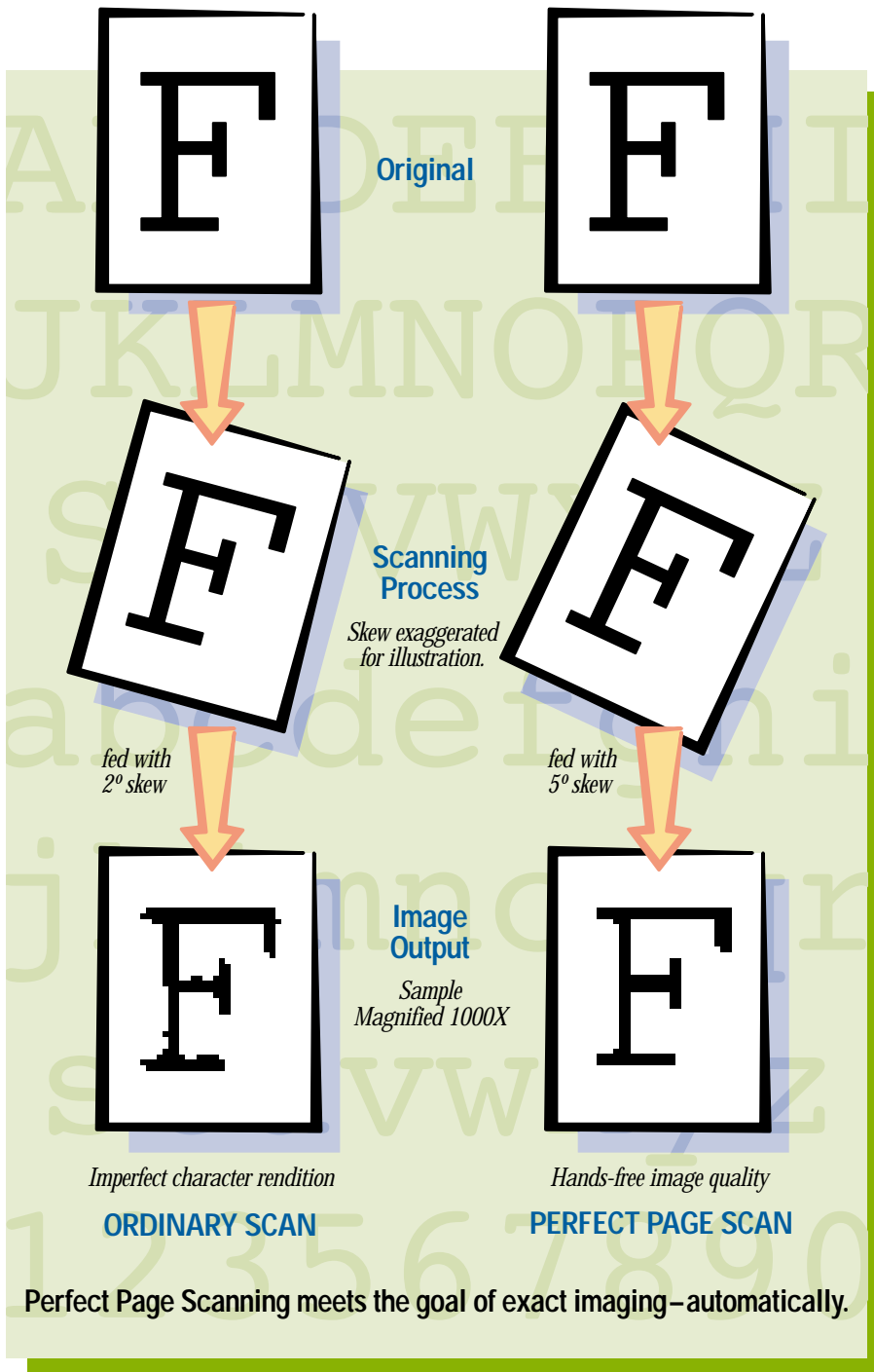




PERFECT PAGE, COLOR AND BITONAL:  
WINNING THE RACE AGAINST TIME, ERRORS, AND COST.

