



## Varian System Server

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**DICOM Conformance Statement Treatment  
Daemon Supplement**



P/N VA8005D3CS\_TD

July 2007

<b>Abstract</b>	This document provides additional DICOM Conformance information about the Treatment Daemon 8.0/8.1. It is a supplement to the Varian System Server DICOM Conformance Statement (DCS) and can only be understood in conjunction with the main document.	
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## Document History

8.0.05	July 18, 2007	Updated formatting prior to PDF creation. Updated product naming. Updated reference to 'Varian System Server DICOM Conformance Statement'.	DAG
8.0.04	March 28, 2007	Ordered first three chapters according to DICOM Part 2.	DAU
8.0.03	March 16, 2007	Fixed heading styles.	DAU
	February 19, 2007	Document reformatted based on latest template PSE Service Manual C.dot. The strings of the elements in the footer are very long this time. As a result, non breaking spaces (shortcut: Ctrl+Shift+Spacebar) together with tabs had to be used to position the elements in the footer.	GABO
	February 9, 2007	Minor changes during review.	DAU
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# 1. Conformance Statement Overview

This document is the DICOM Conformance Statement for the Treatment Daemon. It is a supplement to the Varian System Server DICOM Conformance Statement [2] and can only be understood in combination with it. The Treatment Daemon shares the same code base as the DB Daemon (see [2]). This Conformance Statement supplement only describes the differences between Treatment Daemon and DB Daemon. Everything stated about DB Daemon also applies to Treatment Daemon, unless it contradicts statements made in this document.

Table 1-1 provides an overview of the network services supported by Treatment Daemon.

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
<b>Transfer</b>		
Computed Radiography Image Storage	Yes	Yes
CT Image Storage	Yes	Yes
MR Image Storage	Yes	Yes
Ultrasound Image Storage	No	Yes
Secondary Capture Image Storage	Yes	Yes
X-Ray Angiographic Image Storage	No	Yes
Spatial Registration Storage	No	Yes
Positron Emission Tomography Image Storage	No	Yes
RT Image Storage	Yes	Yes
RT Dose Storage	Yes	Yes
RT Structure Set Storage	Yes	Yes
RT Beams Treatment Record Storage	Yes	Yes
RT Plan Storage	Yes	Yes
RT Treatment Summary Record Storage	Yes	No
RT ION Plan Storage	Yes	Yes
RT Ion Beams Treatment Record Storage	Yes	Yes
<b>Query/Retrieve</b>		
Study Root Query/Retrieve Information Model – FIND	No	Yes
Study Root Query/Retrieve Information Model – MOVE	No	Yes

**Table 1-1: Network Services**

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## **2. Table of Contents**

The table of contents, the list of figures and the list of tables are located at the top of the document.

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## 3. Introduction

### 3.1 Revision History

The document history is located at the top of the document.

### 3.2 Audience

This document is intended for the following groups of persons:

- Customers and hospital staff who want to interface with the Treatment Daemon
- System integrators of medical equipment,
- Other vendors offering interfacing via DICOM,
- Marketing and sales persons.

It is assumed, that the reader is familiar with the DICOM standard.

The document is structured firmly along the template definition as specified in Part 2 of the DICOM standard.

### 3.3 Remarks

See [2], section 3.3 Remarks.

### 3.4 Definitions, Terms and Abbreviations

This section provides the definitions of terms, acronyms, and abbreviations which are used throughout the document. An arrow sign (→) left of a word indicates that it can be looked up in this table.

