

# **Digital Imaging and Communications In Medicine (DICOM)**

*Supplement 35 Retire Referenced Print*

**DICOM Standards Committee, Working Group 6, Base Standard**

1300 N. 17th Street

Rosslyn, Virginia 22209 USA

**Version : Final Text**

**January 30, 1999**

## Foreword

2 In 1983, the American College of Radiology (ACR) and the National Electrical Manufacturers Association  
(NEMA) formed the ACR-NEMA Standards Committee which developed a standard for Digital Imaging and  
4 Communications in Medicine (DICOM). This committee, now called the DICOM Standards Committee,  
has expanded its membership to include many other bio-medical professional societies, vendor  
6 companies, standards developing organizations, and government agencies.

DICOM is developed in liaison with other standardization organizations including CEN TC251 in Europe  
8 and JIRA in Japan, with review also by other organizations including IEEE, HL7 and ANSI in the USA.

This document is a Supplement to the DICOM Standard. It is an extension to the published DICOM  
10 Standard which consists of the following parts:

PS: 3.1 - Introduction and Overview

12 PS: 3.2 - Conformance

PS: 3.3 - Information Object Definitions

14 PS: 3.4 - Service Class Specifications

PS: 3.5 - Data Structures and Encoding

16 PS: 3.6 - Data Dictionary

PS: 3.7 - Message Exchange

18 PS: 3.8 - Network Communication Support for Message Exchange

PS: 3.9 - Point-to-Point Communication Support for Message Exchange

20 PS: 3.10 - Media Storage and File Format

PS: 3.11 - Media Storage Application Profiles

22 PS: 3.12 - Media Format and Physical Media for Media Interchange

PS: 3.13 - Print Management Point-to-Point Communication Support

24 These parts are related but independent documents.

## Scope and Field of Application

2 This Supplement retires the Referenced Print Meta SOP Classes.

4 Since this document proposes changes to existing Parts of DICOM the reader should have a working understanding of the Standard.

This Supplement includes a number of Addenda to existing Parts of DICOM :

- 6 — PS 3.3 Addendum : Print Storage Information Object Definitions
- PS 3.4 Addendum : Print Storage SOP Class, Print Request SOP Class
- 8 — PS 3.6 Addendum : Print Storage Data Dictionary

## Digital Imaging and Communications In Medicine (DICOM)

### Part 3 Addendum Retire Referenced Print

Modify the following Section.

#### B.9 BASIC IMAGE BOX INFORMATION OBJECT DEFINITION

##### B.9.1 IOD description

The Basic Image Box Information Object Definition is an abstraction of the presentation of an image and image related data in the image area of a film. The Basic Image Box IOD describes the presentation parameters and image pixel data which apply to a single image of a sheet of film.

##### B.9.2 IOD modules

Table B.9-1  
BASIC IMAGE BOX IOD MODULES

Module	Reference	Module Description
SOP Common	C.12.1	Contains SOP Common information
Image Box Presentation Module	C.13.5	Contains Image Box presentation information
<del>Image Box Relationship Module</del>	<del>C.13.6</del>	<del>References to related SOPs</del>

The Image Box Relationship Module was previously defined in DICOM. It is now retired. See PS 3.3-1998.

Retire the Following Sections

#### B.13 VOI LUT BOX INFORMATION OBJECT DEFINITION

This section was previously defined in DICOM. It is now retired. See PS 3.3-1998.

**Editor's Note: Delete the balance of this section.**

#### C.13.6 Image Box Relationship Module (Retired)

This section was previously defined in DICOM. It is now retired. See PS 3.3-1998.

