



## Administrative Metadata for Digital Still Images

This data dictionary provides element-by-element descriptions of the <IMAGEMETADATA> block specified in the Harvard University Library Digital Repository Services (DRS) XML DTD Specification. As such, it represents **part** of the comprehensive list of technical data elements relevant to the management of digital still images. (See “Usage Note” below.) In this context, “management” refers to the tasks and operations needed to support image quality assessment and image data processing throughout the image life cycle. “Quality assessment” is defined broadly, as it refers both to machine operations and curatorial evaluations. Technical metadata for digital still images have been identified to anchor meaningful attributes of image quality that can be measured objectively, such as detail, tone, color, and size. In addition, data elements have been proposed to support subjective assessments of “current value” by digital repository managers, curators, or imaging specialists seeking to determine whether intrinsic image quality (aesthetic or functional) sufficiently justifies associated maintenance or processing costs.

Data elements and values are drawn from industry specifications for file formats, as well as published guidelines from other institutions seeking to store and manage large collections of images. (See *Sources Consulted*, p. 13.) Elements and values in this document apply inclusively to all digital image formats, regardless of whether they are used for archival or delivery images.

Usage Note: Consult *DRS Data Loading User Manual: A Guide for Producers of Digital Still Images* for additional instructions needed to construct a valid XML batch file for DRS deposit. This corresponding documentation provides deposit instructions, the full DTD specification, and element-by-element descriptions for XML blocks other than <IMAGEMETADATA>. For example, relationships among files with logical relationships in a given batch — such as external targets, target performance data, and color profiles — are accommodated in <RELATIONSHIPMAP> rather than within <IMAGEMETADATA>.

### Document Administration

This document is authored and administered by the LDI Technical Team. Values and mappings will be expanded as specifications for file formats in addition to TIFF are obtained, particularly when programs are available to automate the collection of metadata by extracting existing information from file headers. This document is next scheduled for review in the summer or fall of 2001 when NISO distributes for comment its draft standard on “Technical Metadata for Digital Still Images.” All questions and comments should be directed to the LDI Reformatting Advisor ([stephen\\_chapman@harvard.edu](mailto:stephen_chapman@harvard.edu)), 495-8596.



## CONTENTS

<b>DIGITAL STILL IMAGES: TECHNICAL METADATA .....</b>	<b>1</b>
SECTION 1: IMAGE ATTRIBUTES (ELEMENTS #1-13).....	1
<i>bitspersample</i> .....	1
<i>compression</i> .....	2
<i>photointerp</i> .....	2
<i>xres</i> .....	3
<i>yres</i> .....	3
<i>resunit</i> .....	4
<i>imagewidth</i> .....	4
<i>imageheight</i> .....	5
<i>orientation</i> .....	5
<i>displayorient</i> .....	6
<i>modified</i> .....	6
<i>targetnotes</i> .....	7
<i>history</i> .....	8
SECTION 2: IMAGE PRODUCTION ATTRIBUTES (ELEMENTS #14-20).....	8
<i>source</i> .....	8
<i>system</i> .....	9
<i>producer</i> .....	9
<i>optres</i> .....	10
<i>prosoftware</i> .....	10
<i>enhancements</i> .....	11
<i>methodology</i> .....	12
<b>SOURCES CONSULTED.....</b>	<b>13</b>

**DIGITAL STILL IMAGES: TECHNICAL METADATA****Section 1: Image Attributes (Elements #1-13)**

Values for these data elements are constructed to facilitate parsing and reporting. Data in the mandatory (#1-3, 6) and mandatory-if-applicable (#4-5) fields will be used to process image files in order to produce new deliverables or to migrate archival files. Optional data (fields #7-13) are to be collected to support image processing, in some cases, *and* to generate summary “collection assessment reports” for curators and data managers.

