

DICOM User Guide Supplement

Omni™ 4K Video System

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Introduction

This supplement to the Omni 4K video system Instructions for Use (IFU) is intended to provide an overview of the Digital Imaging and Communications in Medicine (DICOM) features of the Omni 4K video system. For operating instructions for all other camera system functions, refer to document *720-00041 User Manual, Omni™ 4K Video System*. Please carefully read and follow all warnings and cautions that are published in the IFU prior to use of this equipment.



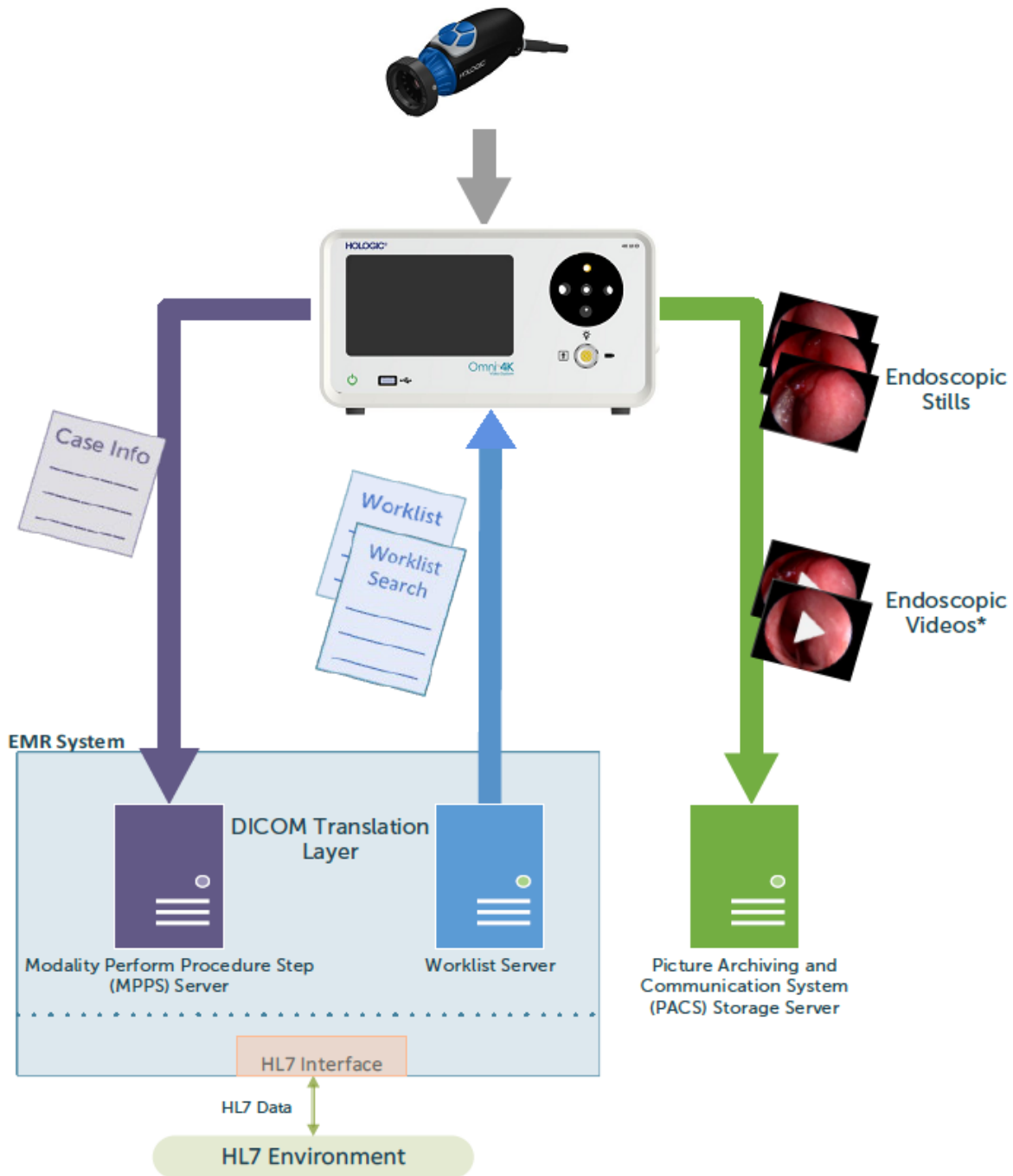
When the device is connected to a network, ensure that the network is secure and appropriate preventative measures (for example, firewalls, network access authentication, malware detection software, etc.) are implemented to prevent device exposure to malware.