**Editor's Note: Delete the balance of this section.**

## Digital Imaging and Communications In Medicine (DICOM)

### Part 4 Addendum :Retire Referenced Print

#### Modify section H.2.1.2. Replace existing Figure H.2-2

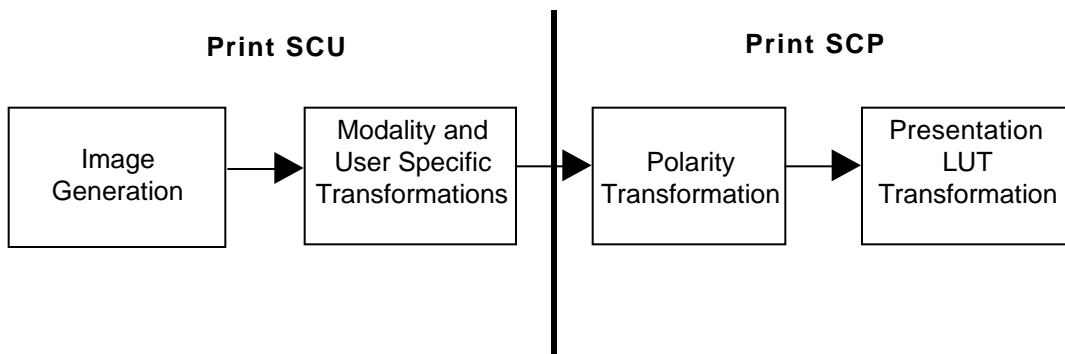
#### H.2.1.2 Grayscale Transformations

The Print Management Service Class supports ~~two a sequence of~~ grayscale transformations and spatial transformations that converts an original image into a printed image.

The sequence of spatial transformations (e.g., magnification and merging of annotation with images) and their relationships with the grayscale transformations are implementation specific and fall beyond the scope of the DICOM Standard.

The sequence of grayscale transformations is important for achieving consistent image quality because of the non-orthogonal nature of the different transformations. Figure H.2-2 describes the sequence of grayscale transformations.

Note: This section previously described Modality LUT and VOI LUT transformations in more detail. Since Referenced Print SOP Classes have been retired, these descriptions no longer apply to the Print Management Service Class. See PS 3.4-1998.



**Figure H.2-2**  
**PRINT MANAGEMENT DATA FLOW MODEL**

#### H.2.1.2.1 Modality and User Specific Transformations

Examples of these transformations are Modality LUT, Mask Subtraction, and VOI LUT.

The Modality LUT transforms manufacturer dependent pixel values into pixel values which are meaningful for the modality and which are manufacturer independent.

The VOI LUT transforms the modality pixel values into pixel values which are meaningful for the user or the application. For example it selects of a range of pixel values to be optimized for display, such as soft tissue or bone windows in a CT image.

#### **H.2.1.2.1 — Modality LUT**

2 The Modality LUT transforms the manufacturer dependent pixel values into pixel values which are  
4 meaningful for the modality and which are manufacturer independent is specified as part of the  
Image IOD.

In the case of a linear transformation, the Modality LUT is described by the Rescale Slope  
6 (0028,1053) and Rescale Intercept (0028,1052). In the case of a non-linear transformation, the  
Modality LUT is described by the Modality LUT module.

8 The meaning of pixel values output from the Modality LUT is modality dependent. For example,  
Hounsfield number for CT, Optical Density for film digitizers. For other modalities the output pixel  
10 values are usually undefined.

#### **H.2.1.2.2 — Value of Interest (VOI) LUT**

12 The Value of interest (VOI) LUT transforms the modality pixel values into pixel values which are  
14 meaningful for the user or the application. For example it selects of a range of pixel values to be  
optimized for display, such as soft tissue or bone windows in a CT image.

The semantics of the VOI pixel values are defined by the Photometric Interpretation (0028,0004)  
16 (see PS 3.3).

In the case of a linear transformation, the VOI LUT Box is described by the Window Center  
18 (0028,1050) and Window Width (0028,1051) In the case of a non-linear transformation, the VOI  
LUT is described by the VOI LUT module (as part of the Image IOD) or by the VOI LUT Box IOD  
20 (referenced by the Image Box IOD). The VOI LUT shall not have any sections with negative slope.

The VOI LUT is either part of the Image IOD or part of the Image Box IOD. If the VOI LUT is part of  
22 both the Image IOD and the Image Box IOD then the Image Box related VOI LUT shall have  
precedence over the Image related VOI LUT.

#### **H.2.1.2.2.3 Polarity**

24 Polarity specifies whether minimum ~~input VOI~~ pixel values shall be displayed as black or white. If  
26 Polarity (2020,0020) is NORMAL then the ~~VOI~~ pixels will be displayed as specified by Photometric  
Interpretation; if Polarity is REVERSE then the ~~VOI~~ pixels will be displayed with the opposite  
28 polarity as specified by Photometric Interpretation.

Polarity (2020,0020) is an Attribute of the Image Box IOD.