<b>AE</b>	Application Entity (→DICOM term)
<b>ALWAYS</b>	Attribute Always Present with a value
<b>ANAP</b>	Attribute Not Always Present
<b>Daemon</b>	Collective term for Windows services accepting →DICOM Associations
<b>DB</b>	Database
<b>DICOM</b>	Digital Imaging and Communications in Medicine, a standard on image communications in medical applications
<b>DIMSE</b>	DICOM Message Service element
<b>DNS</b>	Domain Name System
<b>EMPTY</b>	Attribute is sent without a value
<b>IE</b>	Information Entity
<b>IOD</b>	Information Object Definition (→DICOM term)
<b>Management System</b>	Collective term including →Daemon and →RadOnc Client
<b>Multi-frame Image</b>	Image that contains multiple two-dimensional pixel planes

<b>NEMA</b>	National Electrical Manufacturers Association
<b>PDU</b>	Protocol Data Unit (→DICOM term)
<b>RadOnc</b>	Radiation Oncology Client Applications, including Eclipse
<b>SCU</b>	Service Class User (→DICOM term)
<b>SCP</b>	Service Class Provider (→DICOM term)
<b>SOP</b>	Service-Object-Pair, a definition of an information object (like an image) and of a service (like storage) that can be performed for the object (→DICOM term)
<b>TCP/IP</b>	Transmission Control Protocol / Internet Protocol, a widely used computer networking protocol
<b>UID</b>	Unique Identifier used to identify an object by a worldwide unique identifier (→DICOM term)
<b>VNAP</b>	Value Not Always Present (attribute sent zero length if no value is present)
<b>VR</b>	Value Representation, a data encoding method in →DICOM

