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ISO 12234-4

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2026-01

Digital imaging — Image storage —

Part 4: Digital negative format

Imagerie numérique — Stockage d'image —
Partie 4: Format négatif numérique

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Contents

Page

Foreword ... **viii**
Introduction ... **ix**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 DNG format ... **3**
4.1 Overview ... 3
4.2 File extensions ... 3
4.3 SubIFD trees ... 3
4.4 Byte order ... 3
4.5 Masked pixels ... 4
4.6 Defective pixels ... 4
4.7 Metadata ... 4
4.8 Proprietary data ... 4
4.9 Camera profiles ... 4
4.10 Opcode lists ... 5
4.11 Floating point image data ... 6
4.12 Transparency ... 6
4.13 Proxy DNG files ... 6
4.14 Depth maps ... 6
4.15 Enhanced image data ... 7
4.16 Semantic masks ... 7
4.17 64-bit format ... 8
5 Restrictions and extensions to existing TIFF 6.0 tags ... **8**
5.1 NewSubFileType ... 8
5.1.1 Previews ... 8
5.1.2 Transparency ... 9
5.1.3 Depth maps ... 9
5.1.4 Enhanced image data ... 9
5.1.5 Semantic masks ... 9
5.2 BitsPerSample ... 9
5.3 SampleFormat ... 9
5.4 Compression ... 9
5.5 Predictor ... 10
5.6 PhotometricInterpretation ... 11
5.7 Orientation ... 11
6 DNG image processing model ... **11**
6.1 Mapping raw values to linear reference values ... 11
6.1.1 Linearization ... 12
6.1.2 Black subtraction ... 12
6.1.3 Rescaling (normalization) ... 12
6.1.4 Clipping ... 12
6.2 Mapping camera colour space to CIE XYZ space ... 12
6.2.1 Camera calibration matrices ... 12
6.2.2 One, two, or three colour calibrations ... 12
6.2.3 Definitions used in the following sections ... 13
6.2.4 Translating white balance xy coordinates to camera neutral coordinates ... 13
6.2.5 Translating camera neutral coordinates to white balance xy coordinates ... 14
6.2.6 Camera to XYZ (D50) transform ... 14
6.3 Applying the hue/saturation/value mapping table ... 15
6.3.1 Special compatibility note with DNG 1.2 ... 16
6.4 Opcodes ... 16

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7 DNG tags ... **17**
7.1 ActiveArea ... 17
7.2 AnalogBalance ... 17
7.3 AntiAliasStrength ... 18
7.4 AsShotICCProfile ... 18
7.5 AsShotNeutral ... 19
7.6 AsShotPreProfileMatrix ... 19
7.7 AsShotProfileName ... 20
7.8 AsShotWhiteXY ... 20
7.9 BaselineExposure ... 20
7.10 BaselineExposureOffset ... 21
7.11 BaselineNoise ... 21
7.12 BaselineSharpness ... 22
7.13 BayerGreenSplit ... 22
7.14 BestQualityScale ... 23
7.15 BlackLevel ... 23
7.16 BlackLevelDeltaH ... 23
7.17 BlackLevelDeltaV ... 24
7.18 BlackLevelRepeatDim ... 24
7.19 CalibrationIlluminant1 ... 24
7.20 CalibrationIlluminant2 ... 25
7.21 CalibrationIlluminant3 ... 25
7.22 CameraCalibration1 ... 26
7.23 CameraCalibration2 ... 26
7.24 CameraCalibration3 ... 26
7.25 CameraCalibrationSignature ... 27
7.26 CameraSerialNumber ... 27
7.27 CFALayout ... 27
7.28 CFAPattern ... 28
7.29 CFAPlaneColour ... 29
7.30 CFARepeatPatternDim ... 29
7.31 ChromaBlurRadius ... 29
7.32 ColourimetricReference ... 30
7.33 ColourMatrix1 ... 30
7.34 ColourMatrix2 ... 31
7.35 ColourMatrix3 ... 31
7.36 ColumnInterleaveFactor ... 31
7.36.1 Potential usage ... 32
7.37 CurrentICCProfile ... 32
7.38 CurrentPreProfileMatrix ... 32
7.39 DefaultBlackRender ... 32
7.40 DefaultCropOrigin ... 33
7.41 DefaultCropSize ... 33
7.42 DefaultScale ... 34
7.43 DefaultUserCrop ... 34
7.44 DepthFar ... 34
7.45 DepthFormat ... 35
7.46 DepthMeasureType ... 35
7.47 DepthNear ... 35
7.48 DepthUnits ... 36
7.49 DNGBackwardVersion ... 36
7.50 DNGPrivateData ... 36
7.51 DNGVersion ... 37
7.52 EnhanceParams ... 37
7.53 ExtraCameraProfiles ... 37
7.54 ForwardMatrix1 ... 38
7.55 ForwardMatrix2 ... 38
7.56 ForwardMatrix3 ... 38
7.57 IlluminantData1 ... 39

