At Kodak, we understand that the biggest challenges in color reproduction often occur behind the scenes.

As customers demand higher fidelity presswork, printers are looking to screening technology for practical solutions. This guide classifies screening technology and recommends suitable applications, by examining the AM, FM and Hybrid organization of dots. We hope that it will assist you in determining which solution is right for your business.
The halftone dots in a conventional AM halftone screen are arranged on a grid. Larger dots render darker tonal values, while smaller dots are used for lighter values — hence the term Amplitude (dot size) Modulated (control) screen or simply AM screen. When viewed from a distance, these dots create the illusion of a continuous tone reproduction.

AM screens are characterized by the spacing of dots in terms of frequency, ruling or mesh (lines per inch, lpi or lines per centimeter, lcm). They are further described by a screen angle for each color and by the shape of the dot, mostly round, elliptical or square.

Common screen rulings range up to 200 lpi. Finer screen rulings require high-resolution lasers and process controls to maintain consistent presswork.

**COMMON APPLICATIONS:**
- Newspaper: 85 – 100 lpi (SNAP & ISO)
- Publications: 133 lpi (SWOP & Fogra specifications)
- Commercial: 175 lpi (GRACoL & ISO guidelines)
- Specialty Commercial: 240 – 450 lpi

For screen rulings 200 lpi and finer, prepress and pressroom equipment must be able to reliably render single pixel highlight dots (i.e. 1/2400 dpi).

CMYK dots form a visible structure known as a rosette.

For screen rulings 200 lpi and finer, prepress and pressroom equipment must be able to reliably render single pixel shadow dots (i.e. 1/2400 dpi).

Highlight area

Midtone area

Shadow area

240 lpi AM screening shown
Conventional FM halftones are sometimes referred to as “stochastic” or “first order” screens. Dots are arranged in a random pattern with no set frequency or angle. Dark tones are rendered with more dots and light tones with fewer dots — hence the term Frequency (quantity) Modulated (control) screen, or simply FM screen. Random distribution of the dots eliminates screening moiré, subject moiré and AM rosettes. The microdot structure leads to photographic quality, greater tonal stability on press, a larger color gamut, and reduced ink usage compared to AM or XM screens.

Historically, FM screens have been difficult to render consistently on plate, requiring coarser and grainier dot structures. 10,000 dpi Kodak SQUARE Imaging is alone in its ability to consistently render the 20-21 micron dots required for smooth looking presswork.

**COMMON APPLICATIONS:**

**Specialty Commercial:** 20.1-micron **Staccato** screening

- **Highlight area**
  - Highlight dots are all the same size, randomly arranged to avoid moiré and tightly packed to render as much detail as possible.

- **Midtone area**
  - CMYK dots emulate photographic fidelity and with unique patterns for each separation, **Staccato** 20.1 eliminates the conventional AM rosette structure.

- **Shadow area**
  - Shadow dots are all the same size, randomly arranged to avoid moiré and tightly packed to render as much shadow detail as possible.
Staccato DX screening is available on Kodak NexPress digital production systems and brings the flexibility and power of second order HYBRID FM screening to the digital printing environment. With dots arranged in a pseudo-random pattern, Staccato DX leverages NexPress 8-bit imaging capabilities by using dot size and dry ink density to control tonality and color. The result is smoother than conventional first order FM and comparable to conventional AM rosette screens.

Staccato DX screening eliminates the halftone dot, associated color rosette, moiré and operator difficulties. Staccato DX also leads to a midtone increase in color gamut, an optical dot gain advantage over conventional screens and in some cases, a slight reduction of dry ink consumption.

Staccato DX screening is suitable for long print runs contributing increased color consistency and color stability. Selection of the appropriate application of Staccato DX screening technique is based on the printed work being produced. It is ideal for images that have an increased amount of image detail and for images having periodic patterns that often result in moiré. Staccato DX also enables printing with five or more colors, free of moiré.
Hybrid AM (XM) - Kodak Maxtone screening

Hybrid AM halftones - also referred to as XM (cross-modulated) screening are based on a conventional AM dot structure. However, at the extreme highlights and shadows, tonality is controlled by varying the distribution of dots, in an FM fashion.

