DICOM Conformance Statement

ulrich medical

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1. Conformance Statement Overview

The **ulrich medical RIS/DICOM Interface** is a separately licensable software option for ulrich medical contrast media injectors. It provides the necessary DICOM services to download work lists from an information system and save the injection report as an image file to a network storage device.

Table 1-1 provides an overview of the network services supported by **ulrich medical RIS/DICOM Interface**.

Table 1-1. Network Services

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Secondary Capture Image Storage	Yes	No
Workflow Management		
Modality Worklist Information Model - Find	Yes	No

2. Introduction

2.1 Revision History

Table 3.1. Revision History

Document Version	Date of Issue	Description
R1	2018-03-14	initial revision
R2	2018-12-05	• Tables 4.2.5, 4.2.12: Updated Class UID and Version Name to 3.6.3. • 4.2.2.3.1.1, Fig. 4.2.3: corrected association workflow. • Tables 4.2.-24, 4.2-25: added tags (0032,1070) and (0010,0021) • 4.3.2.2 NTP: new section • Tables 8.1.6, 8.1.7: model name • Tables 8.1.12, 8.2.1: added (0101,101C) • new Table 8.1.13: Extended DICOM Attributes.

Document Version	Date of Issue	Description
R3	2021-01-13	• Table 4.2.-1: Verification Class SOP role defined as SCU and SCP. • Tables 4.2.5, 4.2.13: Updated Class UID and Version Name to 3.6.5. • Tables 4.2-6, 4.2-14: Verification Class Role corrected to SCU. • Table 4.2-9 Added Verification Class SOP. • 4.2.1.4, 4.2.2.4: Added Verification SOP Class to Accepted Presentation Contexts • Table 4.3.2: added NTP client. • 4.4 Changed user role from service to network administrator, configuration menu from service menu to network settings menu. • Added chapters 7.1 Secure Transport Connection Profiles and 7.2 Application Level Security.
R4	2021-10-11	• Table 8.1-11, Table 8.1-12, Table 8.2-1: Text “Private Creator Value“ changed to “**ulrich medical CT motion – Private Tags”.**

2.2 Audience

This document is written for the people that need to understand how the **ulrich medical RIS/PACS Interface** will integrate into their healthcare facility. This includes both those responsible for overall healthcare network policy and architecture, as well as integrators who need to have a detailed understanding of the DICOM features of the product. This document contains some basic DICOM definitions so that any reader may understand how this product implements DICOM features. However, integrators are expected to fully understand all the DICOM terminology, how the tables in this document relate to the product's functionality, and how that functionality integrates with other devices that support compatible DICOM features.

2.3 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between the **ulrich medical RIS/PACS Interface** and other DICOM products. It should be read and understood in conjunction with the DICOM Standard. DICOM by itself does not guarantee interoperability. The Conformance Statement does, however, facilitate a first-level comparison for interoperability between different applications supporting compatible DICOM functionality.

This document is not supposed to replace validation with other DICOM equipment to ensure proper exchange of intended information. In fact, the user should be aware of the following important issues:

- The comparison of different Conformance Statements is just the first step towards assessing interconnectivity and interoperability between the product and other DICOM conformant equipment.
- Test procedures should be defined and executed to validate the required level of interoperability with specific compatible DICOM equipment, as established by the healthcare facility.

2.4 Terms and Definitions

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitions of these terms.

Abstract Syntax

> The information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples: Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE)

> An end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title (AET)

> The externally known name of an Application Entity used to identify a DICOM application to other DICOM applications on the network.

Application Context

> The specification of the type of communication used between Application Entities. Example: DICOM network protocol.

Association

> A network communication channel set up between Application Entities.

Attribute

> A unit of information in an object definition; a data element identified by a tag. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD)

> The specified set of Attributes that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The Attributes may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Module

> A set of Attributes within an Information Object Definition that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation

First phase of Association establishment that allows Application Entities to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context

The set of DICOM network services used over an Association, as negotiated between Application Entities; includes Abstract Syntaxes and Transfer Syntaxes.

Security Profile

A set of mechanisms, such as encryption, user authentication, or digital signatures, used by an Application Entity to ensure confidentiality, integrity, and/or availability of exchanged DICOM data

Service Class Provider (SCP)

Role of an Application Entity that provides a DICOM network service; typically, a server that performs operations requested by another Application Entity (Service Class User). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU)

Role of an Application Entity that uses a DICOM network service, typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

Service/Object Pair Class (SOP Class)

The specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair Instance (SOP Instance)

An information object; a specific occurrence of information exchanged in a SOP Class. Examples: a specific x-ray image.

Tag

A 32-bit identifier for a data element, represented as a pair of four-digit hexadecimal numbers, the "group" and the "element". If the "group" number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

Transfer Syntax

The encoding used for exchange of DICOM information objects and messages. Examples: JPEG compressed (images), little endian explicit value representation.

Unique Identifier (UID)

A globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR)

The format type of an individual DICOM data element, such as text, an integer, a person's name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

2.5 Basics of DICOM Communication

This section describes terminology used in this Conformance Statement for the non-specialist in a simplified way. The key terms used in the Conformance Statement are highlighted in *italics* below.

Two *Application Entities* (devices) that want to communicate with each other over a network using DICOM protocol must first agree on several things during an initial network "handshake". One of the two devices must initiate an *Association* (a connection to the other device), and ask if specific services, information, and encoding can be supported by the other device (*Negotiation*).

DICOM specifies a number of network services and types of information objects, each of which is called an *Abstract Syntax* for the Negotiation. DICOM also specifies a variety of methods for encoding data, denoted *Transfer Syntaxes*. The Negotiation allows the initiating Application Entity to propose combinations of Abstract Syntax and Transfer Syntax to be used on the Association; these combinations are called *Presentation Contexts*. The receiving Application Entity accepts the Presentation Contexts it supports.

For each Presentation Context, the Association Negotiation also allows the devices to agree on *Roles* - which one is the *Service Class User* (SCU - client) and which is the *Service Class Provider* (SCP - server). Normally the device initiating the connection is the SCU, i.e., the client system calls the server, but not always.

The Association Negotiation finally enables exchange of maximum network packet (*PDU*) size, security information, and network service options (called *Extended Negotiation* information).

The Application Entities, having negotiated the Association parameters, may now commence exchanging data. Common data exchanges include queries for worklists and lists of stored images, transfer of image objects and analyses (structured reports) and sending images to film printers. Each exchangeable unit of data is formatted by the sender in accordance with the appropriate *Information Object Definition* and sent using the negotiated Transfer Syntax. There is a Default Transfer Syntax that all systems must accept, but it may not be the most efficient for some use cases. Each transfer is explicitly acknowledged by the receiver with a *Response Status* indicating success, failure, or that query or retrieve operations are still in process.

2.6 Abbreviations

AE	Application Entity
AET	Application Entity Title
CT	Computed Tomography
DHCP	Dynamic Host Configuration Protocol
DICOM	Digital Imaging and Communications in Medicine
DNS	Domain Name System
HIS	Hospital Information System
HL7	Health Level 7 Standard
IOD	Information Object Definition
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISO	International Organization for Standards
MR	Magnetic Resonance Imaging

MSPS	Modality Scheduled Procedure Step
MTU	Maximum Transmission Unit (IP)
MWL	Modality Worklist
NTP	Network Time Protocol
PACS	Picture Archiving and Communication System
PDU	Protocol Data Unit
RIS	Radiology Information System
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
SPS	Scheduled Procedure Step
TCP/IP	Transmission Control Protocol/Internet Protocol
U	Unique (Key Attribute)
UL	Upper Layer
VR	Value Representation

2.7 References

NEMA PS3 Digital Imaging and Communications in Medicine (DICOM) Standard, available free at http://www.dicomstandard.org .

