DICOM Conformance Statement

Protura Robotic Couch System

Version 1.7.5

JULY 2019

P/N 093-002

CIVCO

1 CONFORMANCE STATEMENT OVERVIEW

Protura™ Robotic Couch System software is intended to interface between the Protura Couch (hardware) and record and verify systems, linear accelerator (Linac) software systems, Linac safeguard systems, and/or image guidance systems.

Protura software allows robotic corrections for treatments such as 3D Conformal, IMRT, SRS or SBRT. Available interfaces include patient demographics, Linac Pedestal Location, IGRT move capture, and Remote Control. Protura software stores shift data for patients which can be printed or exported in PDF (.pdf) format.

This conformance statement indicates conformance of Protura Robotic Couch System software with the DICOM v 3.0 standard.

Table 1-1 provides an overview of the network services supported by Protura Robotic Couch System software.

Table 1-1
NETWORK SERVICES

Networking SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
RT Image Storage	No	Yes
RT Structure Set Storage	No	Yes
RT Plan Storage	No	Yes
Spatial Registration Storage	No	Yes
CT Image Storage	No	Yes
Query/Retrieve		
Study Root Query/Retrieve Information Model - FIND	Yes	No
Study Root Query/Retrieve Information Model - MOVE	Yes	No

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3 INTRODUCTION

3.1 REVISION HISTORY

Document Version	Date of Issue	Author	Description
Protura 1.3.0	JULY 2013	JRM	Initial release of document
Protura 1.3.1	SEPTEMBER 2013	JRM	No changes
Protura 1.4.0	MARCH 2014	JRM	No changes
Protura 1.5.0	JULY 2014	JRM	No changes
Protura 1.6.0	MARCH 2015	JRM	No changes
Protura 1.6.1	SEPTEMBER 2015	JRM	No changes
Protura 1.7.0	NOVEMBER 2015	JRM	No changes
Protura 1.7.1	JANUARY 2016	JRM	No changes
Protura 1.7.2	MARCH 2016	JRM	No changes
Protura 1.7.3	JUNE 2017	BNM	No changes
Protura 1.7.4	DECEMBER 2017	BNM	No changes
Protura 1.7.5	JULY 2019	BNM	No changes

3.2 AUDIENCE

This document is for anyone who needs to understand how Protura Robotic Couch System software will integrate into their healthcare facility. This includes both those responsible for overall imaging network policy and architecture, as well as integrators who need to have a detailed understanding of the DICOM features of the product. This document contains some basic DICOM definitions so any reader may understand how this product implements DICOM features. However, integrators are expected to fully understand all the DICOM terminology, how the tables in this document relate to the product's functionality, and how that functionality integrates with other devices that support compatible DICOM features.

3.3 REMARKS

The scope of this DICOM Conformance Statement is to facilitate integration between Protura Robotic Couch System software and other DICOM products. The Conformance Statement should be read and understood in conjunction with the DICOM Standard. DICOM by itself does not guarantee interoperability. The Conformance Statement does, however, facilitate a first-level comparison for interoperability between different applications supporting compatible DICOM functionality.

This Conformance Statement is not supposed to replace validation with other DICOM equipment to ensure proper exchange of intended information. In fact, the user should be aware of the following important issues:

- The comparison of different Conformance Statement is just the first step towards assessing interconnectivity and interoperability between the product and other DICOM conformant equipment.
- Test procedures should be defined and executed to validate the required level of interoperability with specific compatible DICOM equipment, as established by the healthcare facility.

3.4 TERMS AND DEFINITIONS

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitions of these terms.

Abstract Syntax - the information agreed to be exchanged between applications, generally equivalent to a Service/ Object Pair (SOP) Class. Examples: Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE) - an end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title - the externally known name of an Application Entity, used to identify a DICOM application to other DICOM application on the network.

Application Context - the specification of the type of communication used between Application Entities. Example: DICOM network protocol.

Association - a network communication channel set up between Application Entities.

Attribute - a unit of information in an object definition; a data element identified by a tag. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010, 0020), Accession Number (0008, 0050), Photometric Interpretation (0028, 0004), Procedure Code Sequence (0008, 1032).

Information Object Definition (IOD) - the specified set of Attributes that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The Attributes may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG) - a set of standardized image compression techniques available for use by DICOM applications.

Media Application Profile - the specification of DICOM information objects and encoding exchanged on removable media (i.e., CD's).

