GE Medical Systems

Technical Publications

Direction 2347917-100
Revision 1

Precision 500D CONFORMANCE STATEMENT for DICOM V3.0

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1. INTRODUCTION

1.1 OVERVIEW

This DICOM Conformance Statement is divided into Sections as described below:

Section 1 (Introduction), which describes the overall structure, intent, and references for this Conformance Statement

Section 2 (Network Conformance Statement), which specifies the GEMS equipment compliance to the DICOM requirements for the implementation of Networking features.

Section 3 (Media Storage Conformance Statement), which specifies the GEMS equipment compliance to the DICOM requirements for the implementation of Media Storage features.

Section 4 (Patient Root Query/ Retrieve Information Model), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of the Patient Root Query/Retrieve Information Model feature.

Section 5 (Study Root Query/ Retrieve Information Model), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of the Study Root Query/Retrieve Information Model feature.

Section 6 (Patient Study Only Query/ Retrieve Information Model), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of the Patient Study Only Query/Retrieve Information Model feature.

Section 7 (Modality Worklist Information Model Definition), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of the Basic Worklist Management Service feature.

Section 8 (XA Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a XA Information Object.

Section 9 (XRF Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a XRF Information Object.

Section 10 (Network Print SCU Conformance Statement), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of the Network Print feature.

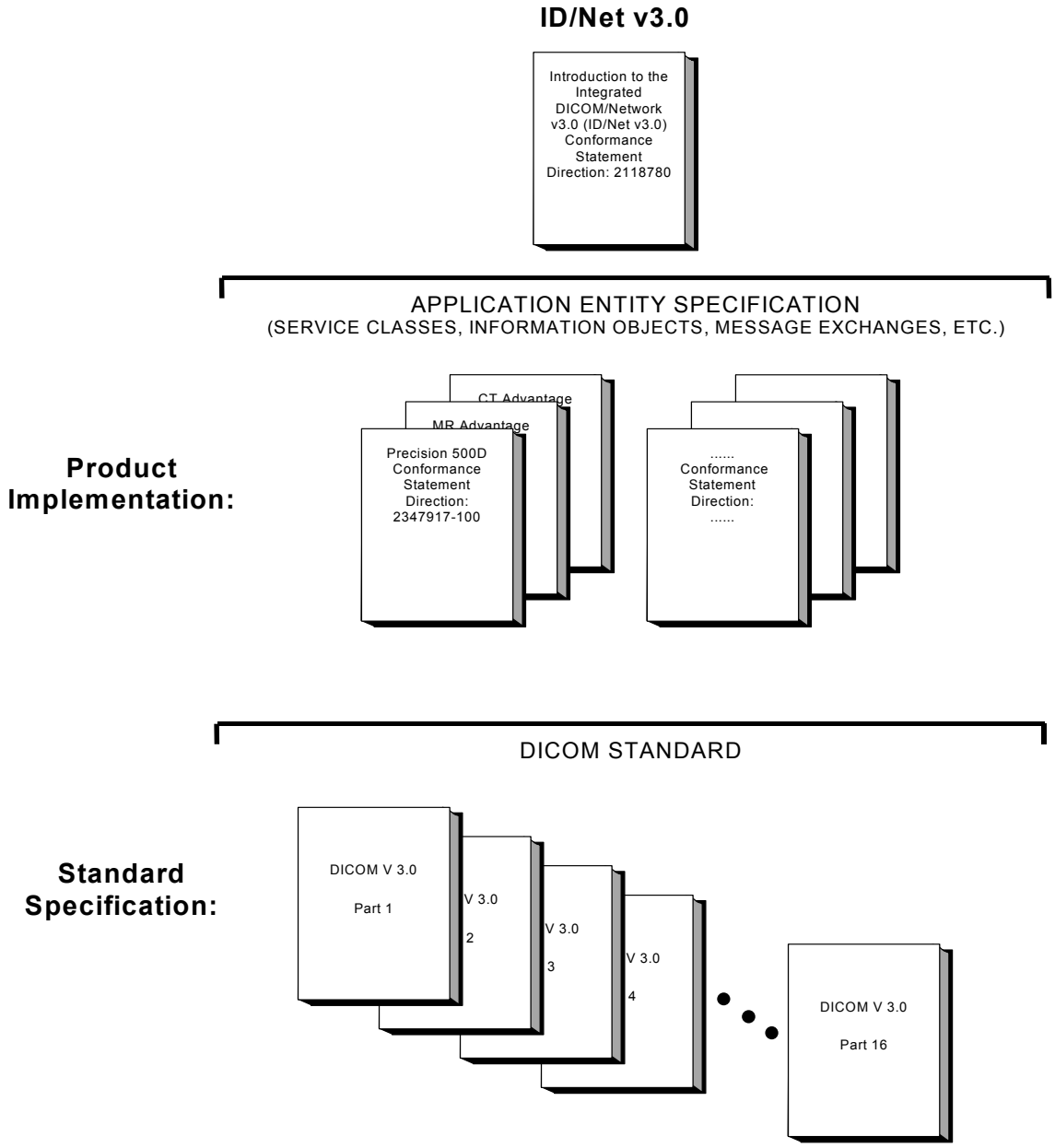
Section 11 (Network Print Management SOP Class Definition), which specifies the GE1MS equipment compliance to DICOM requirements for the implementation of the Network Print Management SOP Class.

Section 12 (Storage Commitment Push Model), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of the Storage Commitment Push Service feature.

Section 13 (Modality Performed Procedure Step), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of the Modality Performed Procedure Step feature.

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

The Documentation Structure of the GEMS Conformance Statements and their relationship with the DICOM v3.0 Conformance Statements is shown in the Illustration below.



This document specifies the DICOM v3.0 implementation. It is entitled:

Precision 500D
Conformance Statement for DICOM v3.0
*Direction **2347917-100***

This DICOM Conformance Statement documents the DICOM v3.0 Conformance Statement and Technical Specification required to interoperate with the GEMS network interface. Introductory information, which is applicable to all GEMS Conformance Statements, is described in the document:

Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0)
Conformance Statement
Direction: 2118780.

This Introduction familiarizes the reader with DICOM terminology and general concepts. It should be read prior to reading the individual products' GEMS Conformance Statements.

The GEMS Conformance Statement, contained in this document, also specifies the Lower Layer communications which it supports (e.g., TCP/IP). However, the Technical Specifications are defined in the DICOM v3.0 Part 8 standard.

For more information including Network Architecture and basic DICOM concepts, please refer to the Introduction.

For more information regarding DICOM, copies of the Standard may be obtained on the Internet at http://medical.nema.org. Comments on the standard may be addressed to:

DICOM Secretariat
NEMA
1300 N. 17th Street, Suite 1847
Rosslyn, VA 22209 USA
+1.703.841.3200

1.3 INTENDED AUDIENCE

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM v3.0 Standards and with the terminology and concepts which are used in those Standards.

If readers are unfamiliar with DICOM v3.0 terminology they should first refer to the document listed below, then read the DICOM v3.0 Standard itself, prior to reading this DICOM Conformance Statement document.

Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0)
Conformance Statement
Direction: 2118780

1.4 SCOPE AND FIELD OF APPLICATION

It is the intent of this document, in conjunction with the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780*, to provide an unambiguous specification for GEMS implementations. This specification, called a

Conformance Statement, includes a DICOM v3.0 Conformance Statement and is necessary to ensure proper processing and interpretation of GEMS medical data exchanged using DICOM v3.0. The GEMS Conformance Statements are available to the public.

The reader of this DICOM Conformance Statement should be aware that different GEMS devices are capable of using different Information Object Definitions. For example, a GEMS CT Scanner may send images using the CT Information Object, MR Information Object, Secondary Capture Object, etc.

Included in this DICOM Conformance Statement are the Module Definitions which define all data elements used by this GEMS implementation. If the user encounters unspecified private data elements while parsing a GEMS Data Set, the user is well advised to ignore those data elements (per the DICOM v3.0 standard). Unspecified private data element information is subject to change without notice. If, however, the device is acting as a "full fidelity storage device", it should retain and re-transmit all of the private data elements which are sent by GEMS devices.

1.5 IMPORTANT REMARKS

The use of these DICOM Conformance Statements, in conjunction with the DICOM v3.0 Standards, is intended to facilitate communication with GE imaging equipment. However, **by itself, it is not sufficient to ensure that inter-operation will be successful**. The **user (or user's agent)** needs to proceed with caution and address at least four issues:

- **Integration** - The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM v3.0), and of this introduction and associated DICOM Conformance Statements when interoperability with non-GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non–GE systems is the **user's** responsibility and should not be underestimated. The **user** is strongly advised to ensure that such an integration analysis is correctly performed.

- **Validation** - Testing the complete range of possible interactions between any GE device and non–GE devices, before the connection is declared operational, should not be overlooked. Therefore, the **user** should ensure that any non–GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non–GE device and the stability of the image data for the intended applications.

  Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non-GE device, as well as when images acquired on non-GE equipment is processed/displayed on a GE console or workstation.

- **Future Evolution** - GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM v3.0 Standard. DICOM v3.0 will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEMS protocol is based on DICOM v3.0 as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM v3.0. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) reflected on by these DICOM Conformance Statements**. The **user** should ensure that any non–GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.

- **Interaction** - It is the sole responsibility of the **non–GE provider** to ensure that communication with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

1.6 REFERENCES

A list of references which is applicable to all GEMS Conformance Statements is included in the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780*.

The information object implementation refers to DICOM PS 3.3 (Information Object Definition).

1.7 DEFINITIONS

A set of definitions which is applicable to all GEMS Conformance Statements is included in *the Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780*.

1.8 SYMBOLS AND ABBREVIATIONS

A list of symbols and abbreviations which is applicable to all GEMS Conformance Statements is included in the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780*.

2. NETWORK CONFORMANCE STATEMENT

2.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the compliance to DICOM conformance requirements for the relevant **Networking** features on this GEMS product. Note that the format of this section strictly follows the format defined in DICOM Standard PS 3.2 (Conformance). Please refer to that part of the standard while reading this section.

The details of the DICOM conformance related to other Information Objects and Information Models supported by the product are included in subsequent sections of this DICOM Conformance Statement.

Precision 500D is an Integrated Radiography & Fluoroscopy Imaging System:

It uses DICOM services to export/import images to/from remote workstations and archives.

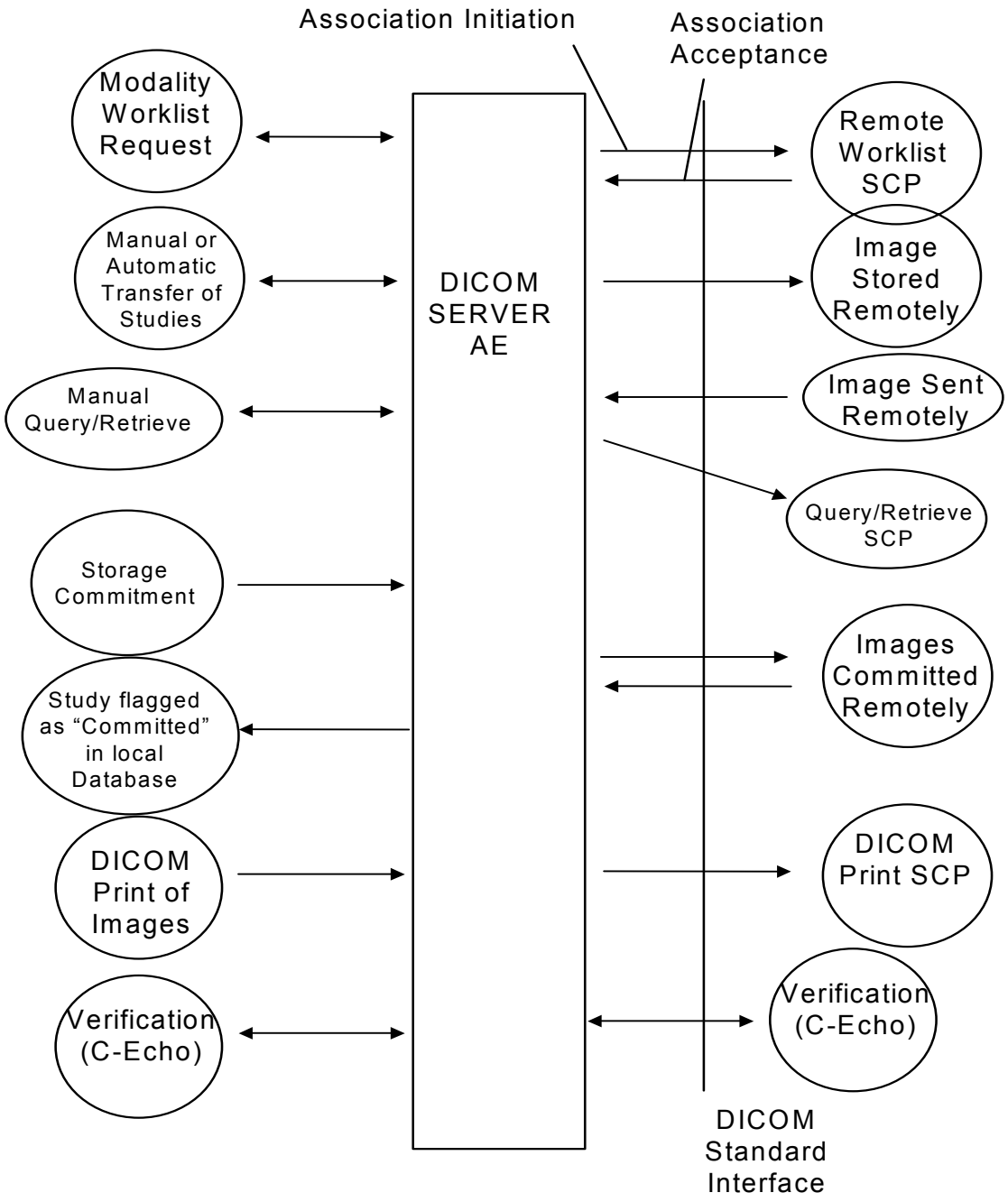
It uses DICOM Storage Commitment service to transfer ownership of images to a remote workstation supporting storage commitment such as an archive system.

It allows a user to query for and display DICOM Modality worklist information from a remote hospital or radiology department information system computer. For example, a user may wish to query for all procedures scheduled to be performed on the system. In this situation, Precision 500D is providing the DICOM Modality Worklist SOP Class service as a service class user (SCU).

2.2 IMPLEMENTATION MODEL

2.2.1 Application Data Flow Diagram

The Basic and Specific Application models for this device are shown in the following Illustration :



2.2.2 Functional Definition of AE's

DICOM Server AE:

The DICOM Server Application Entity (AE) is an application which handles DICOM protocol communication. DICOM SERVER AE is automatically brought up when the Precision 500D system is powered on.

All remote DICOM AE's must be manually configured on the Precision 500D by an operator or field engineer.

The declaration of remote DICOM AE's is done through the Service User Interface (SUIF).

The DICOM SERVER AE is invoked by the following Real World Activities:

I. Manual Transfer of Patients/Studies from the Precision 500D system to a Remote Host.

For this operation, the operator selects patient/studies on the Patient List and then selects the device(s) to send to using the drop down list of stations (maximum of two at once). The user then presses the Send Study button on the Patient List screen to initiate the transfer.

II. Automatic Transfer of Patients/Studies from the Precision 500D system to a Remote Host.

For this operation, the transfer of images is triggered automatically. When Auto-Send is Enabled, all images generated during an acquisition session are automatically sent to the defined auto-push remote host(s) (maximum of 2) when the user closes the exam.

The enabling of the Auto-Send is done from the acquisition screen on the IUI by checking the Auto-send check box. The default state of the Auto-send (On/Off) can be set in the User Preference tab.

III. Images Sent Remotely from a Remote DICOM AE to Precision 500D system.

When images are installed in the local database, they are displayed in the Precision 500D Patient List screen. Only images created on a Precision 500D system will be viewable on the Precision 500D system.

IV. Manual Query/Retrieve

For this operation, the operator presses the Query/Retrieve button on the Patient List screen then selects the station to query from the drop-down list and presses the Perform Query button. The Precision 500D system then queries a remote database to obtain a list of Patient/Studies available on that Remote Host. To retrieve a Patient/Study the user selects the patient from the list and presses the Retrieve Patient Button. The patient is then transferred into the local patient database and is displayed on the Patient List screen.

V. Worklist Query

For this operation, the operator needs to press the Worklist button on the IUI. The Digital will transition to the Worklist screen and perform the default query. The user can then select the exam from the worklist and start the exam by pressing "Start Exam" button on IUI. The Worklist Query criteria are defined in the configuration of the system.

VI. Storage Commitment

For this operation, the operator performs a Manual or Automatic transfer of images to a Storage SCP. Once images are sent a Storage Commitment Request is automatically queued and sent after a short delay.

2.2.3 Sequencing of Real-World Activities

DICOM Server AE:

Worklist Query:

I. The user presses the Worklist button on the IUI and the digital transitions to the worklist screen and automatically queries for a worklist with a default query.

II. The modality worklist SCP returns responses which match the query parameters.

III. The worklist patients are displayed to the user in the Worklist screen on the system.

IV. The user selects the exam to perform and presses the Start Exam button on the IUI.

V. MPPS information is sent to the Worklist provider with status information (see Section 13).

Note: The worklist can be manual queried once in the worklist screen by pressing one of the three default presets along with any parameters entered (Patient Name, Accession Number, etc.).

Automatic Transfer of Patients/Studies:

I. Service configures the devices to automatically send images to (maximum of 2 devices).

II. User Starts an exam.

III. User Acquires images.

IV. User verifies the Auto-send checkbox is checked. (Default state can be set to On/Off in User Preferences).

V. User presses Close button and MPPS information is sent (see Section 13).

VI. Images acquired for the study/exam are automatically sent to the remote host.

Manual Query/Retrieve:

I. The user presses the Query/Retrieve button on the Patient List screen.

II. The user selects the Query criteria and presses the Perform Query button.

III. The user selects the patient to retrieve and presses the Retrieve Patient button.

IV. The images are retrieved and put into the local database and the Patient List is updated with the patient/study.

Manual Send of Images:

I. The user selects the patients to transfer from the Patient List screen and then selects the destinations to transfer to using the drop down list of destinations.