3. Networking

3.1 Implementation Model

3.1.1 Application Data Flow

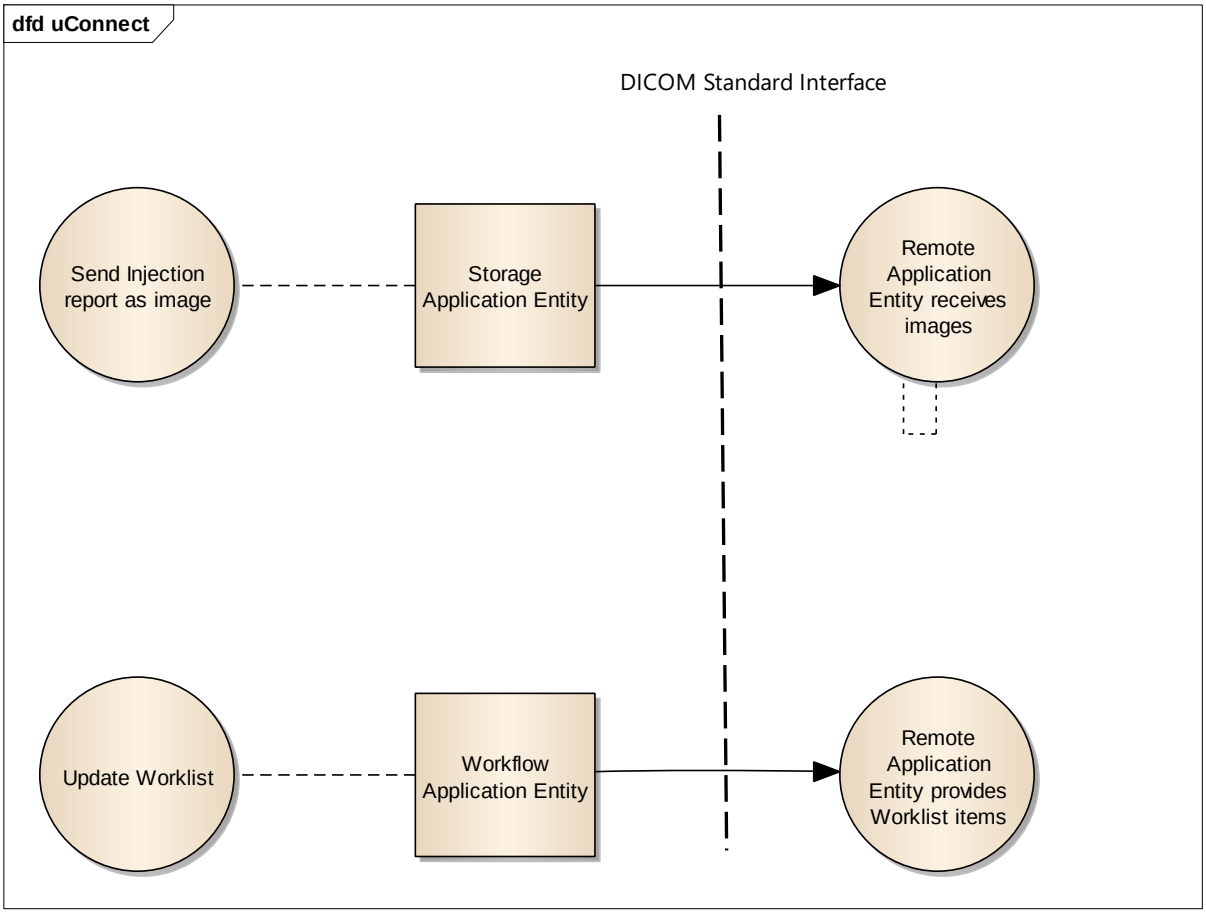

Figure 4.1-1. Application Data Flow Diagram

- The Storage Application Entity sends images to a remote AE. It is associated with the local real-world activity "Send Injection report as image". "Send Injection report as image" is performed automatically after completion of an injection and user confirmation that data are valid or on user request after selecting an injection report from the local injection history for (re-)sending.
  Up to 3 storage destinations can be specified. The Storage AE does not request/support Storage Commitment.
- The Workflow Application Entity receives Worklist information from a remote AE. It is associated with the local real-world activities "Update Worklist" and "Perform Injection". When the "Update Worklist" local real-world activity is performed the Workflow Application Entity queries a remote AE for worklist items and provides the set of worklist items matching the query request. "Update Worklist" is performed as a result of an operator request or automatically at specific, configurable time intervals.

3.1.2 Functional Definition of AEs

3.1.2.1 Functional Definition of Storage Application Entity

User interaction will activate the Storage AE, either at the end of an injection or by selecting a study from the Send History to be (re-)sent. An association request is sent to the destination AE and upon successful negotiation of a Presentation Context the image transfer is started. If the association cannot be opened, the related send-job is set to an error state and can be restarted by the user via job control interface. The Storage AE will not try to initiate another association for this send-job automatically.

3.1.2.2 Functional Definition of Workflow Application Entity

Worklist Update attempts to download a Worklist from a remote node. If the Workflow AE establishes an Association to a remote AE, it will transfer all worklist items received via the open Association. During receiving the worklist response items are counted and the query processing is canceled if the limit of 300 items is reached. The results will be displayed in a separate list, which will be cleared with the next Worklist Update.

3.1.3 Sequencing of Real-World Activities

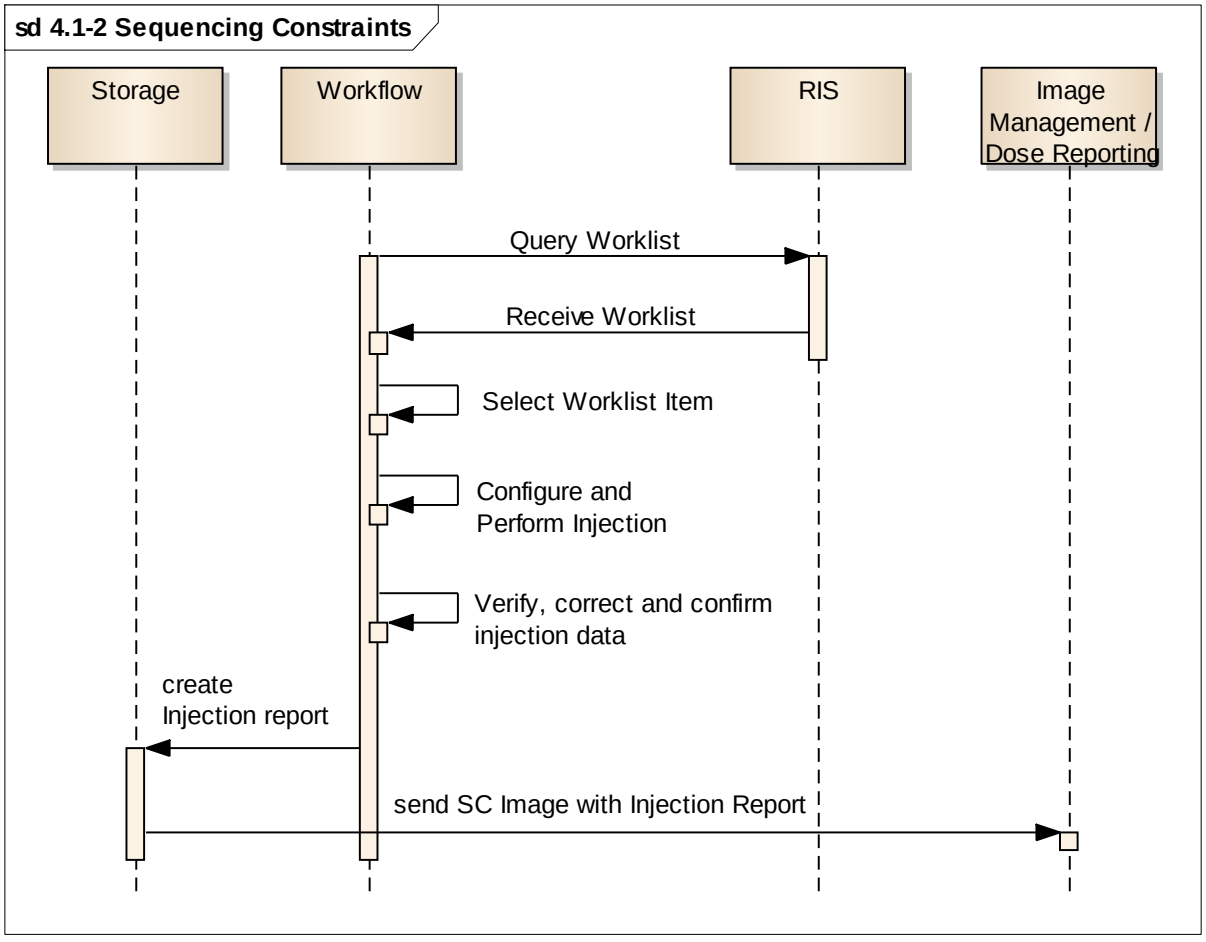

Figure 4.1-2 Sequencing Constraints

Under normal scheduled workflow conditions, the sequencing constraints illustrated in Figure 4.1-2 apply:

1. Query Worklist
2. Receive Worklist of Modality Scheduled Procedure Steps (MSPS)

3. Select Workitem (MSPS) from Worklist
4. Configure and perform injection
5. Verify injection data, correct/add data as required and confirm data as being valid.
6. Create Injection Report and send image to Image Management System and/or Dose Reporting System.

Other workflow situations (e.g., unscheduled procedure steps) will have other sequencing constraints. The image/injection report can be generated from injection history and sent later or omitted if destination is not available.

Data of unscheduled patients can be entered manually. The **ulrich medical RIS/PACS Interface** will generate a new study instance UID in this case.

No Injection Report is created or sent if neither a patient was selected from the Worklist nor patient data (Patient's Name and Patient's Birth Date) has been entered manually by the user.