Module - a set of Attributes within an Information Object Definition that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation - first phase of Association establishment that allows Application Entities to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context - the set of DICOM network services used over an Association, as negotiated between Application Entities; includes Abstract Syntaxes and Transfer Syntaxes.

Protocol Data Unit (PDU) - a packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Security Profile - a set of mechanisms, such as encryption, user authentication, or digital signatures, used by an Application Entity to ensure confidentiality, integrity, and/or availability of exchanged DICOM data.

Service Class Provider (SCP) - role of an Application Entity that provides a DICOM network service; typically, a server that performs operations requested by another Application Entity (Service Class User). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU) - role of an Application Entity that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU).

Service/Object Pair (SOP) Class - the specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance - an information object; a specific occurrence of information exchanged in a SOP Class. Examples: a specific x-ray image.

Tag - a 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the “group” and the “element”. If the “group” number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010, 0020) [Patient ID], (07FE, 0010) [Pixel Data], (0019, 0210) [private data element].

Transfer Syntax - the encoding used for exchange of DICOM information objects and messages. Examples: JPEG compressed (images), little endian explicit value representation.

Unique Identifier (UID) - a globally unique “dotted decimal” string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR) - the format type of an individual DICOM data element, such as text, an integer, a person’s name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

3.5 BASICS OF DICOM COMMUNICATION

This section describes terminology used in this Conformance Statement for the non-specialist. The key terms used in the Conformance Statement are highlighted in italics below. This section is not a substitute for training about DICOM, and it makes many simplifications about the meaning of DICOM terms.

Two Application Entities (devices) that want to communicate with each other over a network using DICOM protocol must first agree on several things during an initial network “handshake”. One of the two devices must initiate an Association (a connection to the other device), and ask if specific services, information, and encoding can be supported by the other device (Negotiation).

DICOM specifies a number of network services and types of information objects, each of which is called an Abstract Syntax for the Negotiation. DICOM also specifies a variety of methods for encoding data, denoted Transfer Syntaxes. The Negotiation allows the initiating Application Entity to propose combinations of Abstract Syntax and Transfer Syntax to be used on the Association; these combinations are called Presentation Contexts. The receiving Application Entity accepts the Presentation Contexts it supports.

For each Presentation Context, the Association Negotiation also allows the devices to agree on Roles - which one is the Service Class User (SCU - client) and which is the Service Class Provider (SCP - server). Normally the device initiating the connection is the SCU, i.e., the client system calls the server, but not always.

The Association Negotiation finally enables exchange of maximum network packet (PDU) size, security information, and network service options (called Extended Negotiation information).

The Application Entities, having negotiated the Association parameters, may now commence exchanging data. Common data exchanges include queries for worklists and lists of stored images, transfer of image objects and analyses (structured reports), and sending images to film printers. Each exchangeable unit of data is formatted by the sender in accordance with the appropriate Information Object Definition, and sent using the negotiated Transfer Syntax. There is a Default Transfer Syntax that all systems must accept, but it may not be the most efficient for some use cases. Each transfer is explicitly acknowledged by the receiver with a Response Status indicating success, failure, or that query or retrieve operations are still in process.

Two Application Entities may also communicate with each other by exchanging media (such as a CD-R). Since there is no Association Negotiation possible, they both use a Media Application Profile that specified “pre-negotiated” exchange media format, Abstract Syntax, and Transfer Syntax.

3.6 ABBREVIATIONS

The following list defines all abbreviations used in this document.

AE	Association Entity
CD-R	Compact Disk Recordable
CT	Computed Tomography
DICOM	Digital Imaging and Communications in Medicine
IOD	Information Object Definition
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISO	International Organization for Standards
JPEG	Joint Photographic Experts Group
MR	Magnetic Resonance Imaging
PDU	Protocol Data Unit
RT	Radiotherapy
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
VR	Value Representation

3.7 REFERENCES

NEMA Standards Publication PS3.2-2011, Digital Imaging and Communications in Medicine (DICOM), 2011, available free at http;//medical.nema.org/

