

Philips Medical Systems

DICOM

CONFORMANCE STATEMENT



DIGITAL DIAGNOST 1.3

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1. INTRODUCTION

This chapter provides general information about the purpose, scope and contents of this Conformance Statement.

1.1. Scope and Field of Application

The scope of this DICOM Conformance Statement is to facilitate data exchange with equipment of Philips Medical Systems. This document specifies the compliance to the DICOM standard (formally called the NEMA PS 3.X standards). It contains a short description of the applications involved and provides technical information about the data exchange capabilities of the equipment. The main elements describing these capabilities are: the supported DICOM Service Object Pair (SOP) Classes, Roles, Information Object Definitions (IOD) and Transfer Syntaxes.

The field of application is the integration of the Philips Medical Systems equipment into an environment of medical devices. This Conformance Statement should be read in conjunction with the DICOM standard and its addenda [DICOM].

1.2. Intended Audience

This Conformance Statement is intended for:

- (Potential) customers
- System integrators of medical equipment
- Marketing staff interested in system functionality
- Software designers implementing DICOM interfaces

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

1.3. Contents and Structure

The DICOM Conformance Statement is contained in chapter 2 through 7 and follows the contents and structuring requirements of DICOM PS 3.2.

1.4. Used Definitions, Terms and Abbreviations

DICOM definitions, terms and abbreviations are used throughout this Conformance Statement. For a description of these, see NEMA PS 3.3 and PS 3.4.

The word Philips in this document refers to Philips Medical Systems.

1.5. References

- [DICOM] The Digital Imaging and Communications in Medicine (DICOM) standard (NEMA PS 3.X):
National Electrical Manufacturers Association (NEMA)
Publication Sales 1300 N. 17th Street, Suite 1847
Rosslyn, Va. 22209, United States of America

1.6. Important Note to the Reader

This Conformance Statement by itself does not guarantee successful interoperability of Philips equipment with non-Philips equipment. The user (or user's agent) should be aware of the following issues:

Interoperability

Interoperability refers to the ability of application functions, distributed over two or more systems, to work successfully together. The integration of medical devices into an IT environment may require application functions that are not specified within the scope of DICOM. Consequently, using only the information provided by this Conformance Statement does not guarantee interoperability of Philips equipment with non-Philips equipment.

It is the user's responsibility to analyze thoroughly the application requirements and to specify a solution that integrates Philips equipment with non-Philips equipment.

Validation

Philips equipment has been carefully tested to assure that the actual implementation of the DICOM interface corresponds with this Conformance Statement.

Where Philips equipment is linked to non-Philips equipment, the first step is to compare the relevant Conformance Statements. If the Conformance Statements indicate that successful information exchange should be possible, additional validation tests will be necessary to ensure the functionality, performance, accuracy and stability of image and image related data. It is the responsibility of the user (or user's agent) to specify the appropriate test suite and to carry out the additional validation tests.

New versions of the DICOM Standard

The DICOM Standard will evolve in future to meet the user's growing requirements and to incorporate new features and technologies. Philips is actively involved in this evolution and plans to adapt its equipment to future versions of the DICOM Standard. In order to do so, Philips reserves the right to make changes to its products or to discontinue its delivery.

The user should ensure that any non-Philips provider linking to Philips equipment also adapts to future versions of the DICOM Standard. If not, the incorporation of DICOM enhancements into Philips equipment may lead to loss of connectivity (in case of networking) and incompatibility (in case of media).

1.7. General Acronyms and Abbreviations.

The following acronyms and abbreviations are used in the document.

ACC	American College of Cardiology
ACN	Application Context Name
ACR	American College of Radiology
AE	Application Entity
ANSI	American National Standard Institute
DICOM	Digital Imaging and Communication in Medicine
DIMSE	DICOM Message Service Element
EBE	Explicit VR Big Endian
ELE	Explicit VR Little Endian
ILE	Implicit VR Little Endian
IMS	Image Management System
IOD	Information Object Definition
MPPS	Modality Performed Procedure Step
MWL	Modality Worklist
NEMA	National Electrical Manufacturers Association
PCR	Philips Computed Radiography
PDU	Protocol Data Unit
RIS	Radiology Information System
RWA	Real World Activity
SCP	Service Class Provider
SCU	Service Class User
SOP	Service Object Pair
TCP/IP	Transmission Control Protocol/Internet protocol
UID	Unique Identifier
WLM	Worklist Management

2. IMPLEMENTATION MODEL

This document is the DICOM Conformance statement for the Philips Medical Systems Digital Diagnost Release 1.3, later referred to as Digital Diagnost. The Digital Diagnost Modality is a Digital X-Ray image generating system (DICOM image type is 'CR'). It contains an Export function based on the DICOM Image Storage to transfer image data from the Digital Diagnost system to a remote system. This DICOM Export function and other functions of Digital Diagnost are described in this document.

Digital Diagnost in a DICOM network

The figure below shows the position of Digital Diagnost in a Radiology environment.

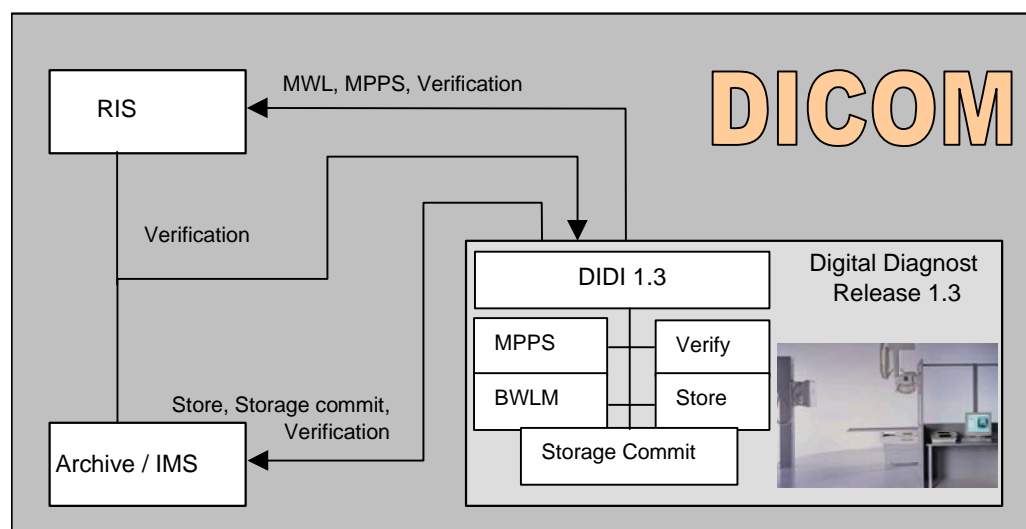


Figure 1. Digital Diagnost in a DICOM network

Digital Diagnost is an embedded modality system for DICOM images. It provides, among other things, the following features:

- The DICOM Verification Service is supported as both, SCU and SCP.
- Store Images to a remote DICOM System
- Performing Storage Commit (Push Model) and support of Storage Commit N-EVENT-REPORT
- Provide Basic Worklist Management (BWLM)
- Provide Modality Performed Procedure Step (MPPS)

2.1. Application Data Flow Diagram

Digital Diagnost 1.3 behaves as a system with one Application Entity. Its related Implementation Model is shown in Figure 2. It shows the AE and graphically depicts the relationship of the AE use of DICOM to Real World Activities. On the left-hand side, the local Real-World Activities are presented whereas on the right-hand side the remote Real-World Activities are presented.