3.2 AE Specifications

3.2.1 Storage Application Entity Specification

3.2.1.1 SOP Classes

ulrich medical RIS/PACS interface provides Standard Conformance to the following SOP Classes:

Table 4.2-1. SOP Classes for AE Storage

SOP Class Name	SOP Class UID	SCU	SCP
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No
Verification	1.2.840.10008.1.1	Yes	Yes

3.2.1.2 Association Policies

3.2.1.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed:

Table 4.2-2. DICOM Application Context for AE Storage

Application Context Name	1.2.840.10008.3.1.1.1

3.2.1.2.2 Number of Associations

ulrich medical RIS/PACS Interface initiates one Association at a time for each destination to which a transfer request is being processed in the active job queue list. Only one job will be active at a time, the other remains pending until the active job is completed or failed.

Table 4.2-3. Number of Associations Initiated for AE Storage

Maximum number of simultaneous Associations	1 (configurable)

Table 4.2-4. Number of Associations Accepted for AE Storage

Maximum number of simultaneous Associations	none

3.2.1.2.3 Asynchronous Nature

ulrich medical RIS/PACS Interface does not support asynchronous communication (multiple outstanding transactions over a single Association).

3.2.1.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

Table 4.2-5. DICOM Implementation Class and Version for AE Storage

Implementation Class UID	1.2.276.0.7230010.3.0.3.6.5
Implementation Version Name	OFFIS_DCMTK_365

3.2.1.3 Association Initiation Policy

3.2.1.3.1 Activity - Send Images

3.2.1.3.1.1 Description and Sequencing of Activities

A user can initiate the creation of one injection report as a SC image instance at a time and request it to be sent to multiple destinations as configured (up to 3). This process takes place either automatically after confirming the data to be sent at the end of an injection or manually after selecting dataset and destination(s) from the Injection History database.

The Storage AE attempts to initiate a new Association in order to issue a C-STORE request. Since only one image is created as part of an injection workflow only one C-STORE request will be issued over the Association.

If the C-STORE Response from the remote Application contains a status other than Success or Warning, the Association and the related send job is aborted. The job can be restarted any time by user interaction.

ulrich medical RIS/PACS Interface does not support storage commitment.

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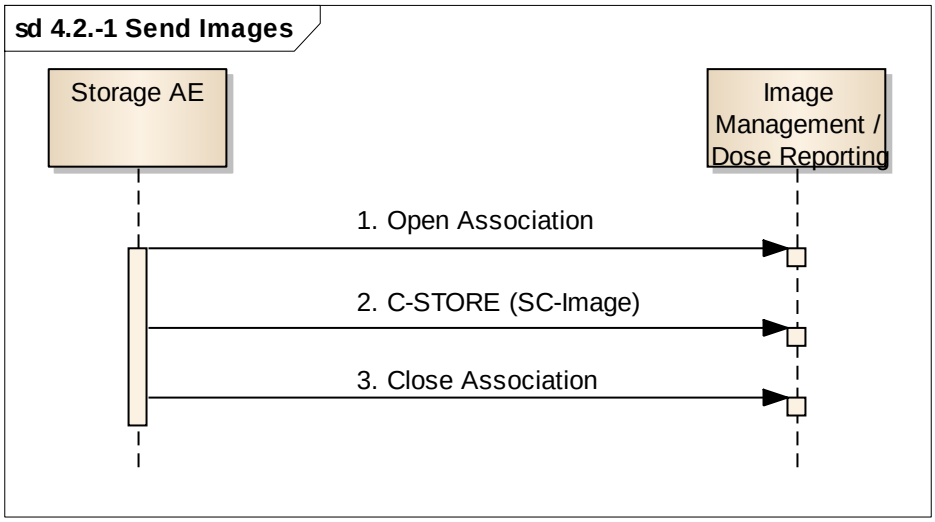

Figure .4.2-1. Sequencing of Activity - Send Images

The sequence of interactions between the Storage AE and an Image Management / Dose Reporting entity (e.g., a storage or archive or dose reporting device supporting the Storage SOP Class as an SCP) is illustrated in Figure B.4.2-1:

1. The Storage AE opens an association with the Image Management device
2. An Injection Report generated as a SC Image is transmitted to the Image Management device using a C-STORE request and the Image Manager replies with a C-STORE response (status success).
3. The Storage AE closes the association with the Image Management device

3.2.1.3.1.2 Proposed Presentation Contexts

ulrich medical RIS/PACS Interface is capable of proposing the Presentation Contexts shown in the following table:

Table 4.2-6. Proposed Presentation Contexts for Activity Send Images

Presentation Context Table					
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 Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 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 Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

3.2.1.3.1.3 SOP Specific Conformance Secondary Image Storage SOP Classes

C-STORE Response Status Handling Behavior

The **ulrich medical RIS/PACS Interface** only evaluates if a C-STORE response has been received. The C-STORE response status is logged but not evaluated.

Communication Failure

The behavior of Storage AE during communication failure is summarized in the Table below:

Table 4.2-7. Storage Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted using A-ABORT and the send job is marked as failed. The reason is logged, and the job failure is reported to the user via the job control application.
Association aborted by the SCP or network layers	The send job is marked as failed. The reason is logged, and the job failure is reported to the user via the job control application.

If a send job fails first time, the Storage AE attempts to initiate a new Association in order to re-issue the C-STORE request once. If the second attempt fails as well, the send job is considered as failed and will be indicated accordingly in the Send History of the user interface.

A failed send job can be restarted by user interaction.

3.2.1.4 Association Acceptance Policy

3.2.1.4.1 Accepted Presentation Contexts

The Storage Application Entity will accept Presentation Contexts as shown in the following table:

Table 4.2-8. Acceptable Presentation Contexts for Activity Send Images

Presentation Context Table					
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 Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None

3.2.1.4.1.1 SOP Specific Conformance for Verification SOP Class

The Storage AE provides standard conformance to the Verification SOP Class as an SCP. If the C-ECHO request was successfully received, a 0000 (Success) status code will be returned in the C-

ECHO response. Otherwise, a C000 (Error - Cannot Understand) status code will be returned in the C-ECHO response.

3.2.2 Workflow Application Entity Specification

3.2.2.1 SOP Classes

ulrich medical RIS/PACS interface provides Standard Conformance to the following SOP Classes:

Table 4.2-9. SOP Classes for AE Workflow

SOP Class Name	SOP Class UID	SCU	SCP
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Yes	No
Verification	1.2.840.10008.1.1	Yes	Yes

3.2.2.2 Association Policies

3.2.2.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed:

Table 4.2-10. DICOM Application Context for AE Workflow

Application Context Name	1.2.840.10008.3.1.1.1

3.2.2.2.2 Number of Associations

ulrich medical RIS/PACS Interface initiates one Association at a time for a Worklist request.

Table 4.2-11. Number of Associations Initiated for AE Workflow

Maximum number of simultaneous Associations	1

3.2.2.2.3 Asynchronous Nature

ulrich medical RIS/PACS Interface does not support asynchronous communication (multiple outstanding transactions over a single Association).

Table 4.2-12. Asynchronous Nature as a SCU for AE Workflow

Maximum number of outstanding asynchronous transactions	1

3.2.2.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

Table 4.2-13. DICOM Implementation Class and Version for AE Workflow

Implementation Class UID	1.2.276.0.7230010.3.0.3.6.5
Implementation Version Name	OFFIS_DCMTK_365

3.2.2.3 Association Initiation Policy

3.2.2.3.1 Activity - Worklist Update

3.2.2.3.1.1 Description and Sequencing of Activities

The **ulrich medical RIS/PACS Interface** is configured to request a Worklist Update at periodic intervals or on demand by the user. An association will be attempted when the application is started and then periodically thereafter or as part of a user request, demanded by the user.

The **ulrich medical RIS/PACS Interface** does allow to set following filters for worklist queries:

- Scheduled Station AE Title (0040,0001)
- Scheduled Procedure Step Start Date (0040,0002)
- Modality (0008,0060)

Upon initiation of the request, the **ulrich medical RIS/PACS Interface** will build an Identifier for the C-FIND request and will wait for Worklist responses. After retrieval of all responses, **ulrich medical RIS/PACS Interface** will access the local database to add or update patient demographic data. To protect the system from overflow, the **ulrich medical RIS/PACS Interface** will limit the number of processed worklist responses to 300. During receiving the worklist response items are counted and surplus items will be ignored if the limit of 300 items is reached. The results will be displayed in a Worklist Screen, which will be updated with the next worklist update.

ulrich medical RIS/PACS Interface keep the association open until the Injector System is shut down or restarted.