4 NETWORKING

4.1 IMPLEMENTATION MODEL

4.1.1 Application Data Flow

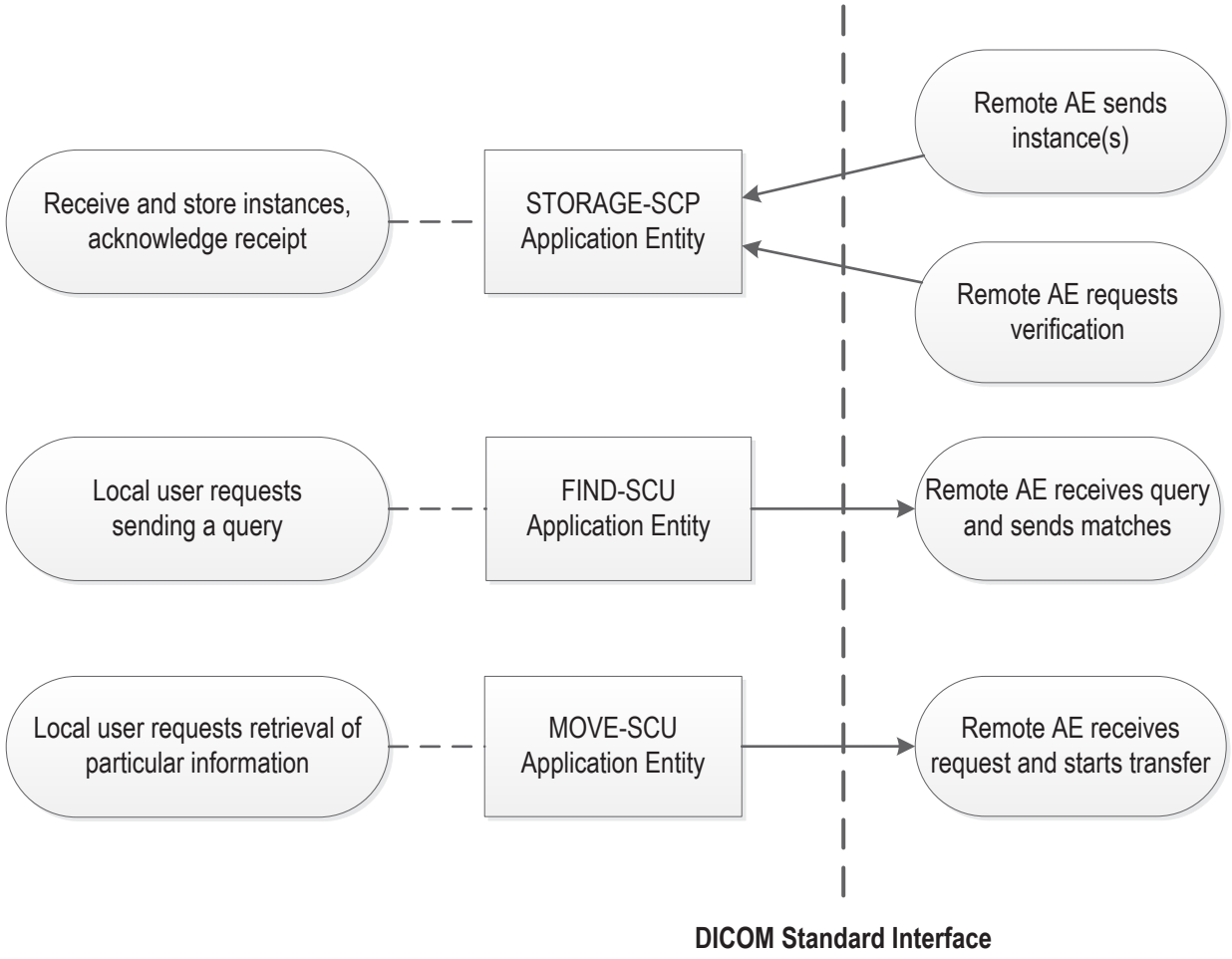

Figure 4-1: Application Data Flow Diagram

The networking services which are implemented in the Protura Robotic Couch System software may be modeled as the separate AE's shown above.

4.1.2 Functional Definitions of AE(s)

4.1.2.1 STORAGE-SCP

STORAGE-SCP listens for connection requests at the port number configured for it. It will accept Presentation Contexts for Storage and Verification SOP Classes. Upon receipt of a Verification Request, STORAGE-SCP will respond with a successful Verification response. Upon receipt of a Storage Request, STORAGE-SCP will store the object that has been successfully received in the local system.

4.1.2.3 FIND-SCU

FIND-SCU is activated through a programmatic selection and initiates a query on study level.