ADVANCED KODAK  
TECHNOLOGY SIMPLIFIES  
IMAGE CAPTURE.

**SPEED, PRECISION, AND ECONOMY OF MOTION.  
THAT'S PERFECT PAGE IN ACTION.**



#### **EXECUTIVE SUMMARY**

The goal of document scanning is to convert paper documents into usable electronic images. Ideally the process will minimize time, labor, and training while optimizing image quality, throughput, and cost effectiveness. To achieve these objectives, Kodak is leveraging its world-renowned imaging expertise by embedding Perfect Page capabilities into its latest generation of bitonal and color production scanners. Based on innovative technologies unique to Kodak, Perfect Page Scanning optimizes virtually every aspect of the “image capture chain.” Working in the background, Perfect Page helps make scanning a simple, more hands-off operation, delivering the ultimate in image quality — first time, every time. It’s one of the important attributes that continue to make Kodak the market leader in production document scanners.

**“The way this [Kodak] scanner does the deskewing and rotating is a big asset, doing it with hardware and not software. Our software now slows down the scanner and breaks up the workflow.”**

Stacy Bellis and Tom Tripodi  
HAB Inc., Bangor, Pennsylvania

The Perfect Page differ  
seeing is believing.

## IN THE QUEST FOR THE PERFECT PAGE, FUNDAMENTALS COME FIRST.

Kodak has been refining production scanners for over a decade to deliver the “Perfect Page,” an optimized image capture process. In all that time, the fundamental requirements driving design haven’t changed.

*Requirement #1:* Make scanning as simple as possible. It’s a means to an end; namely, supplying an imaging application with images. If we could, we would put images online by waving a magic wand. A Perfect Page-enabled *Kodak* scanner is the next best thing.

*Requirement #2:* Image processing is like a chain, so every imaging component and sub-system must be a strong, reliable link. Just as in a relay race, if the lead runner stumbles, the rest of the team either makes up the difference or loses the race. Perfect Page technology provides a robust front end to an imaging system by optimizing all aspects of image capture — automatically.

*Requirement #3:* The best-possible image quality is a must, because a bad image can be worse than no image at all. Imagine an e-mail system that scrambled text at random. How happy would you be if you had to make guesses or ask people to find and resend their messages? It would be like dropping the baton in a relay race. Perfect Page virtually guarantees first-pass image quality that you can count on, scan after scan after scan.

As you’ll see from the discussion that follows, the beauty of Perfect Page Scanning is that it supports all three fundamental requirements. It makes image capture as simple, robust, and high-quality as it can possibly be.

“...the fact that this Perfect Page [processing] is done on board makes the speed of the correction very impressive.”

Robert Jadrijevic and  
Joseph Sulfaro  
Vision & Beyond PTY Ltd.  
Collaroy, Australia

## IDEAL OUTPUT WITHOUT REALLY TRYING: THAT’S PERFECT PAGE.

In a Perfect Page world, production scanning takes place at high speed, without interruption. A scanner operator just loads and unloads paper. Meanwhile, the scanner converts all the visible information into clear, legible digital images that resemble the original document as exactly as possible, without operator guesswork. Downstream, these “Perfect Pages” are immediately readable by recognition programs and people alike. Labor-intensive document preparation and image clean-up after scanning are essentially eliminated.

Now compare Perfect Page with ordinary scanning. Often, scanners must capture images with quality that’s merely “close enough” in order to maintain production speeds. The resulting jagged edges and broken characters and lines, poor contrast

between background and printed areas, and clipped corners can all cause problems later in the imaging application.

The scenario gets worse. Intervention by people or computers before or after scanning adds time and expense to the process, delaying delivery of usable images to those who need to retrieve them. Throughput rates tumble because you may be forced to presort documents, make QC/QA adjustments to scanned images or physically rescan and reinsert images into a batch.

Also there’s the time and expense of training (and retraining) scanner operators in the fine art of scanner control adjustments, which affect both content and quality. With estimates of labor’s contribution to the total cost of scanning running as high as 76 percent, the fewer manual steps, the better.