II. The user then presses the Send Selected Studies button to transfer to the Remote DICOM Storage SCP.

Storage Commitment:

If the selected device the user has sent an exam/study too is configured for Storage Commitment the following happens after an automatic or manual image send:

I. Once the exam/study has been successfully sent the system queues a Storage Commitment request to be sent after a delay.

II. After the delay the Storage Commitment for the transferred images is sent to the Storage SCP.

III. If the Storage Commitment is successful the study is marked as committed on the Patient List screen.

2.3 AE SPECIFICATIONS

2.3.1 DICOM Server AE Specification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an **SCU**:

SOP Class Name	SOP Class UID
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
Patient/Study Only Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1
Patient/Study Only Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31
Storage Commitment Push Model	1.2.840.10008.1.20.1
Verification SOP Class	1.2.840.10008.1.1

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an **SCP** :

SOP Class Name	SOP Class UID
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2

Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Verification SOP Class	1.2.840.10008.1.1

2.3.1.1 Association Establishment Policies

2.3.1.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

Application Context Name	1.2.840.10008.3.1.1.1

The Maximum Length PDU negotiation is included in all association establishment requests.

The maximum length PDU for an association initiated by the DICOM Server AE is:

Maximum Length PDU	No Limitation for Maximum PDU Size

The SOP Class Extended Negotiation is not supported.

SOP Class Extended Negotiation shall NOT be supported for Storage Commitment associations

The user information Items sent by this product are :

- Maximum PDU Length
- Implementation UID
- Implementation Version Name

2.3.1.1.2 Number of Associations

The DICOM Server AE can support a maximum of 32 simultaneous associations.

2.3.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

DICOM Server AE allows a single outstanding operation on any association. Therefore, DICOM Server AE does not support asynchronous operations window negotiation, other than the default as specified by the DICOM specification.

2.3.1.1.4 Implementation Identifying Information

The Implementation UID for this DICOM v3.0 Implementation is:

Precision 500D Implementation UID	1.2.840.113619.6.107

The Implementation Version Name for this DICOM v3.0 Implementation is:

PRECISION_500_D

2.3.1.2 Association Initiation Policy

2.3.1.2.1 Real-World Activity: Manual Transfer of Patients/Studies

2.3.1.2.1.1 Associated Real-World Activity

The operator does the following:

I. Select from the Patient List screen the Patients/Studies to be sent. Selects the Destinations to send to from the two drop down lists of Storage SCP's and presses the Send Selected Studies button.

This will cause:

II. The Precision 500D to retrieve the Patients/Studies from the local database and convert them to DICOM images.

III. The DICOM Server AE will initiate a DICOM association, negotiate with the Remote DICOM Storage SCP an appropriate Transfer Syntax.

IV. Send the images if the negotiation is successful.

2.3.1.2.1.2 Proposed Presentation Context Table

Presentation Context Table - Proposed					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless Hierarch., First-order prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCP	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

		Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless Hierarch., First-order prediction	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70		
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless Hierarch., First-order prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None

2.3.1.2.1.2.1 SOP Specific DICOM Conformance Statement for all Storage SOP Classes

Following are the status codes that are more specifically processed when receiving messages from a **Storage** SCP equipment :

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes	Related Fields Processed if received
Refused	A7xx	Out of resources	Association is closed with Remote AE. Error is logged. Job status is set to retry.	(0000,0902)
	0122	SOP Class not Supported	Association is closed with Remote AE. Error is logged. Job status is set to retry.	(0000,0902)
Error	Cxxx	Cannot Understand	Association is closed with Remote AE. Error is logged. Job status is set to retry.	(0000,0901) (0000,0902)
	A9xx	Data Set does not match SOP Class	Association is closed with Remote AE. Error is logged. Job status is set to retry.	(0000,0901) (0000,0902)
Warning	B000	Coercion of Data Elements	Association is closed with Remote AE. Error is logged. Job status is set to retry.	(0000,0901) (0000,0902)
	B007	Data Set does not match SOP Class	Association is closed with Remote AE. Error is logged. Job status is set to retry.	(0000,0901) (0000,0902)
	B006	Elements Discarded	Association is closed with Remote AE. Error is logged. Job status is set to retry.	(0000,0901) (0000,0902)
Success	0000			None

2.3.1.2.2 Real-World Activity Automatic Transfer of Patients/Studies

2.3.1.2.2.1 Associated Real-World Activity

The operator does the following:

I. Open a patient for an exam.

II. Acquire series/images for the patient.

III. Verify the Auto-send checkbox is checked and closes the study.

This will cause:

IV. The Precision 500D to retrieve the Patients/Studies from the local database and convert them to DICOM images.

V. The DICOM Server AE will initiate a DICOM association, negotiate with the Remote DICOM Storage SCP(s) (maximum of 2 for autosend) an appropriate Transfer Syntax.

VI. Send the images if the negotiation is successful.

2.3.1.2.2.2 Proposed Presentation Context Table

Same as Real World Activity “Manual Transfer of Patients/Studies”

2.3.1.2.2.2.1 SOP Specific DICOM Conformance Statement for all Storage SOP Classes

Same as Real World Activity “Manual Transfer of Patients/Studies”

2.3.1.2.3 Real-World Activity Manual Query/Retrieve

2.3.1.2.3.1 Associated Real-World Activity

The operator does the following:

I. Presses the Query/Retrieve button on the patient list screen.

II. Selects the query criteria and presses the Perform Query button.

III. Selects the patient to retrieve and presses the Retrieve Patient button.

This will cause:

IV. The DICOM Server AE to initiate a DICOM association.

V. The DICOM Server AE to emit a C-FIND request to get a list of patients meeting the query criteria.

VI. The DICOM Server AE to emit a C-MOVE request to retrieve the selected patient(s).

Note: When the retrieved patients are viewed, some fields are displayed differently than during normal review of a non-retrieved study on the system – Date and Time are displayed in DICOM Format, and FPS is displayed on single-shot images with no value.

2.3.1.2.3.2 Proposed Presentation Context Table

Presentation Context Table - Proposed					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Patient/Study Only Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Patient/Study Only Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.3.1.2.3.2.1 SOP Specific DICOM Conformance Statement for the Patient Root Query/Retrieve Information Model - FIND , Study Root Query/Retrieve Information Model - FIND and Patient/Study Only Query/Retrieve Information Model - FIND SOP Classes

Following are the status codes that are more specifically processed when receiving messages from a **Query** SCP equipment :

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes	Related Fields Processed if received
Refused	A700	Out of resources	Association is closed. Job set to Retry status.	(0000,0902)
	0122	SOP Class not Supported	Association is closed. Error logged in log file.	(0000,0902)
Failed	A900	Identifier does not match SOP Class	Association is closed.	(0000,0901) (0000,0902)

		Class	Job set to Retry status.	(0000,0902)
	Cxxx	Unable to process	Association is closed. Job set to Retry status.	(0000,0901) (0000,0902)
Cancel	FE00	Matching terminated due to cancel	Association is closed. Error logged to log file.	None
Success	0000	Matching is complete - No final identifier is supplied		None
Pending	FF00	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.		Identifier
	FF01	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier		Identifier

2.3.1.2.3.2.2 SOP Specific DICOM Conformance Statement for the Patient Root Query/Retrieve Information Model - MOVE , Study Root Query/Retrieve Information Model - MOVE and Patient/Study Only Query/Retrieve Information Model - MOVE SOP Classes

Following are the status codes that are more specifically processed when receiving messages from a **Retrieve** SCP equipment :

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes	Related Fields Processed if received
Refused	A701	Out of resources - Unable to calculate number of matches	Association is closed. Job set to Retry status.	(0000,0902)
	A702	Out of resources - Unable to perform sub-operations	Association is closed. Job set to Retry status.	(0000,1021) (0000,1022) (0000,1023)
	A801	Move Destination Unknown	Association is closed. Job set to Retry status.	(0000,0902)
	0122	SOP Class not Supported	Association is closed. Job set to Retry status.	(0000,0902)
Failed	A900	Identifier does not match SOP Class	Association is closed.	(0000,0901) (0000,0902)

			Job set to Retry status.	
	Cxxx	Unable to process	Association is closed. Job set to Retry status.	(0000,0901) (0000,0902)
Cancel	FE00	Sub-operations terminated due to a Cancel indication	Association is closed. Error logged to log file.	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Warning	B000	Sub-operations Complete - One or more Failures.	Error logged to log file.	(0000,1021) (0000,1022) (0000,1023)
Success	0000	Sub-operations Complete - No Failure.		(0000,1021) (0000,1022) (0000,1023)
Pending	FF00	Sub-operations are continuing -		(0000,1020) (0000,1021) (0000,1022) (0000,1023)

2.3.1.2.4 Real-World Activity Worklist Query

2.3.1.2.4.1 Associated Real-World Activity

The operator does the following:

I. Presses the Worklist button on the IUI.

II. The system automatically queries the Worklist Provider to obtain a Worklist with the default query constraints.

III. User selects the Scheduled Procedure Step to acquire images for and presses Start Exam.

This will cause:

IV. The DICOM Server AE to initiate a DICOM association.

V. The DICOM Server AE to emit a C-FIND request to get a list of patients meeting the query criteria.

Note: For more information on the details of the Modality Worklist Query please see Section 7.

2.3.1.2.4.2 Proposed Presentation Context Table

Presentation Context Table - Proposed					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.3.1.2.4.2.1 SOP Specific DICOM Conformance Statement for the Modality Worklist Information Model - FIND SOP Class

Following are the status codes that are more specifically processed when receiving messages from a **Modality Worklist** SCP equipment :

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes	Related Fields Processed if received
Refused	A700	Out of resources	Association is closed. Error logged in log file.	(0000,0902)
	0122	SOP Class not Supported	Association is closed. Error logged in log file.	(0000,0902)
Failed	A900	Identifier does not match SOP Class	Association is closed. Error logged in log file.	(0000,0901) (0000,0902)
	Cxxx	Unable to process	Association is closed. Error logged in log file.	(0000,0901) (0000,0902)
Cancel	FE00	Matching terminated due to cancel	Association is closed.	None
Success	0000	Matching is complete - No final identifier is supplied		None
Pending	FF00	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.		Identifier
	FF01	Matches are continuing - Warning that one or more Optional Keys were not supported for existence for this Identifier		Identifier

2.3.1.2.5 Real-World Activity Storage Commitment

2.3.1.2.5.1 Associated Real-World Activity

The operator does the following:

I. Select from the Patient List screen the Patients/Studies to be sent. Selects the Destinations to send to from the two drop down lists of Storage SCP's and presses the Send Selected Studies button.

II. Once the transfer is complete and the device is configured for Storage Commitment the Storage Commitment is sent.

This will cause:

III. The DICOM Server AE will initiate a DICOM association, negotiate with the Remote DICOM Storage SCP an appropriate Transfer Syntax for the Storage Commitment.

IV. The DICOM Server AE emits a N-ACTION request. Only one N-ACTION Request is sent for all images to be committed.

2.3.1.2.5.2 Proposed Presentation Context Table

Presentation Context Table - Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.3.1.2.5.2.1 SOP Specific DICOM Conformance Statement for the Storage Commitment Push Model SOP Class

If the association negotiation is not successful the DICOM Server AE retries the association 3 times (after a timeout period). After the 3 tries the job is set to Failure status in the Network Queue.

After the N-ACTION request, if the received N-ACTION Response from the Storage Commitment Provider has a failure status, an error file is logged and the Storage Commitment is abandoned.

After the N-ACTION request, if the received N-ACTION Response from the Storage Commitment Provider has a success status, the DICOM Server AE can receive the N-EVENT-REPORT from the Storage Commitment Provider at any time.

2.3.1.2.5.3 Service Class User Behavior – N-ACTION

N-ACTION is sent when the images are successfully sent to a remote host declared as Storage Commitment Provider on the Precision 500D.

Storage Commitment can be requested for XA Image SOP Class and RF Image SOP Class.

The Referenced Study Component Sequence Attribute is not supported.

The transaction UID is applicable until we receive the N-EVENT-REPORT.

Storage Media File-Set ID & UID Attributes in the N-ACTION are not supported.

When receiving an unsuccessful N-ACTION Response Status Code from the SCP an error is logged in the log file, and the job is set to retry status.

2.3.1.2.5.4 Service Class User Behavior – N-EVENT-REPORT

When receiving the N-EVENT-REPORT, the system looks first for the SOP Instance UID successfully committed. It records them in a log file and flags them in the local database as "Committed". The status of any of the studies can be seen by looking at the Status column on the Patient List Screen (C = Committed). Secondly, the system looks for the SOP Instance UID for which the commit failed and records them in the log file.

2.3.1.2.6 Real-World Activity Verification (C-Echo) SCU

2.3.1.2.6.1 Associated Real-World Activity

I. Enter the SUIF screens on the IUI.

II. Select "Config" button, and then select "C-ECHO" button.

III. Select the DICOM Device to C-ECHO and press the Initiate C-ECHO button.

IV. Display is updated with status of the C-ECHO. Success or Failure is displayed to the user.

2.3.1.2.6.2 Accepted Presentation Context Table

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended**
Name	**UID**	**Name List**	**UID List**		**Negotiation**
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.3.1.2.6.2.1 SOP Specific DICOM Conformance Statement for all Verification SOP Classes

Precision 500D provides standard Conformance to the DICOM Verification Service Class.

2.3.1.3 Association Acceptance Policy

2.3.1.3.1 Real-World Activity Verification (C-ECHO) SCP

2.3.1.3.1.1 Associated Real-World Activity

I. A Remote DICOM Device initiates a C-ECHO.

II. The DICOM Server AE negotiates a transfer syntax and responds to the C-ECHO request with the appropriate status.

2.3.1.3.1.2 Accepted Presentation Context Table

Presentation Context Table - Accepted					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

2.3.1.3.1.2.1 SOP Specific DICOM Conformance Statement for all Verification SOP Classes

Following are the status codes the Application may send back to the SCU Equipment after performing the requested:

Service Status	Status Codes	Further Meaning	Status Code sending explanation	Related Fields sent back to the SCU
Success	0000		Operation Performed properly.	None

2.3.1.3.2 Real-World Activity Image Install

2.3.1.3.2.1 Associated Real-World Activity

I. A Remote DICOM SCU requests image storage.

II. Depending on if the station is configured to be able to send to the DICOM Server AE the DICOM Server AE accepts or rejects the association.

III. If the association is accepted then the images are transmitted and stored in the Local Database.

2.3.1.3.2.2 Accepted Presentation Context Table

Presentation Context Table - Accepted					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless Hierarch., First-order prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	Note 4
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless Hierarch., First-order prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCP	Note 4
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless Hierarch., First-order prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCP	None

NOTE 4

Storage Extended Negotiation is supported. DICOM Server AE negotiates with the following information :

Field Name	Value	Description of Field
Level of Support	2	Level 2 (FULL) SCP
Level of Digital Signature Support	0	Unspecified
Element Coercion	0	Does not coerce any Data Element

2.3.1.3.2.2.1 SOP Specific DICOM Conformance Statement for all Storage SOP Classes

Following are the status codes the Application may send back to the SCU Equipment after performing the requested **Storage** :

Service Status	Status Codes	Further Meaning	Status Code sending explanation	Related Fields sent back to the SCU
Refused	A700	Out of resources	Indicates that there was not enough storage space to store the image. Recovery from this condition is left to the administrative functions.	(0000,0902)

Error	C000	Failed	The operation was not successful.	(0000,0901) (0000,0902)
	C005	Unable to register object, study locked; no new objects allowed.	Indicates that no new objects can be added to this study because it has been locked.	(0000,0901) (0000,0902)
	C008	Cannot Understand	Indicates that the Data Set cannot be parsed into elements.	(0000,0901) (0000,0902)
	A900	Data Set does not match SOP Class	Indicates that the data set does not encode an instance of the SOP Class specified.	(0000,0901) (0000,0902)
Warning	B007	Data Set does not match SOP Class	Indicates that the data Set does not match the SOP Class, but that the image was stored anyway.	(0000,0901) (0000,0902)
Success	0000			None

2.3.1.3.2.3 Presentation Context Acceptance Criterion

The DICOM Server AE will accept any number of Storage Presentation Contexts per association request. Any one Abstract Syntax may be specified more than once in an association request, if the Transfer Syntaxes differ between the Presentation Contexts.

2.3.1.3.3 SOP Specific DICOM Conformance Statement for the Storage Commitment Push Model SOP Class SCU

The DICOM Server AE will only accept the SCU role (which must be proposed via SCP/SCU Role Selection Negotiation) within a Presentation Context for the Storage Commitment Push Model SOP Class.

Upon receiving a Storage Commitment N-EVENT-REPORT (Storage Commitment Result), the DICOM Server AE will validate the Transaction UID against its list of outstanding Storage Commitment Request Transaction UIDs. If it matches an outstanding Request, the AE will mark all SOP Instances for which a success status is indicated with an Archived flag, shown on the patient list as "C" in the status column.

If the Storage Commitment Result indicates any failure status the error will be written to the error log. Any retry is automatically reinitiated as a new Storage Commitment Request. The AE will process specific Failure Reason Codes as described in the table:

Failure Reason	Meaning	Application Behavior When Receiving Reason Code
0110H	Processing failure	Error logged in log file and automatically set to retry status
0112H	No such object instance	Error logged in log file and automatically set to retry status
0213H	Resource limitation	Error logged in log file and automatically set to retry status
0122H	Referenced SOP Class not supported	Error logged in log file.

0119H	Class / Instance conflict	Error logged in log file and automatically set to retry status
0131H	Duplicate transaction UID	Error logged in log file.

The AE always returns a Success Status 0000 to a Storage Commitment N-EVENT-REPORT.

2.4 COMMUNICATION PROFILES

2.4.1 Supported Communication Stacks (PS 3.8, PS 3.9)

DICOM Upper Layer (PS 3.8) is supported using TCP/IP.

2.4.2 OSI Stack

OSI stack not supported

2.4.2.1 Physical Media Support

Not Applicable.

2.4.3 TCP/IP Stack

The TCP/IP stack is inherited from the Operating System.

2.4.3.1 API

Not applicable to this product.

