



DICOM Conformance Statement

VISUREF 150

Version 1.0

Carl Zeiss Meditec AG

Goeschwitzer Strasse 51-52

07745 Jena

Germany

www.zeiss.com/med

1 Conformance Statement Overview

The ZEISS VISUREF 150 is an entry-level autorefractor/keratometer. It allows the measurement of objective refraction including sphere, cylinder, axis. Furthermore, the device determines the central keratometry values of the eye, consisting of corneal radii and the axis. Data on pupil distance between both eyes is also recorded. In pupil mode, diameters, e.g. pupil diameter or white-to-white distance, can be measured manually. In image mode, the user can capture up to 2 images per eye and manipulate illumination parameters. In contact lens mode, the device can measure the base curve of contact lenses. It is used in the ophthalmic workflow to do objective refraction assessment of the patient eye, usually during pre-testing.

This document is structured as suggested in the DICOM Standard (PS 3.2: Conformance).

Table 1-1 Network Services Supported

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Ophthalmic Photography 8 Bit Image Storage	Yes	No
Encapsulated PDF Storage	Yes	No
Autorefraction Measurements Storage	Yes	No
Keratometry Measurements Storage	Yes	No
Workflow Management		
Verification	Yes	No
Modality Worklist Information Model - FIND	Yes	No
Query / Retrieve		
Patient Root Query/Retrieve Information Model - FIND	Yes	No

VISUREF 150 does not support Media Interchange.

2 Table of Contents

1	Conformance Statement Overview	2
2	Table of Contents	3
3	Introduction	5
3.1	Revision History	5
3.2	Audience	5
3.3	Remarks	5
3.4	Definitions and Terms	5
3.5	Abbreviations	7
3.6	References	8
4	Networking	9
4.1	Implementation Model	9
4.1.1	Application Data Flow	9
4.1.2	Functional Definition of AEs	9
4.1.2.1	Functional Definition of VISUREF 150	9
4.1.3	Sequencing of Real-World Activities	10
4.1.3.1	VISUREF 150 Activities	10
4.1.3.2	Scheduled Case	11
4.1.3.3	Unscheduled Case	12
4.2	AE Specifications	13
4.2.1	VISUREF 150 AE Specification	13
4.2.1.1	SOP Classes	13
4.2.1.2	Associations Policies	13
4.2.1.2.1	General	13
4.2.1.2.2	Number of Associations	13
4.2.1.2.3	Asynchronous Nature	13
4.2.1.2.4	Implementation Identifying Information	13
4.2.1.3	Association Initiation Policy	13
4.2.1.3.1	Activity – Verify communication	13
4.2.1.3.2	Activity – Query for worklist items	16
4.2.1.3.3	Activity – Query for patient data	21
4.2.1.3.4	Activity – Send acquired data	26
4.2.1.4	Association Acceptance Policy	28
4.3	Network Interfaces	28
4.3.1	Physical Network Interface	28
4.3.2	Additional Protocols	29
4.3.3	IPv4 and IPv6 Support	29
4.4	Configuration	29
4.4.1	AE Title/Presentation Address Mapping	29
4.4.1.1	Local AE Titles	29
4.4.1.2	Remote AE Titles/Presentation Address Mapping	29
4.4.1.2.1	Workflow Management	29
4.4.1.2.2	Storage and Query/Retrieve	29
4.4.2	Parameters	29
5	Media Interchange	31
6	Support of Character Sets	32
7	Security	33
8	Annexes	34
8.1	IOD Contents	34
8.1.1	Created SOP Instance(s)	34
8.1.1.1	Autorefractive Measurements Information Object Definition	35
8.1.1.2	Keratometry Measurements Information Object Definition	35

8.1.1.3	Ophthalmic Photography 8 Bit Image Information Object Definition	36
8.1.1.4	Encapsulated PDF Information Object Definition.....	37
8.1.1.5	Common Modules	39
8.1.1.6	Autorefractometry Measurements IOD Modules	40
8.1.1.7	Keratometry Measurements IOD Modules	43
8.1.1.8	Ophthalmic Photography 8 Bit Image IOD Modules	45
8.1.1.9	Encapsulated PDF IOD Modules	49
8.1.2	Usage of Attributes from Received IOD's	51
8.1.3	Attribute Mapping.....	52
8.1.4	Coerced/Modified Fields	53
8.2	Data Dictionary of Private Attributes	53
8.3	Coded Terminology and Templates	54
8.3.1	Context Groups	54
8.3.2	Template Specifications	54
8.3.3	Private Code Definitions.....	54
8.4	Grayscale Image Consistency	54
8.5	Standard Extended / Specialized/ Private SOP Classes.....	54
8.6	Private Transfer Syntaxes	55

3 Introduction

3.1 Revision History

Table 3-1 Revision History

Document Version	Date	Author	Changes
1.0	2020-09-17	J. Riesmeier	Initial version

3.2 Audience

This document is written for the people that need to understand how VISUREF 150 will integrate into their healthcare facility. This includes both those responsible for overall imaging 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.

3.3 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between VISUREF 150 and other DICOM products. The Conformance Statement 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 Conformance Statement 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.

3.4 Definitions and Terms

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

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.

Joint Photographic Experts Group (JPEG)

A set of standardized image compression techniques, available for use by DICOM applications.

Matching Key

A Query Key that is used for matching (criteria to be used in the C-FIND request to determine whether an entity matches the query).

Media Application Profile

The specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs).

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.

Protocol Data Unit (PDU)

A packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Query Key

An input value for a query process. Query Keys denote the set of Attributes that are sent from the SCU to the SCP and thus control the result of the query.

Return Key

A Query Key that may be used to specify desired return Attributes (what information in addition to the Matching Key Attributes has to be returned in the C-FIND response).

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 (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 (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.

3.5 Abbreviations

Table 3-2 Abbreviations used in this Document

Abbreviation	Definition
ACSE	Association Control Service Element
ANAP	Attribute is not always present – applicable to type 3 Attributes
AE	Application Entity
APP	Application
ASCII	American Standard Code for Information Interchange
AUTO	Automatically generated, cannot be modified by the operator

CONFIG	Configurable parameter
CZM	Carl Zeiss Meditec
DEF	Default Value
DHCP	Dynamic Host Configuration Protocol
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
DNS	Domain Name System
EBE	Explicit VR Big Endian
ELE	Explicit VR Little Endian
ID	Identifier
ILE	Implicit VR Little Endian
IOD	Information Object Definition
IP	Internet Protocol
ISO	International Organization for Standardization
LAN	Local Area Network
MWL	Modality Worklist
NEMA	National Electrical Manufacturers Association
NTP	Network Time Protocol
PDF	Portable Document Format
PDU	Protocol Data Unit
PL	Pick list
PRQ	Patient Root Query
SCP	Service Class Provider
SCU	Service Class User
SOP	Service Object Pair, union of a specific DICOM service and related IOD
TCP	Transmission Control Protocol
UCS	Universal Coded Character Set
UID	Unique Identifier
USER	User input
UTF	UCS Transformation Format
VNAP	Value not always present (Attribute sent zero length if no value is present) – applicable to type 2 and 2C Attributes
VPN	Virtual Private Network
VR	Value Representation

3.6 References

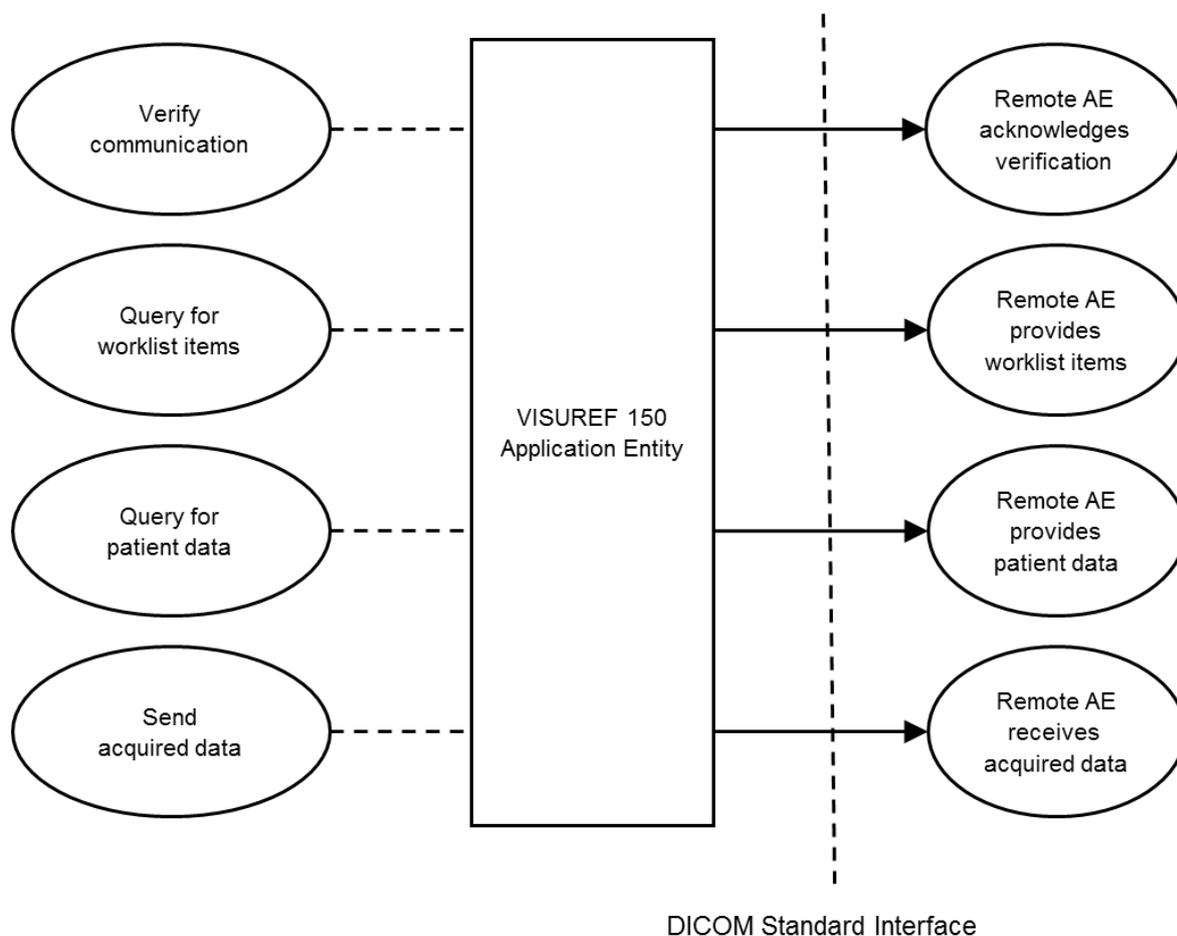
NEMA PS3 / ISO 12052, Digital Imaging and Communications in Medicine (DICOM) Standard, National Electrical Manufacturers Association, Rosslyn, VA, USA (available free at <http://medical.nema.org/>).

4 Networking

4.1 Implementation Model

4.1.1 Application Data Flow

Figure 4-1 Functional Overview



4.1.2 Functional Definition of AEs

Conceptually, the networking services that are implemented by the VISUREF 150 Application Software may be modeled as a single Application Entity (AE).

4.1.2.1 Functional Definition of VISUREF 150

The VISUREF 150 is an entry-level autorefractor/keratometer. It allows the measurement of objective refraction including sphere, cylinder, axis. Furthermore, the device determines the central keratometry values of the eye, consisting of corneal radii and the axis. Data on pupil distance between both eyes is also recorded. In pupil mode, diameters, e.g. pupil diameter or white-to-white distance, can be measured manually. In image mode, the user can capture up to 2 images per eye and manipulate illumination parameters. In contact lens mode, the device can measure the base curve of contact lenses. It is used in the ophthalmic workflow to do objective refraction assessment of the patient eye, usually during pre-testing.

The VISUREF 150 Application Entity allows for:

- Verifying the communication with a remote AE

- Querying a remote AE for worklist items
- Querying a remote AE for patient data
- Sending acquired data to a remote AE

In order to achieve this, the VISUREF 150 Application Entity implements a Service Class User (SCU) for the following DICOM services:

- Verification
- Modality Worklist Information Model - FIND
- Patient Root Query/Retrieve Information Model – FIND
- Ophthalmic Photography 8 Bit Image Storage
- Encapsulated PDF Storage
- Autorefractometry Measurements Storage
- Keratometry Measurements Storage

Most of the DICOM functionality has been integrated into the usual application user interface and will not require any manual invocation of DICOM-specific operations.

The VISUREF 150 Application Software logs extensive information about the DICOM operations to its log file.

4.1.3 Sequencing of Real-World Activities

4.1.3.1 VISUREF 150 Activities

Verify communication

After configuring and enabling the DICOM network interface, the VISUREF 150 Application Entity issues a verification request: first to the remote Modality Worklist Management SCP, then – if this was successful – to the remote Storage and Query/Retrieve SCP. If the verification fails in both cases, the DICOM interface is disabled.

Query for worklist items

If configured accordingly and verification was successful, the VISUREF 150 Application Entity queries the remote Modality Worklist Management SCP for worklist items. A query is issued automatically in a configurable update interval. In addition, the user can update the worklist manually by pressing the “update” button. The resulting worklist items of a query are shown on the user interface in a pick list (Patient Schedule). Details on the requested and displayed DICOM Attributes can be found in Table 4-11.

This activity generates a Scheduled Case.

Query for patient data

If configured accordingly and verification was successful, the VISUREF 150 Application Entity queries the remote Query/Retrieve SCP for patient data. A first (dummy) query is issued automatically when setting up the DICOM network interface. If no patient data is available from the worklist during normal operation, the user can query manually for patient data using one or more supported Matching Key Attributes (see Table 4-15). The resulting patient list is shown on the user interface in a pick list (Search Results).

