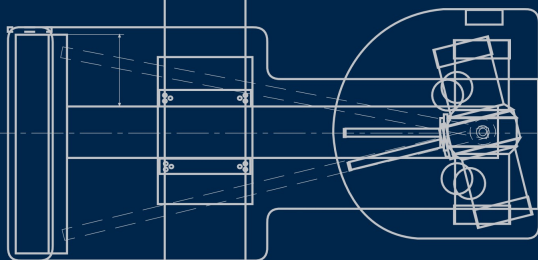


Master Pix DR

MASTER PIX CC

Version 1.0 +



**DICOM
CONFORMANCE
STATEMENT
REVISION 0.0**



Copyright © 2009 by NTB XRAY GmbH

Schoemastrasse 2
D 49356 Diepholz
Germany

Phone: + 49 / 54 41 / 99 26 11

Fax: + 49 / 54 41 / 99 26 16

E-mail: medical@ntbxray.com

Internet: www.ntbxray.net

Document Title: Master Pix CC - DICOM Conformance Statement
Document ID: 2.14.3
Revision: 0.0
State: Jan 17, 2011
File Title: 2.14.3 MPDR_DCM_en
Replaces: -

Contents

1	Introduction	6
1.1	Revision History.....	6
1.2	Abbreviations and Acronyms.....	6
1.3	Audience.....	6
1.4	Remarks.....	6
2	Networking	7
2.1	Implementation Model.....	7
2.1.1	Application Data Flow.....	7
2.1.2	Functional Definition of AEs.....	7
2.1.3	Sequencing of Real-World Activities.....	8
2.2	AE Specification.....	9
2.2.1	Workflow AE.....	9
2.2.2	Storage AE.....	12
2.2.3	Verification AE.....	14
2.3	Network Interfaces.....	15
2.3.1	Physical Network Interface.....	15
2.3.2	Additional Protocols.....	15
2.4	Configuration.....	16
2.4.1	AE Title / Presentation Address Mapping.....	16
2.4.2	Parameters.....	16
3	Support of Character Sets	18
4	Security	19
4.1	Security Profiles.....	19
4.2	Association Level Security.....	19
4.3	Application Level Security.....	19
5	Annexes	20
5.1	IOD Contents.....	20
5.1.1	Created SOP Instances.....	20
5.1.2	Used Attributes from received IOD's.....	24
5.1.3	Attribute Mapping.....	24
5.1.4	Coerced/Modified Fields.....	25
5.2	Data Dictionary of private Attributes.....	25
5.3	Coded Terminology and Templates.....	25
5.4	Grayscale Image Consistency.....	26
5.5	Standard Extended/Specialized/Private SOP Classes.....	26
5.5.1	Extended Digital X-Ray Image.....	26
5.6	Private Transfer Syntaxes.....	26

List of Figures

Figure 2.1: Application Data Flow Diagram.....	7
Figure 2.2: Sequence – Real-World Activities.....	8
Figure 2.3: Sequence – Send and Commit Images.....	13
Figure 2.4: Configuration Dialog.....	16

List of Tables

Table 2.1: SOP Classes for Workflow AE.....	9
Table 2.2: Worklist Request Identifier.....	10
Table 2.3: MPPS N-CREATE / N-SET Request Identifier.....	11
Table 2.4: Proposed Transfer Syntaxes for Workflow AE.....	12
Table 2.5: SOP Classes for Storage AE.....	12
Table 2.6: Proposed Transfer Syntaxes for Storage AE.....	14
Table 2.7: Accepted Transfer Syntaxes for Storage AE.....	14
Table 2.8: SOP Classes for Verification AE.....	14
Table 2.9: Proposed Transfer Syntaxes for Verification AE.....	15
Table 2.10: Accepted Transfer Syntaxes for Verification AE.....	15
Table 2.11: Networking Parameters.....	17
Table 5.1: IOD of created DX SOP Instances.....	20
Table 5.2: Patient Module of created SOP Instances.....	21
Table 5.3: General Study Module of created SOP Instances.....	21
Table 5.4: General Series Module of created SOP Instances.....	21
Table 5.5: General Equipment Module of created SOP Instances.....	22
Table 5.6: General Image Module of create SOP Instances.....	22
Table 5.7: Image Pixel Module of created SOP Instances.....	22
Table 5.8: VOI LUT Module of created SOP Instances.....	22
Table 5.9: Acquisition Context Module of created SOP Instances.....	22
Table 5.10: SOP Common Module of created SOP Instances.....	22
Table 5.11: X-Ray Acquisition Dose Module of created SOP Instances.....	23
Table 5.12: DX Series Module of created SOP Instances.....	23
Table 5.13: DX Anatomy Imaged Module of created SOP Instances.....	23
Table 5.14: DX Image Module of created SOP Instances.....	23
Table 5.15: DX Detector Module of created SOP Instances.....	24
Table 5.16: DX Positioning Module of created SOP Instances.....	24
Table 5.17: Patient Identification Module of created SOP Instances.....	24
Table 5.18: Attribute Mapping between MWL, DX Image and MPPS.....	25

1 Introduction

This document represents the DICOM Conformance Statement for *Master Pix CC* – the software component of the *Master Pix DR*.

1.1 Revision History

Revision	Date	Author	Description
0.0	Jun 23, 2010	SB	Initial version

1.2 Abbreviations and Acronyms

AE	Application Entity
DICOM	Digital Imaging and Communication in Medicine
DX	Digital X-Ray
GUI	Graphical User Interface
HIS	Hospital Information System
IE	Information Entity
IOD	Information Object Definition
LUT	Look Up Table
MPPS	Modality Performed Procedure Step
MWL	Modality Worklist
PACS	Picture Archiving and Communication System
PDU	Protocol Data Unit
RIS	Radiology Information System
SCP	Service Class Provider
SCU	Service Class User
SOP	Service Object Pair
TCP/IP	Transmission Control Protocol / Internet Protocol
UID	Unique Identifier
VOI	Value Of Interest
VR	Value Representation

The different value representations and their abbreviations are explained in DICOM PS 3.5 [1].

