



## Monochrome vs Gray or Color Scanning

**DO NOT SCAN IN MONOCHROME, period!!! You are guaranteed to lose data.**

What is monochrome scanning. Monochrome scanning is a 2 bit format for capturing source data digitally. It is limited to pixels being either on or off, meaning pure black and pure white are the only colors it can store, no shades of gray. Why is that a problem, well if you have ever tried to photocopy your driver license you know why:



There was a time when monochrome scanning was the standard in the industry, clear up until the late 90's and it is clear that it was not the best format to be scanning in because of the potential for data loss. Any document that did not have good contrast between the foreground (text) and the background (the paper) was problematic. There was no guarantee that all of the content would be captured legibly. Sure there were automated thresholding algorithms that tried to recognize low contrast and enhance the foreground but unless you manually reviewed every page to the original and made adjustments, sometimes very extreme, there was a significant potential for data loss. If an original was a preprinted form with nice dark text and someone filled out the form in pencil or worse it was those carbonless copies (white, yellow, pink) where they didn't press hard enough the text would just disappear. If you tried to manually adjust the contrast and rescan the hand written text might be legible but all the form text would just bleed. The only solution for these was to scan the page twice. Many vendors purported that monochrome scanning was the best thing with auto thresholding since the page would be nice and white and the text nice and black. What they didn't tell you is that it didn't work for receipts, faded faxes, documents with light date stamps, blue forms filled out in pencil, pages filled out in blue pencil. Unless a customer compared all the scans to the original they would not know the data was missing. There are hundreds of millions of pages that were scanned this way and they are missing data, many of the originals have sadly been destroyed. Those individuals and agencies that had the forethought not to destroy their originals have since gone back and rescanned everything in grayscale or color.

Below is an example of an image which is fully legible in color in automated scanning with no adjustment. When we try to do the same in monochrome the text disappears. Because the top is a different contract than the bottom, we actually have to get two scans of it and merge it together to get a fully legible image and even then its marginal.