Number	1
Name	<b>bitspersample</b>
Definition	<i>The number of bits per component for each pixel. This field provides N values depending upon the number of components (aka “channels”) in the image.</i>
Required	M
Repeatable	N
Values	1 = 1-bit (bitonal) 4 = 4-bit grayscale 8 = 8-bit grayscale or color 8 8 8 = RGB (total of 24 bits) 24 = JPEG and PhotoCD 48 = TIFF or proprietary formats such as HDR (.hdr)
Mapping	TIFF 258 ( <i>Baseline Required</i> , p22-24, 29)
Examples	
Notes	For GIF, value = 8; for RGB, include one or more ASCII spaces between each number.  The most common values for multi-component image files (i.e., RGB with 8-bits in each component, are listed above.) “Note that this field allows a different number of bits per component for each component corresponding to a pixel. For example, RGB color data could use a different number of bits per component for each of the three color panes. Most RGB files will have the same number of <b>bitspersample</b> for each component. Even in this case, <u>the writer must write all three values.</u> ” (TIFF, p29, emphasis added)



Number	2
Name	<b>compression</b>
Definition	<i>Designates the compression scheme used to store the image data</i>
Required	M
Repeatable	N
Values	1 = uncompressed 4 = CCITT Group 4 5 = LZW (Lempel Ziv Welch) 6 = JPEG YCC = use for PhotoCD* (see Notes below) 32773 = PackBits compression unknown = use in cases where compression type cannot be determined
Mapping	TIFF 259 ( <i>Baseline Required</i> , p21-24, 117)
Examples	
Notes	Commonly used values are listed above. Consult the TIFF specification and/or other format specifications for additional values. Contact the Guideline Administrator to propose additions to the list of acceptable values.  *At present, this value has been designated as a place holder until we determine (from Adobe Corporation and Eastman Kodak) whether there is an appropriate numeric value – a five digit “vendor unique” number (between 32767 and 65535) – to designate the YCC compression native to PCD images.

Number	3
Name	<b>photointerp</b>
Definition	<i>Designates photometric interpretation, the color space of the decompressed image data.</i>
Required	M
Repeatable	N
Values	0 = standard value for 1-bit images 1 = reversed polarity 1-bit, or grayscale 2 = RGB 5 = CMYK 6 = YcbCr (aka YCC) (use for PhotoCD) 8 = CIE Lab
Mapping	TIFF 262 ( <i>Baseline Required</i> , p22-24, 37, and 90)
Examples	
Notes	The most commonly used values are listed. Consult the TIFF specification for two additional values. Contact the Guideline Administrator to propose additions to the list of acceptable values.

M = mandatory, MA = mandatory if applicable, R = recommended, O = optional



Number	4
Name	<b>xres</b>
Definition	<i>Designates the number of pixels per <b>resunit</b> in the image width.</i>
Required	MA (when resunit = 2 or 3)
Repeatable	N
Values	(null) = when <b>resunit</b> is 1 any positive integer = when <b>resunit</b> is 2 or 3
Mapping	TIFF 282 ( <i>Baseline Required</i> , p21-24, 41)
Examples	100 400 600
Notes	This number typically refers to the setting used during scanning. If the image was resampled following scanning, <b>xres</b> must refer to the <i>final</i> number of pixels per <b>resunit</b> in the image width. (See also <b>optres</b> .)  With <b>resunit</b> and <b>yres</b> , <b>xres</b> specifies the preferred dimensions for an output print.

Number	5
Name	<b>yres</b>
Definition	<i>Designates the number of pixels per <b>resunit</b> in the image length.</i>
Required	MA (when resunit = 2 or 3)
Repeatable	N
Values	(null) = when <b>resunit</b> is 1 any positive integer = when <b>resunit</b> is 2 or 3
Mapping	TIFF 283 ( <i>Baseline Required</i> , p21-24, 41)
Examples	100 400 600
Notes	This number typically refers to the setting used during scanning. If the image was resampled following scanning, <b>yres</b> must refer to the <i>final</i> number of pixels per <b>resunit</b> in the image width. (See also <b>optres</b> .)  With <b>resunit</b> and <b>xres</b> , <b>yres</b> specifies the preferred dimensions for an output print.