1.3 Audience

The conformance statement is intended for health system integrators and software developers. It is assumed that the reader has a well understanding of DICOM.

1.4 Remarks

DICOM, by itself, does not guarantee interoperability or successful interconnectivity. The Conformance Statement facilitates a first review for interoperability between different DICOM applications. It does not replace an on-site validation with other DICOM equipment to ensure proper information exchange. This document is primarily intended as a configuration reference.

In this document the software is split into three AEs: *Workflow*, *Storage* and *Verification*, to structure the document and to increase the readability. In the software implementation the entities are merged to one single AE.

2 Networking

2.1 Implementation Model

2.1.1 Application Data Flow

The Verification AE is not depicted in figure 2.1, because the Verification Service has more subliminal use and does not participate in the data flow.

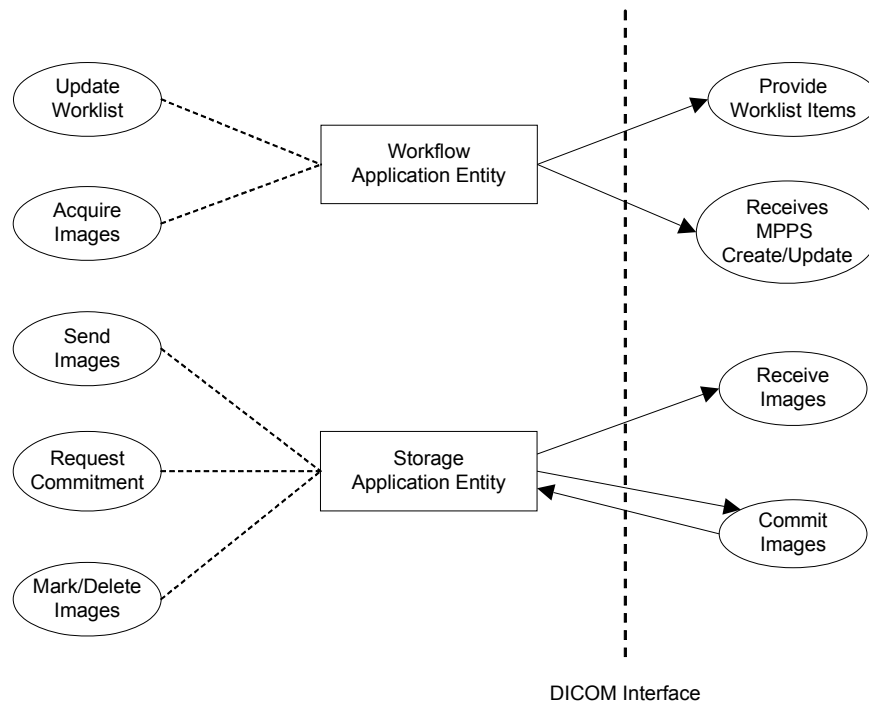


Figure 2.1: Application Data Flow Diagram

2.1.2 Functional Definition of AEs

Workflow AE

The application entity implements the *Modality Worklist Information Model* of the *Basic Worklist Management Service Class* as an SCU. Master Pix CC requests a Worklist with items which are destined for the current station and scheduled for the current day. The user may select an item to proceed with the next procedure step.

The *Modality Performed Procedure Step SOP Class* (formerly defined in the *Study Management Service Class*) is implemented as an SCU. The MPPS is created automatically during the acquisition. It is finalized when the user logs out from the software or when a new procedure step is started. If at least one image is stored locally or sent to a remote archive, the status will be set to *Complete*. If all images are discarded without storing them, the status will be set to *Discontinued*.

Storage AE

The application entity implements the *Storage Service Class* as an SCU. The transmission may be executed automatically after every new acquisition or explicitly by the user.

The *Storage Commitment Service Class* is implemented as an SCU. The software automatically re-

quests Storage Commitment for every transmitted image. If the software is configured for automatic deletion, it will delete the local copy of the image as soon as storage is committed.

Verification AE

The *Verification Service Class* is implemented as an SCU and SCP. The software utilizes this service for connection tests.

2.1.3 Sequencing of Real-World Activities

The Verification Service is not considered in the sequence diagram, because it is called asynchronously and it is not part of the standard workflow.