2.4.3.2 Physical Media Support

DICOM is indifferent to the Physical medium over which TCP/IP executes (e.g. Ethernet V2.0,IEEE 802.3, ATM, FDDI)

Note: For more information about the Physical Media available on Precision 500D, please refer to the Product Data Sheet.

2.4.4 Point-to-Point Stack

A 50-pin ACR-NEMA connection is not applicable to this product.

2.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

2.5.1 Standard Extended /Specialized/Private SOPs

Not Supported.

2.5.2 Private Transfer Syntaxes

Not Supported.

2.6 CONFIGURATION

2.6.1 AE Title/Presentation Address Mapping

DICOM Server AE:

AE Title is user Configurable.

2.6.2 Configurable Parameters

The following fields are configurable for this AE (local):

- Local AE Title
- Local IP Address
- Local Listening Port Number
- Local IP Netmask
- Default Router IP. Only one default router can be configure for all remote nodes.

The following fields are configurable for every remote DICOM AE:

- Remote AE Title
- Remote IP Address
- Listening TCP/IP Port Number

The following fields are configurable:

- Association Establishment Timer
- Maximum Length PDU

2.7 SUPPORT OF EXTENDED CHARACTER SETS

The Precision 500D will support only the ISO_IR 100 (ISO 8859-1:1987 Latin alphabet N 1. supplementary set) as extended character sets. Any incoming SOP instance that is encoded using another extended character set will not be installed in the local database.

2.8 CODES AND CONTROLLED TERMINOLOGY

The product uses no coded terminology.

2.9 SECURITY PROFILES

The product does not conform to any defined DICOM Security Profiles.

It is assumed that the product is used within a secured environment. It is assumed that a secured environment includes at a minimum:

1. Firewall or router protections to ensure that only approved external hosts have network access to the product.

2. Firewall or router protections to ensure that the product only has network access to approved external hosts and services.

3. Any communications with external hosts and services outside the locally secured environment use appropriate secure network channels (such as a Virtual Private Network (VPN))

3. MEDIA STORAGE CONFORMANCE STATEMENT

3.1 INTRODUCTION

This section of the conformance statement (CS) specifies the Precision 500D compliance to DICOM Media Interchange. It details the DICOM Media Storage Application Profiles and roles which are supported by this product.

This Station provides the capabilities to DICOM interchange on CD-R's (Compact Disc Recordable). The Precision 500D works with XA and XRF Image Types.

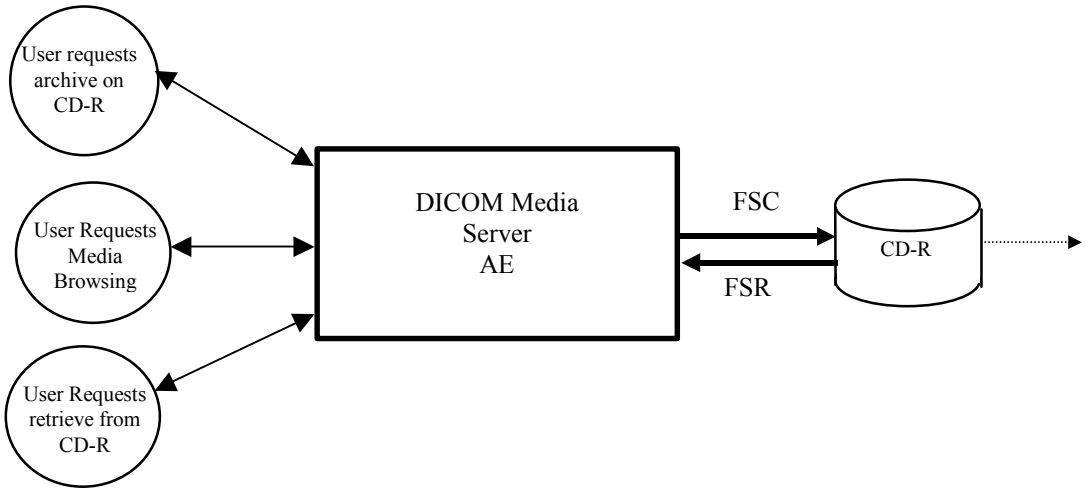
Note that the format of this section strictly follows the format defined in DICOM Standard PS 3.2 (Conformance). Please refer to that part of the standard while reading this section.

3.2 IMPLEMENTATION MODEL

3.2.1 Application Data Flow Diagram

The Basic and Specific Application models for this device are shown in the following Illustration :

ILLUSTRATION 3–1
SPECIFIC AE APPLICATION MODEL



I. Description of the data flow diagram for the CDROM device.

The User selects patients from the patient list screen to be archived and press the Archive to CD button on the Digital Patient List Screen. The images are saved on a single session disk in a one shot operation.

The user can request the reading of a DICOM file set written on a CD by selecting the CD Import from the Query/Retrieve screen. The user can restore the study/patient by selecting from the Query/Retrieve screen and press the Retrieve Patient button.

Note: When archiving to a CD each unique patient must have a unique Patient ID. If the Patient ID is the same between two patients when browsing the CD, the patients will be listed under the same name. When the patients are retrieved the correct names, etc. will be retrieved for the patient.

3.2.2 Functional Definition of AE's

The CD-R DICOM Media Server AE supports the following functions:

I. Has access to patient demographics and pixel data in the local database.

II. Can generate a DICOM File Set (FSC) for XA or XRF Images in a one shot activity.

III. Can read a DICOM File Set (FSR) on a CD.

IV. Can retrieve Patients/Studies from a CD.

3.2.3 Sequencing Requirements

Not applicable.

3.2.4 File Meta Information Options (See PS3.10)

The File Meta-Information for this implementation is :

File Meta-Information Version	**1**
Precision 500D Implementation UID	**1.2.840.113619.6.107**
Implementation Version Name	**PRECISION_500_D**

3.3 AE SPECIFICATIONS

3.3.1 DICOM CD-R Server AE Specification

The DICOM CD-R Server Application Entity provides standard conformance to DICOM Interchange Option of the Media Storage Service Class. The application Profiles and roles are listed below.

Supported Application Profile	Real World Activity	Role	Description
STD-GEN-CD	Archive	FSC	Interchange

STD-GEN-CD	Browse	FSR	Interchange
STD-GEN-CD	Retrieve	FSR	Interchange

3.3.1.1 File Meta Information for the DICOM CD-R Server Application Entity

Following are the values set in the File Meta Information for this AE Title :

Source Application Entity Title	MVF_ARCHIVE

3.3.1.2 Real-World Activities for the DICOM CDR Server Application Entity

3.3.1.2.1 Real-World Activity (RWA) "Archive CD"

The CD-R DICOM Media Server acts as a FSC using the interchange option when requested to copy SOP Instances from the local database to the CD-R.

The user has to insert a blank CD into the CD-R drive. Then, the user selects the Patients/Studies from the Patient List Screen that he wants the CD-R DICOM Media Server to copy onto the CD and presses the "Archive to CD" button.

Before writing the CD, the DICOM Media Server checks for the following conditions:

I. The inserted media is blank and writable. If the condition is not met, an error is displayed to the user and the CD is ejected.

II. The number of images to archive is 300 or less. If the condition is not met, a prompt is displayed to the user that over 300 images are selected and the patients to be archived are automatically reduced to obtain 300 images or less.

Once these checks are successful the CD-R writing process begins with the selected patients.

3.3.1.2.1.1 Media Storage Application Profile for the RWA "Archive CD":

For the list of Application Profiles that invoke this AE for the RWA Archive CD, see the Table in Section "Archive CD AE Specification".

3.3.1.2.1.1.1 Options :

Following are the SOP Classes supported by the RWA Archive CD:

Information Object Definition	SOP Class UID	Transfer Syntax	Transfer Syntax UID
Media Storage Directory Storage	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Little Endian	1.2.840.10008.1.2.1

X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Explicit VR Little Endian	1.2.840.10008.1.2.1

3.3.1.2.2 Real-World Activity (RWA) "Browse CD"

The CD-R DICOM Media Server acts as a FSR using the interchange option when requested to browse the CD.

When the CD-R DICOM Media Server AE is requested to provide a directory listing, it reads the File-Set and displays the DICOMDIR directory entries.

3.3.1.2.2.1 Media Storage Application Profile for the RWA "Browse CD":

For the list of Application Profiles that invoke this AE for the RWA Browse CD, see the Table in Section "Browse CD AE Specification".

3.3.1.2.2.1.1 Options :

Following are the SOP Classes supported by the RWA Browse CD:

Information Object Definition	SOP Class UID	Transfer Syntax	Transfer Syntax UID
Media Storage Directory Storage	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1

3.3.1.2.3 Real-World Activity (RWA) "Retrieve from CD"

The CD-R DICOM Media Server acts as a FSR using the interchange option when requested to retrieve from the CD.

When the CD-R DICOM Media Server AE is requested to provide a directory listing, it reads the File-Set and displays the DICOMDIR directory entries.

User selects Patients/Studies to retrieve from the CD-R and presses the "Retrieve Patient" button. Images are retrieved and populated into the local database.

3.3.1.2.3.1 Media Storage Application Profile for the RWA "Retrieve from CD":

For the list of Application Profiles that invoke this AE for the RWA Browse CD, see the Table in Section "Browse CD AE Specification".

3.3.1.2.3.1.1 Options :

Following are the SOP Classes supported by the RWA Retrieve from CD:

Information Object Definition	SOP Class UID	Transfer Syntax	Transfer Syntax UID
Media Storage Directory Storage	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1

X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Little Endian	1.2.840.10008.1.2.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Explicit VR Little Endian	1.2.840.10008.1.2.1

3.4 AUGMENTED AND PRIVATE APPLICATION PROFILES

No augmented/private profile is implemented

3.5 EXTENSIONS, SPECIALIZATIONS, PRIVATIZATIONS OF SOP CLASSES AND TRANSFER SYNTAXES

Not Applicable.

3.5.1 Extensions, Specializations, and Privatizations of SOP Classes

3.5.1.1 SOP Specific Conformance Statement for SOP Media Storage Directory

Not Applicable.

3.5.2 Private Transfer Syntax Specification

No private Transfer Syntax is written on the media by the described DICOM CD-R Server AE of the Precision 500D.

3.6 CONFIGURATION

The source AE Title is encoded in the File Meta-Information can not be modified.

3.7 SUPPORT OF EXTENDED CHARACTER SETS

The Precision 500D will support only the ISO_IR 100 (ISO 8859-1:1987 Latin alphabet N 1. supplementary set) as extended character sets. Any incoming SOP instance that is encoded using another extended character set will not be installed in the local database.

4. PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL DEFINITION

4.1 INTRODUCTION

This section specifies the use of the DICOM Patient Root Query/Retrieve Model used to organize data and against which a Query/Retrieve will be performed. The contents of this section are:

4.2 - Information Model Description

4.3 - Information Model Entity-Relationship Model

4.4 - Information Model Keys

4.2 PATIENT ROOT INFORMATION MODEL DESCRIPTION

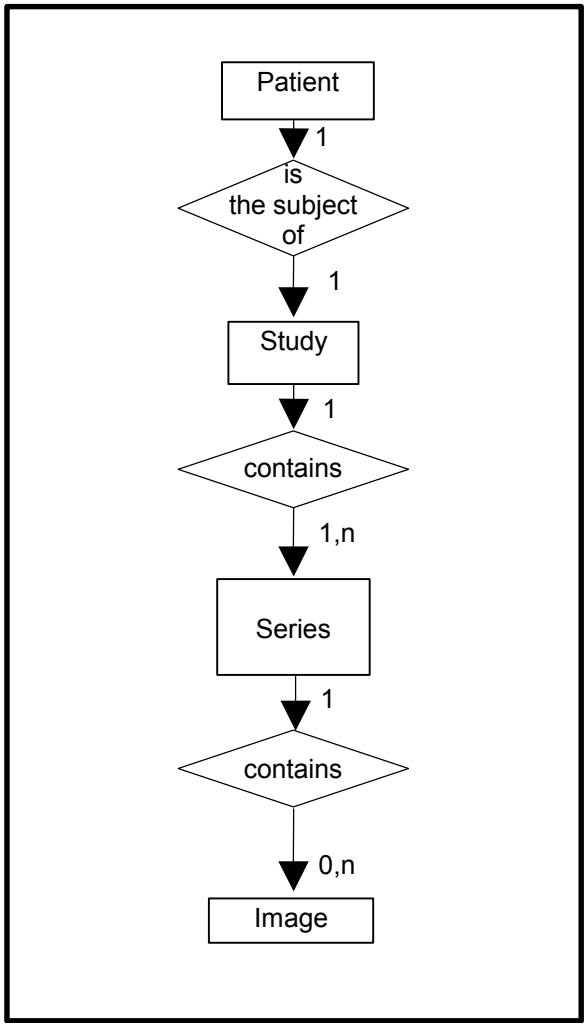
4.3 PATIENT ROOT INFORMATION MODEL ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the Patient Root Information Model schema is shown in Illustration 4.3-1**.** In this figure, the following diagrammatic convention is established to represent the information organization :

- each entity is represented by a rectangular box
- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Patient to Study relationship has 1 Study for each Patient (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

ILLUSTRATION 4.3-1
PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL E/R DIAGRAM



4.3.1 ENTITY DESCRIPTIONS

Please refer to DICOM Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Patient Root Query/Retrieve Information Model.

4.3.2 Precision 500D Mapping of DICOM entities

TABLE 4.3-1
MAPPING OF DICOM ENTITIES TO PRECISION 500D ENTITIES

DICOM	Precision 500D Entity
Patient	Patient
Study	Exam
Series	Series

4.4 INFORMATION MODEL KEYS

Please refer to DICOM Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Patient Root Query/Retrieve Information Model.

The following Level descriptions are included to specify what data elements are supported and what type of matching can be applied. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard PS 3.4 (Service Class Specifications).

4.4.1 Supported Matching

Following are the types of matching that can be request by the implementation :

- Single Value matching
- Universal Matching
- Wild Card Matching
- Range of date

4.4.2 Patient Level

This section defines the keys at the Patient Level of the Patient Root Query/Retrieve Information Model that are supported by this implementation.

TABLE 4.4-1
PATIENT LEVEL ATTRIBUTES FOR THE PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL

Attribute Name	Tag	Type	Note
Patient's Name	(0010,0010)	R	Matching is supported for this data element.
Patient ID	(0010,0020)	U	Matching is supported for this data element.

TABLE 4.4-2
Q/R PATIENT LEVEL AND LOCATION FOR RETRIEVE ATTRIBUTES

Attribute Name	Tag	Type	Note
Query Retrieve Level	(0008,0052)	-	Value = PATIENT

4.4.3 Study Level

This section defines the keys at the Study Level of the Patient Root Query/Retrieve Information Model that are supported by this implementation.

TABLE 4.4-3
STUDY LEVEL ATTRIBUTES FOR THE PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL

Attribute Name	Tag	Type	Attribute Description
Study Date	(0008,0020)	R	Matching is supported for this data element.

Study Time	(0008,0030)	R	Matching is not supported for this data element.
Accession Number	(0008,0050)	R	Matching is supported for this data element.
Study ID	(0020,0010)	R	Matching is supported for this data element.
Study Instance UID	(0020,000D)	U	Matching is not supported for this data element.

TABLE 4.4-4
Q/R STUDY LEVEL AND LOCATION FOR RETRIEVE ATTRIBUTES

Attribute Name	Tag	Type	Note
Query Retrieve Level	(0008,0052)	-	Value = STUDY

4.4.4 Series Level

This section defines the keys at the Series Level of the Patient Root Query/Retrieve Information Model that are supported by this implementation.

TABLE 4.4-5
SERIES LEVEL ATTRIBUTES FOR THE PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	R	Matching is supported for this data element
Series Number	(0020,0011)	R	Matching is not supported for this data element
Series Instance UID	(0020,000E)	U	Matching is not supported for this data element

TABLE 4.4-6
Q/R SERIES LEVEL AND LOCATION FOR RETRIEVE ATTRIBUTES

Attribute Name	Tag	Type	Note
Query Retrieve Level	(0008,0052)	-	Value = SERIES

5. STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL DEFINITION

5.1 INTRODUCTION

This section specifies the use of the DICOM Study Root Query/Retrieve Model used to organize data and against which a Query/Retrieve will be performed. The contents of this section are:

5.2 - Information Model Description

5.3 - Information Model Entity-Relationship Model

5.4 - Information Model Keys

5.2 STUDY ROOT INFORMATION MODEL DESCRIPTION

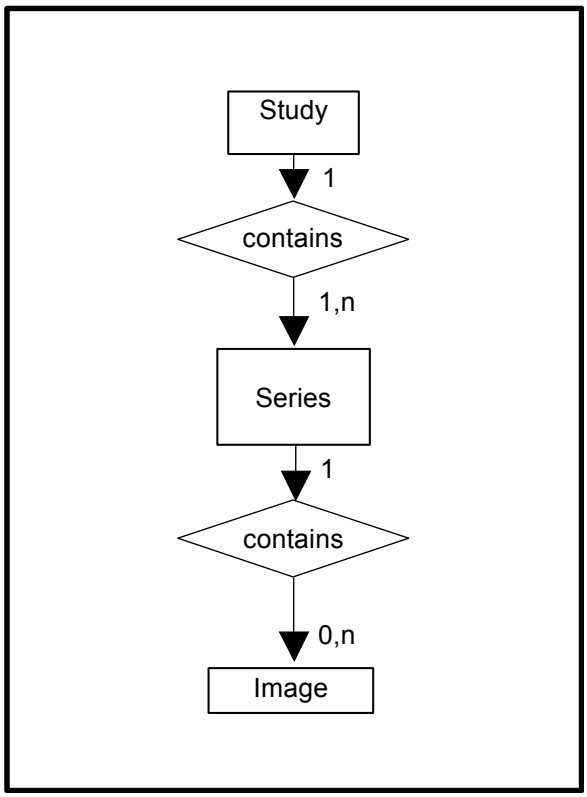
5.3 STUDY ROOT INFORMATION MODEL ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the Study Root Information Model schema is shown in Illustration 5.3-1**.** In this figure, the following diagrammatic convention is established to represent the information organization :

- each entity is represented by a rectangular box
- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series.