This activity generates an Unscheduled Case.

Send acquired data

After a measurement has been made and the user pressed the “finish” button, the acquired measurement data is converted, enriched with data from the currently selected item of the pick list and stored in DICOM format. Depending on the type of measurement, SOP Instances of various SOP Classes are created. If configured accordingly and verification was successful, the VISUREF 150 Application Entity then transfers the created SOP Instances to the remote Storage SCP.

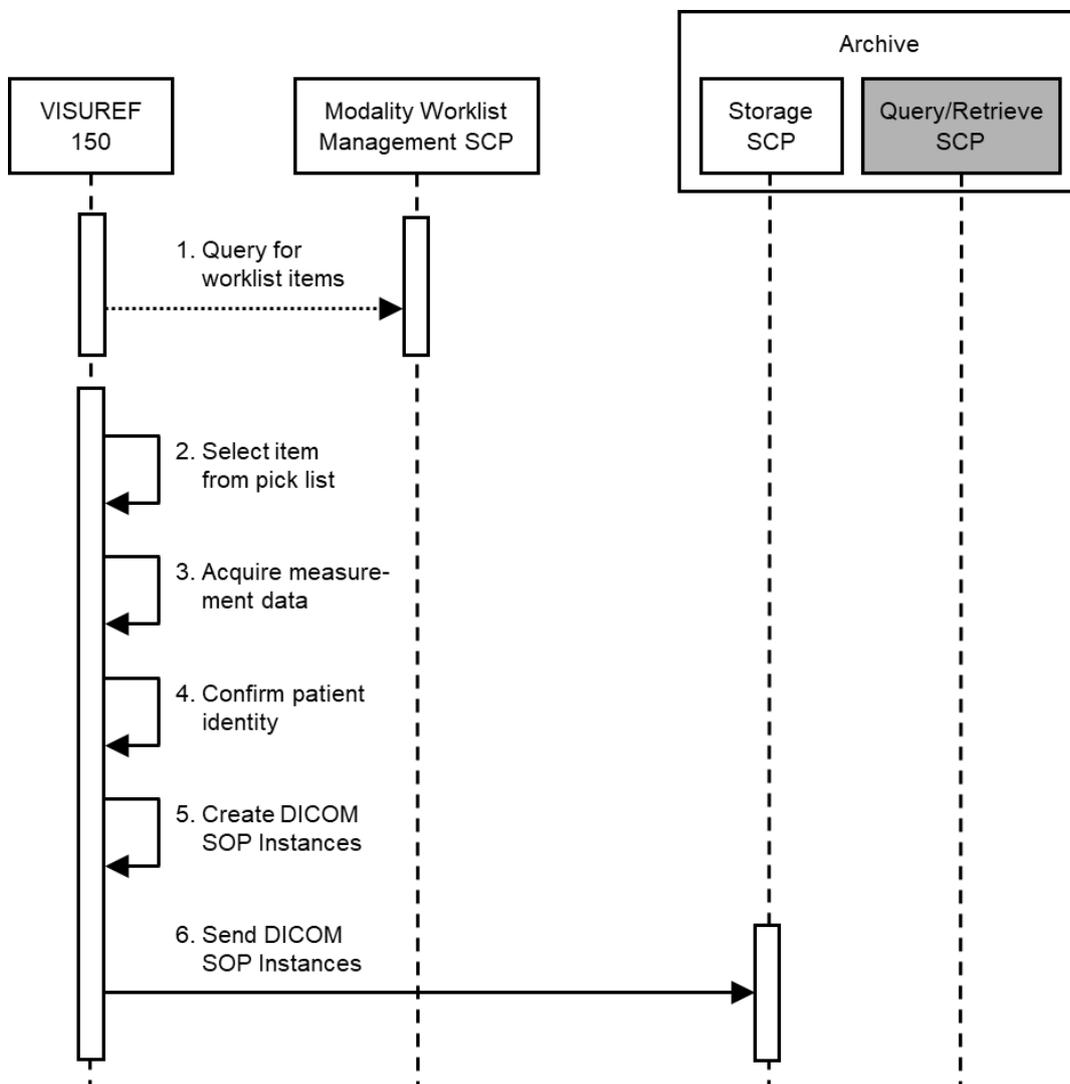
4.1.3.2 Scheduled Case

Usually, the patient arrives at the front desk and the examination has either been scheduled in advance or can be scheduled directly. In any case, all patient- and study-related information is available at the Modality Worklist Management SCP and can therefore be queried by the VISUREF 150 Application Entity.

The procedure is as follows: After the current work list has been received (asynchronously in the background), the user selects the appropriate item from the pick list, acquires the measurement data and confirms the identity of the patient. Finally, the DICOM SOP instances are created with data from the selected worklist item and sent to the Storage SCP.

Figure 4-2 shows the sequence of activities for this “Scheduled Case”.

Figure 4-2 Scheduled Case



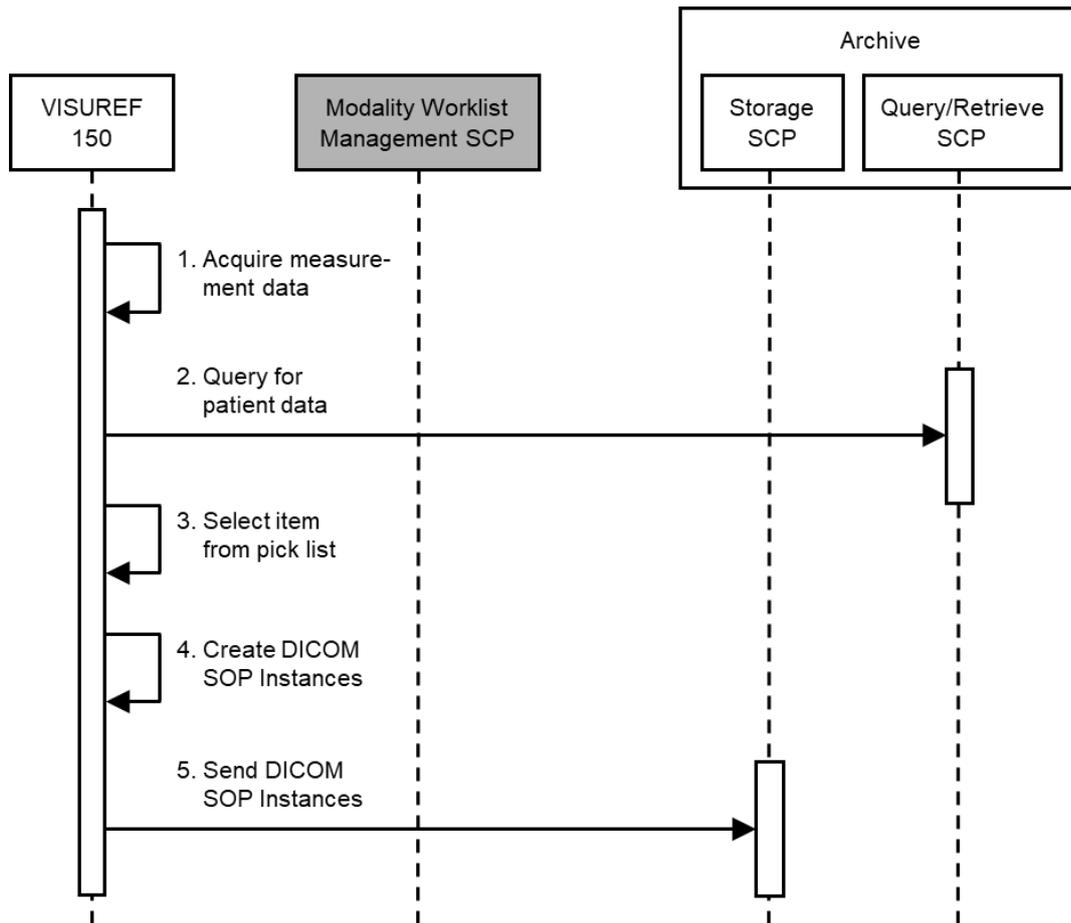
4.1.3.3 Unscheduled Case

If the patient arrives directly at the instrument, so that the patient was not registered at the front desk, or if there is no Modality Worklist Management SCP available, the examination could not be scheduled or the current worklist cannot be requested, respectively. Since no patient-related data can be entered manually to the instrument, a query for patient data has to be issued to the configured Query/Retrieve SCP. The VISUREF 150 Application Entity does not support storing measurement data for an “anonymous patient”.

The procedure is as follows: After the measurement data has been acquired, the user is asked to define a query and select the desired item from the resulting pick list (Search Results). Finally, the DICOM SOP Instances are created with patient data from the selected item and sent to the Storage SCP.

Figure 4-3 shows the sequence of activities for this “Unscheduled Case”.

Figure 4-3 Unscheduled Case



4.2 AE Specifications

4.2.1 VISUREF 150 AE Specification

4.2.1.1 SOP Classes

The VISUREF 150 Application Entity provides Standard Conformance to the following SOP Classes:

Table 4-1 SOP Classes for VISUREF 150

SOP Class Name	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	Yes	No
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	Yes	No
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes	No
Autorefractometry Measurements Storage	1.2.840.10008.5.1.4.1.1.78.2	Yes	No
Keratometry Measurements Storage	1.2.840.10008.5.1.4.1.1.78.3	Yes	No
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	No
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Yes	No

4.2.1.2 Associations Policies

4.2.1.2.1 General

The DICOM standard Application Context Name for DICOM 3.0 is always proposed:

Table 4-2 DICOM Application Context

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

4.2.1.2.2 Number of Associations

Table 4-3 Number of Associations as an Association Initiator for VISUREF 150

Maximum number of simultaneous Associations	1
---	---

4.2.1.2.3 Asynchronous Nature

The VISUREF 150 Application Entity does not support asynchronous communication (multiple outstanding transactions over a single Association).

4.2.1.2.4 Implementation Identifying Information

Table 4-4 DICOM Implementation Class and Version for VISUREF 150

Implementation Class UID	1.2.276.0.7230010.3.0.3.6.4
Implementation Version Name	OFFIS_DCMTK_364

4.2.1.3 Association Initiation Policy

4.2.1.3.1 Activity – Verify communication

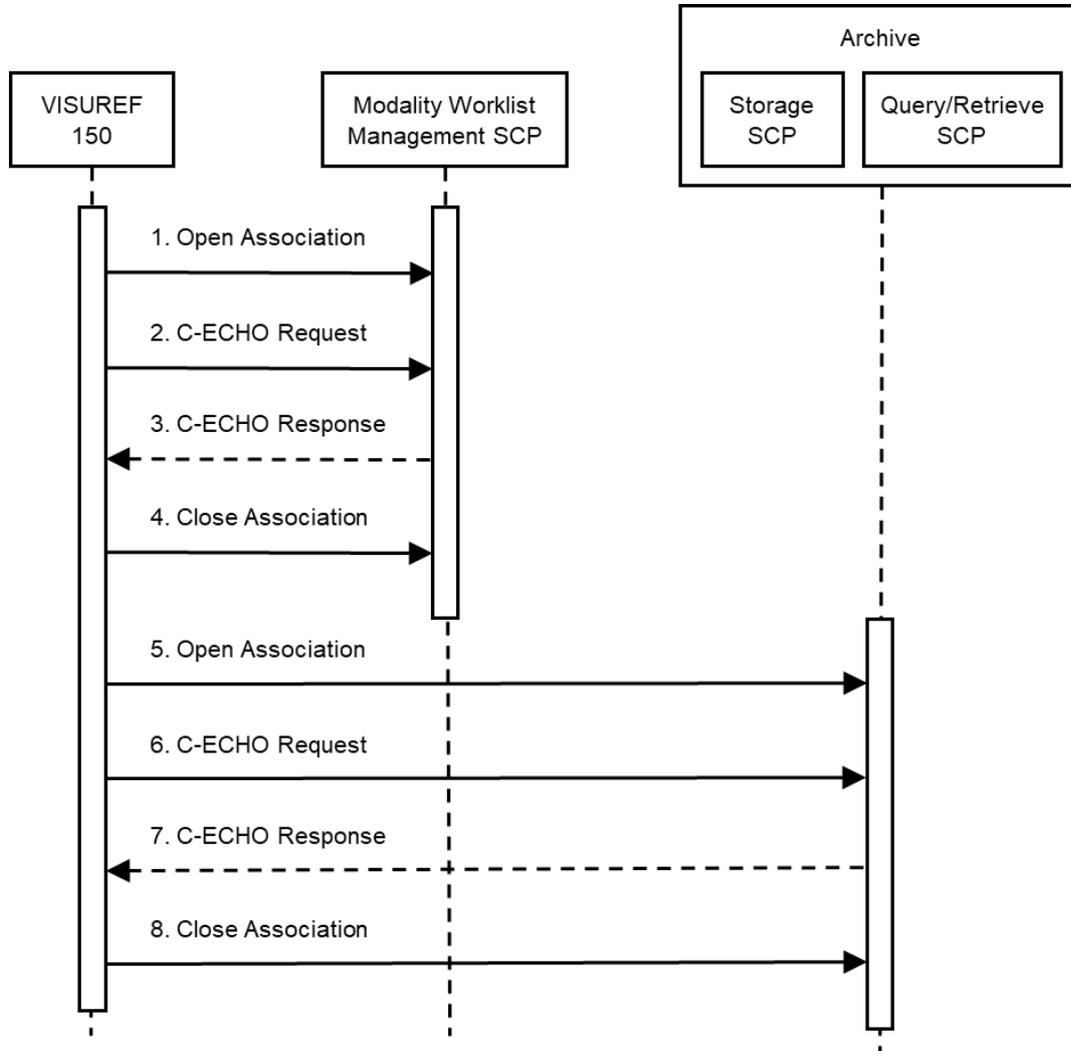
4.2.1.3.1.1 Description and Sequencing of Activities

This activity is used during the configuration phase. It facilitates the setup and management of the DICOM Application Entities, both the local and the remote ones. After configuring and enabling the

DICOM network interface, the VISUREF 150 Application Entity issues a verification request: first to the remote Modality Worklist Management SCP, then – if this was successful – to the remote Storage and Query/Retrieve SCP. If either of them fails, the DICOM interface is disabled. Details can be found in the log file.

