

ACUSON Corporation

AEGIS® System

Models QV100 and QV150

DICOM Interface Option

DICOM Conformance Statement

6 July, 1998

DISCLAIMER

The specifications contained herein are subject change with new releases of the product. Acuson reserves the right to make any changes without prior notice. In no event shall Acuson, its subsidiaries or employees, be held liable for incidental or consequential damages in connection with or arising from the use of this document or any of the information described herein.

Table of Contents

| | | |
|-----------|--|-----------|
| 1. | INTRODUCTION..... | 4 |
| 1.1. | CONNECTION TO PACS | 4 |
| 1.1.1 | <i>PACS stores and distributes studies originating on the QV module.....</i> | 4 |
| 1.1.2 | <i>PACS responds to modality worklist query requests.....</i> | 4 |
| 1.2 | DICOM PRINTING | 4 |
| 2 | IMPLEMENTATION MODEL | 5 |
| 2.1 | APPLICATION DATA FLOW DIAGRAM..... | 5 |
| 2.2 | FUNCTIONAL DEFINITION OF AE | 5 |
| 2.2.1 | <i>Sequencing of Real World Activities.....</i> | 6 |
| 3 | AE SPECIFICATION..... | 6 |
| 3.1 | ASSOCIATION ESTABLISHMENT POLICIES | 8 |
| 3.1.1 | <i>General.....</i> | 8 |
| 3.1.2 | <i>Number of Associations.....</i> | 8 |
| 3.1.3 | <i>Asynchronous Nature</i> | 8 |
| 3.1.4 | <i>Implementation Identifying Information</i> | 8 |
| 3.2 | ASSOCIATION INITIATION BY REAL WORLD ACTIVITY..... | 8 |
| 3.2.1 | <i>Initiate Verification.....</i> | 8 |
| 3.2.2 | <i>Send Study to PACS</i> | 9 |
| 3.2.3 | <i>Modality Worklist Retrieval.....</i> | 11 |
| 3.2.4 | <i>Verification</i> | 11 |
| 3.2.5 | <i>Printing A Study.....</i> | 12 |
| 4 | COMMUNICATION PROFILES | 13 |
| 4.1 | SUPPORTED COMMUNICATIONS STACKS..... | 13 |
| 5 | EXTENSIONS/SPECIALIZATIONS/PRIVATIZATIONS..... | 13 |
| 5.1 | DESCRIPTION OF EXTENDED STANDARD ULTRASOUND IMAGE STORAGE SOP CLASS..... | 13 |
| 6 | CONFIGURATION..... | 13 |
| 6.1 | AE TITLE/PRESENTATION ADDRESS MAPPING | 13 |
| 6.2 | CONFIGURABLE PARAMETERS | 14 |
| 6.2.1 | <i>Photometric Interpretation</i> | 14 |
| 7 | SUPPORT FOR EXTENDED CHARACTER SETS..... | 14 |

AEGIS[®] QV100 and QV150 DICOM Interface Option

DICOM Conformance Statement

1. Introduction

This document is a DICOM Conformance Statement for the Acuson AEGIS QV100 and QV150 (QV, or QV module, hereafter) DICOM Interface Option (the Interface, hereafter). The Interface is a component of the AEGIS[®] Digital image and data management system that connects to:

Picture Archiving and Communication System (PACS) that support DICOM networking via TCP/IP

DICOM 3.0 compliant printing devices that support DICOM networking via TCP/IP

The first section of this document (Introduction) is intended for a general audience. It gives a high level description of the Interface. The remaining sections of this document are technical and readers will need a working knowledge of the DICOM standard to understand these sections. This document is based on the DICOM version 3.0 standard as defined by the National Electrical Manufacturers Association (NEMA) Standard Documents PS 3.1-1996 through 3.8-1996.

1.1. Connection to PACS

Connection to PACS supports the following functions.

1.1.1 PACS stores and distributes studies originating on the QV module

Copies of ultrasound studies originating on the QV module are sent to a PACS system where they are stored. The QV user can initiate a transmission of studies, or studies may be sent automatically in the background.

1.1.2 PACS responds to modality worklist query requests

QV users with the worklist option can query the PACS or modality worklist "broker" for information about scheduled ultrasound studies. Information includes patient demography (such as name, ID, and accession number), study type, and scheduled date and time.

1.2 DICOM Printing

QV users with this option can print acquired ultrasound images directly to DICOM 3.0 compliant color and gray-scale printers.