ILLUSTRATION 5.3-1
STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL E/R DIAGRAM



5.3.1 Entity Descriptions

Please refer to DICOM Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Study Root Query/Retrieve Information Model.

5.3.2 Precision 500D Mapping of DICOM entities

TABLE 5.3-1
MAPPING OF DICOM ENTITIES TO PRECISION 500D ENTITIES

DICOM	Precision 500D Entity
Study	Study
Series	Series

5.4 INFORMATION MODEL KEYS

Please refer to DICOM Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Study Root Query/Retrieve Information Model.

The following Level descriptions are included to specify what data elements are supported and what type of matching can be applied. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard PS 3.4 (Service Class Specifications).

5.4.1 Supported Matching

Following are the types of matching that can be request by the implementation:

- Single Value matching
- Universal Matching
- Wild Card Matching
- Range of date

5.4.2 Study Level

This section defines the keys at the Study Level of the Study Root Query/Retrieve Information Model that are supported by this implementation.

TABLE 5.4-2
STUDY LEVEL ATTRIBUTES FOR THE STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL

Attribute Name	Tag	Type	Attribute Description
Study Date	(0008,0020)	R	Matching is supported for this data element.
Study Time	(0008,0030)	R	Matching is supported for this data element.
Accession Number	(0008,0050)	R	Matching is supported for this data element.
Patient's Name	(0010,0010)	R	Matching is supported for this data element.
Patient ID	(0010,0020)	U	Matching is supported for this data element.
Study ID	(0020,0010)	R	Matching is supported for this data element.
Study Instance UID	(0020,000D)	U	Matching is not supported for this data element.

TABLE 5.4-3
Q/R STUDY LEVEL AND LOCATION FOR RETRIEVE ATTRIBUTES

Attribute Name	Tag	Type	Note
Query Retrieve Level	(0008,0052)	-	Value = STUDY

5.4.3 Series Level

This section defines the keys at the Series Level of the Study Root Query/Retrieve Information Model that are supported by this implementation.

TABLE 5.4-4
SERIES LEVEL ATTRIBUTES FOR THE STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	R	Matching is supported for this data element.
Series Number	(0020,0011)	R	Matching is not supported for this data element.
Series Instance UID	(0020,000E)	U	Matching is not supported for this data element.

TABLE 5.4-5
Q/R SERIES LEVEL AND LOCATION FOR RETRIEVE ATTRIBUTES

Attribute Name	Tag	Type	Note
Query Retrieve Level	(0008,0052)	-	Value = SERIES

6. PATIENT/STUDY ONLY QUERY/RETRIEVE INFORMATION MODEL DEFINITION

6.1 INTRODUCTION

This section specifies the use of the DICOM Patient/Study only Query/Retrieve Model used to organize data and against which a Query/Retrieve will be performed. The contents of this section are:

6.2 - Information Model Description

6.3 - Information Model Entity-Relationship Model

6.4 - Information Model Keys

6.2 PATIENT/STUDY ONLY INFORMATION MODEL DESCRIPTION

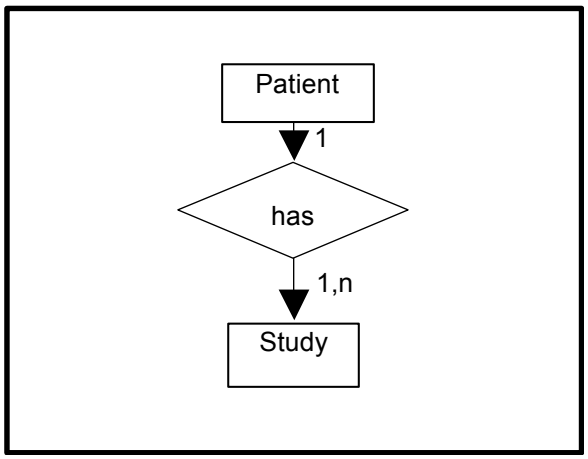
6.3 PATIENT/STUDY ONLY INFORMATION MODEL ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the Patient/Study only Information Model schema is shown in Illustration 6.3-1**.** In this figure, the following diagrammatic convention is established to represent the information organization :

- each entity is represented by a rectangular box
- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Patient and Study can have up to n Studies per Patient, but the Patient to Study relationship has 1 Study for each Patient (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

ILLUSTRATION 6.3-1
PATIENT/STUDY ONLY QUERY/RETRIEVE INFORMATION MODEL E/R DIAGRAM



6.3.1 Entity Description

Please refer to DICOM Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Patient/Study only Query/Retrieve Information Model.

6.3.2 Precision 500D Mapping of DICOM entities

TABLE 6.3-1
MAPPING OF DICOM ENTITIES TO PRECISION 500D ENTITIES

DICOM	Precision 500D Entity
Patient	Patient
Study	Study

6.4 INFORMATION MODEL KEYS

Please refer to DICOM Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Patient/Study only Query/Retrieve Information Model.

The following Level descriptions are included to specify what data elements are supported and what type of matching can be applied. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard PS 3.4 (Service Class Specifications).

6.4.1 Supported Matching

Following are the types of matching that can be request by the implementation :

- Single Value matching
- Universal Matching
- Wild Card Matching
- Range of date

6.4.2 Patient Level

This section defines the keys at the Patient Level of the Patient/Study only Query/Retrieve Information Model that are supported by this implementation.

TABLE 6.4-1
PATIENT LEVEL ATTRIBUTES FOR THE PATIENT/STUDY ONLY QUERY/RETRIEVE INFORMATION MODEL

Attribute Name	Tag	Type	Note
Patient's Name	(0010,0010)	R	Matching is supported for this data element.
Patient ID	(0010,0020)	U	Matching is supported for this data element.

TABLE 6.4-2
Q/R PATIENT LEVEL AND LOCATION FOR RETRIEVE ATTRIBUTES

Attribute Name	Tag	Type	Note
Query Retrieve Level	(0008,0052)	-	Value = PATIENT

6.4.3 Study Level

This section defines the keys at the Study Level of the Patient/Study only Query/Retrieve Information Model that are supported by this implementation.

TABLE 6.4-3
STUDY LEVEL ATTRIBUTES FOR THE PATIENT/STUDY ONLY QUERY/RETRIEVE INFORMATION MODEL

Attribute Name	Tag	Type	Attribute Description
Study Date	(0008,0020)	R	Matching is supported for this data element.
Study Time	(0008,0030)	R	Matching is not supported for this data element.
Accession Number	(0008,0050)	R	Matching is supported for this data element.
Study ID	(0020,0010)	R	Matching is supported for this data element.
Study Instance UID	(0020,000D)	U	Matching is not supported for this data element.

TABLE 6.4-4
Q/R STUDY LEVEL AND LOCATION FOR RETRIEVE ATTRIBUTES

Attribute Name	Tag	Type	Note
Query Retrieve Level	(0008,0052)	-	Value = STUDY

7. MODALITY WORKLIST INFORMATION MODEL DEFINITION

7.1 INTRODUCTION

This section specifies the use of the DICOM Modality Worklist Information Model used to organize data and against which a Modality Worklist Query will be performed. The contents of this section are:

7.2 - Information Model Description

7.3 - Information Model Entity-Relationship Model

7.4 - Information Model Module Table

7.5 - Information Model Keys

7.2 MODALITY WORKLIST INFORMATION MODEL DESCRIPTION

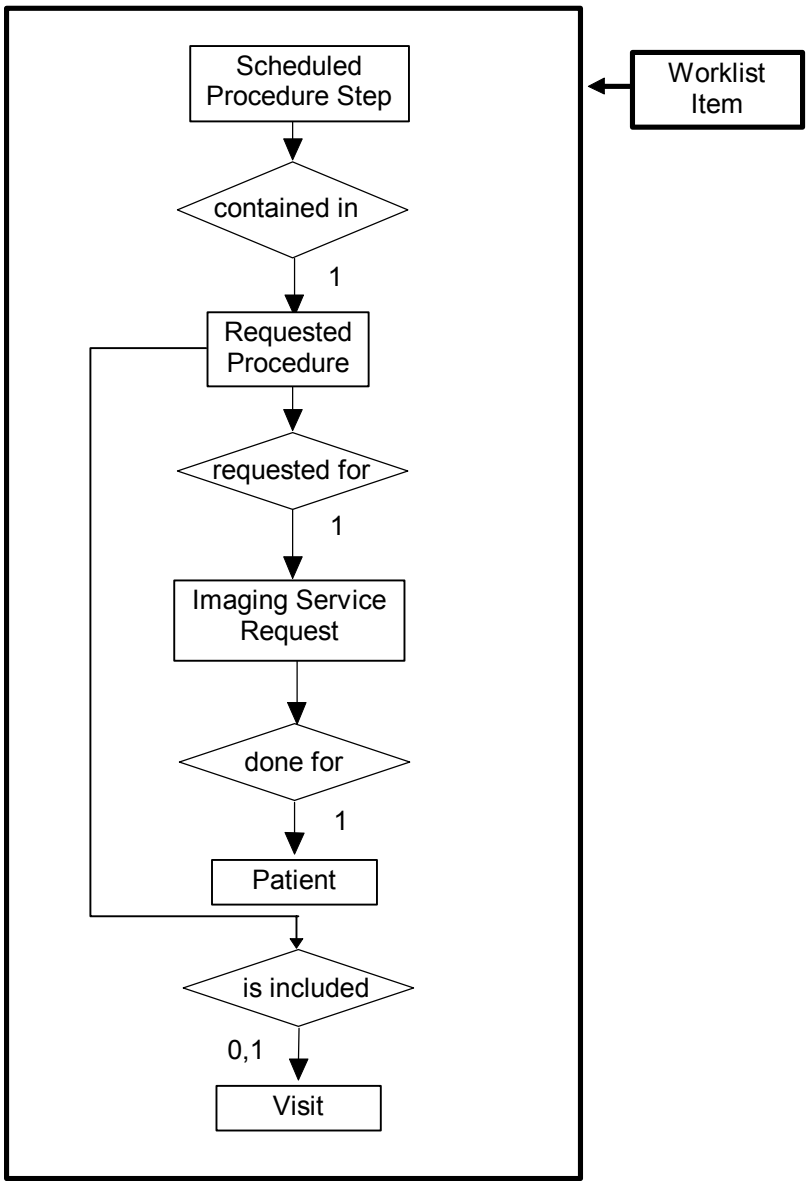
In order to serve as a Service Class Provider (SCP) of the Modality Worklist Service Class, a DICOM Application Entity (AE) possesses information about the attributes of a number of managed worklist items. The items are organized into Modality Worklist Information Modules. In this Service Class, the Information Model plays a role similar to an Information Object Definition of most other DICOM Service Classes.

7.3 MODALITY WORKLIST INFORMATION MODEL ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the Modality Worklist Information Model schema is shown in Illustration 7.3-2. It represents the information that composes a Worklist Item. In this figure, the following diagrammatic convention is established to represent the information organization :

- each entity is represented by a rectangular box
- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

ILLUSTRATION 7.3-2
MODALITY WORKLIST INFORMATION MODEL E/R DIAGRAM



7.3.1 ENTITY DESCRIPTIONS

Please refer to DICOM Standard PS 3.3. (Information Object Definitions) and PS 3.4 (Service Class Specifications) for a description of each of the Entities contained within the Modality Worklist Information Model.

7.3.1.1 Scheduled Procedure Step

A Scheduled Procedure Step is an arbitrarily defined scheduled unit of service that is specified by the Procedure Plan for a Requested Procedure. It specifies one or more Action Items (events) involving equipment (i.e. imaging modality equipment), human resources, location and time (i.e. start time, stop time, duration).

7.3.1.2 Requested Procedure Entity Description

A Requested Procedure is an instance of a Procedure of a given Procedure Type. An instance of a Requested Procedure includes all of the items of information that are specified by an instance of a Procedure Plan that is selected for the Requested Procedure by the imaging service provider.

7.3.1.3 Imaging Service Request Entity Description

An Imaging Service Request is a set of one or more Requested Procedures selected from a list of Procedure Types. An Imaging Service Request is submitted by one authorized imaging service requestor to one authorized imaging service provider in the context of one Service Episode.

7.3.1.4 Visit Entity Description

A Visit is the context which the treatment of management of an arbitrary subset of a Patient's medical condition occurs. A Visit is limited to the description of a Patient's activities at a single facility.

7.3.1.5 Patient Entity Description

A Patient is a person receiving, or registered to receive, healthcare services.

7.3.2 Precision 500D Mapping of DICOM entities

TABLE 7.3-1
MAPPING OF DICOM ENTITIES TO PRECISION 500D ENTITIES

DICOM	Precision 500D Entity
Scheduled Procedure Step	Study / Exam
Requested Procedure	Study / Exam
Imaging Service Request	Study / Exam
Visit	Study / Exam
Patient	Patient

7.4 INFORMATION MODEL MODULE TABLE

Within an entity of the DICOM v3.0 Modality Worklist Information Model, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

Table 7.4-1 identifies the defined modules within the entities which comprise the DICOM v3.0 Modality Worklist Information Model. Modules are identified by Module Name.

See DICOM v3.0 PS 3.3 and PS 3.4 for a complete definition of the entities, modules, and attributes.

TABLE 7.4-1
MODALITY WORKLIST INFORMATION MODEL MODULES

Entity Name	Module Name	Reference
Scheduled Procedure Step	SOP Common	7.5.2.1
	Scheduled Procedure Step	7.5.2.2
Requested Procedure	Requested Procedure	7.5.3.1
Imaging Service Request	Imaging Service Request	7.5.4.1
Visit	Visit Identification	7.5.5.1
	Visit Status	7.5.5.2
	Visit Relationship	7.5.5.3
	Visit Admission	7.5.5.4
Patient	Patient Relationship	7.5.6.1
	Patient Identification	7.5.6.2
	Patient Demographic	7.5.6.3
	Patient Medical	7.5.6.4

7.5 INFORMATION MODEL KEYS

Please refer to DICOM Standard PS 3.3. (Information Object Definitions) and PS 3.4 (Service Class Specifications) for a description of each of the Entities contained within the Modality Worklist Information Model.

The following Module descriptions are included to specify what data elements are supported and what type of matching can be applied. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard PS 3.4 (Service Class Specifications).

7.5.1 Supported Matching

Following are the types of matching that can be request by the implementation :

- Single Value matching
- Wild Card Matching
- Range of date
- Sequence Matching

7.5.2 Scheduled Procedure Step Entity

7.5.2.1 SOP Common Module

TABLE 7.5-1
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Specific Character Set	(0008,0005)	O	1C	No	Matching is not supported.

7.5.2.2 Scheduled Procedure Step Module

TABLE 7.5-2
SCHEDULED PROCEDURE STEP MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Scheduled Procedure Step Sequence	(0040,0100)	R	1	No	
>Scheduled Station AE Title	(0040,0001)	R	1	No	Matching is supported as follows: Either no AE title is supplied (Universal Matching), or the AE Title of the station requesting station. This is selected in the worklist configuration.
>Scheduled Procedure Step Start Date	(0040,0002)	R	1	No	Matching is supported as one of the following: • Today • Yesterday • Tomorrow • Next 7 days • Next 30 days This is selected in the worklist configuration.
>Scheduled Procedure Step Start Time	(0040,0003)	R	1	No	Matching is supported. This is selected in the worklist configuration.
>Modality	(0008,0060)	R	1	No	Matching is supported. The Modality to query for is selected in the worklist configuration.
>Scheduled Station Name	(0040,0010)	O	2	No	Matching is supported. The Station Name to query for is selected in the worklist configuration.
>Scheduled Procedure Step ID	(0040,0009)	O	1	No	

7.5.3 Requested Procedure Entity

7.5.3.1 Requested Procedure Module

TABLE 7.5-3
REQUESTED PROCEDURE MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Requested Procedure ID	(0040,1001)	O	1	Yes	Matching is supported as follows: Either no Requested Procedure ID is supplied (universal mapping), or the Requested Procedure ID entered by the user in the Query Definition screen is supplied for matching.
Requested Procedure Description	(0032,1060)	O	1C	Yes	
Study Instance UID	(0020,000D)	O	1	Yes	
Referenced Study Sequence	(0008,1110)	O	2	Yes	
>Referenced SOP Class UID	(0008,1150)	O	1C	Yes	
>Referenced SOP Instance UID	(0008,1155)	O	1C	Yes	

7.5.4 Imaging Service Request Entity

7.5.4.1 Imaging Service Request Module

TABLE 7.5-4
IMAGING SERVICE REQUEST MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Accession Number	(0008,0050)	O	2	Yes	Matching is supported as follows: Either no Accession Number is supplied (universal mapping), or the Accession Number entered by the user in the Query Definition screen is supplied for matching.
Referring Physician's Name	(0008,0090)	O	2	Yes	
Reason for Imaging Service Request	(0040,2001)	O	3	No	

7.5.5 Visit Entity

7.5.5.1 Visit Identification

None of the data elements from Visit Identification Module are requested.

7.5.5.2 Visit Status

None of the data elements from Visit Status Module are requested.

7.5.5.3 Visit Relationship

None of the data elements from Visit Relationship Module are requested.

7.5.5.4 Visit Admission

None of the data elements from Visit Admission Module are requested.

7.5.6 Patient Entity

7.5.6.1 Patient Relationship

None of the data elements from Patient Relationship Module are requested.

7.5.6.2 Patient Identification

TABLE 7.5-5
PATIENT IDENTIFICATION MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Patient's Name	(0010,0010)	R	1	Yes	Matching is supported as follows: Either no Patient Name is supplied (universal mapping), or the patient name entered by the user in the Query Definition screen is supplied for matching.
Patient ID	(0010,0020)	R	1	Yes	Matching is supported as follows: Either no Patient ID is supplied (universal mapping), or the Patient ID entered by the user in the Query Definition screen is supplied for matching.

7.5.6.3 Patient Demographic

TABLE 7.5-6
PATIENT DEMOGRAPHIC MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Patients Birth Date	(0010,0030)	O	2	Yes	
Patient's Sex	(0010,0040)	O	2	Yes	

7.5.6.4 Patient Medical

None of the data elements from Patient Medical Module are requested.

7.6 PRIVATE DATA DICTIONARY

The Precision 500D Worklist implementation does not define any Private Attributes within the Modality Worklist Information Model.