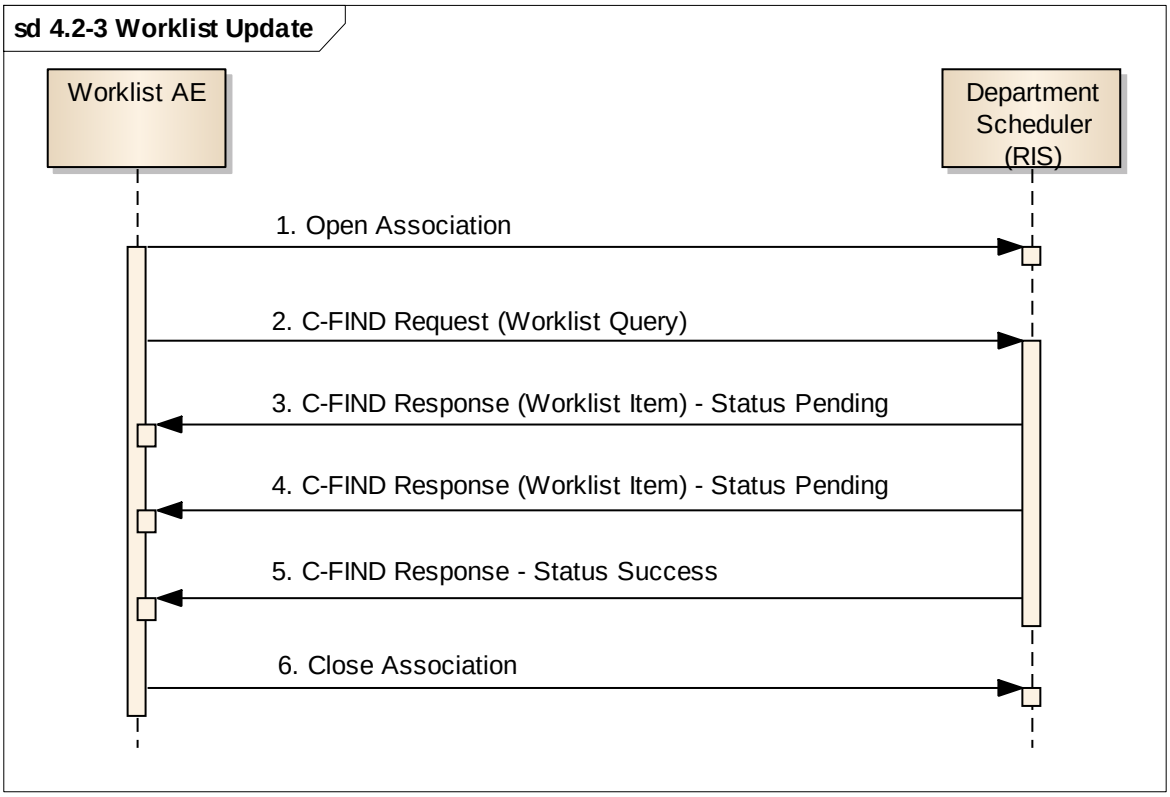

Figure 4.2-3. Sequencing of Activity - Worklist Update

A possible sequence of interactions between the Workflow AE and a Departmental Scheduler (e.g., a device such as a RIS or HIS that supports the Modality Worklist SOP Class as an SCP) is illustrated in the Figure above:

1. The Worklist AE opens an association with the Departmental Scheduler
2. The Worklist AE sends a C-FIND request to the Departmental Scheduler containing the Worklist Query attributes.
3. The Departmental Scheduler returns a C-FIND response containing the requested attributes of the first matching Worklist Item.
4. The Departmental Scheduler returns another C-FIND response containing the requested attributes of the second matching Worklist Item.
5. The Departmental Scheduler returns another C-FIND response with status Success indicating that no further matching Worklist Items exist. This example assumes that only 2 Worklist items match the Worklist Query.
6. The Worklist AE closes the association with the Departmental Scheduler.
7. Steps 1 – 6 are repeated after a configured interval or if issued by the user (Worklist Refresh button).
8. The Departmental Scheduler returns a C-FIND response containing the requested attributes of the first matching Worklist Item.
9. The Departmental Scheduler returns another C-FIND response containing the requested attributes of the second matching Worklist Item.
10. The Departmental Scheduler returns another C-FIND response with status Success indicating that no further matching Worklist Items exist. This example assumes that only 2 Worklist items match the Worklist Query.
11. The user shuts down the Injector System (i.e. after end of a work day or after a system error)

3.2.2.3.1.2 Proposed Presentation Contexts

ulrich medical RIS/PACS Interface will propose Presentation Contexts as shown in the following table:

Table 4.2-14. Proposed Presentation Contexts for Activity Worklist Update

Presentation Context Table					
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
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Modality Worklist Information Model C-FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

3.2.2.3.1.3 SOP Specific Conformance for Modality Worklist

The behavior of **ulrich medical RIS/PACS Interface** when encountering status codes in a Modality Worklist C-FIND response is summarized in the Table below.

Table 4.2-15. Modality Worklist C-FIND Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	The SCP has completed the matches. Worklist items are available for display or further processing.
Pending	Matches are continuing	FF00	The worklist item contained in the Identifier is collected for later display or further processing.
Pending	Matches are continuing - Warning that one or more Optional Keys were not supported	FF01	The worklist item contained in the Identifier is collected for later display or further processing. The status meaning is logged only once for each C-FIND operation.
*	*	Any other status codes.	Any additional error information in the Response will be logged.

The behavior of **ulrich medical RIS/PACS Interface** during communication failure is summarized in the Table below.

Table 4.2-16. Modality Worklist Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted using A-ABORT and the worklist query marked as failed. The reason is logged and reported to the user if an interactive query.
Association aborted by the SCP or network layers	The worklist query is marked as failed. The reason is logged and reported to the user if an interactive query.

Acquired images will always use the Study Instance UID specified for the Scheduled Procedure Step (if available). If an acquisition is unscheduled, a Study Instance UID will be generated locally.

The Tables below provide a description of the **ulrich medical RIS/PACS Interface** Worklist Request and Response Identifiers and specify the attributes that are copied into the images. Unexpected attributes returned in a C-FIND response are ignored.

All values of the C-FIND Request of the DICOM SOP "Modality Worklist Information Model" are empty.

Requested return attributes not supported by the SCP are set to have no value. Non-matching responses returned by the SCP due to unsupported optional matching keys are ignored. No attempt is made to filter out possible duplicate entries.

Table 4.2-17. Modality Worklist C-FIND Request

Description / Module	Tag	VR	VM	Remark / Matching Type
Scheduled Procedure Step Sequence	(0040,0100)	SQ	1	The Attributes of the Scheduled Procedure Step shall only be retrieved with Sequence Matching. The Scheduled Procedure Step Sequence shall contain only a single Item.
>Scheduled Station AE Title	(0040,0001)	AE	1-n	The Scheduled station AE title shall be retrieved with Single Value Matching only.
>Scheduled Procedure Step Start Date	(0040,0002)	DA	1	Scheduled Step Start Date shall be retrieved with Single Value Matching or Range Matching. See remark under Scheduled Procedure Step Start Time (0040,0003).
>Scheduled Procedure Step Start Time	(0040,0003)	TM	1	Scheduled Step Start Time shall be retrieved with Single Value Matching or Range Matching. Scheduled Step Start Date and Scheduled Step Start Time are subject to Range Matching. If both keys are specified for Range Matching, e.g., the date range July 5 to July 7 and the time range 10am to 6pm specifies the time period starting on July 5, 10am until July 7, 6pm. Note: If the Information System does not provide scheduling for individual Procedure Steps, it may use the closest scheduling information it possesses (e.g., Procedures are subject to scheduling instead of Procedure Steps).
>Modality	(0008,0060)	CS	1	The Modality shall be retrieved with Single Value Matching.
>Scheduled Performing Physician's Name	(0040,0006)	PN	1	Scheduled Performing Physician's Name shall be retrieved with Single Value Matching or Wild Card Matching.
>Scheduled Procedure Step Description	(0040,0007)	LO	1	Either the Scheduled Procedure Step Description (0040,0007) or the Scheduled Protocol Code Sequence (0040,0008) or both shall be supported by the SCP.
Requested Procedure Description	(0032,1060)	LO	1	The Requested Procedure Description (0032,1060) or the Requested Procedure Code Sequence (0032,1064) or both shall be supported by the SCP.

