

The CT Synergy (V3.1/V3.2/V3.3/V3.4/V3.5) Conformance Statement

for DICOM V3.0

Direction 2210079
Revision 1.0

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STATEMENT

DIR 2210079 REV 1.0

REVISION HISTORY

REV	DATE	REASON FOR CHANGE
0.3	December 2,1997	Initial Release
1.0	May 22,2000	Revise for v3.2 - 3.5

LIST OF EFFECTIVE PAGES

SECTION	NUMBER	SECTION	NUMBER
Title, p.1	1.0		3.0
Revision History / LOEP, p.2	1.0		3.0

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0 INTRODUCTION

This Conformance Statement (CS) specifies the CT Synergy Scanner System compliance to DICOM v3.0. It details the DICOM Service Classes and roles which are supported by this product from version 3.1.

The CT Synergy product uses DICOM services to export images to other DICOM compliant machines.

Note the format of this section follows the format of the DICOM Standard Part 2 (conformance) Annex A hence the paragraph numbering scheme. Please refer to that part of the standard while reading this section.

1 IMPLEMENTATION MODEL

All DICOM functionality on the CT Synergy product is handled by the DICOM Server Application Entity (AE). The DICOM Server AE is commanded to perform DICOM services through the buttons and menu selections on software user interface. The DICOM Server AE is also listening to a pre-defined port for incoming connections.

.1 Application Data Flow Diagram

ILLUSTRATION 1.1-1

IMPLEMENTATION MODEL DATA FLOW DIAGRAM

There is one local Real-World Activity, *Choose "Push" Option*, which can cause the DICOM Server Application Entity (DICOM Server AE) to initiate a DICOM association to a remote DICOM Application Entity.

The *Choose "Push" Option* Real-World activity consists of an operator selecting one or more study, series or image in the Patient List and choosing either "Push Examination", "Push Series" or "Push Image from the "Network"

pull-down menu on the Patient List to send the image(s) to a selected destination.

There is no Real-World activity required for the DICOM Server AE to respond to an incoming association request. The DICOM Server AE is always prepared to respond to an association request by any remote DICOM AE.

.2 Functional Definition of AE's

DICOM Server Application Entity initiate the following operation:

- Initiate an association to a Remote AE to send image(s). If the Remote AE accepts the presentation context applicable to the image(s) being sent, the DICOM Server AE will send the image(s) by invoking C-STORE-RQ operation for each image on the same association.

The DICOM Server AE waits for association requests from Remote AEs that wish to perform the following operation:

- *Verification:* If a C-ECHO-RQ message is received, the DICOM Server AE will send back a C-ECHO-RSP message with a status of "success".

.3 Sequencing of Real-World Activities

Not Applicable.

2 AE SPECIFICATIONS

.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 (SCU)	SOP Class UID
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7

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

SOP Class Name (SCP)	SOP Class UID
Verification (Echo)	1.2.840.10008.1.1

.1 Association Establishment Policy

.1 General

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

Application Context Name	1.2.840.10008.3.1.1.1
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The Maximum Length PDU negotiation is included in all association establishment requests. The maximum PDU length for association initiated by the DICOM Server AE is:

Maximum Length PDU	10240 bytes
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The maximum PDU length for association accepted by the DICOM Server AE is:

Maximum Length PDU	51200 bytes
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SOP class Extended Negotiation is not supported.

The maximum number of Presentation Context Items that is supported is 20. Note that the same Abstract Syntax may be offered multiple times with different Transfer Syntaxes.

The user information items sent by this product are:

- Maximum PDU Length and,
- Implementation Class UID

.2 Number of Associations

The DICOM Server AE (SCU) will initiate only one DICOM association at a time to perform an image store to a remote host.

The DICOM Server AE (SCP) can have a maximum of four DICOM associations open simultaneously to respond to an echo.

.3 Asynchronous Nature

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

.4 Implementation Identifying Information

The Implementation Class UID for this CT Synergy Implementation is:

CT Synergy Implementation Class UID	1.2.840.113619.6.5
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.2 Association Initiation by Real-World Activity

This AE attempts to initiate a new association due to a “Push” operation initiated by the operator. There is one Real-World Activity (image transfer) to consider.