8. X-RAY ANGIOGRAPHY (XA) INFORMATION OBJECT IMPLEMENTATION

8.1 INTRODUCTION

This section specifies the use of the DICOM XA Image IOD to represent the information included in X-Ray Angiography images produced by this implementation. Corresponding attributes are conveyed using the module construct. The contents of this section are:

8.2 - IOD Description

8.3 - IOD Entity-Relationship Model

8.4 - IOD Module Table

8.5 - IOD Module Definition

8.2 XA IOD IMPLEMENTATION

This section defines the implementation of the XA image information object. Please refer to DICOM Standard Part 3 for more information regarding the XA image information object.

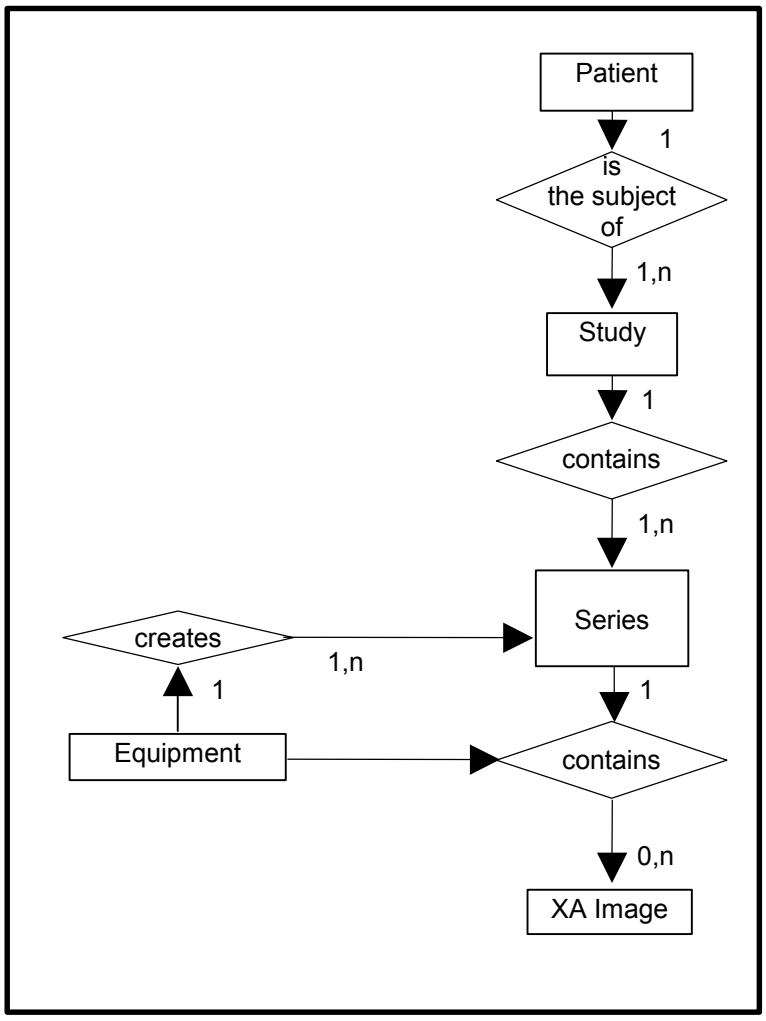
8.3 XA ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the XA Image interoperability schema is shown in Illustration 8.3-1**.** In this figure, the following diagrammatic convention is established to represent the information organization :

- each entity is represented by a rectangular box
- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to ***n*** Images per Series, but the Patient to Study relationship has 1 Study for each Patient (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

ILLUSTRATION 8.3-1
XA IMAGE ENTITY RELATIONSHIP DIAGRAM



8.3.1 ENTITY DESCRIPTIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the XA Information Object.

8.3.2 Precision 500D Mapping of DICOM entities

TABLE 8.3-1
MAPPING OF DICOM ENTITIES TO PRECISION 500D ENTITIES

DICOM	Precision 500D Entity
Patient	Patient
Study	Study
Series	Series
Image	Image
Frame	Not Applicable

8.4 IOD MODULE TABLE

Within an entity of the DICOM v3.0 XA IOD, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

Table 8.4-1 identifies the defined modules within the entities which comprise the DICOM v3.0 XA IOD. Modules are identified by Module Name.

See DICOM v3.0 Part 3 for a complete definition of the entities, modules, and attributes.

TABLE 8.4-1
XA IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	8.5.1.1
Study	General Study	8.5.2.1
	Patient Study	8.5.2.2
Series	General Series	8.5.3.1
Equipment	General Equipment	8.5.4.1
Image	General Image	8.5.5.1
	Image Pixel	8.5.5.2
	Multi-frame	8.5.5.3
	Mask	8.5.5.4
	Display Shutter	8.5.5.5
	VOI LUT	8.5.6.1
	SOP Common	8.5.8.1
	X-Ray Image	8.5.9.1
	X-Ray Acquisition	8.5.9.2
	X-Ray Collimator	8.5.9.3
	XA Positioner	8.5.9.4

8.5 INFORMATION MODULE DEFINITIONS

Please refer to DICOM v3.0 Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the XA Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions).

8.5.1 Common Patient Entity Modules

8.5.1.1 Patient Module

This section specifies the Attributes of the Patient that describe and identify the Patient who is the subject of a diagnostic Study. This Module contains Attributes of the patient that are needed for diagnostic interpretation of the Image and are common for all studies performed on the patient.

TABLE 8.5-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	The value is loaded from the HIS/RIS or is entered by the User.
Patient ID	(0010,0020)	2	The value is loaded from the HIS/RIS or is entered by the User.
Patient's Birth Date	(0010,0030)	2	The value is loaded from the HIS/RIS or is entered by the User.
Patient's Sex	(0010,0040)	2	The value is loaded from the HIS/RIS or is entered by the User.
Referenced Patient Sequence	(0008,1120)	3	This information is only present if retrieved from HIS/RIS.
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	

8.5.2 Common Study Entity Modules

The following Study IE Modules are common to all Composite Image IODs which reference the Study IE. These Module contain Attributes of the patient and study that are needed for diagnostic interpretation of the image.

8.5.2.1 General Study Module

This section specifies the Attributes which describe and identify the Study performed upon the Patient.

TABLE 8.5-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	This value is loaded from the HIS/RIS or is generated by the system.
Study Date	(0008,0020)	2	This is set to today's date when generating a new study.
Study Time	(0008,0030)	2	This is set to the current time when generating a new study.
Referring Physician's Name	(0008,0090)	2	Set to NULL
Study ID	(0020,0010)	2	This value is loaded from the HIS/RIS or is generated by the system.
Accession Number	(0008,0050)	2	This value is loaded from the HIS/RIS or is entered by the User.
Study Description	(0008,1030)	3	This value is loaded from the HIS/RIS or is entered by the User.
Referenced Study Sequence	(0008,1110)	3	This information is present only if retrieved from HIS/RIS
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	

8.5.2.2 Patient Study Module

This section defines Attributes that provide information about the Patient at the time the Study was performed.

TABLE 8.5-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	Set to NULL
Patient's Size	(0010,1020)	3	Set to NULL
Patient's Weight	(0010,1030)	3	Set to NULL

8.5.3 Common Series Entity Modules

The following Series IE Modules are common to all Composite Image IODs which reference the Series IE.

8.5.3.1 General Series Module

This section specifies the Attributes which identify and describe general information about the Series within a Study.

TABLE 8.5-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	XA = X-Ray Angiography
Series Instance UID	(0020,000E)	1	UID is generated by the system.
Series Number	(0020,0011)	2	Series Number is generated by the system.
Laterality	(0020,0060)	2C	Set to NULL
Series Date	(0008,0021)	3	This is set to today's date when generating a new series.
Series Time	(0008,0031)	3	This is set to the current time when generating a new series.
Performing Physicians' Name	(0008,1050)	3	This value is loaded from the HIS/RIS or is entered by the User.
Series Description	(0008,103E)	3	This value generated by the system based on the protocol selected.

8.5.4 Common Equipment Entity Modules

The following Equipment IE Module is common to all Composite Image IODs which reference the Equipment IE.

8.5.4.1 General Equipment Module

This section specifies the Attributes which identify and describe the piece of equipment which produced a Series of Images.

TABLE 8.5-5
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Value set to "GEMS"
Institution Name	(0008,0080)	3	Value comes from configuration of the system.
Institution Address	(0008,0081)	3	Value comes from configuration of the system.
Station Name	(0008,1010)	3	Configured in DICOM Configuration screens.
Manufacturer's Model Name	(0008,1090)	3	Value set to "Precision 500D"
Software Versions	(0018,1020)	3	

8.5.5 Common Image Entity Modules

The following Image IE Modules are common to all Composite Image IODs which reference the Image IE.

8.5.5.1 General Image Module

This section specifies the Attributes which identify and describe an image within a particular series.

TABLE 8.5-6
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Number Generated by the system.
Image Date	(0008,0023)	2C	This is set to today's date when generating a new image.
Image Time	(0008,0033)	2C	This is set to the current time when generating a new image.
Image Type	(0008,0008)	3	See 8.5.5.1.1.1.
Acquisition Number	(0020,0012)	3	Number Generated by the system.

8.5.5.1.1 General Image Attribute Descriptions

8.5.5.1.1.1 Image Type

Value 1 shall have the following Enumerated Value:

– ORIGINAL identifies an Original Image

Value 2 shall have the following Enumerated Value:

– PRIMARY identifies a Primary Image

Value 3 shall have the following Enumerated Value:

– SINGLE PLANE identifies a Single Plane Acquisition

8.5.5.2 Image Pixel Module

This section specifies the Attributes that describe the pixel data of the image.

TABLE 8.5-7
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Always set to 1.
Photometric Interpretation	(0028,0004)	1	MONOCHROME2
Rows	(0028,0010)	1	Always set to 1024.
Columns	(0028,0011)	1	Always set to 1024.
Bits Allocated	(0028,0100)	1	Either 16 or 8 depending on image.
Bits Stored	(0028,0101)	1	Either 10 or 8 depending on image.
High Bit	(0028,0102)	1	Either 9 or 7 depending on image.
Pixel Representation	(0028,0103)	1	Always set to 0.
Pixel Data	(7FE0,0010)	1	

8.5.5.3 Multi-Frame Module

This section specifies the Attributes of a Multi-frame pixel data Image.

TABLE 8.5-8
MULTI-FRAME MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	
Frame Increment Pointer	(0028,0009)	1	00181063H = Frame Time (0018,1063)

8.5.5.4 Mask Module

TABLE 8.5-9
MASK MODULE

Attribute Name	Tag	Type	Attribute Description
Mask Subtraction Sequence	(0028,6100)	1	
Mask Operation	(0028,6101)	1	
Mask Frame Numbers	(0028,6110)	1C	
Mask Sub-pixel Shift	(0028,6114)	3	

8.5.5.5 Display Shutter Module

TABLE 8.5-10
DISPLAY SHUTTER MODULE

Attribute Name	Tag	Type	Attribute Description
Shutter Shape	(0018,1600)	1	CIRCULAR
Center of Circular Shutter	(0018,1610)	1C	Depends on calibration, Default 512\512
Radius of Circular Shutter	(0018,1612)	1C	Depends on calibration, Default 512

8.5.6 Common Lookup Table Modules

8.5.6.1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

TABLE 8.5-11
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
VOI LUT Sequence	(0028,3010)	3	
>LUT Descriptor	(0028,3002)	1C	
>LUT Data	(0028,3006)	1C	
Window Center	(0028,1050)	3	
Window Width	(0028,1051)	1C	

8.5.7

8.5.8 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

8.5.8.1 SOP Common Module

This section defines the Attributes which are required for proper functioning and identification of the associated SOP Instances. They do not specify any semantics about the Real-World Object represented by the IOD.

TABLE 8.5-12
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	
SOP Instance UID	(0008,0018)	1	Derived from Date/Time Stamp of the study, series and image.
Specific Character Set	(0008,0005)	1C	Set to ISO_IR 100 = Latin Alphabet No. 1

8.5.9 X-Ray Modules

This Section describes Modules used in one or more X-Ray IODs. These Modules contain Attributes that are specific to X-Ray images.

8.5.9.1 X-Ray Image Module

TABLE 8.5-13
X-RAY IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame Increment Pointer	(0028,0009)	1C	00181063H = Frame Time (0018,1063)
Image Type	(0008,0008)	1	SINGLE PLANE
Pixel Intensity Relationship	(0028,1040)	1	LIN
Samples per Pixel	(0028,0002)	1	Set to 1.
Photometric Interpretation	(0028,0004)	1	Either MONOCHROME1 or MONOCHROME2 depending on image.
Bits Allocated	(0028,0100)	1	Either 16 or 8 depending on image type.
Bits Stored	(0028,0101)	1	Either 10 or 8 depending on image type.
High Bit	(0028,0102)	1	Either 9 or 7 depending on image type.
Pixel Representation	(0028, 0103)	1	Always set to 0.

8.5.9.2 X-Ray Acquisition Module

TABLE 8.5-14
X-RAY ACQUISITION MODULE

Attribute Name	Tag	Type	Attribute Description
KVP	(0018,0060)	2	From image acquisition
Radiation Setting	(0018,1155)	1	SC or GR, depending on image.
X-Ray Tube Current	(0018,1151)	2C	Unit: mA – From image acquisition
Exposure Time	(0018,1150)	2C	Unit: ms – From image acquisition
Exposure	(0018,1152)	2C	Unit: mAs – From image acquisition

8.5.9.3 X-Ray Collimator

TABLE 8.5-15
X-RAY COLLIMATOR MODULE

Attribute Name	Tag	Type	Attribute Description
Collimator Shape	(0018,1700)	1	RECTANGULAR
Collimator Left Vertical Edge	(0018,1702)	1C	
Collimator Right Vertical Edge	(0018,1704)	1C	
Collimator Upper Horizontal Edge	(0018,1706)	1C	
Collimator Lower Horizontal Edge	(0018,1708)	1C	

8.5.9.4 XA Positioner Module

TABLE 8.5-6
XA POSITIONER MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Positioner Motion	(0018,1500)	2C	STATIC
Positioner Primary Angle	(0018,1510)	2	Set to 0
Positioner Secondary Angle	(0018,1511)	2	Set to 0

9. X-RAY RF (XRF) INFORMATION OBJECT IMPLEMENTATION

9.1 INTRODUCTION

This section specifies the use of the DICOM XRF Image IOD to represent the information included in X-Ray RF images produced by this implementation. Corresponding attributes are conveyed using the module construct. The contents of this section are:

9.2- IOD Description

9.3- IOD Entity-Relationship Model

9.4 - IOD Module Table

9.5 - IOD Module Definition

9.2 XRF IOD IMPLEMENTATION

This section defines the implementation of the XRF image information object. Please refer to DICOM Standard Part 3 for more information regarding the XRF image information object.

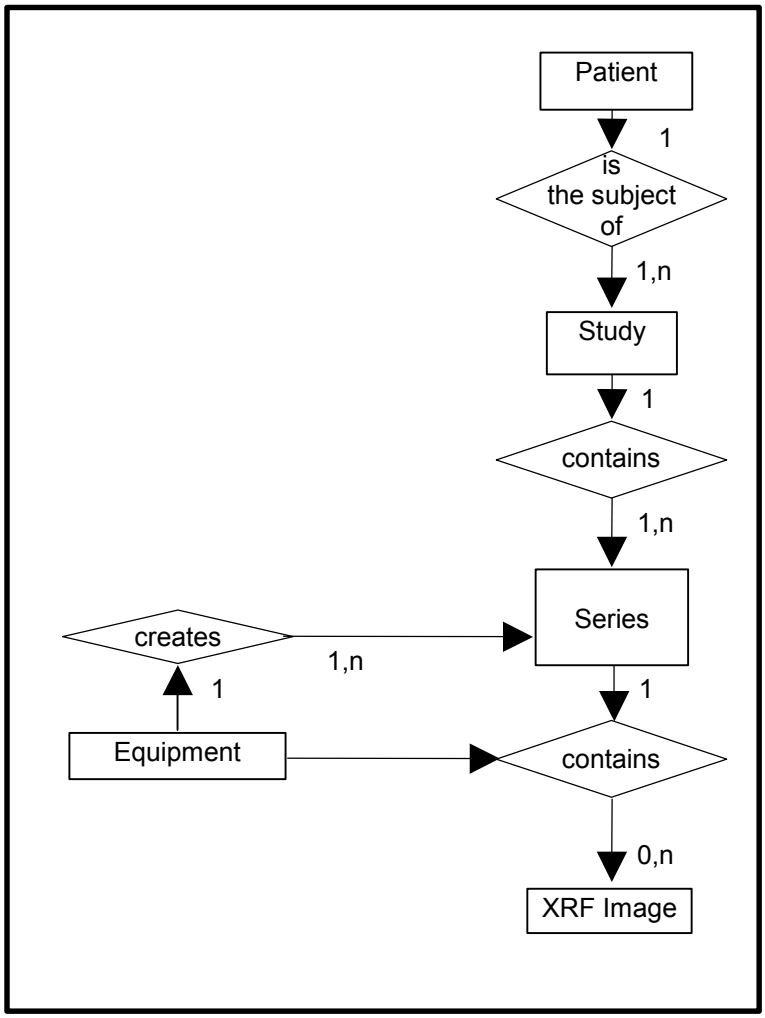
9.3 XRF ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the XRF Image interoperability schema is shown in Illustration 9.3-1. In this figure, the following diagrammatic convention is established to represent the information organization :

- each entity is represented by a rectangular box
- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to ***n*** Images per Series, but the Patient to Study relationship has 1 Study for each Patient (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

ILLUSTRATION 9.3-1
XRF IMAGE ENTITY RELATIONSHIP DIAGRAM



9.3.1 ENTITY DESCRIPTIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the XRF Information Object.

9.3.2 Precision 500D Mapping of DICOM entities

TABLE 9.3-1
MAPPING OF DICOM ENTITIES TO PRECISION 500D ENTITIES

DICOM	Precision 500D Entity
Patient	Patient
Study	Study
Series	Series
Image	Image
Frame	Not Applicable

9.4 IOD MODULE TABLE

Within an entity of the DICOM v3.0 XRF IOD, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

Table 9.4-1 identifies the defined modules within the entities which comprise the DICOM v3.0 XRF IOD. Modules are identified by Module Name.