2 Implementation Model

The Interface is a single DICOM Application Entity. The system administrator can configure its application entity title. It performs the following functions:

Sends ultrasound studies to a PACS for storage, distribution and viewing

Queries a PACS or a modality worklist "broker" for information about modality worklist information

Prints acquired images to DICOM printers

2.1 Application Data Flow Diagram

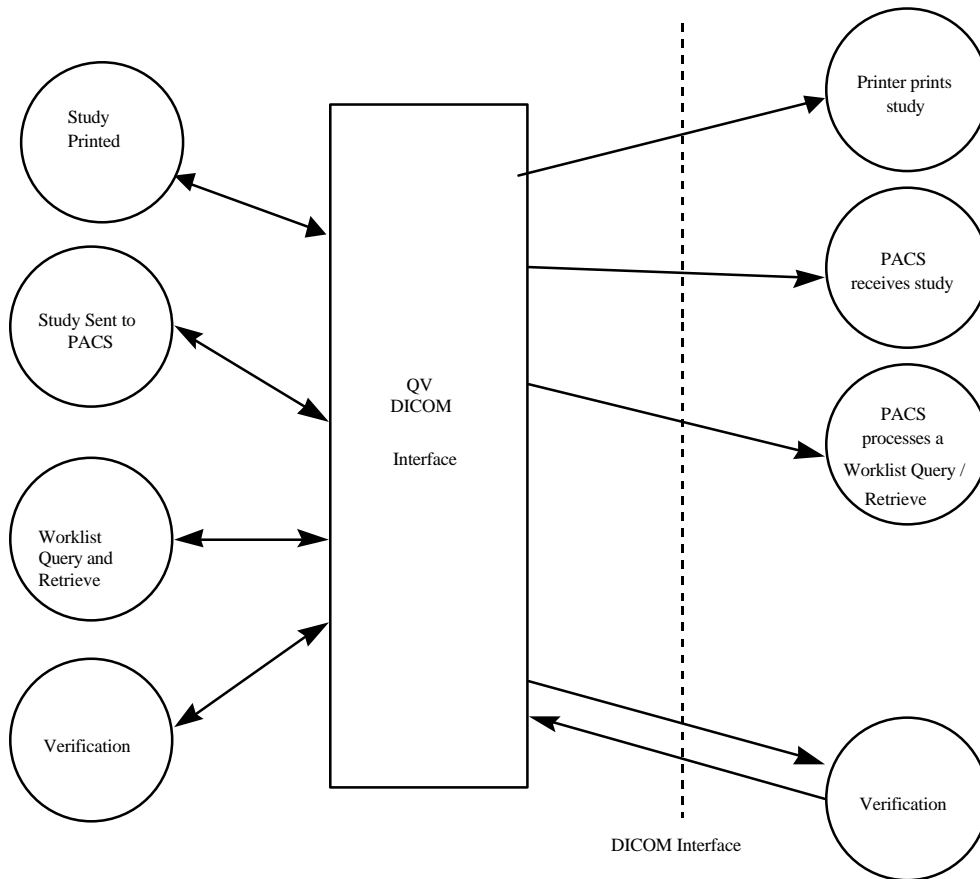


Figure 1: Implementation Model

2.2 Functional Definition of AE

The Interface Application Entity performs the functions described in the Introduction section of this document. This section describes the sequences of real world activities that are involved in performing these functions.

2.2.1 Sequencing of Real World Activities

2.2.1.1 Study Sent to PACS

1. The QV module initiates an Association with the PACS.
2. The QV module sends a study to the PACS.

2.2.1.2 Query/Retrieve of Modality Worklist Initiated by the QV Module

1. When the QV module is on the network, the QV attempts to retrieve the modality worklist that matches the scheduled studies that occur within the desired date range.
2. Retrieved worklist is stored on the QV module for use while the QV module is off the network.

2.2.1.3 Verification initiated by the QV Module

1. The system administrator manually initiates a verification operation.
2. The remote system PACS responds.
3. The success or failure of the operation is displayed.
4. Verification initiated by PACS System.

2.2.1.4 The Remote System Initiates a Verification

1. The QV module responds to the Verification.

2.2.1.5 Printing A Study

1. A user manually selects a study to be printed at the QV module, or the QV module is configured to automatically print the most recently acquired ultrasound study.
2. The QV module attempts to establish an Association with a DICOM printer.
3. The QV module sends images to the printer. If printing is invoked manually, the QV module displays the status of the print job.
4. When the printing session is complete, the QV module closes the Association.

3 AE Specification

The QV DICOM Interface option is a single DICOM application entity which both initiates and accepts Associations.