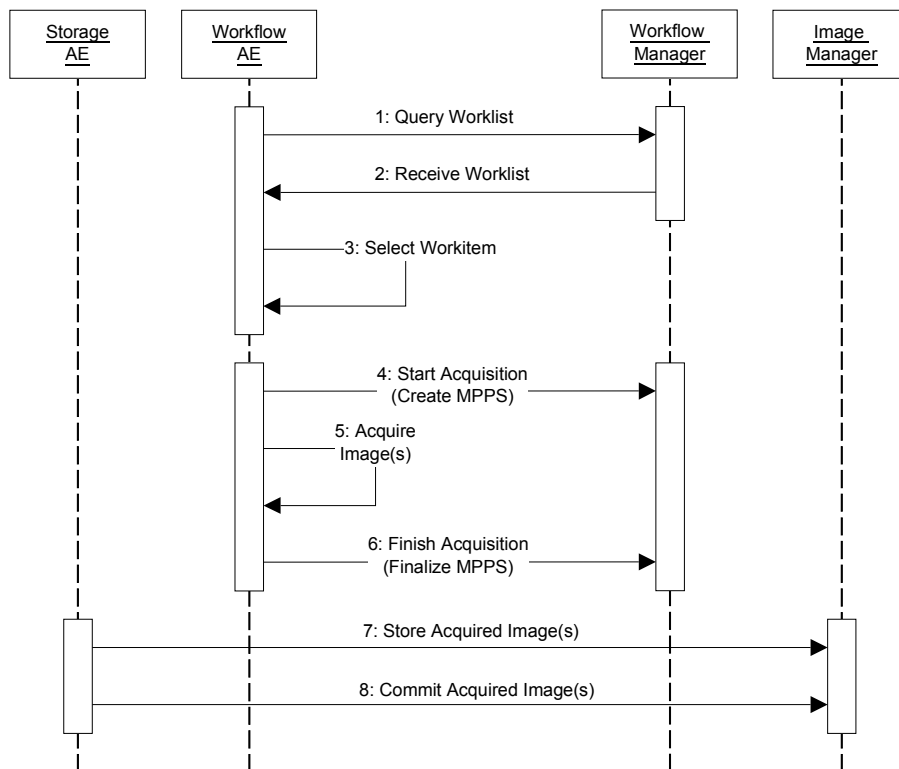


Figure 2.2: Sequence – Real-World Activities

The *Workflow Manager* represents a HIS/RIS or another information system responsible for scheduling. The *Image Manager* is usually a PACS.

2.2 AE Specification

2.2.1 Workflow AE

SOP Classes

The Workflow AE of Master Pix CC provides conformance to the following DICOM SOP Classes:

Table 2.1: SOP Classes for Workflow AE

SOP Class Name	SOP Class UID	SCU	SCP
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	x	
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	x	

Association Policies

General

The DICOM standard application context name is always proposed:

Application Context Name 1.2.840.10008.3.1.1.1

The maximum PDU length is 16384 bytes. Extended negotiation is not supported.

Number of Associations

Master Pix CC initiates one association at a time for a Worklist request or for MPPS creation/update.

Asynchronous Nature

This AE does not support asynchronous communication.

Implementation Identifying Information

The implementation information for this AE is:

Implementation Class UID 1.2.276.0.7230010.3.0.3.5.4
 Implementation Version Name OFFIS_DCMTK_354

Association Initiation Policy

Activity – Update Worklist

The user initiates a new acquisition and a dialog is opened to list the scheduled procedure steps. While the dialog is open, the user may update the list at any time.

The Workflow AE opens an association to the Workflow Manager and sends a C-FIND request containing the Worklist Query attributes. The Workflow Manager returns one or more C-FIND responses containing the matching Worklist Items. After the last Worklist Item the Workflow AE closes the association.

If any other SCP response status than *Success* or *Pending* is received, the user is notified about the warning or the failure. Details about the response are written into a log file.

Table 2.2 provides a description of Worklist Request Identifier, sent by Master Pix CC. Unexpected attributes returned by the SCP are ignored. The table provides the attribute names grouped into modules, the DICOM tag and the DICOM value representation. The last five columns indicate the occurrence as query or return keys and should be read as follows:

M: Matching Keys for Worklist Update. An “x” indicates that Master Pix CC will supply this attribute for matching.

R: Return Keys. An “x” indicates that Master Pix CC will supply this attribute as Return Key with zero length.

Q: Interactive Query Keys. An “x” indicates that Master Pix CC will supply this attribute as Matching Key, if entered in the Worklist dialog.

D: Displayed Keys. An “x” indicates that the attribute is displayed to the user during the Worklist dialog.

IOD: An “x” indicates that the attribute is included into the object instances (images) created during the procedure step.

Table 2.2: Worklist Request Identifier

Module/Attribute Name	Tag	VR	M	R	Q	D	IOD
Scheduled Procedure Step							
Scheduled Procedure Step Sequence	(0040, 0100)	SQ		x			
> Scheduled Station AE	(0040, 0001)	AE	(x)	x			
> Scheduled Procedure Step Start Date	(0040, 0002)	DA	x				
> Scheduled Procedure Step Start Time	(0040, 0003)	TM		x			
> Modality	(0008, 0060)	CS	x				
> Scheduled Performing Physician's Name	(0040, 0006)	PN		x			
> Scheduled Procedure Step Description	(0040, 0007)	LO		x			x
> Scheduled Station Name	(0040, 0010)	SH	(x)	x			
> Scheduled Protocol Code Sequence	(0040, 0008)	SQ		x			x
> Pre-Medication	(0040, 0012)	LO		x			
> Scheduled Procedure Step ID	(0040, 0009)	SH		x		x	x
Requested Procedure							
Requested Procedure ID	(0040, 1001)	SH		x			x
Requested Procedure Description	(0032, 1060)	LO		x			
Requested Procedure Code Sequence	(0032, 1064)	SQ		x			
Study Instance UID	(0020, 000D)	UI		x			x
Requested Procedure Priority	(0040, 1003)	SH		x			
Referenced Study Sequence	(0008, 1110)	SQ		x			x
Imaging Service Request							
Accession Number	(0008, 0050)	SH		x		x	x
Referring Physician's Name	(0008, 0090)	PN		x			x
Patient Identification							
Patient's Name	(0010, 0010)	PN		x		x	x
Patient ID	(0010, 0020)	LO		x	x	x	x
Patient's Birth Name	(0010, 1005)	PN		x			x
Patient Demographic							
Patient's Birth Date	(0010, 0030)	DA		x		x	x
Patient's Sex	(0010, 0040)	CS		x		x	x
Patient Comment	(0010, 4000)	LT		x			x
Patient Medical							
Patient State	(0038, 0500)	LO		x			
Medical Alerts	(0010, 2000)	LO		x			

Activity – Acquire Images

The user selects a Worklist Item and proceeds with the acquisition.

The Workflow AE opens an association to the Workflow Manager and sends an N-CREATE request to create an MPPS instance with status of “IN PROGRESS”. Then the association is closed.

When the user continues with another Worklist Item or logs out from the system, the Workflow AE opens the association again and sends an N-SET request to finalize the old MPPS instance.

The user is notified about warnings or the failures which arise during the acquisition process. Details about the responses from the Workflow Manager are written to a log file.

