Technical Publications

Direction 2204858
Revision 1

LOGIQ 500 V/R 4.00 CONFORMANCE STATEMENT for DICOM

GE Medical Systems

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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.

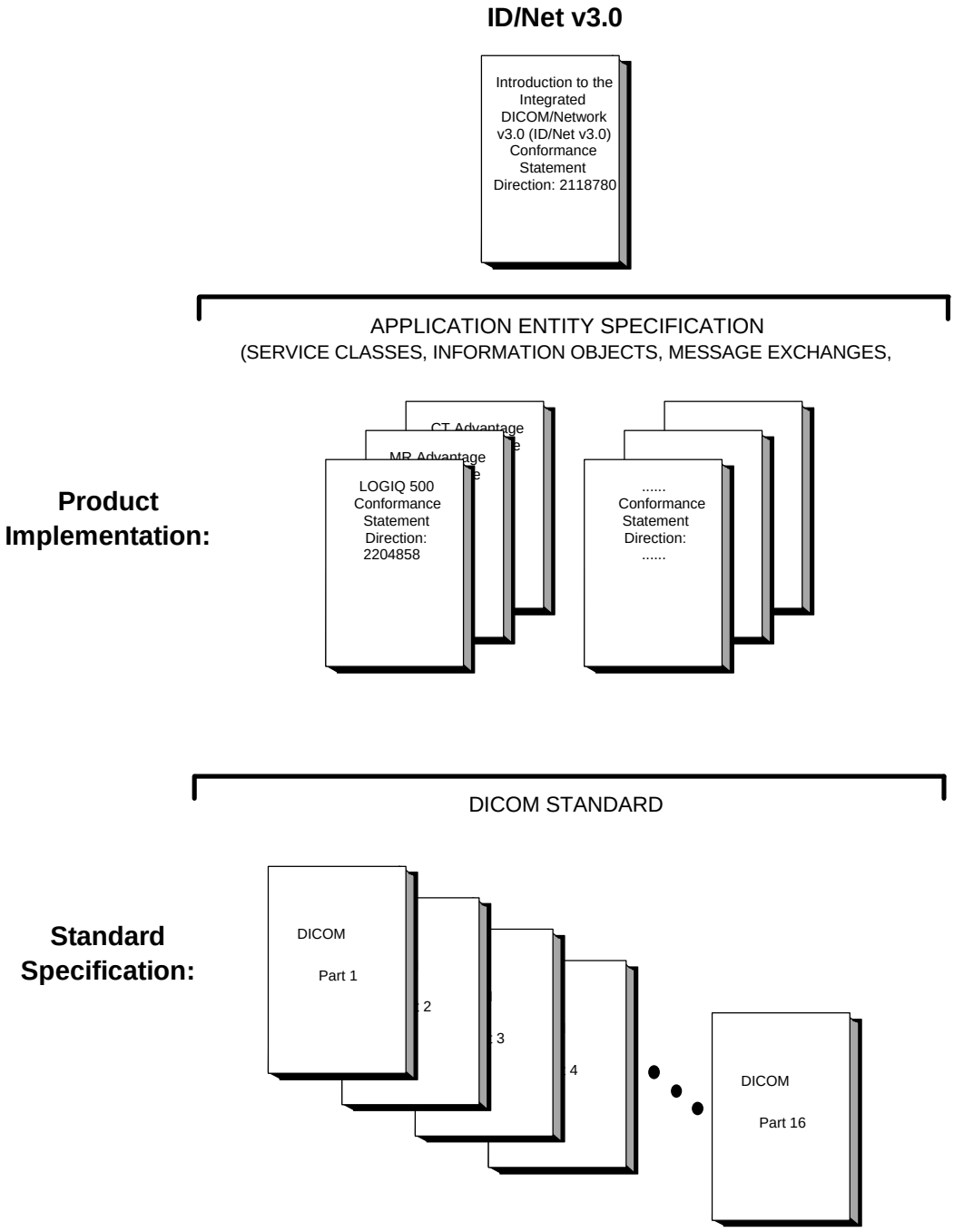
Section 3 (Ultrasound Information Object Implementation), which specifies the GEMS equipment compliance to the DICOM requirements for the implementation of an Ultrasound Information Object.

Section 4 (Secondary Capture Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Secondary Capture Information Object.

Section 5 (Print Management Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of the Basic Print Meta SOP Classes (Gray and Color).

1.2. OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

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



This document specifies the DICOM implementation. It is entitled:

LOGIQ 500 V/R 4.00
Conformance Statement for DICOM
Direction ***2204858***

This DICOM Conformance Statement documents the DICOM 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 Part 8 standard.

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

For the convenience of software developers, there is "collector" Direction available. By ordering the collector, the Introduction described above and all of the currently published GEMS Product Conformance Statements will be received. The collector Direction is:

ID/Net v3.0 Conformance Statements
Direction: 2117016

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

1.3. 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 Standards and with the terminology and concepts which are used in those Standards.

If readers are unfamiliar with DICOM terminology they should first refer to the document listed below, then read the DICOM 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 Conformance Statement and is necessary to ensure proper processing and interpretation of GEMS medical data exchanged using DICOM. 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 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 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), 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 Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEMS protocol is based on DICOM as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM. **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).and Supplement 5 (Ultrasound Application Profile, IOD, and Transfer Syntax Extensions).

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.

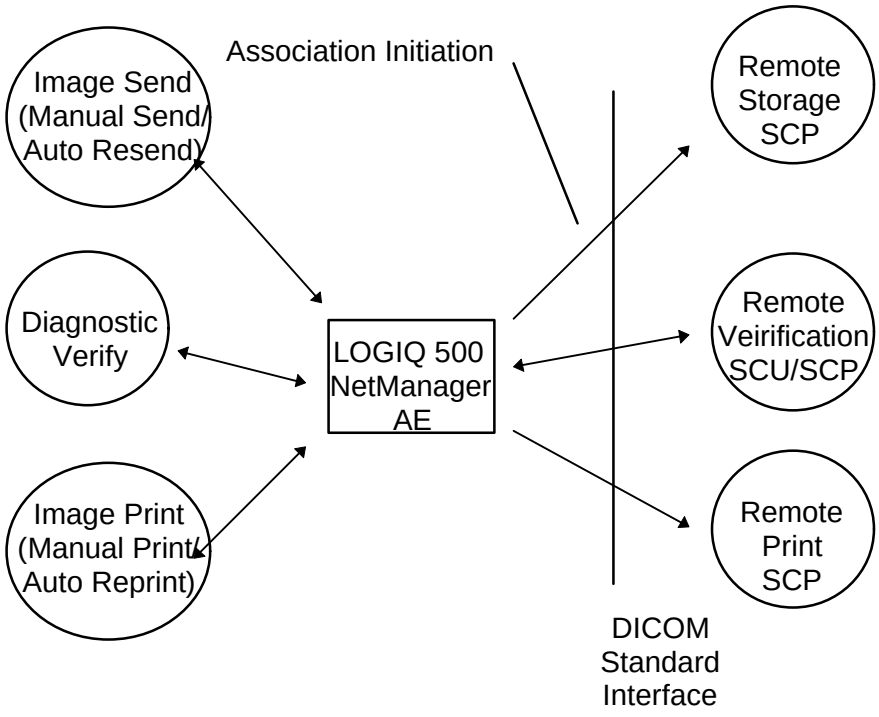
The LOGIQ 500 is an ultrasound scanning device that provides the user with the capability to transfer digital ultrasound images over a LAN to remote devices for archiving and/or printing, using DICOM.

LOGIQ 500 DICOM is an optional software product which supports DICOM and permits interoperability across equipment produced by different vendors that also utilize DICOM services. On any given network, LOGIQ 500 can send images to multiple archive/review stations (PACS) and printers. The network is easily configured at any time, but is normally done at software installation by a GEMS Field Engineer. LOGIQ 500 has one application entity (AE) that provides all DICOM services that are required to support the "send", "print" and "verify" services.

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 :



LOGIQ 500 NetManager Specific AE Implementation Model

The LOGIQ 500 NetManager Application Entity (AE) is an application which handles all DICOM protocol communications. NetManager AE is automatically brought up when the machine is powered on if the DICOM option is installed on the system.