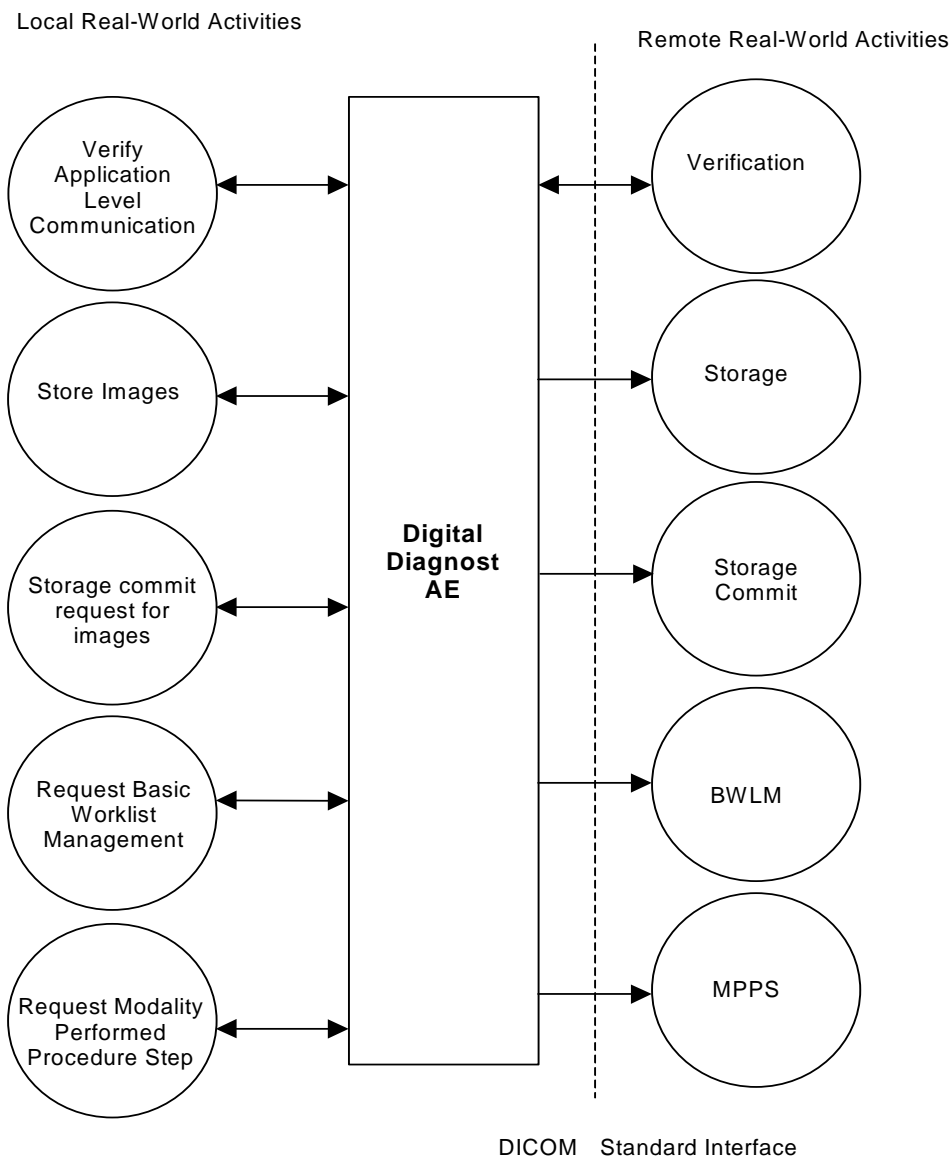


Figure 2. Digital Diagnost Implementation Model

As documented in the PS 3.4, the arrows in the diagram have the following meanings:

- An arrow pointing to the right indicates the local application entity initiates an association.
- An arrow pointing to the left indicates the local application entity accepts an association.



2.2. Functional Definition of Application Entities

The Digital Diagnost acts as Service Class User (SCU) and Service Class Provider (SCP) for the Verification Service Class. Digital Diagnost provides both a selection of a target Application Entity (presented as a user readable "Logical Name") and Push-button ("verify") method for initiating a connection. The push-button initiates a message to the DICOM Verification Module and changes the status field to "Waiting for Response". After a Verification Message exchanged, the process returns a status-code.

The Digital Diagnost DICOM Export application entity acts as a Service Class User (SCU) of the Storage Service Class. After invoking it will open an association to the remote system. For each image to be transported a retrieve action from the internal Digital Diagnost storage will take place followed by the conversion to a DICOM message to be transferred to the remote system. Further the Digital Diagnost acts as Service Class User (SCU) of the Storage Commit Service Class. The DICOM Storage Commitment service (Push Model) is performed by an additional (optional) processing thread. Its output is directed to the IMS for requesting safe storage of the images previously transmitted.

The Digital Diagnost acts as Service Class User (SCU) for the Basic Worklist Management Service (BWLM) Class. By default, the patient/examination list update is performed by a "Broad Query" with pre-configured matching keys. This Worklist query may be performed in the system background. The background "Broad Query" is a configuration option that may be disabled. The patient/examination list may also be updated by a "Broad Query" issued by the operator.

The patient/examination list may also be updated by a "Patient Query" with specific matching keys issued by the operator.

This Worklist query is performed from the patient list User Interface (UI).

The Digital Diagnost acts as Service Class User (SCU) for the Modality Performed Procedure Step (MPPS) Service Class. The MPPS Service requires that the BWLM option is enabled. When performing the first acquisition of a scheduled or unscheduled Procedure Step, the system generates a MPPS IN PROGRESS message (N_CREATE). After having done the acquisition(s) and going back to the patient list, the operator selects the MPPS status COMPLETED (= default) or DISCONTINUED, and the system generates the final N_SET message.

2.3. Sequencing the Real-World Activities

The following sequence of Real-World activities is supported by the system:

2.3.1. Broad Query

- The system requests a Worklist (initiates a BWLM request) either by the background "Broad Query" option or issued by the operator
- If the query has been initiated by the operator, a result notification is given back.
- The user selects a patient from the patient list GUI and opens the Examination GUI.

2.3.2. Patient Query (Optionally)

- The user requests a patient oriented worklist by entering matching values in the Patient Query GUI.
- After the patient related worklist items have been returned, the system directly opens the Examination GUI with the patient's examination context.

2.3.3. Default Acquisitions (Examination GUI)

- The user starts the examination. When the user confirms the first acquisition of an examination, the system sets the MPPS status to "IN PROGRESS" and a DICOM N-CREATE message is sent back to the RIS.
- When the examination has been performed and the user goes back to the patient list menu, a MPPS N-SET command (with status COMPLETED or DISCONTINUED) is sent to the RIS and the system exports the examination.
- With a C-STORE request the images are sent from Digital Diagnost to a remote DICOM system (Archive or DICOM printer).
- A Storage Commit request may be sent to the remote DICOM system (Archive).

2.3.4. Re-Processing Acquisitions (Viewer GUI)

- If images of an examination have to be re-processed and re-exported with different post-processing, the user selects the images of the patient's examination in the Viewing tool GUI.
- When a new post-processing of the first image of an examination is confirmed by the user, the system sets the MPPS status to "IN PROGRESS" and a DICOM N-CREATE message is sent to the RIS.
- When all intended images of an examination have been re-processed and confirmed and the user goes back to the patient list menu, a MPPS N-SET command (with status COMPLETED) is sent to the RIS and the system exports the re-processed images as new instances of this examination.
- With a C-STORE request the images are sent from Digital Diagnost to a remote DICOM system (Archive or DICOM printer).
- A Storage Commit request may be sent to the remote DICOM system (Archive).

2.3.5. Taking Non-Digital Acquisitions

- The user starts an examination with acquisitions on the non-digital Registration Device (e.g. on Philips PCR cassettes).
- When the acquisitions have been performed and the user goes back to the patient list menu, the system sets the MPPS status to "IN PROGRESS" and a

DICOM N-CREATE message is sent back to the RIS, immediately followed by a MPPS N-SET command (with status COMPLETED or DISCONTINUED).

- The MPPS messages show an empty referenced image sequence.
- No images can be sent from Digital Diagnost to a remote DICOM system.
- The subsequent image processing and distribution is performed at the PCR system.



3. AE SPECIFICATIONS

Digital Diagnost DICOM Export acts as a single Application Entity:

- Digital Diagnost AE

The Digital Diagnost Application Entity is specified in section 3.1.

3.1. Digital Diagnost AE

The Digital Diagnost Application Entity provides Standard Extended Conformance to the following DICOM 3.0 SOP class as an SCU specified in Table 1:

Table 1. Supported SOP class by the Digital Diagnost Export AE as SCU

SOP class Name	UID
Verification	1.2.840.10008.1.1
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.3.1
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3

The Digital Diagnost Application Entity provides Standard Extended Conformance to the following DICOM 3.0 SOP class as an SCP specified in Table 2:

Table 2. Supported SOP class by the Digital Diagnost Export AE as SCP

SOP class Name	UID
Verification	1.2.840.10008.1.1

3.1.1. Association Establishment Policies

3.1.1.1. General

The Digital Diagnost Application Entity proposes the following DICOM Application Context Name (ACN): 1.2.840.10008.3.1.1.1

For SOPs Verification, Computed Radiography Image Storage, and Storage Commitment Push Model SOP Class, the Digital Diagnost AE will offer a fixed maximum PDU size of 28K = 28672 bytes on the associations initiated by the application itself.

For SOPs Modality Worklist Information Model – FIND and Modality Performed Procedure Step SOP Class, the Digital Diagnost AE will offer a fixed maximum PDU size of 16K = 16384 bytes on the associations initiated by the application itself.

3.1.1.2. Number of Associations

The Digital Diagnost export will attempt to establish one association per SOP class at a time.

3.1.1.3. Asynchronous Nature

The Digital Diagnost export does not support asynchronous operations and will not perform asynchronous window negotiation.

3.1.1.4. Implementation Identifying Information

THE IMPLEMENTATION CLASS UID	1.3.46.670589.26.1.3
THE IMPLEMENTATION VERSION NAME	DigiDiagnost1.3

3.1.2. Association Acceptance Policy

The Digital Diagnost AE accepts Associations for the following purposes:

- To allow remote applications to verify application level communication with the Digital Diagnost AE.
- To accept N-EVENT-REPORT requests.