.1 Push Image(s) to Remote AE

.1 Associated Real-World Activity

The operator must first select a destination by choosing “Select Remote Host” from the “Network” pull-down menu and then choose ahostname.

The operator then selects one or more study, series, or images in the Patient List and then chooses either “Push Examination”, “Push Series”, or “Push Image” from the “Network” pull-down menu on the Patient List.

This operation causes:

- the system to build a DICOM image from its data.
- the initiation of a DICOM negotiation with the Remote Host AE.
- the emission of C-STORE command if negotiation is successful.

Note: If multiple study, series, or images are chosen to be pushed, one association will be established for each of the studies, series, or images.

.2 Proposed Presentation Contexts

The following table shows the proposed presentation contexts for the DICOM Server AE after Real-World Activity “Push” Operation has been performed.

Table 2.1.2.1.2-1 Proposed Presentation Contexts for DICOM Server AE and Real-World activity Push Image(s)

Presentation Context Table - Proposal					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

.1 SOP Specific Conformance Statement for Image Storage SOP Classes

This implementation can perform multiple C-STORE operations over a single association.

Upon receiving a C-STORE confirmation containing a Successful status, this implementation will perform the next C-STORE operation. The association will be maintained if possible.

Upon receiving a C-STORE confirmation containing a Refused status, this implementation will terminate the association. The current request (exam(s), series(s) or image(s)) is considered failed.

Upon receiving a C-STORE confirmation containing any status that is not Success or Refused, this implementation will consider the current request to be a failure but will continue to attempt to send the remaining images in the request on the same association.

Each association negotiation supports an "Association Timer". This timer starts when the association request is sent and stops when the association is established. The time-out is 30 seconds.

Each C-STORE operation supports an "Operation Inactivity Timer". This time-out starts once the first C-STORE request has been issued (after association establishment) and is reset each time a C-STORE response has been received or when subsequent C-STORES are sent. This time-out is 90 seconds.

Each C-STORE operation also supports a "Session Timer". This timer starts when the association is established and stops when the association is ended. This time-out is 60 minutes.

If any of the three timers mentioned above expires, the connection is closed and the operation in progress is considered failed.

When DICOM Server AE initiates an association to issue a C-STORE, the following operation will be performed:

The selected images(CT images and/or Secondary Capture images) will be transmitted by the DICOM Server AE with the same elements as was originally created locally. Refer to **Appendix A** for the list modules and attributes that this product supports.

.3 Association Acceptance Policy

The DICOM Server AE places no limitations on who may connect to it.

Any remote AE can open an association to the DICOM Server AE for the purpose of verification.

.1 Verification Request from Remote AE

This AE is indefinitely listening for associations. No operator action is required to respond to a *verification* message.

.1 Associated Real-World Activity

The Real-World Activity associated with the verification request is to send a C-ECHO response message with a status of "success" to the requesting AE.

.2 Presentation Context Table

Table 2.1.3.1.2-1: Acceptable Presentation Contexts for DICOM Server AE and Real-World Activity, Verification Request

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

.1 SOP Specific Conformance to Verification SOP Class

The DICOM Server AE provides standard conformance to the DICOM Verification Service Class.

Each association negotiation supports an “Association Timer”. This timer starts when the association request is received and stops when the association is established. The time-out is 30 seconds.

Each C-ECHO operation supports an “Operation Inactivity Timer”. This time-out starts once the first C-ECHO is received and is reset each time a C-ECHO response is sent. This time-out is 30 seconds.

Each C-ECHO operation also supports a “Session Timer”. This timer starts when the association is established and stops when the association is ended. This time-out is 60 minutes.

If any of the three timers mentioned above expires, the connection is closed and the operation in progress is considered failed.

3 COMMUNICATION PROFILES

.1 Supported Communication Stacks (parts 8,9)

DICOM Upper Layer (Part 8) is supported using TCP/IP.

.2 TCP/IP Stack

The TCP/IP stack is inherited from a UNIX Operating System.

.1 Physical Media Support

The DICOM Server AE is indifferent to the physical medium over which TCP/IP executes; they inherit this from the UNIX system upon which they execute.

4 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

Not Applicable.