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7.58 IlluminantData2 ... 40
7.59 IlluminantData3 ... 40
7.60 ImageSequenceInfo ... 40
7.61 ImageStats ... 41
7.62 JXLDistance ... 44
7.63 JXLEffort ... 44
7.64 JXLDecodeSpeed ... 45
7.65 LensInfo ... 45
7.66 LinearizationTable ... 45
7.67 LinearResponseLimit ... 46
7.68 LocalizedCameraModel ... 46
7.69 MakerNoteSafety ... 46
7.70 MaskedAreas ... 47
7.71 MaskSubArea ... 47
7.71.1 Example ... 48
7.72 NewRawImageDigest ... 49
7.73 NoiseProfile ... 49
7.74 NoiseReductionApplied ... 50
7.75 OpcodeList1 ... 50
7.76 OpcodeList2 ... 50
7.77 OpcodeList3 ... 51
7.78 OriginalBestQualityFinalSize ... 51
7.79 OriginalDefaultCropSize ... 51
7.80 OriginalDefaultFinalSize ... 52
7.81 OriginalRawFileData ... 52
7.82 OriginalRawFileDigest ... 53
7.83 OriginalRawFileName ... 54
7.84 PreviewApplicationName ... 54
7.85 PreviewApplicationVersion ... 54
7.86 PreviewColourSpace ... 55
7.87 PreviewDateTime ... 55
7.88 PreviewSettingsDigest ... 55
7.89 PreviewSettingsName ... 56
7.90 ProfileCalibrationSignature ... 56
7.91 ProfileCopyright ... 56
7.92 ProfileDynamicRange ... 57
7.93 ProfileEmbedPolicy ... 58
7.94 ProfileGainTableMap ... 59
7.95 ProfileGainTableMap2 ... 60
7.95.1 DataType ... 61
7.95.2 Gamma ... 62
7.95.3 GainMin and GainMax ... 62
7.95.4 Application ... 62
7.95.5 Compatibility with ProfileGainTableMap ... 62
7.95.6 IFD 0 vs Camera Profile IFD ... 63
7.95.7 IFD 0 vs Raw IFD ... 63
7.96 ProfileGroupName ... 63
7.97 ProfileHueSatMapData1 ... 64
7.98 ProfileHueSatMapData2 ... 64
7.99 ProfileHueSatMapData3 ... 64
7.100 ProfileHueSatMapDims ... 65
7.101 ProfileHueSatMapEncoding ... 65
7.102 ProfileLookTableEncoding ... 66
7.103 ProfileLookTableData ... 67
7.104 ProfileLookTableDims ... 68
7.105 ProfileName ... 68
7.106 ProfileToneCurve ... 68
7.107 RawDataUniqueID ... 69
7.108 RawImageDigest ... 69