3.1.2.1. Real-World Activity – Verification**3.1.2.1.1. Associated Real-World Activity**

The Digital Diagnost Application Entity accepts associations from systems that wish to verify application level communication using the C-ECHO command.

3.1.2.1.2. Presentation Context Table

Digital Diagnost proposes the presentation contexts as given in the next table.

Table 3. Proposed Presentation Contexts for the Digital Diagnost Verification SCP

Abstract Syntax		Transfer Syntax		Role	Ext.Neg.
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	ILE	1.2.840.10008.1.2	SCP	None
		ELE	1.2.840.10008.1.2.1		
		EBE	1.2.840.10008.1.2.2		

3.1.2.1.3. SOP Specific Conformance – C-ECHO

Digital Diagnost provides standard conformance to the DICOM Verification Service Class.

3.1.2.1.4. Presentation Context Acceptance Criterion

The Digital Diagnost Application Entity accepts all contexts in the intersection of the proposed and acceptable Presentation Contexts. This means that multiple Proposed Presentation Contexts with the same SOP Class but different Transfer Syntaxes are accepted. Nevertheless ELE is the preferred Transfer Syntax. There is no check for duplicate contexts and are therefore accepted.

3.1.2.2. Real-World Activity – N-EVENT-REPORT

3.1.2.2.1. Associated Real-World Activity

The Digital Diagnost Application Entity accepts (only from configured systems) associations that wish to report Storage Commitment events.

3.1.2.2.2. Presentation Context Table

Digital Diagnost proposes the presentation contexts as given in the next table.

Table 4. Proposed Presentation Contexts for the Digital Diagnost Verification SCP

Abstract Syntax		Transfer Syntax		Role	Ext.Neg.
Name	UID	Name List	UID List		
Storage	1.2.840.10008.1.20.1	ILE	1.2.840.10008.1.2	SCU	None
Commitment		ELE	1.2.840.10008.1.2.1		
Push Model		EBE	1.2.840.10008.1.2.2		

3.1.2.2.3. SOP Specific Conformance – N-EVENT-REPORT

Digital Diagnost provides standard conformance to the DICOM Storage Commitment Push Model Class.

3.1.2.2.4. Presentation Context Acceptance Criterion

The Digital Diagnost Application Entity accepts all contexts in the intersection of the proposed and acceptable Presentation Contexts. This means that multiple Proposed Presentation Contexts with the same SOP Class but different Transfer Syntaxes are accepted. Nevertheless ELE is the preferred Transfer Syntax. There is no check for duplicate contexts and are therefore accepted.

3.1.3. Association Initiation Policy

For each request an association to the peer entity is established.

3.1.3.1. Real-World Activity - Verification

3.1.3.1.1. Associated Real-World Activity

The Digital Diagnost Application Entity invokes an association to a remote system.

3.1.3.1.2. Presentation Context Table

The Digital Diagnost Application Entity proposes the presentation contexts as given in the next table.

Table 5. Proposed Presentation Contexts for the Digital Diagnost Verification SCU

Abstract Syntax		Transfer Syntax		Role	Ext.Neg.
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	ILE	1.2.840.10008.1.2	SCU	None
		ELE	1.2.840.10008.1.2.1		
		EBE	1.2.840.10008.1.2.2		

3.1.3.1.3. SOP Specific Conformance to Verification SOP Classes

The Digital Diagnost provides standard conformance to the DICOM Verification Service Class.

3.1.3.2. Real-World Activity – Export

3.1.3.2.1. Associated Real-World Activity

The DICOM Image Export can be done on the following ways:

- The operator requests via the user Interface the export of the selected Digital Diagnost image to a remote system.
- The generation of a new Digital Diagnost image will result in an automatic export of that image when the system is configured in automatic export mode.

For each export request a new association is set up and the transfer of the images is started. The association is released when the transfer is ended. The transferred image will not be deleted from the system. In case of unsuccessful transfer with special response status conditions (e.g. Store SCP down), a new attempt will be done automatically every N seconds, at which N is configurable. These queued export requests can be aborted by the operator.

3.1.3.2.2. Presentation Context Table

The Digital Diagnost Application Entity proposes the presentation contexts as given in the next table.

Table 6. Proposed Presentation Contexts for the Digital Diagnost Export SCU

Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Computed Radiogr. Image Storage	1.2.840.10008.5.1.4.1.1.1	ILE ELE EBE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

3.1.3.2.3. SOP Specific Conformance to the Storage SOP Class

The status of the C-STORE Response (Success, Refused, Error, Warning) will be displayed via the user interface. Extended negotiation is not supported.

Table 7 lists the applied optional and extended modules and attributes of the CR IOD. Conditional attributes Patient Orientation (type 2C), Image Date (type 2C), Image Time (type 2C), Specific Character Set (type 1C) are always present.

Table 7. Applied optional Modules and Attributes of the applied CR IOD

IE	Module	Optional Attributes	Conditional Attributes
Patient	Patient	Other Patient's ID, Ethnic Group, Patient Comments	-
Study	General Study	Study Description, Physician(s) of Record, Referenced Study Sequence	-
	Patient Study	Additional Patient's History	-
Series	General Series	Series Date, Series Time, Operator's Name, Protocol Name, Series Description, Referenced Study Component Sequence, Request Attributes Sequence	Laterality.
	CR Series	Filter Type, Collimator/Gridname, Focal Spot(s), Focal Spot(s), Plate Type	
Equipment	General Equipment	Institution Name, Station Name, Institutional Department Name, Manufacturer's Model Name, Device Serial Number, Software Version(s), Date of Last Calibration, Time of Last Calibration	-
Image	General Image	Image Type, Acquisition Number, Image Comments	Content Date, Content Time, Patient Orientation
	Image Pixel	-	-
	X-Ray Acquisition	Image Area Dose Product, Imager Pixel Spacing, Grid	-
	XRF Tomography Acquisition	Scan Options, Tomo Angle, Tomo Time	Tomo Layer Height -
	CR Image	KVP. Distance Source to Detector. Exposure Time.	-

IE	Module	Optional Attributes	Conditional Attributes
		Exposure, Imager Pixel Spacing,-Generator Power, Acquisition Device Processing Description, Processing Function, Post processing Function, Sensitivity	
	VOI LUT	Window Center	Window Width
	SOP Common	-	Specific Character Set

The modules selected from the CR Image IOD module table of DICOM 3.0 and the extended modules are given in the table below.

Table 8. Applied Modules in the Extended CR IOD

IE	Module		Reference
Patient	Patient	M	Table 9
	Patient Identification	U	Table 10
	Patient Medical	M	Table 11
Study	General Study	M	Table 12
	Patient Study	U	Table 13
	Study Scheduling	U	Table 14
Series	General Series	M	Table 15
	CR Series	M	Table 16
Equipment	General Equipment	M	Table 17
Image	General Image	M	Table 18
	Image Pixel	M	Table 19
	CR Image	M	Table 20
	X-Ray Acquisition	M	Table 21
	XRF Tomography Acquisition	C	Table 22
	VOI LUT	U	Table 23
	SOP Common	M	Table 24
	Private	M	Table 25

The details of these applied modules are given in the tables below. The list of possible attribute values is given (if applicable). The situation that an attribute is present conditionally/optionally or that an attribute may contain a zero length value, is indicated too.



Table 9. Comp. Radiogr. Image Storage SOP Class - C-STORE-RQ - Patient Module

Attribute Name	Tag	Note
Patient's Name	0010,0010	Patient's full name.
Patient ID	0010,0020	Primary hospital identification number or code for the patient.
Patient's Birth Date	0010,0030	Birth data of the patient.
Patient's Sex	0010,0040	Sex of the named patient. Applied Value(s): F, M, O
Other Patient IDs	0010,1000	Other identification numbers or codes used to identify the patient.
Ethnic Group	0010,2160	Ethnic group or race of the patient.
Patient Comments	0010,4000	User-defined additional information about the patient.

Table 10. Comp. Radiogr. Image Storage SOP Class-C-STORE-RQ-Pat. Ident. Module

Attribute Name	Tag	Note
Issuer of Patient ID	0010,0021	

Table 11. Comp. Radiogr. Image Storage SOP Class-C-STORE-RQ-Pat. Med. Module

Attribute Name	Tag	Note
Medical Alerts	0010,2000	
Contrast Allergies	0010,2110	
Pregnancy Status	0010,21C0	Applied Value(s): 0001, 0002, 0003, 0004
Special Needs	0038,0050	
Patient State	0038,0500	

Table 12. Comp. Radiogr. Image Storage SOP Class-C-STORE-RQ-Gen. Study Mod.