Back to the Perfect Page capability designed into *Kodak* production scanners. It enables the scanners to optimize image quality while automating more of the work. This reduces labor and increases throughput to the host application. With Perfect Page, what was on the page is what appears in the image. Just like a good first leg in the relay race, optimal scanner throughput and image quality contribute to winning performance throughout the rest of the imaging application.

## FOR HIGH-PERFORMANCE IMAGE CAPTURE, YOU PUSH THE BUTTON. PERFECT PAGE DOES THE REST.

To appreciate how Perfect Page streamlines and optimizes the document imaging chain, consider conventional photography. For best results, you use a good camera with a sharp lens, a precise shutter, and accurate exposure control. You load the camera with film that delivers consistently good quality — *Kodak Gold Max* Film, for example — and take your picture.

Before you can frame an 8-by-10 glossy and admire your work, the film must be processed and a print made. Any substandard component or poorly executed step in this series of events puts the final outcome at risk.

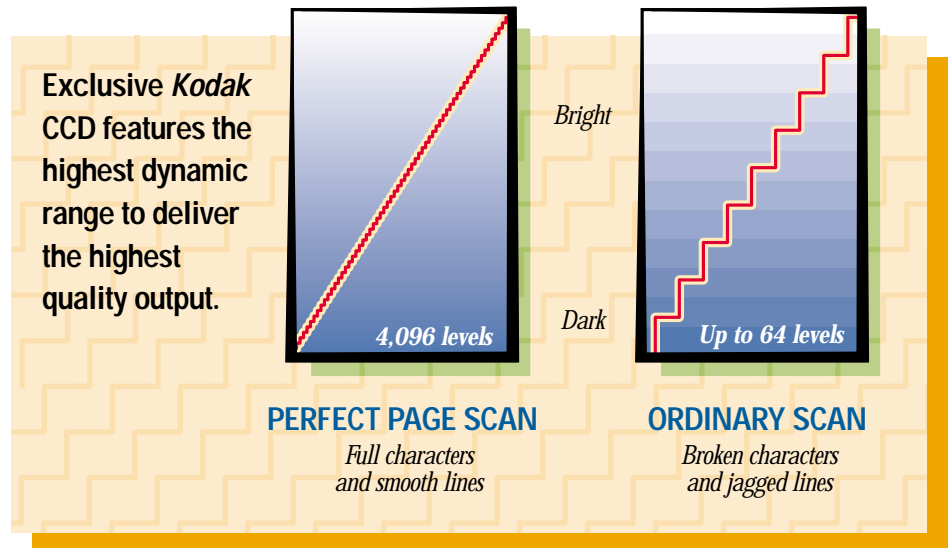
Now look at the document imaging chain. Depending on a scanner's capability, you may have to sort documents into batches of similar contrast and color and scan them with varying scanner settings. Image capture takes place inside the scanner, where a lens system, lighting, and an electronic sensor take the place of camera, flash, and film. To make images ready for the host imaging system, they must pass through digital processing steps and human QC/QA, if required.

Just as in the relay race, each leg of the imaging race is dependent on all of the previous legs. For example, raw image capture that's less than optimum compromises the effectiveness of any subsequent digital processing.

### THE PERFECT PAGE IMAGING CHAIN: NO WEAK LINKS ALLOWED.

Kodak has been continuously upgrading illumination, lens design, sensor performance, and processing hardware and firmware since the

introduction of its first production scanners in the early 1990s. Guided by real-world experience and the voice of the customer, a steady series of innovations have improved every part of the document imaging chain. The result is Perfect Page Scanning.



*“ Perfect Page is definitely in line with propelling the industry forward by assuring that capture is as painless as possible for users. Perfect Page should improve workflow by reducing rejects and eliminating rescans. “*  
*“...Kodak puts a lot of R&D into making an image that's as clear as possible. They've taken core technology that exists within the company and are building image manipulation into the scanner at no extra charge. Kodak is raising the bar with Perfect Page. ”*

Susan Moyse  
InfoTrends Research Group, Inc.