Description / Module	Tag	VR	VM	Remark / Matching Type
Requested Contrast Agent	(0032,1070)	LO	1	Contrast agent requested for use in the Scheduled Procedure Step.
Study Instance UID	(0020,000D)	UI	1	Unique identifier of the Series.
Study Date	(0008,0020)	DA	1	The values of Study Date (0008,0020) and Study Time (0008,0030) may be provided in order to achieve consistency of Study level Attributes in composite instances generated in multiple performed procedure steps on different devices, and the worklist values may be updated by the SCP based on information received from Modality Performed Procedure Steps or by examining the composite instances generated.
Study Time	(0008,0030)	TM	1	The values of Study Date (0008,0020) and Study Time (0008,0030) may be provided in order to achieve consistency of Study level Attributes in composite instances generated in multiple performed procedure steps on different devices, and the worklist values may be updated by the SCP based on information received from Modality Performed Procedure Steps or by examining the composite instances generated.
Accession Number	(0008,0050)	SH	1	A RIS generated number that identifies the order for the Study.
Requesting Physician	(0032,1032)	PN	1	Name of the physician who requested the study.
Referring Physician's Name	(0008,0090)	PN	1	Name of the patient's referring physician.
Patient's Name	(0010,0010)	PN	1	Patient Name shall be retrieved with Single Value Matching or Wild Card Matching.
Patient ID	(0010,0020)	LO	1	Patient ID shall be retrieved with Single Value Matching.
Issuer of Patient ID	(0010,0021)	LO	1	Identifier of the Assigning Authority (system, organization, agency, or department) that issued the Patient ID.

Description / Module	Tag	VR	VM	Remark / Matching Type
Patient‘s Birth Date	(0010,0030)	DA	1	Birth date of the patient.
Patient's Sex	(0010,0040)	CS	1	Sex of the named patient. Enumerated Values: M - male F - female O - other
Patient's Weight	(0010,1030)	DS	1	Weight of the Patient, in kg.
All other Attributes of the Patient Demographic Module		-	-	-
Patient's Age	(0010,1010)	AS	1	Age of the Patient.
Medical Alerts	(0010,2000)	LO	1-n	Conditions to which medical staff should be alerted (e.g. contagious condition, drug allergies, etc.)
Allergies	(0010,2110)	LO	1-n	Description of prior reaction to contrast agents, or other patient allergies or adverse reactions.

Table 4.2-18. Modality Worklist C-FIND Response

Description / Module	Tag	VR	VM	Remark	Response Value is used for
Scheduled Procedure Step Sequence	(0040,0100)	SQ	1		-
>Scheduled Station AE Title	(0040,0001)	AE	1-n		-
>Scheduled Procedure Step Start Date	(0040,0002)	DA	1		-

Description / Module	Tag	VR	VM	Remark	Response Value is used for
>Scheduled Procedure Step Start Time	(0040,0003)	TM	1		-
>Modality	(0008,0060)	CS	1		-
>Scheduled Performing Physician's Name	(0040,0006)	PN	1		-
>Scheduled Procedure Step Description	(0040,0007)	LO	1		- GUI Display
Requested Procedure Description	(0032,1060)	LO	1		- GUI Display - SC Image
Requested Contrast Agent	(0032,1070)	LO	1	Contrast agent requested for use in the Scheduled Procedure Step.	- SC Image
Study Instance UID	(0020,000D)	UI	1	Unique identifier of the Series.	- SC Image
Study Date	(0008,0020)	DA	1		-
Study Time	(0008,0030)	TM	1		-
Accession Number	(0008,0050)	SH	1	A RIS generated number that identifies the order for the Study.	- GUI Display - SC Image
Requesting Physician	(0032,1032)	PN	1	Name of the physician who requested the study.	- GUI Display
Referring Physician's Name	(0008,0090)	PN	1	Name of the patient's referring physician.	- GUI Display - SC Image

Description / Module	Tag	VR	VM	Remark	Response Value is used for
Patient's Name	(0010,0010)	PN	1		- GUI Display - SC Image
Patient ID	(0010,0020)	LO	1		- GUI Display - SC Image
Issuer of Patient ID	(0010,0021)	LO	1	Identifier of the Assigning Authority (system, organization, agency, or department) that issued the Patient ID.	- SC Image
Patient‘s Birth Date	(0010,0030)	DA	1	Birth date of the patient.	- GUI Display - SC Image
Patient's Sex	(0010,0040)	CS	1	Sex of the named patient. Enumerated Values: M - male F - female O - other	- GUI Display - SC Image
Patient's Weight	(0010,1030)	DS	1	Weight of the Patient, in kg.	- GUI Display - SC Image
All other Attributes of the Patient Demographic Module		-	-	-	-
Patient's Age	(0010,1010)	AS	1	Age of the Patient.	- GUI Display - SC Image
Medical Alerts	(0010,2000)	LO	1-n	Conditions to which medical staff should be alerted (e.g. contagious condition, drug allergies, etc.)	- SC Image
Allergies	(0010,2110)	LO	1-n	Description of prior reaction to contrast agents, or other patient allergies or adverse reactions.	- GUI Display - SC Image

3.2.2.4 Association Acceptance Policy

3.2.2.4.1 Accepted Presentation Contexts

The Workflow Application Entity will accept Presentation Contexts as shown in the following table:

Table 4.2-19. Acceptable Presentation Contexts for Activity Worklist Update

Presentation Context Table					
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
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

3.2.2.4.1.1 SOP Specific Conformance for Verification SOP Class

The Workflow AE provides standard conformance to the Verification SOP Class as an SCP. If the C-ECHO request was successfully received, a 0000 (Success) status code will be returned in the C-ECHO response. Otherwise, a C000 (Error - Cannot Understand) status code will be returned in the C-ECHO response.

3.3 Network Interfaces

3.3.1 Physical Network Interface

ulrich medical RIS/PACS Interface supports a single network interface. One of the following physical network interfaces will be set automatically depending on installed hardware options.

Table 4.3-1. Supported Physical Network Interfaces

Ethernet 100baseT
Ethernet 10baseT

3.3.2 Additional Protocols

ulrich medical RIS/PACS Interface conforms to the System Management Profiles listed in the Table below. All requested transactions for the listed profiles and actors are supported. Supports for optional transactions are listed in the Table below:

Table 4.3-2. Supported System Management Profiles

Profile Name	Actor	Protocols Used	Optional Transactions	Security Support
Network Address Management	DHCP Client	DHCP	N/A	N/A
	DNS Client	DNS	N/A	N/A
Time Synchronization	NTP Client	NTP	N/A	N/A

3.3.2.1 DHCP

DHCP can be used to obtain TCP/IP network configuration information. Support for DHCP can be configured via the Service Settings. The network parameters obtainable via DHCP are shown in the Table below. No default used if the DHCP server does not provide a value. The Service Settings provide means to configure the machine name. If DHCP is not in use, TCP/IP network configuration information must be manually configured via the Service Settings Menu.

Table 4.3-3. Supported DHCP Parameters

DHCP Parameter	Default Value
IP Address	None
Default Gateway	Requested machine name
List of NTP servers	Empty list
List of DNS servers	Empty list
Routers	Empty list
Static routes	None
Domain name	None
Subnet mask	Derived from IP Address
Broadcast address	Derived from IP Address
Default router	None

If the DHCP server refuses to renew a lease on the assigned IP address all active DICOM Associations will be aborted.

3.3.2.2 NTP

One NTP Server IP address can be configured via the Service/Installation Screen. If no NTP Server is identified, then the local clock will be used as a time reference.

3.3.3 IPv4 and IPv6 Support

This product only supports IPv4 connections.

3.4 Configuration

3.4.1 AE Title/Presentation Address Mapping

3.4.1.1 Local AE Title

The local applications (Storage and Workflow) use the AE Title and TCP/IP Ports configured by the Network Administrator via the Network Settings Menu. No Default AE Title and no default TCP/IP Port is provided. Both must be configured during installation.

3.4.1.2 Remote AE Title/Presentation Address Mapping

The AE Title, host names and port numbers of remote applications must be configured by the network administrator via the **ulrich medical RIS/PACS Interface** Network Settings Menu.

3.4.1.2.1 Storage

The **ulrich medical RIS/PACS Interface** Network Settings Menu must be used to set the AE Titles, port-numbers, and IP addresses of the remote Storage SCPs. Associations will only be accepted from AE Titles as entered in the Network Settings Menu and associations from unknown AE Titles will be rejected. Up to three remote Storage SCPs can be defined. Any Storage SCP can be configured to be an "Archive" device.

3.4.1.2.2 Workflow

The **ulrich medical RIS/PACS Interface** Network Settings Menu must be used to set the AE Titles, port-numbers, and IP addresses of the remote Modality Worklist SCP. Only a single remote Modality Worklist SCP can be defined.

4. Media Interchange

The **ulrich medical RIS/PACS Interface** does not allow for importing/exporting image data with exchangeable media.

5. Support of Character Sets

All **ulrich medical RIS/PACS Interface** DICOM applications support the Defined Terms for Specific Character Set in Table 6.2-1.

Table 6.2-1: Supported Specific Character Set Defined Terms

Character Set Description	Defined Term
Latin alphabet No. 1	ISO_IR 100
Unicode in UTF-8	ISO_IR_192

6. Security

It is assumed that **ulrich medical RIS/PACS Interface** is used within a secured environment. It is assumed that a secured environment includes at a minimum:

a. Firewall or router protections to ensure that only approved external hosts have network access to the **ulrich medical RIS/PACS Interface**.

b. Firewall or router protections to ensure that the **ulrich medical RIS/PACS Interface** only has network access to approved external hosts and services.

c. Any communication with external hosts and services outside the locally secured environment use appropriate secure network channels (e.g., such as a Virtual Private Network (VPN)).