All remote DICOM devices that are to be used by the LOGIQ 500 must be manually configured via the network configuration menu on the scanner. Normally this done during software installation by a GE Field engineer.

There are three local real-world activities that occur in the LOGIQ 500 - Image Send, Image Print and Remote Verification. Image Send and Image Print can be done in either automatic or manual mode.

All DICOM activities handled in a queue manner by one AE NetManager, running on the scanner. If the scanner is removed from the network for some reason (i.e. a portable exam), the requests remain queued and are executed when the network connection is restored. This allows portable exams to be done without losing any images.

Image Send can be used in an Manual Send mode. One of the 4 VFD menu buttons (Storage Dest1, Storage Dest2, Storage Dest3, Storage Dest4) is configured to capture an image and to send it to one available Storage SCP. During the exam the operator pressed the configured VFD menu button to capture an image. The image is stored on the local hard drive and is queued to the NetManager Application. The NetManager then sends the image without user intervention to the Storage SCP assigned to the VFD menu button. The transfer is done in the background while scanning or other operator activities continue.

In automatic resend mode, Images which are captured on the hard disk and but failed to transfer to the Storage SCP, will be resent automatically. The number of retries and retry Interval time are configurable at the Image transferring queue status menu.

All images which are captured and sent to the storage server will be removed from the local hard drive automatically because of limited hard drive space. All images which are captured but fail to transfer to the specified storage server after a preset number of retries remain on the hard drive. These images are listed on the Image transferring queue status menu. The operator can remove or resend these images tothe specified Storage SCP from this menu.

Image Print works much the same way as Image Send, in both Manual Send and Automatic Resend Modes, the only difference being that the destination is a printer.

All images which are captured and sent to a printer or storage server are deleted from the local hard disk at the end of a successful transaction.

Aside from the two local real-world activities already mentioned, there is one other called Verification Diagnostics, which exists for the purpose of performing basic communication checks between the LOGIQ 500 and other network devices. DICOM verification of specified remote host(s) can be initiated by choosing the “EXECUTE” button displayed on Host Verification Menu. The NetManager will verify communication with each network device that is configured on the Network Configuration Menu. It will test the storage services available for each configured network storage SCP. The current status of all configured devices will be displayed on the right hand side of the menu for each device tested.

2.2.2. Functional Definition of AE's

The Application Entity 1, NetManager, supports the following functions:

- Manually or automatically initiates a DICOM association to send images
- Manually or automatically initiates a DICOM association to print images
- Initiates a DICOM verification to assist in network diagnostics

- Responds to DICOM verification requests from other device(s)

2.2.3. Sequencing of Real-World Activities

Not Applicable

2.3. AE SPECIFICATIONS

2.3.1. LOGIQ 500 NetManager AE Specification

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

SOP Class Name	SOP Class UID
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18
Verification SOP Class	1.2.840.10008.1.1

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

SOP Class Name	SOP Class UID
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 LOGIQ 500 NetManager is:

Maximum Length PDU	4110

Note that the Max PDU length is not configurable. It is fixed by design to minimize internal memory requirements.

The SOP Class Extended Negotiation is not supported.

The maximum number of Presentation Context Items that will be proposed is 14.

Note that the same Abstract Syntax may be offered multiple times with different Transfer Syntax's.

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 NetManager AE will initiate only one DICOM association at a time to perform an image Store, Print or Verify.

2.3.1.1.3. Asynchronous Nature

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

2.3.1.1.4. Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

LOGIQ 500 Implementation UID	**1.2.840.113619.6.20**

The Implementation Version Name for this DICOM Implementation is:

LOGIQ 500 Implementation Version Name	**LOGIQYMS_AK_VD00**

2.3.1.2. Association Initiation Policy

The NetManager AE attempts to establish a new association with a remote device due three Real-World Activities:

- A. "Manual Send/Auto Re-send" initiated by the operator for a specific image or group of images.
- B. "Manual Print/Auto Re-Print" initiated by the operator for a specific image or group of images.
- C. "Verification" which verifies application level communication between peer DICOM AE's for service purposes.

2.3.1.2.1. Real-World Activity - A ("Image Send")

Although there are two different ways for the operator to initiate an image transmission the DICOM initiation and transfer process are identical.

2.3.1.2.1.1. Associated Real-World Activity

Upon manual or automatic request, an image will be sent to a DICOM Storage SCP. If an error occurs during the transmission, the current association is released and a new association will be initiated. The maximum number of retries is 9999. Images that remain on the local hard disk will be removed after the image transmission process has completed successfully. Images that are not transferred successfully will remain on the hard disk until the user removes them or tries to resend them to the specified Storage SCP and succeeds.

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**		
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCU	None
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.2	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 terminated; image not transferred	(0000,0902)
	0122	SOP Class not Supported	association is terminated; image not transferred	(0000,0902)
Error	Cxxx	Cannot Understand	association is terminated; image not transferred	(0000,0901) (0000,0902)
	A9xx	Data Set does not match SOP Class	association is terminated; image not transferred	(0000,0901) (0000,0902)
Warning	B000	Coercion of Data Elements	treated as a 'Successful' response	(0000,0901) (0000,0902)

	B007	Data Set does not match SOP Class	treated as a 'Successful' response	(0000,0901) (0000,0902)
	B006	Elements Discarded	treated as a 'Successful' response	(0000,0901) (0000,0902)
Success	0000			None

2.3.1.2.1.2.2. SOP Specific DICOM Conformance Statement for Image Storage SOP Classes

Manual Send Mode:

This Implementation can queue multiple C-STORE requests. This is done in the case that Storage buttons in the DICOM VFD Menu are selected before the previous C-STORE operation has been completed. The maximum number of images that can be captured on the hard drive is 15. No C-STORE operation will be accepted if 15 C-STORE requests remain queued. An association for a requested C-STORE operation is initiated after the association of a previous C-STORE operation has been terminated, even if the previous image could not be sent to specified Storage SCP successfully. Images are sent one image at a time, as they are acquired. On receipt of a C_STORE confirmation containing either a Successful or a Failed status, this implementation will perform the next C-STORE operation. Note that even if a Failed status is received, this implementation will continue to send images that remain queued.

Automatic Resend Mode:

For images which have been captured and for which an error occurs during the transmission, the current association is released and a new association initiated automatically to re-send images to the specified Storage SCP. The number of retries and the retry interval time are configurable via the Image Transferring Queue Status Menu.

All mandatory modules for the SC IOD and US IOD are provided by the NetManager.

Each C-STORE operation supports a "Per Image" Store Timeout. This timeout starts once a C-STORE request has been issued and stops once a C-STORE confirmation has been recieved. This timeout is 120 seconds.

2.3.1.2.2 Real-World Activity - B ("Image Print")

Although there are two different methods for the operator to initiate a print, the DICOM association initiation and transfer processes are identical.

Manual Print Mode:

When the remote device is configured to have images sent to it, the operator can select the image by pressing the Print Destination key on the DICOM VFD menu, causing the image to be transferred to the remote printer.

Automatic Re-print Mode:

For images which have been captured and for which an error occurs during the transmission, the current association is released and a new association initiated automatically to re-print the images to the specified Print SCP. The number of retries and the retry interval time are configurable via the Image Transferring Queue Status Menu.

2.3.1.2.2.1 Associated Real-world Activity

Upon a request by the operator (Manual Print/Automatic re-print), an image will be sent to a DICOM Print SCP. If an error occurs during the transmission, the current association is released and a new association initiated. The maximum number of retries is 15.

2.3.1.2.2.2 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 Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCU	None
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18	Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCU	None

2.3.1.2.2.2.1 SOP Specific DICOM Conformance Statement for all Print SOP Classes

2.3.1.2.2.2.1.2 SOP Specific Conformance for Basic Grayscale Print Management

Standard conformance is provided to Basic Grayscale Print Management Meta SOP Class as an SCU. ALL mandatory elements for film sessions, basic film boxes and basic grayscale images boxes are provided by the NetManager AE.

2.3.1.2.2.2.1.3 SOP Specific Conformance for Basic Color Print Management

Standard conformance is provided to the DICOM Basic Color Print Management Meta SOP Class as a SCU. All mandatory elements for film sessions, basic film boxes and basic color images boxes are provided by the NetManager AE.