Figure 4-4 shows the sequence of activities for “Verify communication”.

Figure 4-4 Sequencing of Activity “Verify communication”



4.2.1.3.1.2 Proposed Presentation Contexts

The following Presentation Contexts are proposed for each initiated Association.

Table 4-5 Proposed Presentation Contexts for Activity “Verify communication”

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg
Name	UID 1.2.840.10008. ...	Name List	UID List 1.2.840.10008. ...		
Verification	1.1	ILE	1.2	SCU	None

4.2.1.3.1.2.1 Extended Negotiation

No Extended Negotiation is performed.

4.2.1.3.1.3 SOP Specific Conformance

4.2.1.3.1.3.1 SOP Specific Conformance to Verification SOP Class

The VISUREF 150 Application Entity provides Standard Conformance to the Verification SOP Class as an SCU.

The VISUREF 150 Application Entity will behave as described in Table 4-6 when receiving the C-ECHO response command message.

Table 4-6 C-ECHO Response Status Handling Behavior for Activity “Verify communication”

Service Status	Further Meaning	Error Code	Reason
Warning	Warning	Bxxx (or 0107 or 0116)	The remote AE returned a status code of the class “Warning” (which is not specified for the C-ECHO command). Details are reported to a log file that is available to administrators.
Success	Success	0000	The requested Verification was confirmed by the remote AE. No message is displayed on the user interface but details are reported to a log file that is available to administrators.
		All other codes	The remote AE returned a status code of some other class. This is not treated as an error. Details are reported to a log file that is available to administrators.

Table 4-7 Communication Failure Behavior for Activity “Verify communication”

Exception	Behavior
TCP/IP connection could not be established within the specified time range (configurable parameter).	The DICOM interface is disabled. An error message is displayed on the user interface. Details are reported to a log file that is available to administrators.
Data could not be sent or received on a network socket within the specified time range (configurable parameter).	The DICOM interface is disabled. An error message is displayed on the user interface. Details are reported to a log file that is available to administrators.
ACSE response message could not be received within the specified time range (configurable parameter).	The DICOM interface is disabled. An error message is displayed on the user interface. Details are reported to a log file that is available to administrators.
DIMSE response message could not be received within the specified time range (configurable parameter).	The DICOM interface is disabled. An error message is displayed on the user interface. Details are reported to a log file that is available to administrators.
Association aborted by the SCP using A-ABORT or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure).	The DICOM interface is disabled. An error message is displayed on the user interface. Details are reported to a log file that is available to administrators.

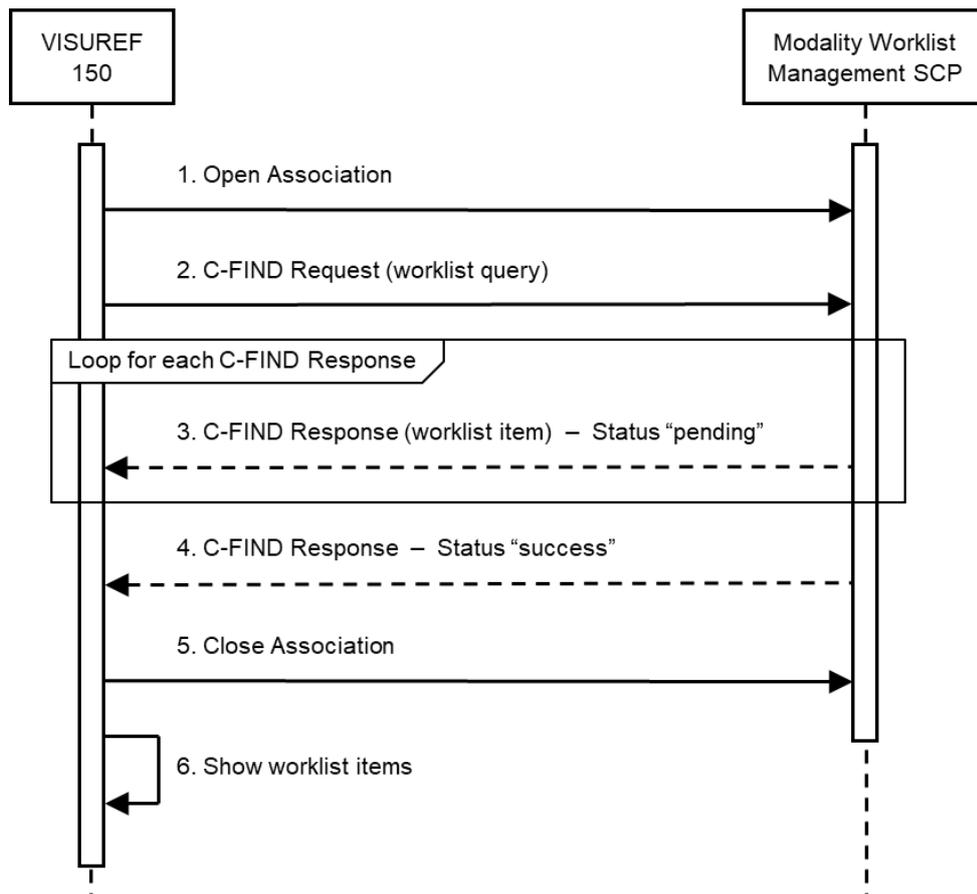
4.2.1.3.2 Activity – Query for worklist items

4.2.1.3.2.1 Description and Sequencing of Activities

This activity is used by the VISUREF 150 Application Entity to query a remote Modality Worklist Management SCP for worklist items. Such a query is issued automatically in a configurable update interval. The resulting worklist items of such a query are shown on the user interface in a pick list (Patient Schedule), which is limited to 9 worklist items. In addition, the user can update the worklist manually by pressing the “update” button within the data allocation process which is triggered when finalizing workflow for unscheduled case/anonymous patients (valid for data allocation mode enhanced only). In this context the complete list of worklist items can be accessed. If no worklist items are returned since there are no matches, the Unscheduled Case applies (see Section 4.1.3.3). However, if the query fails, the DICOM interface is disabled. Details on the failure can be found in the log file.

Figure 4-4 shows the basic sequence of activities for “Query for worklist items”.

Figure 4-5 Sequencing of Activity “Query for worklist items”



4.2.1.3.2.2 Proposed Presentation Contexts

The following Presentation Contexts are proposed for each initiated Association.

Table 4-8 Proposed Presentation Contexts for Activity “Query for worklist items”

Presentation Context Table						
Name	Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
	UID	1.2.840.10008. ...	Name List	UID List		
	... 5.1.4.31		ELE	... 1.2.1	SCU	None
			EBE	... 1.2.2		

Modality Worklist Information Model - FIND		ILE	... 1.2		
--	--	-----	---------	--	--

If offered a choice of Transfer Syntaxes in the accepted Presentation Contexts, the VISUREF 150 Application Entity will prefer the Transfer Syntax Explicit VR Little Endian (ELE).

4.2.1.3.2.2.1 Extended Negotiation

No Extended Negotiation is performed.

4.2.1.3.2.3 SOP Specific Conformance

4.2.1.3.2.3.1 SOP Specific Conformance to Modality Worklist Information Model - FIND SOP Class

The VISUREF 150 Application Entity provides Standard Conformance to the Modality Worklist Information Model - FIND SOP Class as an SCU.

The VISUREF 150 Application Entity will behave as described in Table 4-9 when receiving the C-FIND response command message.

Table 4-9 C-FIND Response Status Handling Behavior for Activity “Query for worklist items”

Service Status	Further Meaning	Error Code	Reason
Failure	Refused: Out of resources	A7xx	This is not treated as an error. Details are reported to a log file that is available to administrators.
	Refused: SOP Class not supported	A8xx	This is not treated as an error. Details are reported to a log file that is available to administrators.
	Error: Identifier does not match SOP Class	A9xx	This is not treated as an error. Details are reported to a log file that is available to administrators.
	Failed: Unable to process	Cxxx	This is not treated as an error. Details are reported to a log file that is available to administrators.
Cancel	Matching terminated due to Cancel request	FE00	Should never occur since cancel requests are never issued.
Success	Matching is complete – No final identifier is supplied	0000	The current query is completed successfully. The pick list on the user interface is updated with the received worklist items. Details are reported to a log file that is available to administrators.
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Current worklist item is added to an internal list but not yet presented to the user. Details are reported to a log file that is available to administrators.
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or	FF01	Current worklist item is added to an internal list but not yet presented to the user. Details are reported to a log file that is available to administrators.

	matching for this Identifier		
		All other codes	The remote AE returned an unknown status code. This is not treated as an error. Details are reported to a log file that is available to administrators.

Table 4-10 Communication Failure Behavior for Activity “Query for worklist items”

Exception	Behavior
TCP/IP connection could not be established within the specified time range (configurable parameter).	The DICOM interface is disabled. No message is displayed on the user interface but details are reported to a log file that is available to administrators.
Data could not be sent or received on a network socket within the specified time range (fixed value).	The DICOM interface is disabled. No message is displayed on the user interface but details are reported to a log file that is available to administrators.
ACSE response message could not be received within the specified time range (configurable parameter).	The DICOM interface is disabled. No message is displayed on the user interface but details are reported to a log file that is available to administrators.
DIMSE response message could not be received within the specified time range (configurable parameter).	The DICOM interface is disabled. No message is displayed on the user interface but details are reported to a log file that is available to administrators.
Association aborted by the SCP using A-ABORT or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure).	The DICOM interface is disabled. No message is displayed on the user interface but details are reported to a log file that is available to administrators.

Unexpected Attributes returned in a C-FIND response are ignored in the same manner as requested (optional) Attributes not returned by the SCP. Non-matching responses returned by the SCP due to unsupported Matching Key Attributes are not filtered locally by the VISUREF 150 Application Entity and thus will still be shown in the patient list. Duplicate responses are filtered out. In addition, the C-FIND response dataset is checked for “compatibility” with the application before being further processed, i.e. it is checked whether the value field length is within the specified limits and whether all required Attributes are actually present.

The Attribute Specific Character Set (0008,0005) will always be included in the query (with a value of “ISO_IR 192”). If present in the response, its element value will be used to identify character sets other than the default character set for display of strings in the patient list. Please note, however, that only ISO_IR 100 (ISO 8859-1, Latin 1) and ISO_IR 192 (UTF-8) are supported (see Section 6). If another character set is specified, the response is ignored and a warning message is reported to the log file.

No cancel requests are ever issued for this activity.

The VISUREF 150 Application Entity uses a broad matching scheme that consists of the Attributes Modality (0008,0060), Scheduled Station AE Title (0040,0001) and Scheduled Procedure Step Start Date (0040,0002). The Scheduled Station AE Title is a configurable value and is identical to the Application Entity Title of VISUREF 150. Patient-based queries are not supported.

Table 4-11 lists the Attributes that are requested from the remote AE. It also shows in detail which of these Attributes are used as Matching Keys, required as Return Keys, imported into the application, displayed on the user interface and copied to the created SOP Instance.

Table 4-11 Attributes involved in Modality Worklist C-FIND Request and Response

Tag	Attribute Name	Query Keys Matching	Mandatory Query Keys Return	Imported	Displayed	Copied to SOP Instance
Scheduled Procedure Step (SPS)						
(0040,0100)	Scheduled Procedure Step Sequence		X			
> (0040,0001)	Scheduled Station AE Title	DEF	X	X		
> (0040,0002)	Scheduled Procedure Step Start Date	AUTO	X	X		
> (0040,0003)	Scheduled Procedure Step Start Time		X	X		
> (0008,0060)	Modality	AUTO	X	X		
> (0040,0006)	Scheduled Performing Physician's Name			X		
> (0040,0007)	Scheduled Procedure Step Description		X ¹	X		X
> (0040,0010)	Scheduled Station Name					
> (0040,0011)	Scheduled Procedure Step Location					
> (0040,0008)	Scheduled Protocol Code Sequence		X ¹	X		X
>> (0008,0100)	Code Value		X*	X		X
>> (0008,0102)	Coding Scheme Designator		X*	X		X
>> (0008,0103)	Coding Scheme Version			X		X
>> (0008,0104)	Code Meaning		X*	X		X
> (0040,0012)	Pre-Medication					
> (0040,0009)	Scheduled Procedure Step ID		X	X		X
> (0032,1070)	Requested Contrast Agent					
> (0040,0020)	Scheduled Procedure Step Status					
Requested Procedure						
(0040,1001)	Requested Procedure ID		X	X		X
(0032,1060)	Requested Procedure Description		X ²	X		X
(0032,1064)	Requested Procedure Code Sequence		X ²	X		X
> (0008,0100)	Code Value		X*	X		X
> (0008,0102)	Coding Scheme Designator		X*	X		X
> (0008,0103)	Coding Scheme Version			X		X
> (0008,0104)	Code Meaning		X*	X		X
(0020,000D)	Study Instance UID		X	X		X
(0008,0020)	Study Date			X		X
(0008,0030)	Study Time			X		X
(0008,1110)	Referenced Study Sequence			X		X
> (0008,1150)	Referenced SOP Class UID		X*	X		X
> (0008,1155)	Referenced SOP Instance UID		X*	X		X
(0040,1003)	Requested Procedure Priority					
(0040,1004)	Patient Transport Arrangements					

(0040,1400)	Requested Procedure Comments					
Imaging Service Request						
(0008,0050)	Accession Number			X		X
(0032,1032)	Requesting Physician			X		X
(0008,0090)	Referring Physician's Name			X		X
Visit Identification						
(0038,0010)	Admission ID					
Visit Status						
(0038,0300)	Current Patient Location					
Visit Relationship						
(0008,1120)	Referenced Patient Sequence					
> (0008,1150)	Referenced SOP Class UID					
> (0008,1155)	Referenced SOP Instance UID					
Patient Identification						
(0010,0010)	Patient's Name ¹		X	X	PL, APP	X
(0010,0020)	Patient ID		X	X	PL, APP	X
(0010,0021)	Issuer of Patient ID			X		X
(0010,1000)	Other Patient IDs			X		X
Patient Demographics						
(0010,0030)	Patient's Birth Date			X	PL, APP	X
(0010,0040)	Patient's Sex			X	PL, APP	X
(0010,1030)	Patients Weight					
(0040,3001)	Confidentiality Constraint on Patient Data Description					
(0010,2160)	Ethnic Group			X		X
(0010,4000)	Patient Comments			X		X
Patient Medical						
(0038,0500)	Patient State					
(0010,2110)	Allergies					
(0010,21C0)	Pregnancy Status					
(0010,2000)	Medical Alerts					
(0038,0050)	Special Needs					

Note¹: Only the patient's name of the alphabetic component group is displayed on the user interface. However, the entire name including all five components of all three component groups is imported and copied to the SOP Instance.