5 CONFIGURATION

.1 AE Title/Presentation Address Mapping

The CT Synergy Scanner System allows the user to “add”, “Remove”, or “Update the mapping of remote AE Titles to IP Addresses and Ports. These options can be selected from the “Remote Host Selection” menu displayed by choosing “Select Remote Host” from the “Network” pull-down menu on the Patient List.

.2 Configurable Parameters

The following fields are configurable for the DICOM Server AE:

- Local AE Title (the machine hostname)
- Local IP Address

- Note:**
- (i) All configurations for local AE must be performed by a GE Field Engineer.
 - (ii) The local port on which the CT Synergy Scanner System receives the incoming TCP/IP connections is port 4006.

The following fields are configurable for every remote DICOM AE:

- Remote AE Title
- Responding TCP/IP Port
- Remote IP Address

6 SUPPORT OF EXTENDED CHARACTER SETS

No extended character sets are supported.

Appendix A

Modules/Attributes

Enclosed is the listing of modules and attributes used by this implementation for CT IOD.

A.1 CT Image IOD

A.1.1 CT Image IOD Modules

IE	Module	Reference (DICOM PS3.3)	Usage
Patient	Patient	C.7.1.1	M
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
Series	General Series	C.7.3.1	M
Frame of Reference	Frame of Reference	C.7.4.1	M
Equipment	General Equipment	C.7.5.1	M
Image	General Image	C.7.6.1	M
	Image Plane	C.7.6.2	M
	Image Pixel	C.7.6.3	M
	Contrast Bolus	C.7.6.4	C
	CT Image	C.8.2.1	M
	VOI LUT	C.11.2	U
	SOP Common	C.12.1	M

A.1.2 CT Image attributes(Module wise)

A.1.2.1 Patient Module

Attribute Name	Tag	Type	Notes
Patient Name	(0010,0010)	2	
Patient ID	(0010,0020)	2	
Patient's Birth Date	(0010,0030)	2	
Patient's Sex	(0010,0040)	2	

A.1.2.2 General Study Module

Attribute Name	Tag	Type	Notes
Study Instance UID	(0020,000D)	1	
Study Date	(0008,0020)	2	
Study Time	(0008,0030)	2	
Referring Physician's Name	(0008,0090)	2	
Study ID	(0020,0010)	2	
Accession Number	(0008,0050)	2	
Study Description	(0008,1030)	3	

A.1.2.3 Patient Study Module

Attribute Name	Tag	Type	Notes
Patient's Age	(0010,1010)	3	

A.1.2.4 General Series Module

Attribute Name	Tag	Type	Notes
Modality	(0008,0060)	1	
Series Instance UID	(0020,000E)	1	
Series Number	(0020,0011)	2	
Laterality	(0020,0060)	2C	
Protocol Name	(0018,1030)	3	
Patient Position	(0018,5100)	2C	

A.1.2.5 Frame of Reference Module

Attribute Name	Tag	Type	Notes
Frame of Reference	(0020,0052)	1	
Position Reference Indicator	(0020,1040)	2	

A.1.2.6 General Equipment Module

Attribute Name	Tag	Type	Notes
Manufacturer	(0008,0070)	2	
Station Name	(0008,1010)	3	
Manufacturers Model Name	(0008,1090)	3	
Software Versions	(0018,1020)	3	
Pixel Padding Value	(0028,0120)	3	

A.1.2.7 General Image Module

Attribute Name	Tag	Type	Notes
Image Number	(0020,0013)	2	
Image Date	(0008,0023)	2C	
Image Time	(0008,0033)	2C	
Image Type	(0008,0008)	3	
Acquisition Number	(0020,0012)	3	
Acquisition Date	(0008,0022)	3	
Acquisition Time	(0008,0032)	3	

A.1.2.8 Image Plane Module

Attribute Name	Tag	Type	Notes
Pixel Spacing	(0028,0030)	1	
Image Orientation (Patient)	(0020,0037)	1	
Image Position (Patient)	(0020,0032)	1	
Slice Thickness	(0018,0050)	2	
Image Slice Location	(0020,1041)	3	