Attribute Name	Tag	Note
Study Instance UID	0020,000D	Unique identifier for the Study.
Study Date	0008,0020	Date the study started.
Study Time	0008,0030	Time the study started.
Accession Number	0008,0050	A RIS generated number, which identifies the order of the study.
Referring Physician's Name	0008,0090	Patient's referring physician.
Study ID	0020,0010	User or equipment generated Study identifier.
Study Description	0008,1030	Institution-generated description or classification of the Study (Component performed).
Physician(s) of Record	0008,1048	Added by DICOM 3.3-1993 Supplement 4 (XA)! Phvsician(s) who are responsible for

Attribute Name	Tag	Note
		the overall patient care at time of Study.
Referenced Study Sequence	0008,1110	A Sequence, which provides reference to a Study SOP Class/Instance pair. The sequence may have zero or more items. Encoded as sequence of items: (0008,1150) and (0008:1155).
>Referenced SOP Class UID	0008,1150	Uniquely identifies the referenced SOP Class required if Referenced Study Sequence (008:1110) is sent. Applied Value(s): 1.2.840.10008.3.1.2.3.1
>Referenced SOP Instance UID	0008,1155	Uniquely identifies the referenced SOP Instance. Required if Referenced Study Sequence (0008:1110) is sent.

Table 13. Comp. Radiogr. Image Stor. SOP Class-C-STORE-RQ-Study Sched. Mod.

Attribute Name	Tag	Note
Procedure Code Sequence	0008,1032	
>Code Value	0008,0100	
>Coding Scheme Designator	0008,0102	
>Coding Scheme Version	0008,0103	
>Code Meaning	0008,0104	

Table 14. Comp. Radiogr. Image Storage SOP Class-C-STORE-RQ-Pat. Study Module

Attribute Name	Tag	Note
Additional Patient History	0010,21B0	Additional information about the patient's medical history.

Table 15. Comp. Radiogr. Image Storage SOP Class-C-STORE-RQ-Gen. Ser. Module

Attribute Name	Tag	Note
Modality	0008,0060	Type of equipment that originally acquired the data used to create the image in this series. Applied Value(s): CR
Series Instance UID	0020,000E	Unique identifier of the Series.
Series Number	0020,0011	A number that identifies the Series.
Laterality	0020,0060	Laterality of (paired) body part examined. Required if the body part examined is a paired structure. Applied Value(s): L, R
Series Date	0008,0021	Date the Series started.
Series Time	0008,0031	Time the Series started.
Protocol Name	0018,1030	User-defined description of the conditions under which the Series was performed.
Series Description	0008,103E	User provided description of the Series

Attribute Name	Tag	Note
Operator's Name	0008,1070	Technologist(s) supporting the series.
Referenced Study Component Sequence	0008,1111	Uniquely identifies the Study Component SOP Instance to which the series is related.
>Referenced SOP Class UID	0008,1150	Uniquely identifies the referenced SOP Class. Required if Referenced Study Component Sequence (0008:1111) is sent. Applied Value(s): 1.2.840.10008.3.1.2.3.2, 1.2.840.10008.3.1.2.3.3
>Referenced SOP Instance UID	0008,1155	Uniquely identifies the referenced SOP Instance. Required if referenced Study Component Sequence (0008:1111) is sent.
Body Part Examined	0018,0015	Applied Value(s): ABDOMEN, ANKLE, BREAST, CHEST, CLAVICLE, COCCYX, CSPINE, ELBOW, EXTREMITY, FOOT, HAND, HIP, KNEE, LSPINE, PELVIS, SHOULDER, SKULL, SSPINE, TSPINE Additional Applied Value(s): HEAD, HEART, NECK, LEG, ARM, JAW
Request Attributes Sequence	0040,0275	
>Requested Procedure ID	0040,1001	Identifier, which identifies the Requested Procedure in the Imaging Service Request. Required if Sequence is present.
>Scheduled Procedure Step ID	0040,0009	Identifier, which identifies the Scheduled Procedure in the Imaging Service Request. Required if Sequence is present.
>Scheduled Procedure Step Description	0040,0007	
>Scheduled Action Item Code Sequence	0040,0008	
>>Code Value	0008,0100	
>>Coding Scheme Designator	0008,0102	
>>Coding Scheme Version	0008,0103	
>>Code Meaning	0008,0104	

Table 16. Comp. Radiogr. Image Storage SOP Class-C-STORE-RQ-CR Series Module

Attribute Name	Tag	Note
Body Part Examined	0018,0015	Text Description of the part of the body examined. Applied Value(s): ABDOMEN, ANKLE, ARM, BREAST, CHEST, CLAVICLE, COCCYX, CSPINE, ELBOW, EXTREMITY, FOOT, HAND, HIP, KNEE, LSPINE, PELVIS, SHOULDER, SKULL, SSPINE, TSPINE Additional Applied Value(s): HEAD, HEART, NECK, LEG, ARM, JAW
View Position	0018,5101	Radiographic view associated with Patient

Attribute Name	Tag	Note
		Position (0018,5100). Applied Value(s): AP, LL, LLD, LLO, PA, RL, RLD, RLO
Filter Type	0018,1160	Label for the type of filter inserted into the x-ray beam.
Collimator/Grid Name	0018,1180	Label describing any grid inserted.
Focal Spot	0018,1190	Size of the focal spot in mm. For devices with variable focal spot or multiple focal spots, small dimension followed by large dimension.
Plate Type	0018,1260	Label of type of storage phosphor plates used in this series.

Table 17. Comp. Radiogr. Image Stor. SOP Class-C-STORE-RQ-Gen. Equipm. Mod.

Attribute Name	Tag	Note
Manufacturer	0008,0070	Manufacturer of the equipment that produced the digital images. Applied Value(s): Philips Medical Systems
Institution Name	0008,0080	Institution where the equipment is located that produced the digital images.
Station Name	0008,1010	Use defined name identifying the machine that produced the digital images.
Institutional Department Name	0008,1040	Department in the institution where the equipment is located that produced the digital images.
Manufacturer's Model Name	0008,1090	Manufacturers model number of the equipment that produced the digital images. Applied Values: digital DIAGNOST
Device Serial Number	0018,1000	Manufacturers serial number of the equipment that produced the digital images.
Software Version(s)	0018,1020	Manufacturers designation of software version of the equipment that produced the digital images. Applied Value(s): Version 1.3
Date of Last Calibration	0018,1200	Date when the image acquisition device calibration was last changed in any way. Multiple entries may be used for additional calibrations at other times.
Time of Last Calibration	0018,1201	Time when the image device was last changed in any way. Multiple entries may be used.

Table 18. Comp. Radiogr. Image Storage SOP Class-C-STORE-RQ-Gen. Image Mod.

Attribute Name	Tag	Note
Instance Number	0020,0013	
Patient Orientation	0020,0020	Required if image does not require Image Orientation and Image Position. Format <u>o1\o2</u> . Where o1, o2 are one or two of the <u>Defined Values</u> : A, P, R, L, H, F
Content Date	0008,0023	
Content Time	0008,0033	
Image Type	0008,0008	Applied Value(s): DERIVED\PRIMARY
Acquisition Number	0020,0012	
Image Comments	0020,4000	

Table 19. Comp. Radiogr. Image Storage SOP Class-C-STORE-RQ-Image Pixel Mod.

Attribute Name	Tag	Note
Samples per Pixel	0028,0002	Number of samples (planes) in this image.
Photometric Interpretation	0028,0004	Applied Value(s): MONOCHROME1, MONOCHROME2
Rows	0028,0010	Number of rows in the image.
Columns	0028,0011	Number of Columns in the image.
Bits Allocated	0028,0100	Applied Value(s): 16, 8
Bits Stored	0028,0101	Applied Value(s): 15, 12, 10, 8
High Bit	0028,0102	Applied Value(s): 14, 11, 9, 7
Pixel Representation	0028,0103	Applied Value(s): 0
Pixel Data	7FE0,0010	

Table 20. Comp. Radiogr. Image Storage SOP Class-C-STORE-RQ - CR Image Module

Attribute Name	Tag	Note
Photometric Interpretation	0028,0004	
KVP	0018,0060	Peak kilo voltage output of the x-ray generator used.
Distance Source to Detector	0018,1110	
Exposure Time	0018,1150	Time of x-ray exposure in msec.
Exposure	0018,1152	The product of exposure time and X-ray Tube Current expressed in mAs.
Imager Pixel Spacing	0018,1164	
Generator Power	0018,1170	Power in kW to the x-ray generator.
Acquisition Device Processing Description	0018,1400	Describes device-specific processing associated with the image (e.g. Organ Description).
Processing Function	0018,5020	Note: This attribute does not belong to the

Attribute Name	Tag	Note
		CR-Image module. It has been added for Thoravision (declared as "extended CR-Image attribute") and has been used since then.
Post processing Function	0018,5021	Note: This attribute does not belong to the CR-Image module. It has been added for Thoravision (declared as "extended CR-Image attribute") and has been used since then.
Sensitivity	0018,6000	Read out sensitivity.