Values of column "Query Keys Matching":

DEF

The default value of the associated Attribute can be configured in the DICOM settings screen.

AUTO

The value is determined automatically.

Values of column "Mandatory Query Keys Return":

X

The Attribute shall be present in the Modality Worklist C-FIND response. If any of the required Attributes is missing, the relevant Modality Worklist C-FIND response

item (Scheduled Procedure Step) will be ignored and not imported by the Application Software.

X*

The Attribute shall be present in the Modality Worklist C-FIND response if its enclosing sequence is present. If any of the required Attributes is missing, the relevant Modality Worklist C-FIND response item (Scheduled Procedure Step) will be ignored and not imported by the Application Software.

X¹

Either the Scheduled Procedure Step Description (0040,0007) or the Scheduled Protocol Code Sequence (0040,0008) or both shall be present in the Modality Worklist C-FIND response.

X²

Either the Requested Procedure Description (0032,1060) or the Requested Procedure Code Sequence (0032,1064) or both shall be present in the Modality Worklist C-FIND response.

Values of column “Imported”:

X

The value gets imported into the application. Thus, this value may affect SOP Instances that are created as a result of the performed examination.

Values of column “Displayed”:

PL

Values of this Attribute are visible in the pick list.

APP

Values of this Attribute are visible in the application’s Completed Measurements Buffer.

Values of column “Copied to SOP Instance”:

X

Values of marked Attributes will be stored in created SOP Instances (see Section 8.1.3).

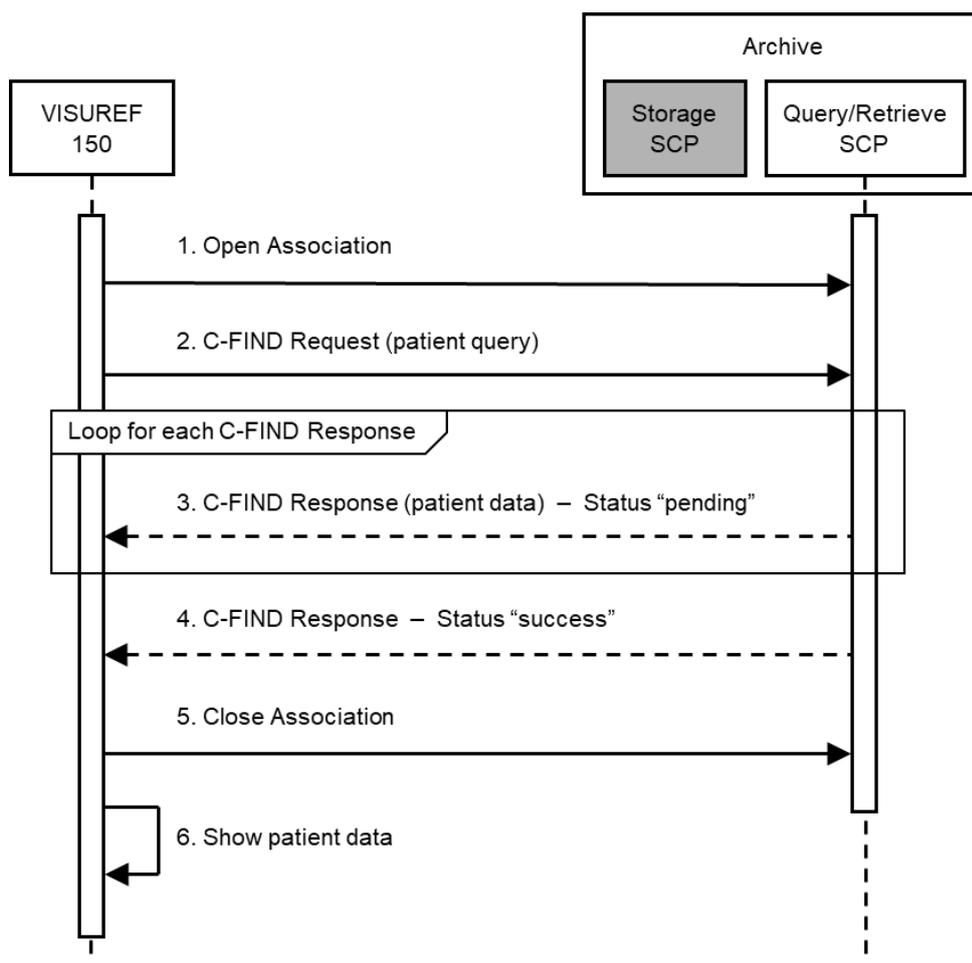
4.2.1.3.3 Activity – Query for patient data

4.2.1.3.3.1 Description and Sequencing of Activities

This activity is used by the VISUREF 150 Application Entity to query a remote Query/Retrieve SCP for patient data. A first (dummy) query is issued automatically when setting up the DICOM network interface. If no patient data is available from the worklist during normal operation, the user can query manually for patient data (using one or more supported Matching Key Attributes) after a new measurement has been made. If successful, the resulting patient list is shown on the user interface in a pick list. If no patient data is returned since there are no matches, a message is shown to the user who can then perform another query using different Matching Key Attributes. However, if the query fails, the DICOM interface is disabled. Details on the failure can be found in the log file.

Figure 4-6 shows the basic sequence of activities for “Query for patient data”.

Figure 4-6 Sequencing of Activity “Query for patient data”



4.2.1.3.3.2 Proposed Presentation Contexts

The following Presentation Contexts are proposed for each initiated Association.

Table 4-12 Proposed Presentation Contexts for Activity “Query for patient data”

Presentation Context Table						
Name	Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
	UID	1.2.840.10008. ...	Name List	UID List		
Patient Root Query/Retrieve Information Model - FIND	... 5.1.4.1.2.1.1		ELE	... 1.2.1	SCU	None
			EBE	... 1.2.2		
			ILE	... 1.2		

If offered a choice of Transfer Syntaxes in the accepted Presentation Contexts, the VISUREF 150 Application Entity will prefer the Transfer Syntax Explicit VR Little Endian (ELE).

4.2.1.3.3.2.1 Extended Negotiation

No Extended Negotiation is performed. This also mean that relational queries are not supported.

4.2.1.3.3.3 SOP Specific Conformance

4.2.1.3.3.3.1 SOP Specific Conformance to Patient Root Query/Retrieve Information Model - FIND SOP Class

The VISUREF 150 Application Entity provides Standard Conformance to the Patient Root Query/Retrieve Information Model - FIND SOP Class as an SCU.

The VISUREF 150 Application Entity will behave as described in Table 4-13 when receiving the C-FIND response command message.

Table 4-13 C-FIND Response Status Handling Behavior for Activity "Query for patient data"

Service Status	Further Meaning	Error Code	Reason
Failure	Refused: Out of resources	A7xx	This is not treated as an error. Details are reported to a log file that is available to administrators.
	Refused: SOP Class not supported	A8xx	This is not treated as an error. Details are reported to a log file that is available to administrators.
	Error: Identifier does not match SOP Class	A9xx	This is not treated as an error. Details are reported to a log file that is available to administrators.
	Failed: Unable to process	Cxxx	This is not treated as an error. Details are reported to a log file that is available to administrators.
Cancel	Matching terminated due to Cancel request	FE00	No message is displayed on the user interface but details are reported to a log file that is available to administrators.
Success	Matching is complete – No final identifier is supplied	0000	The current query is completed successfully. The pick list on the user interface is updated with the received patient data. Details are reported to a log file that is available to administrators.
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Current patient data is added to an internal list but not yet presented to the user. If a maximum number of responses (configurable parameter) has been received, a cancel request is sent to the remote AE. Details are reported to a log file that is available to administrators.
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier	FF01	Current patient data is added to an internal list but not yet presented to the user. If a maximum number of responses (configurable parameter) has been received, a cancel request is sent to the remote AE. Details are reported to a log file that is available to administrators.
		All other codes	The remote AE returned an unknown status code. This is not treated as an error. Details are reported to a log file that is available to administrators.

Table 4-14 Communication Failure Behavior for Activity “Query for patient data”

Exception	Behavior
TCP/IP connection could not be established within the specified time range (configurable parameter).	The DICOM service is disabled. A message is displayed on the user interface. Details are reported to a log file that is available to administrators. The user has the option to retry.
Data could not be sent or received on a network socket within the specified time range (fixed value).	The DICOM service is disabled. No message is displayed on the user interface but details are reported to a log file that is available to administrators.
ACSE response message could not be received within the specified time range (configurable parameter).	The DICOM service is disabled. No message is displayed on the user interface but details are reported to a log file that is available to administrators.
DIMSE response message could not be received within the specified time range (configurable parameter).	The DICOM service is disabled. No message is displayed on the user interface but details are reported to a log file that is available to administrators.
Association aborted by the SCP using A-ABORT or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure).	The DICOM service is disabled. No message is displayed on the user interface but details are reported to a log file that is available to administrators.

All queries are performed on PATIENT level. Other query/retrieve levels are not supported.

Unexpected Attributes returned in a C-FIND response are ignored in the same manner as requested (optional) Attributes not returned by the SCP. Non-matching responses returned by the SCP due to unsupported Matching Key Attributes are not filtered locally by the VISUREF 150 Application Entity and thus will still be shown in the patient list. Duplicate responses are filtered out. In addition, the C-FIND response dataset is checked for “compatibility” with the application before being further processed, i.e. it is checked whether the value field length is within the specified limits and whether all required Attributes are actually present.

The Attribute Specific Character Set (0008,0005) will always be included in the query (with a value of “ISO_IR 192”). If present in the response, its element value will be used to identify character sets other than the default character set for display of strings in the patient list. Please note, however, that only ISO_IR 100 (ISO 8859-1, Latin 1) and ISO_IR 192 (UTF-8) are supported (see Section 6). If another character set is specified, the response is ignored, and a warning message is both displayed on the user interface and reported to the log file.

By default, a cancel request is issued after a configured number of C-FIND responses has been received (see Section 4.4.2). In addition, the number of C-FIND responses stored and further processed by the VISUREF 150 Application Entity can be limited to configurable number, i.e. whether or not the cancel request is actually considered by the SCP.

The VISUREF 150 Application Entity uses a flexible matching scheme that consists of the Attributes Patient’s Name (0010,0010), Patient ID (0010,0020), Patient’s Birth Data (0010,0030) and Patient’s Sex (0010,0040). At least one of these Attributes has to be specified by the user with a non-empty value but also a combination of Attributes is allowed. Depending on the data entered by the user, multiple C-FIND requests might be issued. The resulting responses are collected to fill the pick list on the user interface.

Table 4-15 lists the Attributes that are requested from the remote AE. It also shows in detail which of these Attributes are used as Matching Keys (with one of the given types of matching), imported into the application, displayed on the user interface and copied to the created SOP Instance.

Table 4-15 Attributes involved in Patient Root Query/Retrieve C-FIND Request and Response

Tag	Attribute Name	Query Keys Matching	Types of Matching	Imported	Displayed	Copied to SOP Instance
Query/Retrieve Level PATIENT						
(0010,0010)	Patient's Name ¹	X	S, W	X	PL, APP	X
(0010,0020)	Patient ID	X	S, W	X	PL, APP	X
(0010,0021)	Issuer of Patient ID			X		X
(0010,0030)	Patient's Birth Date	X	S, R	X	PL, APP	X
(0010,0040)	Patient's Sex	X	S	X	PL, APP	X
(0010,1000)	Other Patient IDs			X		X
(0010,2160)	Ethnic Group			X		X
(0010,4000)	Patient Comments			X		X

Note¹: Only the patient's name of the alphabetic component group is displayed on the user interface. However, the entire name including all five components of all three component groups is imported and copied to the SOP Instance.

Values of column "Query Keys Matching":

X

The value is used as a Matching Key if non-empty (entered by the user).

Values of column "Types of Matching":

S

Single Value Matching

W

Wildcard Matching

R

Range Matching

Values of column "Imported":

X

The value gets imported into the application. Thus, this value may affect SOP Instances that are created as a result of the performed examination.

Values of column "Displayed":

PL

Values of this Attribute are visible in the pick list.

APP

Values of this Attribute are visible in the application's Completed Measurements Buffer.

Values of column "Copied to SOP Instance":

X

Values of marked Attributes will be stored in created SOP Instances (see Section 8.1.3).