Table 2.3 provides a description of the MPPS N-CREATE and N-SET request identifiers sent by Master Pix CC. "MWL" indicates attributes which are copied from the Modality Worklist. "Empty" attributes are sent with zero length. An "x" indicates that an appropriate value will be sent.

Table 2.3: MPPS N-CREATE / N-SET Request Identifier

Module/Attribute Name	Tag	VR	N-CREATE	N-SET
Performed Procedure Step Relationship				
Patient's Name	(0010, 0010)	PN	MWL	
Patient ID	(0010, 0020)	LO	MWL	
Patient's Birth Date	(0010, 0030)	DA	MWL	
Patient's Sex	(0010, 0040)	CS	MWL	
Referenced Patient Sequence	(0008, 1120)	SQ	Empty	
Scheduled Step Attributes Sequence	(0040, 0270)	SQ	1 item	
> Study Instance UID	(0020, 000D)	UI	MWL	
> Referenced Study Sequence	(0008, 1110)	SQ	MWL	
> Accession Number	(0008, 0050)	SH	MWL	
> Requested Procedure ID	(0040, 1001)	SH	MWL	
> Requested Procedure Description	(0032, 1060)	LO	MWL	
> Scheduled Procedure Step ID	(0040, 0009)	SH	MWL	
> Scheduled Procedure Step Description	(0040, 0007)	LO	MWL	
> Scheduled Protocol Code Sequence	(0040, 0008)	SQ	MWL	
Performed Procedure Step Information				
Performed Station AE Title	(0040, 0241)	AE	Config	
Performed Station Name	(0040, 0242)	SH	Config	
Performed Location	(0040, 0243)	SH	Empty	
Performed Procedure Step Start Date	(0040, 0244)	DA	Actual start date	
Performed Procedure Step Start Time	(0040, 0245)	TM	Actual start time	
Performed Procedure Step End Date	(0040, 0250)	DA	Empty	Actual end date
Performed Procedure Step End Time	(0040, 0251)	TM	Empty	Actual end time
Performed Procedure Step Status	(0040, 0252)	CS	IN PROGRESS	DICONTINUED or COMPLETED
Performed Procedure Step Description	(0040, 0254)	LO	Empty	
Performed Procedure Type Description	(0040, 0255)	LO	Empty	
Procedure Code Sequence	(0008, 1032)	SQ	Empty	
Image Acquisition Results				
Modality	(0008, 0060)	CS	DX	
Study ID	(0020, 0010)	SH	x	
Performed Protocol Code Sequence	(0040, 0260)	SQ	Empty	
Performed Series Sequence	(0040, 0340)	SQ	Empty	1 or more items

Module/Attribute Name	Tag	VR	N-CREATE	N-SET
> Performing Physician's Name	(0008, 1050)	PN		Empty
> Operator's Name	(0008, 1070)	PN		Empty
> Protocol Name	(0018, 1030)	LO		x
> Series Instance UID	(0020, 000E)	UI		x
> Series Description	(0008, 103E)	LO		Empty
> Retrieve AE Title	(0008, 0054)	AE		Empty
> Referenced Image Sequence	(0008, 1140)	SQ		1 item
>> Referenced SOP Class UID	(0008, 1150)	UI		x
>> Referenced SOP Instance UID	(0008, 1155)	UI		x

Proposed Presentation Contexts

For each SOP Class the Workflow AE proposes one presentation context containing the transfer syntaxes of table 2.4.

Table 2.4: Proposed Transfer Syntaxes for Workflow AE

Transfer Syntax Name	Transfer Syntax UID
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2
Implicit VR Little Endian	1.2.840.10008.1.2

Association Acceptance Policy

The Workflow AE does not accept associations.

2.2.2 Storage AE

SOP Classes

The Storage AE of Master Pix CC provides conformance to the following DICOM SOP Classes:

Table 2.5: SOP Classes for Storage AE

SOP Class Name	SOP Class UID	SCU	SCP
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	x	
Digital X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	x	
Multi-Frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	x	
Storage Commitment Push Model	1.2.840.10008.1.20.1		x

Association Policies

General

The DICOM standard application context name is always proposed:

Application Context Name 1.2.840.10008.3.1.1.1

The maximum PDU length is 16384 bytes. Extended negotiation is not supported.

Number of Associations

Master Pix CC initiates one association at a time for storage requests. Master Pix CC accepts associations to receive N-EVENT-REPORT notifications for the Storage Commitment Push Model SOP Class.

Asynchronous Nature

The Storage AE does not support asynchronous communication (multiple outstanding transactions over a single association).

Implementation Identifying Information

The implementation information for this AE is:

Implementation Class UID	1.2.276.0.7230010.3.0.3.5.4
Implementation Version Name	OFFIS_DCMTK_354

Association Initiation Policy

Activity – Send Images

The user may select one or more images and request them to be sent to a configured destination. In addition the program can be configured to send new acquisitions automatically.

The Storage AE opens an association to a remote AE. If the Storage AE successfully establishes the association it will transfer the instances one after another using C-STORE requests. After the last C-STORE response the Storage AE sends one Storage Commitment request (N-ACTION) for the transmitted instances. After the N-ACTION response the association is closed. A separate thread accepts an association for the N-EVENT-REPORT request.

Figure 2.3 shows an example of the transmission and commitment of two DX images.