#### **H.2.1.2.3.4 Presentation LUT**

30 The Presentation LUT transforms the polarity pixel values into Presentation Values (P-Values),  
32 which are meaningful for display of the images. P-Values are approximately related to human  
perceptual response. They are intended to facilitate consistent display with common input for  
34 both hardcopy and softcopy display devices and be independent of the specific class or  
characteristics of the display device. It is used to realize image display tailored for specific  
36 modalities, applications, and user preferences

In the Print Management Service Class, the Presentation LUT is part of the Presentation LUT IOD.

38 Hardcopy devices convert P-Values into optical density for printing. This conversion depends on  
40 desired image D-max and D-min. It also depends on expected viewing conditions such as  
lightbox intensity for transparency films. The conversion to printed density is specified in the  
Presentation LUT SOP Class.

If the modality desires to natively specify P-Values as its output, it can negotiate for support of the Presentation LUT, but specify a LUT that is an identity function. The identity function informs the display device that no further translation is necessary.

Note: Performing this translation in the printer prevents potential loss of precision (detail) that would occur if this translation were to be performed on many of the existing 8-bit modalities.

### Modify section H.3.1

#### H.3.1 Scope

Print Management conformance is defined in terms of supported Meta SOP Classes, which correspond with the mandatory functionality, and of supported optional SOP Classes, which correspond with additional functionality.

A Meta SOP Class corresponds with a pre-defined group of SOP Classes. The following Print Management Meta SOP Class Instances are defined:

- Basic Grayscale Print Management Meta SOP Class
- Basic Color Print Management Meta SOP Class
- ~~— Referenced Grayscale Print Management Meta SOP Class~~
- ~~— Referenced Color Print Management Meta SOP Class~~
- Pull Stored Print Management Meta SOP Class

### Modify section H.3.2

#### H.3.2 Print Management Meta SOP Classes

##### H.3.2.1 Description

The Basic Print Management Meta SOP Classes correspond with the minimum functionality that an implementation of the Print Management Service Class shall support. The Basic Print Management Meta SOP Classes support the following mandatory features:

- preformatted grayscale images or preformatted color images; preformatted images are images where annotation, graphics, overlays are burned in
- pre-defined film layouts (image display formats)
- basic presentation parameters on film session, film box and image box level
- basic device management

The optional SOP Classes described in Section H.3.3 may be used with the Basic Print Management Meta SOP Classes.

~~The Referenced Print Management Meta SOP Classes provide additional functionality to support printing of modality specific images. This includes applying Lookup Tables to the image pixel data.~~

~~The optional SOP Classes described in Section H.3.3 may be used with the Referenced Print Management Meta SOP Classes.~~

The Pull Stored Print Management Meta SOP Class is an extension of the Basic Print Management Meta SOP Class. It supports the following mandatory features:

- Film box (page) level printing
- Printing of Hardcopy Grayscale/Color and other Preformatted Images
- Images are send separately from the print parameters
- Print parameters are stored in the Stored Print Storage SOP Instance
- Stored Print Storage SOP Instances and the Image SOP Instances are sent to the printer by the various Storage SOP Classes

**Retire the Following Sections**

**H.3.2.2.3 Referenced Grayscale Print Management Meta SOP Class (Retired)**

This section was previously defined in DICOM. It is now retired. See PS 3.4-1998.

*Editor's Note: Delete the balance of this section.*

**H.3.2.2.4 Referenced Color Print Management Meta SOP Class (Retired)**

This section was previously defined in DICOM. It is now retired. See PS 3.4-1998.

*Editor's Note: Delete the balance of this section.*

**Modify the first part of section H.3.3.2**

**H.3.3.2 List of Optional SOP Classes**

The following optional SOP Classes may be used in conjunction with the Basic Print Management Meta SOP Classes and the Referenced Print Management Meta SOP Classes specified in Section H.3.2.2.

SOP Class Name	Reference	Usage SCU/SCP
Basic Annotation Box SOP Class	H.4.4	U/U
Print Job SOP Class	H.4.5	U/U
Image Overlay Box SOP Class	H.4.8	U/U
Presentation LUT SOP Class	H.4.9	U/U

**Modify section H.3.4**

**H.3.4 Conformance statement**

The implementation Conformance Statement of these SOP Classes shall follow PS 3.2.