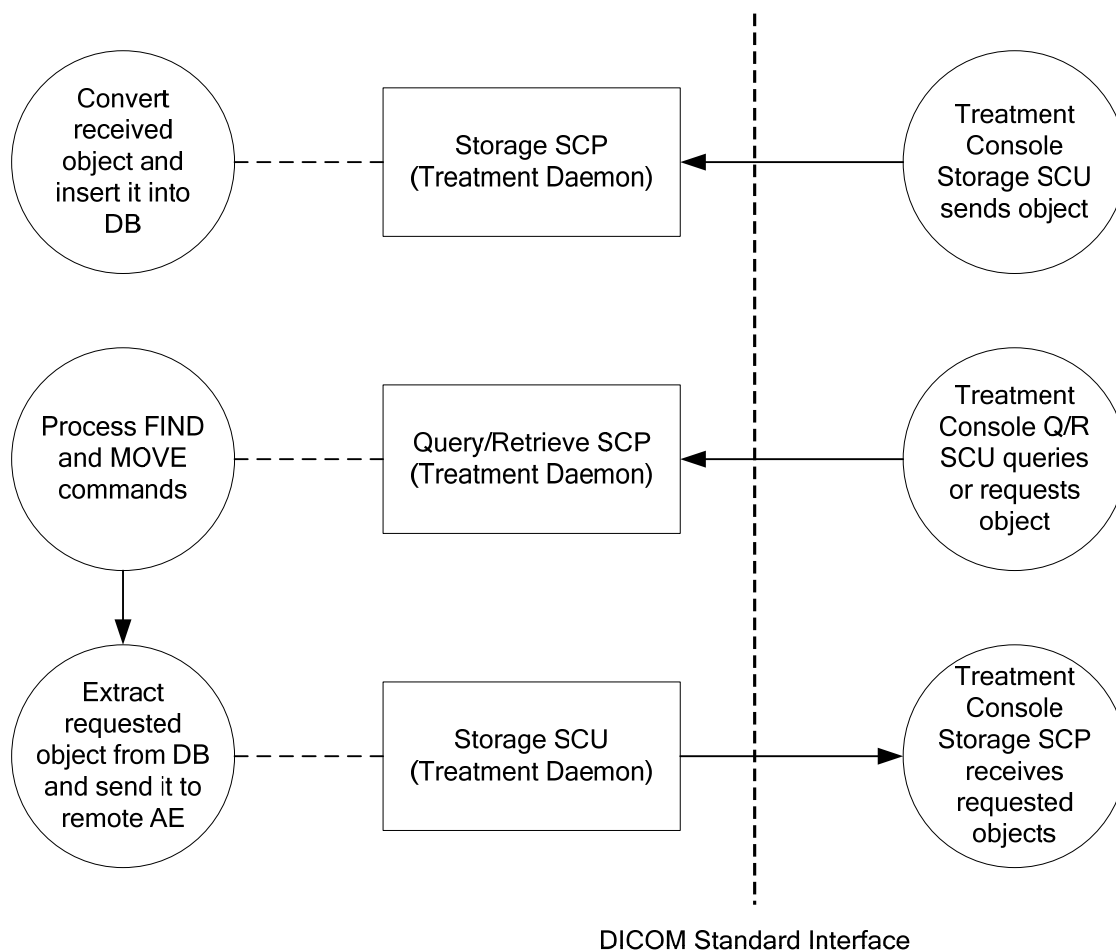
## 3.5 References

- [1] Digital Imaging and Communications in Medicine (DICOM), Parts 1-14 (2006), National Electrical Manufacturers Association (NEMA)  
Rosslyn, VA  
United States of America
- [2] Varian System Server DICOM Conformance Statement  
B VA8005D3CS  
Baden, Switzerland
- [3] On-Board Imager 1.3 DICOM Conformance Statement  
B KC1300D3CS  
Baden, Switzerland

## 4. Networking

### 4.1 Implementation Model

#### 4.1.1 Application Data Flow



**Figure 4-1: SCP Role Application Data Flow Diagram**

#### **Treatment Daemon Storage SCP Application Entity**

The Treatment Daemon works as a Storage SCP. It is connected to the Varian System Database and inserts received objects directly to the DB. Treatment Daemon's Storage SCP is invoked by a remote Storage SCU at the Treatment Console.

#### **Treatment Daemon Query/Retrieve SCP Application Entity**

The Treatment Daemon works as a Query/Retrieve SCP. It provides access to all DICOM objects stored on Varian System Database. Treatment Daemon's Query/Retrieve SCP is invoked by a remote Query/Retrieve SCU at the Treatment Console searching for and retrieving objects.

### **Treatment Daemon Storage SCU Application Entity**

Treatment Daemon's Storage SCU is invoked by Treatment Daemon's Query/Retrieve SCP to transfer requested objects to a remote Storage SCP at the Treatment Console.

## **4.1.2 Functional Definition of AE's**

### **4.1.2.1 Functional Definition of Treatment Daemon Application Entity**

The Treatment Daemon Application Entity is running continuously as a service and is responsible for handling incoming association requests of other Application Entities. It accepts Storage and Query/Retrieve requests of SOP Classes listed in Table 1-1. Received objects are stored directly to the DB, queries for objects are answered based on objects stored in the DB, and requested objects are extracted from the DB and sent to the requestor. However, only "copies" of objects are exported, they will not be removed from the database.

Storage SCP and Query/Retrieve SCP services are supported in parallel by the same Application Entity which technically is identical to the same instance of the DB Daemon service.

Multiple Treatment Daemons can be running in parallel when configured as different Application Entities.

### **4.1.3 Sequencing of Real World Activities**

Not applicable because importing and exporting objects can happen in any sequence and independent of each other.

## **4.2 AE Specifications**

### **4.2.1 Treatment Daemon Application Entity**

#### **4.2.1.1 SOP Classes**

See [2], section 4.2.3.1 SOP Classes.

#### **4.2.1.2 Association Policies**

##### **4.2.1.2.1 General**

See [2], section 4.2.1.2.1 General.

##### **4.2.1.2.2 Number of Associations**

See [2], section 4.2.3.2.2 Number of Associations.

##### **4.2.1.2.3 Asynchronous Nature**

See [2], section 4.2.3.2.3 Asynchronous Nature.

##### **4.2.1.2.4 Implementation Identifying Information**

Treatment Daemon may run in different operational modes to provide backwards compatibility; for details see section 4.2.1.2.4.1.

The implementation information for this Application Entity is defined in the following table. The selected Implementation Class UID used by Treatment Daemon for initiating associations (e.g. for issuing C-STORE commands as sub-operation while performing a C-MOVE command).