Number	6
Name	<b>resunit</b>
Definition	<i>Designates the intended placement of pixels in the <b>xres</b> and <b>yres</b> dimensions of the printed image.</i>
Required	M
Repeatable	N
Values	1 = no absolute unit; no meaningful absolute dimensions 2 = inch 3 = centimeter
Mapping	TIFF 296 ( <i>Baseline Required</i> , p21-24, 38)
Examples	
Notes	Value = 1 when area-array scanning devices such as digital cameras or slide scanners are used.  Value “1” used for images that may have a non-square aspect ratio, but no meaningful absolute dimensions. In copy work, this value should also be used when source measurements are unknown (e.g., when a photo intermediate such as 35mm negative film is the source).  The same formulas may be used when <b>resunit</b> = 3 and source dimensions are given in centimeters (in the <b>source</b> field).

Number	7
Name	<b>imagewidth</b>
Definition	<i>Designates the number of columns per image, i.e. the total number of pixels in the horizontal or X dimension.</i>
Required	O
Repeatable	N
Values	any positive integer
Mapping	TIFF 256 ( <i>Baseline Required</i> , p21-24, 34)
Examples	3072
Notes	Note that <b>imagewidth</b> is not the same as <b>xres</b> , which refers to the total number of pixels per <b>resunit</b> .



Number	8
Name	<b>imageheight</b>
Definition	<i>Designates the number of rows per image, i.e. the total number of pixels in the vertical or Y dimension.</i>
Required	O
Repeatable	N
Values	any positive integer
Mapping	TIFF 257 ( <i>Baseline Required</i> , p21-24, 34)
Examples	2048
Notes	Note that <b>imageheight</b> is not the same as <b>yres</b> , which refers to the total number of pixels per <b>resunit</b> .

Number	9
Name	<b>orientation</b>
Definition	<i>Designates the orientation of the image, with respect to the placement of its columns (<b>imagewidth</b>) and rows (<b>imageheight</b>), as it was saved to disk.</i>
Required	O
Repeatable	N
Values	1 = normal* 3 = normal rotated 180° 6 = normal rotated cw 90° 8 = normal rotated ccw 90° 9 = unknown
Mapping	TIFF 274 (p36)
Examples	
Notes	* “normal” is defined as follows: when opened, the top (0 <sup>th</sup> ) row of pixels corresponds to the visual top of the image, and the first (0 <sup>th</sup> ) column of pixels on left corresponds to the visual left-hand side of the image.  Consult TIFF for additional values referring to mirrored images. (Note that TIFF/EP supports only the five values proposed in the above list of enumerated type values.)  This field is to be used to record only the orientation of the image, <u>not</u> the orientation of the device (e.g., camera) used to capture the image (see, DIG35 C.3.2.5 “Camera Capture Settings”) and TIFF/EP 5.2.12, which defines orientation as “...the orientation of the camera relative to the scene, when the image was captured.”  Contact the Guideline Administrator to propose additions to the list of acceptable values.



Number	10
Name	<b>displayorient</b>
Definition	<i>Designates the orientation in which the image should be presented to a conventional monitor with a 3:2 aspect ratio.</i>
Required	O
Repeatable	N
Values	Portrait landscape
Mapping	n.a.
Examples	
Notes	<p>This value is important to record when the orientation optimized for the screen is different from that optimized for printing, particularly when the delivery application/user interface does not include an image rotation tool.</p> <p>While <b>orientation</b> refers to the placement of pixels in the digital image file, <b>displayorient</b> refers to the preferred orientation in which to display the content (text, picture, table, etc.) <i>within</i> the file.</p>

Number	11
Name	<b>modified</b>
Definition	<i>Designates the date or datetime the image was last modified.</i>
Required	O
Repeatable	N
Values	YYYYMMDD YYYY:MM:DD YYYY:MM:DD HH:MM:SS
Mapping	TIFF 306 (p31)
Examples	19990811 1999:08:11 1999:08:11 11:56:00
Notes	<p>The datetime syntax must comply with the W3C "NOTE-datetime" (see <b>Sources Consulted</b>). Unless an effort was made to record the date or datetime when the image was photographed, this value shall either be the same as <b>createdate</b> (recorded in the objectData in the batch file) or shall be reported as null.</p> <p>For YYYY:MM:DD HH:MM:SS, designate hours as 00-24, and insert a space between the date and time.</p> <p>Related field: <b>createdate</b> (see the objectData portion of the DRS DTD)</p>