Table 21. Comp. Radiogr. Image Storage SOP Class-C-STORE-RQ-X-ray Acqu. Mod.

Attribute Name	Tag	Note
Image Area Dose Product	0018,115E	
Imager Pixel Spacing	0018,1164	
Grid	0018,1166	Applied Value(s): IN, NONE

Table 22. Comp. Radio. Image Stor. SOP Class-C-STORE-RQ-X-ray Tomo. Acq. Mod.

Attribute Name	Tag	Note
Scan Options	0018,0022	Applied Value(s): TOMO
Tomo Layer Height	0018,1460	
Tomo Angle	0018,1470	
Tomo Time	0018,1480	

Table 23. Comp. Radiogr. Image Storage SOP Class - C-STORE-RQ - VOI Lut Module

Attribute Name	Tag	Note
Window Center	0028,1050	
Window Width	0028,1051	Required if Window Center (0028,1050) is sent.

Table 24. Comp. Radiogr. Image Storage SOP Class-C-STORE-RQ-Sop Common Mod.

Attribute Name	Tag	Note
Specific Character Set	0008,0005	Required if an expanded or replacement character set is used. Applied Value(s): ISO_IR 100, ISO_IR 101, ISO_IR 109, ISO_IR 110, ISO_IR 126, ISO_IR 127, ISO_IR 138, ISO_IR 144, ISO_IR 148
SOP Class UID	0008,0016	Mandatory for Composite IODs only. Applied Value(s): 1.2.840.10008.5.1.4.1.1.1
SOP Instance UID	0008,0018	Mandatory for Composite IODs only.

Table 25. Comp. Radiogr. Image Storage SOP Class - C-STORE-RQ - Private Group

Attribute Name	Tag	Note
Private Creator Group 0019	0019,0019	
Route AET	0019,1922	
PCR Print Scale	0019,1923	
PCR Print Job End	0019,1924	
PCR No Film Copies	0019,1925	
PCR Film Layout Position	0019,1926	
PCR Print Report Name	0019,1927	
RAD Protocol Printer	0019,1970	
RAD Protocol Medium	0019,1971	
Unprocessed Flag	0019,1990	
Key Values	0019,1991	
Destination Post processing Function	0019,1992	
Version	0019,19A0	
Ranging Mode	0019,19A1	
Abdomen Brightness	0019,19A2	
Fixed Brightness	0019,19A3	
Detail Contrast	0019,19A4	
Contrast Balance	0019,19A5	
Structure Boost	0019,19A6	
Structure Preference	0019,19A7	
Noise Robustness	0019,19A8	
Noise Dose Limit	0019,19A9	
Noise Dose Step	0019,19AA	
Noise Frequency Limit	0019,19AB	
Weak Contrast Limit	0019,19AC	
Strong Contrast Limit	0019,19AD	
Structure Boost Offset	0019,19AE	
Smooth Gain	0019,19AF	
Measure Field 1	0019,19B0	
Measure Field 2	0019,19B1	
Key Percentile 1	0019,19B2	
Key Percentile 2	0019,19B3	
Density LUT	0019,19B4	
Brightness	0019,19B5	
Gamma	0019,19B6	
Private Creator	0089,0010	Applied Value(s): DIDI TO PCR 1.1

3.1.3.3. Real-World Activity – Storage Commitment

3.1.3.3.1. Associated Real-World Activity

The DICOM Storage Commitment SOP (Push Model) is performed by an additional (optional) processing thread. Upon transfer of an image to an archive, the Digital Diagnost Application Entity initiates an association for the request of Storage Commitment on a remote System. A DICOM N-ACTION message is sent to the remote system. After Digital Diagnost has received the DICOM N-ACTION response, and the DICOM N-EVENT report message, it sends a DICOM N-EVENT report response message to the remote system. Upon completion of the N-ACTION, the association (by default) will be released. Digital Diagnost may be configured to accept receipts via N-EVENT report on separate associations. The storage commitment results are displayed in the Patient List (“Number of successful commitments”) and in the Viewing tool per single image.

3.1.3.3.2. Presentation Context Table

Digital Diagnost Application Entity will propose the presentation contexts as given in the next table.

Table 26. Proposed Pres. Contexts for the Digital Diagnost Storage Commit SCU

Abstract Syntax	UID	Transfer Syntax	UID List	Role	Ext. Neg.
Storage Commit	1.2.840.10008.1.20.1.1	ILE	1.2.840.10008.1.2	SCU	None
		ELE	1.2.840.10008.1.2.1		
		EBE	1.2.840.10008.1.2.2		

Note: ELE is preferred

3.1.3.3.3. SOP Specific Conformance – N-ACTION

Storage Commitment is accomplished according to the real world activity described earlier. The ACP AE Storage Commitment provides Standard conformance to the Storage Commitment SOP Class.

If storage commitment is enabled, Digital Diagnost requests a storage commitment N-ACTION message after any storage of an image on the configured Archive that has the capability of safe storage. Digital Diagnost supports Storage Commitment image by image. This means that it is not possible to commit all images of a study at one time. This implies that an N-ACTION request only refers to one Store SOP instance.

When performing Storage Commitment several errors can occur. Digital Diagnost is able to react on this situations in a logical way. The Table below gives an overview of possible error messages.



Table 27. Error Messages during Storage Commitment

Scenario	Error	Note
N-ACTION request failed	Failed to connect to remote host	Retry N-ACTION request
	Association Negotiation failed	Inform user Note
N-ACTION resp. status code unsuccessful	No such SOP Instance	Retry C-STORE request
	Processing failure	Retry N-ACTION request
	Resource limitation	Retry N-ACTION request
	Class instance conflict	Inform user Note
	Duplicate invocation	Inform user Note
	Invalid argument value	Inform user Note
	Invalid SOP instance	Inform user Note
	Mistyped argument	Inform user Note
	No such action	Inform user Note
	No such SOP class	Inform user Note
N-EVENT report failure	Unrecognized operation	Inform user Note
	Success	No action required
N-EVENT report failure	No such SOP instance	Retry C-STORE request
	Processing failure	Retry N-ACTION request
	Resource limitation	Retry N-ACTION request
	Class instance conflict	Inform user Note
	Referenced SAOP class not supported	Inform user Note
	Duplicate transaction UID	Inform user Note

Note: these error conditions inform the user that there is an error and are not solvable by Digital Diagnost. The actions performed if this error occurs are "ABORT" to delete the job.

Table 28. Stor. Commit. Push Model SOP Class-N-ACTION-RQ-Stor. Commit. Module

Attribute Name	Tag	Note
Transaction UID	0008,1195	
Referenced SOP Sequence	0008,1199	
>Referenced SOP Class UID	0008,1150	
>Referenced SOP Instance UID	0008,1155	
Referenced Study Component Sequence	0008,1111	
>Referenced SOP Class UID	0008,1150	Uniquely identifies the referenced SOP Class. Required if Referenced Study Component Sequence (0008:1111) is sent. Applied Value(s): 1.2.840.10008.3.1.2.3.2, 1.2.840.10008.3.1.2.3.3
>Referenced SOP Instance UID	0008,1155	Uniquely identifies the referenced SOP Instance. Required if referenced Study Component Sequence (0008:1111) is sent.



3.1.3.4. Real-World Activity – Management Worklist (MWL) - FIND

3.1.3.4.1. Associated Real-World Activity

For each Broad or specific Worklist request, an association towards the Basic Worklist Management SCP is established and a C-FIND request is transmitted. The Broad query can be configured with a combination of the matching keys:

- Scheduled Station AE Title
- Scheduled Procedure Step Start Date
- Modality

Each of the matching keys is optional but one key is minimum required. The association will be closed on reception of the last C-FIND response. The Worklist Query result is displayed in the Patient List.

3.1.3.4.2. Presentation Context Table

Digital Diagnost Application Entity will propose the presentation contexts as given in the next table.

Table 29. Proposed Presentation Contexts for the Digital Diagnost MWL SCU

Abstract Syntax	UID	Transfer Syntax	UID List	Role	Ext. Neg.
MWL-FIND	1.2.840.10008.5.1.4.31	ILE ELE EBE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

Note: ELE is preferred

3.1.3.4.3. SOP Specific Conformance – MWL-FIND

By default, the patient/examination list update is performed by a “Broad” Query with pre-configured matching keys. This MWL query may be performed in the system background and may be disabled. The time interval between subsequent background queries is configurable.

The Broad Query may also be issued by the operator and will be performed from the Patient List User interface. If the query has been initiated by the operator, a result notification is sent back. The Broad Query will be cancelled automatically by C-FIND-CANCEL request after a configurable maximum number of returned Worklist items. After cancellation a notification is generated, for possible modification of the query key(s) or the key value(s) or the configured maximum number of Worklist items.

Specific Character Set

By configuration, Digital Diagnost Application Entity may add the Specific Character Set (0008,0005) as return attribute (0-length) in the MWL-FIND request.

