FADGI Guidelines and Compliance

January 2021

In 2007, the federal government agencies began a collaborative effort to articulate "common sustainable set of technical guidelines, methods, and practices for digitized and born digital historical, archival and cultural content." This effort led to the creation of FADGI (Federal Agencies Digital Guidelines Initiative) standards—a four-star ranking system for image quality.

FADGI is still a work in progress but has taken on greater importance with National Archives and Records Administration (NARA) and Office of Management and Budget's (OMB) announcement that they will stop accepting hardcopy materials after December 31, 2022 and will only accept digitized records that meet FADGI three-star guidelines.

The FADGI digitization program consists of three elements:

- Technical Guidelines and Parameters
- Best Practices
- Digital Imaging Conformance Evaluation (DICE)

These three elements, when implemented together, form a FADGI-compliant digitization environment.

FADGI conformance is a process of continuous validation to known and accepted standards, best practices, and adhering to the technical guidelines as detailed in the proposed FADGI guidelines document.

SO, WHAT ARE THE FADGI TECHNICAL GUIDELINES AND PARAMETERS?

FADGI defines four quality levels of imaging, from one star to four stars. Higher star ratings relate to better and more consistent image quality, but require greater technical competence of the operators, more detailed quality processes, and increased capabilities from the imaging systems.

ONE STAR - Should only be considered informational, in that images are not of a sufficient quality to be useful for optical character recognition or other information processing techniques. One-star imaging is appropriate for applications where the intent is to provide a reference to locate the original, or the intent is textual only with no repurposing of the content.

TWO STAR - Appropriate where there is no reasonable need or expectation of achieving three or four star performance. These images will have informational value only, and may or may not be suitable for Optical Character Recognition (OCR).

THREE STAR - A very good professional image capable of serving almost all use cases. This includes being suitable for OCR as well as for reprint on the best commercially available printers.

FOUR STAR - Images created to a four-star level represent the state-of-the-art in image capture and are suitable for almost any use.

The table below is from the 2016 final version of the FADGI guidelines and gives you an idea of the image capture standards outlined for each of the four "Star" levels.

DOCUMENTS (UNBOUND): GENERAL COLLECTIONS

Performance Level:

	1 STAR	2 STAR	3 STAR	4 STAR
Master File Format	TIFF, JPEG 2000, PDF/A	TIFF, JPEG 2000, PDF/A	TIFF, JPEG 2000, PDF/A	TIFF, JPEG 2000, PDF/A
Access File Formats	All	All	All	All
Resolution	150 ppi	300 ppi	300 ppi	400 ppi
Bit Depth	8	8	8 or 16	16
Color Space	Grey Gamma 2.2 SRGB	Adobe 1998 SRGB ProPhoto ECIRGBv2	Adobe 1998 SRGB ProPhoto ECIRGBv2	Adobe 1998 SRGB ProPhoto ECIRGBv2
Color	Greyscale or Color	Color	Color	Color
Measurement Parameters				
Tone Response (OECF) (Luminance)	+ 9 count levels ≤ 8	+ 9 count levels ≤ 8	+ 6 count levels ≤ 5	+ 3 count levels ≤ 2
White Balance Error (Luminance)	+ 8 count levels ≤ 8	+ 6 count levels ≤ 6	+ 4 count levels ≤ 4	+ 3 count levels ≤ 2
Illuminance Non-Uniformity	<8%	<5%	<3%	<1%
Color Accuracy (Mean ΔE2000)	<10	<8	<5	<4
Color Channel Misregistration	<1.2 pixel	<.80 pixel	<.50 pixel	<.33 pixel
MTF10 (10% SFR)	sampling efficiency > 60% and SFR response at half sampling frequency < 0.4	sampling efficiency > 70% and SFR response at half sampling frequency < 0.4	sampling efficiency > 80% and SFR response at half sampling frequency < 0.4	sampling efficiency > 90% and SFR response at half sampling frequency < 0.4
MTF50 (50% SFR)	50% of half sampling frequency: [30%,85%]	50% of half sampling frequency: [30%,85%]	50% of half sampling frequency: [35%,75%]	50% of half sampling frequency: [40%,65%]
Reproduction Scale Accuracy	<+/- 5% of AIM	<+/- 3% of AIM	<+/- 2% of AIM	<+/- 1% of AIM
Sharpening (Maximum MTF)	<1.3	<1.2	<1.1	<=1.0
Noise ΔL* St. Dev (Luminance)	>6 count levels < 4	>5 count levels < 3	>4 count levels < 2	>3 count levels < 1

Count values are expressed as 8 bit equivalents.