Instruments Used														
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Contamination Survey of Material / Inner Container (circle one) Direct _____ Removable _____ CL _____ dpm/100cm <sup>2</sup> FI _____ dpm/100cm <sup>2</sup> FY _____ dpm/100cm <sup>2</sup> TY _____ dpm/100cm <sup>2</sup> Tritium _____ dpm/100cm <sup>2</sup>			Contamination Survey of Material / Inner Container (circle one) Direct _____ Removable _____ CL _____ dpm/100cm <sup>2</sup> FI _____ dpm/100cm <sup>2</sup> FY _____ dpm/100cm <sup>2</sup> TY _____ dpm/100cm <sup>2</sup> Tritium _____ dpm/100cm <sup>2</sup>			Contamination Survey of Material / Inner Container (circle one) Direct _____ Removable _____ CL _____ dpm/100cm <sup>2</sup> FI _____ dpm/100cm <sup>2</sup> FY _____ dpm/100cm <sup>2</sup> TY _____ dpm/100cm <sup>2</sup> Tritium _____ dpm/100cm <sup>2</sup>			Contamination Survey of Material / Inner Container (circle one) Direct _____ Removable _____ CL _____ dpm/100cm <sup>2</sup> FI _____ dpm/100cm <sup>2</sup> FY _____ dpm/100cm <sup>2</sup> TY _____ dpm/100cm <sup>2</sup> Tritium _____ dpm/100cm <sup>2</sup>			Contamination Survey of Material / Inner Container (circle one) Direct _____ Removable _____ CL _____ dpm/100cm <sup>2</sup> FI _____ dpm/100cm <sup>2</sup> FY _____ dpm/100cm <sup>2</sup> TY _____ dpm/100cm <sup>2</sup> Tritium _____ dpm/100cm <sup>2</sup>		
Radiation Survey of Material/Inner Container At Contact _____ At 30 cm (1 Ft) _____ R <sub>1</sub> γ + N _____ mRem/hr _____ mRem/hr			Radiation Survey of Material/Inner Container At Contact _____ At 30 cm (1 Ft) _____ R <sub>1</sub> γ + N _____ mRem/hr _____ mRem/hr			Radiation Survey of Material/Inner Container At Contact _____ At 30 cm (1 Ft) _____ R <sub>1</sub> γ + N _____ mRem/hr _____ mRem/hr			Radiation Survey of Material/Inner Container At Contact _____ At 30 cm (1 Ft) _____ R <sub>1</sub> γ + N _____ mRem/hr _____ mRem/hr			Radiation Survey of Material/Inner Container At Contact _____ At 30 cm (1 Ft) _____ R <sub>1</sub> γ + N _____ mRem/hr _____ mRem/hr		
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External Radiation Survey of Package/Outer Container At Contact _____ At 30 cm (1 Ft) _____ R <sub>2</sub> γ + N _____ mRem/hr _____ mRem/hr			External Radiation Survey of Package/Outer Container At Contact _____ At 30 cm (1 Ft) _____ R <sub>2</sub> γ + N _____ mRem/hr _____ mRem/hr			External Radiation Survey of Package/Outer Container At Contact _____ At 30 cm (1 Ft) _____ R <sub>2</sub> γ + N _____ mRem/hr _____ mRem/hr			External Radiation Survey of Package/Outer Container At Contact _____ At 30 cm (1 Ft) _____ R <sub>2</sub> γ + N _____ mRem/hr _____ mRem/hr			External Radiation Survey of Package/Outer Container At Contact _____ At 30 cm (1 Ft) _____ R <sub>2</sub> γ + N _____ mRem/hr _____ mRem/hr		
Comments / Controls _____			Comments / Controls _____			Comments / Controls _____			Comments / Controls _____			Comments / Controls _____		
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Why was monochrome the standard? Because it was too slow and too costly to scan in gray or color and the files were 5x the size. 1TB drives didn't exist and when they did they were very expensive. A box of documents in monochrome was like 200Mb and in color is was 1.3Gb. A high speed scanner in the 90s could scan 200 images per minute in monochrome and would slow to 20 pages per minute in grayscale. There were even \$2000 hardware boards (Adrenaline boards) that would perform auto thresholding in hardware to speed up the process.

What changed was the cost of storage dropped drastically, CPU power increased, RAM got cheaper and scanners were optimized for color and gray scanning. Starting in the mid 2000s it was possible to scan at 300 images per minute in monochrome, gray or color and some devices could output both monochrome and color at fully rated speed. There was a transition period where vendors provided an archive version in color and a derivative in monochrome because many of the document management vendors only supported monochrome. Eventually these agencies got a software upgrade and were able to swap out the unreliable monochrome images for color.

Across the Federal Government they have standardized on 300dpi color and are in the process of transitioning to require FADGI 3 star compliant devices. (<https://www.digitizationguidelines.gov/>) which is a standard to require daily calibration of scanning devices.

Could you still see monochrome scanning and vendors attempting to convince you to scan in monochrome. Yes primarily when scanning microfilm because the devices are very expensive, \$50k+ for a good one. A vendor can easily pick up an old film scanner for \$2k and make you think it's a good and inexpensive solution. You are guaranteed to loose data, even with good film. It would be rare to find a vendor scanning paper documents anymore because you can pickup a fast color scanner used on ebay for like \$2k. It may not be as fast or catch all the double feeds but if they have a good process to catch double feeds they could create a fully legible collection. Newer scanners are more reliable, faster and have very reliable double feed detection and double feed skip technology which mitigates human error with double feeds.

It is important to know the history of monochrome scanning so you can see it if a vendor attempts to sell it as a viable service. Avoid it at all costs and the most important this is to **Test your Vendor**. Have them scan a box and bill you for it. Do 100% QC on that box and make sure the price doesn't change from the estimate or if it does that there is good reason. If it doubles or triples get a quote from another vendor. It is advisable that you perform some minimum level of QC on every box and have a process to reject back to the vendor. The last thing you want to do is to let a vendor scan your entire collection, you perform no QC, you pay them, the boxes get destroyed and they are gone leaving you with illegible scans.