Other network security procedures such as automated intrusion detection may be appropriate in some environments. Additional security features may be established by the local security policy and are beyond the scope of this conformance statement.

6.1 Secure Transport Connection Profiles

The **ulrich medical RIS/PACS Interface** allows to select the following Secure Transport Connection Profiles as defined in DICOM PS3.15 2020e, B Secure Transport Connecrtion Profiles:

a. none.

b. BCP 195 TLS Secure Connection Profile.

c. Non-Downgrading BCP 195 TLS Secure Transport Connection Profile.

Security Transport Connection Files can be selected individually for each client (Workflow Application Entity and up to 3 Storage Application Entities).

6.1.1 BCP 195 TLS Secure Connection Profile

If this profile is selected, the client tries to connect to the server using TLS 1.2 and will try to negotiate with lower versions down to TLS 1.0 if the server rejects higher versions.

6.1.1.1 Trusted Certificates

The **ulrich medical RIS/PACS Interface** allows for installation of trusted certificates in pem format. Installation is done as part of the network configuration by the network administrator. All clients share the same trusted certificate folder.

6.1.1.2 Client Authentication

The **ulrich medical RIS/PACS Interface** supports client authentication. If enabled, the client will present its client certificate to the server for authentication.

6.1.1.2.1 Client Certificate

The **ulrich medical RIS/PACS Interface** allows for installation of one certificate in pem format. It is possible to provide the certificate private key as separate .key file or have the key embedded in the certificate file.
Installation is done as part of the network configuration by the network administrator. All clients share and provide the same client certificate. Hence the servers must provide the corresponding trusted certificate.

6.1.1.2.2 Private key passphrase

The private key is supposed to be passphrase protected. The passphrase must be entered as part of the network configuration if client authentication has been enabled. The passphrase must be at least 8 Characters long and must contain alphabetical upper/lower case characters, numbers and special characters.

6.1.1.3 Supported Cipher Suites

- TLS_DHE_RSA_WITH_AES_128_GCM_SHA256 (only TLS 1.2)
- TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 (only TLS 1.2)
- TLS_DHE_RSA_WITH_AES_256_GCM_SHA384 (only TLS 1.2)
- TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384 (only TLS 1.2)
- TLS_RSA_WITH_AES_128_CBC_SHA

- TLS_RSA_WITH_3DES_EDE_CBC_SHA

No additional cipher suites can be installed.

6.1.1.4 TLS Error Handling

The **ulrich medical RIS/PACS Interface** client using a BCP 195 security profile will act as follows, if connection is not established/dropped per the TLS protocol:

a. The client's status indicator will turn red (error) or orange (warning)
b. An error code will be displayed for the affected connection(s) on the Network Connection Overview Screen. See Table 7.1-1 below.

Table 7.1-1 TLS Error Codes

Error Code	Failure
C-3504	No trusted certificate found. Certificate file missing or corrupt.
C-3505	No client certificate found. Certificate file missing or corrupt.
C-3506	No client certificate key found. Key file missing or corrupt.
C-3507	Client certificate and key do not match.
C-3508	WARNING: At least one of the trusted certificate files will expire. This error code appears first 14 days ahead of the expiry date.
C-3509	WARNING: Client certificate file will expire. This error code appears first 14 days ahead of the expiry date.
C-3510	At least one of the trusted certificates in use did expire.
C-3511	Client certificate did expire.

6.1.2 Non-Downgrading BCP 195 TLS Secure Connection Profile

If this profile is selected, the client tries to connect to the server using TLS 1.2. It will not try to negotiate with lower versions if the server rejects higher versions.

All other statements made in **6.1.1 BCP 195 TLS Secure Connection Profile** also apply for the Non-Downgrading BCP 195 TLS Secure Connection Profile, however the supported cipher suites are reduced to TLS 1.2.

6.1.2.1 Supported Cipher Suites

- TLS_DHE_RSA_WITH_AES_128_GCM_SHA256
- TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256
- TLS_DHE_RSA_WITH_AES_256_GCM_SHA384
- TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384

No additional cipher suites can be installed.

6.2 Application Level Security

6.2.1 User authentication

a. The **ulrich medical RIS/PACS Interface** features can only be used if an authorized user is logged in.
   A strong password must be used for login.
   The user is logged out automatically after a configurable time of inactivity (5-30 minutes).
   The logged in user is recorded as operator in the secondary capture image.
   Login attempts are recorded in the system logs.

b. For network configuration a network administrator user is defined. The network administrator must be logged in in order to change any network setting.

c. For user configuration a key operator user is defined. The key operator, network administrator or service technician must be logged in to maintain user data..

7. Annexes

7.1 IOD Contents

7.1.1 Created SOP Instances

Table 8.1-1 specifies the attributes of Secondary Capture Image transmitted by the **ulrich medical RIS/PACS Interface** storage application.

The following tables use several abbreviations.

The abbreviations used in the "Presence of …" column are:

VNAP Value Not Always Present (attribute sent zero length if no value is present)

ANAP Attribute Not Always Present

ALWAYS Always Present

EMPTY Attribute is sent without a value

The abbreviations used in the "Source" column:

MWL the attribute value source Modality Worklist

USER the attribute value source is from User input

AUTO the attribute value is generated automatically

CONFIG the attribute value source is a configurable parameter

Note:

All dates and times are encoded in the local configured calendar and time. Date, Time and Time zone are configured using the Service/Installation Tool.

7.1.1.1 Secondary Capture Image IOD

Table 8.1-1. IOD of Created Secondary Capture SOP Instances

IE	Module	Reference	Presence of Module
Patient	Patient	Table 8.1-2	ALWAYS
Study	General Study	Table 8.1-3	ALWAYS
	Patient Study	Table 8.1-4	ALWAYS
Series	General Series	Table 8.1-5	ALWAYS
Equipment	General Equipment	Table 8.1-6	ALWAYS
	SC Equipment	Table 8.1-7	ALWAYS
Image	General Image	Table 8.1-8	ALWAYS
	Image Pixel	Table 8.1-9	ALWAYS
	SC Image Module	-	optional attributes, never
	SOP Common	Table 8.1-10	ALWAYS
	Enhanced Contrast/Bolus	Table 8.1-11	ALWAYS
	Private Application	Table 8.1-12	ALWAYS
	Extended DICOM Attributes	Table 8.1-13	ALWAYS

7.1.1.2 Modules

Table 8.1-2. Patient Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient's Name	(0010,0010)	PN	From Modality Worklist or user input. Values supplied via Modality Worklist will be entered as received. Values supplied via user input will contain First Name, Middle Name and last Name components (some possibly empty). Maximum 64 characters.	VNAP	MWL/USER
Patient ID	(0010,0020)	LO	From Modality Worklist or user input. Maximum 64 characters.	VNAP	MWL/USER
Issuer of Patient ID	(0010,0021)	LO	Identifier of the Assigning Authority (system, organization, agency, or department) that issued the Patient ID. From Modality Worklist.	VNAP	MWL

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient's Birth Date	(0010,0030)	DA	From Modality Worklist or user input	VNAP	MWL/USER
Patient's Sex	(0010,0040)	CS	From Modality Worklist or user input	VNAP	MWL/USER

NOTE: Either Patient's Name or Patient ID or both will be present.

Table 8.1-3. General Study Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Study Instance UID	(0020,000D)	UI	From Modality Worklist or generated by device	ALWAYS	MWL/AUTO
Study Date	(0008,0020)	DA	<YYYYMMDD>	ALWAYS	AUTO
Study Time	(0008,0030)	TM	<HHMMSS.FFFFFF>	ALWAYS	AUTO
Referring Physician's Name	(0008,0090)	PN	From Modality Worklist	VNAP	MWL
Study ID	(0020,0010)	SH	Fix value: 0	ALWAYS	AUTO
Accession Number	(0008,0050)	SH	From Modality Worklist or user input	VNAP	MWL/USER
Study Description	(0008,1030)	LO	Comment text box in study list. Maximum 1024 characters.	VNAP	USER

Table 8.1-4. Patient Study Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient's Age	(0010,1010)	AS	Calculated from Patient's Birth Date input on base of actual Date	ALWAYS	AUTO
Patient's Weight	(0010,1030)	DS	From Modality Worklist or user input	VNAP	MWL/USER
Patient's Size	(0010,1020)	DS	From Modality Worklist or user input	VNAP	MWL/USER
Medical Alerts	(0010,2000)	LO	From Modality Worklist	VNAP	MWL
Allergies	(0010,2110)	LO	From Modality Worklist	VNAP	MWL