What you  
from your



## THE INSIDE STORY ON RAW CAPTURE THE PERFECT PAGE WAY.

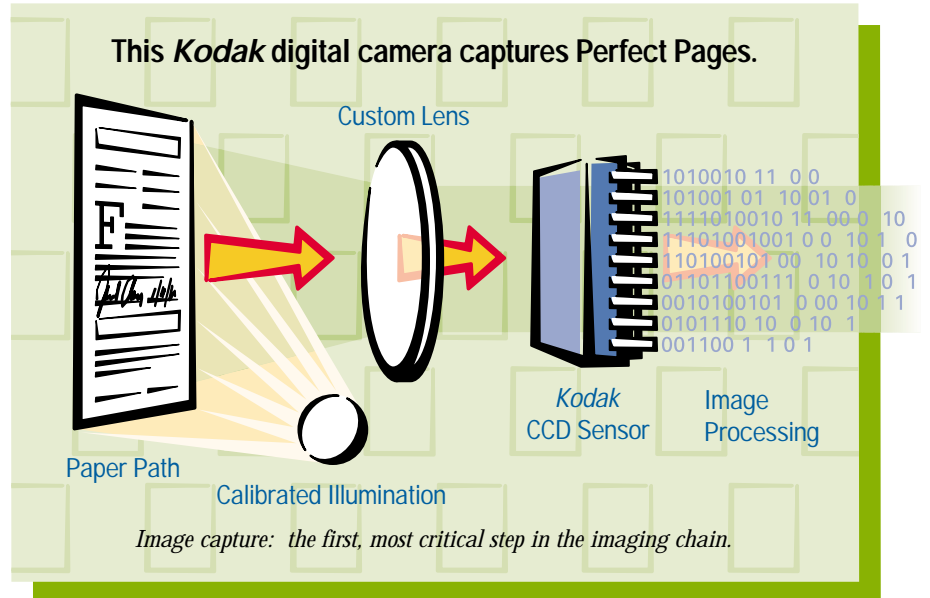
If you took the cover off a Perfect Page-enabled scanner, you'd be able to see some of what makes it superior. Kodak designs the multi-element lenses, mirrors, and sensors. This allows Kodak engineers to optimize critical interactions among these picture-taking components. After all, if this first step isn't done correctly, no amount of image processing can make up for it.

**“ I like this idea of the Perfect Page. We have problems with faint images and this seems to do a good job. The things they're feeding it are challenging ” and they all look good.**

**Roger Radford  
BAX Global, Irvine, California**

### *Calibrated Illumination*

To compensate for variations in light intensity as lamps age or are replaced, *Kodak* scanners can be recalibrated quickly and easily at any time by feeding a calibration sheet. Competitive scanners may require an onsite service call by a service technician for calibration, which adds expense and inconvenience.



### *Custom Optics*

As noted above, Kodak custom-designs its own optics. Lenses are tuned for the spectrum of the scanner bulbs to provide superior light transmission and ensure that the scanner can be operated at rated speeds. Optical formulas are carefully specified to provide distortion-free, flat focus across the entire width of the paper path. Combined with calibrated illumination, the lens delivers consistently even contrast and sharpness from edge to edge, resulting in higher achievable resolutions.

### *High-Performance Sensor Array*

The sensors used in *Kodak* scanners are the highest-speed CCDs in the industry. Where competitors capture 12 to 16 million pixels per second, *Kodak* CCDs capture 24 to 60 million pixels per second. It's like loading your camera with high-speed, high-resolution film. This image capture horsepower allows *Kodak* scanners to perform raw capture at higher resolutions (up to 600 dpi for bitonal; up to 300 dpi for color ) using less light while maintaining

high-speed document transport.

Reduced light intensity translates into lower temperatures inside the scanner and better reliability and longer lamp life. It also controls image bleed-through for clearer, cleaner-looking images. Higher-resolution capture means the camera can gather a greater amount of data for more accurate image processing.

A superior dynamic range also distinguishes the CCD arrays used in Perfect Page-enabled scanners. Where ordinary scanners squeak by with 64 levels of gray, *Kodak* scanners work with 4,096 levels. This results in clearer images because of better definitions of gray levels used to differentiate the boundaries between lines and characters from the background. It also helps the scanner handle variations in documents, negating the need for sorting or adjusting scanning parameters to accommodate "difficult" documents during scanning or after in processing.

expected  
scanner, a

Page.