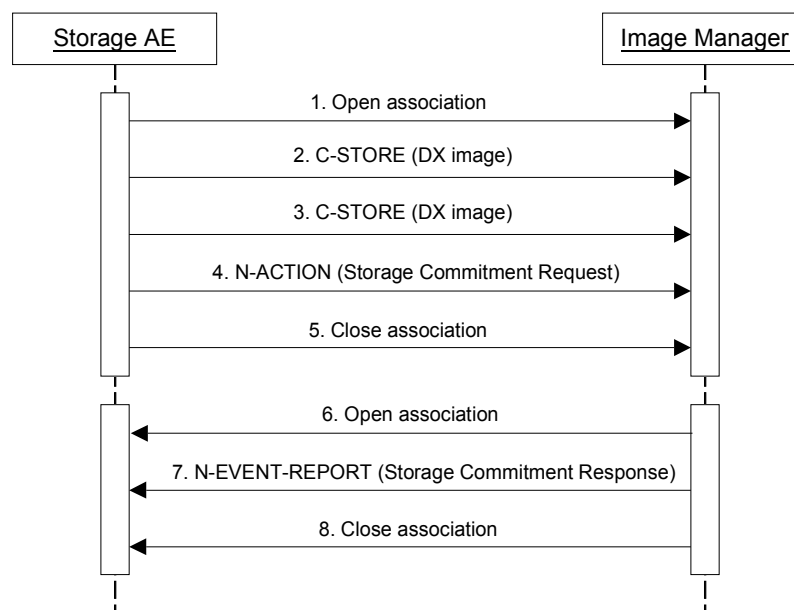


Figure 2.3: Sequence – Send and Commit Images

If the Storage response is a warning or a failure, the user will be notified and the details are written to a log file. If the Image Manager sends a successful Storage Commitment response, the images will be marked as *committed*. If the images have already been marked for *deletion* before, they will immediately be removed from the local archive.

Proposed Presentation Contexts

For each SOP Class the Storage AE proposes one presentation context containing the transfer syntaxes of table 2.6.

Table 2.6: Proposed Transfer Syntaxes for Storage AE

Transfer Syntax Name	Transfer Syntax UID
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2
Implicit VR Little Endian	1.2.840.10008.1.2

Association Acceptance Policy

Activity – Receive Storage Commitment Response

The Storage AE will accept associations in order to receive responses to a Storage Commitment request. For the sequencing see figure 2.3 above.

Accepted Presentation Contexts

For each SOP Class the Storage AE accepts one presentation context containing the transfer syntaxes of table 2.7.

Table 2.7: Accepted Transfer Syntaxes for Storage AE

Transfer Syntax Name	Transfer Syntax UID
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2
Implicit VR Little Endian	1.2.840.10008.1.2

2.2.3 Verification AE

SOP Classes

The Verification AE of Master Pix CC provides conformance to the following SOP Classes:

Table 2.8: SOP Classes for Verification AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	X	X

Association Policies

General

The DICOM standard application context name is always proposed:

Application Context Name 1.2.840.10008.3.1.1.1

The maximum PDU length is 16384 bytes. Extended negotiation is not supported.

Number of Associations

Master Pix CC initiates one association at a time as an SCU and accepts one association as an SCP from any remote AE.

Asynchronous Nature

The Verification AE does not support asynchronous communication (multiple outstanding transactions over a single association).

Implementation Identifying Information

The implementation information for this AE is:

Implementation Class UID 1.2.276.0.7230010.3.0.3.5.4
 Implementation Version Name OFFIS_DCMTK_354

Association Initiation Policy

Activity – Request Echo

The Echo request may either be invoked by the user or automatically by the program.

The user may invoke an Echo request from the configuration dialog in the program. Thus the user can check whether the entered parameters for the remote DICOM servers are correct. The user is immediately informed about the success of the Echo request.

If the software invokes the Echo request automatically, it will take place in the background. This is done before new acquisitions for example, to make sure the connection has not been disrupted. If the request is successful, the user will not realize the communication. If the request fails, the user will be warned about the disrupted connection and the acquisition process will be canceled.

Proposed Presentation Contexts

The Verification AE proposes one presentation context containing transfer syntaxes of table 2.9.

Table 2.9: Proposed Transfer Syntaxes for Verification AE

Transfer Syntax Name	Transfer Syntax UID
Implicit VR Little Endian	1.2.840.10008.1.2

Association Acceptance Policy

Activity – Receive Echo

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

Accepted Presentation Contexts

The Verification AE accepts one presentation context containing transfer syntaxes of table 2.10.

Table 2.10: Accepted Transfer Syntaxes for Verification AE

Transfer Syntax Name	Transfer Syntax UID
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2
Implicit VR Little Endian	1.2.840.10008.1.2

2.3 Network Interfaces

Master Pix CC provides conformance to *DICOM V3.0 TCP/IP Network Communication Support* as defined in DICOM PS 3.8 [2].

2.3.1 Physical Network Interface

Master Pix CC connects to any medium that supports TCP/IP.

2.3.2 Additional Protocols

Master Pix CC does not support additional protocols.

2.4 Configuration

2.4.1 AE Title / Presentation Address Mapping

The mapping of AE Titles to Presentation Addresses is configured via a Configuration Dialog (figure 2.4) at runtime. For details see Service Manual [3].

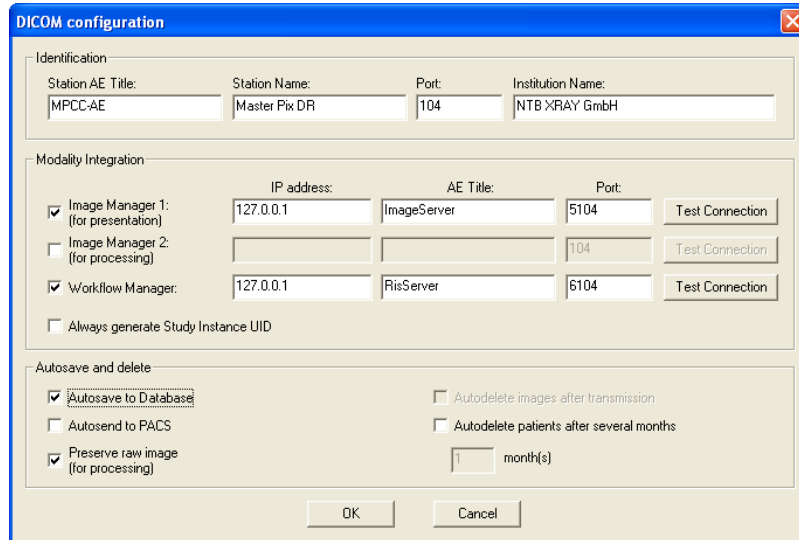


Figure 2.4: Configuration Dialog

Local AE Titles

Outwards Master Pix CC is represented by a single application entity:

Default AE Title: MPCC-AE

Default TCP/IP Port: 104

Remote AE Titles

One Modality Worklist SCP / MPPS SCP can be defined as “Workflow Manager”. One or two Storage SCPs can be defined as “Image Managers”. It is possible to define one and the same SCP as Workflow Manager *and* Image Manager.