4.1.2.4 MOVE-SCU

MOVE-SCU is activated through programmatic selection. A connection to the remote AE is established to initiate the retrieval. The STORAGE-SCP AE receives the retrieved instances and stores them in the local system.

4.1.3 Sequencing of Real-World Activities

All SCP activities are performed asynchronously in the background and are not dependent on any sequencing. The only limitation is that the STORAGE-SCP only accepts one association at a time.

All SCU activities are initiated through programmatic selection.

4.2 AE SPECIFICATIONS

4.2.1 STORAGE-SCP

4.2.1.1 SOP Classes

STORAGE-SCP provides standard conformance to the following DICOM SOP classes.

Table 4.2-1
SOP CLASSES FOR AE STORAGE-SCP

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	No	Yes
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	No	Yes
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	No	Yes
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	No	Yes
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	No	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	No	Yes

4.2.1.2 Association Policies

4.2.1.2.1 General

STORAGE-SCP accepts but never initiates associations. The DICOM standard application context name, which is always proposed, is:

Table 4.2-2
DICOM APPLICATION CONTEXT

Application Context Name	1.2.840.10008.3.1.1.1

The maximum PDU size is 16384 bytes, which is the default size.

SOP Class extended negotiation is not supported.

4.2.1.2.2 Number of Associations

Table 4.2-3
NUMBER OF ASSOCIATIONS AS AN ASSOCIATION ACCEPTOR FOR STORAGE-SCP

Maximum number of simultaneous associations	1

4.2.1.2.3 Asynchronous Nature
Asynchronous mode of operation is not supported.

4.2.1.2.4 Implementation Identifying Information

Table 4.2-4
DICOM IMPLEMENTATION CLASS AND VERSION FOR AE STORAGE-SCP

Implementation Class UID	1.2.276.0.7230010.3.0.3.6.0
Implementation Version Name	OFFIS_DCMTK_360

4.2.1.3 Association Initiation Policy
STORAGE-SCP does not initiate associations.

4.2.1.4 Association Acceptance Policy
STORAGE-SCP accepts any association for which at least one presentation context is accepted. The calling and called application entity titles are ignored. The responding application entity name will always be identical to the called application entity title which was specified by the remote AE. Association requests may be rejected with the following results and reasons.

Table 4.2-5
ASSOCIATION REJECTION REASONS

RESULT	SOURCE	REASON	DESCRIPTION
Rejected permanent	Provider, presentation related	Temporary congestion	Resource limitation; process creation failed.
Rejected transient	User	Application context name not supported	Incorrect application context name

4.2.1.4.1 Activity - REMOTE AE SENDS INSTANCE(S)

4.2.1.4.1.1 Description and Sequencing of Activities

As one instance is received from a remote AE, STORAGE-SCP will store this instance in the local file system.

4.2.1.4.1.2 Accepted Presentation Contexts

Table 4.2-6
ACCEPTABLE PRESENTATION CONTEXTS FOR STORAGE-SCP AND REMOTE AE SENDS INSTANCE(S)

PRESENTATION CONTEXT TABLE					
ABSTRACT SYNTAX		TRANSFER SYNTAX		ROLE	EXT. NEG.
NAME	UID	NAME LIST	UID LIST		
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	NONE
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.4.81.3	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	NONE
RT Plan Storage	1.2.840.10008.5.1.4.1.1.4.81.5	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	NONE
Spacial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	NONE
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	NONE

4.2.1.4.1.2.1 Extended Negotiations

No extended negotiation is performed.

4.2.1.4.1.3 SOP Specific Conformance

4.2.1.4.1.3.1 SOP Specific Conformance to Storage SOP Classes

STORAGE-SCP provides standard conformance to the Storage Service Class.

STORAGE-SCP will receive any supported DICOM instances transmitted on the open association provided that the correct presentation context is used. If an instance is received successfully, it is stored on the local file system. For all supported storage SOP classes, no integrity checks of the received instances are performed beyond tests of a very basic structural integrity. In particular, the sending system is not prevented from transmitting incomplete or incorrect IOD's. When storing an instance in the local system, group length values and sequence lengths of an instance are re-computed by STORAGE-SCP; these values may, therefore, be changed.

4.2.1.4.1.3.2 Presentation Context Acceptance Criterion

STORAGE-SCP will accept all presentation context which contain one of the supported SOP classes and one of the supported transfer syntaxes.

