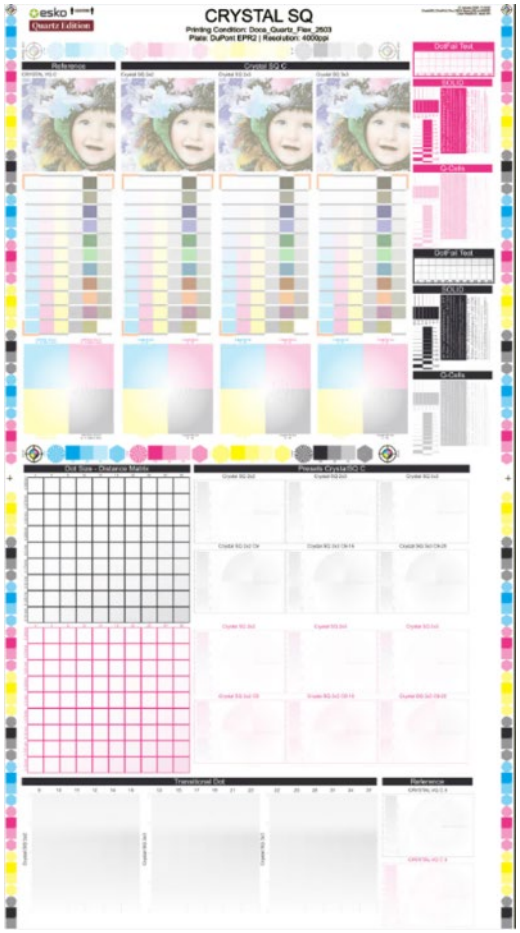
Crystal S calibration Chart

To select and calibrate Crystal S towards a specific printing condition, a dedicated Crystal S chart is generated in the Crystal S wizard; there is chart for Crystal S NP and one for Crystal SQ (with Q-Cells using the Q-Optics).
It is used to select the proper Crystal S screen, select the right highlights and to make the proper tone adjustment curves.



Crystal S NP chart (for Labels)

The top part of the chart is used to select the proper Crystal S screen version and to measure-in the tone response, the bottom part is used to verify the highlights.



Crystal SQ chart (Flexibles or Labels)

The top part of the chart is used to select the proper Crystal S screen version and to measure-in the tone response, the bottom part is used to verify the highlights.

The different dot sizes of a Crystal S screen

A Crystal S screen uses different dot sizes in different tonal areas for optimal and stable reproduction of tones.

Highlight dot

This is the dot size used in the highlights of the screen.

The required dot size for reproducing light tints highly depends on how isolated these dots are in the highlights tonal area of the screen: In flexo isolated fine dots are more difficult to print because they are more fragile; they have deeper shoulders on the flexo plate and/or they have to endure more printing pressure. Crystal S screens modulate tone by changing the number of dots and dot clusters. Therefore, in highlights the distance between dots becomes larger, the highlight dot becomes more isolated. Especially for a Crystal S screen with a low frequency (e.g. Crystal S 180) this can result in the FM dot to print unstable.
In that case the Crystal S screen can be setup with a larger highlight dot compared to its FM dot.

When a Crystal S screen is used with a high frequency (e.g. Crystal S 300), the average distance between dots is considerably shorter.
E.g. For the Crystal S 300, the average distance between dots at 5% is comparable to a 300LPI AM screen.
In that case dots in the highlights of this Crystal S screen can be kept smaller than its FM dot, resulting in less grainy highlights.

Quarter tone FM dot

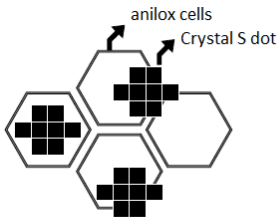
This is the rectangular-shaped FM dot size used by the screen in the tonal area between 5% to 30%.
In this tonal area the FM dots in the screen are isolated: they don't touch each other so they don't form clusters.