See DICOM v3.0 Part 3 for a complete definition of the entities, modules, and attributes.

TABLE 9.4-1
XRF IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	9.5.1.1
Study	General Study	9.5.2.1
	Patient Study	9.5.2.2
Series	General Series	9.5.3.1
Equipment	General Equipment	9.5.4.1
Image	General Image	9.5.5.1
	Image Pixel	9.5.5.2
	Multi-frame	9.5.5.3
	Display Shutter	9.5.5.4
	X-Ray Image	9.5.8.1
	X-Ray Acquisition	9.5.8.2
	X-Ray Collimator	9.5.8.3
	VOI LUT	9.5.6.1
	SOP Common	9.5.7.1

9.5 INFORMATION MODULE DEFINITIONS

Please refer to DICOM v3.0 Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the XRF Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions).

9.5.1 Common Patient Entity Modules

9.5.1.1 Patient Module

This section specifies the Attributes of the Patient that describe and identify the Patient who is the subject of a diagnostic Study. This Module contains Attributes of the patient that are needed for diagnostic interpretation of the Image and are common for all studies performed on the patient.

TABLE 9.5-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	The value is loaded from the HIS/RIS or is entered by the User.
Patient ID	(0010,0020)	2	The value is loaded from the HIS/RIS or is entered by the User.
Patient's Birth Date	(0010,0030)	2	The value is loaded from the HIS/RIS or is entered by the User.
Patient's Sex	(0010,0040)	2	The value is loaded from the HIS/RIS or is entered by the User.
Referenced Patient Sequence	(0008,1120)	3	This information is only present if retrieved from HIS/RIS.
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	

9.5.2 Common Study Entity Modules

The following Study IE Modules are common to all Composite Image IODs which reference the Study IE. These Module contain Attributes of the patient and study that are needed for diagnostic interpretation of the image.

9.5.2.1 General Study Module

This section specifies the Attributes which describe and identify the Study performed upon the Patient.

TABLE 9.5-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	This value is loaded from the HIS/RIS or is generated by the system.
Study Date	(0008,0020)	2	This is set to today's date when generating a new study.
Study Time	(0008,0030)	2	This is set to the current time when generating a new study.
Referring Physician's Name	(0008,0090)	2	Set to NULL.
Study ID	(0020,0010)	2	This value is loaded from the HIS/RIS or is generated by the system.
Accession Number	(0008,0050)	2	This value is loaded from the HIS/RIS or is entered by the User.
Study Description	(0008,1030)	3	This value is loaded from the HIS/RIS or is entered by the User.
Referenced Study Sequence	(0008,1110)	3	This information is present only if retrieved from HIS/RIS
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	

9.5.2.2 Patient Study Module

This section defines Attributes that provide information about the Patient at the time the Study was performed.

TABLE 9.5-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	Set to NULL
Patient's Size	(0010,1020)	3	Set to NULL
Patient's Weight	(0010,1030)	3	Set to NULL

9.5.3 Common Series Entity Modules

The following Series IE Modules are common to all Composite Image IODs which reference the Series IE.

9.5.3.1 General Series Module

This section specifies the Attributes which identify and describe general information about the Series within a Study.

TABLE 9.5-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	RF = X-Ray RF
Series Instance UID	(0020,000E)	1	UID is generated by the system.
Series Number	(0020,0011)	2	Series Number is generated by the system.
Laterality	(0020,0060)	2C	Set to NULL
Series Date	(0008,0021)	3	This is set to today's date when generating a new series.
Series Time	(0008,0031)	3	This is set to the current time when generating a new series.
Performing Physicians' Name	(0008,1050)	3	This value is loaded from the HIS/RIS or is entered by the User.
Series Description	(0008,103E)	3	This value generated by the system based on the protocol selected.

9.5.4 Common Equipment Entity Modules

The following Equipment IE Module is common to all Composite Image IODs which reference the Equipment IE.

9.5.4.1 General Equipment Module

This section specifies the Attributes which identify and describe the piece of equipment which produced a Series of Images.

TABLE 9.5-5
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Value set to "GEMS"
Institution Name	(0008,0080)	3	Value comes from configuration of the system.
Institution Address	(0008,0081)	3	Value comes from configuration of the system.
Station Name	(0008,1010)	3	Configured in DICOM Configuration screens.
Manufacturer's Model Name	(0008,1090)	3	Value set to "Precision 500D"
Software Versions	(0018,1020)	3	

9.5.5 Common Image Entity Modules

The following Image IE Modules are common to all Composite Image IODs which reference the Image IE.

9.5.5.1 General Image Module

This section specifies the Attributes which identify and describe an image within a particular series.

TABLE 9.5-6
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Number Generated by the system.
Image Date	(0008,0023)	2C	This is set to today's date when generating a new image.
Image Time	(0008,0033)	2C	This is set to the current time when generating a new image.
Image Type	(0008,0008)	3	See 9.5.5.1.1.1
Acquisition Number	(0020,0012)	3	Number Generated by the system.

9.5.5.1.1 General Image Attribute Descriptions

9.5.5.1.1.1 Image Type

Value 1 shall have the following Enumerated Value:

- ORIGINAL identifies an Original Image

Value 2 shall have the following Enumerated Value:

- PRIMARY identifies a Primary Image

Value 3 shall have the following Enumerated Value:

- SINGLE PLANE identifies a Single Plane Acquisition

9.5.5.2 Image Pixel Module

This section specifies the Attributes that describe the pixel data of the image.

TABLE 9.5-7
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Always set to 1.
Photometric Interpretation	(0028,0004)	1	Either MONOCHROME1 or MONOCHROME2 depending on image.
Rows	(0028,0010)	1	Always set to 1024.
Columns	(0028,0011)	1	Always set to 1024.
Bits Allocated	(0028,0100)	1	Either 16 or 8 depending on image.
Bits Stored	(0028,0101)	1	Either 10 or 8 depending on image.
High Bit	(0028,0102)	1	Either 9 or 7 depending on image.
Pixel Representation	(0028,0103)	1	Always set to 0.
Pixel Data	(7FE0,0010)	1	

9.5.5.3 Multi-Frame Module

This section specifies the Attributes of a Multi-frame pixel data Image.

TABLE 9.5-8
MULTI-FRAME MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	
Frame Increment Pointer	(0028,0009)	1	00181063H = Frame Time (0018,1063)

9.5.5.4 Display Shutter Module

TABLE 9.5-9
DISPLAY SHUTTER MODULE

Attribute Name	Tag	Type	Attribute Description
Shutter Shape	(0018,1600)	1	CIRCULAR
Center of Circular Shutter	(0018,1610)	1C	Depends on calibration, Default 512\512
Radius of Circular Shutter	(0018,1612)	1C	Depends on calibration, Default 512

9.5.6 Common Lookup Table Modules

9.5.6.1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

TABLE 9.5-10
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
VOI LUT Sequence	(0028,3010)	3	
>LUT Descriptor	(0028,3002)	1C	
>LUT Data	(0028,3006)	1C	
Window Center	(0028,1050)	3	
Window Width	(0028,1051)	1C	

9.5.7 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

9.5.7.1 SOP Common Module

This section defines the Attributes which are required for proper functioning and identification of the associated SOP Instances. They do not specify any semantics about the Real-World Object represented by the IOD.

TABLE 9.5-11
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	
SOP Instance UID	(0008,0018)	1	Derived from Date/Time Stamp of the study, series and image.
Specific Character Set	(0008,0005)	1C	Set to ISO_IR 100 = Latin Alphabet No. 1

9.5.8 X-Ray Modules

This Section describes Modules used in one or more X-Ray IODs. These Modules contain Attributes that are specific to X-Ray images.

9.5.8.1 X-Ray Image Module

TABLE 9.5-12
X-RAY IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame Increment Pointer	(0028,0009)	1C	00181063H = Frame Time (0018,1063)
Image Type	(0008,0008)	1	SINGLE PLANE
Pixel Intensity Relationship	(0028,1040)	1	LIN
Samples per Pixel	(0028,0002)	1	Set to 1.
Photometric Interpretation	(0028,0004)	1	Set to MONOCHROME2
Bits Allocated	(0028,0100)	1	Either 16 or 8 depending on image type.
Bits Stored	(0028,0101)	1	Either 10 or 8 depending on image type.
High Bit	(0028,0102)	1	Either 9 or 7 depending on image type.
Pixel Representation	(0028, 0103)	1	Always set to 0.

9.5.8.2 X-Ray Acquisition Module

TABLE 9.5-13
X-RAY ACQUISITION MODULE

Attribute Name	Tag	Type	Attribute Description
KVP	(0018,0060)	2	From image acquisition
Radiation Setting	(0018,1155)	1	SC or GR, depending on image.
X-Ray Tube Current	(0018,1151)	2C	Unit: mA – From image acquisition
Exposure Time	(0018,1150)	2C	Unit: ms – From image acquisition
Exposure	(0018,1152)	2C	Unit: mAs – From image acquisition

9.5.8.3 X-Ray Collimator

TABLE 9.5-14
X-RAY COLLIMATOR MODULE

Attribute Name	Tag	Type	Attribute Description
Collimator Shape	(0018,1700)	1	RECTANGULAR
Collimator Left Vertical Edge	(0018,1702)	1C	
Collimator Right Vertical Edge	(0018,1704)	1C	
Collimator Upper Horizontal Edge	(0018,1706)	1C	
Collimator Lower Horizontal Edge	(0018,1708)	1C	

10. NETWORK PRINT SCU CONFORMANCE STATEMENT

10.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the compliance to DICOM conformance requirements for the relevant Grayscale **Network Printing** features on this GEMS product. Note that the format of this section strictly follows the format defined in DICOM Standard PS 3.2 (Conformance). Please refer to that part of the standard while reading this section.

The Precision 500D system has the ability to:

Compose Film - select position of images on the printed sheet

Film Study – Film all images in the Study in order acquired.

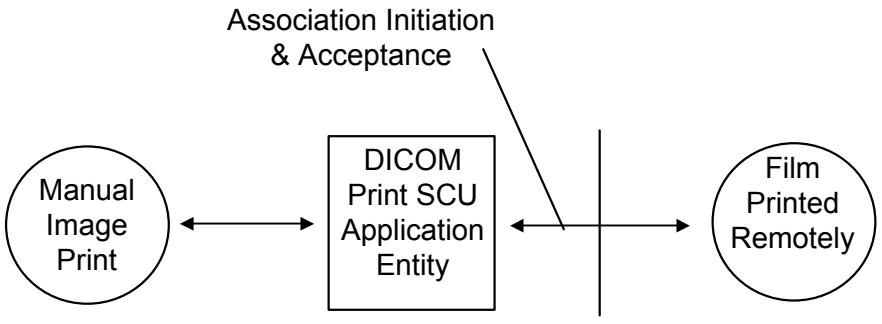
Film Tagged – Film only the tagged images in the study in order acquired.

All printing control is initiated by the IUI (Integrated User Interface) of the product.

10.2 IMPLEMENTATION MODEL

10.2.1 Application Data Flow Diagram

The Basic and Specific Application models for this device are shown in the following Illustration:



The DICOM Print SCU Application Entity (AE) is an application which handles DICOM protocol communication with the Remote DICOM Printers. The DICOM Print SCU AE is activated when the user requests for a print.

The DICOM Print SCU AE is invoked by the following Real World Activity:

I. Compose Film Print

For this operation, the operator selects images in the order they wish to print the images on the film. Once the film is filled the operator selects Print Sheet to send the film to the Remote DICOM Printer.

II. Film Study

For this operation, the operator presses the Film Study button and all images in the study are printed in order acquired.

III. Film Tagged

For this operation, the operator tags the images to be printed. The operator then presses the Film Tagged button and all tagged images are printed in order acquired.

10.2.2 Functional Definition of AE's

The DICOM Print SCU AE supports the following functions:

I. Access to the pixel data in the local database.

II. Initiate a DICOM association to send the DICOM SOP Classes (corresponding to the DICOM Print Management service class) to a remote DICOM Printer.

10.2.3 Sequencing of Real-World Activities

10.2.3.1 Film Study Image Print

For example, when a Film Study print operation is initiated:

1. The user opens a patient/study for review.
2. Presses the Film Study button on the IUI.
3. Initiates a DICOM association and selects a Presentation Context
4. N-GETs printer status from the well known Printer SOP Instance
5. N-CREATEs a Basic Film Session SOP Instance
6. N-CREATEs a Basic Film Box SOP Instance for each film
7. N-SETs the Basic Film Box SOP Instance with the Image Box SOP Instance for each image on the film
8. N-ACTIONs on the Basic Film Box SOP Instance.
9. N-DELETEs on the Basic Film Box SOP Instance.

10. Receives N-EVENT-REPORTs of the well known Printer SOP Instance indicating printer status

11. If no N-EVENT-REPORT has been received after a configurable timeout performs an NGET to obtain the printer status from the well known Printer SOP Instance

12. Releases the DICOM association after printing is successful or failure has been signaled to the user

10.3 AE SPECIFICATIONS

10.3.1 DICOM Print SCU AE Specification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an **SCU**:

SOP Class Name	SOP Class UID
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9
Basic Annotation Box SOP Class	1.2.840.10008.5.1.1.15

Note: Support of the Basic Grayscale Print Management Meta SOP Class as an SCU mandates support for the Basic Film Session, Basic Film Box, Basic Grayscale Image Box and Printer SOP Classes as an SCU.

10.3.1.1 Association Establishment Policies

10.3.1.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

Application Context Name	1.2.840.10008.3.1.1.1

The Maximum Length PDU negotiation is included in all association establishment requests.

The maximum length PDU for an association initiated by the DICOM Print SCU AE is:

Maximum Length PDU	No Limitation for Maximum PDU Size

The Print Management Service Class does not support extended negotiation.

The user information Items sent by this product are:

- Maximum PDU Length
- Implementation UID
- Implementation Version Name

10.3.1.1.2 Number of Associations

The DICOM Print SCU supports only one association at a time. Requests are internally queued.

10.3.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

10.3.1.1.4 Implementation Identifying Information

The Implementation UID for this DICOM v3.0 Implementation is:

Precision 500D Implementation UID	1.2.840.113619.6.107

The Implementation Version Name for this DICOM v3.0 Implementation is:

PRECISION_500_D

10.3.1.2 Association Initiation Policy

The DICOM Print SCU AE initiates one association with the selected Remote DICOM Printer. No other association can be opened by the DICOM Print SCU AE while the current association is active.

10.3.1.2.1 Real-World Activity Compose Film Print

10.3.1.2.1.1 Associated Real-World Activity

The operator does the following:

I. Open patient/study for review.

II. Selects the Compose Film Tab and format to print on the IUI.

III. Selects images in order they wish to have the images printed.

IV. Presses Print Sheet once all images to be printed on the film are selected.

This operation will cause the DICOM Print SCU AE to try to establish the association with the requested DICOM Printer and send the images for printing.

10.3.1.2.1.2 Proposed Presentation Context Table

Presentation Context Table - Proposed					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Basic Annotation Box SOP Class	1.2.840.10008.5.1.1.15	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

10.3.1.2.1.2.1 SOP Specific DICOM Conformance Statement for Print Management SOP Classes

For each of the supported Print Management SOP and Meta SOP Classes, the optional attributes and service elements supported, the valid range of values for mandatory and optional attributes, and the status code behavior are described in Annex.

10.3.1.2.2 Real-World Activity Film Study

10.3.1.2.2.1 Associated Real-World Activity

The operator does the following:

I. Open patient/study for review.

II. Selects the Batch Film Tab and format to print on the IUI.

III. Presses Film Study button.

This operation will cause the DICOM Print SCU AE to try to establish the association with the requested DICOM Printer and send the all the images for printing.

10.3.1.2.2.2 Proposed Presentation Context Table

Same as “Compose Film Print” real world activity.

10.3.1.2.2.2.1 SOP Specific DICOM Conformance Statement for Print Management SOP Classes

Same as “Compose Film Print” real world activity.

10.3.1.2.3 Real-World Activity Film Tagged

10.3.1.2.3.1 Associated Real-World Activity

The operator does the following:

I. Open patient/study for review.

II. Selects the Batch Film Tab and format to print on the IUI.

III. Tag the images (by selecting on IUI) the images you wish to print.

IV. Press the Film Tagged button on the IUI.

This operation will cause the DICOM Print SCU AE to try to establish the association with the requested DICOM Printer and send the tagged images for printing.

10.3.1.2.3.2 Proposed Presentation Context Table

Same as “Compose Film Print” real world activity.

10.3.1.2.3.2.1 SOP Specific DICOM Conformance Statement for Print Management SOP Classes

Same as “Compose Film Print” real world activity.

11. PRINT MANAGEMENT SOP CLASS DEFINITION

11.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the supported Print Management SOP and Meta SOP Classes, the optional attributes and service elements supported, the valid range of values for mandatory and optional attributes, and the status code behaviour.

This section contains:

11.2.1 - Basic Film Session SOP Class

11.2.2 - Basic Film Box SOP Class

11.2.3 - Image Box SOP Classes

11.2.4 - Printer SOP Class

11.2.5 - Print Job SOP Class

11.2.6 - Basic Annotation Box SOP Class

11.2.7 - Image Overlay Box SOP Class

11.2 PRINT MANAGEMENT SOP CLASS DEFINITIONS

11.2.1 Basic Film Session SOP Class

11.2.1.1 IOD Description

11.2.1.1.1 IOD modules

Module	Reference	Module Description
SOP Common		Contains SOP Common information
Basic Film Session Presentation Module	11.2.1.1.2	Contains Film Session presentations information
Basic Film Session Relationship	11.2.1.1.3	References to related SOPs

11.2.1.1.2 Basic Film Session Presentation Module

Attribute name	Tag	Attribute Description
Number of Copies	(2000,0010)	1 to 9
Print Priority	(2000,0020)	HIGH or MED or LOW depending on the configuration of the associated Remote DICOM printer. MEDis the default value always sent.
Medium Type	(2000,0030)	PAPER or CLEAR FILM or BLUE FILM depending on the configuration of the associated Remote DICOM printer.
Film Destination	(2000,0040)	MAGAZINE or PROCESSOR depending on the configuration of the associated Remote DICOM Printer.
Film Session Label	(2000,0050)	Human readable label that idetifies the film session. Empty by default.