Implementation Class UID (Vision 6.5 Mode)	1.2.246.352.70.2.1.10
Implementation Class UID (ARIA Mode)	1.2.246.352.70.2.1.12
Implementation Version Name	(not used)

**Table 4-1: DICOM Implementation Class and Version for Treatment Daemon Application Entity**

#### 4.2.1.2.4.1 Operational Mode

Treatment Daemon can run in following two operational modes:

- Vision 6.5 Mode
- ARIA Mode

Operational mode is selected automatically during Association Negotiation depending on the Implementation Class UID of the Association Requesting peer. The following table shows which accepted Implementation Class UID triggers what operational mode of Treatment Daemon.

Accepted Implementation Class UID	Operational Mode
1.2.246.352.70.2.1.9	Vision 6.5 Mode
1.2.246.352.70.2.1.11	ARIA Mode

**Table 4-2: Operational Modes of Treatment Daemon Application**

#### 4.2.1.3 Association Initiation Policy

The Treatment Daemon Application Entity does not initiate Associations.

#### 4.2.1.4 Association Acceptance Policy

Treatment Daemon restricts access to exactly one user-configured Application Entity.

##### 4.2.1.4.1.1 Activity – Receive Storage Request

##### 4.2.1.4.1.2 Description and Sequencing of Activities

See [2], section 4.2.3.4.1.1 Description and Sequencing of Activities.

##### 4.2.1.4.1.3 Accepted Presentation Contexts

See [2], section 4.2.3.4.1.2 Accepted Presentation Contexts.

##### 4.2.1.4.1.4 SOP Specific Conformance for all Storage SOP Classes

See [2], section 4.2.3.4.1.3 SOP Specific Conformance for all Storage SOP Classes.

##### 4.2.1.4.1.4.1 Presentation Context Acceptance Criterion

See [2], section 4.2.3.4.1.3.1 Presentation Context Acceptance Criterion.

#### 4.2.1.4.1.4.2 Transfer Syntax Selection Policies

See [2], section 4.2.3.4.1.3.2 Transfer Syntax Selection Policies.

#### 4.2.1.4.1.4.3 Response Status

See [2], section 4.2.3.4.1.3.3 Response Status.

#### 4.2.1.4.1.4.4 Private Extended Response Status

Treatment Daemon Application Entity Extends the C-STORE Response Message with a private sequence of log entries created by the Application Entity while processing the corresponding C-STORE Request.

For details about this private Log Entry Sequence see section A.2.1.1.

#### 4.2.1.4.1.5 SOP Specific Conformance for RT Plan Storage

See [2], section 4.2.3.4.1.8 SOP Specific Conformance for RT Plan Storage.

#### 4.2.1.4.1.5.1 Handling of Concurrent Editing

Even though it should not be an issue anymore with ARIA, Treatment Daemon is still checking for an incoming plan whether the same plan (Minor Plan Revision) or a referenced predecessor plan (Major Plan Revision) already exists on the DB. If this is the case, and the plan residing on the DB has been changed since it had last been sent out via this Treatment Daemon, a concurrency warning will be returned.

A concurrency warning is sent as a C-STORE Response with Error Code (0000,0900) 0000 (Service Status Success) and Error Comment (0000,0902) containing one of the following strings, depending on the circumstances:

- [37] Concurrent minor plan changes of somebody else are lost.

Suggested User Message: The Plan was modified by another application concurrently. Modifications to the plan from the other application are lost.

Explanation: While a minor plan modification has been performed at the treatment workstation, another minor plan modification has been applied on the management system. Since the local changes on the management system have been saved first, they got lost because they have been overridden by the Treatment Daemon.

- [37] Concurrent major plan change. Saved to predecessor plan now.

Suggested User Message: Changes saved to predecessor plan only. Consolidate changes in the new plan.

