



Merge Technologies Inc.
1126 S. 70th Street
Milwaukee, Wisconsin 53214-3151
(414) 977-4000 phone (414) 977-3940 fax

ExamWorks+ Version 1.2

DICOM Conformance Statement

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0. Introduction

ExamWorks+ is a component of the MergeWorks[™] family of DICOM network image management products. The ExamWorks+ allows DICOM imaging devices to connect to a DICOM network with Modality Worklist, Modality Perform Procedure Step, and Storage Commitment corrections. It provides efficient and transparent network connectivity, allowing imaging devices to operate in an integrated healthcare environment.

1. Implementation Model

1.1 Application Data Flow

ExamWorks+ acquires medical images for the purpose of image storage and defines five DICOM Application Entities (AE); the Modality Worklist Query AE, Image Send AE, Modality Perform Procedure Step AE, Image Receive AE, and Storage Commitment AE.

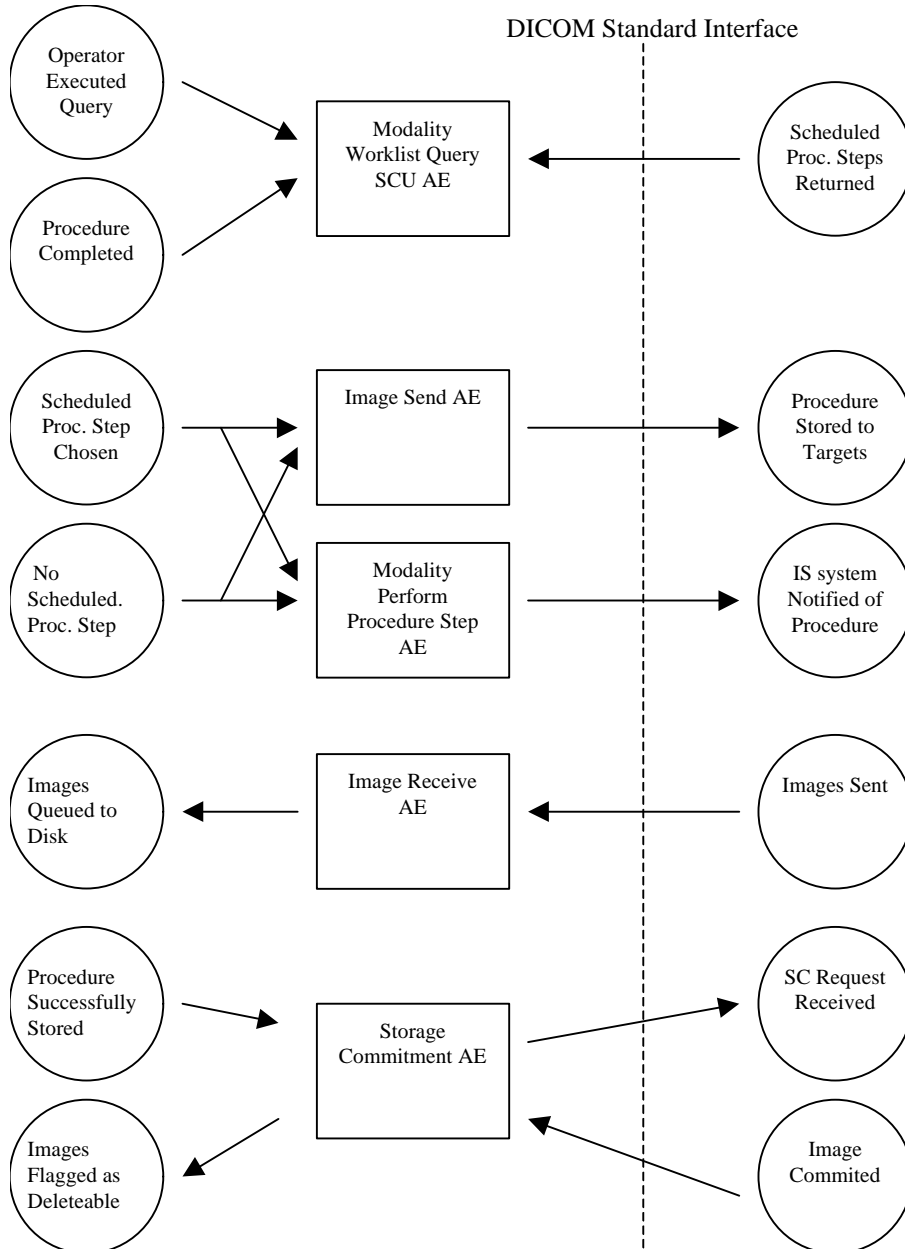


Figure 1:

Implementation Model

The ExamWorks+ Application Entities define applications that handle DICOM protocol communication to accomplish DICOM Image Store capabilities, Modality Performed Procedure Step, Storage Commitment, and Modality Worklist Queries. The real-world activities are listed as follows:

The ExamWorks+ Image Receive AE listens for incoming DICOM store associations. When an association is received, the images are queued to disk and sorted based on their DICOM headers. The operator notifies the ExamWorks+ when all the images have been received. The Modality Worklist (MWL) Query AE then opens an association to the IS system and sends a MWL C-FIND request. If a single match is returned, then the data received is incorporated into the image (This feature can be disabled). If a single match is not received, the procedure is displayed on the user interface. In this case, the operator should select the scheduled procedure(s) that are appropriate or choose to send the images on without a scheduled procedure.

The MPPS AE opens up an association with the IS system and informs it that the scheduled procedure step was completed, and what images were acquired. If the procedure was sent on without choosing a scheduled procedure, then the MPPS message is set up as defined by the IHE model as an "Unscheduled" performed procedure.

The Image Send AE then opens up an association to all selected targets, and stores the images. Upon success, the Storage Commitment AE opens an association to all configured commitment targets, and it attempts to commit the images from the procedure. The Storage Commitment AE also listens for incoming associations, and responds to the incoming N-EVENT-REPORTs from the commitment target.

1.2 Functional Definitions

The ExamWorks+ Modality Worklist Query AE supports the following functions:

- Initiate a DICOM association with the MWL SCP and send a Modality Worklist C-FIND Query.

The ExamWorks+ Image Send AE supports the following functions:

- Initiate a DICOM association and send out DICOM Storage class objects

The ExamWorks+ Modality Perform Procedure Step AE supports the following functions:

- Initiate a DICOM association and send out DICOM MPPS N-CREATE & N-SET messages

The ExamWorks+ Image Receive AE supports the following functions:

- Listen for incoming DICOM associations and receive Storage Class objects.

The ExamWorks+ Storage Commitment AE supports the following functions:

- Initiate a DICOM association and commit every image from a procedure
- Listen for incoming DICOM associations and receive reports on the commitment status

1.3 Sequencing of Real-World Activities

A procedure is acquired through the Storage Receive AE. The MWL Query AE will generate a worklist query. A scheduled procedure step is chosen. The procedure is sent to the MPPS AE and Image Send AE as defined by the currently selected targets. The MPPS AE will inform the IS system of its status. The Storage Commitment AE will commit the sent procedure.

2. Application Entity (AE) Specifications

2.1 ExamWorks+ Modality Worklist Query AE Specification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as a SCU:

SOP Class Name	SOP Class UID
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31

2.1.1 Association Establishment Policies

2.1.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

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

The Maximum Length PDU negotiation is included in all association establishment requests.

The maximum length PDU for an association initiated is:

Maximum Length PDU	16 Kbytes
--------------------	-----------

The SOP class Extended Negotiation is not supported.

The maximum number of Presentation Contexts Items that will be proposed is 1.

The user info items sent by this product are:

- Maximum PDU Length
- Implementation Class UID
- Implementation Version Name

2.1.1.2 Number of Associations

The Modality Worklist Management AE has the ability to support two simultaneous associations.

2.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.1.1.4 Implementation Identifying Information

The Implementation Class UID for the ExamWorks+ implementation is:

Implementation Class UID	2.16.840.1.113669.2.1.1
--------------------------	-------------------------

2.1.2 Association Initiation by Real World Activity

The ExamWorks+ will initiate a Modality Worklist Information Query via the Modality Worklist Query AE as procedures are passed through the ExamWorks+ system. The operator may also initiate a Modality Worklist Information Query.

2.1.2.1 Real-world activity: Modality Worklist Query

2.1.2.1.1 Associated real-world activity for Modality Worklist Query

The ExamWorks+ Modality Worklist Query AE initiates an association to query a remote Information or PACS System. Upon completion of the C-FIND, the association is released.

The operator views this information and then selects the appropriate scheduled procedure step that corresponds to the procedure received. The attributes from the scheduled procedure step are placed inside the image headers generated by the ExamWorks+ Modality Worklist Query and also conveyed in the Modality Performed Procedure Step object.