Table 8.1-5. General Series Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Modality	(0008,0060)	CS	fix value: OT	ALWAYS	AUTO
Series Instance UID	(0020,000E)	UI	Generated by device	ALWAYS	AUTO
Series Number	(0020,0011)	IS	fix value: 0	ALWAYS	AUTO
Series Date	(0008,0021)	DA	<YYYYMMDD>	ALWAYS	AUTO
Series Time	(0008,0031)	TM	<HHMMSS.FFFFFF>	ALWAYS	AUTO
Operator‘s Name	(0008,1070)	PN	name of logged in operator.	ALWAYS	AUTO

Table 8.1-6. General Equipment Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Manufacturer	(0008,0070)	LO	**ulrich medical**	ALWAYS	AUTO
Manufacturer's Model Name	(0008,1090)	LO	**CT motion**	ALWAYS	AUTO

Table 8.1-7. SC Equipment Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Conversion Type	(0008,0064)	CS	fix value: **SYN (**synthetic image)	ALWAYS	AUTO
Secondary Capture Device ID	(0018,1010)	LO	model identifier	ALWAYS	AUTO
SC Device Manufacturer	(0018,1016)	LO	**ulrich medical**	ALWAYS	AUTO
SC Device Model Name	(0008,1018)	LO	**CT motion**	ALWAYS	AUTO
SC Device SW Versions	(0018,1019)	LO	Manufacturer's designation of software version of the Secondary Capture Device	ALWAYS	AUTO

Table 8.1-8. General Image Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Instance Number	(0020,0013)	IS	fix value: **1** (number identifying the image. Only one image is created).	ALWAYS	AUTO

Table 8.1-9. Image Pixel Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Samples per Pixel	(0028,0002)	US	fix value: **3**	ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	CS	fix value: **RGB**	ALWAYS	AUTO
Rows	(0028,0010)	US	fix value: **1600** (number of rows in the image)	ALWAYS	AUTO
Columns	(0028,0011)	US	fix value: **1200** (number of columns in the image)	ALWAYS	AUTO
Bits Allocated	(0028,0100)	US	fix value: **8** (bits allocated for each pixel sample)	ALWAYS	AUTO
Bits Stored	(0028,0101)	US	fix value: **8** (bits stored for each pixel sample)	ALWAYS	AUTO
High Bit	(0028,0102)	US	fix value: **7** (most significant bit for pixel sample data)	ALWAYS	AUTO
Pixel Representation	(0028,0103)	US	fix value: **0000H** (data representation of pixel data: unsigned integer)	ALWAYS	AUTO
Planar Configuration	(0028,0006)	US	fix value: **0 (**Indicates whether the pixel data are sent color-by-plane or color-by-pixel. 0 = by pixel, for RGB this means R1,G1,B1,R2,G2,B2,…)	ALWAYS	AUTO
Pixel Data	(7FE0,0010)	OB	data stream of the pixel samples that comprise the image.	ALWAYS	AUTO

Table 8.1-10. SOP Common Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
SOP Class UID	(0008,0016)	UI	fix value: **1.2.840.10008.5.1.4.1.1.7**	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	Generated by device (ulrich medical root UID 1.2.276.0.112 plus device id plus generated information.	ALWAYS	AUTO

Table 8.1-11. Enhanced Contrast/Bolus Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Contrast/Bolus Agent Sequence	(0018,0012)	SQ	Sequence that identifies one or more contrast agents administered prior to or during the acquisition.	ALWAYS	AUTO
>Include Table 8.8-1 "Code Sequence Macro Attributes"	-	-	*Baseline [DICOM] part 16 Section CID 12 "Radiographic Contrast Agent".*	-	-
>Code Value	(0008,0100)	SH	See [DICOM] part 3 Section 8.1. - **C-10120** (for saline) - **C-B0300** (for contrast media)	ALWAYS	AUTO
>Coding Scheme Designator	(0008,0102)	SH	See [DICOM] part 3 Section 8.2. - fix values	ALWAYS	AUTO
>Coding Scheme Version	(0008,0103)	SH	See [DICOM] part 3 Section 8.2. - fix value: **20160314**	ALWAYS	AUTO
>Code Meaning	(0008,0104)	LO	See [DICOM] part 3 Section 8.3. - **Water** (for saline media) - **Contrast Agent** (for contrast media)	ALWAYS	AUTO
>Contrast/Bolus Agent Number	(0018,9337)	US	Identifying number, unique within this SOP Instance, of the agent administered. The number shall be 1 for the first Item and increase by 1 for each subsequent Item.	ALWAYS	AUTO
>Contrast/Bolus Administration Route Sequence	(0018,0014)	SQ	Sequence that identifies the route of administration of contrast agent. Only a single Item shall be included in this Sequence.	ALWAYS	AUTO
>>Include Table 8.8-1 "Code Sequence Macro Attributes"	-	-	*Baseline [DICOM] part 16 Section CID 11 "Route of Administration".*	-	-
>>Code Value	(0008,0100)	SH	See [DICOM] part 3 Section 8.1. - fix value: **G-D101**	ALWAYS	AUTO

Attribute Name	Tag	VR	Value	Presence of Value	Source
>>Coding Scheme Designator	(0008,0102)	SH	See [DICOM] part 3 Section 8.2. - fix value: **SRT**	ALWAYS	AUTO
>>Coding Scheme Version	(0008,0103)	SH	See [DICOM] part 3 Section 8.2. - fix value: **20160314**	ALWAYS	AUTO
>>Code Meaning	(0008,0104)	LO	See [DICOM] part 3 Section 8.3. - fix value: **Intravenous route**	ALWAYS	AUTO
>Contrast/Bolus Ingredient Code Sequence	(0018,9338)	SQ	Active ingredient of agent. Zero or more Items shall be included in this Sequence.	ALWAYS	AUTO
>>Include Table 8.8-1 "Code Sequence Macro Attributes"	-	-	*Baseline [DICOM] part 16 Section CID 13 "Radiographic Contrast Agent Ingredient".*	-	-
>Code Value	(0008,0100)	SH	See [DICOM] part 3 Section 8.1. - **C-10120** (for saline) - **C-11400** (for contrast media, Iodine)	ALWAYS	AUTO
>Coding Scheme Designator	(0008,0102)	SH	See [DICOM] part 3 Section 8.2. - fix value: **SRT**	ALWAYS	AUTO
>Coding Scheme Version	(0008,0103)	SH	See [DICOM] part 3 Section 8.2. - fix value: **20051101**	ALWAYS	AUTO
>Code Meaning	(0008,0104)	LO	See [DICOM] part 3 Section 8.3. - **Water** (for saline media) - **Iodine** (for contrast media)	ALWAYS	AUTO
>Contrast/Bolus Volume	(0018,1041)	DS	Total volume administered in milliliters of diluted contrast agent.	ALWAYS	AUTO
>Contrast/Bolus Ingredient Concentration	(0018,1049)	DS	Contrast Agent: Milligrams of active ingredient per milliliter of agent.	VNAP	USER
>Contrast/Bolus Ingredient Percent by Volume	(0052,0001)	FL	Saline: Percentage by volume of active ingredient in the total volume.	VNAP	USER
>Contrast Administration Profile Sequence	(0018,9340)	SQ	Sequence that describes one or more phases of contrast administered. One or more Items are permitted in this Sequence.	ALWAYS	AUTO
>>Contrast/Bolus Volume	(0018,1041)	DS	Volume administered during this phase in milliliters of diluted contrast agent.	ALWAYS	AUTO
>>Contrast/Bolus Start Time	(0018,1042)	TM	Time of start of administration. Note: only used for injected sequence representation, not for programmed sequence	VNAP	AUTO
>>Contrast/Bolus Stop Time	(0018,1043)	TM	Time of end of administration. Note: only used for injected sequence representation, not for programmed sequence	VNAP	AUTO
>>Contrast Flow Rate	(0018,1046)	DS	Rate of administration in milliliters/sec. Only a single value shall be present.	ALWAYS	AUTO

Attribute Name	Tag	VR	Value	Presence of Value	Source
>>Contrast Flow Duration	(0018,1047)	DS	Duration of injection in seconds. Only a single value shall be present.	ALWAYS	AUTO
>>additional Private tags	-	-	provided for applications that want to read the media type per phase	-	
>>Private Creator	(0101,0010)	LO	**ulrich medical CTmotion - Private Tags**	-	
>> Media Type	(0101,101A)	LO	Media Type: - **Contrast agent** - **Water**	ALWAYS	AUTO
additional DICOM tags	-	-	-	-	
Contrast/Bolus Agent	(0018,0010)	LO	Contrast Agent Name	VNAP	USER