2.3.1.2.3 Real-World Activity - C ("Diagnostic Verify")

Verification Service Class is used as a diagnostic and informative tool on the LOGIQ 500 to provide information to the user regarding status of network devices (PACS, printers) that have been configured on the scanner.

2.3.1.2.3.5 Associated Real-world Activity

The user may initiate a DICOM Verify by selecting ‘Echo Test’ on the Host Verification Menu When selected, each of the configured network devices will be tested. One at a time, with a DICOM C-ECHO. The results of the C-ECHO are displayed on the screen, opposite the device AE title.

Associations will be released upon the receipt of each C-ECHO confirmation.

2.3.1.2.3.6 Proposed Presentation Context Table

Presentation Context Table - Proposed					
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	SCU	None

2.3.1.2.3.2.1 SOP Specific DICOM Conformance Statement for Verify SOP Class

The NetManager AE provides standard conformance to the Verification SOP Class as an SCU.

2.3.1.3. Association Acceptance Policy

The NetManager AE accepts an association only when the LOGIQ 500 scanner receives a Verification request from another network device.

2.3.1.3.1. Real-World Activity - Verification Request

2.3.1.3.1.1.Associated Real-World Activity

An incoming Verification Request will cause the NetManager AE to accept the association and respond with a verification response.

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 Verify SOP Class

The NetManager AE provides standard conformance to the Verification SOP Class as a SCP.

2.3.1.3.1.3. Presentation Context Acceptance Criterion

No criterion.

2.3.1.3.1.4. Transfer Syntax Selection Policies

Only Little Endian transfer Syntax is supported and there is no priority selection policy.

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.

2.4.3. TCP/IP Stack

The TCP/IP stack is inherited from a pSOS/pNA Operating System which the LOGIQ 500 application is built on.

2.4.3.1. API

Not applicable to this product.

2.4.3.2. Physical Media Support

Ethernet v2.0, IEEE 802.3.

2.5. EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

2.5.1. Standard Extended /Specialized/Private SOPs

Not applicable to this product.

2.6. CONFIGURATION

2.6.1. AE Title/Presentation Address Mapping

The Local AE title is configurable and is normally configured by a GEMS Service Engineer during DICOM software installation. It can also be modified by the user if the need arises. The AE Title is a set from the Network Configuration Menu as part of the user interface.

2.6.2. Configurable Parameters

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

- Local AE Title
- Local IP Address
- Local Listening TCP/IP port number(port 104 is the default port number)

- Local IP Netmask
- Local routing table information

The following fields are configurable for remote DICOM storage and print AE's:

- Remote AE Title
- Remote IP Address
- Responding TCP/IP port number (only 4 digits' port number is available)
- Remote host name

Note: All configurations must be performed by a GE Field Engineer.

2.7. SUPPORT OF EXTENDED CHARACTER SETS

ISO-IR 100 Latin alphabet No.1, supplementary font code set is supported.

3. ULTRASOUND (US) INFORMATION OBJECT IMPLEMENTATION

3.1. INTRODUCTION

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

3.2 - IOD Description

3.3 - IOD Entity-Relationship Model

3.4 - IOD Module Table

3.5 - IOD Module Definition

3.2. US IOD IMPLEMENTATION

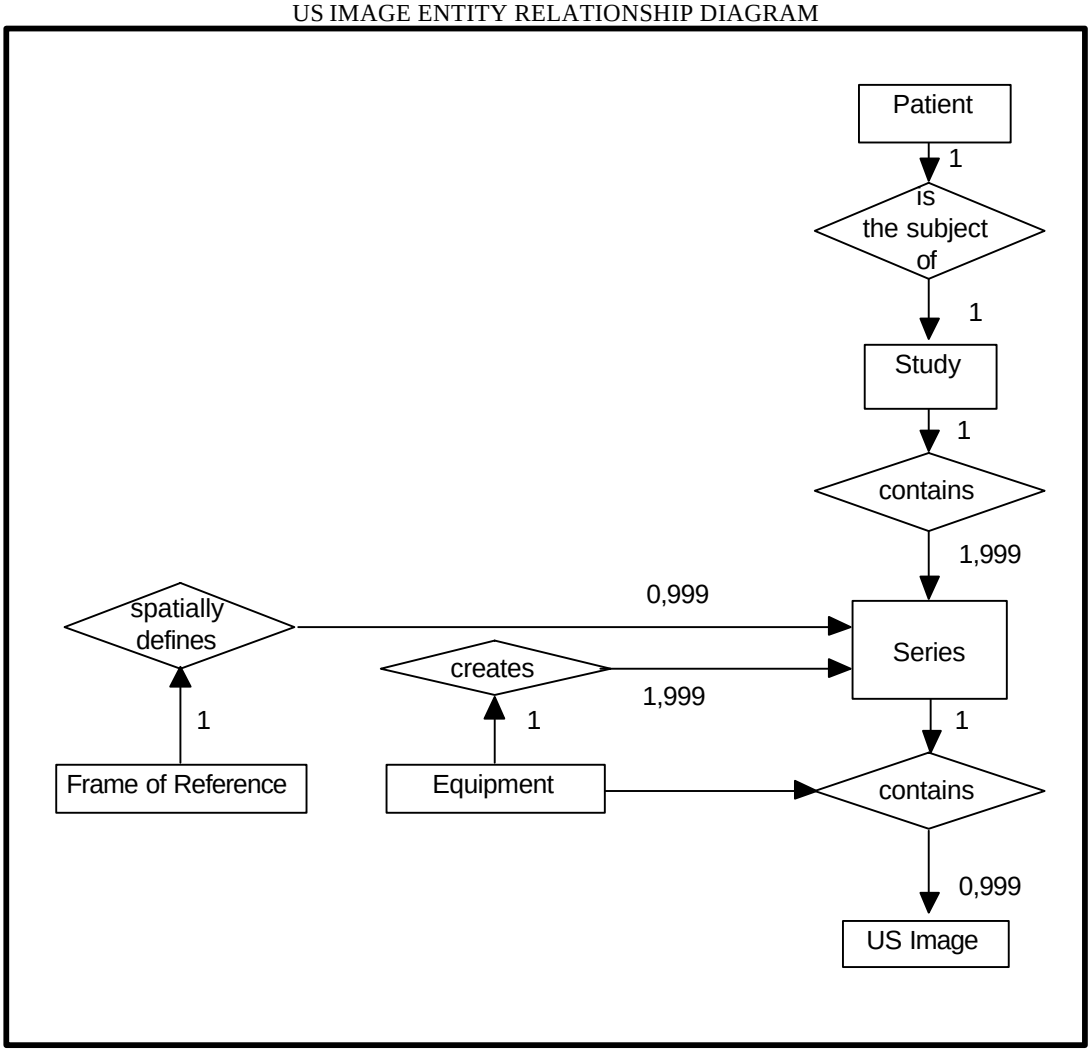
3.3. US ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the US Image interoperability schema is shown in Illustration 3.3-1**.** 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 Images 999 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 3.3-1
US IMAGE ENTITY RELATIONSHIP DIAGRAM



3.3.1. ENTITY DESCRIPTIONS

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

3.3.1.1. Patient Entity Description

Patient Entity defines the characteristics of a Patient who is the subject of medical Studies which produce medical images. A Patient is diagnosed by one or more Studies.

3.3.1.2. Study Entity Description

A Study Entity defines a medical Study performed on a Patient. A Study is a collection of one or more Series of medical images which are logically related to each other for the purpose of diagnosing a Patient.

3.3.1.3. Series Entity Description

A Series Entity defines the attributes which identify distinct logical sets of images. All Series with a Study are of the same modality type.

3.3.1.4. Equipment Entity Description

The Equipment Entity describes the imaging hardware which produced a particular Series of images.

3.3.1.5. Frame of Reference Entity Description

The Frame of Reference Entity uniquely identifies the spatial coordinate system which has been used to produce an Image. An Image is related to one, and only one, Frame of Reference.

3.3.1.6. US Image Entity Description

The Image Entity defines the attributes which fully describe the pixel data of an Ultrasound image. The pixel data which was either generated as a direct result of Ultrasound scanning or derived from the pixel data of other US images (DEFF files stored on MODs).