Explanation: A new plan revision has been created on the management system while a minor plan change has been performed at the treatment workstation. As a result the minor plan change is based on a plan revision which is now a former (outdated) plan revision and therefore changes are applied to the now outdated and not to the current revision.

- [37] Concurrent plan changes are not consolidated in new plan.

Suggested User Message: The plan was modified by another application concurrently. Modifications to the plan from the other application are not consolidated in the new plan.

Explanation: While a major plan modification has been performed at the treatment workstation, a minor plan modification has been applied on the management system. The major plan modification is saved as a new plan revision and therefore minor changes performed at the management system are not incorporated in this latest plan revision.

#### 4.2.1.4.1.6 SOP Specific Conformance for RT Beams Treatment Record Storage and RT Ion Beams Treatment Record Storage

See [2], section 4.2.3.4.1.9 SOP Specific Conformance for RT Beams Treatment Record Storage and RT Ion Beams Treatment Record Storage.

##### 4.2.1.4.1.6.1 Connecting Treatment Records to a Field and Session

Treatment records are connected automatically to a corresponding SessionField object (on the DB) referencing a Session which has the lowest session number among those with status "Active" or "Partially Completed – Active".

#### 4.2.1.4.2 Activity – Handling Query and Retrieval Requests

##### 4.2.1.4.2.1 Description and Sequencing of Activities

See [2], section 4.2.3.4.2.1 Description and Sequencing of Activities  
targetDescSeqAct2  
targetDescriptionSequencingActivities2

##### 4.2.1.4.2.2 Accepted Presentation Contexts

See [2], section 4.2.3.4.2.2 Accepted Presentation Contexts.

##### 4.2.1.4.2.3 SOP Specific Conformance for all Query/Retrieve SOP Classes

###### 4.2.1.4.2.3.1 Presentation Context Acceptance Criterion

See [2], section 4.2.3.4.2.3.1 Presentation Context Acceptance Criterion.

###### 4.2.1.4.2.3.2 Transfer Syntax Selection Policies

See [2], section 4.2.3.4.2.3.2 Transfer Syntax Selection Policies.

##### 4.2.1.4.2.4 SOP Specific Conformance for Study Root Query SOP Classes

###### 4.2.1.4.2.4.1 Matching Behavior

The following additional Query Keys are supported as compared to DB Daemon:

Name	Tag	VR	Type	Types of Matching
<b>Composite Object Level (Query Level PLAN)</b>				
Plan Type	(3257,1001)	CS	O	S, U (see Note 1)

**Table 4-3: Study Root C-FIND SCP Supported Elements for Treatment Daemon**

Note 1 This Element is used only for performing the find operation and is never returned.

When a C-FIND Request with a non-standard Query Level of “TREATMENTSUMREC” or “TREATMENTSUMMARYRECORD” is received the C-FIND Responses will contain the following values for Query Level, depending on Operational Mode of Treatment Daemon.

Operational Mode	Value of Query Level
Vision 6.5 Mode	TREATMENTSUMMARYRECORD
ARIA Mode	TREATMENTSUMREC

**Table 4-4: Query Level in a C-FIND Response for C-FIND Request with private Query Level TREATMENTSUMREC**

**4.2.1.4.2.4.2 Response Status**

See [2], section 4.2.3.4.2.4.2 Response Status.

**4.2.1.4.2.5 SOP Specific Conformance for RT Plan Move**

See [2], section 4.2.3.4.2.8 SOP Specific Conformance for RT Plan Move.

**Planned Verification Image**

Because the size of a verification image to be taken is not known in advance (this depends on the imager used), a width and height of zero pixels is assumed. As a consequence, the RT Image Position (3002,0012), in Planned Verification Image Sequence (300A,00CA), describes directly the position of the image receptor’s center. This is because these coordinates are the same as those of the upper left hand corner of an image with zero number of pixels in x and y directions.

**Planned Verification Image**

Setup fields are used for pre-plan verification procedures. For specific conformance definitions, see [3]. Note that use of setup fields for most use cases will be retired in future, as DICOM Worklist is taken into use along the standard specification.