Upon receiving a C-FIND response containing a Failure Status, the ExamWorks+ aborts the association.

2.1.2.1.2 Proposed presentation contexts for Modality Worklist

The presentation context proposed by the ExamWorks+ Modality Worklist Query AE is as follows:

Modality Worklist Presentation Context Table

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.1.2.1.2.1 SOP specific conformance for Modality Worklist Management SOP Class

Following are the status codes that are processed by the ExamWorks+ Modality Worklist Query AE when received from a remote Modality Worklist SCP system:

Service Status	Status Codes	Further Meaning	Behavior upon receiving Status Codes
Refused	A700	Out of resources	Processing of the matches and the association is terminated. Successful (if any) matches that have been previously received are not used.
Failed	A900	Identifier does not match SOP Class	The association is terminated and the status is logged into the system error log.

	Cxxx	Unable to process	Processing of the matches and the association is terminated. Successful (if any) matches that have been previously received are not used.
Cancel	FE00	Matching terminated due to cancel	Processing of the matches and the association is terminated. Successful (if any) matches that have been previously received are not used. Note that this should not occur, as the ExamWorks+ Modality Worklist Query AE does not initiate C-FIND-CANCEL requests.
Success	0000	Matching is complete - No final identifier is supplied	The association is released and the matches received are stored.
Pending	FF00	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	Processing of the matches continues.
	FF01	Matches are continuing - Warning that one or more Option Keys were not supported for existence of this identifier.	Processing of the matches continues without any warnings or errors.

The following table illustrates the Matching and Return Key attributes used by the ExamWorks+ AE when performing a query to the remote Modality Worklist SCP. Attributes that are used for Matching Keys provide matching based on the DICOM requirements. Attributes that are used for Return Keys set the value to zero length (i.e. universal matching). If necessary, the ExamWorks+ can be configured so that none of these query attributes are sent. Any information available in the incoming Storage object can be used as search criteria.

DICOM Description / Module	Tag	Description
Scheduled Procedure Step		
Scheduled Procedure Step Sequence	0040,0100	
>Scheduled Station AE title	0040,0001	This attribute may be based on the AE title assigned to the Modality Worklist Query AE
>Scheduled Procedure Step Start Date	0040,0002	This attribute may be set up to send a range based on an offset and current system date
>Scheduled Procedure Step Start Time	0040,0003	This attribute may be set up to send a range based on an offset and current system time
>Modality	0008,0060	
>Scheduled Procedure Step Description	0040,0005	
>Scheduled Action Item Code Sequence	0040,0008	It and it's sub components maybe be configured to be set to zero length
>Scheduled Procedure Step ID	0040,0009	
Requested Procedure		
Requested Procedure ID	0040,1001	

Requested Procedure Description	0032,1060	
Requested Procedure Code Sequence	0032,1064	It and it's sub components maybe be configured to be set to zero length
Study Instance UID	0020,000D	
Referenced Study Sequence	0008,1110	It and it's sub components maybe be configured to be set to zero length
Imaging Service Request		
Accession Number	0008,0050	
Referring Physician's Name	0008,0090	
Patient Identification		
Referenced Patient Sequence	0008,1120	It and it's sub components maybe be configured to be set to zero length
Patient's Name	0010,0010	
Patient ID	0010,0020	
Patient Demographic		
Patients Birth Date	0010,0030	
Patient's Sex	0010,0040	
Patient's Weight	0010,1030	
Patient's Size	0010,1020	
Occupation	0010,2180	
Patient Medical		
Additional Patient's History	0010,21B0	
Visit Admission		
Admitting Diagnosis Description	0008,1080	
(Additional Attributes as defined by DICOM)		

2.1.3 Association Acceptance Policy

Modality Worklist Query AE does not accept DICOM associations.

2.2 ExamWorks+ Image Send AE Specification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as a SCU:

SOP Class Name	SOP Class UID
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1

MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
X-Ray Angiographic Bi-Plane Image Storage	1.2.840.10008.5.1.4.1.1.12.3
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1

2.2.1 Association Establishment Policies

2.2.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

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

The Maximum Length PDU negotiation is included in all association establishment requests.

The maximum length PDU for an association initiated is:

Maximum Length PDU	16 Kbytes
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The SOP class Extended Negotiation is not supported.

The maximum number of Presentation Contexts Items that will be proposed is 1.