3.3.2. LOGIQ 500 Mapping of DICOM entities

TABLE 3.3.2-1
MAPPING OF DICOM ENTITIES TO LOGIQ 500 ENTITIES

DICOM	LOGIQ 500 Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image
Curve	not used

3.4. IOD MODULE TABLE

Within an entity of the DICOM US 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 data sets.

The following table identifies the defined modules within the entities which comprise the DICOM US Single Frame IOD created by the LOGIQ 500. Modules are identified by Module Name.

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

TABLE 3.4-1
US IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	3.5.1.1
Study	General Study	3.5.2.1
	Patient Study	3.5.2.2
Series	General Series	3.5.3.1
Frame of Reference	Frame of Reference	not used
	US Frame of Reference	not used
Equipment	General Equipment	3.5.5.1
Image	General Image	3.5.6.1
	Image Pixel	3.5.6.2
	Contrast/Bolus	not used
	Palette Color Lookup Table	not used
	US Region Calibration	3.5.8.1
	US Image	3.5.8.2
	Overlay Plane	not used
	VOI LUT	not used
	SOP Common	3.5.7.1
Curve	Curve Identification	not used
	Curve	not used
	Audio	not used
	SOP Common	not used

The Image and Curve IEs are mutually exclusive. Each SOP Instance using this IOD shall contain exactly one of these IODs. Curve entities are not created by this implementation.

3.5. INFORMATION MODULE DEFINITIONS

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

3.5.1. Common Patient Entity Modules

3.5.1.1. 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 3.5.1.1-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	May be entered from User Interface. Limited to 29 characters.
Patient ID	(0010,0020)	2	May be entered from User Interface. Limited to 14 characters.
Patient's Birth Date	(0010,0030)	2	Always zero length (no value sent).
Patient's Birth Time	(0010,0032)	3	Always zero length (no value sent).
Patient's Sex	(0010,0040)	2	May be entered from User Interface; limited to 'M' and 'F'
Other Patient IDs	(0010,1000)	3	Always zero length (no value sent)
Other Patient Names	(0010,1001)	3	Always zero length (no value sent)
Patient Comments	(0010,4000)	3	Always zero length (no value sent)

3.5.2. 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.

3.5.2.1. General Study Module

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

TABLE 3.5.2.1-1
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Implementation UID + Ethernet Address of CPU board + Image Capture Date + Study ID
Study Date	(0008,0020)	2	Image Capture Date
Study Time	(0008,0030)	2	Image Capture Time
Referring Physician's Name	(0008,0090)	2	Always zero length (no value sent)
Study ID	(0020,0010)	2	Internal value which is incremented when user defines a new patient.
Accession Number	(0008,0050)	2	Always zero length (no value sent)
Study Description	(0008,1030)	3	Always zero length (no value sent)
Name of Physician(s) Reading Study	(0008,1060)	3	Always zero length (no value sent)

3.5.2.2. Patient Study Module

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

TABLE 3.5.2.2-1
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	May be entered from User Interface
Patient's Size	(0010,1020)	3	May be entered from User Interface
Patient's Weight	(0010,1030)	3	May be entered from User Interface
Additional Patient's History	(0010,21B0)	3	Always zero length (no value sent)

3.5.3. Common Series Entity Modules

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

3.5.3.1. General Series Module

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

TABLE 3.5.3.1-1
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Defined Term: US
Series Instance UID	(0020,000E)	1	Implementation UID + Ethernet Address of CPU board + Image Capture Date + Study ID + Image Capture Date
Series Number	(0020,0011)	2	Always zero length (no value sent)
Laterality	(0020,0060)	2C	Always zero length (no value sent)
Series Date	(0008,0021)	3	Always zero length (no value sent)
Series Time	(0008,0031)	3	Always zero length (no value sent)
Performing Physiciansí Name	(0008,1050)	3	Always zero length (no value sent)
Operators' Name	(0008,1070)	3	Always zero length (no value sent)

3.5.4. Common Frame Of Reference Entity Modules

The following Frame of Reference IE Module is common to all Composite Image IODs which reference the Frame of Reference IE.

3.5.5. Common Equipment Entity Modules

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

3.5.5.1. General Equipment Module

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

TABLE 3.5.5.1-1
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Implementation defined string “GEMS Ultrasound”
Institution Name	(0008,0080)	3	Always zero length (no value sent)
Institution Address	(0008,0081)	3	Always zero length (no value sent)
Station Name	(0008,1010)	3	Always zero length (no value sent)
Manufacturer's Model Name	(0008,1090)	3	Implementation defined string “LOGIQ 500”
Device Serial Number	(0018,1000)	3	Implementation UID + Ethernet Address of CPU board
Software Versions	(0018,1020)	3	Defined Term: “V/R 1.04”

3.5.6. Common Image Entity Modules

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

3.5.6.1. General Image Module

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

TABLE 3.5.6.1-1
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Internal value which is incremented for each captured image
Patient Orientation	(0020,0020)	2C	Always zero length (no value sent)
Image Date	(0008,0023)	2C	Date of image archived
Image Time	(0008,0033)	2C	Time of image archived
Image Type	(0008,0008)	3	See 3.5.6.1.1.2.
Acquisition Date	(0008,0022)	3	Always zero length (no value sent)
Acquisition Time	(0008,0032)	3	Always zero length (no value sent)
Image Comments	(0020,4000)	3	Always zero length (no value sent)

3.5.6.1.1. General Image Attribute Descriptions

3.5.6.1.1.1. Patient Orientation

This Attribute is sent with Always zero length (no value sent).

3.5.6.1.1.2. Image Type

Value 1 shall have the following Enumerated Values:

– ORIGINAL identifies an Original Image
when the image has been created by the LOGIQ 500.

Value 2 shall have the following Enumerated Values:

– PRIMARY identifies a Primary Image
when the image has been created by the LOGIQ 500.

See 3.5.8.2.1.1 for Defined Terms used for Value 3
Value sent with zero length if image not created by the LOGIQ 50.

3.5.6.2. Image Pixel Module

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

TABLE 3.5.6.2-1
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Value of '1' when Photometric Interpretation element value = 'MONOCHROME2' Value of '3' when Photometric Interpretation element value = 'RGB'
Photometric Interpretation	(0028,0004)	1	Defined Terms: MONOCHROME2 RGB
Rows	(0028,0010)	1	Value always = 462 for NTSC image. = 548 for PAL image
Columns	(0028,0011)	1	Value always = 608 for NTSC image = 720 for PAL image
Bits Allocated	(0028,0100)	1	Value always = 0008H
Bits Stored	(0028,0101)	1	Value always = 0008H
High Bit	(0028,0102)	1	Value always = 0007H
Pixel Representation	(0028,0103)	1	Value always = 0000H -unsigned integer
Pixel Data	(7FE0,0010)	1	
Planar Configuration	(0028,0006)	1C	Fixed Value: 0001H = color-by-plane
Smallest Image Pixel Value	(0028,0106)	3	Always zero length (no value sent)
Largest Image Pixel Value	(0028,0107)	3	Always zero length (no value sent)

3.5.7. General Modules

The SOP Common Moduleis mandatory for all DICOM IODs.

3.5.7.1. 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 3.5.7.1-1
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	"1.2.840.10008.5.1.4.1.1.6.1" or "1.2.840.10008.5.1.4.1.1.6"
SOP Instance UID	(0008,0018)	1	Implementation UID + Ethernet Address of CPU board + Image Capture Date + Study ID + Image Capture Date + Image Number
Specific Character Set	(0008,0005)	1C	Defined Term: Always "ISO_IR 100"

3.5.8. US Modules

This Section describes US Series, Equipment, and Image Modules. These Modules contain Attributes that are specific to US Image IOD.

3.5.8.1. US Region Calibration Module

This section contains IOD Attributes that describe an ultrasound region calibration.