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7.109 RawToPreviewGain ... 70
7.110 ReductionMatrix1 ... 70
7.111 ReductionMatrix2 ... 70
7.112 ReductionMatrix3 ... 71
7.113 RGBTables ... 71
7.113.1 General ... 71
7.113.2 Notes on the tag fields ... 72
7.113.3 Background table ... 73
7.113.4 Table transform pipeline ... 74
7.113.5 Notes on applying the colour transforms ... 75
7.114 RowInterleaveFactor ... 76
7.115 SemanticInstanceID ... 77
7.116 SemanticName ... 77
7.117 SubTileBlockSize ... 77
7.118 UniqueCameraModel ... 78
7.119 WhiteLevel ... 78

8 Opcodes ... 78
8.1 DeltaPerColumn ... 79
8.1.1 Syntax ... 79
8.1.2 Description ... 79
8.2 DeltaPerRow ... 80
8.2.1 Syntax ... 80
8.2.2 Description ... 80
8.3 FixBadPixelsConstant ... 81
8.3.1 Syntax ... 81
8.3.2 Description ... 81
8.4 FixBadPixelsList ... 81
8.4.1 Syntax ... 81
8.4.2 Description ... 82
8.5 FixVignetteRadial ... 82
8.5.1 Syntax ... 82
8.5.2 Description ... 82
8.6 GainMap ... 83
8.6.1 Syntax ... 83
8.6.2 Description ... 84
8.7 MapPolynomial ... 85
8.7.1 Syntax ... 85
8.7.2 Description ... 85
8.8 MapTable ... 86
8.8.1 Syntax ... 86
8.8.2 Description ... 86
8.9 ScalePerColumn ... 87
8.9.1 Syntax ... 87
8.9.2 Description ... 87
8.10 ScalePerRow ... 88
8.10.1 Syntax ... 88
8.10.2 Description ... 88
8.11 TrimBounds ... 89
8.11.1 Syntax ... 89
8.11.2 Description ... 89
8.12 WarpFisheye ... 89
8.12.1 Syntax ... 89
8.12.2 Description ... 89
8.12.3 Notes and restrictions ... 91
8.13 WarpRectilinear ... 91
8.13.1 Syntax ... 91
8.13.2 Description ... 91
8.13.3 Notes and restrictions ... 93

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8.14 WarpRectilinear2 93
8.14.1 Syntax 94
8.14.2 Description 94
8.14.3 Special compatibility note and relationship to previous warp opcodes 95
Annex A (informative) **Compatibility with legacy versions of DNG** **96**
Bibliography **100**

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 42, *Photography*.

A list of all parts in the ISO 12234 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Advanced and professional photographers often choose to capture and edit photos in raw format, for additional flexibility and artistic control. Unlike display-referred formats (such as JPEG, PNG, and TIFF) which store images that have already been processed by the camera, raw formats store unprocessed or minimally processed data directly from the camera sensor. This enables photographers to adjust many parameters to taste, including white balance, tone mapping, noise reduction, sharpening, and so on. Photos in raw format are analogous to film negatives in a photographer's workflow, so they are often referred to as "digital negatives."

The purpose of this document is to define a standardized file format for storing raw photographs. This file format can be used in a wide range of hardware and software applications for generating, processing, managing, transcoding, or archiving raw photographs. Since raw photographs are closely tied to the camera sensor and other characteristics, camera manufacturers may use and support their own Vendor Raw formats to meet various design requirements.

The name of this file format is Digital Negative (DNG). DNG is an extension of TIFF 6.0 and is compatible with TIFF-EP standard. It is possible (but not required) for a DNG file to simultaneously comply with both this document and the TIFF-EP standard.

Adobe Systems published the "Digital Negative (DNG) Specification." This includes specifying DNG by capturing and reconciling major adoptions and implementations of Adobe DNG.

Annex A describes the relationship of this document to the Adobe versions of DNG.

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Digital imaging — Image storage —

Part 4:
Digital negative format

1 Scope

This document specifies the Digital Negative (DNG) image file format. A DNG file meets the requirements provided in this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 12234-1, *Electronic still-picture imaging — Removable memory — Part 1: Basic removable-memory model*

ISO 12234-3, *Electronic still picture imaging — Removable memory — Part 3: XMP for digital photography*

ISO/TS 22028-3, *Photography and graphic technology — Extended colour encodings for digital image storage, manipulation and interchange — Part 3: Reference input medium metric RGB colour image encoding (RIMM RGB)*

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3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
opcode
image processing instruction to be executed on reading

3.2
raw
unprocessed or minimally processed image data which is directly related to the colur information captured by the sensor and suitable for further processing

Note 1 to entry: In this document there is a distinction between "vendor raw" and "standard raw", defined below, and use "raw" to refer to "'standardized raw".