Hybrid AM/XM screens were developed to enable higher screen rulings by overcoming resolution limitations in areas like flexography, some web printing, and low resolution imaging or plates.

Kodak Maxtone screening allows independent control of highlight and shadow dot sizes for all supported screen rulings, angles and dot shapes. This enables custom configuration of screens to suit presswork.

A perfect complement to Kodak AM and Kodak Maxtone screening is Kodak HyperFlex technology which enables smaller highlight dots to print.

COMMON APPLICATIONS:
Flexo: 120 - 200 lpi with minimum 40 micron highlights.
Specialty Publications: 200 - 240 lpi with 20 - 30 micron highlights
Premium Commercial: 240 - 450 lpi

Highlight area
Smallest highlight dot sizes are determined by limitations in plate making and printing processes. Kodak Maxtone screening enables independent control of highlight dot sizes to suit a wide variety of applications.

Midtone area
As with the conventional AM screens, the CMYK dots in Hybrid AM screens are arranged by frequency and angle to form rosettes.

Shadow area
Smallest shadow dot sizes are determined by limitations in plate making and printing processes. Kodak Maxtone screening enables independent control of shadow dot sizes to suit a wide variety of applications.
Hybrid FM – Kodak 10 and 20 micron Staccato screening

Staccato screening is referred to as second order FM or Hybrid FM and is preferred over first order FM screens for smoother looking presswork. In the highlights, tonality is controlled in an FM fashion, by varying the quantity of dots. In the quarter-tones and midtones, tonality is controlled by varying dot size and shape, which minimizes visible grain and moiré.

Like conventional FM screens, Hybrid FM screens increase stability on press, deliver a larger color gamut, and reduce ink usage. Hybrid FM screening also eliminates moiré, rosettes and the effects of minor mis-registration.

10,000 dpi Kodak squarespot Imaging is alone in its ability to consistently render the microdot structures found in 10 and 20 micron Staccato screening.

Different patterns are used for each process color with six additional patterns available for extended process color printing when using the Kodak Spotless printing solution.

COMMON APPLICATIONS:

Publications: 25 to 36-micron Staccato screening
Commercial: 20 to 25-micron Staccato screening
Newspaper: 36-micron Staccato screening
Packaging: 20 to 36-micron Staccato screening
Specialty: 10-micron Staccato screening (see cover sample)
Hybrid FM – Kodak 25 and 36 micron Staccato screening

Staccato screening is also available in coarser configurations that complement lower resolution presswork, plates or imaging. To a lesser extent, 25 micron and 36 micron Staccato screens offer the same benefits as finer Hybrid FM screens. These include greater stability on press, larger color gamut, and reduced ink usage. Hybrid FM screening also eliminates moiré, rosettes and the effects of minor mis-registration.

Different patterns are used for each process color with six additional patterns available for extended process color printing when using the Kodak Spotless printing solution.

COMMON APPLICATIONS:
Publications: 25 to 36-micron Staccato screening
Commercial: 20 to 25-micron Staccato screening (see adjacent page for 25 micron screening)
Newspaper: 36-micron Staccato screening
Packaging: 20 to 36-micron Staccato screening
Specialty: 10-micron Staccato screening (see cover sample)

Highlight area
Highlight dots are all the same size; randomly arranged to avoid moiré and tightly packed to render as much detail as possible. The use of the highlight dot can be controlled by choosing alternate Staccato screens.

Midtone area
CMYK dots emulate photographic fidelity and emulate the conventional AM rosette structure. With unique patterns for each process color, dots form curving clusters in the midtones to yield smoother results while preserving the photographic benefits of first generation FM screens. The size of midtone clusters can be controlled by choosing alternate Staccato screens.

Shadow area
Shadow dots are all the same size; randomly arranged to avoid moiré and tightly packed to render as much shadow detail as possible. The size of the shadow dot size can be controlled by choosing alternate Staccato screens.