2.4.2 Parameters

The most of the low-level parameters for network communication are not configurable in Master Pix CC. Read table 2.11 for details.

Table 2.11: Networking Parameters

Parameter	Configurable	Default Value
General Parameters		
Max PDU Receive Size	No	16384 Bytes
Max PDU Send Size	No	16384 Bytes
Time-out waiting for completion of a TCP/IP connect request	No	5 s
Storage Commitment Parameters		
Maximum number of simultaneously accepted associations	No	1
Modality Worklist Parameters		
Query Worklist for specific Scheduled Station AE Title	Yes	MPCC-AE
Query Worklist for specific Scheduled Station Name	Yes	Master Pix DR
Query Worklist for specific Modality Value	No	DX

3 Support of Character Sets

Master Pix CC supports the default character repertoire (ISO 646).

The software might accept input of other single byte character sets depending from the settings of the operating system. But information of the character sets are not retained.

4 Security

4.1 Security Profiles

Master Pix CC does not support any specific security profiles.

4.2 Association Level Security

Master Pix CC does not support any specific security measures at association level. It is assumed that Master Pix CC is used within a secured environment.

4.3 Application Level Security

Master Pix CC has a user management system that prevents the software from unauthorized access on application level. At program start the user has to log in with his user name and his password.

5 Annexes

5.1 IOD Contents

5.1.1 Created SOP Instances

During normal operation Master Pix CC creates only Digital X-Ray Images for Processing and Digital X-Ray Images for Presentation. Secondary Capture Images are only created as a result of import operations and are not part of the typical modality workflow. Thus the focus in this section lies on the Digital X-Ray Images that are created by the modality.

The tables below specify the presence and source of attributes and modules in the created DICOM images. Attributes and modules which belong to the IOD but do not occur in the tables, are never sent by Master Pix CC.

Following terms and abbreviations are used for the "Presence" column:

- Always The module/attribute is always present
- VNAP Value not always present (attribute sent zero length if no value is present)
- Empty Attribute always zero length
- ANAP Attribute not always present

Following terms and abbreviations are user for the "Source" column:

- MLW The value is copied from the Modality Worklist.
- MPPS The value is copied from the Modality Performed Procedure Step.
- Auto The value is fixed or generated automatically.
- User The value is a user input.
- Config The value results from the software configuration.

Extended Digital X-Ray Image IOD

Table 5.1: IOD of created DX SOP Instances

IE	Module	Reference	Presence
Patient	Patient	Table 5.2	Always
	Patient Identification	Table 5.17	Depends on user input
Study	General Study	Table 5.3	Always
	Series	Table 5.4	Always
Equipment Image	General Series	Table 5.12	Always
	DX Series	Table 5.12	Always
	General Equipment	Table 5.5	Always
	General Image	Table 5.6	Always
	Image Pixel	Table 5.7	Always
	DX Anatomy Imaged	Table 5.13	Always
	DX Image	Table 5.14	Always
	DX Detector	Table 5.15	Always
	DX Positioning	Table 5.16	Always
	X-Ray Acquisition Dose	Table 5.11	Always
VOI LUT	Table 5.8	Always	
Acquisition Context	Table 5.9	Always	
SOP Common	Table 5.10	Always	

Common Modules

Table 5.2: Patient Module of created SOP Instances

Attribute Name	Tag	VR	Presence	Source	Comment
Patient's Name	(0010, 0010)	PN	VNAP	MWL/User	
Patient ID	(0010, 0020)	LO	Always	MWL/User	
Patient's Birth Date	(0010, 0030)	DA	VNAP	MWL/User	
Patient's Sex	(0010, 0040)	CS	VNAP	MWL/User	
Patient Comments	(0010, 4000)	LT	ANAP	MWL/User	

Table 5.3: General Study Module of created SOP Instances

Attribute Name	Tag	VR	Presence	Source	Comment
Study Instance UID	(0020, 000D)	UI	Always	MWL/Auto	
Study Date	(0008, 0020)	DA	Always	Auto	
Study Time	(0008, 0030)	TM	Always	Auto	
Referring Physician's Name	(0008, 0090)	PN	VNAP	MWL	
Study ID	(0020, 0010)	SH	Always	Auto	generated from date and time
Accession Number	(0008, 0050)	SH	VNAP	MWL	
Study Description	(0008, 1030)	LO	ANAP	User	
Referenced Study Sequence	(0008, 1110)	SQ	ANAP	MWL	