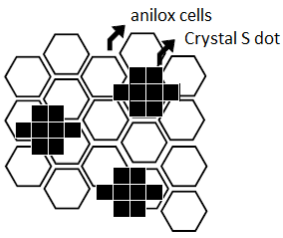
Table 2: Quarter tone FM dot size for the different Crystal S screens

Crystal screen	Quarter tone FM dot
Crystal S 200	20pix (5x4)
Crystal S 220	16pix (4x4)
Crystal S 260	12pix (4x3)
Crystal S 300	9pix (3x3)

It is important to have the smallest possible FM dot size in this tonal area so that the perceived ruling is at its highest, with the least graininess.
However, the anilox grid and volume must support this fine dot.

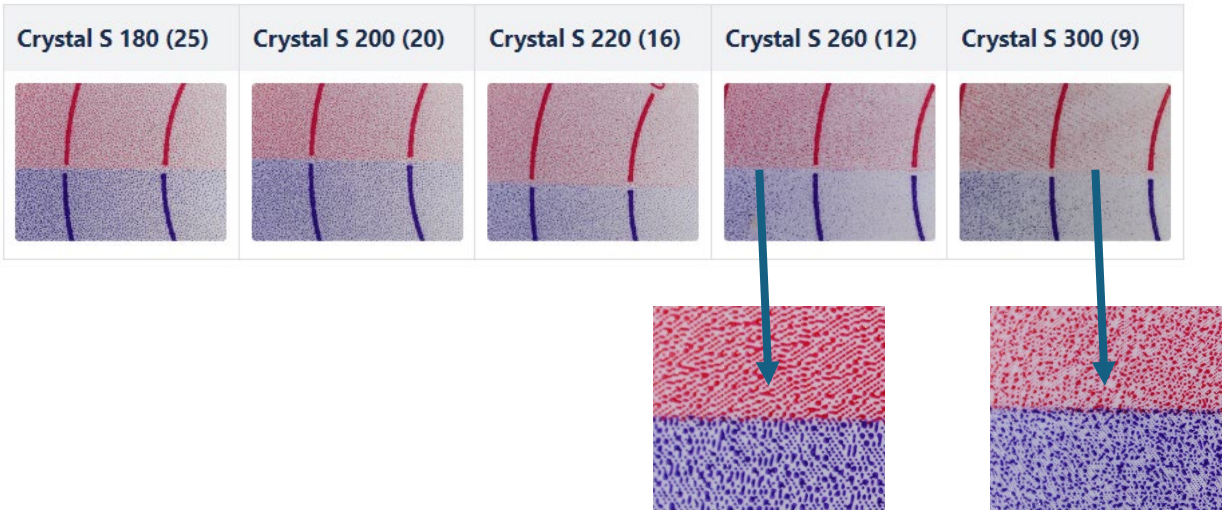
If the anilox volume is too high and/or the anilox grid is too coarse, the mindot (highlights effect) or the FM dot might be under or over-inked.



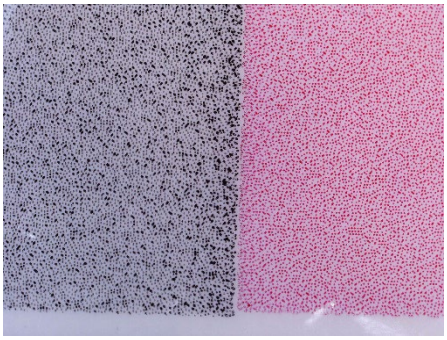


The below images are enlarged print captures of the circular vignettes on the Crystal S calibration chart.
The vignette screened with Crystal S 300 (9) screen shows non-linear behaviour. The FM dot in quarter tones is too fine for the anilox: fine FM dot clusters are not printing while other get over-inked.