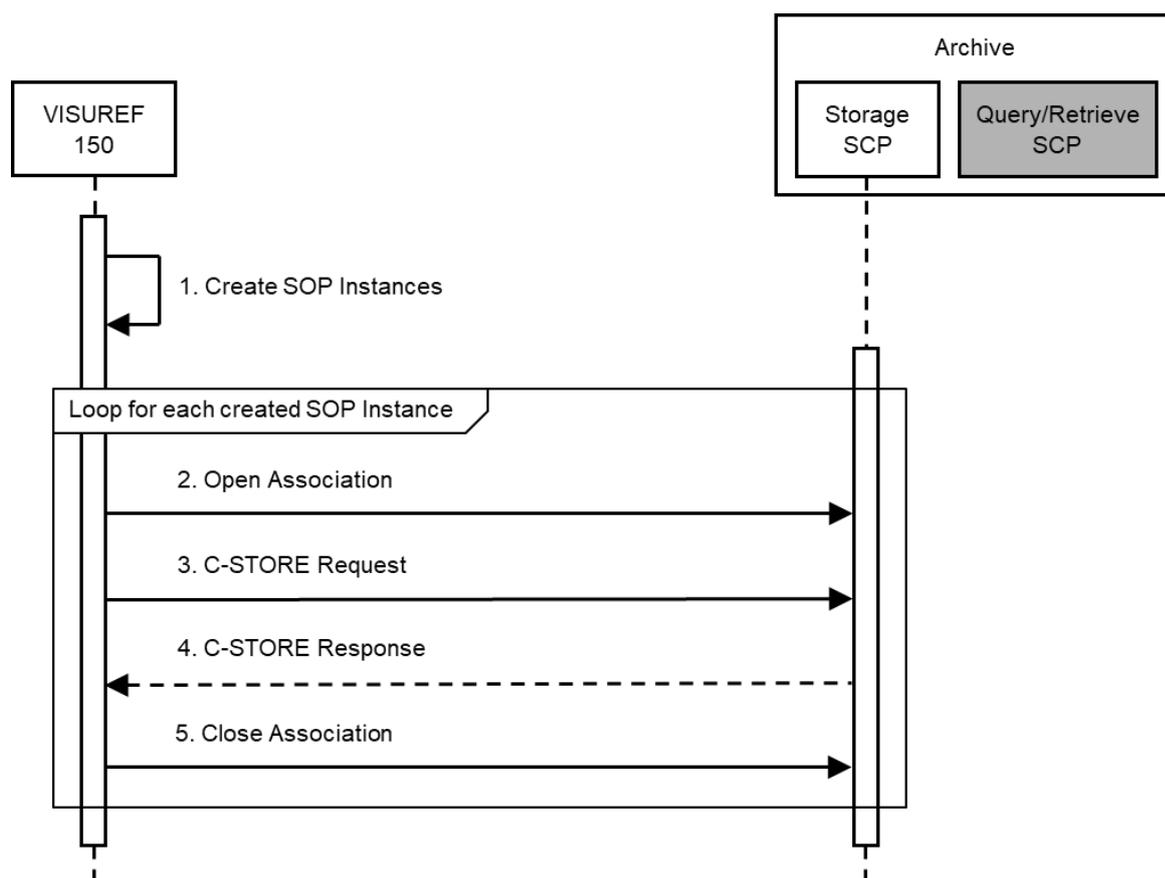
4.2.1.3.4 Activity – Send acquired data

4.2.1.3.4.1 Description and Sequencing of Activities

This activity is used by the VISUREF 150 Application Entity to transfer acquired data to a remote Storage SCP. After a measurement has been made and the user pressed the “finish” button, the acquired measurement data is converted, enriched with data from the currently selected item of the pick list and stored in DICOM format. Depending on the type of measurement, SOP Instances of various SOP Classes are created. Finally, the created SOP Instances are transferred to the remote Storage SCP using the appropriate Storage SOP Class. For each SOP Instance, a new Association is initiated. The success or failure is displayed on the user interface by a colored symbol. Details can be found in the log file.

Figure 4-7 shows the basic sequence of activities for “Send acquired data”.

Figure 4-7 Sequencing of Activity “Send acquired data”



4.2.1.3.4.2 Proposed Presentation Contexts

The following Presentation Contexts are proposed for the first association that is initiated after the DICOM interface has been enabled.

Table 4-16 Proposed Presentation Contexts for Activity “Send acquired data”

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID 1.2.840.10008. ...	Name List	UID List 1.2.840.10008. ...		
	... 5.1.4.1.1.77.1.5.1	ELE	... 1.2.1	SCU	None

Ophthalmic Photography 8 Bit Image Storage		ILE	... 1.2		
Encapsulated PDF Storage	... 5.1.4.1.1.104.1	ELE	... 1.2.1	SCU	None
		ILE	... 1.2		
Autorefractometry Measurements Storage	... 5.1.4.1.1.178.2	ELE	... 1.2.1	SCU	None
		ILE	... 1.2		
Keratometry Measurements Storage	... 5.1.4.1.1.178.3	ELE	... 1.2.1	SCU	None
		ILE	... 1.2		

If a particular Storage SOP Class is not supported by the Storage SCP (“Abstract Syntax Not Supported”), the corresponding Presentation Context is not proposed for subsequent associations. If offered a choice of Transfer Syntaxes in the accepted Presentation Contexts, the VISUREF 150 Application Entity will prefer the Transfer Syntax Explicit VR Little Endian (ELE).

4.2.1.3.4.2.1 Extended Negotiation

No Extended Negotiation is performed.

4.2.1.3.4.3 SOP Specific Conformance

4.2.1.3.4.3.1 SOP Specific Conformance to Storage SOP Classes

The VISUREF 150 Application Entity provides Standard Conformance to the respective Storage SOP Class as an SCU.

The VISUREF 150 Application Entity will behave as described in Table 4-17 when receiving the C-STORE response command message.

Table 4-17 C-STORE Response Status Handling Behavior for Activity “Send acquired data”

Service Status	Further Meaning	Error Code	Reason
Failure	Refused: Out of resources	A7xx	This is treated as a permanent failure. The error status is displayed on the user interface. Details are reported to a log file that is available to administrators.
	Refused: SOP Class not supported	A8xx	This is treated as a permanent failure. The error status is displayed on the user interface. Details are reported to a log file that is available to administrators.
	Error: Data Set does not match SOP Class	A9xx	This is treated as a permanent failure. The error status is displayed on the user interface. Details are reported to a log file that is available to administrators.
	Failed: Cannot understand	Cxxx	This is treated as a permanent failure. The error status is displayed on the user interface. Details are reported to a log file that is available to administrators.
Warning	Coercion of Data Elements	B000	Transmission of the SOP Instance is considered successful. The success status is displayed on the user interface. Details are reported to a log file that is available to administrators.
	Data Set does not match SOP Class	B007	Transmission of the SOP Instance is considered successful.

			The success status is displayed on the user interface. Details are reported to a log file that is available to administrators.
	Elements discarded	B006	Transmission of the SOP Instance is considered successful. The success status is displayed on the user interface. Details are reported to a log file that is available to administrators.
		Bxxx (or 0107 or 0116)	The remote AE returned an unknown warning status code. Transmission of the SOP Instance is considered successful. The success status is displayed on the user interface. Details are reported to a log file that is available to administrators.
Success	Success	0000	The SOP Instance was received successfully by the remote AE. The success status is displayed on the user interface. Details are reported to a log file that is available to administrators.
		All other codes	The remote AE returned an unknown status code. This is treated as an error. The error status is displayed on the user interface. Details are reported to a log file that is available to administrators.

Table 4-18 Communication Failure Behavior for Activity “Send acquired data”

Exception	Behavior
TCP/IP connection could not be established within the specified time range (configurable parameter).	The error status is displayed on the user interface. Details are reported to a log file that is available to administrators.
Data could not be sent or received on a network socket within the specified time range (configurable parameter).	The error status is displayed on the user interface. Details are reported to a log file that is available to administrators.
ACSE response message could not be received within the specified time range (configurable parameter).	The error status is displayed on the user interface. Details are reported to a log file that is available to administrators.
DIMSE response message could not be received within the specified time range (configurable parameter).	The error status is displayed on the user interface. Details are reported to a log file that is available to administrators.
Association aborted by the SCP using A-ABORT or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure).	The error status is displayed on the user interface. Details are reported to a log file that is available to administrators.

4.2.1.4 Association Acceptance Policy

The VISUREF 150 Application Entity does not accept associations.

4.3 Network Interfaces

4.3.1 Physical/ Network Interface

The physical network interface is not visible for the VISUREF 150 Application Software. It uses the communication stack as offered by the Operating System.

4.3.2 Additional Protocols

VISUREF 150 supports DHCP (Dynamic Host Configuration Protocol) as a client in order to automatically assign an IP address and other network configuration parameters to the device. It also supports DNS (Domain Name System) as a client to resolve hostnames and NTP (Network Time Protocol) as a client to synchronize the system time.

4.3.3 IPv4 and IPv6 Support

The VISUREF 150 Application Software supports IPv4 connections only.

4.4 Configuration

The network-related configuration is usually specified at the time of installation by an operator.

4.4.1 AE Title/Presentation Address Mapping

The mapping from AE Titles to IP addresses (or hostnames) and TCP/IP ports is configurable as described in the following subsections.

4.4.1.1 Local AE Titles

The local AE Title and the IP address (or hostname) of the device can be configured in the “General / Service” and the “Interface / LAN” section of the “Settings” dialog. Table 4-19 shows the default values.

Table 4-19 AE Title Configuration Table

Application Entity	Default AE Title	Default TCP/IP Port
VISUREF 150	VR150:<serial-number>	Not applicable

4.4.1.2 Remote AE Titles/Presentation Address Mapping

The remote AE Titles, IP addresses (or hostnames) and TCP/IP ports can be configured individually for the following services in the “Interface / LAN” section of the “Settings” dialog.

4.4.1.2.1 Workflow Management

The VISUREF 150 Application Entity allows for specifying a single remote Modality Worklist Management SCP. After the AE Title, IP address (or hostname) and TCP/IP port of the remote AE have been configured, the Verification SOP Class is negotiated and a C-ECHO request is sent on a new Association in order to check the configuration.

4.4.1.2.2 Storage and Query/Retrieve

The VISUREF 150 Application Entity allows for specifying a single remote Storage and Query/Retrieve SCP. After the AE Title, IP address (or hostname) and TCP/IP port of the remote AE have been configured, the Verification SOP Class is negotiated and a C-ECHO request is sent on a new Association in order to check the configuration.

If no remote Storage and Query/Retrieve SCP is configured, the same remote AE is used as defined for Workflow Management (see Section 4.4.1.2.1).

4.4.2 Parameters

The VISUREF 150 Application Entity allows for configuring a number of parameters. Table 4-20 only shows those configuration parameters that are relevant to DICOM communication.

Table 4-20 Configuration Parameters Table

Parameter	Configurable (Yes/No)	Default Value
General Parameters		
Time-out waiting for response to TCP/IP connection request	Yes	15 seconds
Time-out for ACSE messages	Yes	30 seconds
Time-out for DIMSE messages	Yes	Unlimited
Maximum PDU size the AE can receive	No	16.384 bytes
Network log level	No	Debug
Verification SCU Parameters		
Time-out for network socket	Yes	60 seconds
Modality Worklist SCU Parameters		
Time-out for network socket	No	60 seconds
Automatic worklist update	No	Enabled
Worklist update interval	Yes	30 seconds
Maximum number of worklist items to be processed	No	Unlimited
Maximum number of worklist items to be displayed in the pick list (Patient Schedule)	No	9
Maximum number of worklist items to be displayed in the pick list in enhanced data allocation mode	No	Unlimited
Query/Retrieve SCU Parameters		
Time-out for network socket	No	60 seconds
Maximum number of query responses (send cancel request if exceeded)	Yes	25
Storage SCU Parameters		
Time-out for network socket	Yes	60 seconds

5 Media Interchange

Media Interchange is not supported by the VISUREF 150 Application Software.

6 Support of Character Sets

In addition to the Default Character Repertoire (ASCII), the VISUREF 150 Application Entity supports the character sets listed in Table 6-1.

Table 6-1 Supported Character Set

Character Set Description	Defined Term
UTF-8 encoded Unicode	ISO_IR 192 (Default)
Latin alphabet No. 1	ISO_IR 100

For the activities “Query for worklist items” and “Query for patient data”, the Attribute Specific Character Set (0008,0005) is always added to the C-FIND request dataset with a value of “ISO_IR 192” (UTF-8). In the C-FIND response dataset, all of the three supported character sets can be processed. If another character set is used by the SCP, the dataset cannot be processed and a warning message is reported to a log file that is available to administrators.

For the activity “Send acquired data”, the character set to be used for the created SOP Instances depends on the character strings used in the acquired data, i.e. whether the Attribute Specific Character Set (0008,0005) is added to the SOP Instance and its value is determined automatically.

7 Security

The DICOM capabilities of the VISUREF 150 Application Software do not support any specific security measures.

It is assumed that VISUREF 150 Application Software is used within a secured environment. It is assumed that a secured environment includes at a minimum:

- Firewall or router protections to ensure that only approved external hosts have network access to VISUREF 150 Application Software.
- Firewall or router protections to ensure that VISUREF 150 Application Software only has network access to approved external hosts and services.
- 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.

8 Annexes

8.1 IOD Contents

8.1.1 Created SOP Instance(s)

The configurable parameters that are used for creating DICOM SOP Instances are listed in Table 8-1.