TABLE 3.5.8.1-1
US REGION CALIBRATION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Sequence of Ultrasound Regions	(0018,6011)	1	Object always contains 4 regions but may not have data in each region
>Region Location Min x_0	(0018,6018)	1	Varies with scanning mode
>Region Location Min y_0	(0018,601A)	1	Varies with scanning mode
>Region Location Max x_1	(0018,601C)	1	Varies with scanning mode
>Region Location Max y_1	(0018,601E)	1	Varies with scanning mode
>Physical Units X Direction	(0018,6024)	1	Enumerated Values supported: 0003H cm for B,M mode 0004H sec for D, Physio mode
>Physical Units Y Direction	(0018,6026)	1	Enumerated Values supported: 0003H cm for B,M mode 0005H Hertz for D mode (Frequency) 0007H cm/sec for D mode (Velocity) 0000H None for Physio Wave
>Physical Delta X	(0018,602C)	1	Varies with scanning mode
>Physical Delta Y	(0018,602E)	1	Varies with scanning mode
>Reference Pixel x_0	(0018,6020)	3	Varies with scanning mode
>Reference Pixel y_0	(0018,6022)	3	Varies with scanning mode
>Ref. Pixel Physical Value X	(0018,6028)	3	Value always = 0
>Ref. Pixel Physical Value Y	(0018,602A)	3	Value always = 0
>Region Spatial Format	(0018,6012)	1	Enumerated Values supported: 0000H None 0001H 2D 0002H M-Mode 0003H Spectral 0004H Wave form
>Region Data Type	(0018,6014)	1	Enumerated Values supported: 0000H None or not applicable 0001H Tissue 0004H CW Spectral Doppler 0009H d(volume)/dt Trace 000AH ECG Trace 000BH Pulse Trace
>Region Flags	(0018,6016)	1	Bit 1 Scaling Protection used Bit 2 Doppler Scale Type used
>Transducer Frequency	(0018,6030)	3	Hexadecimal value of current probe frequency, scaled by 16 bits

>Pulse Repetition Frequency	(0018,6032)	3	Hexadecimal value of current probe PRF, scaled by 16 bits

3.5.8.2. US Image Module

This section specifies the Attributes that describe ultrasound images.

TABLE 3.5.8.2-1
US IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples Per Pixel	(0028,0002)	1	Value of '1' when Photometric Interpretation element value = 'MONOCHROME2' Value of '3' when Photometric Interpretation element value = 'RGB'
Photometric Interpretation	(0028,0004)	1	Defined Terms: MONOCHROME2 RGB
Bits Allocated	(0028,0100)	1	Value always = 0008H
Bits Stored	(0028,0101)	1	Value always = 0008H
High Bit	(0028,0102)	1	Value always = 0007H
Planar Configuration	(0028,0006)	1	Enumerated Value supported: 0001H - color-by-plane
Pixel Representation	(0028,0103)	1	Value always = 0000H -unsigned integer
Image Type	(0008,0008)	2	See 3.5.8.2.1.1.
Number of Stages	(0008,2124)	2C	Value always = '1'
Number of Views in Stage	(0008,212A)	2C	Value always = '1'
Stage Name	(0008,2120)	3	Always zero length (no value sent)
Stage Number	(0008,2122)	3	Value always = '0'
View Number	(0008,2128)	3	Value always = '0'

3.5.8.2.1. US Image Attribute Descriptions

3.5.8.2.1.1. Image Type

Specify which of the following Defined Terms for Value 3 are created:

ABDOMINAL	GYNECOLOGY	OBSTETRICAL
EPICARDIAL	SMALL PARTS	VASCULAR

4. SC INFORMATION OBJECT IMPLEMENTATION

4.1. INTRODUCTION

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

4.2 - IOD Description

4.3 - IOD Entity-Relationship Model

4.4 - IOD Module Table

4.5 - IOD Module Definition

4.2. SC IOD IMPLEMENTATION

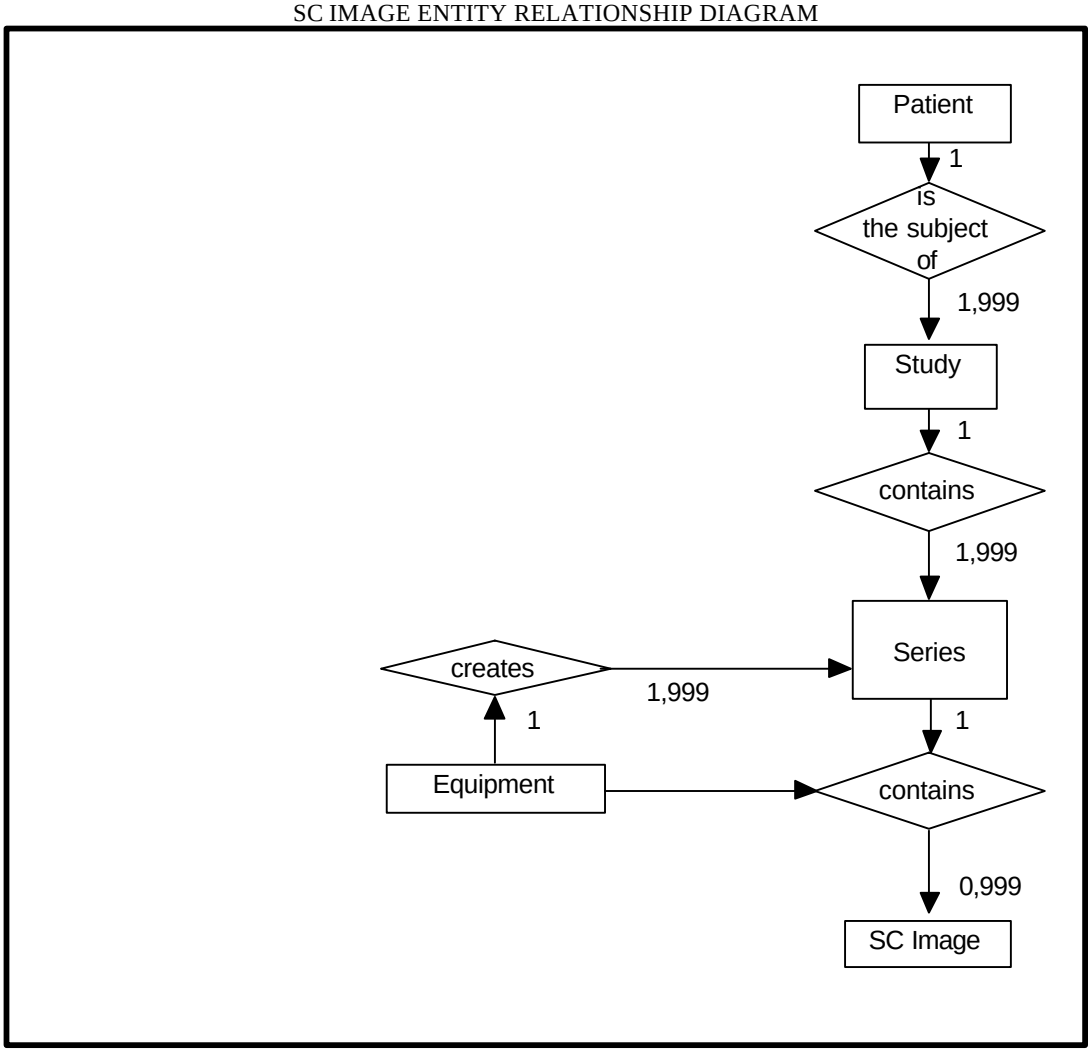
4.3. SC ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the SC Image interoperability 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 999 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
SC IMAGE ENTITY RELATIONSHIP DIAGRAM



4.3.1. ENTITY DESCRIPTIONS

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

4.3.1.1. Patient Entity Description

Patient Entity defines the characteristics of a Patient who is the subject of medical Studies which produce medical images. A Patient is diagnosed by one or more Studies.

4.3.1.2. Study Entity Description

A Study Entity defines a medical Study performed on a Patient. A Study is a collection of one or more Series of medical images which are logically related to each other for the purpose of diagnosing a Patient. Each Study can be associated with one, and only one Patient.

4.3.1.3. Series Entity Description

A Series Entity defines the attributes which identify distinct logical sets of images. All Series within a Study are of the same modality type.

4.3.1.4. Equipment Entity Description

The Equipment Entity describes the imaging hardware which produced a particular Series of images. A Single piece of Equipment may produce one or more Series within a Study.

4.3.1.5. SC Image Entity Description

4.3.1.6. Overlay Entity Description

4.3.1.7. VOI Lookup Table Entity Description

4.3.2. LOGIQ 500 Mapping of DICOM entities

TABLE 4.3.2-1
MAPPING OF DICOM ENTITIES TO LOGIQ 500 ENTITIES

DICOM	LOGIQ 500 Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image
Frame	Not Applicable

4.4. IOD MODULE TABLE

Within an entity of the DICOM SC 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 data sets.