A.1.2.9 Image Pixel Module

Attribute Name	Tag	Type	Notes
Samples Per Pixel	(0028,0002)	1	
Photometric Interpretation	(0028,0004)	1	
Rows	(0028,0010)	1	
Columns	(0028,0011)	1	
Bits Allocated	(0028,0100)	1	
Bits Stored	(0028,0101)	1	
High Bit	(0028,0102)	1	
Pixel Representation	(0028,0103)	1	
Pixel Data	(7FE0,0010)	1	

Smallest Image Pixel Value	(0028,0106)	3	
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A.1.2.10 Contrast/Bolus Module

Attribute Name	Tag	Type	Notes
Contrast/Bolus Agent	(0018,0010)	2	

A.1.2.11 CT Image Module

Attribute Name	Tag	Type	Notes
Image Type	(0008,0008)	1	
Samples per Pixel	(0028,0002)	1	
Photometric Interpretation	(0028,0004)	1	
Bits Allocated	(0028,0100)	1	
Bits Stored	(0028,0101)	1	
High Bit	(0028,0102)	1	
Rescale Intercept	(0028,1052)	1	
Rescale Slope	(0028,1053)	1	
KVP	(0018,0060)	2	
Acquisition Number	(0020,0012)	2	
Scan Options	(0018,0022)	3	
Date Collection Diameter	(0018,0090)	3	
Reconstruction Diameter	(0018,1100)	3	
Distance Source to Detector	(0018,1110)	3	
Distance Source to Patient	(0018,1111)	3	
Gantry / Detector Tilt	(0018,1120)	3	
Table Height	(0018,1130)	3	
Rotation Direction	(0018,1140)	3	
Exposure Time	(0018,1150)	3	
Xray Tube Current	(0018,1151)	3	
Convolution Kernel	(0018,1210)	3	

A.1.2.12 VOI LUT Module

Attribute Name	Tag	Type	Notes
Window Center	(0028,1050)	3	
Window Width	(0028,1051)	1C	

A.1.2.13 SOP Common Module

Attribute Name	Tag	Type	Notes
SOP Class UID	(0008,0016)	1	
SOP Instance UID	(0008,0018)	1	

A.2 Secondary Capture(SC) Image IOD

Note : In the usage section of the following appendix, [*] indicates the element is not currently formatted in the image.

A.2.1 SC Image IOD Modules

IE	Module	Reference (DICOM PS3.3)	Usage
Patient	Patient	C.7.1.1	M
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
Series	General Series	C.7.3.1	M
Equipment	General Equipment	C.7.5.1	M
	SC Equipment	C.8.6.1	M
Image	General Image	C.7.6.1	M
	Image Pixel	C.7.6.3	M
	SC Image	C.8.6.2	M
	Overlay Plane	C.9.2	U
	Modality LUT	C.11.1	U
	VOI LUT	C.11.2	U
	SOP Common	C.12.1	M

A.1.2 CT Image attributes(Module wise)

A.2.2.1 Patient Module

Attribute Name	Tag	Type	Notes
Patient Name	(0010,0010)	2	
Patient ID	(0010,0020)	2	
Patient's Birth Date	(0010,0030)	2	
Patient's Sex	(0010,0040)	2	
Referenced Patient Sequence	(0008,1120)	3	

A.2.2.2 General Study Module

Attribute Name	Tag	Type	Notes
Study Instance UID	(0020,000D)	1	
Study Date	(0008,0020)	2	
Study Time	(0008,0030)	2	
Referring Physician's Name	(0008,0090)	2	
Study ID	(0020,0010)	2	
Accession Number	(0008,0050)	2	
Study Description	(0008,1030)	3	

A.2.2.3 Patient Study Module*None.***A.2.2.4 General Series Module**

Attribute Name	Tag	Type	Notes
Modality	(0008,0060)	1	
Series Instance UID	(0020,000E)	1	
Series Number	(0020,0011)	2	
Laterality	(0020,0060)	2C	

A.2.2.5 General Equipment Module

Attribute Name	Tag	Type	Notes
Manufacturer	(0008,0070)	2	
Institution Name	(0008,0080)	3	
Station Name	(0008,1010)	3	
Manufacturers Model Name	(0008,1090)	3	

A.2.2.6 SC Equipment Module*None.***A.2.2.7 General Image Module**

Attribute Name	Tag	Type	Notes
Image Number	(0020,0013)	2	
Image Date	(0008,0023)	2C	
Image Time	(0008,0033)	2C	
Image Type	(0008,0008)	3	