Table 8-1 Configurable Parameters for Creating DICOM SOP Instances

Parameter	Configurable (Yes/No)	Default Value
Source of Study Date and Study Time values	Yes	Scheduled Case: Worklist, Unscheduled Case: Empty
Coding Scheme Designator for SNOMED codes	Yes	SCT

Abbreviations used for Presence of Values (PoV):

VNAP

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

ANAP

Attribute is not always present

ALWAYS

Attribute is always present with a value

EMPTY

Attribute is sent without a value

Abbreviations used for Sources of Data (Source):

USER

The Attribute value source is from User input

AUTO

The Attribute value is generated automatically

MWL

The Attribute value is the same as the value received using a DICOM service such as Modality Worklist

CONFIG

The Attribute value source is a configurable parameter

ACQUISITION

The Attribute value is generated from a data acquisition/measurement process

ANALYSIS

The Attribute value is generated from a post-acquisition data analysis/calculation

PRQ

The Attribute value is same as the value received using a DICOM service such as Patient Root Query

8.1.1.1 Autorefracton Measurements Information Object Definition

Table 8-2 Autorefracton Measurements IOD – Module Overview

IE	Module	Reference	Presence of Module
Patient			
	Patient	Table 8-6	ALWAYS
	Clinical Trial Subject		NEVER
Study			
	General Study	Table 8-7	ALWAYS
	Patient Study		NEVER
	Clinical Trial Study		NEVER
Series			
	General Series	Table 8-10	ALWAYS
	Autorefracton Measurements Series	Table 8-11	ALWAYS
	Clinical Trial Series		NEVER
Equipment			
	General Equipment	Table 8-8	ALWAYS
	Enhanced General Equipment	Table 8-9	ALWAYS
Measurements			
	General Ophthalmic Refractive Measurements	Table 8-12	ALWAYS
	Autorefracton Measurements	Table 8-13	ALWAYS
	Extended Autorefracton Parameters (<i>private</i>)	Table 8-14	ALWAYS
	CZM NIM Internal (<i>private</i>)	Table 8-15	ALWAYS
	SOP Common	Table 8-16	ALWAYS

8.1.1.2 Keratometry Measurements Information Object Definition

Table 8-3 Keratometry Measurements IOD – Module Overview

IE	Module	Reference	Presence of Module
Patient			
	Patient	Table 8-6	ALWAYS
	Clinical Trial Subject		NEVER
Study			
	General Study	Table 8-7	ALWAYS
	Patient Study		NEVER
	Clinical Trial Study		NEVER

Series			
	General Series	Table 8-17	ALWAYS
	Keratometry Measurements Series	Table 8-18	ALWAYS
	Clinical Trial Series		NEVER
Equipment			
	General Equipment	Table 8-8	ALWAYS
	Enhanced General Equipment	Table 8-9	ALWAYS
Measurements			
	General Ophthalmic Refractive Measurements	Table 8-19	ALWAYS
	Keratometry Measurements	Table 8-20	ALWAYS
	Extended Keratometry Parameters (<i>private</i>)	Table 8-21	ALWAYS
	CZM NIM Internal (<i>private</i>)	Table 8-22	ALWAYS
	SOP Common	Table 8-23	ALWAYS

8.1.1.3 Ophthalmic Photography 8 Bit Image Information Object Definition

Table 8-4 Ophthalmic Photography 8 Bit Image IOD – Module Overview

IE	Module	Reference	Presence of Module
Patient			
	Patient	Table 8-6	ALWAYS
	Clinical Trial Subject		NEVER
Study			
	General Study	Table 8-7	ALWAYS
	Patient Study		NEVER
	Clinical Trial Study		NEVER
Series			
	General Series	Table 8-24	ALWAYS
	Ophthalmic Photography Series	Table 8-25	ALWAYS
	Clinical Trial Series		NEVER
Frame of Reference			
	Synchronization	Table 8-26	ALWAYS
Equipment			
	General Equipment	Table 8-8	ALWAYS
Image			
	General Image	Table 8-27	ALWAYS

	Image Pixel	Table 8-28	ALWAYS
	Enhanced Contrast Bolus		NEVER
	Cine	Table 8-29	ALWAYS
	Multi-frame	Table 8-30	ALWAYS
	Device		NEVER
	Acquisition Context		NEVER
	Ophthalmic Photography Image	Table 8-31	ALWAYS
	Ocular Region Imaged	Table 8-32	ALWAYS
	Ophthalmic Photography Acquisition Parameters	Table 8-33	ALWAYS
	Ophthalmic Photographic Parameters	Table 8-34	ALWAYS
	ICC Profile		NEVER
	CZM Ophthalmic Photography 8 Bit Image Extension (<i>private</i>)	Table 8-35	ALWAYS
	SOP Common	Table 8-36	ALWAYS
	Common Instance Reference		NEVER
	Frame Extraction		NEVER

8.1.1.4 Encapsulated PDF Information Object Definition

Table 8-5 Encapsulated PDF IOD – Module Overview

IE	Module	References	Presence of Module
Patient			
	Patient	Table 8-6	ALWAYS
	Clinical Trial Subject		NEVER
Study			
	General Study	Table 8-7	ALWAYS
	Patient Study		NEVER
	Clinical Trial Study		NEVER
Series			
	Encapsulated Document Series	Table 8-37	ALWAYS
	Clinical Trial Series		NEVER
	CZM Encapsulated PDF Series Extension		NEVER
Equipment			
	General Equipment	Table 8-8	ALWAYS
	SC Equipment	Table 8-38	ALWAYS

Encapsulated Document			
	Encapsulated Document	Table 8-39	ALWAYS
	SOP Common	Table 8-40	ALWAYS
	CZM Encapsulated PDF Instance Extension		NEVER
	CZM NIM Internal		NEVER

8.1.1.5 Common Modules

Table 8-6 Module "Patient" of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Patient's Name	(0010,0010)	PN		ALWAYS	MWL, PRQ
Patient ID	(0010,0020)	LO		ALWAYS	MWL, PRQ
Issuer of Patient ID	(0010,0021)	LO		ANAP	MWL, PRQ
Patient's Birth Date	(0010,0030)	DA		VNAP	MWL, PRQ
Patient's Sex	(0010,0040)	CS		VNAP	MWL, PRQ
Other Patient IDs	(0010,1000)	LO		ANAP	MWL, PRQ
Ethnic Group	(0010,2160)	SH		ANAP	MWL, PRQ
Patient Comments	(0010,4000)	LT		ANAP	MWL, PRQ

Table 8-7 Module "General Study" of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Study Instance UID	(0020,000D)	UI	Copied from selected worklist entry if MWL is used. If MWL is not used, VISUREF 150 generates a new unique identifier with a constant prefix of "1.2.276.0.75.2.1.68.1.1." followed by a date/time stamp and machine specific identifier.	ALWAYS	MWL, AUTO
Study Date	(0008,0020)	DA		VNAP	MWL, ACQUISITION
Study Time	(0008,0030)	TM		VNAP	MWL, ACQUISITION
Referring Physician's Name	(0008,0090)	PN		VNAP	MWL
Study ID	(0020,0010)	SH	Copied from Requested Procedure ID (0040,1001).	VNAP	MWL
Accession Number	(0008,0050)	SH		VNAP	MWL
Study Description	(0008,1030)	LO	Copied from Requested Procedure Description (0032,1060) if available.	ANAP	MWL
Physician(s) of Record	(0008,1048)	PN	Copied from Requesting Physician (0032,1032) if available.	ANAP	MWL
Referenced Study Sequence	(0008,1110)	SQ		ANAP	MWL
> Referenced SOP Class UID	(0008,1150)	UI		ALWAYS	MWL
> Referenced SOP Instance UID	(0008,1155)	UI		ALWAYS	MWL

Procedure Code Sequence	(0008,1032)	SQ	Copied from Requested Procedure Code Sequence (0032,1064) if available.	ANAP	MWL
> Code Value	(0008,0100)	SH		ALWAYS	MWL
> Coding Scheme Designator	(0008,0102)	SH		ALWAYS	MWL
> Coding Scheme Version	(0008,0103)	SH		ANAP	MWL
> Code Meaning	(0008,0104)	LO		ALWAYS	MWL

Table 8-8 Module “General Equipment” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Manufacturer	(0008,0070)	LO	Carl Zeiss Meditec	ALWAYS	AUTO
Manufacturer's Model Name	(0008,1090)	LO	VISUREF 150	ALWAYS	AUTO
Device Serial Number	(0018,1000)	LO		ALWAYS	AUTO
Software Version(s)	(0018,1020)	LO	Software version of the device controller (DC) followed by software version of the system interface controller (SIC). Each version has the format: “v<major>.<minor>.<bugfix>”	ALWAYS	AUTO

Table 8-9 Module “Enhanced General Equipment” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Manufacturer	(0008,0070)	LO	Carl Zeiss Meditec	ALWAYS	AUTO
Manufacturer's Model Name	(0008,1090)	LO	VISUREF 150	ALWAYS	AUTO
Device Serial Number	(0018,1000)	LO		ALWAYS	AUTO
Software Version(s)	(0018,1020)	LO	Software version of the device controller (DC) followed by software version of the system interface controller (SIC). Each version has the format: “v<major>.<minor>.<bugfix>”	ALWAYS	AUTO

8.1.1.6 Autorefracton Measurements IOD Modules

Table 8-10 Autorefracton Measurements IOD – Module “General Series” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Series Instance UID	(0020,000E)	UI	VISUREF 150 uses a constant prefix of "1.2.276.0.75.2.1.68.1.2." followed by a date/time stamp and machine specific identifier.	ALWAYS	AUTO
Series Number	(0020,0011)	IS	1	ALWAYS	AUTO
Laterality	(0020,0060)	CS		NEVER	

Series Date	(0008,0021)	DA	Date of first measurement if available; otherwise date of last measurement.	ALWAYS	ACQUISITION
Series Time	(0008,0031)	TM	Time of first measurement if available; otherwise time of last measurement.	ALWAYS	ACQUISITION
Series Description	(0008,103E)	LO	Autorefracton VISUREF 150	ALWAYS	AUTO
Request Attributes Sequence	(0040,0275)	SQ		ANAP	MWL
> Requested Procedure ID	(0040,1001)	SH		ALWAYS	MWL
> Requested Procedure Description	(0032,1060)	LO		ANAP	MWL
> Scheduled Procedure Step ID	(0040,0009)	SH		ALWAYS	MWL
> Scheduled Procedure Step Description	(0040,0007)	LO		ANAP	MWL
> Scheduled Protocol Code Sequence	(0040,0008)	SQ		ANAP	MWL
>> Code Value	(0008,0100)	SH		ALWAYS	MWL
>> Coding Scheme Designator	(0008,0102)	SH		ALWAYS	MWL
>> Coding Scheme Version	(0008,0103)	SH		ANAP	MWL
>> Code Meaning	(0008,0104)	LO		ALWAYS	MWL

Table 8-11 Autorefracton Measurements IOD – Module “Autorefracton Measurements Series” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Modality	(0008,0060)	CS	AR	ALWAYS	AUTO

Table 8-12 Autorefracton Measurements IOD – Module “General Ophthalmic Refractive Measurements” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Instance Number	(0020,0013)	IS	1	ALWAYS	AUTO
Content Date	(0008,0023)	DA	Date of last measurement.	ALWAYS	ACQUISITION
Content Time	(0008,0033)	TM	Time of last measurement.	ALWAYS	ACQUISITION
Measurement Laterality	(0024,0113)	CS	R, L or B	ALWAYS	ACQUISITION
Image Comments	(0020,4000)	LT		ANAP	USER

Table 8-13 Autorefracton Measurements IOD – Module “Autorefracton Measurements” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Autorefracton Right Eye Sequence	(0046,0050)	SQ	Only present if right eye has been measured.	ANAP	ACQUISITION

> Sphere Power	(0046,0146)	FD		ALWAYS	ACQUISITION
> Cylinder Sequence	(0046,0018)	SQ		ALWAYS	ACQUISITION
>> Cylinder Power	(0046,0147)	FD		ALWAYS	ACQUISITION
>> Cylinder Axis	(0022,0009)	FL		ALWAYS	ACQUISITION
Autorefracton Left Eye Sequence	(0046,0052)	SQ	Only present if left eye has been measured.	ANAP	ACQUISITION
> Sphere Power	(0046,0146)	FD		ALWAYS	ACQUISITION
> Cylinder Sequence	(0046,0018)	SQ		ALWAYS	ACQUISITION
>> Cylinder Power	(0046,0147)	FD		ALWAYS	ACQUISITION
>> Cylinder Axis	(0022,0009)	FL		ALWAYS	ACQUISITION
Distance Pupillary Distance	(0046,0060)	FD		ANAP	ACQUISITION

Table 8-14 Autorefracton Measurements IOD – Module “Extended Autorefracton Parameters” (private) of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Private Creator	(2909,0010)	LO	99CZM_VISUREF_AR_Parameters	ALWAYS	AUTO
Vertex Distance	(2909,1000)	FD		ALWAYS	CONFIG
Sphere Shift	(2909,1001)	FD		ALWAYS	CONFIG
Step Refraction	(2909,1002)	FD	Only present if rounding enabled.	ANAP	CONFIG

Table 8-15 Autorefracton Measurements IOD – Module “CZM NIM Internal” (private) of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Private Creator	(2201,0010)	LO	99CZM_NIM_INTERNAL_01	ALWAYS	AUTO
IOD Name Meta Info	(2201,1000)	LT	VisurefAutorefractonMeasurements	ALWAYS	AUTO

Table 8-16 Autorefracton Measurements IOD – Module “SOP Common” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
SOP Class UID	(0008,0016)	UI	1.2.840.10008.5.1.4.1.1.78.2	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	VISUREF 150 uses a constant prefix of "1.2.276.0.75.2.1.68.1.3." followed by a date/time stamp and machine specific identifier.	ALWAYS	AUTO
Specific Character Set	(0008,0005)	CS	"ISO_IR 100" or "ISO_IR 192". Absent if only ASCII characters used.	ANAP	AUTO
Instance Creation Date	(0008,0012)	DA	Current system date	ANAP	AUTO
Instance Creation Time	(0008,0013)	TM	Current system time	ANAP	AUTO
Timezone Offset From UTC	(0008,0201)	SH		ALWAYS	CONFIG
Content Qualification	(0018,9004)	CS	PRODUCT or RESEARCH	ALWAYS	CONFIG