The user info items sent by this product are:

- Maximum PDU Length
- Implementation Class UID
- Implementation Version Name

2.2.1.2 Number of Associations

The ExamWorks+ Image Send AE has the ability to support one association.

2.2.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.2.1.4 Implementation Identifying Information

The Implementation Class UID for the ExamWorks+ implementation is:

Implementation Class UID	2.16.840.1.113669.2.1.1
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2.2.2 Association Initiation by Real World Activity

The ExamWorks+ Image Send AE will initiate the sending (DICOM Storage) of the individual images making up a procedure based on the user selecting a scheduled procedure step(s) or choosing to send it as unscheduled.

2.2.2.1 Real World Activity SCHEDULED PROCEDURE STEP(s) CHOSEN / NO SCHEDULED PROCEDURE STEP FOR THIS PERFORMED PROCEDURE

2.2.2.1.1 Associated Real World Activity

The ExamWorks+ transmits images via the DICOM Storage Service Class they were received using the Presentation Contexts defined in the Table shown in section 2.2.2.1.2, to all of the selected destination device(s).

2.2.2.1.2 Proposed Presentation contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Computed Radiography Image Storage	1.2.840.10008.5 .1.4.1.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
CT Image Storage	1.2.840.10008.5 .1.4.1.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Ultrasound Multi-frame Image Storage	1.2.840.10008.5 .1.4.1.1.3.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
MR Image Storage	1.2.840.10008.5 .1.4.1.1.4	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Ultrasound Image Storage	1.2.840.10008.5 .1.4.1.1.6.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Secondary Capture Image Storage	1.2.840.10008.5 .1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
X-Ray Angiographic Image Storage	1.2.840.10008.5 .1.4.1.1.12.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	.1.4.1.1.12.2	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
X-Ray Angiographic Bi-plane Image Storage	1.2.840.10008.5	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	.1.4.1.1.12.3	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Nuclear Medicine Image Storage	1.2.840.10008.5	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	.1.4.1.1.12.0	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Positron Emission Tomography (PET) Image Storage	1.2.840.10008.5	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	.1.4.1.1.128	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Standalone PET Curve	1.2.840.10008.5	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	.1.4.1.1.129	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Radiotherapy Image Storage	1.2.840.10008.5	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	.1.4.1.1.481.1	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	.1.4.1.1.1.1	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	.1.4.1.1.1.1.1	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	.1.4.1.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	.1.4.1.1.1.2.1	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	.1.4.1.1.1.3	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	.1.4.1.1.1.3.1	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

2.2.2.1.2.1 SOP Specific Conformance Statement for the Storage SOP Classes

The images comprising a procedure will be sent with a single C-STORE request.

Upon receiving a C-STORE response containing an Error or a Refused status the implementation will release the association. All of the images associated with a procedure will be considered by the ExamWorks+ to have failed to transfer. The ExamWorks+ Image Send AE has the ability to automatically recover from this situation and will attempt to send all the images at a later time. This retry mechanism will continue for a number of retries, and then be moved into an error directory.

The following tables define the Image Send AE's usage of the some standard modules in the Storage SOP Classes. Only the modules that may be directly affected by the ExamWorks+ will be referenced, all others are as received from the incoming image.

Data from the incoming store will be used, except for fields overridden from the scheduled procedure step, or the SOP Instance UID.

2.2.2.1.2.1.1 Patient Entity Module

2.2.2.1.2.1.1.1 Patient Module

Attribute Name	Data Element	Type	Notes
Patient Name	0010, 0010	2	
Patient ID	0010, 0020	2	
Patient DOB	0010, 0030	2	
Patient Sex	0010, 0040	2	

2.2.2.1.2.1.2 Study Entity Module

2.2.2.1.2.1.2.1 General Study

Attribute Name	Data Element	Type	Notes
Study Date	0008, 0020	2	
Study Time	0008, 0030	2	
Accession Number	0008, 0050	2	
Ref Physicians' Name	0008, 0090	2	
Study Instance UID	0020, 000D	1	
Study ID	0020, 0010	2	

2.2.2.1.2.1.3 Equipment Entity Module

2.2.2.1.2.1.3.1 General Equipment

The attributes in this module are supported through configuration of ExamWorks+ by trained service personal at the time of installation. Note: This information is related to the equipment that generated the original image, not ExamWorks+.