Textual and illustrated materials generally represent clean, high-contrast book pages and documents with clearly legible type, e.g., evenly printed typeset or laser printed pages without background discoloration. This includes visual-arts elements of limited significance and generally consisting of printed halftones, line art, explanatory tables and drawings.

Recommended Technologies

- Planetary scanners with or without glass platens
- Digital cameras
- Pass through manual or automatically fed document scanners
- Flatbed scanners

Not Recommended Technologies

- Lighting systems that raise the surface temperature of the original more than 6 degrees F (3 degrees C) in the total imaging process

Notes

- For master files, documents should be imaged to include the entire area of the page and a small amount beyond to define the page area.
- At four-star, no software de-skew is permitted. Images must be shot to a +/- 1 degree tolerance.
- Care must be taken to use an appropriate solid backing color when imaging documents if needed. Any color may be used as appropriate, but if used must extend beyond the original on all sides.
- Image capture resolutions above 400 ppi may be appropriate for some materials, but imaging at higher resolutions is not required to achieve four-star compliance.

Aimpoint Variability
Reference color calibration targets are surrogates for the colors in the actual collections. While current color management systems do well in connecting target colors to actual object colors, inaccuracies are inevitable due to metamerism and other factors. Careful calibration of a digitization system using a DICE reference target (for reflection copy), or an appropriate color target for transmission originals, provides a best compromise calibration for most digitization.

WHAT ARE THE RECOMMENDED BEST PRACTICES?

The previous table is just one of the many performance level specifications outlined in the FADGI guidelines document. Guidelines are also provided for the imaging environment, equipment testing and calibration routines, and best practices. Some of these are outlined below.

General guidelines for still image capture:

- Do not apply pressure with a glass platen or otherwise unless approved by a paper conservator.

- Do not use vacuum boards or high UV light sources unless approved by a paper conservator.

- Do not use auto page turning devices unless approved by a paper conservator.

- For master files, pages, documents, and photographs should be imaged to include the entire area of the page, document, or photograph.

- For bound items, the digital image should capture as far into the gutter as practical but must include all of the content that is visible to the eye.

- If a backing sheet is used on a translucent piece of paper to increase contrast and readability, it must extend beyond the edge of the page to the end of the image on all open sides of the page.

- For master files, documents should be imaged to include the entire area and a small amount beyond to define the area.

- Do not use lighting systems that raise the surface temperature of the original more than 6 degrees F (3 degrees C) in the total imaging process.

- When capturing oversized material, if the sections of a multiple scan item are compiled into a single image, the separate images should be retained for archival and printing purposes.

- The use of glass or other materials to hold photographic images flat during capture is allowed, but only when the original will not be harmed by doing so. Care must be taken to assure that flattening a photograph will not result in emulsion cracking, or the base material being damaged. Tightly curled materials must not be forced to lay flat.

- For original color transparencies, the tonal scale and color balance of the digital image should match the original transparency being scanned to provide accurate representation of the image.

- When scanning negatives, for master files the tonal orientation may be inverted to produce a positive. The resulting image will need to be adjusted to produce a visually-pleasing representation. Digitizing negatives is very analogous to printing negatives in a darkroom, and it is very dependent on the photographer's/technician's skill and visual literacy to produce a good image. There are few objective metrics for evaluating the overall representation of digital images produced from negatives.

- The lack of dynamic range in a film scanning system will result in poor highlight and shadow detail and poor color reproduction.

- No image retouching is permitted to master files.

These details were pulled directly from the standard. They cover a lot of ground, but there are always decisions to be made that are uniquely related to the material to be digitized. There are 50 or so more pages of this standard related to workflow, color management, data storage, file naming, and technical metadata.