Table 3: Comparison of different Crystal S screen in quarter tones



The below image is an enlarged print capture of a 20% black and magenta patch using Crystal S 300.
On the black inked patch, you can see that some dots print lighter than others and the FM dot selected for black is too fine.
On the magenta inked patch, all dots printing equal, so the FM dot selected for magenta is ok



Midtone FM dot

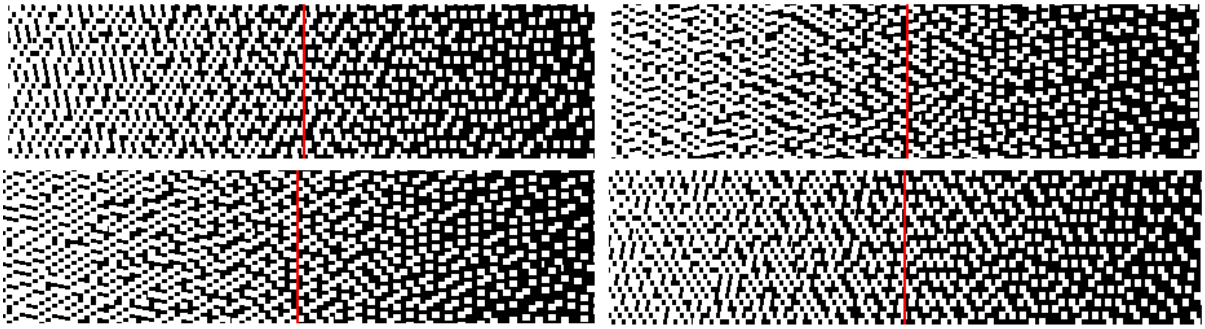
This is the rectangular-shaped FM dot size used in midtones of the Crystal S screens. Midtones cover the tonal area between 30% to 60%.
The FM dot size used in this tonal area is the FM quarter tone dot increased by 1 pixel in both directions.

Table 4: Midtone FM dot size for the different Crystal S screens

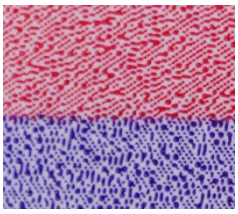
Crystal screen	Midtone FM dot
Crystal S 200	30pix (6x5)
Crystal S 220	25pix (5x5)
Crystal S 260	20pix (5x4)
Crystal S 300	16pix (4x4)

In this area the FM dots are connecting and forming dot clusters.
The positioning and orientation of the dot clusters is different for different screen angles of Crystal S screens. This is to obtain optimal overprint behaviour.

Table 5: Different Crystal S screen orientations / angles

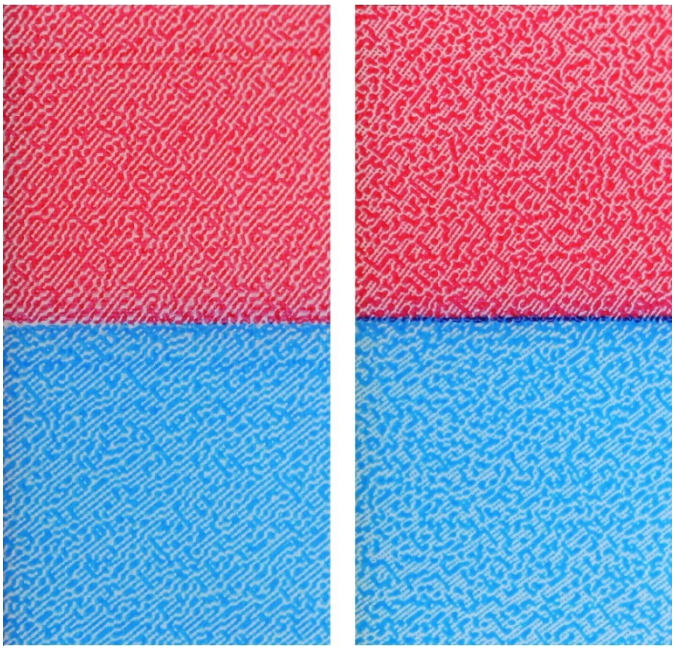


Below is a captured image of a 40% patch printed with Magenta and Cyan.
For magenta a Crystal S screen with angle 37.5° is used, for cyan 7.5° angle is used.
You can see that the orientation of dot clusters is different for the two inks.



This tonal area is most critical towards un-controlled ink-bridging between clusters of dots.
If the screen version is not suitable, the midtones will show patterning, tonal jumps and large dot gain.
It is again important to use an anilox with lowest possible ink volume.