3.3
reader
device that consumes files compliant with this document

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3.4
standard raw
raw files conformant with this document

Note 1 to entry: This is in contrast to vendor raw files which are typically vendor specific. In the context of this document, raw = standard raw and vendor raw will be referred to as vendor raw.

3.6
tag
12-byte record having different formats

Note 1 to entry: The formats are as follow:

Bytes 0–1: The Tag ID Field, which is a number that identifies the particular tag.

Bytes 2–3: The Data Type Field, which is one of the following values:

1 = BYTE, an 8-bit unsigned integer.

2 = ASCII, a string of 8-bit bytes containing 7-bit ASCII character codes terminated with a NULL code.

3 = SHORT, a 16-bit (2-byte) unsigned integer.

4 = LONG, a 32-bit (4-byte) unsigned integer.

5 = RATIONAL, is two LONGs. The first LONG is the numerator and the second LONG is the denominator.

6 = SBYTE, is a signed 8-bit integer

7 = UNDEFINED, indicates an 8-bit byte that can take any value depending on the field definition.

8 = SSHORT, is a signed 16-bit integer

9 = SLONG, is a signed 32-bit integer

10 = SRATIONAL, is two SLONGs: the first represents the numerator of the fraction, the second represents the denominator, which shall be non-zero.

11 = FLOAT, is 32-bit (4-byte) float in IEEE-754 format

12 = DOUBLE, is 64-bit (8-byte) float in IEEE-754 format

Bytes 4–7: The Count Field, which indicates the number of Data Type values (not the number of bytes) stored by the tag.

Bytes 8–11: The value or offset field, which indicates the tag value(s) if they can be stored in these 4 bytes, or the offset to the data if more room is required. The offset value is the relative offset from the Byte Order field in the file header.

3.7
TIFF tag and value
logical entity consisting of a TIFF tag and its value, where this logical concept is implemented as an 12 byte IFD entry

Note 1 to entry: The tag value(s) if they can be stored in the last 4 bytes, or the offset to the data if more room is required. The offset value is the relative offset from the byte order field, first two bytes of the file in the file header.

3.8
DNG file
file compliant with this document

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3.9
vendor raw
<common usage>raw files referring to a variety of non-standardized raw file formats independently specified by any number of vendors

Note 1 to entry: For the purposes of this document, these will be referred to as 'vendor raw' and 'raw' will refer to this 'standardized raw' document.

3.10
colour space
colour space encoding in which manual edits or image enhancement processing is performed

Note 1 to entry: Manual edits in a colour space are performed viewing the effect of the edits on some medium which becomes the reference medium for the editing process. Typically, the black and white points of this medium are encoded at the minimum and maximum working colour space values. In this case, in order to obtain accurate colourimetric values, the black and white scaling corresponding to the reference medium used must be undone. XYZ scaling is typically recommended (see ISO 22028-2).

Note 2 to entry: When a colour space encoding used for a standard colour image encoding is also used as a current space, it may still be necessary to perform a colour re-rendering of the values associated with the (potentially variable) working colour space reference medium to make them appropriate for the colour image encoding reference medium, and for open exchange. For example, When the sRGB colour space encoding specified in IEC 61966-2-1 is used as a working colour space for the editing of motion picture content, viewing it in a dark theatrical environment, the resulting images will be encoded in the sRGB colour space encoding but not in the sRGB colour image encoding. Consequently, they will not produce good results if exchanged and interpreted according to the sRGB colour image encoding standard.

Note 3 to entry: Image enhancement processing may involve the application of algorithms in different working spaces as different operations and algorithms may be optimized for particular working spaces.