The Digital Diagnost AE supports the returned value ISO_IR 100 (ISO Latin Alphabet 1).

If a BWLM SCP returns a different value, or sends characters that exceed the set of ISO_IR 100, the C-FIND response is accepted, but related data values may be corrupted.

The table below gives an overview of the matching keys for a Broad Query.

Table 30. Matching Keys for Broad Query

Attribute Name	Tag	Note
Scheduled Station AE Title	0040,0001	Digital Diagnost individual AE Title; default matching key
Scheduled Procedure Step Start Date	0040,0002	Configurable one of: date of <today> date of <today> and subsequent dates date of prior to and incl. <today> This key is used combined with AE Title or Modality type.
Modality (type)	0008,0060	This key may be used if the Worklist is generated for a "modality pool"; although Digital Diagnost always produces CR images, it may query for CR and DX (configurable) images

Wildcard matching ("*" only) in Scheduled AE Title-may be configured; it is performed by local means and not by DICOM. The date matching without any other key is not supported. When date matching is configured, the date value is continuously generated from local system time. The modality type query may be used for environments that do not schedule per individual modality's AE Title, but for a modality pool.

The returned Scheduled Station AE Title (0040,0001) may contain 1 single value only. The Digital Diagnost AE cannot handle multiple values in this attribute and treats this case as 'not scheduled for local AET'.

The optional Patient Based Worklist Query is typically triggered by operator action when a patient arrives at the system for examination. Digital Diagnost expects the operator to enter the value(s) of the search key(s). The search key entry fields are individually (de)/activated by configuration. At least one of the key entry fields must be filled when issuing a query.

The table below gives an overview of the matching keys for a Patient Query

Table 31. Matching Keys for Patient Query

Attribute Name	Tag	Note
Patient's Name	0010,0010	Identified from admission form or bar code field.
Patient ID	0010,0020	Identified from admission form or bar-code field
Accession Number	0008,0050	Identified from admission form or bar-code field
Requested Procedure ID	0040,1001	Identified from admission form or bar-code field
Scheduled Station AE Title	0040,0001	This key may be optionally (default: no) added by the system. Its value is the Digital Diagnost individual AE Title

Attribute Name	Tag	Note
Scheduled Procedure Step Start Date	0040,0002	This key may be optionally (default: no) added by the system. Its value is (Configurable) one of: date of <today> date of <today> and subsequent dates date of prior to and incl. <today>

Wildcard search (using "*" only) is supported for "Patient Name. The format of the patient name entry is configurable:

- Single field in DICOM notation
- Two fields (last name, first name)

The Broad or Patient Query will be cancelled automatically ("auto-cancellation") by C-FIND-CANCEL request after a configurable maximum number of returned Worklist items, returning only the so far respond/extracted items. This number is specific for Broad and Patient queries each. After cancellation, the operator will be notified.

3.1.3.4.3.1. Patient Merge

Patients are merged by the combined keys Patient ID (0010,0020) and Issuer of Patient ID (0010,0021). If the RIS constantly does not use the Issuer of Patient ID, the Patient ID will suffice.

3.1.3.4.3.2. Scheduled Procedure Step (= Examination) Merge

Examinations are merged by the combined keys Study Instance UID (0020,000D) and Scheduled Procedure Step ID (0040,0009).

3.1.3.4.3.3. Merging Sequence

The sequence is:

- 1.) Try to merge the patient.
- 2.) Try to merge the examination.

The details of the applied modules are given in the tables below. The list of possible attribute values is given (if applicable).

Table 32. MWL Inform. Model - FIND SOP Class - C-FIND-RQ – Pat. Ident. Module

Attribute Name	Tag	Note
Patient's Name	0010,0010	Optional matching key
Patient ID	0010,0020	Optional matching key
Issuer of Patient ID	0010,0021	
Other Patient IDs	(0010,1000)	Not evaluated



Table 33. MWL Inform. Model - FIND SOP Class - C-FIND-RQ – Pat. Demogr. Module

Attribute Name	Tag	Note
Patient's Birth Date	0010,0030	
Patient's Sex	0010,0040	
Patient Data Confidentiality Constraint Description	0040,3001	
Ethnic group	(0010,2160)	Not evaluated
Patient Comments	(0010,4000)	Not evaluated

Table 34. MWL Inform. Model - FIND SOP Class - C-FIND-RQ - Patient Medical Module

Attribute Name	Tag	Note
Medical Alerts	0010,2000	
Contrast Allergies	0010,2110	
Additional Patient History	0010,21B0	
Pregnancy Status	0010,21C0	
Special Needs	0038,0050	
Patient State	0038,0500	

Table 35. MWL Inform. Model - FIND SOP Class - C-FIND-RQ - Visit Status Module

Attribute Name	Tag	Note
Current Patient Location	0038,0300	

Table 36. MWL Info. Model - FIND SOP Class-C-FIND-RQ–Sched. Proced. Step Mod.

Attribute Name	Tag	Note
Scheduled Procedure Step Sequence	0040,0100	
>Modality	0008,0060	Optional matching key; Applied Value(s): CR, DX
>Scheduled Procedure Step Start Date	0040,0002	Optional matching key
>Scheduled Procedure Step Start Time	0040,0003	
>Scheduled Performing Physician's Name	0040,0006	
>Scheduled Procedure Step Description	0040,0007	
>Scheduled Action Item Code Sequence	0040,0008	
>>Code Value	0008,0100	
>>Coding Scheme Designator	0008,0102	Not evaluated
>>Coding Scheme Version	0008,0103	Not evaluated
>>Code Meaning	0008,0104	Not evaluated
>Scheduled Procedure Step ID	0040,0009	
>Requested Contrast Agent	(0032,1070)	Not evaluated

Attribute Name	Tag	Note
>Scheduled AE Title	(0040,0001)	Optional matching key; The return attribute may contain 1 value only
>Scheduled Procedure Step End Date	(0040,0004)	Not evaluated
>Scheduled Procedure Step End Time	(0040,0005)	Not evaluated
>Scheduled Station Name	(0040,0010)	Not evaluated
>Scheduled Procedure Step Location	(0040,0011)	Not evaluated
>Pre-Medication	(0040,0012)	Not evaluated
>Scheduled Procedure Step Status	(0040,0020)	Not evaluated
>Comments on the Scheduled Procedure Step	(0040,0400)	Not evaluated

Table 37. MWL Inform. Model - FIND SOP Class-C-FIND-RQ – Req. Procedure Module

Attribute Name	Tag	Note
Referenced Study Sequence	0008,1110	
>Referenced SOP Class UID	0008,1150	
>Referenced SOP Instance UID	0008,1155	
Study Instance UID	0020,000D	
Requested Procedure Description	0032,1060	
Requested Procedure Code Sequence	0032,1064	
>Code Value	0008,0100	
>Coding Scheme Designator	0008,0102	Not evaluated
>Coding Scheme Version	0008,0103	Not evaluated
>Code Meaning	0008,0104	Not evaluated
Requested Procedure ID	0040,1001	Optional matching key
Names of Intended Recipients of Results	(0040,1010)	Not evaluated
Requested Procedure Comments	(0040,1400)	Not evaluated

Table 38. MWL Inform. Model - FIND SOP Class-C-FIND-RQ – Imag. Serv. Req. Mod.

Attribute Name	Tag	Note
Accession Number	0008,0050	Optional matching key
Referring Physician's Name	0008,0090	
Requesting Physician	(0032,1032)	Not evaluated
Requesting Service	(0032,1033)	Not evaluated
Imaging Service Request Comments	(0040,2400)	Not evaluated

3.1.3.5. Real-World Activity – Modality Performed Procedure Step

3.1.3.5.1. Associated Real-World Activity

A Digital Diagnost “Examination” is regarded equivalent to a DICOM Procedure Step. It is scheduled or manually entered before an acquisition is taken, and performed by taking acquisitions. Since an examination may be re-opened after having been closed, and each examination workflow context is enclosed in one MPPS, one examination may result in 0:n MPPS instances.

After the first acquisition for a Scheduled Procedure Step has been performed, the system sets the MPPS status of the related exam to “IN PROGRESS” and generates an initial MPPS IN PROGRESS message by N-CREATE. The system does not generate intermediate MPPS IN PROGRESS messages for subsequent acquisitions of this Scheduled Procedure Step instance.

Digital Diagnost also generates MPPS IN PROGRESS / N-CREATE messages for images re-processed and exported by the Viewing tool, i.e. outside an acquisition session. Digital Diagnost does not generate MPPS messages for simple image re-export by the Viewing tool.

After finishing the appropriate acquisition(s), the system will change the MPPS status of the related examination to “COMPLETED” and generate a MPPS COMPLETED message by N-SET.

Digital Diagnost also generates MPPS messages for unscheduled examinations.

The MPPS COMPLETED message will list the UID’s of all related DICOM exported images and format of (optionally) generated direct prints.