M = mandatory, MA = mandatory if applicable, R = recommended, O = optional



Number	12
Name	<b>targetnotes</b>
Definition	<i>Designates the name of the “internal” target(s) scanned in-frame with the source item.</i>
Required	O
Repeatable	N
Values	(null) = for derived images where target(s) are cropped string, string; string, string = name of target(s)
Mapping	n.a.
Examples	[single target] Kodak 18% gray card [single target] Kodak Q-60EI Target for Kodak Ektachrome, IT8.7/1-1993 [two targets] Kodak 18% gray card; Kodak Q-60EI Target for Kodak Ektachrome, IT8.7/1-1993
Notes	<p>Recommended syntax: use manufacturer’s full name of target, including its associated standard, whenever possible. Separate each sub-part by a comma and a single space. When multiple targets are used, separate target 1 from target 2 (etc.) by a semicolon and a single space.</p> <p>“Targets are used as concise physical benchmarks for absolute energetic and spatial information about the item of interest at time of capture. They are, in essence, Rosetta stones for the source. As such, their utility is undisputed whenever corrections or faithful reconstructions of the source document are required. ...</p> <p>Depending on workflows and philosophy, targets can be considered as either external or internal to a digital image. <u>Internal targets are part of a digital image by being within the field of view at time of capture.</u> External targets are typically captured session-to-session and usually give temporally sparse information between image captures. For stable capture environments their utility can be equivalent to internal targets. Since they are not part of the digital image itself, their location must be managed in order to maintain a thread to the source.” (<i>NISO Data Dictionary</i>, p. 30, emphasis added.)</p>



Number	13
Name	<b>history</b>
Definition	<i>Designates the image change history.</i>
Required	O
Repeatable	N
Values	free text
Mapping	n.a.
Examples	
Notes	

## Section 2: Image Production Attributes (Elements #14-20)

Values for these optional data elements are constructed with reporting rather than parsing in mind. The intended applications are to generate a printed summary report for collection assessment — to answer questions such as, “Are these images worth the cost of migration? Could quality be improved by rescanning? — or to aid in the drafting of technical specifications for the production of new archival or delivery images.

Number	14
Name	<b>source</b>
Definition	<i>Designates the physical attributes of the source material relevant to interpreting digital image accuracy and/or quality.</i>
Required	O
Repeatable	N
Values	free text
Mapping	n.a.
Example	8" x 10" black and white print yellowed with age 35mm color negative Kodak Royal Gold 100 Emul. 3712011
Notes	Use this field to document the physical attributes of the source material <i>not already recorded in descriptive metadata</i> that is relevant to the interpretation of the accuracy and/or quality of the digital image.



Number	15
Name	<b>system</b>
Definition	<i>Designates the manufacturer and model names/numbers for the scanner or digital camera and its associated driver/imaging software.</i>
Required	O
Repeatable	N
Values	Scanner Manufacturer; Model Name/Number; Software Name and Version Number
Mapping	TIFF 271, 272, 305 (p35, 35, and 39)
Example	Scitex; Leaf Volare; Leaf Colorshop 4.0
Notes	Concatenate values and separate each value with a semicolon followed by a blank space. Recommended syntax: record values in following order: manufacturer (“Make”); model name or number followed by serial number of device if desired (“Model”); software name and version number (“Software”). This field refers only to the image capture system. Related field: <b>prosoftware</b> .

Number	16
Name	<b>producer</b>
Definition	<i>Designates the organization-level producer(s) of the image.</i>
Required	O
Repeatable	N
Values	free text optional ADAPT code
Mapping	TIFF 315 (“Artist”) (p28) <i>might</i> apply, but use caution – technically speaking, this field is to be used to record the name of the “person who created the image”
Examples	Luna Imaging, Inc. HCL Digital Imaging Group [multiple producers] Luna Imaging, Inc.; HCL Digital Imaging Group
Notes	Separate names of bureaus with a semicolon followed by a blank space. When multiple service bureaus are used, explain each bureau’s role in the <b>methodology</b> .