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4 DNG format

4.1 Overview

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This clause describes the DNG file format. A DNG file shall comply with all of the format requirements of TIFF 6.0, unless otherwise noted in this document.

4.2 File extensions

It is recommended to use the file extension DNG or dng. For example, IMG_1234.DNG or IMG_1234.dng.

4.3 SubIFD trees

It is recommended that DNG files use SubIFD trees, as described in TIFF-EP. However, DNG files shall not use SubIFD chains.

The highest-resolution and quality IFD shall use a NewSubFileType value of 0.

Reduced-resolution or reduced-quality thumbnails or previews, if any, should use NewSubFileType equal to 1 (for a primary preview) or 10001.H (for an alternate preview).

It is recommended that the first IFD contain a low-resolution thumbnail, as described in TIFF-EP.

4.4 Byte order

DNG files may use either byte order (big-endian or little-endian).

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4.5 Masked pixels

Some camera sensors measure the black encoding level using masked pixels at the edges of the sensor. These pixels can either be trimmed before storing the image, or they can be included in the stored image. If the masked pixels are not trimmed, the area of the non-masked pixels shall be specified using the ActiveArea tag.

The black encoding level information extracted from these masked pixels should be used to either pre-compensate the raw data stored in the file or they should be included in the file using the tags for specifying the black level.

This black encoding level information shall be included, even if the masked pixels are not trimmed, to allow DNG readers to process the image without requiring knowledge of the best way to compute the black levels for any given camera model.

4.6 Defective pixels

There are two methods to treat defective pixels in a DNG file.

The first method is to remove (for instance, interpolate over) the defective pixels before storing the raw image into the DNG file.

The second is to include an appropriate opcode (either FixBadPixelsConstant or FixBadPixelsList) in the OpcodeList1 tag.

4.7 Metadata

Metadata can be stored in DNG in the following ways:

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— Using TIFF-EP (ISO 12234-2) metadata tags

— Using EXIF metadata tags

— Using the IPTC metadata tag (tag code 33723)

— Using the XMP metadata tag (tag code 700)

NOTE TIFF-EP and EXIF use nearly the same metadata tag set, but TIFF-EP stores the tags in IFD 0, while EXIF store the tags in a separate IFD. It is recommended to use a separate EXIF IFD.

4.8 Proprietary data

Proprietary data may be stored using private tags, private IFDs, or a private MakerNote. It is recommended to use the DNGPrivateData and MakerNoteSafety tags to ensure that programs that edit DNG files preserve this proprietary data.

NOTE Camera manufacturers can include proprietary data in a raw file for use in their own software. Use of such proprietary data can result in different images.

4.9 Camera profiles

A DNG file shall contain at least 1 camera profile. The primary camera profile shall be stored in IFD 0.

A DNG file may store additional camera profiles using the ExtraCameraProfiles tag.

A camera profile consists of a set of tags. Some tags are mandatory, while others are optional.

The tags belonging to a camera profile are:

— BaselineExposureOffset

— CalibrationIlluminant1

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— CalibrationIlluminant2
— CalibrationIlluminant3
— ColourMatrix1
— ColourMatrix2
— ColourMatrix3
— DefaultBlackRender
— ForwardMatrix1
— ForwardMatrix2
— ForwardMatrix3
— IlluminantData1
— IlluminantData2
— IlluminantData3
— ProfileCalibrationSignature
— ProfileCopyright
— ProfileDynamicRange
— ProfileEmbedPolicy
— ProfileGroupName
— ProfileHueSatMapData1
— ProfileHueSatMapData2
— ProfileHueSatMapData3
— ProfileHueSatMapDims
— ProfileHueSatMapEncoding
— ProfileLookTableData
— ProfileLookTableDims
— ProfileLookTableEncoding
— ProfileName
— ProfileToneCurve
— ReductionMatrix1
— ReductionMatrix2
— ReductionMatrix3

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4.10 Opcode lists

The concept of “Opcode Lists” enables additional image processing steps to be specified in an extensible manner.

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