After abandoning or discontinuing a procedure step, the operator may set the MPPS status of the related examination to “DISCONTINUED” and the system generates a MPPS DISCONTINUED message. The reason for abandoning or discontinuing a procedure step is unspecified.

3.1.3.5.1.1. Sequencing of Performed Procedure Steps

The performed sequence order of scheduled procedure steps may be interchanged by the user.

3.1.3.5.1.2. Interleave of Performed Procedure Steps

MPPS messages may interleave. Depending on the application workflow optimization by the user, an MPPS sequence like this may come up:

```
MPPS / Inst UID 1: N_CREATE / IN PROGRESS
MPPS / Inst UID 2: N_CREATE / IN PROGRESS
MPPS / Inst UID 3: N_CREATE / IN PROGRESS
...
MPPS / Inst UID 2: N_SET / COMPLETED
MPPS / Inst UID 1: N_SET / COMPLETED
MPPS / Inst UID 3: N_SET / COMPLETED
```

(i.e.: running multiple procedure steps ‘in parallel’).

3.1.3.5.2. Presentation Context Table

Digital Diagnost will propose the presentation contexts as given in the next table.

Table 39. Proposed Presentation Context for the Verification by the RIS AE

Abstract Syntax	UID	Transfer Syntax	UID List	Role	Ext. Neg.
MPPS	1.2.840.10008.3.1.2.3.3	ILE ELE EBE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

Note: For Modality Performed Procedure Step, ELE is preferred.

3.1.3.5.3. SOP Specific Conformance

When performing the first acquisition of a Scheduled or Unscheduled Procedure Step, Digital Diagnost generates a MPPS IN PROGRESS message. Digital Diagnost does not generate intermediate IN PROGRESS (N-SET) messages and does not support the Performed Procedure Step Exception Management Option. Digital Diagnost has no Billing Code Tables and does not support the Performed Procedure Step Billing and Material Management Option, except default values for Medium Type (2000,0030) and Film Size ID (2010,0050), if optional Local Print is configured.

If for application reasons the operator decides to perform a scheduled (or unscheduled) Procedure Step (= Examination) not on the Digital Detector, but on the attached conventional film cassette, the resulting MPPS messages do list the Performed Protocol Code etc., but no image references.

If the operator decides to perform a Procedure Step partly by the Digital Detector and partly by the attached conventional film cassette, the result of this Procedure Step, for data consistency reason, is sent by 2 separate MPPS instances: one for the digital part, the other for the conventional part.

An MPPS sequence like this comes up:

MPPS / Inst UID 1 (digital part): N_CREATE / IN PROGRESS
MPPS / Inst UID 2 (conventional part): N_CREATE / IN PROGRESS

MPPS / Inst UID 1 (digital part): N_SET / COMPLETED
MPPS / Inst UID 2 (conventional part): N_SET / COMPLETED

3.1.3.5.3.1. Assisted Acquisition Protocol Setting Option

Digital Diagnost by default derives the specific acquisition protocol from the Scheduled Protocol Code Sequence Items. Any single Item results in an 'Examination'.

Digital Diagnost supports 3 more (configurable) mapping relations, as shown below:

- Examination is selected from Scheduled Protocol Code Items->Code Value 0040,0008 (default)
- Examination is selected from Scheduled Procedure Step Description 0040,0007
- Examination is selected from Requested Procedure Code Items->Code Value 0032,1064

- Examination is selected from Requested Procedure Description 0032,1060

Digital Diagnost does not evaluate the attributes Coding Scheme Version 008,0103, Coding Scheme Designator 0008,0102, Code Meaning 0008,0104, but only the Code Value 0008,0100, for mapping the examination settings. That is, Digital Diagnost expects, that any used Code Value is unique (unambiguous) within a given RIS domain.

Per Scheduled Procedure Step, Digital Diagnost is able to accept up to 15 items in the Scheduled Protocol Code Sequence.

If more items are sent, the supernumerary items are dropped, and an operator alert is created.

3.1.3.5.3.2. Restrictions Depending on Number of Sched. Protocol Code Items

If the Scheduled Procedure Step contains only 1 Item in the Scheduled Protocol Code Sequence, there is nothing special, and this case is highly recommended.

If the Scheduled Procedure Step contains multiple (N) Items in the Scheduled Protocol Code Sequence, the Scheduled Procedure Step is split into N examinations, where any single examination refers to only 1 Scheduled Protocol Code Item.

When such an examination is returned back via MPPS, also the Performed Protocol Code Sequence will show only 1 item. If all N Scheduled Procedure Step's are performed in a 1:1 relation, N MPPS instances will be sent back to the RIS, and the sum of all Performed Protocol Code Items will be N.

Table 40. MPPS SOP Class - N-CREATE-RQ - Sop Common Module

Attribute Name	Tag	Note
Specific Character Set	0008,0005	Applied Value(s): ISO_IR 100
SOP Class UID	0008,0016	Applied Value(s): 1.2.840.10008.3.1.2.3.3
SOP Instance UID	0008,0018	

Table 41. MPPS SOP Class - N-CREATE-RQ - Image Acquisition Results Module

Attribute Name	Tag	Note
Modality	0008,0060	Applied Value: CR
Study ID	0020,0010	If scheduled: Req. Procedure ID, else: equipment generated Study identifier
Performed Action Item Code Sequence	0040,0260	
>Code Value	0008,0100	
>Coding Scheme Designator	0008,0102	
>Coding Scheme Version	0008,0103	
>Code Meaning	0008,0104	
Performed Series Sequence	0040,0340	0 length

Table 42. MPPS SOP Class - N-CREATE-RQ – Perform. Proced. Step Inform. Module

Attribute Name	Tag	Note
Procedure Code Sequence	0008,1032	
>Code Value	0008,0100	
>Coding Scheme Designator	0008,0102	
>Coding Scheme Version	0008,0103	
>Code Meaning	0008,0104	
Performed Station AE Title	0040,0241	
Performed Station Name	0040,0242	0 length
Performed Location	0040,0243	0 length
Performed Procedure Step Start Date	0040,0244	
Performed Procedure Step Start Time	0040,0245	
Performed Procedure Step End Date	0040,0250	0 length
Performed Procedure Step End Time	0040,0251	0 length
Performed Procedure Step Status	0040,0252	Applied Value IN PROGRESS
Performed Procedure Step ID	0040,0253	
Performed Procedure Step Description	0040,0254	0 length
Performed Procedure Type Description	0040,0255	0 length

Table 43. MPPS SOP Class - N-CREATE-RQ – Perform. Proced. Step Relat. Module

Attribute Name	Tag	Note
Patient's Name	0010,0010	
Patient ID	0010,0020	
Issuer of Patient ID	0010,0021	
Patient's Birth Date	0010,0030	
Patient's Sex	0010,0040	
Referenced Patient Sequence	0008,1120	0 length
Scheduled Step Attribute Sequence	0040,0270	
>Accession Number	0008,0050	
>Referenced Study Sequence	0008,1110	0 length if unscheduled
>>Referenced SOP Class UID	0008,1150	
>>Referenced SOP Instance UID	0008,1155	
>Accession Number	0008,0050	
>Study Instance UID	0020,000D	
>Requested Procedure ID	0040,1001	0 length if unscheduled
>Requested Procedure Description	0032,1060	0 length if unscheduled
>Scheduled Procedure Step ID	0040,0009	0 length if unscheduled
>Scheduled Procedure Step Description	0040,0007	0 length if unscheduled
>Scheduled Protocol Code Sequence	0040,0008	0 length

Table 44. MPPS SOP Class - N-CREATE-RQ - Radiation Dose Module

Attribute Name	Tag	Note
Anatomical Structure, Space or Region Sequence	0008,2229	0 length
Image Area Dose Product	0018,115E	0 length
Total Number of Exposures	0040,0301	0 length
Exposure Dose Sequence	0040,030E	0 length

Table 45. MPPS SOP Class - N-CREATE-RQ - Billing & Material Mgmt. Code Module

Attribute Name	Tag	Note
Film Consumption Sequence	0040,0321	0 length

Table 46. MPPS SOP Class - N-SET-RQ - Sop Common Module

Attribute Name	Tag	Note
Specific Character Set	0008,0005	Applied Value(s): ISO_IR 100
SOP Class UID	0008,0016	
SOP Instance UID	0008,0018	

Table 47. MPPS SOP Class - N-SET-RQ - Image Acquisition Results Module

Attribute Name	Tag	Note
Performed Action Item Code Sequence	0040,0260	1 item only
>Code Value	0008,0100	
>Coding Scheme Designator	0008,0102	
>Coding Scheme Version	0008,0103	
>Code Meaning	0008,0104	
Performed Series Sequence	0040,0340	N items
>Retrieve AE Title	0008,0054	0 length
>Series Description	0008,103E	0 length
>Performing Physician's Name	0008,1050	0 length
>Operator's Name	0008,1070	N values
>Referenced Image Sequence	0008,1140	In Non-Tomo Examinations 1 item only. In Tomo-Examinations N items. Missing after conventional acquisition.
>>Referenced SOP Class UID	0008,1150	Presently only CR class
>>Referenced SOP Instance UID	0008,1155	
>Protocol Name	0018,1030	Copy of Perf. Act. Item -> Code Value
>Series Instance UID	0020,000E	
>Referenced Standalone SOP Instance Sequence	0040,0220	0 length