			<p>“PRODUCT” if the content was produced with approved (released) hardware and software.</p> <p>“RESEARCH” if the content was produced with hardware and software which did not have approved state, e.g. some intermediate implementation state or a pre-release for clinical studies.</p>		
--	--	--	---	--	--

8.1.1.7 Keratometry Measurements IOD Modules

Table 8-17 Keratometry Measurements IOD – Module “General Series” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Series Instance UID	(0020,000E)	UI	VISUREF 150 uses a constant prefix of "1.2.276.0.75.2.1.68.1.2." followed by a date/time stamp and machine specific identifier.	ALWAYS	AUTO
Series Number	(0020,0011)	IS	2	ALWAYS	AUTO
Laterality	(0020,0060)	CS		NEVER	
Series Date	(0008,0021)	DA	Date of first measurement if available; otherwise date of last measurement.	ALWAYS	ACQUISITION
Series Time	(0008,0031)	TM	Time of first measurement if available; otherwise time of last measurement.	ALWAYS	ACQUISITION
Series Description	(0008,103E)	LO	Keratometry VISUREF 150	ALWAYS	AUTO
Request Attributes Sequence	(0040,0275)	SQ		ANAP	MWL
> Requested Procedure ID	(0040,1001)	SH		ALWAYS	MWL
> Requested Procedure Description	(0032,1060)	LO		ANAP	MWL
> Scheduled Procedure Step ID	(0040,0009)	SH		ALWAYS	MWL
> Scheduled Procedure Step Description	(0040,0007)	LO		ANAP	MWL
> Scheduled Protocol Code Sequence	(0040,0008)	SQ		ANAP	MWL
>> Code Value	(0008,0100)	SH		ALWAYS	MWL
>> Coding Scheme Designator	(0008,0102)	SH		ALWAYS	MWL
>> Coding Scheme Version	(0008,0103)	SH		ANAP	MWL
>> Code Meaning	(0008,0104)	LO		ALWAYS	MWL

Table 8-18 Keratometry Measurements IOD – Module “Keratometry Measurements Series” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Modality	(0008,0060)	CS	KER	ALWAYS	AUTO

Table 8-19 Keratometry Measurements IOD – Module “General Ophthalmic Refractive Measurements” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Instance Number	(0020,0013)	IS	1	ALWAYS	AUTO
Content Date	(0008,0023)	DA	Date of last measurement.	ALWAYS	ACQUISITION
Content Time	(0008,0033)	TM	Time of last measurement.	ALWAYS	ACQUISITION
Measurement Laterality	(0024,0113)	CS	R, L or B	ALWAYS	ACQUISITION
Image Comments	(0020,4000)	LT		ANAP	USER

Table 8-20 Keratometry Measurements IOD – Module “Keratometry Measurements” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Keratometry Right Eye Sequence	(0046,0070)	SQ	Only present if right eye has been measured.	ANAP	ACQUISITION
> Steep Keratometric Axis Sequence	(0046,0074)	SQ		ALWAYS	ACQUISITION
>> Radius of Curvature	(0046,0075)	FD		ALWAYS	ACQUISITION
>> Keratometric Power	(0046,0076)	FD		ALWAYS	ACQUISITION
>> Keratometric Axis	(0046,0077)	FD		ALWAYS	ACQUISITION
> Flat Keratometric Axis Sequence	(0046,0080)	SQ		ALWAYS	ACQUISITION
>> Radius of Curvature	(0046,0075)	FD		ALWAYS	ACQUISITION
>> Keratometric Power	(0046,0076)	FD		ALWAYS	ACQUISITION
>> Keratometric Axis	(0046,0077)	FD		ALWAYS	ACQUISITION
Keratometry Left Eye Sequence	(0046,0071)	SQ	Only present if right eye has been measured.	ANAP	ACQUISITION
> Steep Keratometric Axis Sequence	(0046,0074)	SQ		ALWAYS	ACQUISITION
>> Radius of Curvature	(0046,0075)	FD		ALWAYS	ACQUISITION
>> Keratometric Power	(0046,0076)	FD		ALWAYS	ACQUISITION
>> Keratometric Axis	(0046,0077)	FD		ALWAYS	ACQUISITION
> Flat Keratometric Axis Sequence	(0046,0080)	SQ		ALWAYS	ACQUISITION
>> Radius of Curvature	(0046,0075)	FD		ALWAYS	ACQUISITION
>> Keratometric Power	(0046,0076)	FD		ALWAYS	ACQUISITION
>> Keratometric Axis	(0046,0077)	FD		ALWAYS	ACQUISITION

Table 8-21 Keratometry Measurements IOD – Module “Extended Keratometry Parameters” (private) of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Private Creator	(290B,0010)	LO	99CZM_VISUREF_KER_Parameters	ALWAYS	AUTO
Keratometry Index	(290B,1000)	FD		ALWAYS	CONFIG
Step Keratometry	(290B,1001)	FD	Only present if rounding enabled.	ANAP	CONFIG

Table 8-22 Keratometry Measurements IOD – Module “CZM NIM Internal” (private) of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Private Creator	(2201,0010)	LO	99CZM_NIM_INTERNAL_01	ALWAYS	AUTO
IOD Name Meta Info	(2201,1000)	LT	VisurefKeratometryMeasurements	ALWAYS	AUTO

Table 8-23 Keratometry Measurements IOD – Module “SOP Common” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
SOP Class UID	(0008,0016)	UI	1.2.840.10008.5.1.4.1.1.78.3	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	VISUREF 150 uses a constant prefix of "1.2.276.0.75.2.1.68.1.3." followed by a date/time stamp and machine specific identifier.	ALWAYS	AUTO
Specific Character Set	(0008,0005)	CS	“ISO_IR 100” or “ISO_IR 192”. Absent if only ASCII characters used.	ANAP	AUTO
Instance Creation Date	(0008,0012)	DA	Current system date	ANAP	AUTO
Instance Creation Time	(0008,0013)	TM	Current system time	ANAP	AUTO
Timezone Offset From UTC	(0008,0201)	SH		ALWAYS	CONFIG
Content Qualification	(0018,9004)	CS	PRODUCT or RESEARCH “PRODUCT” if the content was produced with approved (released) hardware and software. “RESEARCH” if the content was produced with hardware and software which did not have approved state, e.g. some intermediate implementation state or a pre-release for clinical studies.	ALWAYS	CONFIG

8.1.1.8 Ophthalmic Photography 8 Bit Image IOD Modules

Table 8-24 Ophthalmic Photography 8 Bit Image IOD – Module “General Series” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Series Instance UID	(0020,000E)	UI	VISUREF 150 uses a constant prefix of "1.2.276.0.75.2.1.68.1.2." followed by a date/time stamp and machine specific identifier.	ALWAYS	AUTO
Series Number	(0020,0011)	IS	6	ALWAYS	AUTO

Laterality	(0020,0060)	CS		NEVER	
Series Date	(0008,0021)	DA	Date of first measurement if available; otherwise date of last measurement.	ALWAYS	ACQUISITION
Series Time	(0008,0031)	TM	Time of first measurement if available; otherwise time of last measurement.	ALWAYS	ACQUISITION
Series Description	(0008,103E)	LO	Photographic Image VISUREF 150	ALWAYS	AUTO
Request Attributes Sequence	(0040,0275)	SQ		ANAP	MWL
> Requested Procedure ID	(0040,1001)	SH		ALWAYS	MWL
> Requested Procedure Description	(0032,1060)	LO		ANAP	MWL
> Scheduled Procedure Step ID	(0040,0009)	SH		ALWAYS	MWL
> Scheduled Procedure Step Description	(0040,0007)	LO		ANAP	MWL
> Scheduled Protocol Code Sequence	(0040,0008)	SQ		ANAP	MWL
>> Code Value	(0008,0100)	SH		ALWAYS	MWL
>> Coding Scheme Designator	(0008,0102)	SH		ALWAYS	MWL
>> Coding Scheme Version	(0008,0103)	SH		ANAP	MWL
>> Code Meaning	(0008,0104)	LO		ALWAYS	MWL

Table 8-25 Ophthalmic Photography 8 Bit Image IOD – Module “Ophthalmic Photography Series” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Modality	(0008,0060)	CS	OP	ALWAYS	AUTO

Table 8-26 Ophthalmic Photography 8 Bit Image IOD – Module “Synchronization” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Synchronization Frame of Reference UID	(0020,0200)	UI	VISUREF 150 uses a constant prefix of "1.2.276.0.75.2.1.68.1.5." followed by a date/time stamp and machine specific identifier.	ALWAYS	AUTO
Synchronization Trigger	(0018,106A)	CS	NO TRIGGER	ALWAYS	AUTO
Acquisition Time Synchronized	(0018,1800)	CS	N	ALWAYS	AUTO

Table 8-27 Ophthalmic Photography 8 Bit Image IOD – Module “General Image” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Patient Orientation	(0020,0020)	CS		EMPTY	

Image Comments	(0020,4000)	LT		ANAP	USER
----------------	-------------	----	--	------	------

Table 8-28 Ophthalmic Photography 8 Bit Image IOD – Module “Image Pixel” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Rows	(0028,0010)	US		ALWAYS	ACQUISITION
Columns	(0028,0011)	US		ALWAYS	ACQUISITION
Bits Allocated	(0028,0100)	US	8	ALWAYS	ACQUISITION
Bits Stored	(0028,0101)	US	8	ALWAYS	ACQUISITION
High Bit	(0028,0102)	US	7	ALWAYS	ACQUISITION
Pixel Data	(7FE0,0010)	OB		ALWAYS	ACQUISITION

Table 8-29 Ophthalmic Photography 8 Bit Image IOD – Module “Cine” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Frame Time	(0018,1063)	DS	0	ALWAYS	AUTO

Table 8-30 Ophthalmic Photography 8 Bit Image IOD – Module “Multi-frame” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Number of Frames	(0028,0008)	IS	1	ALWAYS	AUTO
Frame Increment Pointer	(0028,0009)	AT	(0018,1063)	ALWAYS	AUTO

Table 8-31 Ophthalmic Photography 8 Bit Image IOD – Module “Ophthalmic Photography Image” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Image Type	(0008,0008)	CS	ORIGINAL\PRIMARY	ALWAYS	AUTO
Instance Number	(0020,0013)	IS	Consecutive number starting with 1 for the first Instance of a Series.	ALWAYS	AUTO
Samples per Pixel	(0028,0002)	US	1	ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	CS	MONOCHROME2	ALWAYS	AUTO
Pixel Representation	(0028,0103)	US	0	ALWAYS	AUTO
Planar Configuration	(0028,0006)	US		NEVER	
Pixel Spacing	(0028,0030)	DS		ANAP	ACQUISITION
Content Time	(0008,0033)	TM	Date of last measurement.	ALWAYS	ACQUISITION
Content Date	(0008,0023)	DA	Time of last measurement.	ALWAYS	ACQUISITION
Acquisition Datetime	(0008,002A)	DT	Date and time of first measurement if available; otherwise date and time of last measurement.	ALWAYS	ACQUISITION
Lossy Image Compression	(0028,2110)	CS	00	ALWAYS	AUTO
Presentation LUT Shape	(2050,0020)	CS	IDENTITY	ALWAYS	AUTO

Burned In Annotation	(0028,0301)	CS	NO	ALWAYS	AUTO
----------------------	-------------	----	----	--------	------

Table 8-32 Ophthalmic Photography 8 Bit Image IOD – Module “Ocular Region Imaged” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Image Laterality	(0020,0062)	CS	R or L	ALWAYS	ACQUISITION
Anatomic Region Sequence	(0008,2218)	SQ	(81745001, SCT, "Eye") or (T-AA000, SRT, "Eye")	ALWAYS	CONFIG
> Code Value	(0008,0100)	SH		ALWAYS	CONFIG
> Coding Scheme Designator	(0008,0102)	SH		ALWAYS	CONFIG
> Coding Scheme Version	(0008,0103)	SH		NEVER	
> Code Meaning	(0008,0104)	LO		ALWAYS	CONFIG

Table 8-33 Ophthalmic Photography 8 Bit Image IOD – Module “Ophthalmic Photography Acquisition Parameters” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Patient Eye Movement Commanded	(0022,0005)	CS		EMPTY	
Horizontal Field of View	(0022,000C)	FL		EMPTY	
Refractive State Sequence	(0022,001B)	SQ		EMPTY	
Emmetropic Magnification	(0022,000A)	FL		EMPTY	
Intra Ocular Pressure	(0022,000B)	FL		EMPTY	
Pupil Dilated	(0022,000D)	CS		EMPTY	

Table 8-34 Ophthalmic Photography 8 Bit Image IOD – Module “Ophthalmic Photographic Parameters” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Acquisition Device Type Code Sequence	(0022,0015)	SQ	(409903006, SCT, "External Camera") or (R-1021B, SRT, "External Camera")	ALWAYS	CONFIG
> Code Value	(0008,0100)	SH		ALWAYS	CONFIG
> Coding Scheme Designator	(0008,0102)	SH		ALWAYS	CONFIG
> Coding Scheme Version	(0008,0103)	SH		NEVER	
> Code Meaning	(0008,0104)	LO		ALWAYS	CONFIG
Illumination Type Code Sequence	(0022,0016)	SQ		EMPTY	
Light Path Filter Type Stack Code Sequence	(0022,0017)	SQ		EMPTY	
Image Path Filter Type Stack Code Sequence	(0022,0018)	SQ		EMPTY	
Lenses Code Sequence	(0022,0019)	SQ		EMPTY	

Detector Type	(0018,7004)	CS		EMPTY	
---------------	-------------	----	--	-------	--