Table 5.4: General Series Module of created SOP Instances

Attribute Name	Tag	VR	Presence	Source	Comment
Modality	(0008, 0060)	CS	Always	Auto	'DX'
Series Instance UID	(0020, 000E)	UI	Always	Auto	
Series Number	(0020, 0011)	IS	Always	Auto	
Series Date	(0008, 0021)	DA	Always	Auto	
Series Time	(0008, 0031)	TM	Always	Auto	
Protocol Name	(0008, 1030)	LO	Always	Config	exposure program
Series Description	(0008, 103E)	LO	ANAP	Auto	=(0008, 0068)
Request Attributes Sequence	(0040, 0275)	SQ	ANAP	Auto	inserted in case of MWL
> Requested Procedure ID	(0040, 1001)	SH	Always	MWL	if item is present
> Scheduled Procedure Step ID	(0040, 0009)	SH	Always	MWL	if item is present
> Scheduled Procedure Step Description	(0040, 0007)	LO	ANAP	MWL	
> Scheduled Protocol Code Sequence	(0040, 0008)	SQ	ANAP	MWL	
Performed Procedure Step ID	(0040, 0253)	SH	ANAP	Auto	generated from date and time
Performed Procedure Step Start Date	(0040, 0244)	DA	ANAP	Auto	
Performed Procedure Step Start Time	(0040, 0245)	TM	ANAP	Auto	

Table 5.5: General Equipment Module of created SOP Instances

Attribute Name	Tag	VR	Presence	Source	Comment
Manufacturer	(0008, 0070)	LO	Always	Auto	'NTB GMBH GERMANY'
Institution Name	(0008, 0080)	LO	ANAP	Config	
Station Name	(0008, 1010)	SH	ANAP	Config	

Table 5.6: General Image Module of create SOP Instances

Attribute Name	Tag	VR	Presence	Source	Comment
Instance Number	(0020, 0013)	IS	Always	Auto	
Patient Orientation	(0020, 0020)	CS	Always	Auto	calculated from the user selected View Position
Image Type	(0008, 0008)	CS	Always	Auto	
Acquisition Datetime	(0008, 002A)	DT	Always	Auto	
Burned In Annotation	(0028, 0301)	CS	Always	Auto	'NO'
Lossy Image Compression	(0028, 2110)	CS	Always	Auto	'00'
Presentation LUT Shape	(2050, 0020)	CS	Always	Auto	'IDENTITY'

Table 5.7: Image Pixel Module of created SOP Instances

Attribute Name	Tag	VR	Presence	Source	Comment
Samples per Pixel	(0028, 0002)	US	Always	Auto	'1'
Photometric Interpretation	(0028, 0004)	CS	Always	Auto	'MONOCHROME2'
Rows	(0028, 0010)	US	Always	Auto	height
Columns	(0028, 0011)	US	Always	Auto	width
Bits Allocated	(0028, 0100)	US	Always	Auto	'16'
Bits Stored	(0028, 0101)	US	Always	Auto	'12'
High Bit	(0028, 0102)	US	Always	Auto	'11'
Pixel Representation	(0028, 0103)	US	Always	Auto	'0'
Pixel Data	(7FE0, 0010)	OW	Always	Auto	

Table 5.8: VOI LUT Module of created SOP Instances

Attribute Name	Tag	VR	Presence	Source	Comment
VOI LUT Sequence	(0028, 3010)	SQ	ANAP	Auto	if gamma <> 1
> LUT Descriptor	(0028, 3002)	US	Always	Auto	'4096\0\12' if item is present
> LUT Data	(0028, 3006)	US	Always	Auto	if item is present
Window Center	(0028, 1050)	DS	Always	Auto/User	
Window Width	(0028, 1051)	DS	Always	Auto/User	

Table 5.9: Acquisition Context Module of created SOP Instances

Attribute Name	Tag	VR	Presence	Source	Comment
Acquisition Context Sequence	(0040, 0555)	SQ	Empty	-	

Table 5.10: SOP Common Module of created SOP Instances

Attribute Name	Tag	VR	Presence	Source	Comment
SOP Class UID	(0008, 0016)	UI	Always	Auto	
SOP Instance UID	(0008, 0018)	UI	Always	Auto	
Instance Number	(0020, 0013)	IS	Always	Auto	see Table 5.6

X-Ray Modules

Table 5.11: X-Ray Acquisition Dose Module of created SOP Instances

Attribute Name	Tag	VR	Presence	Source	Comment
KVP	(0018, 0060)	DS	Always	Config	
X-Ray Tube Current	(0018, 1151)	IS	Always	Config	
X-Ray Tube Current in μ A	(0018, 8151)	DS	Always	Config	=(0018, 1151)
Exposure Time	(0018, 1150)	IS	Always	Auto	
Distance Source to Detector	(0018, 1110)	DS	Always	Auto	
Image and Fluoroscopy Area Dose Product	(0018, 115E)	DS	ANAP	Auto	if a DAP meter is connected

Digital X-Ray Modules

Table 5.12: DX Series Module of created SOP Instances

Attribute Name	Tag	VR	Presence	Source	Comment
Modality	(0008, 0060)	CS	Always	Auto	see Table 5.4
Presentation Intent Type	(0008, 0068)	CS	Always	Auto	depends on SOP Class

Table 5.13: DX Anatomy Imaged Module of created SOP Instances

Attribute Name	Tag	VR	Presence	Source	Comment
Image Laterality	(0020, 0062)	CS	Always	User	
Anatomic Region Sequence	(0008, 2218)	SQ	Always	User	

Table 5.14: DX Image Module of created SOP Instances

Attribute Name	Tag	VR	Presence	Source	Comment
Image Type	(0008, 0008)	CS	Always	Auto	see Table 5.6
Samples per Pixel	(0028, 0002)	US	Always	Auto	see Table 5.7
Photometric Interpretation	(0028, 0004)	CS	Always	Auto	see Table 5.7
Bits Allocated	(0028, 0100)	US	Always	Auto	see Table 5.7
Bits Stored	(0028, 0101)	US	Always	Auto	see Table 5.7
High Bit	(0028, 0102)	US	Always	Auto	see Table 5.7
Pixel Representation	(0028, 0103)	US	Always	Auto	see Table 5.7
Pixel Intensity Relationship	(0028, 1040)	CS	Always	Auto	'LIN'
Pixel Intensity Relationship Sign	(0028, 1041)	SS	Always	Auto	depends on applied filters
Rescale Intercept	(0028, 1052)	DS	Always	Auto	'0'
Rescale Slope	(0028, 1053)	DS	Always	Auto	'1'
Rescale Type	(0028, 1054)	LO	Always	Auto	'US'
Presentation LUT Shape	(2050, 0020)	CS	Always	Auto	see Table 5.6
Lossy Image Compression	(0028, 2110)	CS	Always	Auto	see Table 5.6
Patient Orientation	(0020, 0020)	CS	Always	Auto	see Table 5.6
Burned In Annotation	(0028, 0301)	CS	Always	Auto	see Table 5.6
VOI LUT Sequence	(0028, 3010)	SQ	ANAP	Auto	see Table 5.8
Window Center	(0028, 1050)	DS	Always	Auto/User	see Table 5.8
Window Width	(0028, 1051)	DS	Always	Auto/User	see Table 5.8