## TO REACH THE GOAL OF THE PERFECT PAGE, EACH IMAGE IS PERFECTLY PROCESSED INSIDE THE SCANNER.

Let's recap the Perfect Page story so far. As in the camera/film analogy, the all-important picture-taking step has taken place with accurate focusing and proper exposure. If it's wrong here, image processing won't save it later. Fortunately, the scanner has captured a great raw image using superior components, an optimized lens and a high-performance CCD array calibrated for the actual illumination. Now, just like the exposed image on the 35mm film, the raw image requires some processing.

### PROCESSING IN COLOR

To optimize your color images for quality and file size, *Kodak* scanners use the high-speed computing power from the image processing engine. Through the use of specialized integrated circuits, built into Perfect Page-enabled *Kodak* scanners, you get high-quality color images that are quickly and easily deskewed and autocropped during scanning.

### PROCESSING IN GRAYSCALE

*Kodak* scanners create optimum quality bitonal images of scanned documents by working with the grayscale representation of source documents. Grayscale processing makes better use of the raw image data, manipulating the image prior to converting it to bitonal. The image processing engine, which resides on a circuit board built into Perfect Page-enabled *Kodak* scanners, provides the speed and analysis needed to work with the grayscale information.

All the image processing steps, such as deskew, autocrop and conversion to a bitonal, single-bit image, are done on board at full rated speed. With *Kodak's* Perfect Page Scanning, the end result is sharper characters and optimum clarity for better OCR/ICR read rates.

Without Perfect Page Scanning, image processing is often handled outside the scanner, via software on a PC.

With some external image manipulation software applications, the image processing chain *starts* with a bitonal, single-bit data stream. Deskewing bitonal images produces jagged lines and mis-shaped characters, reducing image clarity and OCR performance.

### GETTING THE EDGE — ON ALL FOUR SIDES OF THE PAGE.

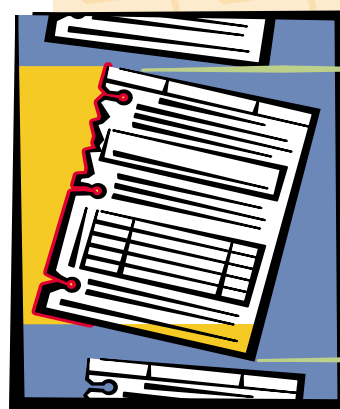
The first step in Perfect Page image processing is to determine where the document begins and ends. An algorithm called Contour Tracing searches the entire scanned image for outer boundaries. It isn't fooled by torn edges, successive skewed images, or cases in which the trailing edge of one document is close to the

leading edge of the next. No part of the page is cut off as with ordinary image processing systems. Contour Tracing is integral to the Perfect Page, paving the way for highly accurate deskewing, autocropping, and/or border reduction.

### PUTTING THE IMAGE ON THE STRAIGHT AND NARROW.

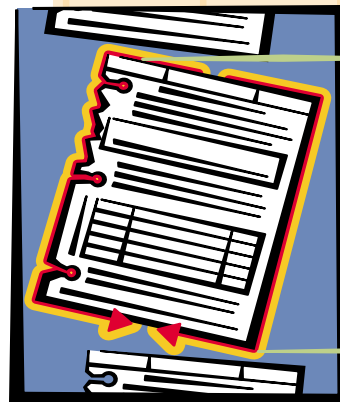
The Perfect Page image processor "knows" the edges and up/down orientation of the page, thanks to Contour Tracing technology, and has the 8-bit data stream to work with. In a step called grayscale deskew, it corrects any page rotation introduced during transport without creating jagged edges and staircasing artifacts.

#### Expanding the boundaries of edge detection accuracy.



ORDINARY SCAN

*Missing edges and corner clipping due to tight inter-document spacing.*



PERFECT PAGE SCAN with Contour Tracing

*Contour Tracing algorithm detects the complete outline of the document.*

Text and graphics appear straight and smooth, providing the quality so important for applications involving Optical Character Recognition (OCR) or barcode reading.