Table 4.4-1 identifies the defined modules within the entities which comprise the DICOM SC IOD. Modules are identified by Module Name.

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

TABLE 4.4-1
SC IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	4.5.1.1
Study	General Study	4.5.2.1
	Patient Study	Not used
Series	General Series	4.5.3.1
Equipment	General Equipment	4.5.4.1
	SC Equipment	4.5.7.1
Image	General Image	4.5.5.1
	Image Pixel	4.5.5.2
	SC Image	4.5.7.2
	Overlay Plane	Not used
	Modality LUT	Not used
	VOI LUT	Not used
	SOP Common	4.5.6.1

4.5. INFORMATION MODULE DEFINITIONS

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

4.5.1. Common Patient Entity Modules

4.5.1.1. 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 4.5.1.1-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	May be entered from User Interface. Limited to 29 characters.
Patient ID	(0010,0020)	2	May be entered from User Interface. Limited to 14 characters.
Patient's Birth Date	(0010,0030)	2	Always zero length (no value sent).
Patient's Sex	(0010,0040)	2	May be entered from User Interface; limited to 'M' and 'F'
Patient's Birth Time	(0010,0032)	3	Always zero length (no value sent).
Other Patient IDs	(0010,1000)	3	Always zero length (no value sent).
Other Patient Names	(0010,1001)	3	Always zero length (no value sent).
Patient Comments	(0010,4000)	3	Always zero length (no value sent).

4.5.2. 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.

4.5.2.1. General Study Module

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

TABLE 4.5.2.1-1
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Implementation UID + Ethernet Address of CPU board + Image Capture Date + Study ID
Study Date	(0008,0020)	2	Image Capture Date
Study Time	(0008,0030)	2	Image Capture Time
Referring Physician's Name	(0008,0090)	2	Always zero length (no value sent)
Study ID	(0020,0010)	2	Internal value which is incremented when user defines a new patient.
Accession Number	(0008,0050)	2	Always zero length (no value sent)
Study Description	(0008,1030)	3	Always zero length (no value sent)
Name of Physician(s) Reading Study	(0008,1060)	3	Always zero length (no value sent)

4.5.2.2. Patient Study Module

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

TABLE 4.5.2.2-1
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	May be entered from User Interface
Patient's Size	(0010,1020)	3	May be entered from User Interface
Patient's Weight	(0010,1030)	3	May be entered from User Interface
Additional Patient’s History	(0010,21B0)	3	Always zero length (no value sent)

4.5.3. Common Series Entity Modules

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

4.5.3.1. General Series Module

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

TABLE 4.5.3.1-1
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Defined Term: US
Series Instance UID	(0020,000E)	1	Implementation UID + Ethernet Address of CPU board + Image Capture Date + Study ID + Image Capture Date
Series Number	(0020,0011)	2	Always zero length (no value sent)
Laterality	(0020,0060)		Always zero length (no value sent)
Series Date	(0008,0021)	3	Always zero length (no value sent)
Series Time	(0008,0031)	3	Always zero length (no value sent)
Performing Physiciansí Name	(0008,1050)	3	Always zero length (no value sent)
Operators' Name	(0008,1070)	3	Always zero length (no value sent)

4.5.4. Common Equipment Entity Modules

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

4.5.4.1. General Equipment Module

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

TABLE 4.5.4.1-1
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Implementation defined string “GEMS Ultrasound”
Institution Name	(0008,0080)	3	Always zero length (no value sent)
Institution Address	(0008,0081)	3	Always zero length (no value sent)
Station Name	(0008,1010)	3	Always zero length (no value sent)
Manufacturer's Model Name	(0008,1090)	3	Implementation defined string “LOGIQ 500”
Device Serial Number	(0018,1000)	3	Implementation UID + Ethernet Address of CPU board
Software Versions	(0018,1020)	3	Defined Term: “V/R 1.04”

4.5.4.1.1. General Equipment Attribute Descriptions

4.5.5. Common Image Entity Modules

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

4.5.5.1. General Image Module

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

TABLE 4.5.5.1-1
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Internal value which is incremented for each captured image
Patient Orientation	(0020,0020)	2C	Always zero length (no value sent)
Image Date	(0008,0023)	2C	Date of image archived
Image Time	(0008,0033)	2C	Time of image archived
Image Type	(0008,0008)	3	See 4.5.5.1.1.2.
Acquisition Date	(0008,0022)	3	Always zero length (no value sent)
Acquisition Time	(0008,0032)	3	Always zero length (no value sent)
Image Comments	(0020,4000)	3	Always zero length (no value sent)

4.5.5.1.1. General Image Attribute Descriptions

4.5.5.1.1.1. Patient Orientation

This attribute is always sent with zero length.

4.5.5.1.1.2. Image Type

Value 1 shall have the following Enumerated Values:

- ORIGINAL identifies an Original Image

when the image has been created by the LOGIQ 500.

Value 2 shall have the following Enumerated Values:

- PRIMARY identifies a Primary Image

when the image has been created by the LOGIQ 500.

Value sent with zero length if image not creatad by the LOGIQ 500.

4.5.5.2. Image Pixel Module

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

TABLE 4.5.5.2-1
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Value of '1' when Photometric Interpretation element value = 'MONOCHROME2' Value of '3' when Photometric Interpretation element value = 'RGB'
Photometric Interpretation	(0028,0004)	1	Defined Terms: MONOCHROME2 RGB
Rows	(0028,0010)	1	Value always = 462 for NTSC image. = 548 for PAL image
Columns	(0028,0011)	1	Value always = 608 for NTSC image = 720 for PAL image
Bits Allocated	(0028,0100)	1	Value always = 0008H
Bits Stored	(0028,0101)	1	Value always = 0008H
High Bit	(0028,0102)	1	Value always = 0007H
Pixel Representation	(0028,0103)	1	Value always = 0000H -unsigned integer
Pixel Data	(7FE0,0010)	1	
Planar Configuration	(0028,0006)	1C	Fixed Value: 0001H = color-by-plane
Smallest Image Pixel Value	(0028,0106)	3	Always zero length (no value sent)
Largest Image Pixel Value	(0028,0107)	3	Always zero length (no value sent)

4.5.6. General Modules

The SOP Common Moduleis mandatory for all DICOM IODs.

4.5.6.1. 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 4.5.6.1-1-
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	"1.2.840.10008.5.1.4.1.1.7"
SOP Instance UID	(0008,0018)	1	Implementation UID + Ethernet Address of CPU board + Image Capture Date + Study ID + Image Capture Date + Image Number
Specific Character Set	(0008,0005)	1C	Defined Term: Always " ISO_IR 100"

4.5.7. SC Modules

This Section describes SC Equipment, and Image Modules. These Modules contain Attributes that are specific to SC Image IOD.

4.5.7.1. SC Equipment Module

This Module describes equipment used to convert images into a DICOM format.

TABLE 4.5.7.1-1
SC IMAGE EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Conversion Type	(0008,0064)	1	Defined Terms used: DI = Digital Interface
Modality	(0008,0060)	3	Defined Term: US
Secondary Capture Device ID	(0018,1010)	3	Always zero length (no value sent)
Secondary Capture Device Manufacturer	(0018,1016)	3	Implementation defined string "GEMS Ultrasound"
Secondary Capture Device Manufacturer's Model Name	(0018,1018)	3	Always zero length (no value sent)
Secondary Capture Device Software Version	(0018,1019)	3	Implementation defined string "V/R 1.04"

4.5.7.2. SC Image Module

The table in this Section contains IOD Attributes that describe SC images.

TABLE 4.5.7.2-1
SC IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Date of Secondary Capture	(0018,1012)	3	Always zero length (no value sent)
Time of Secondary Capture	(0018,1014)	3	Always zero length (no value sent)

5. PRINT MANAGEMENT SOP CLASS DEFINITION

5.1. 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 behavior.