**Operational Mode**

Presence and value of certain Attributes as well as nodes in XML Extended Interface (see Appendix D) depends on Operational Mode of Treatment Daemon (see 4.2.1.2.4.1). Representation of following information differs depending on Operational Mode:

- Beam type; whether a beam is a Treatment of a Setup Field
- Custom code of compensator and block

The following table shows values of standard Attributes in an RT Plan IOD used for Setup Fields.

Attribute Name	Tag	Operational Mode	Comment
<b>RT Beams Module</b>			
>Treatment Delivery Type	(300A,00CE)	Vision 6.5 Mode	Value: TREATMENT
		ARIA Mode	Value: SETUP

**Table 4-5: Value of Attributes of a Setup Field in RT Plan depending on Operational Mode**

The following table shows which nodes are exported in XML Extended Interface depending on Operational Mode. Node “FieldType” is used in Vision 6.5 Mode to distinguish between Treatment and Setup Fields. Node “CustomAddOn” and it’s child nodes contain additional information for blocks and compensators as well as information for stand-alone trays that do not hold beam modifying accessories but serve as a dongle instead to enable for example high-dose treatment techniques etc.

Node Name	Operational Mode	Comment
>>>> FieldType	Vision 6.5 Mode	Present. Possible values are TREATMENT and SETUP.
	ARIA Mode	Absent
>>>> CustomAddOn	Vision 6.5 Mode	Present for Block, Compensator and stand-alone Trays.
	ARIA Mode	Present only for stand-alone Trays, never written for Blocks and Compensators.

**Table 4-6: Presence of Nodes in XML Extended Interface depending on Operational Mode**

#### 4.2.1.4.2.6 SOP Specific Conformance for RT Beams Treatment Record Find

When a C-FIND Request with a non-standard Query Level of “TREATMENTRECORD” is received the C-FIND Responses will contain filled out Attributes as listed in [2], Table 4-44 (Study Root C-FIND SCP Supported Elements for DB Daemon).

The information contained in the C-FIND responses is intended to be useful for a treatment machine to determine the treatment status of the current fraction if dose has been delivered only partially. It is sufficient for knowing for each beam of a plan whether dose has been applied completely or partially, and in the latter case for knowing exactly where dose delivery has been interrupted on the last treatment session.

Attributes Referenced SOP Class UID (0008,1150) shall contain RT Plan or RT Ion Plan SOP Class UID, Referenced SOP Instance UID (0008,1155) shall contain the SOP Instance UID of the plan for which RT Beams Treatment Record information shall be retrieved.

## 4.3 Network Interfaces

See [2], section 4.3 Network Interfaces.

## 4.4 Configuration

### 4.4.1 AE Title/Presentation Address Mapping

#### 4.4.1.1 Local AE Titles

The Treatment Daemon Application Entity use the AE Title and TCP/IP port numbers configured via the Daemon Configuration Wizard application.

Application Entity	Default AE Title	Default TCP/IP Port
Treatment Daemon	No Default	57345 (configurable)

**Table 4-7: AE Title Configuration Table**

**4.4.1.2 Remote AE Title/Presentation Address Mapping**

See [2], section 4.4.1.2.5 DB Daemon, with following difference:

Calling AE Title verification is always switched on by default and not configurable.

**4.4.2 Parameters**

The following table shows DICOM relevant configuration parameters. While some of them may be configured directly via a configuration dialog or a configuration application, other values can only be accessed via the Registry or can not be configured at all.

Parameter	Configurable (Yes/No)	Default Value
<b>General Parameters</b>		
Max PDU Receive Size	No	Unlimited
Max PDU Send Size	No	32768 Bytes (32kB)
Time-out waiting for a acceptance or rejection response to an Association request or Association Release request (Application Level Timeout)	Yes	30s
<b>Treatment Daemon Specific Parameters</b>		
Time-out awaiting a Response to a DIMSE Request (Low-Level Timeout)	Yes	240s
Connection timeout after which an Association will be released when idle.	No	1h
Maximum number of simultaneously accepted Associations	No	Unlimited
Storage SOP Class support	No	Active
Query/Retrieve SOP Class support.	No	Active
Private Extended Response Status	Yes	Active

**Table 4-8: Configuration Parameters Table**

## 5. Media Interchange

Not applicable.