Attribute Name	Data Element	Type	Notes
Manufacturer	0008, 0070	3	May be hard-coded to override the incoming data
Institution Name	0008, 0080	3	May be hard-coded to override the incoming data
Station Name	0008, 1010	3	May be hard-coded to override the incoming data
Inst. Department Name	0008, 1040	3	
Mfg. Model Name	0008, 1090	3	May be hard-coded to override the incoming data
S/W Versions	0018, 1020	3	

2.2.2.1.2.1.4 Image Entity Module

2.2.2.1.2.1.4.1 SOP Common

Attribute Name	Data Element	Type	Notes
SOP Class UID	0008, 0016	1	
SOP Instance UID	0008, 0018	1	

2.2.3 Association Acceptance Policy

Image Send AE does not accept DICOM associations.

2.3 ExamWorks+ Modality Perform Procedure Step AE Specification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an SCU:

SOP Class Name	SOP Class UID
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3

2.3.1 Association Establishment Policies

2.3.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

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

The Maximum Length PDU negotiation is included in all association establishment requests.

The maximum length PDU for an association initiated is:

Maximum Length PDU	16 Kbytes
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The SOP class Extended Negotiation is not supported.

The maximum number of Presentation Contexts Items that will be proposed is 1.

The user info items sent by this product are:

- Maximum PDU Length
- Implementation Class UID
- Implementation Version Name

2.3.1.2 Number of Associations

The Modality Perform Procedure Step AE has the ability to support one association.

2.3.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.3.1.4 Implementation Identifying Information

The Implementation Class UID for the ExamWorks+ implementation is:

Implementation Class UID	2.16.840.1.113669.2.1.1
--------------------------	-------------------------

2.3.2 Association Initiation by Real World Activity

The ExamWorks+ will initiate a Modality Perform Procedure Step N-CREATE and N-SET via the Modality Perform Procedure Step AE as scheduled procedures steps are confirmed for this procedure.

2.3.2.1 Real-world activity: SCHEDULED PROCEDURE STEP(s) CHOSEN / NO SCHEDULED PROCEDURE STEP FOR THIS PERFORMED PROCEDURE

2.3.2.1.1 Associated real-world activity for Modality Perform Procedure Step

The ExamWorks+ Modality Perform Procedure Step AE initiates an association to the PPS server and sends an N-CREATE message with all appropriate information for the study. An N-SET message is then sent with end dates and times, with a status of COMPLETED or DISCONTINUED, and image instance information. Upon completion of the N-SET, the association is released.

2.3.2.1.2 Proposed presentation contexts for Modality Worklist

The presentation context proposed by the ExamWorks+ Modality Perform Procedure Step AE is as follows:

Performed Procedure Step Presentation Context Table

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.3.2.1.2.1 SOP specific conformance for Modality Performed Procedure Step SOP Class

2.3.2.1.2.1.1 Modality Performed Procedure Step - N-CREATE

The following table defines the use of the N-CREATE DIMSE Service.

Message Field	Tag	Req. Type SCU/SCP	Description
Scheduled Procedure Step Information			
Scheduled Step Attribute Seq.	0040,0270	1/1	
>Study Instance UID	0020,000D	1/1	Obtained via Modality Worklist

>Referenced Study Sequence	0008,1110	2/2	Obtained via Modality Worklist or sent zero length
>Accession Number	0008,0050	2/2	Obtained via Modality Worklist or operator input or sent zero length
>Requested Procedure ID	0040,1001	2/2	Obtained via Modality Worklist or sent zero length
>Requested Procedure Description	0032,1060	2/2	Obtained via Modality Worklist or sent zero length
>Scheduled Procedure Step ID	0040,0009	2/2	Obtained via Modality Worklist or sent zero length
>Scheduled Procedure Step Description	0040,0007	2/2	Obtained via Modality Worklist or sent zero length
>Scheduled Action Item Code Sequence	0040,0008	2/2	Obtained via Modality Worklist or sent zero length
>>Code Value	0008,0100	1C/1	Sent if Sequence Item is present
>>Coding Scheme designator	0008,0102	1C/1	Sent if Sequence Item is present
>>Code Meaning	0008,0104	3/3	Sent if Sequence Item is present and available in the Modality Worklist
Patient's Name	0010,0010	2/2	Obtained via incoming data, Modality Worklist ,or operator input or sent zero length
Patient ID	0010,0020	2/2	Obtained via incoming data, Modality Worklist ,or operator input or sent zero length
Patient's Birth Date	0010,0032	2/2	Obtained via incoming data, Modality Worklist ,or operator input or sent zero length
Patient's Sex	0010,0040	2/2	Obtained via incoming data, Modality Worklist ,or operator input or sent zero length
Referenced Patient Sequence	0008,1120	2/2	Sent zero length
Performed Procedure Step Information			
Performed Procedure Step ID	0040,0253	1/1	Generated by ExamWorks+
Performed Station AE Title	0040,0241	1/1	Generated by ExamWorks+
Performed Procedure Step Start Date	0040,0244	1/1	Generated by ExamWorks+
Performed Procedure Step Start Time	0040,0245	1/1	Generated by ExamWorks+
Performed Procedure Step Status	0040,0252	1/1	IN PROGRESS
Performed Procedure Step Description	0040,0254	2/2	Sent zero length
Performed Procedure Type Description	0040,0255	2/2	Sent zero length
Procedure Code Sequence	0008,1032	2/2	Sent zero length