This section contains:

5.2 Basic Print Management Meta SOP Classes

5.3 Print Management SOP Class Definitions

5.4 Print Management IODs

5.5 IOD Module Definition

5.2. BASIC PRINT MANAGEMENT META SOP CLASSES

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

The LOGIQ 500 supports the Basic Grayscale Print Management Meta SOP Class and the Basic Color Print Management Meta SOP Class. These are defined in Table 5.2.1-1 and Table 5.2.2-1

5.2.1. Basic Grayscale Print Management Meta SOP Class

The Basic Grayscale Print Management Meta SOP Class is defined by the following set of supported SOP Classes.

TABLE 5.2.1-1 BASIC GRAYSCALE PRINT MANAGEMENT META SOP CLASS

SOP Class Name	Usage SCU	Reference
Basic Film Session SOP Class	M	see 5.3.1
Basic Film Box SOP Class	M	see 5.3.2
Basic Grayscale Image Box SOP Class	M	see 5.3.3.1
Printer SOP Class	M	see 5.3.4

5.2.2. Basic Color Print Management Meta SOP Class

The Basic Color Print Management Meta SOP Class is defined by the following set of supported SOP Classes.

TABLE 5.2.2-1 BASIC COLOR PRINT MANAGEMENT META SOP CLASS

SOP Class Name	Usage SCU	Reference
Basic Film Session SOP Class	M	see 5.3.1
Basic Film Box SOP Class	M	see 5.3.2
Basic Color Image Box SOP Class	M	see 5.3.3.2
Printer SOP Class	M	see 5.3.4

5.3. PRINT MANAGEMENT SOP CLASS DEFINTIONS

5.3.1. Basic Film Session SOP Class

The Basic Film session IOD describes the presentation parameters which are common for all the films of a film session. The DIMSE services that are applicable to the IOD are shown in Table 5.3.1-1.

Table 5.3.1-1 DIMSE SERVICE GROUP

DIMSE Service Element	Usage SCU	Reference
N-CREATE	M	see 5.3.1.1.1
N-SET	U	see 5.3.1.1.2
N-DELETE	U	see 5.3.1.1.3
N-ACTION	U	see 5.3.1.1.4

5.3.1.1. DIMSE Service Group

5.3.1.1.1. N-CREATE

The N-CREATE DIMSE Service is used by the LOGIQ 500 to request that the SCP (printer) create a Film Session SOP Instance. Table 5.4.2-1 defines the Basic Film Session Presentation Module attributes used in this request.

- **Status**

The status values which are specific for this SOP Class are defined as follows.

Status	Meaning	Code
Success	Film session successfully created	0000
Warning	Memory allocation not supported	B600

- **Behavior**

A Warning status code shall indicate that the SCP has created the SOP Instance but the SCU has no control over the memory allocation scheme.

The Basic Film Session SOP Instances shall be created before the Film Box SOP Instance are created.

At any time the SCU shall only support one Basic Film Session SOP Instance on an Association.

5.3.1.1.2. N-SET

Not used in this implementation.

5.3.1.1.3. N-DELETE

The N-DELETE DIMSE Service is used by the LOGIQ 500 to request the SCP (printer) to delete the complete Film Session SOP Hierarchy. The root Film Session SOP Instance UID is sent to the SCP to accomplish this.

- **Status**

There are no specific status codes.

- **Behavior**

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

5.3.1.1.4. N-ACTION

Not used in this implementation.

5.3.2. Basic Film Box SOP Class

The Basic Film Box IOD is an abstraction of the presentation of one film of the film session. The DIMSE services that are applicable to the IOD are shown in Table 5.3.2-1.

Table 5.3.2-1 DIMSE SERVICE GROUP

DIMSE Service Element	Usage SCU	Reference
N-CREATE	M	see 5.3.2.1.1
N-ACTION	M	see 5.3.2.1.2
N-DELETE	U	see 5.3.2.1.3
N-SET	U	see 5.3.2.1.4

5.3.2.1. DIMSE Service Group

5.3.2.1.1. N-CREATE

The N-CREATE DIMSE Service is used by the LOGIQ 500 to request that the SCP create a Film Box SOP Instance. Table 5.4.2-1 defines the Basic Film Box Presentation Module attributes used in this request.

- **Status**

There are no specific status codes.

- **Behavior**

The SCU uses the N-CREATE to request the SCP to create a Basic Film Box SOP Instance.

5.3.2.1.2. N-ACTION

The N-ACTION DIMSE Service is used by the LOGIQ 500 to request the SCP (printer) to print one copy of a single film of the film session.

- **Status**

Status	Meaning	Code
Success	Film accepted for printing; if supported, the Print Job SOP Instance is created.	0000
Warning	Film Box SOP Instance hierarchy does not contain image Box SOP Instances (empty page).	B603
Failure	Unable to create Print Job SOP Instance;print queue is full.	C602
	Image position collision: multiple images assigned to single position.	C604
	Image size is larger than image box size (by using the specified magnification value).	C603

- **Behavior**

The SCU uses the N-ACTION to request the SCP to print one copy of a single film of the film session.

5.3.2.1.3. N-DELETE

Not used in this implementation.

5.3.2.1.4. N-SET

Not used in this implementation.

5.3.3. Image Box SOP Class

5.3.3.1. Basic Grayscale Image Box SOP Class

The Basic Grayscale Image Box IOD is an abstraction of the presentation of an image and image related data in the image area of a film. The DIMSE services that are applicable to the IOD are shown in Table 5.3.3-1.

Table 5.3.3-1 DIMSE SERVICE GROUP

DIMSE Service Element	Usage SCU	Reference
N-SET	M	see 5.3.3.1.1

5.3.3.1.1. N-SET

The N-SET DIMSE Service is used by the LOGIQ 500 to update the Basic Grayscale Image Box SOP Instance. Table 5.5.2.-5 defines the Basic Image Box Presentation Module attributes used.

- **Status**

The status values which are specific for the SOP Class are defined as follows.

Staus	Meaning	Code
Failure	Insufficient memory in printer to store the image	C605

- **Behavior**

The SCU uses the N-SET to request the SCP to update a Basic Grayscale Image Box SOP Instance. The SCU shall only specify the SOP Instance UID of a Basic Grayscale Image Box Belonging to the last created Film Box SOP Instance and shall specify the list of Attributes for which the Attribute Values are to be set.

5.3.3.2. Basic Color Image Box SOP Class

The Basic Color Image Box IOD is an abstraction of the presentation of an image and image related data in the image area of a film. The DIMSE services that are applicable to the IOD are shown in Table 5.3.3-2.

Table 5.3.3-2 DIMSE SERVICE GROUP

DIMSE Service Element	Usage SCU	Reference
N-SET	M	see 5.3.3.2.1

5.3.3.2.1. N-SET

The N-SET DIMSE service is used by the LOGIQ 500 to update the Basic Color Image Box SOP Instance. Table 5.5.2-5 defines the Basic Image Box Presentation Module attributes used.

- **Status**

The status values which are specific for this SOP Class are defined as follows.

Status	Meaning	Code
Failure	Insufficient memory in printer to store the image	C605

- **Behavior**

The SCU uses the N-SET to request the SCP to update a Basic Color image Box SOP Instance. The SCU shall only specify the SOP Instance UID of a Basic Color Image Box belonging to the last created Film Box SOP Instance and shall specify the list of Attributes for which the Attribute Values are to be set.

5.3.4. Printer SOP Class

The Printer IOD is an abstraction of the hard copy printer and is the basic Information Entity to monitor the status of the printer. The DIMSE services that are applicable to the IOD are shown in Table 5.3.4-1.

5.3.4.1. DIMSE Service Group

Table 5.3.4-1 DIMSE SERVICE GROUP

DIMSE Service Element	Usage SCU	Reference
N-EVENT-REPORT	M	see 5.3.4.1.1
N-GET	U	see 5.3.4.1.2

5.3.4.1.1. N-EVENT_REPORT

The LOGIQ 500 confirms the N-EVENT-REPORT initiated by the SCP (printer)

- **Behavior**

The SCU shall return the confirmation from the N-EVENT-REPORT operation.

5.3.4.1.2. N-GET

Used by the LOGIQ 500 to request the SCP to get a Printer SOP Instance. Table 5.5.2-6 defines the Printer Module attributes.

5.4. PRINT MANAGEMENT IODS

Within an entity of a DICOM Print Management, attributes are grouped into a 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 data sets.

Table 5.4.1-1, Table 5.4.2-1, Table 5.4.3-1, and Table 5.4.4-1 identify the defined modules within the entities which comprise the DICOM Print Management Service IODs. Modules are identified by Module Name.