4.2.1.4.1.3.3. Transfer Syntax Selection Policies

In case of uncompressed transmission, the default behavior of STORAGE-SCP is to select for each presentation context containing a supported SOP class the explicit VR transfer syntax with the byte order matching the local machine byte order. If this transfer syntax is not available, the explicit VR transfer syntax with opposite byte order is selected. If this is also unavailable, implicit VR little endian is selected if available, otherwise the presentation context is rejected.

4.2.1.4.1.3.4 Response Status

STORAGE-SCP will behave as described in the table below when generating C-STORE response command message.

Table 4.2-7
RESPONSE STATUS FOR AE STORAGE-SCP AND
REMOTE AE SENDS INSTANCE(S)

SERVICE STATUS	FURTHER MEANING	ERROR CODE	BEHAVIOR
Success	Success	0000	The DICOM instance was successfully received and stored in the local system.
Refused	Out of Resources	A700	Application out of memory, file system or database write error (i.e. disk is full or missing rights). The DICOM instance was not stored. An error message is output to the service logs.
Error	Data set does not match SOP class	A900	The SOP Class UID or SOP Instance UID in the C-STORE-RQ does not match the corresponding UID in the received dataset. The DICOM instance was stored anyway. An error message is output to the service logs.
	Cannot understand	C000	The received DICOM instance did not include a SOP Class UID or SOP Instance UID. The DICOM instance was stored anyway. An error message is output to the service logs.
Warning	Coercion of Data Elements	B000	Never sent, no coercion is ever performed.
	Data Set does not match SOP Class	B007	Never sent.
	Elements discarded	B006	Never sent.

4.2.1.4.2 Activity - REMOTE AE REQUESTS VERIFICATION

4.2.1.4.2.1 Description and Sequencing of Activities

A remote AE sends an Echo Request to verify that STORAGE-SCP is awake and listening. STORAGE-SCP responds with success status as long as the request can be parsed.

4.2.1.4.2.2 Accepted Presentation Contexts

Table 4.2-8
ACCEPTABLE PRESENTATION CONTEXTS FOR STORAGE-SCP AND
REMOTE AE REQUESTS VERIFICATION

PRESENTATION CONTEXT TABLE					
ABSTRACT SYNTAX		TRANSFER SYNTAX		ROLE	EXT. NEG.
NAME	UID	NAME LIST	UID LIST		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	NONE

4.2.1.4.2.2.1 Extended Negotiations

No extended negotiation is performed.

4.2.1.4.2.3 SOP Specific Conformance

4.2.1.4.2.3.1 SOP Specific Conformance to STORAGE SOP Classes

STORAGE-SCP provides standard conformance to the Verification Service Class.

4.2.1.4.2.3.2 Presentation Context Acceptance Criterion

STORAGE-SCP will accept all presentation context which contain the supported SOP classes and one of the supported transfer syntaxes.

4.2.1.4.2.3.3 Transfer Syntax Selection Policies

The default behavior of STORAGE-SCP is to select for each presentation context containing a supported SOP class the explicit VR transfer syntax with the byte order matching the local machine byte order. If this transfer syntax is not available, the explicit VR transfer syntax with opposite byte order is selected. If this is also unavailable, implicit VR little endian is selected if available, otherwise the presentation context is rejected.

4.2.2 FIND-SCU

4.2.2.1 SOP Classes

FIND-SCU provides standard conformance to the following DICOM SOP classes.

Table 4.2-9
SOP CLASSES FOR AE FIND-SCU

SOP Class Name	SOP Class UID	SCU	SCP
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No

4.2.2.2 Association Policies

4.2.2.2.1 General

FIND-SCU initiates but never accepts associations. The DICOM standard application context name, which is always proposed, is:

Table 4.2-10
DICOM APPLICATION CONTEXT

Application Context Name	1.2.840.10008.3.1.1.1

The maximum PDU size is 16384 bytes, which is the default size.

SOP Class extended negotiation is not supported.

4.2.2.2.2 Number of Associations

Table 4.2-11
NUMBER OF ASSOCIATIONS AS AN ASSOCIATION ACCEPTOR FOR FIND-SCU

Maximum number of simultaneous associations	1

4.2.2.2.3 Asynchronous Nature

Asynchronous mode of operation is not supported.