A.2.2.8 Image Pixel Module

Attribute Name	Tag	Type	Notes
Samples Per Pixel	(0028,0002)	1	
Photometric Interpretation	(0028,0004)	1	
Rows	(0028,0010)	1	
Columns	(0028,0011)	1	
Bits Allocated	(0028,0100)	1	
Bits Stored	(0028,0101)	1	
High Bit	(0028,0102)	1	
Pixel Representation	(0028,0103)	1	
Pixel Data	(7FE0,0010)	1	

A.2.2.9 SC Image Module*None.***A.2.2.10 Overlay Plane Module***None. The overlay plane module is not used as graphics and text annotations are burned into pixel data.***A.2.2.11 Modality LUT Module**

Attribute Name	Tag	Type	Notes
Rescale Intercept	(0028,1052)	1C	
Rescale Slope	(0028,1053)	1C	

A.2.2.12 VOI LUT Module

Attribute Name	Tag	Type	Notes
Window Center	(0028,1050)	3	

Window Width	(0028,1051)	1C	
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A.2.2.13 SOP Common Module

Attribute Name	Tag	Type	Notes
SOP Class UID	(0008,0016)	1	
SOP Instance UID	(0008,0018)	1	

Note :

3D Reformatted Images

Following conditional element is currently not encoded in the image.

Attribute Name	Tag	Type	Module	Notes
Rescale Type	(0028,1054)	1C	Modality LUT (C.11.1)	.

Following retired element is encoded in the image.

Attribute Name	Tag
Length to End	(0008,0001)

Following elements are encoded in the image.

Attribute Name	Tag	Type	Module	Notes
Slice Thickness	(0018,0050)	2	Image Plane (C.7.6.2)	
Spacing between Slices	(0018,0088)	3	(C.8.3.1)	

Screen Save Images

Following mandatory element is currently not encoded in the image.

Attribute Name	Tag	Type	Module	Notes
Conversion Type	(0008,0064)	1	SC Equipment (C.8.6.1)	

Following conditional element is not encoded in the image

Attribute Name	Tag	Type	Module	Notes
Rescale Type	(0028,1054)	1C	Modality LUT (C.11.1)	

Following retired elements are present in the image.

Attribute Name	Tag
Length to End	(0008,0001)
Data Set SubType	(0008,0041)

Additional attributes for Standard Extended Secondary Capture Image IOD

Attribute Name	Tag	Type	Module
Contrast/Bolus Agent	(0018,0010)	2	Contrast/Bolus (C.7.6.4)
Scan Options	(0018,0022)	3	CT Image (C.8.2.1)
Slice Thickness	(0018,0050)	2	Image Plane
KVP	(0018,0060)	2	CT Image (C.8.2.1)
Data Collection Diameter	(0018,0090)	3	CT Image (C.8.2.1)
Reconstruction Diameter	(0018,1100)	3	CT Image (C.8.2.1)
Distance Source to Diameter	(0018,1110)	3	CT Image (C.8.2.1)
Distance Source to Patient	(0018, 1111)	3	CT Image (C.8.2.1)
Gantry/Detector Tilt	(0018, 1120)	3	CT Image (C.8.2.1)
Table Height	(0018, 1130)	3	CT Image (C.8.2.1)
Rotation Direction	(0018, 1140)	3	CT Image (C.8.2.1)
Exposure Time	(0018, 1150)	3	CT Image (C.8.2.1)
Xray Tube Current	(0018, 1151)	3	CT Image (C.8.2.1)
Convolution Kernel	(0018, 1210)	3	CT Image (C.8.2.1)
Image Position (Patient)	(0020,0032)	1	Image Plane (C.7.6.2)
Image Orientation	(0020,0037)	1	Image Plane (C.7.6.2)
Frame of Reference UID	(0020,0052)	1	Frame of Reference (C.7.4.1)
Position Reference Indicator	(0020,1040)	2	Frame of Reference (C.7.4.1)
Slice Location	(0020,1041)	3	Image Plane (C.7.6.2)
Pixel Spacing	(0028,0030)	1	Image Plane (C.7.6.2)