Table 5.15: DX Detector Module of created SOP Instances

Attribute Name	Tag	VR	Presence	Source	Comment
Detector Type	(0018, 7004)	CS	Empty	–	
Imager Pixel Spacing	(0018, 1164)	DS	Always	Config	results from Pixelbinning
Pixel Spacing	(0028, 0030)	DS	Always	Config	results from Pixelbinning

Table 5.16: DX Positioning Module of created SOP Instances

Attribute Name	Tag	VR	Presence	Source	Comment
View Position	(0018, 5101)	CS	ANAP	User	
View Code Sequence	(0054, 0220)	SQ	Always	User	
Distance Source to Detector	(0018, 1110)	DS	Always	Auto	see Table 5.11

Additional Modules

Table 5.17: Patient Identification Module of created SOP Instances

Attribute Name	Tag	VR	Presence	Source	Comment
Patient's Name	(0010, 0010)	PN	VNAP	MWL/User	see Table 5.2
Patient ID	(0010, 0020)	LO	Always	MWL/User	see Table 5.2
Patient's Birth Name	(0010, 1005)	PN	ANAP	MWL/User	

5.1.2 Used Attributes from received IOD's

Master Pix CC does not receive SOP Instances. The usage of Modality Worklist attributes is described in section 2.2.1.

5.1.3 Attribute Mapping

The relationships between attributes received via Modality Worklist, stored in acquired images and communicated via MPPS are summarized in table 5.18.

Table 5.18: Attribute Mapping between MWL, DX Image and MPPS

Modality Worklist	DX Image IOD	MPPS IOD
Patient's Name	Patient's Name	Patient's Name
Patient ID	Patient ID	Patient ID
Patient's Birth Date	Patient's Birth Date	Patient's Birth Date
Patient's Sex	Patient's Sex	Patient's Sex
Patient's Birth Name	Patient's Birth Name	-
Patient Comments	Patient Comments	-
-	-	Scheduled Step Attributes Sequence
Study Instance UID	Study Instance UID	> Study Instance UID
Referenced Study Sequence	Referenced Study Sequence	> Referenced Study Sequence
Accession Number	Accession Number	> Accession Number
Referring Physician's Name	Referring Physician's Name	-
-	Requested Attributes Sequence	-
Requested Procedure ID	> Requested Procedure ID	> Requested Procedure ID
Requested Procedure Description	-	> Requested Procedure Description
Scheduled Procedure Step Sequence	-	-
> Scheduled Procedure Step ID	> Scheduled Procedure Step ID	> Scheduled Procedure Step ID
> Scheduled Procedure Step Description	> Scheduled Procedure Step Description	> Scheduled Procedure Step Description
> Scheduled Protocol Code Sequence	> Scheduled Protocol Code Sequence	> Scheduled Protocol Code Sequence
-	-	Performed Series Sequence
-	Protocol Name	> Protocol Name
-	Series Instance UID	> Series Instance UID
-	-	> Referenced Image Sequence
-	SOP Class UID	>> Referenced SOP Class UID
-	SOP Instance UID	>> Referenced SOP Instance UID
-	Study ID	Study ID

5.1.4 Coerced/Modified Fields

The Workflow AE will coerce values for type 1 attributes (e.g. Study Instance UID), if the values are not provided by the Workflow Manager.

5.2 Data Dictionary of private Attributes

Master Pix CC does not provide any private attributes.

5.3 Coded Terminology and Templates

The contents of Anatomic Region Sequence (0008, 2218) in acquired images will be filled with an anatomic code selected by the user from a list. The list of anatomic codes corresponds to Context Group 4009 of the DICOM Content Mapping Resource [4].

The contents of View Code Sequence (0054, 0220) in acquired images will be filled with a view code selected by the user from a list. The list of view codes corresponds to Context Group 4010 of the DICOM Content Mapping Resource [4].

Coded data from the Modality Worklist might be mapped to the Image IOD and/or the MPPS but will not be further analyzed.

5.4 Grayscale Image Consistency

Master Pix CC is a software for acquisition and transmission of DX Images and provides some basic functions for grayscale correction. Diagnostic finding is *not* the purpose of the software. Thus the attached display system is beyond the scope of Master Pix CC.

5.5 Standard Extended/Specialized/Private SOP Classes

5.5.1 Extended Digital X-Ray Image

The DX Images provided by Master Pix CC may contain the additional attribute Patient's Birth Name (0010, 1005) from the Patient Identification Module as described in section 5.1.1.

5.6 Private Transfer Syntaxes

Master Pix CC does not support any Private Transfer Syntaxes.

References

- [1] National Electrical Manufacturers Association: DICOM PS 3.5: Data Structures and Encoding, 2008
- [2] National Electrical Manufacturers Association: DICOM PS 3.8: Network Communication Support for Message Exchange, 2008
- [3] NTB XRAY GmbH: Master Pix DR - Service Manual, 2010
- [4] National Electrical Manufacturers Association: DICOM PS 3.16: Content Mapping Resource, 2008