The Interface provides Standard Conformance as a SCU and SCP to the following DICOM 3.0 SOP Class.

| Table 1: Verification SOP Class Supported as SCU and SCP | |
|--|-------------------|
| SOP Class Name | SOP Class UID |
| Verification SOP Class | 1.2.840.10008.1.1 |

The Interface provides Standard Extended Conformance as a SCU to the following DICOM 3.0 SOP Class. This SOP Class has been extended by the addition of private elements.

| Table 2: Storage SOP Class Supported as SCU | |
|---|-------------------------------------|
| SOP Class Name | SOP Class UID |
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 |
| Ultrasound Image Storage | 1.2.840.10008.5.1.4.1.1.6 (Retired) |
| | 1.2.840.10008.5.1.4.1.1.6.1 |

The Interface provides Standard Conformance to the following Print Service Class as an SCU.

| Table 3: Print SOP Classes Supported as SCU | |
|---|----------------------------|
| SOP Class Name | SOP Class UID |
| Basic Grayscale Print Management Meta SOP Class | 1.2.840.10008.5.1.4.1.1.9 |
| Basic Color Print Management Meta SOP Class | 1.2.840.10008.5.1.4.1.1.18 |

The Interface provides Standard Conformance to the following Basic Worklist Management SOP Classes as an SCU (formerly called the Modality Worklist).

| Table 4: Basic Worklist Management SOP Classes Supported as SCU | |
|---|------------------------|
| SOP Class Name | SOP Class UID |
| Modality Worklist Information Model - FIND | 1.2.840.10008.5.1.4.31 |

3.1 Association Establishment Policies

3.1.1 General

The Interface will attempt to initiate Associations in response to valid internal requests whether manually or automatically generated. The Interface will only initiate Associations with known Application Entities as configured by the QV system administrator. Likewise, the interface will only accept Association requests from known Application Entities.

The maximum size PDU transmitted by the Interface will be 32 KB unless a lower maximum is specified by the receiver during Association Negotiation, in which case that value is used. Note that the peer must negotiate a maximum PDU that is at least 128 bytes. Otherwise, the Association may be rejected based on this parameter. The maximum size of PDU that may be received by the Interface is 32K.

3.1.2 Number of Associations

The maximum number of simultaneous Associations is determined by the internal DICOM AE implementation to be up to four, not exceeding one Association per active service class.

3.1.3 Asynchronous Nature

The Interface does not support asynchronous operations; hence, it will not support asynchronous window negotiations.

3.1.4 Implementation Identifying Information

The Interface will be identified by:

Implementation class UID = 1.2.840.113680.m.n

Implementation Version Name = DS_m.n

Where 'm' designates the major-software-version number of the ACUSON Corporation's DICOM Stack Framework upon which the Interface's DICOM implementation is based. The value 'n' designates a revision number within a major software version release. For example, if the underlying QV DICOM implementation uses the ACUSON Corporation's DICOM Stack Framework version 15.1, then the implementation UID would be 1.2.840.113680.15.1 and the implementation version name string would be DS15.1

3.2 Association Initiation by Real World Activity

3.2.1 Initiate Verification

3.2.1.1 Associated Real-World Activity

Verification requests may be initiated manually by the system administrator during system configuration and testing. They may also be issued automatically during certain operations of the Interface.

NOTE: In addition to DICOM based (C-ECHO) verification, the Interface can issue an ICMP-ECHO packet (also known as a 'ping' packet) for testing the basic TCP/IP-level connectivity.

3.2.1.2 Proposed Presentation Contexts

Table 5: Proposed Presentation Contexts for the Interface Application Entity and Real-World Activity Initiate Verification

| Presentation Context Table | | | | | |
|----------------------------|-------------------|---|-------------------|------|----------------------|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name | UID List | | |
| Verification | 1.2.840.10008.1.1 | DICOM Implicit VR Little Endian transfer Syntax | 1.2.840.10008.1.2 | SCU | None |

3.2.2 Send Study to PACS

3.2.2.1 Associated Real-World Activity

The Interface initiates the establishment of an Association with the PACS system. Only one Study is transferred over an Association. The Association is closed when the transfer is completed. If a Study is restarted and additional images are added to the study after it has been transferred an additional Association will be established and the entire set of study images is transferred.

3.2.2.2 Proposed Presentation Contexts

Table 6: Proposed Presentation Contexts for the Interface Application Entity and Real-World Activity Send Study to PACS

| Presentation Context Table | | | | | |
|---------------------------------|-------------------------------------|---|---------------------|------|----------------------|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name | UID List | | |
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 | DICOM Implicit VR Little Endian transfer Syntax | 1.2.840.10008.1.2 | SCU | None |
| Ultrasound Image Storage | 1.2.840.10008.5.1.4.1.1.6 (Retired) | DICOM Implicit VR Little Endian transfer Syntax | 1.2.840.10008.1.2 | SCU | None |
| | 1.2.840.10008.5.1.4.1.1.6.1 | DICOM Implicit VR Little Endian transfer Syntax | 1.2.840.10008.1.2 | SCU | None |
| | | RLE Compression Transfer Syntax | 1.2.840.10008.1.2.5 | SCU | None |

The new SOP class (1.2.840.10008.5.1.4.1.1.6.1) with the RLE compression transfer syntax is most desirable. If the Association Negotiation results in the acceptance of both abstract transfer syntaxes, the Interface will always use the newer SOP class. The DICOM standard has retired the "old" SOP class (1.2.840.10008.5.1.4.1.1.6), however, for backward compatibility purposes, the retired SOP class will be acceptable.