11.2.1.1.3 Basic Film Session Relationship Module

Attribute Name	Tag	Attribute Description
Referenced Film Box Sequence	(2000,0500)	Empty
>Referenced SOP Class UID	(0008,1150)	Empty
>Referenced SOP Instance UID	(0008,1155)	Empty

11.2.1.2 DIMSE Service Group

DIMSE Service Element	Usage SCU
N-CREATE	M
N-SET	Not Used
N-DELETE	Not Used
N-ACTION	Not Used

11.2.1.2.1 N-CREATE

11.2.1.2.1.1 Attributes

Attribute Name	Tag	Usage SCU
Number of Copies	(2000,0010)	Used
Print Priority	(2000,0020)	Used
Medium Type	(2000,0030)	Used
Film Destination	(2000,0040)	Used
Film Session Label	(2000,0050)	Used, not sent if empty
Memory Allocation	(2000,0060)	Not Used

11.2.1.2.1.2 Status

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
Warning	B600	Memory allocation not supported	Association is aborted.
Success	0000	Film session successfully created	Next Step described in the sequencing of Real-World Activities paragraph is performed.

11.2.1.2.1.3 Behavior

No specific behavior.

11.2.1.2.2 N-SET

This service is not used.

11.2.1.2.3 N-DELETE

This service is not used.

11.2.1.2.4 N-ACTION

This service is not used.

11.2.2 Basic Film Box SOP Class

11.2.2.1 IOD Description

The DICOM Print SCU AE Supports the following DIMSE Service Element of the Basic Film Box SOP Class.

- The N-CREATE DIMSE Service element sent by the DICOM Print SCU AE requests the Remote DICOM Print SCP to create an instance of Basic Film Box.

- The N-ACTION DIMSE Service element sent by the DICOM Print SCU AE requests the Remote DICOM Print SCP to print the Basic Film Box onto the hardcopy printer.

- The N-DELETE DIMSE Service element sent by the DICOM Print SCU AE requests the Remote DICOM Print SCP to release the Basic Film Box instance.

11.2.2.1.1 IOD modules

Module	Reference	Module Descripion
SOP Common		Contains SOP Common information
Basic Film Box Presentation Module	11.2.2.1.2	Contains Film Box presentation information
Basic Film Box Relationship	11.2.2.1.3	References to related SOPs

11.2.2.1.2 Basic Film Box Presentation Module

Attribute Name	Tag	Attribute Description
Image Display Format	(2010,0010)	STANDARD\C,R SLIDE
Annotation Display Format ID	(2010,0030)	ANNOTATION by default.
Film Orientation	(2010,0040)	PORTRAIT
Film Size ID	(2010,0050)	8INX10IN 10INX12IN 10INX14IN 11INX14IN 14INX14IN 14INX17IN 24CMX24CM 24CMX30CM
Magnification Type	(2010,0060)	Interpolation type by which the printer magnifies the image in order to fit the image in the image box on film; Defined Terms: REPLICATE BILINEAR CUBIC NONE
Smoothing Type	(2010,0080)	Only Valid for Magnification type = CUBIC
Border Density	(2010,0100)	BLACK or WHITE
Empty Image Density	(2010,0110)	BLACK or WHITE
Min Density	(2010,0120)	Positive integer, or 0 by default
Max Density	(2010,0130)	Positive integer, or 300 by default
Trim	(2010,0140)	YES or NO
Configuration Information	(2010,0150)	Empty by default.

11.2.2.1.3 Basic Film Box Relationship Module

Attribute Name	Tag	Attribute Description
Referenced Film Session Sequence	(2010,0500)	Empty
>Referenced SOP Class UID	(0008,1150)	Empty
>Referenced SOP Instance UID	(0008,1155)	Empty
Referenced Image Box Sequence	(2010,0510)	Empty
>Referenced SOP Class UID	(0008,1150)	Empty
>Referenced SOP Instance UID	(0008,1155)	Empty
Referenced Basic Annotation Box Sequence	(2010,0520)	Empty
>Referenced SOP Class UID	(0008,1150)	Empty
>Referenced SOP Instance UID	(0008,1155)	Empty

11.2.2.2 DIMSE Service Group

DIMSE Service Element	Usage SCU
N-CREATE	M
N-ACTION	M
N-DELETE	Used
N-SET	Not Used

11.2.2.2.1 N-CREATE

11.2.2.2.1.1 Attributes

Attribute Name	Tag	Usage SCU
Image Display Format	(2010,0010)	M
Referenced Film Session Sequence	(2010,0500)	M
>Referenced SOP Class UID	(0008,1150)	M
>Referenced SOP Instance UID	(0008,1155)	M
Referenced Image Box Sequence	(2010,0510)	-
>Referenced SOP Class UID	(0008,1150)	-
>Referenced SOP Instance UID	(0008,1155)	-
Referenced Basic Annotation Box Sequence	(2010,0520)	Not Used
>Referenced SOP Class UID	(0008,1150)	Not Used
>Referenced SOP Instance UID	(0008,1155)	Not Used
Film Orientation	(2010,0040)	Used
Film Size ID	(2010,0050)	Used
Magnification Type	(2010,0060)	Used
Max Density	(2010,0130)	Used
Configuration Information	(2010,0150)	Used, Not sent if empty
Annotation Display Format ID	(2010,0030)	Used
Smoothing Type	(2010,0080)	Used, not sent if empty or magnification is not equal to CUBIC
Border Density	(2010,0100)	Used
Empty Image Density	(2010,0110)	Used
Min Density	(2010,0120)	Used
Trim	(2010,0140)	Used

11.2.2.2.1.2 Status

There are no specific status codes.

11.2.2.2.1.3 Behavior

There is no specific behavior.

11.2.2.2.2 N-SET

This service is not used.

11.2.2.2.3 N-DELETE

11.2.2.2.3.1 Behavior

The SCU uses the N-DELETE to request the SCP to delete the Basic Film Box SOP Instance hierarchy.

11.2.2.2.4 N-ACTION

N-ACTION is used to print the current film of the film session.

11.2.2.2.4.1 Attributes

Action Type Name	Action Type ID	Attribute	Tag	Usage SCU
Print	1	Referenced Print Job Sequence	(2100,0500)	Not Used
		>Referenced SOP Class UID	(0008,1150)	Not Used
		>Referenced SOP Instance UID	(0008,1155)	Not Used

11.2.2.2.4.2 Status

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
Success	0000	Film accepted for printing; if supported, the Print Job SOP Instance is created	Next step describe in the sequencing of Real-World Activities paragraph is performed.
Warning	B603	Film Box SOP Instance hierarchy does not contain Image Box SOP Instances (empty page)	This case should not happen.
Failure	C602	Unable to create Print Job SOP Instance; print queue is full	Association is aborted. Job set to retry status.
	C604	Image position collision : multiple images assigned to single image position	Association is aborted. Job set to retry status.
	C603	Image size is larger than image box size (by using the specified magnification value)	Association is aborted. Job set to retry status.

11.2.2.2.4.3 Behavior

The DICOM Print SCU AE uses the N-ACTION to request the SCP to print one or more copies of a single film of the film session.

11.2.3 Image Box SOP Classes

11.2.3.1 Basic Grayscale Image Box SOP Class

11.2.3.1.1 IOD description

The DICOM Print SCU AE supports the following DIMSE Service Element of the Basic Grayscale Image Box SOP Class.

- The N-SET DIMSE Service element sent by the DICOM Print SCU AE requests the Remote DICOM Print SCP to set the attributes of the Basic Grayscale Image Box Instance.

11.2.3.1.1.1 IOD modules

Module	Reference	Module Description
SOP Common		Contains SOP Common information
Image Box Presentation Module	11.2.3.1.1.2	Contains Image Box presentation information
Image Box Relationship Module	11.2.3.1.1.3	References to related SOPs

11.2.3.1.1.2 Image Box Pixel Presentation Module

Attribute Name	Tag	Attribute Description
Image Position	(2020,0010)	
Polarity	(2020,0020)	NORMAL = pixels shall be printed as specified by the Photometric Interpretation (0028,0004) REVERSE = pixels shall be printed with the opposite polarity as specified by the Photometric Interpretation (0028,0004)
Magnification Type	(2010,0060)	Same value as defined in the Film Box
Smoothing Type	(2010,0080)	Same value as defined in the Film Box
Requested Image Size	(2020,0030)	Specify range of values sent.
Preformatted Grayscale Image Sequence	(2020,0110)	This sequence is always included if the Image Box is a Basic Grayscale Image Box.
>Samples Per Pixel	(0028,0002)	1
>Photometric Interpretation	(0028,0004)	MONOCHROME2
>Rows	(0028,0010)	1024
>Columns	(0028,0011)	1024
>Pixel Aspect Ratio	(0028,0034)	Specify range of values sent.
>Bits Allocated	(0028,0100)	8
>Bits Stored	(0028,0101)	8
>High Bit	(0028,0102)	7
>Pixel Representation	(0028,0103)	0
>Pixel Data	(7FE0,0010)	

11.2.3.1.1.3 Image Box Relationship Module

Attribute Name	Tag	Attribute Description
Referenced Image Sequence	(0008,1140)	Not Used
>Referenced SOP Class UID	(0008,1150)	Not Used
>Referenced SOP Instance UID	(0008,1155)	Not Used
>Referenced Frame Number	(0008,1160)	Not Used
Referenced Image Overlay Box Sequence	(2020,0130)	Not Used
>Referenced SOP Class UID	(0008,1150)	Not Used
>Referenced SOP Instance UID	(0008,1155)	Not Used
>Referenced Frame Number	(0008,1160)	Not Used
Referenced VOI LUT Sequence	(2020,0140)	Not Used
>Referenced SOP Class UID	(0008,1150)	Not Used
>Referenced SOP Instance UID	(0008,1155)	Not Used

11.2.3.1.2 DIMSE Service Group

DIMSE Service Element	Usage SCU
N-SET	M

11.2.3.1.2.1 N-SET

11.2.3.1.2.1.1 Attributes

Attribute Name	Tag	Usage SCU
Image Position	(2020,0010)	M
Preformatted Grayscale Image Sequence	(2020,0110)	M
>Samples Per Pixel	(0028,0002)	M
>Photometric Interpretation	(0028,0004)	M
>Rows	(0028,0010)	M
>Columns	(0028,0011)	M
>Pixel Aspect Ratio	(0028,0034)	1\1
>Bits Allocated	(0028,0100)	M
>Bits Stored	(0028,0101)	M
>High Bit	(0028,0102)	M
>Pixel Representation	(0028,0103)	M
>Pixel Data	(7FE0,0010)	M
Polarity	(2020,0020)	Used
Referenced Overlay Sequence	(0008,1130)	Not Used
>SOP Class UID	(0008,1150)	Not Used
>SOP Instance UID	(0008,1155)	Not Used
Magnification Type	(2010,0060)	Used
Smoothing Type	(2010,0080)	Used
Requested Image Size	(2020,0030)	Not Used

11.2.3.1.2.1.2 Status

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
Failue	C605	Insufficient memory in printer to store the image	Association is aborted. Job set to retry status.

11.2.3.1.2.1.3 Behavior

There is no specific behavior.

The SCU does not instruct the SCP to erase the image in the image position by setting a zero length and no value in the Attribute Preformatted Grayscale Image Sequence (2020,0110) or Preformatted Grayscale Image Sequence (2020,0111).

11.2.4 Printer SOP Class

11.2.4.1 IOD Description

11.2.4.1.1 IOD modules

Module	Reference	Module Description
SOP Common		Contains SOP Common information
Printer Module	11.2.4.1.2	Contains status information to monitor the printer

11.2.4.1.2 Printer Module

Attribute Name	Tag	Attribute Description
Printer Status	(2110,0010)	For the behaviour defined for the following term NORMAL: Association goes on. WARNING: Associatoin goes on if SUPPLY LOW or SUPPLY EMPTY FAILURE: Assoication is aborted.
Printer Status Info	(2110,0020)	Behaviour is defined for: SUPPLY EMPTY SUPPLY LOW
Printer Name	(2110,0030)	Printer shall return value.
Manufacturer	(0008,0070)	Printer shall return value.
Manufacturer Model Name	(0008,1090)	Printer shall return value.
Device Serial Number	(0018,1000)	Printer shall return value.
Software Versions	(0018,1020)	Printer shall return value.
Date Of Last Calibration	(0018,1200)	Printer shall return value.
Time Of Last Calibration	(0018,1201)	Printer shall return value.

11.2.4.2 DIMSE Service Group

DIMSE Service Element	Usage SCU
N-EVENT-REPORT	M
N-GET	U

11.2.4.2.1 N-EVENT-REPORT

11.2.4.2.1.1 Attributes

Event Type Name	Event Type ID	Attribute	Tag	Usage SCU
Normal	1			
Warning	2	Printer Name	(2110,0030)	
		Printer Status Info	(2110,0020)	
Failure	3	Printer Name	(2110,0030)	
		Printer Status Info	(2110,0020)	

11.2.4.2.1.2 Behavior

If the printer status is FAILURE: Association is aborted and the job is put in Retry status.

If the printer status is WARNING and it is SUPPLY LOW or SUPPLY EMPTY the job completes successfully, other warnings the job is aborted and the job is put in Retry status.

11.2.4.2.2 N-GET

11.2.4.2.2.1 Attributes

Attribute name	Tag	Usage SCU
Printer Status	(2110,0010)	Used
Printer Status Info	(2110,0020)	Used
Printer Name	(2110,0030)	Used
Manufacturer	(0008,0070)	Used
Manufacturer Model Name	(0008,1090)	Used
Device Serial Number	(0018,1000)	Not Used
Software Versions	(0018,1020)	Not Used
Date Last Calibration	(0018,1200)	Not Used
Last Calibration	(0018,1201)	Not Used

11.2.4.2.2.2 Behavior

If the printer status is FAILURE: Association is aborted and the job is put in Retry status.

If the printer status is WARNING and it is SUPPLY LOW or SUPPLY EMPTY the job completes successfully, other warnings the job is aborted and the job is put in Retry status.

11.2.5 Print Job SOP Class

This SOP Class is not supported by this implementation.

11.2.6 Basic Annotation Box SOP Class

This SOP Class is not supported by this implementation.

11.2.7 Image Overlay Box SOP Class

This SOP Class is not supported by this implementation.

12. STORAGE COMMITMENT PUSH MODEL SOP CLASS DEFINITION

12.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the Storage Commitment Push Model SOP Class, the optional attributes and service elements supported, the valid range of values for mandatory and optional attributes, and the status code behaviour.

12.2 STORAGE COMMITMENT PUSH MODEL SOP CLASS DEFINITION

12.2.1 IOD Description

12.2.1.1 STORAGE COMMITMENT MODULE

TABLE 12.2-1
STORAGE COMMITMENT MODULE

Attribute Name	Tag	Attribute Description
Transaction UID	(0008,1195)	Based on IP address, Date, Time, and then a random number.
Retrieve AE Title	(0008,0054)	When received in N-EVENT-REPORT, it is supported but ignored.
Storage Media File-Set ID	(0088,0130)	When received in N-EVENT-REPORT, it is supported but ignored..
Storage Media File-Set UID	(0088,0140)	When received in N-EVENT-REPORT, it is supported but ignored.
Referenced SOP Sequence	(0008,1199)	
>Referenced SOP Class UID	(0008,1150)	
>Referenced SOP Instance UID	(0008,1155)	
>Retrieve AE Title	(0008,0054)	Supported but ignored.
>Storage Media File-Set ID	(0088,0130)	Supported but ignored.
>Storage Media File-Set UID	(0088,0140)	Supported but ignored.
Referenced Study Component Sequence	(0008,1111)	Not Sent
>Referenced SOP Class UID	(0008,1150)	
>Referenced SOP Instance UID	(0008,1155)	
Failed SOP Sequence	(0008,1198)	
>Referenced SOP Class UID	(0008,1150)	
>Referenced SOP Instance UID	(0008,1155)	See Table Below

TABLE 12.2-2
FAILURE REASON VALUES AND SEMANTICS

Failure Reason	Meaning	SCU Behavior
0110H	Processing failure	Logged into log file. Job set to retry status.
0112H	No such object instance	Logged into log file. Job set to retry status.
0213H	Resource limitation	Logged into log file. Job set to retry status.
0122H	Referenced SOP Class not supported	Logged into log file. Job set to retry status.
0119H	Class / Instance conflict	Logged into log file. Job set to retry status.
0131H	Duplicate transaction UID	Logged into log file. Job set to retry status.

12.2.2 DIMSE Service Group

DIMSE Service Element	Usage SCU/SCP
N-EVENT-REPORT	M/M
N-ACTION	M/M

12.2.3 Operations

12.2.3.1 Action Information

TABLE 12.2-3
STORAGE COMMITMENT REQUEST - ACTION INFORMATION

Action Type Name	Action Type ID	Attribute	Tag	Requirement Type SCU/SCP
Request Storage Commitment	1	Transaction UID	(0008,1195)	1/1
		Referenced SOP Sequence	(0008,1199)	1/1
		>Referenced SOP Class UID	(0008,1150)	1/1
		>Referenced SOP Instance UID	(0008,1155)	1/1

12.2.3.2 Service Class User Behavior

N-ACTION is sent when the images are successfully sent to a remote host declared as Storage Commitment Provider on the Precision 500D.

Storage Commitment can be requested for XA Image SOP Class and RF Image SOP Class.

The Referenced Study Component Sequence Attribute is not supported.

The transaction UID is applicable until we receive the N-EVENT-REPORT.

Storage Media File-Set ID & UID Attributes in the N-ACTION are not supported.

When receiving an unsuccessful N-ACTION Response Status Code from the SCP an error is logged in the log file, and the job is set to retry status.

12.2.3.3 Status Codes

No Service Class specific status values are defined for the N-ACTION Service. See PS 3.7 for general response status codes.