The below image is a capture of a 40% patch printed from 2 conditions.
On the left print the clusters are inked properly, on the right print the clusters are not inked evenly and causing graininess in midtones.



Shadows FM holes

This is the rectangle-shaped FM hole size (non-inked part of the screens) used in shadows of the Crystal S screens.
The FM hole size used in this tonal area is equal to the FM midtone dot size, increased by 1 pixel in both directions.

Table 6: Shadows FM hole size for the different Crystal S screens

Crystal screen	Shadows FM hole Size
Crystal S 200	42pix (7x6)
Crystal S 220	36pix (6x6)
Crystal S 260	30pix (6x5)
Crystal S 300	25pix (5x5)

If this size is too small, holes can be filled with ink resulting in reduction of contrast in the shadows area.

Crystal S screen selection

A Crystal S screen is selected based on its behaviour in midtones:
For the Crystal S NP, 9-pix dot clusters (Crystal S 300) can be used if the printing condition uses very low ink volumes. If inking is less precise, dot bridging can occur between clusters causing tone jumps or patterning around 30-40% tone areas. In that case, larger dot clusters need to be selected, e.g. 16 or 20pix clusters (Crystal S 200). However, using 20pix dots in highlights can cause graininess. In that case, smaller dots should be used in the highlight area of the screen.

The Crystal S NP calibration chart used in Print Control Wizard has 4 basic Crystal S NP screens to select from: **Crystal S 300 9, Crystal S 260 12, Crystal S 220 16 and Crystal S 200 20.**

Same for the Crystal SQ. The Crystal SQ 2x2 has the finest pixelated dots and can be used if the printing condition uses very low ink volumes. If more ink volume is used, a basic Crystal SQ screen needs to be selected with larger pixelated dots, because when dots are too small dot bridging can occur between clusters causing tone jumps or patterning around 30-40% tone areas.

The Crystal SQ calibration chart used in Print Control Wizard has 3 basic Crystal SQ screens to select from: **Crystal SQ 2x2, Crystal SQ 2x3 and Crystal SQ 3x3.**

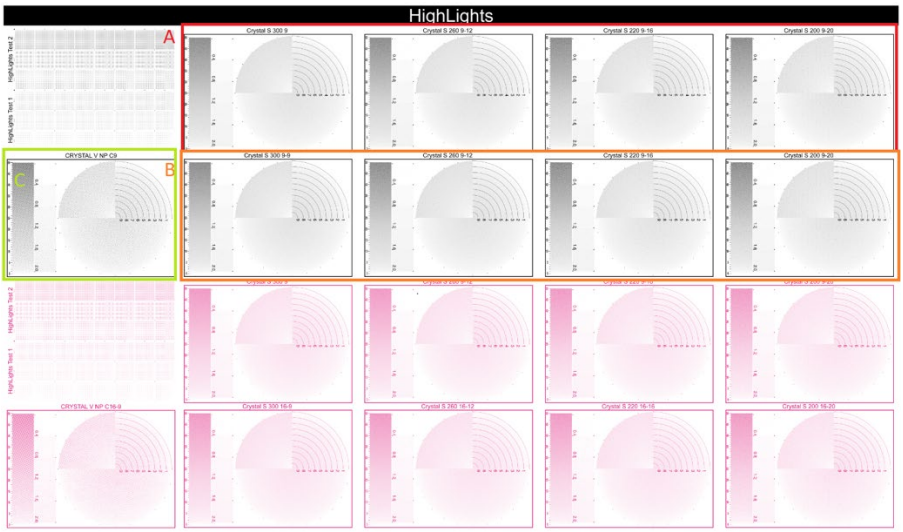
Crystal S Highlight selection

Crystal S supports an advanced highlight technique whereby the modulation in highlights changes from pure FM to a mixture of FM and AM. In the highlights, both the number of dots and their sizes are modified to change tone.

Highlight Presets

The optimal highlights can be derived from the printed Crystal S calibration chart.