Performed Procedure Step End Date	0040,0250	2/2	Sent zero length
Performed Procedure Step End Time	0040,0251	2/2	Sent zero length
Image Acquisition Results			
Modality	0008,0060	1/1	
Study ID	0020,0010	2/2	Generated by ExamWorks+
Performed Action Item Code Sequence	0040,0260	2/2	Sent zero length
Performed Series Sequence	0040,0340	2/2	Sent zero length

2.3.2.1.2.1.2 Modality Performed Procedure Step - N-SET

The following table defines the use of the N-SET DIMSE Service.

Message Field	Tag	Req. Type SCU/SCP	Description
Scheduled Procedure Step Information			
Scheduled Step Attribute Seq.	0040,0270	Not allowed	No attributes in this sequence may be set
Patient's Name	0010,0010	Not allowed	
Patient ID	0010,0020	Not allowed	
Patient's Birth Date	0010,0032	Not allowed	
Patient's Sex	0010,0040	Not allowed	
Referenced Patient Sequence	0008,1120	Not allowed	No attributes in this sequence may be set
Performed Procedure Step Information			
Performed Procedure Step ID	0040,0253	Not allowed	
Performed Station AE Title	0040,0241	Not allowed	
Performed Station Name	0040,0242	Not allowed	
Performed Location	0040,0243	Not allowed	
Performed Procedure Step Start Date	0040,0244	Not allowed	
Performed Procedure Step Start Time	0040,0245	Not allowed	
Performed Procedure Step Status	0040,0252	3/1	COMPLETED or DISCONTINUED
Performed Procedure Step Description	0040,0254	3/2	
Performed Procedure Step End Date	0040,0250	2/2	Generated by ExamWorks+

Performed Procedure Step End Time	0040,0251	2/2	Generated by ExamWorks+
Image Acquisition Results			
Modality	0008,0060	Not allowed	
Study ID	0020,0010	Not allowed	
Performed Action Item Code Sequence	0040,0260	2/2	
>Code Value	0008,0100	1C/1	
>Coding Scheme Designator	0008,0102	1C/1	
>Code Meaning	0008,0104	3/3	
Performed Series Sequence	0040,0340	2/2	
>Performing Physician's Name	0008,1050	2C/2	
>Protocol Name	0018,1030	1C/1	
>Operator's Name	0008,1070	2C/2	
>Series Instance UID	0020,000E	1C/1	
>Series Description	0008,103E	2C/2	
>Retrieve AE Title	0008,0054	2C/2	
>Referenced Image Sequence	0008,1140	2C/2	
>>Referenced SOP Class UID	0008,1150	1C/1	
>>Referenced SOP Instance UID	0008,1155	1C/1	

2.3.3 Association Acceptance Policy

Modality Perform Procedure Step AE does not accept DICOM associations.

2.4 ExamWorks+ Storage Commitment AE Specification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as a SCU:

SOP Class Name	SOP Class UID
Storage Commitment	1.2.840.10008.1.20.1

2.4.1 Association Establishment Policies

2.4.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

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

The Maximum Length PDU negotiation is included in all association establishment requests.

The maximum length PDU for an association initiated is:

Maximum Length PDU	16 Kbytes
--------------------	-----------

The SOP class Extended Negotiation is not supported.

The maximum number of Presentation Contexts Items that will be proposed is 1.