12.2.4 Notifications

12.2.4.1 Event Information

TABLE 12.2-4
STORAGE COMMITMENT RESULT - EVENT INFORMATION

Event Type Name	Event Type ID	Attribute	Tag	Requirement Type SCU/SCP
Storage Commitment Request Successful	1	Transaction UID	(0008,1195)	-/1
		Referenced SOP Sequence	(0008,1199)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1
		>Referenced SOP Instance UID	(0008,1155)	-/1
Storage Commitment Request Complete - Failures Exist	2	Transaction UID	(0008,1195)	-/1
		Referenced SOP Sequence	(0008,1199)	-/1C
		>Referenced SOP Class UID	(0008,1150)	-/1
		>Referenced SOP Instance UID	(0008,1155)	-/1
		Failed SOP Sequence	(0008,1198)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1
		>Referenced SOP Instance UID	(0008,1155)	-/1
		>Failure Reason	(0008,1197)	-/1

12.2.4.2 Service Class User Behavior

When receiving the N-EVENT-REPORT, the system looks first for the SOP Instance UID successfully committed. It records them in a log file and flags them in the local database as

"Committed". The status of any of the studies can be seen by looking at the Status column on the Patient List Screen (C = Committed). Secondly, the system looks for the SOP Instance UID for which the commit failed and records them in the log file.

12.2.4.3 Status Codes

No Service Class specific status values are defined for the N-EVENT-REPORT Service. See PS 3.7 for general response status codes.

13. PERFORMED PROCEDURE STEP CONFORMANCE STATEMENT

13.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the compliance to DICOM conformance requirements for the Performed Procedure Step feature on Precision 500D. Note that the format of this section strictly follows the format defined in DICOM Standard PS 3.2 (Conformance). Please refer to that part of the standard while reading this section. The PPS option for Precision 500D allows a Modality Performed Procedure Step to be communicated to the Hospital/Radiology information system. The PPS feature is providing the DICOM Modality Performed Procedure Step service as a service class user (SCU).

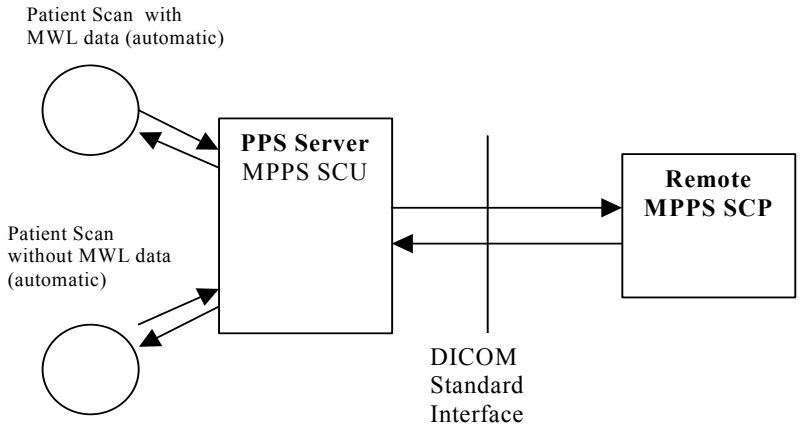
This feature works in conjunction with DICOM Modality Work-list feature, if installed. However the conformance of this feature is independent of Modality work-list feature. For information on conformance of Modality Work-List feature to DICOM standard please refer to the appropriate section.

13.2 IMPLEMENTATION MODEL

The DICOM 'Performed Procedure Step' service is provided by the PPS Server DICOM AE. The PPS Server DICOM AE is commanded to perform Performed Procedure Step services either automatically or through the user interface.

13.2.1 APPLICATION DATA FLOW DIAGRAM

The basic Application models for the feature are shown in the following illustration:



13.2.2 Functional Definition of AEs

The PPS Server AE is implemented as an application process on the scanner host computer.

The PPS Server AE initiates the following functions.

- *Start PPS*: Initiates a DICOM association in order to create a DICOM Modality Performed Procedure Step SOP instance in the remote AE. If the remote AE accepts a presentation context applicable to Modality performed Procedure Step, the PPS Server AE will issue a request to create the SOP instance in the remote AE via the N-CREATE service.

- *Complete PPS*: Initiates a DICOM association in order to update a DICOM Modality Performed Step instance that is already created with the remote AE. If the remote AE accepts a presentation context applicable to Modality performed Procedure Step, the PPS Server AE will issue a request to update the SOP instance in the remote AE via the N-SET service. The PPS Status is set to 'COMPLETED'.

- *Discontinue PPS*: Initiates a DICOM association in order to update a DICOM Modality Performed Step instance that is already created with the remote AE. If the remote AE accepts a presentation context applicable to Modality performed Procedure Step, the PPS Server AE will issue a request to update the SOP instance in the remote AE via the N-SET service. The PPS Status is set to 'DISCONTINUED'.

13.2.3 Sequencing of Real-World Activities

13.2.3.1 PPS from acquisition system with MWL data

The system has a Modality Work-list Server AE installed. Work-List information is obtained from HIS/RIS system through the use of Basic Work-list Management Service. Use of the information retrieved in the creation of Image SOP instance is described Modality Work-list Conformance statement. Use of the information retrieved in MPPS SOP instances is described later in this document.

- The system initiates a 'Start PPS' before starting a scan, i.e. when the image acquisition is started. The system retrieves necessary information related to the Scheduled Procedure Step from Modality Work-list Server. PPS Server AE initiates a MPPS (Modality Performed Procedure Step) N-CREATE request to the remote AE (MPPS SCP), in-order to create a MPPS SOP instance at the remote AE.

- The MPPS SCP returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data.

- System includes the necessary information related to Scheduled Procedure Steps and the Performed procedure Step in the image instances created.

- At the end of image acquisition, system initiates a 'Complete PPS' or 'Discontinue PPS' based on the choice selected by the user using the user interface provided. The user is also given a choice 'Defer PPS' which is described below. PPS Server AE initiates a MPPS N-SET request to the remote AE, in-order to update the MPPS SOP instance, that is already created.

- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data.

- At the end of image acquisition, if the user has chosen 'Defer PPS', the user is provided with an interface to 'Complete PPS' or 'Discontinue PPS' at any later time. The user might to alter the image set generated through acquisition, before invoking these operations. Note that the user explicitly uses the user interface provided to invoke this operation.

- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data.

13.2.3.2 PPS from acquisition system without MWL data

The system either does not have a Modality Work-list Server AE installed or a Modality Work-list Server AE installed but no Work-List information is obtained from HIS/RIS system for the current procedure that is being performed. The information required for performing the procedure is supplied through the user interface of the system. The use of this information in MPPS SOP instances is described later in this document.

- The system initiates a 'Start PPS' before starting a scan, i.e. when the image acquisition is started. PPS Server AE initiates a MPPS (Modality Performed Procedure Step) N-CREATE request to the remote AE (MPPS SCP), in-order to create a MPPS SOP instance at the remote AE.

- The MPPS SCP returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data.

- System includes the necessary information related to Scheduled Procedure Steps and the Performed procedure Step in the image instances created.

- At the end of image acquisition, system initiates a 'Complete PPS' or 'Discontinue PPS' based on the choice selected by the user using the user interface provided. The user is also given a choice 'Defer PPS' which is described below. PPS Server AE initiates a MPPS N-SET request to the remote AE, in-order to update the MPPS SOP instance, that is already created.

- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data.

- At the end of image acquisition, if the user has chosen 'Defer PPS', the user is provided with an interface to 'Complete PPS' or 'Discontinue PPS' at any later time. The user might to alter the image set generated through acquisition, before invoking these operations. Note that the user explicitly uses the user interface provided to invoke this operation, as in the case of PPS generated for post-processing, which is described in the following section.

- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data.

13.3 AE SPECIFICATION

13.3.1 PPS Server AE Specification

This Application Entity provides Standard Conformance to the following DICOM v3.0 SOP Classes as an SCU:

SOP Class Name	SOP Class UID
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3

13.3.1.1 Association Establishment Policies

13.3.1.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

Application Context Name	1.2.840.10008.3.1.1.1

The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU from an association initiated by the PPS Server AE is:

Maximum Length PDU	No Limitation for Maximum PDU Size

The SOP Class Extended negotiation is not supported.

The maximum number of presentation negotiation items that will be proposed is 1.

The user information items sent by this AE are

- Maximum PDU Length
- Implementation UID
- Implementation Version Name

13.3.1.1.2 Number of Associations

The PPS Server will initiate only one DICOM association at any time to perform a PPS operation to the remote AE.

13.3.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations are performed synchronously.

13.3.1.1.4 Implementation Identifying information

The implementation UID for this DICOMv3.0 Implementation is:

PPS Feature for Precision 500D Implementation UID	1.2.840.113619.6.107

13.3.1.2 Association Initiation Policy

The PPS Server AE initiates a new association for every PPS operation initiated.

13.3.1.2.1 Real-World Activity: Performed Procedure Step creation and update

13.3.1.2.1.1 Associated Real-World Activity

The real-world activities are mentioned in section *13.2.3 Sequencing of Real-World Activities*. Each of the real world activity results in either creating a new Performed procedure Step SOP

instance at the remote SCP or updating an already created Performed Procedure Step SOP instance as per the DICOM v3.0 standard.

13.3.1.2.1.2 Proposed Presentation Context Table

The following table shows the proposed presentation contexts for the PPS Server AE after any of the real-world activity listed in section *13.2.3 Sequencing of Real-World Activities*, is initiated.

Presentation Context Table - Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

13.3.1.2.1.2.1 SOP Specific DICOM Conformance Statement for MPPS SOP class

If the remote AE does not support the proposed Presentation context, an appropriate error message logged. Only one association is opened at a time.

All the operations used by this SOP class support an association timer, which is configurable. The timer is started when a request (association request, N-CREATE request or N-SET request) is sent and stopped when the respective response is received. The default time-out value is 60 seconds.

All the operations used by this SOP class support a “Session Timer”. This timer is started when the association is established and stopped when association is ended. The default time-out value is 300 seconds.

If any of the above timers expires the association is aborted and the operation in-progress is considered FAILED.

In any case an operation (N-CREATE or N-SET) fails, system updates the state.

13.3.1.3 Association Acceptance Policy

The PPS Server AE does not respond to attempts by remote AE to open an association.

13.4 COMMUNICATION PROFILES

13.4.1 Supported Communication Stacks (PS 3.8)

DICOM Upper Layer (PS 3.8) is supported using TCP/IP.

13.4.2 OSI Stack

The OSI Communication stack is not supported by this implementation.

13.4.3 TCP/IP Stack

The TCP/IP stack is inherited from the Windows operating system

13.4.3.1 API

Not Applicable to this product.

13.4.3.2 Physical Media Support

Ethernet 802.3 provides the physical network layer for this product.

13.4.4 Point-to-Point Stack

The Point-to-Point Stack is not supported by this implementation.

13.5 EXTENSIONS/SPECIALIZATION/PRIVATIZATION

13.5.1 Standard Extended/Specialized/Private SOPs

PPS for Precision 500D does not implement any private SOP classes.

13.5.2 Private Transfer Syntaxes

PPS for Precision 500D does not implement any private Transfer Syntaxes.

13.6 CONFIGURATION

The PPS feature is configured by GEMS Field Service Engineers. The DICOM configuration items below are configurable or re-configurable by the Field Service Engineer and are not accessible by users through the Precision 500D user interface.

13.6.1 AE Title/Presentation address Mapping

PPS allows for the configuration of the following parameters which pertain to the remote AE.

- Remote AE (HIS/RIS) IP Address - IP Address used to contact the remote AE
- Remote AE (HIS/RIS) IP Port - IP Port used to contact the remote AE
- Remote MPPS AE Title AE - Application Entity Title

These parameters define where the MPPS requests will be directed. Configuration of these parameters is performed by GEMS Field Service engineers, using the installation facilities.

13.6.2 Configurable Parameters

The following are configurable for the PPS Server AE:

- Local AE Title
- Local IP Address
- Local IP net-mask
- Local IP gateway

The following parameters are configurable, but need change only in case of a system software upgrade:

- Implementation UID
- PDU size
- Association time-out period
- Session time-out period

13.7 SUPPORT OF EXTENDED CHARACTER SETS

PPS feature for Precision 500D does not support any extended character set.

13.8 N-CREATE & NSET REQUEST MESSAGE

PPS Feature for Precision 500D supports all named attributes listed in Table F.7.2.1 in PS3.4 of DICOM standard. That is, attributes that are not explicitly referenced by name in the table are not supported.

For the MPPS associated with an acquisition, the following attributes are copied from the Modality Work-list SCU into the MPPS request Message, if procedure performed corresponds to the SPS information retrieved through the Modality Work-list.

Precision 500D supports the selection of only a single SPS for an exam. The following are applicable.

- Single SPS selection results in single PPS message.
- Referenced Study Sequence - a maximum of one Item is supported. This attribute will be present only if SPS information is available from Modality Work-list SCU.
- At the end of acquisition the user might choose to 'Defer PPS' and later choose to 'Complete PPS' or 'Discontinue PPS' from the user interface provided in the system. In this case, the date and time when user chooses to 'Complete PPS' or 'Discontinue PPS' is taken as the Performed Procedure Step End Date and Performed Procedure Step End Time respectively (Not the actual end date and end time of acquisition).

13.9 ERROR HANDLING AND RECOVERY

PPS Server AE does not define any extended error codes. The standard error codes are handled. On a response with status 'success' for the N-CREATE or N-SET request, the system updates the state and indicates the same on the user interface. On a response with status other than 'success' the operation is deemed 'Failed' and the system updates the state and indicates the same on the user interface. If the request has failed or response is not received before the association timeout, the operation is deemed 'Failed' and the system updates the state.

If the operation is 'Failed', detailed message is logged into system log-file.

13.10 USE OF SPECIFIC DICOM DATA

The following table gives specific usage of some of attributes in the MPPS SOP instance created, with reference to each of the real-world scenarios mentioned in section *13.2.3* of this document.

Attribute Name	Tag	Usage in MPPS Instance	
		Acquisition with MWL data	Acquisition without MWL data
Specific Character Set	(0008,0005)	Not used	Not used

Attribute Name	Tag	Usage in MPPS Instance	
		Acquisition with MWL data	Acquisition without MWL data
Scheduled Step Attribute Sequence	(0040,0270)	Only one item	
>Study Instance UID	(0020,000D)	Copied from SPS	Created by system
>Referenced Study Sequence	(0008,1110)	Not Used	Not Used
>Accession Number	(0008,0050)	Copied from SPS	User input on system
>Placer Order Number/Imaging Service Request	(0040,2006)	Not Used	Not Used
>Filler Order Number/Imaging Service Request	(0040,2007)	Not Used	Not Used
>Requested Procedure ID	(0040,1001)	Copied from SPS	Not Used
>Requested Procedure Description	(0032,1060)	Not Used	Not Used
>Placer Order Number/Procedure	(0040,1006)	Not Used	Not Used
>Filler Order Number/Procedure	(0040,1007)	Not Used	Not Used
>Scheduled Procedure ID	(0040,0009)	Copied from SPS	Not Used
>Scheduled Procedure Step Description	(0040,0007)	Not Used	Not Used
>Scheduled Action Item Code Sequence	(0040,0008)	Not Used	Not Used
Patient's Name	(0010,0010)	Copied from SPS	User input on system
Patient ID	(0010,0020)	Copied from SPS	User input on system
Patient's Birth Date	(0010,0032)	Copied from SPS	User input on system
Patient's Sex	(0010,0040)	Copied from SPS	User input on system
Referenced Patient Sequence	(0008,1120)	Not Used	Not Used
Performed Procedure Step ID	(0040,0253)	Copied from SPS	Created at scanner
Performed Station AE Title	(0040,0241)	Set to system AE Title	Set to system AE title
Performed Station Name	(0040,0242)	Not Used	Not Used
Performed Location	(0040,0243)	Not Used	Not Used
Performed Procedure Step Start Date	(0040,0244)	Date exam started on system	Date exam started on system

Attribute Name	Tag	Usage in MPPS Instance	
		Acquisition with MWL data	Acquisition without MWL data
Performed Procedure Step Start Time	(0040,0245)	Time exam started on system	Time exam started on system
Performed Procedure Step Status	(0040,0252)	See Note 1	See Note 1
Performed Procedure Step Description	(0040,0254)	Not Used	Not Used
Performed Procedure Type Description	(0040,0255)	Not Used	Not Used
Procedure Code Sequence	(0008,1032)	Not Used	Not Used
Performed Procedure Step End Date	(0040,0250)	Date exam ended on system	Date exam ended on system
Performed Procedure Step End Time	(0040,0251)	Time exam ended on system	Time exam ended on system
Study ID	(0020,0010)	Copied from SPS	Not Used
Performed Action Item Code Sequence	(0040,0260)	Not Used	Not Used
Performed Series Sequence	(0040,0340)	Not Used	Not Used
>Performing Physician's Name	(0008,1050)	Not Used	Not Used
>Protocol Name	(0018,1030)	Not Used	Not Used
>Operator's Name	(0008,1070)	Not Used	Not Used
>Retrieve AE Title	(0008,0054)	Not Used	Not Used
>Referenced Image Sequence	(0008,1140)	Not Used	Not Used
>Referenced Standalone SOP Instance Sequence	(0040,0220)	Not Used	Not Used
Total Time of Fluoroscopy	(0040,0300)	Time in seconds of Fluoroscopy during exam	Time in seconds of Fluoroscopy during exam
Entrance Dose	(0040,0302)	Entrance Dose for Exam in dGy	Entrance Dose for Exam in dGy
Image Area Dose Product	(0018,115E)	Total Area Dose for exam in $dGycm^2$	Total Area Dose for exam in $dGycm^2$
>All other attributes from Performed Series Sequence		Not Used	Not Used

Attribute Name	Tag	Usage in MPPS Instance	
		Acquisition with MWL data	Acquisition without MWL data
(which Table F.7.2.1 of DICOM standard PS3.4 does not explicitly list)			
All other attributes from Billing and Material Code Module (which Table F.7.2.1 of DICOM standard PS3.4 does not explicitly list)		Not Used	Not Used

Note 1:

- When PPS start (N-CREATE) message is sent, this element will have the value “INPROGRESS”
- When PPS end (N-SET) message is sent, this element will have either “COMPLETE” or “DISCONTINUE” based on user selection.