Number	17
Name	<b>optres</b>
Definition	<i>Designates the actual number of photo elements in the scanning sensor (colloquially known as “the maximum optical resolution” for a system).</i>
Required	O
Repeatable	N
Values	[any positive integer] dpi = *use for all linear-sensor scanners (MonochromeLinear, ColorTriLinear, ColorSequentialLinear)  longer dimension [positive integer] x smaller dimension [positive integer] = *use for all area-sensor scanners (MonochromeArea, OneChipColorArea, TwoChipColorArea, ThreeChipColorArea, ColorSequentialArea)
Mapping	n.a.
Examples	400 dpi 3,072 x 2,048
Notes	This element helps to characterize the quality of the scanner that was used. This number is likely to be different from <b>xres</b> and <b>yres</b> .

Number	18
Name	<b>prosoftware</b>
Definition	<i>Designates the name and version of the image processing software used to edit or transform the image data captured at scanning.</i>
Required	O
Repeatable	N
Values	free text
Mapping	n.a.
Examples	Adobe Photoshop 4.0 TMS Sequoia ScanFix 4.0 TMS Sequoia ScanFix 4.0; Adobe Photoshop 4.0
Notes	Recommended syntax for a single program: manufacturer software version. When multiple programs are used, concatenate values and the values for program 1 from program 2 with a semicolon followed by a blank space. If possible, record these names in chronological order (first to last).  <b>Do not</b> include the name of the scanning software in this field. See <b>system</b> .



Number	19
Name	<b>enhancements</b>
Definition	<i>Designates the settings, or description of their function, used by the prosoftware.</i>
Required	O
Repeatable	N
Values	free text
Mapping	n.a.
Examples	hue/saturation correction despeckling, deskewing, and sharpening
Notes	<p>Use this field to note the processes applied (“actions”) – ideally as an ordinal listing—to the image data created at scanning, particularly irreversible transformations (such as sharpening) that bear upon image quality. For multiple actions, separate the descriptions for each by a semicolon and single space.</p> <p>If the script itself is to be saved as a separate file (e.g., <i>photoshop.ATN</i>), this object must be accommodated in the DTD in a manner similar to that used for profiles and performance data related to targets. (See the objectData portion of the DRS DTD.)</p>



Number	20
Name	<b>methodology</b>
Definition	<i>Designates the methodology and rationale to digitize an object or collection.</i>
Required	O
Repeatable	N
Values	free text, limited to 4,000 characters
Mapping	n.a.
Examples	<p>See, “Scanning the Collection” notes associated with selected American Memory collections, <a href="http://lcweb2.loc.gov/ammem/ammemhome.html">http://lcweb2.loc.gov/ammem/ammemhome.html</a></p> <p>[example from LDI project] Digital images were created by staff in the Harvard College Library Digital Imaging Group in 1999 by scanning printed original pages with an auto-document-feeder scanner. Prior to scanning, Harvard College Library Conservation Services disbound and trimmed pages from duplicate copies of annual reports.</p> <p>Each side of each page, including blank pages, was scanned to create a 600 dpi 1-bit TIFF archival image. All archival images were saved with Group 4 compression. Following scanning, all 1-bit TIFFs were enhanced using TMS Sequoia’s ScanFix™ software to optimize the files for optical character recognition (OCR). These files were delivered to University of Michigan Digital Library Production Services for OCR and low-level SGML markup compliant with Text Encoding Initiative (TEI) guidelines. The OCR-generated ASCII was not corrected. Structured evaluations confirmed that these specifications yielded page images sufficient to create 1:1 preservation-quality reprints, as well as OCR-generated ASCII adequate to support a search retrieval rate of 97%.</p> <p>Selected covers and foldout images were also scanned in color with a 3K x 2K digital camera. Color archival images were saved as 24-bit TIFF images with no compression.</p> <p>For on-screen display in the page-turning application, 100 dpi 4-bit GIF images were created from the archival TIFFs. Image Alchemy was used for TIFF-to-GIF conversion. Evaluations confirmed that this specification achieved the optimum balance between legibility and size, with an 800 x 600 pixel monitor designated as the default monitor resolution.</p>
Notes	Use this free-text field to document any aspects of the conversion methodology not already accounted for in other metadata. If you choose to use a local filename as the free-text for this field — as an alternative to including a methodology note with each image — you will <i>not</i> be able to query DRS to report which images are associated with the “Methodology” file.



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