The user info items sent by this product are:

- Maximum PDU Length
- Implementation UID

2.4.1.2 Number of Associations

The ExamWorks+ Storage Commitment AE has the ability to support multiple associations.

2.4.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.4.1.4 Implementation Identifying Information

The Implementation Class UID for the ExamWorks+ implementation is:

Implementation Class UID	2.16.840.1.113669.2.1.1
--------------------------	-------------------------

2.4.2 Association Initiation by Real World Activity

The ExamWorks+ Storage Commitment AE will initiate the storage commitment N-ACTION requests as soon as all images in a procedure have been stored to all targets without error.

2.4.2.1 Real-world activity: PROCEDURE SUCCESSFULLY STORED

2.4.2.1.1 Associated real-world activity for Storage Commitment

Upon transfer of images for a procedure, the ExamWorks+ Storage Commitment AE initiates an association for the request of Storage Commitment on a remote Archive or PACS System. Upon completion of the N-ACTION, the association is released. In order to relate the N-ACTION to future updates (i.e. incoming N-EVENT-REPORTs) the Transaction UID used is recorded. There are no timers related to the management of the association.

Upon receiving an incoming association with an N-ACTION response containing a Failure Status, the status will be logged to the system log file and the implementation will terminate the association.

For cases when the called Storage Commitment SCP is not functioning (i.e. momentarily off-line), the ExamWorks+ Storage Commitment implementation queues the N-ACTION request for future retransmission. This queue is "non-blocking" which enables ExamWorks+ to continue acquiring imaging procedures while the Storage Commitment SCP is off-line. A configurable timer is set to trigger the retransmission of the queued entries. Entries are not to be deleted from the queue unless done so by a successful response from the commitment target.

The N-ACTION message is generated without operator interaction.

2.4.2.1.2 Proposed presentation contexts for Storage Commitment

The presentation context proposed by the ExamWorks+ Storage Commitment is as follows:

Storage Commitment Presentation Context Table

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Storage Commitment	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.4.2.1.2.1 SOP specific conformance for Storage Commitment SOP Class

The ExamWorks+ Storage Commitment AE provides Standard conformance to the Storage Commitment SOP Class.

There are no SOP class specific status codes defined by DICOM for the N-ACTION or the N-EVENT-REPORT, therefore, only general statuses from PS3.7 are used.

2.4.3 Association Acceptance Policy

The ExamWorks+ Storage Commitment AE will accept all incoming associations as defined by the following real world activities.

2.4.3.1 Real World Activity IMAGES COMMITTED

The incoming N-EVENT-REPORT is the reply generated by the called storage commitment SCP to the above N-ACTION. Upon receiving an N-EVENT-REPORT message containing failed requests, the status will be logged to the system log file.

2.4.3.1.1 Associated Real World Activity

The ExamWorks+ receives N-EVENT-REPORT using the Presentation Contexts defined in the Table shown in section 2.4.3.1.2, to all of the selected destination device(s).

2.4.3.1.2 Acceptable Presentation Contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Storage Commitment	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.4.3.1.2.1 SOP Specific Conformance Statement for the Storage SOP Classes

This Application Entity provides Standard Conformance to the SOP Classes defined in the SOP Class table in section 2.4.

2.4.3.1.3 Presentation Context Acceptance Criterion

All of the above presentation context in section 2.4.3.1.2 are accepted.

2.4.3.1.4 Transfer Syntax Selection Policies

The Storage Commitment AE SCU accepts Implicit Little Endian.

2.5 ExamWorks+ Image Receive SCP AE Specification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as a SCP:

SOP Class Name	SOP Class UID
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
X-Ray Angiographic Bi-Plane Image Storage	1.2.840.10008.5.1.4.1.1.12.3
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1

2.5.1 Association Establishment Policies

2.5.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

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

The Maximum Length PDU negotiation is included in all association establishment requests.

The maximum length PDU for an association initiated is:

Maximum Length PDU	16 Kbytes
---------------------------	------------------

The SOP class Extended Negotiation is not supported.

The maximum number of Presentation Contexts Items that will be proposed is 1.

The user info items sent by this product are:

- Maximum PDU Length
- Implementation Class UID
- Implementation Version Name

2.5.1.2 Number of Associations

The ExamWorks+ Image Receive AE has the ability to support five simultaneous association.

2.5.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.5.1.4 Implementation Identifying Information

The Implementation Class UID for the ExamWorks+ implementation is:

Implementation Class UID	2.16.840.1.113669.2.1.1
---------------------------------	--------------------------------

2.5.2 Association Initiation by Real-World Activity

The ExamWorks+ Image Receive AE does not initiate DICOM associations.