WHAT IS DICE AND HOW IS IT USED?

The Digital Imaging Conformance Evaluation program (DICE) provides the measurement and monitoring component of a FADGI compliant digitization program.

DICE consists of two components:

• Image targets (both reflective and transmissive)

• Analysis software

The DICE targets have been designed to comply with various International Organization for Standardization (ISO) specifications, and the parameters as defined in the FADGI program have been validated through years of use at participating federal agencies.

Device-Level Target
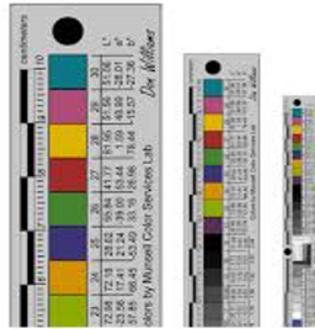
Object-Level Targets

The device-level target is a companion to the object-level targets and is designed to allow operators to do scanner performance measurements over a larger field of view. The device-level target is best suited for scanner benchmarking or session-to-session quality control.

There are other targets and measurement programs available, but these have not been evaluated and cannot be substituted for use in a FADGI-compliant environment.

Certification of FADGI conformance must be measured using DICE targets and analysis software.

Establishing common guidelines for capturing information in a consistent, efficient, and scalable way makes it easier to exchange content, facilitate collaboration, and ensure that the digital product will have a uniform quality for preservation and future usage.

The FADGI guidelines also take a lot of the guesswork out of determining which scanning technologies will deliver the best resolution and color accuracy for a digital transformation project.

WHAT TECHNOLOGIES ARE AVAILABLE TO MEET FADGI STANDARDS?

Quality Associates, Inc. (QAI) has partnered with several of the industry leaders that have been manufacturing capture solutions that allow us to provide FADGI compliant solutions and services to our clients:

The Crowley Company (Crowley) – Crowley has been consistently meeting the FADGI standards with their Zeutschel (overhead large-format book and document), Mekel Technology MACH-Series (microfilm), and InoTec (document) scanner solutions. The Crowley technical staff have also worked closely with federal archivists in several government agencies to help define and fully understand current FADGI standards.

ibml - ibml has released the FADGI-compliant Fusion series (document scanners).

Kodak-Alaris – Kodak has the 5850 (document scanner) that meets the FADGI standards.

DOES EVERY PROJECT NEED TO BE FADGI COMPLIANT?

As a quick reminder, FADGI compliance is measured at levels of one to four stars, with four stars as the most demanding.

According to **Corin van de Griek**, *Crowley's image quality and color accuracy specialist,* "To meet a star rating, images must consistently meet the resolution requirement (i.e.: 600 DPI) at 85% or better. Higher stars mean slower throughput due to the need for daily target scans, equipment calibrations, and having to rescan images with minute drifts that would be easily accepted on a non-compliant project."

When asked to describe how the star system might be applied to materials to be digitized, Corin gave this "very general" outline:

★ to ★★ **RATINGS**	Used for content and images frequently accessed
★★★ **RATINGS**	Used for content and context. In the case of a document, this might include the ability to note – from the digitized image – paper condition, paper weave, age, ink type, and other attributes critical to researchers
★★★★ **RATINGS**	Used as an effective surrogate for the original (ie: fine arts) and in cases in which the original should no longer be handled, touched, transported, etc. unless absolutely necessary

If you are planning to digitize a collection of records you will probably be asking yourself if FADGI compliance is a true requirement. If the collection will stay local or be uploaded to your digital content management solution for the ease of search and retrieval, you may never have to worry about FADGI compliance.

If the collection has any chance of being transferred to the National Archives or the Library of Congress, then yes, it would be in your best interest to have a solution in place that meets the respective FADGI requirements.

FOR MORE INFORMATION

To learn more about QAI and its records management expertise, visit our **NARA M-19-21 Readiness Center** website (https://www.qualityassociatesinc.com/nara-compliance-readiness/). You can contact us directly at **infoedge22@ quailityassociatesinc.com** or 410-884-9100.

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