4.2.2.2.4 Implementation Identifying Information

Table 4.2-12
DICOM IMPLEMENTATION CLASS AND VERSION FOR AE FIND-SCU

Implementation Class UID	1.2.276.0.7230010.3.0.3.6.0
Implementation Version Name	OFFIS_DCMTK_360

4.2.2.3 Association Initiation Policy

FIND-SCU attempts to initiate a new association through programmatic selection.

4.2.2.3.1 Activity - LOCAL USER REQUESTS SENDING A QUERY

4.2.2.3.1.1 Description and Sequencing of Activities

A single attempt will be made to query the remote AE.

4.2.2.3.1.2 Proposed Presentation Contexts

Table 4.2-13
PROPOSED PRESENTATION CONTEXTS FOR AE FIND-SCU AND
LOCAL USER REQUESTS SENDING A QUERY

PRESENTATION CONTEXT TABLE					
ABSTRACT SYNTAX		TRANSFER SYNTAX		ROLE	EXT. NEG.
NAME	UID	NAME LIST	UID LIST		
Study Root Query/ Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	NONE

By default, FIND-SCU will propose all uncompressed transfer syntaxes with local byte ordering first.

4.2.2.3.1.2.1 Extended Negotiations

No extended negotiation is performed. Relational queries are not supported.

4.2.2.3.1.3 SOP Specific Conformance

4.2.2.3.1.3.1 SOP Specific Conformance to C-FIND SOP Classes

FIND-SCU provides standard conformance to the supported C-FIND SOP Class.

Only a single information model, Study Root, is supported. All queries are initiated at the highest level of the information model (the STUDY level). No C-CANCEL requests are ever issued.

Unexpected attributes returned in a C-FIND response (those not requested) are not shown to the user but reported to the service logs. Requested return attributes not returned by the SCP are ignored and left blank in the list on the user interface. Non-matching responses returned by the SCP due to unsupported matching keys are not filtered locally by the FIND-SCU and, thus, will be presented in the list. No attempt is made to filter out duplicate responses.

Since extended character sets are not supported *see section 6), the Specific Character Set (0008, 0005) attribute is not used in the query.

Table 4.2-14
STUDY ROOT REQUEST IDENTIFIER FOR AE FIND-SCU

ATTRIBUTE NAME	TAG	TYPES OF MATCHING
Level	(0008, 0052)	Single Value
Patient	(0010, 0020)	Single Value
SOP Instance UID	(0008, 0018)	Single Value
Study Set UID	(0020, 000D)	Single Value

4.2.2.3.1.3.2 Presentation Context Acceptance Criterion

FIND-SCU does not accept associations.

4.2.2.3.1.3.3 Transfer Syntax Selection Policies

Since FIND-SCU proposes a single presentation context only, the SCP is responsible for the transfer syntax selection.

4.2.2.3.1.3.4 Response Status

FIND-SCU will behave as described in the table below when generating C-FIND response command message.

Table 4.2-15
RESPONSE STATUS HANDLING BEHAVIOR FOR AE FIND-SCU AND
LOCAL USER REQUESTS SENDING A QUERY

SERVICE STATUS	FURTHER MEANING	ERROR CODE	BEHAVIOR
Success	Matching is complete - No final identifier is supplied	0000	Current query is completed successfully.
Refused	Out of Resources	A700	This is treated as a permanent failure.
Failed	Data set does not match SOP class	A900	This is treated as a permanent failure.
	Unable to process	Cxxx	This is treated as a permanent failure.
Cancel	Matching terminated due to cancel request	FE00	Should never occur since Cancel requests are never issued.
Pending	Matches are continuing - Current match is supplied and any optional keys were supported in the same manner as required keys.	FF00	Current match is added to the internal list of studies.
	Matches are continuing - Warning that one or more optional keys were not supported for existence and/or matching for this identifier.	FF01	Current match is added to the internal list of studies. This is treated as a permanent failure.

Table 4.2-16
COMMUNICATION FAILURE BEHAVIOR FOR FIND-SCU AND
LOCAL USER REQUESTS SENDING A QUERY

EXCEPTION	BEHAVIOR
TCP/IP connection could not be established within the specified time range (configurable parameter).	An error message is reported to the service logs.
ASCE response message could not be received within the specified time range (configurable parameter).	An error message is reported to the service logs.
DIMSE response message could not be received within the specified time range (configurable parameter.	An error message is reported to the service logs.
Association aborted by the SCP using A-ABORT or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure).	An error message is reported to the service logs.