The lower part of this chart is dedicated to Crystal S highlights.
A part consist of a image objects with a circular and linear vignette, each object using different highlight presets for Black and Magenta.



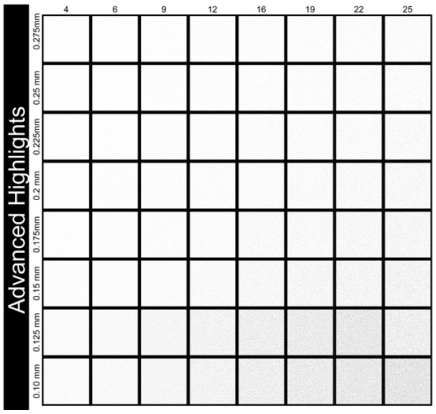
Crystal S highlight presets based on a Crystal V NP C9 (black) and Crystal V NP C16-9 (magenta).

Presets A: All the Crystal S screens with the mindot set at 9 pixels.
Presets B: All the Crystal S screens with the mindot set to the same mindot as used for the Crystal V screen.
Presets C: The Crystal V screen with its calibrated highlight settings.

Dot distance - Dot size matrix object

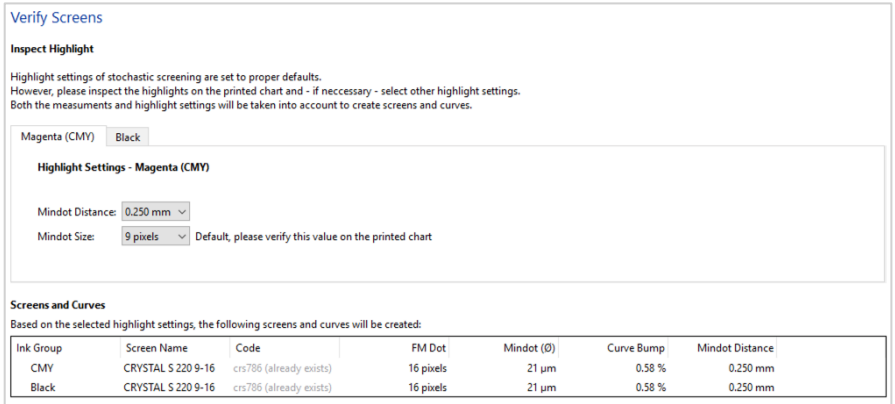
Next to the presets, the chart contains also a dot size matrix object; this object relates dot distance with dot size.
Since Crystal S screens use a higher frequency compared to Crystal V screens, dot distances are typically smaller. Therefore, the Crystal S calibration chart contains a dot distance - dot size matrix object with smaller distances and dots.

Each row in the matrix represents a specific dot distance. The distances vary from 0.10mm to 0.275mm in steps of 0.025mm.
Each column in the matrix represents a specific dot size. Dot size varies from 4 to 25 pixels.
Note: The dot size indicates the surface of the dot in pixels.



Selection of the highlights in Print Control Wizard

In the below wizard page, you can define/change the Mindot size and Mindot Distance – the default Mindot size is 9 pixels. If you select 'none' then the dotsize of the midtones is used all the way through in the highlights (no transition).



Crystal S Dot gain

On the printed calibration chart, it is possible that the Crystal S screened objects appear considerably darker or lighter than the Crystal V screened objects. This is to be expected as the tone response of the two screens is quite different. On the charts, the parts that are screened with Crystal S are pre-compensated with the H-34 presssync curve because it is expected that the Crystal S screen has more dot gain. However, this pre-compensation curve could be under or over-compensating.

In the calibration wizard tone scales of Crystal S screens are measured and a new set of adjustment curves will be created to bring the tones at the same level as the Crystal V screens.
The new set of adjustment curves dedicated for the Crystal S screen is added to the printing condition curves strategy (icpro file).

When the wizard is completed, the resulting Crystal S curves are displayed when selecting ‘Stochastic screening (FM)’ in the advanced calibration option.
It is important to verify if the curves created for the Crystal S screen are ok: too much compensation could indicate that the Crystal S screen is not suitable for this specific print condition.