2.5.3 Association Acceptance Policy

The ExamWorks+ Image Receive AE will accept all incoming associations as defined by the following real world activities.

2.5.3.1 Real World Activity RECEIVE INCOMING STORE REQUEST

Images are managed by the ExamWorks+ Image Receive AE based on association. Each incoming association defines a procedure.

2.5.3.1.1 Associated Real World Activity

The ExamWorks+ receives images via the DICOM Image Storage Service Class using the Presentation Contexts defined in the Table shown in section 2.5.3.1.2, to all of the selected destination device(s).

2.5.3.1.2 Acceptable Presentation Contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Computed Radiography Image Storage	1.2.840.10008.5	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
	.1.4.1.1.1	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
CT Image Storage	1.2.840.10008.5 .1.4.1.1.2	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5 .1.4.1.1.3.1	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None
MR Image Storage	1.2.840.10008.5 .1.4.1.1.4	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None
Ultrasound Image Storage	1.2.840.10008.5 .1.4.1.1.6.1	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None
Secondary Capture Image Storage	1.2.840.10008.5 .1.4.1.1.7	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None
X-Ray Angiographic Image Storage	1.2.840.10008.5 .1.4.1.1.12.1	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5 .1.4.1.1.12.2	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None
X-Ray Angiographic Bi-plane Image Storage	1.2.840.10008.5 .1.4.1.1.12.3	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None
Nuclear Medicine Image Storage	1.2.840.10008.5 .1.4.1.1.20	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None
Positron Emission Tomography (PET) Image Storage	1.2.840.10008.5 .1.4.1.1.128	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None
Standalone PET Curve	1.2.840.10008.5 .1.4.1.1.129	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None
Radiotherapy Image Storage	1.2.840.10008.5 .1.4.1.1.481.1	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5 .1.4.1.1.1.1	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5 .1.4.1.1.1.1.1	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5 .1.4.1.1.1.2	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5 .1.4.1.1.1.2.1	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5 .1.4.1.1.1.3	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCP	None

2.5.3.1.2.1 SOP Specific Conformance Statement for the Storage SOP Classes

This Application Entity provides Standard Conformance to the SOP Classes defined in the SOP Class table in section 2.5.

2.5.3.1.3 Presentation Context Acceptance Criterion

All of the above presentation context, in any combination or order, are accepted.

2.5.3.1.4 Transfer Syntax Selection Policies

If the SCU proposes all three syntax, the ExamWorks+ will choose them in the priority order of Implicit Little Endian, Explicit Little Endian, and Explicit Big Endian.

3. Communication Profiles

3.1 Supported Communication Stacks

3.1.1 OSI Stack

Not applicable to this product.

3.1.2 TCP/IP Stack

DICOM Upper Layer (PS 3.8) is supported using TCP/IP. The TCP/IP stack is inherited from the operating system.

3.1.2.1 API

Not applicable to this product.

3.1.2.2 Physical Media Support

Ethernet v2.0, IEEE 802.3.

3.1.3 Point-to-Point Stack

Not applicable to this product.

4. Extensions/Specialization's/Privatization's

ExamWorks+ provides standard conformance to all implemented SOP classes.

5. Configuration

5.1 *AE Title/Presentation Address Mapping*

The following fields are configurable for the ExamWorks+ AEs (local):

- Local AE Titles
- Local IP Address

The following fields are configurable for every remote DICOM AE:

- Remote AE Titles
- Listening TCP/IP Port
- Remote IP Address

5.2 *Other Configurable Parameters*

Each association negotiation supports an " Association Timer ", called ARTIM. This timer starts when the association request is sent and stops when the association is established. This timer is configurable by the Merge Service engineer to facilitate WAN connections. The default value is set to 30 seconds.

Each association also supports a WRITE_TIMEOUT for individual writes throughout the life of the association. This timer starts at the beginning of the network transmission of a PDU. If the timeout is reached, the ExamWorks+ AE ceases the transmission of the PDU and aborts the association. This timer is also adjustable by the Merge Service engineer to facilitate WAN connections. The default value is 15 seconds.

6. Support of Extended Character Sets

The ISO Latin 1 character set is supported for the Store Receive and Send, as well as the Modality Worklist Query and Modality Performed Procedure Step AEs.