4.2.2.4 Association Acceptance Policy

FIND-SCU does not accept associations.

4.2.3 MOVE-SCU

4.2.3.1 SOP Classes

MOVE-SCU provides standard conformance to the following DICOM SOP classes.

Table 4.2-17
SOP CLASSES FOR AE MOVE-SCU

SOP Class Name	SOP Class UID	SCU	SCP
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No

4.2.3.2 Association Policies

4.2.3.2.1 General

MOVE-SCU initiates but never accepts associations. The DICOM standard application context name, which is always proposed, is:

Table 4.2-18
DICOM APPLICATION CONTEXT

Application Context Name	1.2.840.10008.3.1.1.1

The maximum PDU size is 16384 bytes, which is the default size.

SOP Class extended negotiation is not supported.

4.2.3.2.2 Number of Associations

Table 4.2-19
NUMBER OF ASSOCIATIONS AS AN ASSOCIATION ACCEPTOR FOR FIND-SCU

Maximum number of simultaneous associations	1

4.2.3.2.3 Asynchronous Nature

Asynchronous mode of operation is not supported.

4.2.3.2.4 Implementation Identifying Information

Table 4.2-20
DICOM IMPLEMENTATION CLASS AND VERSION FOR AE MOVE-SCU

Implementation Class UID	1.2.276.0.7230010.3.0.3.6.0
Implementation Version Name	OFFIS_DCMTK_360

4.2.3.3 Association Initiation Policy

MOVE-SCU attempts to initiate a new association each time the program requests retrieval of particular studies. Each study is retrieved using a separate association.

4.2.3.3.1 Activity - LOCAL USER REQUESTS SENDING A QUERY

4.2.3.3.1.1 Description and Sequencing of Activities

A single attempt will be made to retrieve a study from the remote AE.

4.2.3.3.1.2 Proposed Presentation Contexts

Table 4.2-21
PROPOSED PRESENTATION CONTEXTS FOR AE MOVE-SCU AND
LOCAL USER REQUESTS RETRIEVAL OF PARTICULAR STUDIES

PRESENTATION CONTEXT TABLE					
ABSTRACT SYNTAX		TRANSFER SYNTAX		ROLE	EXT. NEG.
NAME	UID	NAME LIST	UID LIST		
Study Root Query/ Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	NONE

By default, MOVE-SCU will propose all uncompressed transfer syntaxes with local byte ordering first.

4.2.3.3.1.2.1 Extended Negotiations

No extended negotiation is performed.

4.2.3.3.1.3 SOP Specific Conformance

4.2.3.3.1.3.1 SOP Specific Conformance to C-MOVE SOP Classes

MOVE-SCU provides standard conformance to the supported C-MOVE SOP Class.

Only a single information model, Study Root, is supported. All retrieval is performed at the highest level of the information model (the STUDY level). No C-CANCEL requests are ever issued.

The retrieval is performed from the same AE that was used for the query performed by MOVE-SCU. The studies are retrieved to the local system by specifying the destination as the AE Title of the local STORAGE-SCP. This implies that the remote AE must be preconfigured to determine the presentation address corresponding to the STORAGE-SCP. The STORAGE-SCP will accept storage requests addressed to it from anywhere, so no pre-configuration of the local AE to accept associations from the remote AE is necessary.

Table 4.2-22
STUDY ROOT REQUEST IDENTIFIER FOR AE MOVE-SCU

ATTRIBUTE NAME	TAG	TYPES OF MATCHING
Level	(0008, 0052)	Single Value
Patient	(0010, 0020)	Single Value
SOP Instance UID	(0008, 0018)	Single Value

4.2.3.3.1.3.2 Presentation Context Acceptance Criterion

MOVE-SCU does not accept associations.

4.2.3.3.1.3.3 Transfer Syntax Selection Policies

Since MOVE-SCU proposes a single presentation context only, the SCP is responsible for the transfer syntax selection.

4.2.3.3.1.3.4 Response Status

MOVE-SCU will behave as described in the table below when receiving C-MOVE response command message.