**PAINTING THE PERFECT PAGE, PIXEL BY CAREFUL PIXEL.**

The image still needs to be converted from grayscale to bitonal for the host imaging system. This process is called thresholding, and there's more than one way to do it.

Perfect Page image processing uses a computationally intensive approach called Adaptive Threshold Processing (ATP). This looks at the 48 neighboring pixels around each individual pixel in order to find the closest boundary transition between black and white.

Other processes look at just a few surrounding pixels. Which do you think would make it easier to identify a friend from a photo — to look at the tip of his or her nose, the whole nose, or the eyebrows, eyes, nose, ears, mouth, and chin? ATP does the latter. The benefits are visible in cleaner, better-defined characters.

Depending on the model and applications, Perfect Page-enabled scanners can perform other image manipulations along with deskew. These may include autcrop, border reduction, error diffusion, and dithering. All occur faster than with ordinary scanning systems because they take place on-the-fly within the scanner, rather than in software on a PC.

**THE BENEFITS OF PERFECT PAGE KEEP ADDING UP.**

With Perfect Page Scanning, the document image capture process is streamlined, requiring fewer operator and software steps, and reducing the cost of pre- and post-scanning labor.

High-speed image processing enables *Kodak* production scanners to operate at rated throughput speeds without operator intervention or the cost of additional accessory boards and software. It also reduces the need for training, an important consideration when facing high operator turnover.

The uniformly high quality of Perfect Page images essentially eliminates the need for QC/QA and rescans — virtual or otherwise. Accurate images get into the host application's workflow faster and are available more quickly to those who need to retrieve them.

For example, whether data entry is performed manually or via OCR, Perfect Page improves the speed and accuracy of input. And for image-enabled applications, clear, unambiguous information allows processing clerks and service reps to make the right decisions without guesswork. This maximizes profits and customer satisfaction.

Let's return to our fundamental scanning requirements for a moment. Capture and expert processing happen inside the scanner, to make things simple for the operator. The race is run quickly; data is passed to the next runner in the imaging chain with perfect synchronization.

Clearly, if you want to optimize

**All resolutions are not created equal!**

**ORDINARY SCAN**  
200 dpi  
*Areas of dense detail fill in.*

**PERFECT PAGE**  
200 dpi  
*Detail is maintained thanks to a wider dynamic response range and optimized raw image capture.*

quality and the overall scanning process, a Perfect Page-enabled scanner is the ultimate in color and black-and-white scanning. And there's no extra charge for the extra performance. Perfect Page is standard on the latest *Kodak* Scanners rated from 170 up to 640 images per minute. It's exactly what you need for color and black-and-white scanning that's simply perfect.

**PERFECT PAGE Image Processing Bitonal and Color**

Bitonal	Color
Contour Tracing	Contour Tracing
Skew Correction	Skew Correction
Auto Cropping	Auto Cropping
Adaptive Threshold Processing	
Border Reduction	
Error Diffusion	
Halftone Removal	

THE  
PERFECT  
PAGE  
SCANNING  
STORY.

“At Eastman Kodak Company, we know how to capture and preserve images — that’s our heritage and our business.”

HOW ADVANCED KODAK TECHNOLOGY  
DELIVERS SIMPLIFIED IMAGE CAPTURE.

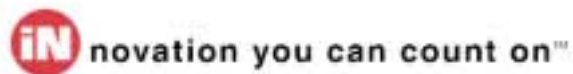
“Our scanner technology couples state-of-the-art sensors and fine-tuned optics to the best feeding and paper-handling systems in the industry. Then it applies innovative image processing and our comprehensive understanding of color science. Our unique grasp of the entire imaging chain enables us to deliver unsurpassed image quality and maximum readability.”

*Pete Rudak, Chief Technical Officer  
Document Imaging, Eastman Kodak Company*

For more information on specific features for the various Perfect Page-enabled Kodak Scanners, please refer to the product specifications in our sales brochures.



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DOCUMENT  
IMAGING