Table 8.1-12. Private Application Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Private Creator	(0101,0010)	LO	**ulrich medical CTmotion - Private Tags**	ALWAYS	AUTO
Injection Program	(0101,1010)	LO	Program Name of the Injection	VNAP	USER
Contrast Agent	(0101,101B)	LO	The name of the contrast agent used for injection. Copy of (0018,0010) for applications not supporting Enhanced Contrast/Bolus module.	VNAP	USER
Contrast Agent Concentration	(0101,101C)	SH	The concentration in mg/ml of the contrast agent used for injection. Copy of (0018,1049) for applications not supporting Enhanced Contrast/Bolus module	VNAP	USER
Contrast Media Container Volume	(0101,1020)	SH	Contrast Media Container Volume	VNAP	USER
Contrast Media Lot Number	(0101,1021)	LO	Contrast Media Lot Number	VNAP	USER
Contrast Media Expiry Date	(0101,1022)	DA	Contrast Media Expiry Date	VNAP	USER
Saline Media Container Volume	(0101,1030)	SH	Saline Media Container Volume	VNAP	USER
Saline Media Lot Number	(0101,1031)	LO	Saline Media Lot Number	VNAP	USER
Saline Media Expiry Date	(0101,1032)	DA	Saline Media Expiry Date	VNAP	USER
Operator ID	(0101,1040)	LO	Operator ID	ALWAYS	AUTO
Operator Annotations	(0101,1041)	ST	Operator Annotations	VNAP	USER

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient eGFR	(0101,1050)	SH	Patient eGFR	VNAP	USER
Patient eGFR Lab Date	(0101,1051)	DA	Patient eGFR Lab Date	VNAP	USER
Cannula Size	(0101,1052)	SH	Cannula Size	VNAP	USER
Injection Time	(0101,1060)	SH	Injection Time	ALWAYS	AUTO
Injection Pressure Maximum	(0101,1061)	SH	Injection Pressure Maximum	ALWAYS	AUTO
Injection Total Volume Contrast	(0101,1065)	SH	Injection Total Volume Contrast	ALWAYS	AUTO
Injection Total Volume Saline	(0101,1066)	SH	Injection Total Volume Saline	ALWAYS	AUTO
Injection Total Volume	(0101,1067)	SH	Injection Total Volume	ALWAYS	AUTO
Programmed Injection Time	(0101,1070)	SH	Programmed Injection Time	ALWAYS	AUTO
Programmed Pressure Limit	(0101,1071)	SH	Programmed Pressure Limit	ALWAYS	AUTO
Programmed Total Volume Contrast	(0101,1075)	SH	Programmed Total Volume Contrast	ALWAYS	AUTO
Programmed Total Volume Saline	(0101,1076)	SH	Programmed Total Volume Saline	ALWAYS	AUTO
Programmed Total Volume	(0101,1077)	SH	Programmed Total Volume	ALWAYS	AUTO
Programmed Injection Sequence	(0101,10a0)	SQ	Programmed Injection Bolus Sequence	ALWAYS	AUTO
> Contrast/Bolus Agent Sequence	(0018,0012)	SQ	see **Table 8.1-11. Enhanced Contrast/Bolus Module of Created SOP Instances**	-	-

Table 8.1-13. Extended DICOM Attributes Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Requesting Physician	(0032,1032)	PN	Name of the physician who requested the study.	VNAP	AUTO
Requested Procedure Description	(0032,1060)	LO	The Requested Procedure Description (0032,1060) or the Requested Procedure Code Sequence (0032,1064) or both shall be supported by the SCP.	VNAP	USER
Requested Contrast Agent	(0032,1070)	LO	Contrast agent requested for use in the Scheduled Procedure Step.	VNAP	USER
Scheduled Performing Physician's Name	(0040,0006)	PN	Scheduled Performing Physician's Name shall be retrieved with Single Value Matching or Wild Card Matching.	VNAP	USER

Attribute Name	Tag	VR	Value	Presence of Value	Source
Scheduled Procedure Step Description	(0040,0007)	LO	Institution-generated description or classification of the Scheduled Procedure Step to be performed.	VNAP	USER

7.1.2 Used Fields in Received IOD By Application

The **ulrich medical RIS/PACS Interface** storage application does not receive SOP Instances. The usage of attributes received via Modality Worklist is described in **Table 4.2-**.

7.1.3 Attribute Mapping

The relationships between attributes received via Modality Worklist and stored in the SC Image created are summarized in **Table 8.1-31.**. There is no relation between Modality Worklist and the SC Image attributes for attributes not listed in the table.

Attributes that may be changed by the user before being stored are marked (U).

Table 8.1-31. Attribute Mapping Between Modality Worklist and SC Image

Modality Worklist	SC Image IOD
Study Date	Study Date
Study Time	Study Time
Accession Number	Accession Number (U)
Referring Physician's Name	Referring Physician's Name
Patient Name	Patient Name (U)
Patient ID	Patient ID (U)
Issuer of Patient ID	Issuer of Patient ID
Patient's Birth Date	Patient's Birth Date (U)
Patient's Sex	Patient's Sex (U)
Patient’s Age	Patient’s Age (U)
Patient's Weight	Patient's Weight (U)
Medical Alerts	Medical Alerts
Allergies	Allergies
Study Instance UID	Study Instance UID
Requesting Physician	Requesting Physician
Requested Procedure Description	Requested Procedure Description (U)

Modality Worklist	SC Image IOD
Requested Contrast Agent	Requested Contrast Agent
Scheduled Performing Physician's Name	Scheduled Performing Physician's Name
Scheduled Procedure Step Description	Scheduled Procedure Step Description

7.1.4 Coerced/Modified Fields

The Modality Worklist AE will truncate attribute values received in the response to a Modality Worklist Query if the value length is longer than the maximum length permitted by the attribute's VR.

7.1.5 Data Dictionary of Private Attributes

The Private Attributes added to created SOP Instances are listed in Table 8.2-1. **ulrich medical RIS/PACS Interface** reserves blocks of private attributes in groups **0101**. Further details on usage of these private attributes are contained in section 7.1 IOD Contents.

Table 8.2-1. Data Dictionary of Private Attributes

Tag	Attribute Name	VR	VM	Attribute Description
(0101,0010)	Private Creator	LO	1	**ulrich medical CTmotion - Private Tags**
(0101,1010)	Injection Program	LO	1	Program Name of the Injection
(0101,101A)	Media Type	LO	1	Media Type used for a bolus phase: **- Contrast Agent** **- Water**
(0101,101B)	Contrast Agent	LO	1	The name of the contrast agent used for injection. Copy of (0018,0010) for applications not supporting Enhanced Contrast/Bolus module.
(0101,101C)	Contrast Agent Concentration	SH	1	The concentration in mg/ml of the contrast agent used for injection. Copy of (0018,1049) for applications not supporting Enhanced Contrast/Bolus module
(0101,1020)	Contrast Media Container Volume	SH	1	Contrast Media Container Volume
(0101,1021)	Contrast Media Lot Number	LO	1	Contrast Media Lot Number
(0101,1022)	Contrast Media Expiry Date	DA	1	Contrast Media Expiry Date
(0101,1030)	Saline Media Container Volume	SH	1	Saline Media Container Volume
(0101,1031)	Saline Media Lot Number	LO	1	Saline Media Lot Number
(0101,1032)	Saline Media Expiry Date	DA	1	Saline Media Expiry Date
(0101,1040)	Operator ID	LO	1	Operator ID
(0101,1041)	Operator Annotations	ST	1	Operator Annotations

Tag	Attribute Name	VR	VM	Attribute Description
(0101,1050)	Patient eGFR	SH	1	Patient eGFR
(0101,1051)	Patient eGFR Lab Date	DA	1	Patient eGFR Lab Date
(0101,1052)	Cannula Size	SH	1	Cannula Size
(0101,1060)	Injection Time	SH	1	Injection Time
(0101,1061)	Injection Pressure Maximum	SH	1	Injection Pressure Maximum
(0101,1065)	Injection Total Volume Contrast	SH	1	Injection Total Volume Contrast
(0101,1066)	Injection Total Volume Saline	SH	1	Injection Total Volume Saline
(0101,1067)	Injection Total Volume	SH	1	Injection Total Volume
(0101,1070)	Programmed Injection Time	SH	1	Programmed Injection Time
(0101,1071)	Programmed Pressure Limit	SH	1	Programmed Pressure Limit
(0101,1075)	Programmed Total Volume Contrast	SH	1	Programmed Total Volume Contrast
(0101,1076)	Programmed Total Volume Saline	SH	1	Programmed Total Volume Saline
(0101,1077)	Programmed Total Volume	SH	1	Programmed Total Volume
(0101,10a0)	Programmed Injection Sequence	SQ	1	Programmed Injection Bolus Sequence
(0018,0012)	> Contrast/Bolus Agent Sequence	SQ	1	see **Table 8.1-11. Enhanced Contrast/Bolus Module of Created SOP Instances**

7.2 Standard Extended / Specialized / Private SOP Classes

No Specialized or Private SOP Classes are supported.

7.3 Private Transfer Syntaxes

No Private Transfer Syntaxes are supported.

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