Table 4.2-23
RESPONSE STATUS HANDLING BEHAVIOR FOR AE MOVE-SCU AND
LOCAL USER REQUESTS RETRIEVAL OF PARTICULAR STUDIES

SERVICE STATUS	FURTHER MEANING	ERROR CODE	BEHAVIOR
Success	Sub-operations complete - no failures	0000	Current retrieval is completed successfully
Refused	Out of resources - Unable to calculate number of matches	A700	Retrieval is terminated. An error message is reported to the service logs.
	Out of resources - Unable to perform sub-operations	A701	Retrieval is terminated. An error message is reported to the service logs.
	Move destination unknown	A801	Retrieval is terminated. An error message is reported to the service logs.
Failed	Data set does not match SOP Class	A900	Retrieval is terminated. An error message is reported to the service logs.
	Unable to process	Cxxx	Retrieval is terminated. An error message is reported to the service logs.
Cancel	Sub-operations terminated due to Cancel indication	FE00	A warning message is reported to the service logs. Should never occur since Cancel requests are never issued.
Warning	Sub-operations complete - One or more failures	B000	Retrieval is considered successful. A warning message is reported to the service logs.
Pending	Sub-operations are pending	FF00	Retrieval continues

Table 4.2-24
COMMUNICATION FAILURE BEHAVIOR FOR MOVE-SCU AND
LOCAL USER REQUESTS RETRIEVAL OF PARTICULAR STUDIES

EXCEPTION	BEHAVIOR
TCP/IP connection could not be established within the specified time range (configurable parameter)	An error message is reported to the service logs.
ASCE response message could not be received within the specified time range (configurable parameter)	An error message is reported to the service logs.
DIMSE response message could not be received within the specified time range (configurable parameter)	An error message is reported to the service logs.
Association aborted by the SCP using A-ABORT or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	An error message is reported to the service logs.

4.2.3.3.1.3.5 Sub-Operation Dependent Behavior

Since the C-MOVE operation is dependent on completion of C-STORE sub-operations that are occurring on a separate association, the question of failure of operations on the other association(s) must be considered.

MOVE-SCU completely ignores whatever activities are taking place in relation to the STORAGE-SCP AE that is receiving the retrieved instances. Once the C-MOVE has been initiated, it runs to completion (or failure) as described in the C-MOVE response command message(s). There is no attempt by MOVE-SCU to confirm that instances have actually been successfully received or locally stored.

Whether or not completely or partially successfully retrievals are made available in the local system to the user is purely dependent on the success or failure of the C-STORE sub-operations, not on any explicit action by MOVE-SCU.

Whether or not the remote AE attempts to retry any failed C-STORE sub-operations is beyond the control of MOVE-SCU.

If the association on which the C-MOVE was issued is aborted for any reason, whether or not the C-STORE sub-operations continue is dependent on the remote AE; the local STORAGE-SCP will continue to accept associations and storage operations regardless.

4.2.3.4 Association Acceptance Policy

MOVE-SCU does not accept associations.

4.3 NETWORK INTERFACES

4.3.1 Physical Network Interface

The DICOM applications of Protura Robotic Couch System software are indifferent to the physical medium over which TCP/IP is used.

4.3.2 Additional Protocols

When host names rather than IP addresses are used in the configuration to specify presentation addresses for remote AEs, the application is dependent on the name resolution mechanism of the underlying operating system.

4.3.3 IPv4 AND IPv6 Support

Protura Robotic Couch System software only supports IPv4 connections.

4.4 CONFIGURATION

The configuration can be changed by the user in the Configurations and Settings tab of the user interface. Details are described in the User Guide.

4.4.1 AE Title / Presentation Address Mapping

The server and local AE titles, as well as the IP Address and Port Number are configurable in the Configurations and Settings tab of the user interface.

5 MEDIA STORAGE

Protura does not support Media Storage

6 SUPPORT OF EXTENDED CHARACTER SETS

6.1 OVERVIEW

No dedicated support for Character Sets beyond the Default Character Repertoire is available. However, text fields containing characters not in the Default Character Repertoire when importing an Instance will appear unchanged when re-exporting the same Instance again.

6.2 DISPLAY BEHAVIOR

Correct display of characters not in the Default Character Repertoire depends on available/configured operating system support.

7 SECURITY

7.1 SECURITY PROFILES

Protura does not support any security profiles.

7.2 ASSOCIATION LEVEL SECURITY

The STORAGE-SCP accepts associations from all remote AE's, i.e., there is no restriction to certain AE titles and/or IP address.

7.3 APPLICATION LEVEL SECURITY

Protura does not support any application level security.

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