HXM Screening module

Technical Note Hqn077

September 2008

1 Introduction

This document describes the HXM (Harlequin Cross-Modulated) screening plugin for the Harlequin RIP™. HXM screening is supplied as a plugin upgrade to the Harlequin RIP and requires a security password for it to be enabled.

In the current printing on paper marketplace the challenge between increasing costs, particularly paper, results in lower quality papers being used coupled with higher customer expectations. HXM screening is a solution that addresses both these issues. Higher screen rulings can be used without major re-tooling, producing visually higher quality printing. The range of screens offered within the HXM screen set can handle both matte and gloss stocks.

HXM screening is a combination of Traditional Amplitude Modulated (AM) screening and Pseudo-Randomized Frequency Modulated (FM) screening which allows higher screen rulings than is provided by AM screens alone.

The following information is available:

2 System requirements

To operate correctly the HXM screening plugin requires:

- A v7.1 or later Harlequin RIP.
- A security key (password).

3 Installation notes

The HXM screening plugin needs two procsets normally present in v8.0 RIPs: **HqnHtm** and **HqnPluginConf**. **HqnHtm** (replacing `add_sfdef`) adds the screen definitions to the RIP's screen table. **HqnPluginConf** adds the definitions to the Screen Names list for use with the Harlequin RIP GUI. The plugin installer will install versions of both files when a v7.x RIP is detected.

The plugin is installed into a new directory called **\SW\Tiles**. This keeps the screen definitions away from the screen cache (in **\SW\Screens**).

A new Extra start file is provided which activates the HXM screen set on start-up.

When using the HXM screens you must ensure that the Resolution is correctly configured within the RIP.

Note: Do not use the HXM screening plugin with ink jet printers.

4 An overview of AM and FM screening

A common artifact of conventional fixed screening (AM) is moiré. This can be reduced by careful manipulation of screen angles, adjusting the input resolution and increasing the output lines per inch (LPI). Other screening types can eliminate moiré but have additional printing requirements so may not be suitable in some applications. Increasing the LPI can greatly reduce moiré but this requires that the printing system uses higher screen rulings, and printing at higher screen rulings places additional demands on the entire pre-press and press systems where dot gain or tone value increase (TVI) and registration become more critical, especially where color fidelity and print quality are to be maintained. The challenge with conventional AM screening is to be able to print the smallest dots possible to enhance detail, maintain highlight detail, and to provide smooth gradients when present.

HXM screens have been designed to solve the printing challenges that come from printing at higher screen rulings.

Frequency Modulated Screening (FM) places dots of varying size in a pseudo-random way to produce the required tints. Some of the advantages include increased apparent sharpness and the removal of cross screen and object moiré. This is accomplished because the dots are dispersed instead of clustered as they are in a traditional periodic screen.

Some of the limitations of FM screens, because of the variable dots, include ink tack needing adjustment from conventional screens, printing blanket hardness, TVI, dots not being printable for long runs and substrate quality which can cause piling. Also some FM screens can show graininess in the highlights for some colors. FM does provide the possibility for making ink savings and, if process control is tightly maintained, has been shown to be able to print purer colors. Second order FM screens have attempted to control the press issues but research and testing is still required to optimize an FM screen to a given printing press.

5 What is HXM hybrid screening?

Hybrid screening is designed to improve print quality by increasing the output LPI for any given resolution. For example, if a printer is currently imaging plates at 2400 DPI with output at 150 LPI and is able to hold a 1% dot when printing on the required substrate, using HXM screens it would be possible to print at 200–250 LPI without any special pre-press or on press requirements. The TVI difference between the current printing setup and the HXM screens would need to be adjusted to optimize the printing.

The areas that suffer most when trying to increase the LPI for a given printing condition, typically the substrate being the largest factor, is the loss of dots in the highlights and merging of dots in the shadows (loss of shadow detail). Using current computer-to-plate imaging systems at 2400 DPI it has been shown that a 0.5% dot can be produced on some plating material. However, only a very controlled printing system, on the finest sheet fed presses with premium gloss paper stock can this 0.5% dot actually print over the course of a reasonable press run. This is where HXM comes in. HXM recognizes the issue and is, therefore, designed to carefully control the dot size and placement in the 0–8% and 92–100% range within the tone scale.

In essence, a Traditional AM dot shape is used (something similar to Euclidean) for the 9–91% tonal region and a Frequency Modulated or FM dot for the two end regions. Two distinct features make this type of screen a true Hybrid. First is the use of two screening types to form a combined screen, and second the fact that the dot size is fixed at a known printable size, which ensures print quality at the extreme ends of the tonal scale. The number and placement of the dots in the FM regions use a combination of blue noise masks and a randomization generator but are aligned with the traditional screens to ensure a smooth transition from the FM to AM or AM to FM.

6 Which HXM screens are available?

The first step in optimizing for HXM screens is to determine how the current printing method is holding highlight dots. If, for example, you are currently printing at 175 LPI and can print a 2% dot reliably, this is an indication of where to begin in the selection of an HXM screen set. At 2400 DPI and 175 LPI, a 2% dot would equal a 21 micron spot. By referencing Table 1, on page 5 you can see that HXM Fine would be the correct match and therefore a good starting point from which to run tests. You would then choose what LPI is required and begin testing.