Table 8-35 Ophthalmic Photography 8 Bit Image IOD – Module “CZM Ophthalmic Photography 8 Bit Image Extension” (private) of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Pupil Size	(0046,0044)	FD		ANAP	ACQUISITION

Table 8-36 Ophthalmic Photography 8 Bit Image IOD – Module “SOP Common” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
SOP Class UID	(0008,0016)	UI	1.2.840.10008.5.1.4.1.1.77.1.5.1	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	VISUREF 150 uses a constant prefix of "1.2.276.0.75.2.1.68.1.3." followed by a date/time stamp and machine specific identifier.	ALWAYS	AUTO
Specific Character Set	(0008,0005)	CS	"ISO_IR 100" or "ISO_IR 192". Absent if only ASCII characters used.	ANAP	AUTO
Instance Creation Date	(0008,0012)	DA	Current system date	ANAP	AUTO
Instance Creation Time	(0008,0013)	TM	Current system time	ANAP	AUTO
Timezone Offset From UTC	(0008,0201)	SH		ALWAYS	CONFIG
Content Qualification	(0018,9004)	CS	PRODUCT or RESEARCH "PRODUCT" if the content was produced with approved (released) hardware and software. "RESEARCH" if the content was produced with hardware and software which did not have approved state, e.g. some intermediate implementation state or a pre-release for clinical studies.	ALWAYS	CONFIG

8.1.1.9 Encapsulated PDF IOD Modules

Table 8-37 Encapsulated PDF IOD – Module “Encapsulated Document Series” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Modality	(0008,0060)	CS	DOC	ALWAYS	AUTO
Series Instance UID	(0020,000E)	UI	VISUREF 150 uses a constant prefix of "1.2.276.0.75.2.1.68.1.2." followed by a date/time stamp and machine specific identifier.	ALWAYS	AUTO
Series Number	(0020,0011)	IS	5	ALWAYS	AUTO
Series Description	(0008,103E)	LO	Measurement Report PDF VISUREF 150	ALWAYS	AUTO
Request Attributes Sequence	(0040,0275)	SQ		ANAP	MWL

> Requested Procedure ID	(0040,1001)	SH		ALWAYS	MWL
> Requested Procedure Description	(0032,1060)	LO		ANAP	MWL
> Scheduled Procedure Step ID	(0040,0009)	SH		ALWAYS	MWL
> Scheduled Procedure Step Description	(0040,0007)	LO		ANAP	MWL
> Scheduled Protocol Code Sequence	(0040,0008)	SQ		ANAP	MWL

Table 8-38 Encapsulated PDF IOD – Module “SC Equipment Series” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Conversion Type	(0008,0064)	CS	SYN	ALWAYS	AUTO

Table 8-39 Encapsulated PDF IOD – Module “Encapsulated Document” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
Instance Number	(0020,0013)	IS	1	ALWAYS	AUTO
Content Date	(0008,0023)	DA		VNAP	AUTO
Content Time	(0008,0033)	TM		VNAP	AUTO
Acquisition Datetime	(0008,002A)	DT	Date and time of first measurement if available; otherwise date and time of last measurement.	ALWAYS	ACQUISITION
Burned In Annotation	(0028,0301)	CS	YES	ALWAYS	AUTO
Source Instance Sequence	(0042,0013)	SQ		ANAP	AUTO
> Referenced SOP Class UID	(0008,1150)	UI		ALWAYS	AUTO
> Referenced SOP Instance UID	(0008,1155)	UI		ALWAYS	AUTO
> Purpose of Reference Code Sequence	(0040,A170)	SQ	Code (128224, DCM, “Source measurement”) for instances of a Measurements IOD. Code (121324, DCM, “Source image”) for instances of an Image IOD.	ALWAYS	AUTO
>> Code Value	(0008,0100)	SH		ALWAYS	AUTO

>> Coding Scheme Designator	(0008,0102)	SH		ALWAYS	AUTO
>> Coding Scheme Version	(0008,0103)	SH		NEVER	
>> Code Meaning	(0008,0104)	LO		ALWAYS	AUTO
Document Title	(0042,0010)	ST	VISUREF150Report	ALWAYS	AUTO
Concept Name Code Sequence	(0040,A043)	S Q		EMPTY	AUTO
MIME Type of Encapsulated Document	(0042,0012)	LO	application/pdf	ALWAYS	AUTO
Encapsulated Document	(0042,0011)	O B		ALWAYS	AUTO

Table 8-40 Encapsulated PDF IOD – Module “SOP Common” of Created SOP Instances

Attribute Name	Tag	VR	Value	PoV	Source
SOP Class UID	(0008,0016)	UI	1.2.840.10008.5.1.4.1.1.104.1	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	VISUREF 150 uses a constant prefix of "1.2.276.0.75.2.1.68.1.3." followed by a date/time stamp and machine specific identifier.	ALWAYS	AUTO
Specific Character Set	(0008,0005)	CS	"ISO_IR 100" or "ISO_IR 192". Absent if only ASCII characters used.	ANAP	AUTO
Instance Creation Date	(0008,0012)	DA	Current system date	ANAP	AUTO
Instance Creation Time	(0008,0013)	TM	Current system time	ANAP	AUTO
Timezone Offset From UTC	(0008,0201)	SH		ALWAYS	CONFIG
Content Qualification	(0018,9004)	CS	PRODUCT or RESEARCH "PRODUCT" if the content was produced with approved (released) hardware and software. "RESEARCH" if the content was produced with hardware and software which did not have approved state, e.g. some intermediate implementation state or a pre-release for clinical studies.	ALWAYS	CONFIG

8.1.2 Usage of Attributes from Received IOD's

The usage of Attributes received via Modality Worklist is described in Section 4.2.1.3.2.3.1. The usage of Attributes received via Patient Root Query is described in Section 4.2.1.3.3.3.1.

8.1.3 Attribute Mapping

In Scheduled Case, the values of the following Attributes are copied from the selected worklist item (column “Modality Worklist”) to the created SOP Instances (column “Instance IOD”). None of the Attributes can be edited by the user.

Table 8-41 Attribute Mapping between Modality Worklist and Instance IOD

Modality Worklist		Instance IOD		Editable
(0010,0010)	Patient's Name	(0010,0010)	Patient's Name	No
(0010,0020)	Patient ID	(0010,0020)	Patient ID	No
(0010,0021)	Issuer of Patient ID	(0010,0021)	Issuer of Patient ID	No
(0010,1000)	Other Patient IDs	(0010,1000)	Other Patient IDs	No
(0010,0030)	Patient's Birth Date	(0010,0030)	Patient's Birth Date	No
(0010,0040)	Patient's Sex	(0010,0040)	Patient's Sex	No
(0010,2160)	Ethnic Group	(0010,2160)	Ethnic Group	No
(0010,4000)	Patient Comments	(0010,4000)	Patient Comments	No
(0008,0020)	Study Date	(0008,0020)	Study Date ¹	No
(0008,0030)	Study Time	(0008,0030)	Study Time ¹	No
(0008,0050)	Accession Number	(0008,0050)	Accession Number	No
(0008,0090)	Referring Physician's Name	(0008,0090)	Referring Physician's Name	No
(0040,1001)	Requested Procedure ID	(0020,0010)	Study ID	No
		(0040,0275) > (0040,1001)	Request Attributes Sequence > Requested Procedure ID	No
(0032,1032)	Requesting Physician	(0008,1048)	Physician(s) of Record	No
(0032,1060)	Requested Procedure Description	(0008,1030)	Study Description	No
		(0040,0275) > (0032,1060)	Request Attributes Sequence > Requested Procedure Description	No
(0032,1064)	Requested Procedure Code Sequence	(0008,1032)	Procedure Code Sequence	No
> (0008,0100)	Code Value	> (0008,0100)	Code Value	No
> (0008,0102)	Coding Scheme Designator	> (0008,0102)	Coding Scheme Designator	No
> (0008,0103)	Coding Scheme Version	> (0008,0103)	Coding Scheme Version	No
> (0008,0104)	Code Meaning	> (0008,0104)	Code Meaning	No
(0020,000D)	Study Instance UID	(0020,000D)	Study Instance UID	No
(0008,1110)	Referenced Study Sequence	(0008,1110)	Referenced Study Sequence	No
> (0008,1150)	Referenced SOP Class UID	> (0008,1150)	Referenced SOP Class UID	No
> (0008,1155)	Referenced SOP Instance UID	> (0008,1155)	Referenced SOP Instance UID	No

(0040,0100)	Scheduled Procedure Step Sequence	(0040,0275)	Request Attributes Sequence	No
> (0040,0007)	Scheduled Procedure Step Description	> (0040,0007)	Scheduled Procedure Step Description	No
> (0040,0008)	Scheduled Protocol Code Sequence	> (0040,0008)	Scheduled Protocol Code Sequence	No
>> (0008,0100)	Code Value	>> (0008,0100)	Code Value	No
>> (0008,0102)	Coding Scheme Designator	>> (0008,0102)	Coding Scheme Designator	No
>> (0008,0103)	Coding Scheme Version	>> (0008,0103)	Coding Scheme Version	No
>> (0008,0104)	Code Meaning	>> (0008,0104)	Code Meaning	No
> (0040,0009)	Scheduled Procedure Step ID	> (0040,0009)	Scheduled Procedure Step ID	No

Note¹: Depending on the configuration (see Table 8-1), the values for Study Date (0008,0020) and Study Time (0008,0030) are either copied from the selected worklist item or taken from the acquired measurement data.

In Unscheduled Case, if a Patient Root Query has been issued, the values of the following Attributes are copied from the selected result dataset (column "Patient Query") to the created SOP Instances (column "Instance IOD"). None of the Attributes can be edited by the user.

Table 8-42 Attribute Mapping between Patient Query and Instance IOD

Patient Query		Instance IOD		Editable
(0010,0010)	Patient's Name	(0010,0010)	Patient's Name	No
(0010,0020)	Patient ID	(0010,0020)	Patient ID	No
(0010,0021)	Issuer of Patient ID	(0010,0021)	Issuer of Patient ID	No
(0010,1000)	Other Patient IDs	(0010,1000)	Other Patient IDs	No
(0010,0030)	Patient's Birth Date	(0010,0030)	Patient's Birth Date	No
(0010,0040)	Patient's Sex	(0010,0040)	Patient's Sex	No
(0010,2160)	Ethnic Group	(0010,2160)	Ethnic Group	No
(0010,4000)	Patient Comments	(0010,4000)	Patient Comments	No

8.1.4 Coerced/Modified Fields

VISUREF 150 does not coerce or modify any fields.

8.2 Data Dictionary of Private Attributes

The private Attributes added to created SOP Instances are listed in the following tables. VISUREF 150 reserves blocks of private Attributes in groups 2201, 2909 and 290B. Further details on the use of these private Attributes are described in Section 8.1.1.

Table 8-43 Private Dictionary Group (2201,0010) = "99CZM_NIM_INTERNAL_01"

Occurs in: Autorefraction Measurements SOP Instance, Keratometry Measurements SOP Instance

Tag	Attribute Name	VR	VM
(2201,0010)	Private Creator	LO	1

(2201,1000)	IOD Name Meta Info	LT	1
-------------	--------------------	----	---

Table 8-44 Private Dictionary Group (2909,0010) = “99CZM_VISUREF_AR_Parameters”

Occurs in: Autorefracton Measurements SOP Instance

Tag	Attribute Name	VR	VM
(2909,0010)	Private Creator	LO	1
(2909,1000)	Vertex Distance	FD	1
(2909,1001)	Sphere Shift	FD	1
(2909,1002)	Step Refraction	FD	1

Table 8-45 Private Dictionary Group (290B,0010) = “99CZM_VISUREF_KER_Parameters”

Occurs in: Keratometry Measurements SOP Instance

Tag	Attribute Name	VR	VM
(290B,0010)	Private Creator	LO	1
(290B,1000)	Keratometry Index	FD	1
(290B,1001)	Step Keratometry	FD	1

8.3 Coded Terminology and Templates

Coded terminology is used for the created SOP Instances as described in Section 8.1.1.

The contents of Requested Procedure Code Sequence (0032,1064) and Scheduled Protocol Code Sequence (0040,0008) supplied in worklist items will be mapped to Attributes of the respective Instance IOD as described in Table 8-41.

The codes for Anatomic Region Sequence (0008,2218) and Acquisition Device Type Code Sequence (0022,0015) are not configurable but the coding scheme to be used (“SRT” or “SCT”) can be configured at installation time (see Table 8-1).

8.3.1 Context Groups

VISUREF 150 does not use or support any Context Groups.

8.3.2 Template Specifications

VISUREF 150 does not use or support any Templates.

8.3.3 Private Code Definitions

VISUREF 150 does not use or support any private codes.

8.4 Grayscale Image Consistency

VISUREF 150 does not make use of the DICOM Grayscale Standard Display Function.

8.5 Standard Extended / Specialized/ Private SOP Classes

VISUREF 150 uses Standard Extended SOP Classes by adding the following private Modules to created SOP Instances (see Section 8.1.1 for details):

- Extended Autorefracton Parameters Module (Table 8-14) and CZM NIM Internal Module (Table 8-15) are added to the Autorefracton Measurements IOD.
- Extended Keratometry Parameters Module (Table 8-21) and CZM NIM Internal Module (Table 8-22) are added to the Keratometry Measurements IOD.

- CZM Ophthalmic Photography 8 Bit Image Extension Module (Table 8-35) is added to the Ophthalmic Photography 8 Bit Image IOD.

VISUREF 150 does not use or support any Specialized SOP Class or Private SOP Class.

8.6 Private Transfer Syntaxes

VISUREF 150 does not use or support any private Transfer Syntax.



Carl Zeiss Meditec AG
Goeschwitzer Strasse 51-52
07745 Jena
Germany
www.zeiss.com/essential-line
www.zeiss.com/med
www.zeiss.com/dicom