## 6. Support of Character Sets

See [2], section 6 Support of Character Sets.

## 7. Security

### 7.1 Security Profiles

No Security Profiles are supported.

### 7.2 Association Level Security

#### 7.2.1 Treatment Daemon

The Treatment Daemon Application Entity always checks the following values when determining whether to accept Association Open Requests:

- Called AE Title
- Calling AE Title
- IP address of Association Request originator
- Implementation UID

Treatment Daemon accepts only following Implementation UIDs:

Accepted Implementation UID	Description
1.2.246.352.70.2.1.9	Treatment 6.5
1.2.246.352.70.2.1.11	Treatment 8

Table 7-1: Accepted Implementation UID

### 7.3 Application Level Security

See [2], section 7.3.2 File Daemon and DB Daemon.

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# Appendix A Specialization

## A.1 IOD Contents

See [2], section Appendix A.1 IOD Contents.

## A.2 Data Dictionary of Private Attributes

See [2], section Appendix A.2 Data Dictionary of Private Attributes.

### A.2.1 Private Attributes used by Treatment Daemon Application Entity

The following table contains a list of private Attributes that are used only in Treatment Daemon Application Entities.

Tag	Name	VR	VM
(3301,1000)	Log Entry Sequence	SQ	0..n
(3301,1001)	Entry Number	SL	1
(3301,1002)	Section Number	SL	1
(3301,1003)	Error Level	CS	1
(3301,1004)	Log Level	CS	1
(3301,1005)	Log Text	ST	1

**Table A-1: Private Attributes used by Treatment Daemon Application Entity**

#### A.2.1.1 Log Entry Sequence

Table A-2 below shows the Attributes of private Log Entry Sequence as sent with C-STORE Response Messages.

Attribute Name	Tag	T	Description
Log Entry Sequence	(3301,1000)	3	Introducing private sequence of log messages.
> Entry Number	(3301,1001)	1	Arbitrary number, increasing with order of log entries. Number is unique within Log Entry Sequence.
> Section Number	(3301,1002)	1	Log section number.

Attribute Name	Tag	T	Description
> Error Level	(3301,1003)	1	Enumerated Values: SUCCESS: Indicates a successful operation. Normally used in conjunction with an empty Log Text. INFORMATION: Standard log entry. WARNING_ERROR: Log entry warning about an exceptional case. Should be reviewed by user. REJECT_ERROR: Log entry reporting an error that ultimately leads to the failure of the whole operation.
> Log Level	(3301,1004)	1	Enumerated Values: SIMPLE_LOG: Simple user log message. NORMAL_LOG: Detailed user log message. DETAILED_LOG: Detailed log messages intended only for advanced users or engineers.
> Log Text	(3301,1005)	2	Human-readable log message text.

Table A-2: Private Log Entry Sequence in C-STORE Response

### A.3 Coded Terminology and Templates

See [2], section Appendix A.3 Coded Terminology and Templates.

### A.4 Grayscale Image Consistency

See [2], section Appendix A.4 Grayscale Image Consistency.

### A.5 Standard Extended/Specialized/Private SOP Classes

See [2], section Appendix A.5 Standard Extended/Specialized/Private SOP Classes.

### A.6 Private Transfer Syntaxes

See [2], section Appendix A.6 Private Transfer Syntaxes.

## **Appendix B Object Matching Criteria**

See [2], section Appendix B Object Matching Criteria.

## **Appendix C IOD Details**

See [2], section Appendix C IOD Details.

## **Appendix D Extended Interface**

See [2], section Appendix D Extended Interface.

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