See DICOM for a complete definition of the entities, modules and attributes.

5.4.1. Film Session IOD Module

TABLE 5.4.1-1 FILM SESSION IOD MODULE

Module Name	Reference
SOP Common Module	5.5.1.1
Basic Film Session Presentation Module	5.5.2.1
Basic Film Session Relationship Module	5.5.2.2

5.4.2. Basic Film Box IOD Module Table

TABLE 5.4.2-1 BASIC FILM BOX IOD MODULES

Nodule Name	Reference
SOP Common Module	5.5.1.1
Basic Film Box Pixel Presentation Module	5.5.2.3
Basic Film Box Relationship Module	5.5.2.4

5.4.3. Basic Image Box IOD Module Table

TABLE 5.4.3-1 IMAGE BOX IOD MODULES

Module Name	Reference
SOP Common Module	5.5.1.1
Image Box Pixel Presentation Module	5.5.2.5
Image Box Relationship Module	not used

5.4.4. Printer IOD Module Table

TABLE 5.4.4-1 PRINTER IOD MODULES

Module Name	Reference
SOP Common Module	5.5.1.1
Printer Module	5.5.2.6

5.5. INFORMATION MODULE DEFINITIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules that comprise the Print Management.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported.

5.5.1. General Module

5.5.1.1. 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 5.5.1-1 SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Varies with Module Instance and DIMSE Service being used. 1.2.840.10008.5.1.1.1 (Film Session) 1.2.840.10008.5.1.1.2 (Film Box) 1.2.840.10008.5.1.1.4 (Image Box) 1.2.840.10008.5.1.1.16 (Printer Job)
SOP Instance UID	(0008,0018)	1	provided by SCP (printer)
Specific Character Set	(0008,0005)	1C	Not used
Instance Creation Date	(0008,0012)	3	Not used
Instance Creation Time	(0008,0013)	3	Not used
Instance Creation UID	(0008,0014)	3	Not used

5.5.2. Print Management Modules

5.5.2.1. Basic Film Session Presentation Module

This section defines the Attributes which are common for all films of a film session

TABLE 5.5.2-1 BASIC FILM SESSION PRESENTATION MODULE ATTRIBUTES

Attribute Name	Tag	USAGE (SCU)	Attribute Description
Number of Copies	(2000,0010)	U	Always '1'
Print Priority	(2000,0020)	U	Always 'MED'
Medium Type	(2000,0030)	U	NULL
Film Destination	(2000,0040)	U	Not sent
Film Session Label	(2000,0050)	U	Not sent
Memory Allocation	(2000,0060)	U	NULL

5.5.2.2. Basic Film Session Relationship Module

TABLE 5.5.2-2 BASIC FILM SESSION RELATIONSHIP MODULE ATTRIBUTES

Attribute Name	Tag	USAGE (SCU)	Attribute Description
Referenced Film Box Sequence	(2000,0500)	U	Not used
Referenced SOP Class UID	(0008,1150)	U	Not used
Referenced SOP Instance UID	(0008,1155)	U	Not used

5.5.2.3. Basic Film Box Presentation Module

The attributes described in Table 5.5.2-3 apply when the DIMSE Services N-CREATE, N-SET, N-DELETE or N-SET are used.

TABLE 5.5.2-3 BASIC FILM BOX PRESENTATION MODULE ATTRIBUTES

Attribute Name	Tag	USAGE (SCU)	Attribute Description
Image Display Format	(2010,0010)	U	STANDARD\1,1
Annotation Display Format ID	(2010,0030)	U	Not Used
Film Orientation	(2010,0040)	U	LANDSCAPE
Film Size ID	(2000,0040)	U	8INX10IN
Magnification Type	(2010,0060)	U	REPLICATE.
Smoothing Type	(2010,0080)	U	Not sent
Border Density	(2010,0100)	U	Not sent
Empty Image Density	(2010,0110)	U	Not sent
Min Density	(2010,0120)	U	Not sent
Max Density	(2010,0130)	U	Not sent
Trim	(2010,0140)	U	Not sent
Configuration Information	(2010,0150)	U	Not sent

5.5.2.4. Basic Film Box Relationship Module

This section defines the attributes which describe the common parameters which apply for all images on a given sheet of film.

TABLE 5.5.2-4 BASIC FILM BOX RELATIONSHIP MODULE ATTRIBUTES

Attribute Name	Tag	USAGE (SCU)	Attribute Description
Referneced Film Session Sequence	(2010,0500)	U	NULL
Referenced SOP Class UID	(0080,1150)	U	1.2.840.10008.5.1.1.1
Referenced SOP Instance UID	(0008,1155)	U	Provided by SCP printer
Referenced Image Box Sequence	(2010,0510)	U	Not used
Referenced SOP Class UID	(0008,1150)	U	
Referenced SOP Instance UID	(0008,1155)	U	
Referenced Basic Annotation Sequence	(2010,0520)	U	Not used
Referenced SOP Class UID	(0008,1150)	U	
Referenced SOP Instance UID	(0008,1155)	U	

5.5.2.5. Image Box Pixel Presentation Module

The attributes described in apply when the DIMSE Service N-SET is used.

TABLE 5.5.2-5 IMAGE BOX PIXEL PRESENTATION MODULE ATTRIBUTES

Attribute Name	Tag	USAGE (SCU)	Attribute Description
Image Position	(2020,0010)	M	value = '1'
Polarity	(2020,0030)	U	NORMAL
Magnification Type	(2010,0060)	U	REPLIATE
Smoothing Type	(2010,0080)	U	NULL value
Requested Image Size	(2020,0030)	U	NULL value
Preformatted Grayscale Image Sequence	(2020,0110)	M	value = '1'
>Samples Per Pixel	(0028,0002)	M	Value = '1'
>Photometric Interpretation	(0028,0004)	M	Defined Term NONOCHROME2 used
>Rows	(0028,0010)	M	Value always = 462 for NTSC image = 548 for PAL image
>Columns	(0028,0011)	M	Value always = 608 for NTSC image = 720 for PAL image
>Pixel Aspect Ratio	(0028,0034)	MC	1/1
>Bits Allocated	(0028,0100)	M	Value always = 0008H
>Bits Stored	(0028,0101)	M	Value always = 0008H
>High Bit	(0028,0102)	M	Value always = 0007H
>Pixel Representation	(0028,0103)	M	Defined Value '0' - unsigned integer
>Pixel Data	(7FE0,0010)	M	
Preformatted Grayscale Image Sequence	(2020,0110)	U	value = '1'
>Samples Per Pixel	(0028,0002)	M	Value = '1'
>Photometric Interpretation	(0028,0004)	M	Defined Term RGB used
>Rows	(0028,0010)	M	Value always = 462 for NTSC image = 548 for PAL image
>Columns	(0028,0011)	M	Value always = 608 for NTSC image = 720 for PAL image
>Pixel Aspect Ratio	(0028,0034)	MC	1/1
>Bits Allocated	(0028,0100)	M	Value always = 0008H
>Bits Stored	(0028,0101)	M	Value always = 0008H
>High Bit	(0028,0102)	M	Value always = 0007H
>Pixel Representation	(0028,0103)	M	Defined Value '0' - unsigned integer
>Pixel Data	(7FE0,0010)	M	

5.5.2.6. Printer Module

This section defines the attributes that are used to monitor the status of the printer. The attributes described in Table 5.5.2-6 apply when the DIMSE Service N-GET is used.

TABLE 5.5.2-6 PRINTER MODULE ATTRIBUTES

Attribute Name	Tag	USAGE (SCU)	Attribute Description
Printer Status	(2110,0010)	U	Obtained from SCP
Printer Status Info	(2110,0020)	U	Obtained from SCP
Printer Name	(2110,0030)	U	Obtained from SCP
Manufacturer	(0008,0070)	U	Obtained from SCP
Manufacturer Model Name	(0008,1090)	U	Obtained from SCP
Device Serial Number	(0008,1000)	U	Obtained from SCP
Software Versions	(0008,1020)	U	Obtained from SCP
Date of Last Calibration	(0008,1200)	U	Obtained from SCP
Time of Last Calibration	(0008,1201)	U	Obtained from SCP