The SCU Conformance Statement shall specify the following items:

- 2 — maximum number of supported Associations at the same time
- list of supported SOP Classes and Meta SOP Classes
- 4 — for each of the supported SOP and Meta SOP Classes:
  - list of supported optional SOP Class Attributes and DIMSE Service Elements
  - 6 — for each supported Attribute (mandatory and optional Attribute), the valid range of values

8  
The SCP Conformance Statement shall specify the following items:

- 10 — maximum number of supported Associations at the same time
- list of supported SOP Classes and Meta SOP Classes
- 12 — minimum and maximum number of printable pixel matrix per supported film size
- for each of the supported SOP Classes:
  - 14 — list of supported optional SOP Class Attributes and DIMSE Service Elements
  - for each supported Attribute (mandatory and optional Attribute):
    - 16 — valid range of values
    - default value if no value is supplied by the SCU
    - 18 — status code (Failure or Warning) if SCU supplies a value which is out of range
  - for each supported DIMSE Service, the SCP behavior for all specific status codes
- 20 — description of each supported custom Image Display Format (2010,0010) e.g., position and dimensions of each composing image box, numbering scheme of the image positions
- 22 — description of each supported Annotation Display Format ID (2010,0030) e.g., position and dimensions of annotation box, font, number of characters
- 24 — description of each supported configuration table (e.g. identification, content)
- 26 — if the SCP supports N-ACTION for the Film Session SOP Class then the SCP shall specify the maximum number of collated films
- 28 — ~~for Referenced Meta SOP Class Implementations, the conditions under which stored Image SOP Instances are deleted.~~

30  
32 **Modify Film Session N-DELETE Behavior**

**H.4.1.2.3.2 Behavior**

34 The SCU uses the N-DELETE to request the SCP to delete the Basic Film Session SOP Instance hierarchy. The SCU shall specify the SOP Instance UID of the Basic Film Session (root).

36 The SCP shall delete the specified SOP Instance hierarchy.

38 The SCP shall not delete Image SOP Instances ~~or VOI LUT Box SOP Instances~~ as long as there are outstanding references to these SOP Instances

Note: It is beyond the scope of the Standard to specify when the SCP actually deletes the Image SOP Instances. ~~or VOI LUT Box SOP Instances.~~ See Note in Section H.4.3.3.2.1.3.

The SCP shall return the status code of the requested SOP Instance deletion. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

## Modify Film Box N-DELETE Behavior

### H.4.2.2.3.1 Behavior

The SCU uses the N-DELETE to request the SCP to delete the Basic Film Box SOP Instance hierarchy. The SCU shall specify the SOP Instance UID of the last created Basic Film Box (root).

The SCP shall delete the specified SOP Instance hierarchy and shall remove the UID of the deleted Basic Film Box SOP Instance from the list of SOP Instance UIDs of the Film Box UIDs Attribute of the parent Basic Film Session SOP Instance.

The SCP shall return the status code of the requested SOP Instance hierarchy deletion. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

The SCP shall not delete Image SOP Instances ~~or VOI LUT Box SOP Instances~~ as long as there are outstanding references to these SOP Instances

Note: It is beyond the scope of the Standard to specify when the SCP actually deletes the Image SOP Instances. ~~or VOI LUT Box SOP Instances.~~

## Retire the Following Sections

### H.4.3.3 Referenced Image Box SOP Class (Retired)

This section was previously defined in DICOM. It is now retired. See PS 3.4-1998.

***Editor's Note: Delete the balance of this section.***

### H.4.7 VOI LUT Box SOP Class (Retired)

This section was previously defined in DICOM. It is now retired. See PS 3.4-1998.

***Editor's Note: Delete the balance of this section.***

## Retire H.6.2

### H.6.2 Advanced Example (Retired)

This section was previously defined in DICOM. It is now retired. See PS 3.4-1998.

***Editor's Note: Delete the balance of this section.***

## Digital Imaging and Communications In Medicine (DICOM)

2

### Part 6 Addendum Print Storage Data Dictionary

4

6

#### Retire the following Attributes

2020,0130 Referenced Overlay Box Sequence

8

2020,0140 Ref. VOI LUT Sequence

10

#### Modify Table A-1

12

**Table A-1  
UID VALUES**

UID Value	UID NAME	UID TYPE	Part
1.2.840.10008.5.1.1.4.2	Referenced Image Box SOP Class (Retired)	SOP Class	PS 3.4
1.2.840.10008.5.1.1.9.1	Referenced Grayscale Print Management Meta SOP Class (Retired)	Meta SOP Class	PS 3.4
1.2.840.10008.5.1.1.18.1	Referenced Color Print Management Meta SOP Class (Retired)	Meta SOP Class	PS 3.4

14