3.2.2.3 SOP Specific Conformance

3.2.2.3.1 Photometric Interpretation

If the Association negotiation results in the selection of the RLE Lossless Image Compression Transfer Syntax (UID=1.2.840.10008.1.2.5) then the Interface sends the image pixels using the YBR_FULL Photometric Interpretation. If the Association negotiation results in the selection of the DICOM Implicit VR Little Endian transfer Syntax then the Interface sends image pixels using either Photometric Interpretation MONOCHROM2 or RGB. The system administrator can configure which interpretation to use.

3.2.3 Modality Worklist Retrieval

3.2.3.1 Associated Real-World Activity

The Interface automatically generates C-FIND requests in order to query and retrieve information about scheduled studies from a connected PACS.

3.2.3.2 Proposed Presentation Contexts

Table 7: Proposed Presentation Contexts for the Interface Application Entity and Real-World Activity Modality Worklist Information Retrieval

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

3.2.3.2.1 Optional Keys supported

The modality worklist feature implemented for the Interface may use the following additional keys.

Table 8: Optional keys supported for Basic Worklist Management SOP Class SCU

| Attribute Name | Tag | Attribute Description |
|------------------------------------|-------------|--|
| Reason for the Requested Procedure | (0040,1002) | Reason for requesting this image procedure. Note: this reason is more specific to the requested procedure than the reason mentioned in the image service request (0040,2001) |

3.2.4 Verification

3.2.4.1 Real World Activity

The Interface accepts Associations from known Application Entities that wish to perform verification operations (C-ECHO) on the AEGIS system.

3.2.4.2 Associated Real World Activity

The real world activity associated with the C-ECHO request is that an external node wishes to verify network or Interface operation without initiating any actual work.

3.2.4.3 Presentation Context Table

Table 9: Acceptable Presentation Contexts for the Interface Application Entity and Real-World Activity PACS Verification

| Presentation Context Table | | | | | |
|----------------------------|-------------------|---|-------------------|------|----------------------|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name | UID List | | |
| Verification | 1.2.840.10008.1.1 | DICOM Implicit VR Little Endian transfer Syntax | 1.2.840.10008.1.2 | SCP | None |

3.2.5 Printing A Study

3.2.5.1 Associated Real-World Activity

A QV user can request printing of acquired ultrasound study to one or two DICOM printers. The Interface has an automatic background printing capability where the completion of a study causes automatic background printing of the entire study. The manual printing capability permits the user to manually select studies to print. There is also a special "dual" printing mode in which the Interface automatically routes a study's color images to a color capable printer and the gray-scale images to a gray-scale only printer.

3.2.5.2 Proposed Presentation Context

Table 10: Proposed Presentation Contexts for the Interface Application Entity and Real-World Activity QV module Printing A Study

| Presentation Context Table | | | | | |
|---|----------------------------|---|-------------------|------|----------------------|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name | UID List | | |
| Basic Grayscale Print Management Meta SOP Class | 1.2.840.10008.5.1.4.1.1.9 | DICOM Implicit VR Little Endian transfer Syntax | 1.2.840.10008.1.2 | SCU | None |
| Basic Color Print Management Meta SOP Class | 1.2.840.10008.5.1.4.1.1.18 | DICOM Implicit VR Little Endian transfer Syntax | 1.2.840.10008.1.2 | SCU | None |

This implementation does not support Basic Annotation Box SOP Class, Print Job SOP Class, and Image Overlay Box SOP Class.

3.2.5.3 SOP Specific Conformance

3.2.5.3.1 Optional and Private Elements

No private elements are transmitted for this service.

4 Communication Profiles

4.1 Supported Communications Stacks

The Interface provides DICOM 3.0 TCP/IP Network Communication Support as described in Part eight of the DICOM Standard.

5 Extensions/Specializations/Privatizations

5.1 Description of Extended Standard Ultrasound Image Storage SOP Class

The Interface does not include private elements in the SOP instance in the current implementation.

6 Configuration

6.1 AE Title/Presentation Address Mapping

The system administrator sets the AE Title.

The system administrator enters a list of valid Application Entity titles. Associations are only accepted from and initiated with entities entered in this list.

6.2 Configurable Parameters

6.2.1 Photometric Interpretation

A system administrator can configure the transfer of ultrasound studies to the PACS to use MONOCHROME2 or RGB for the default transfer syntax of DICOM Implicit VR Little Endian.

7 Support for Extended Character Sets

The Interface only supports the DICOM 3.0 default character set at this time.