Screen name	Highlight	Micron size	Shadow
HXM X-Fine	1 x 1	10.58 (11)	2 x 2
HXM Fine	2 x 2	21.16 (21)	2 x 3
HXM Medium	3 x 3	31.75 (32)	4 x 4
HXM Coarse	4 x 4	42.23 (42)	6 x 6

Table 1 Image resolution 2400 DPI

Table 2, on page 5 and Table 3, on page 6 show some of the DPI and LPI options possible with the HXM screening technology for a traditional and round dot shape. The items in bold are currently part of the HXM Generic screen sets. The screen tile sizes are fixed and the LPI options are therefore calculated from these tiles. Some rounding has occurred but you can see the relationship of say 1200 DPI at 120 LPI and 2400 DPI at 240 LPI which has doubled.

Note: Alternative options to suit your specific printing requirements can be calculated and created and would be handled by special request.

1200 DPI	2400 DPI
	133 LPI
75 LPI	**150 LPI**
85 LPI	170 LPI
95 LPI	190 LPI
105 LPI	**210 LPI**
120 LPI	**240 LPI**

Table 2 Traditional dot shape DPI/LPI

1200 DPI	2400 DPI
	133 LPI
75 LPI	**150 LPI**
85 LPI	170 LPI
95 LPI	190 LPI
105 LPI	210 LPI
120 LPI	240 LPI

Table 3 Round dot shape DPI/LPI

To continue the example of using the HXM Fine screens, the highlight printing would maintain the 21 micron spot size throughout but alter their number and placement to obtain the correct tone scale value. The same process is done in the darkest area of the tone scale. This ensures that at the higher screen rulings for our example (190 LPI, 210 LPI, or 240 LPI from the table above), provided the same process control is maintained, the highlight and shadow regions will hold the dots at 21 microns (which was shown to be printable) and thus higher quality printing can be achieved.

As shown in the tables above a limited number of HXM Generic screen sets have been created and made available for evaluation. Three industry segments were defined as follows: Newspaper printing, Commercial printing, and Flexo Printing. From the Table 2, on page 5 the Traditional Dot shape screens at 1200 DPI at 105 LPI and 120 LPI along with the 2400 DPI at 210 LPI and 240 LPI should be considered as the recommended screens for Newspaper printing. The 2400 DPI at 133 LPI and 150 LPI should be considered the recommended screens for Commercial printing. Lastly, the entire round dot offerings including 1200 LPI at 75 LPI, 85 LPI, 95 LPI, 105 LPI and 120 LPI along with the 2400 LPI at 133 LPI and 150 LPI should be considered the working set for Flexo printing. The HXM Generic screen sets are not a complete set of all possible combinations but a reference set. Specific OEM requests for alternative screen sets within the fixed tile size limitations can be discussed through account managers.

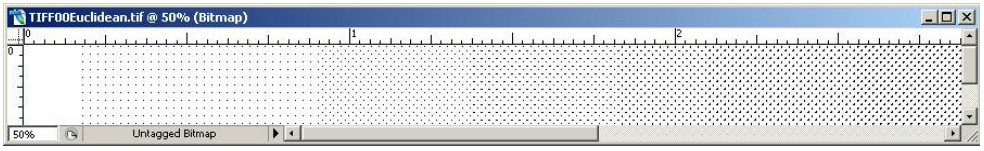
Table 4, on page 7 shows the list of screens available for each package.

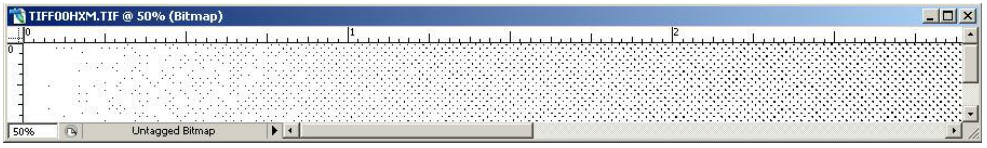
HXM Newsprint	HXM Commercial		HXM Flexo	
1200 DPI Traditional dot	1200 DPI Traditional dot	2400 DPI Traditional dot	1200 DPI Round dot	2400 DPI Round dot
75 LPI	75 LPI		75 LPI	
85 LPI	85 LPI	133 LPI	85 LPI	133 LPI
95 LPI	95 LPI	150 LPI	95 LPI	150 LPI
105 LPI	105 LPI	210 LPI	105 LPI	210 LPI
120 LPI	120 LPI	240 LPI	120 LPI	240 LPI

Table 4 List of screens for each available package

7 Screenings compared

Shown below are sample images of traditional screening using a Euclidean Dot and the HXM Screens using the FM to Traditional Dot. Notice how the dots differ in placement and size in this example as seen in the highlight end of the tone scale.





Note: These samples are simulations created so that they can be printed on standard laser printers at 600 x 600 DPI. In some instances they may not be reproduced accurately.

8 Calibration

If reasonable results are achieved after printing the test files using the HXM screens, a set of transfer curves should be calculated for each colorant. Ideally, this would mean printing a multi-step tone scale for the 175 LPI work as normal and the HXM screen at, for example, 210 LPI using the current printing process control. A 30 step target is recommended but lesser steps could also work well. Also, because the screening can be slightly different for each colorant combined with likely different TVI, it is recommended that each colorant has a transfer curve calculated. Ideally, the test form should contain both sets of step tone scales and it has been observed that in some cases running the plate twice through the imager can accomplish this. Other options are available, for example changing the plates on press and returning to the same solid ink densities (SIDs). These adjustments can then be added to the Harlequin RIP as press curves or tone curves depending on the workflow. Once completed, work intended for everyday 175 LPI work could be changed to the higher LPI should it be required.

Note: Calibration can also be included/embedded into the screens but this would require custom work on Global Graphics part and would also mean that the printing parameters and process control must be locked down. Thus a paper change or press change, for example, would not be possible. In some applications this solution may be preferable.

9 Document history

Change history		
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