Table 48. MPPS SOP Class - N-SET-RQ - Performed Procedure Step Inform. Module

Attribute Name	Tag	Note
Procedure Code Sequence	0008,1032	
>Code Value	0008,0100	
>Coding Scheme Designator	0008,0102	
>Coding Scheme Version	0008,0103	
>Code Meaning	0008,0104	
Performed Procedure Step End Date	0040,0250	
Performed Procedure Step End Time	0040,0251	
Performed Procedure Step Status	0040,0252	Applied Value(s): COMPLETED, DISCONTINUED
Performed Procedure Step Description	0040,0254	Zero length
Performed Procedure Type Description	0040,0255	Zero length

Table 49. MPPS SOP Class - N-SET-RQ - Radiation Dose Module

Attribute Name	Tag	Note
Image Area Dose Product	0018,115E	Not accumulating: re-processed images, non-digital images.
Total Number of Exposures	0040,0301	Not counting: re-processed images
Exposure Dose Sequence	0040,030E	0 length for non-digital images
>KVP	0018,0060	
>Exposure Time	0018,1150	

Table 50. MPPS SOP Class - N-SET-RQ - Billing & Material Management Code Module

Attribute Name	Tag	Note
Film Consumption Sequence	0040,0321	If local print option configured; else zero length
>Medium Type	2000,0030	Applied Value: CLEAR FILM
>Film Size ID	2010,0050	Applied Value 14INX17IN

4. COMMUNICATION PROFILES

4.1. TCP/IP Stack

The Digital Diagnost provides DICOM 3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM 3.0 Standard.

4.1.1. Physical Media Support

The Digital Diagnost system supports ISO 8802-3 10BASE-T and 100Base-TX Ethernet.

5. EXTENSIONS/SPECIALIZATION/PRIVATIZATION



6. CONFIGURATION

The configuration of a Digital Diagnost system is done by means of updating the configuration database. This should be done by Philips service engineers only.

6.1. AE Title/Presentation Address mapping

6.1.1. Local AE Titles and Presentation Addresses

The local Application Entity Title and Presentation Address are configurable.

6.1.2. Remote AE Titles and Presentation Addresses

All remote applications to be selected as destination (SCP) are configurable for the following items:

- The Application Entity Title of the remote application.
- The Presentation Address at which the remote application should accept association requests.

6.2. Configurable Parameters

6.2.1. Common for all SOP Classes

ARTIM timeout (default = 20 s)
Associate Reply timeout (default = 20 s)
Response timeout (default = 15 s)

6.2.2. AET Specifics

In the Configuration dialogue 'DICOM Net Options' the column "Appl. Type" supports the enumerated values:

- ARCHIVE
- BWLM
- MPPS
- IMS
- LOCAL

In DICOM Net Options a column "Logical Name" is introduced that translates the remote Application Entity Title (AET) in a user readable string for Graphical User Interface (GUI) display. These Logical Names are used in GUIs, when a DICOM destination system has to be selected.

6.2.3. Verification

The port number is the listening port number of the Verification SCP and the port where to receive the N_EVENT_REPORT. The default values for the Local AE Title is:

- AE Title: digitalDIAGNOST
- Port Number: 3000

6.2.4. Storage

6.2.4.1. Automatic Transfer

Automatic transfer of generated images to a configured destination can be configured on or off (i.e. the automatic export mode; see section 'Real-World Activity – Export').

6.2.4.2. Export Filter

The Digital Diagnost system stores images internally with 15-bit depth, MONOCHROME1 format. The pixel values are 10000 times that of the optical density, which these pixels should have on film.

The Export Filter converts the Digital Diagnost pixel data into data fitting the requirements of the receiving station.

To meet the different requirements of different receiving stations, it is possible to create one Configuration for every SCP.

6.2.4.2.1. Configurable Attributes

For every SCP it is possible to configure the following:

Bits stored (0028, 0101)
 Photometric Interpretation (0028, 0004)
 One of four modes

6.2.4.2.1.1. Bits Stored

See also 'Computed Radiography Image Storage SOP Class-C-STORE-RQ-Image Pixel Module'. The possible values for Bits Stored are:
 8, 10, 12, 15.

Giving the following derived values:

Bits allocated: 8, 16, 16, 16
 High Bit: 7, 9, 11, 14.

6.2.4.2.1.2. Photometric Interpretation

The possible values for Photometric Interpretation are:
 MONOCHROME1 or MONOCHROME2.

6.2.4.2.1.3. Modes

6.2.4.2.1.3.1. Full Range

The source data range is mapped to the full destination range.

Advantage: Uses the maximum precision of the output range.

Disadvantage: There is the possibility that consecutive images are harder to compare.

It is possible to apply an additional non-linear pixel transformation.

6.2.4.2.1.3.2. Film-like

The number of bits is reduced by the division through a constant factor.

Advantage: Consecutive images are easier to compare

Disadvantage: Reduced precision, compared to that of full range mode.

It is possible to apply an additional non-linear pixel transformation.

6.2.4.2.1.3.3. Grayscale Display Function Standard (p-Values)

The Digital Diagnost image pixel values represent optical densities on a film according to DICOM PS 3.14. An image is a kind of virtual film, which can be put in front of a virtual light box. The result is a range of luminescence values. These values are transformed into perceptual linear values using the whole output range which is defined by the "Bits stored" parameter.

These values are exported.

The viewing station should be able to display these values in a perceptual linear manner. This means in most cases a non-linear mapping between the input pixel and the data sent to the graphic card.

Advantage: Very good quality, if the viewing station supports the Grayscale Standard Display Function.

Disadvantage: There are viewing stations not supporting the Grayscale Standard Display Function.

6.2.4.2.1.3.4. Measured

In addition to the processing described before, a second pixel transformation is calculated by using measured luminescence values of the viewing device.

This results in a perceptual linear behavior of the viewing device.

Advantage: It is possible to achieve results similar to the results of a viewing Station supporting the Grayscale Display Function Standard (p-values).

Disadvantage: Changing brightness and contrast at the viewing station, the calibration has to be redone and the Export Filter settings must be adapted. Changing window center/window width at the viewing station can produce results below optimum.

6.2.5. Storage Commitment

The Storage Commit process reads the following parameters:

Table 51. Storage Commit Parameters

Item	Description
StCommitNEventTimeout	Enable and set (in seconds) or disable the possibility to accept N-EVENT Reports in the same association the N-ACTION request is sends. Equal to "0": don't accept in the same association Equal to ">0": accept for given seconds (Note: This is an important parameter at installation time that has to be carefully committed with the hospital DICOM-Officer)
StCommitRetryCount	Set the number of retries if a Storage Commitment request failed. Equal to "-1": retry forever (Note: If the value is set to ">0" the related SOP Instances can be deleted after retry count has expired)
StCommitNActionDelay	Number of seconds to delay a Storage Commitment request. (Note: Use this parameter if the Image Manager is not able to serve a Storage Commitment request immediately after a C-Store.) Default: 0
StCommitRetryTimeout	Set the time (in seconds) between retries of a Storage Commitment request.

6.2.6. Worklist Management

Table 52. Configuration Parameters BWLM

Name	Description / Default Value
BackgroundQuery	No
BackgrdQueryTimeInterval	60
BroadQueryMaxItems	Limit before Cancellation; Def=1000 (range 1 – 1200)
BroadQueryWithDate	No
DateRange	Today, Today or earlier, Today or later; Def=Today
BroadQueryWithAET	Yes
AETWildcard	No (see Note 1)
AETWildcardExpr	Wildcard Expression using '**'
BroadQueryWithModality	No
BroadQueryModalityType	CR
PatientQueryMaxItems	Limit before Cancellation; Def=100 (range 1 – 1200)
PatientQueryWithDate	No
PatientQueryWithAET	Yes
PatientQueryWithAccessionNo	Yes
PatientQueryWithName	Yes
PatientNameWithWildcard	No
PatientQueryWithID	Yes
PatientQueryWithReqProcID	Yes
QueryWithSpecificCharSetAttribute	Add Return Attribute 0008,0005 (Def=No)

Note 1: AET wildcard matching is performed with local, not with DICOM means.

6.2.7. Modality Performed Procedure Step

The MPPS option of Digital Diagnost requires the Basic Worklist management option is enabled.

7. SUPPORT OF EXTENDED CHARACTER SETS

7.1. Character Sets

The Digital Diagnost export supports Character Set ISO-IR 100.