Note: Technical Specifications for the DICOM functionality can be found in *Appendix 1 – DICOM Conformance Statement*.

Note: Throughout this document, to illustrate any differences, images are presented side by side to show screenshots of the various functions as they appear on the front panel of the console (camera control unit) and on the tablet.

Product Description

The Digital Imaging and Communications in Medicine (DICOM) server integration upgrade is a software package that allows the Omni 4K video system to facilitate communication with health record systems by converting endoscopic videos and stills into DICOM format for storage. The device is compatible with HL7-based Electronic Health Record (EHR) and Electronic Medical Record (EMR) systems that support a DICOM translation layer. The Modality Worklist and Modality Perform Procedure Step (MPPS) servers often serve as a translation layer between DICOM capable devices and HL7-based EMR systems to enable scheduling and other features. For more information regarding the functions and proper operation of the camera system, please refer to document 720-00041 *User Manual, Omni™ 4K Video System*.



*Endoscopic videos supported on some EMR systems.

Figure 1 – DICOM Data Flow using the Omni 4K Video System

DICOM Installation and Operation

Key Installation

A Hologic DICOM license is provided via a USB flash drive containing an activation key, which activates DICOM functionality when installed in the designated Camera Control Unit (CCU). To enable DICOM functionality on the camera system, power on the console and insert the License Key flash drive into the front panel USB port. The DICOM functionality should auto-enable once the flash drive is properly inserted.

Note: A license key is unique to one console and cannot be used to activate DICOM functionality on other camera systems.

To verify that the key was accepted and DICOM functions are properly enabled, navigate to the Settings → Network page, which should display a “DICOM” menu option. After this verification, then the license key flash drive can be removed.

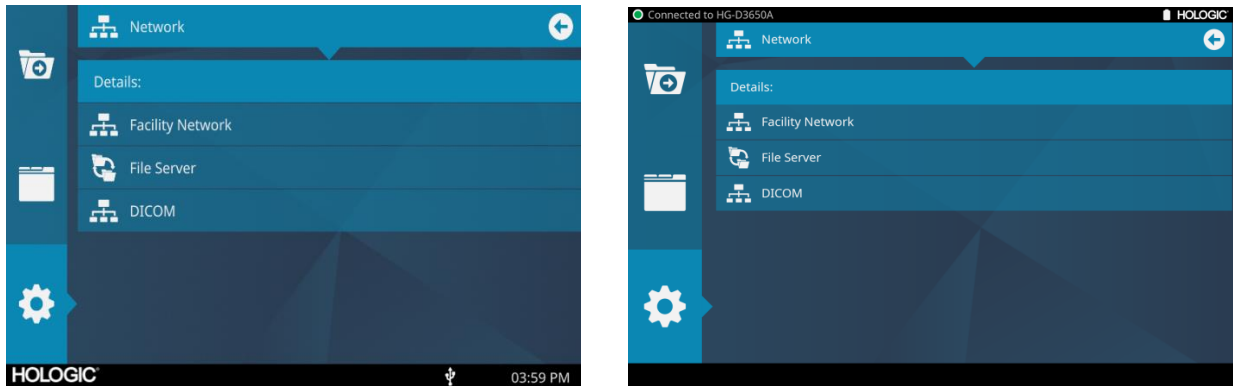


Figure 2 – Network Page on Console (left) and mobile tablet (right).

Note: If the DICOM option does not appear after inserting the USB drive into the front panel, contact your local sales representative or customer service.

General DICOM Setup

The DICOM setup page can be accessed in Settings → Network → DICOM.

“Station application entity” is the unique identifier for the camera system when interacting with DICOM storage and worklist servers. The Administrator of the DICOM Servers/Hospital Information System must assign this unique identifier prior to use in a DICOM environment.

From this page, the user can access the setup pages for Worklist, Modality Perform Procedure Step, and Storage Servers to configure the settings of their DICOM server(s) and test DICOM server compatibility.

Note: It is required that DICOM server settings be configured and tested prior to surgery to prevent possible delay.

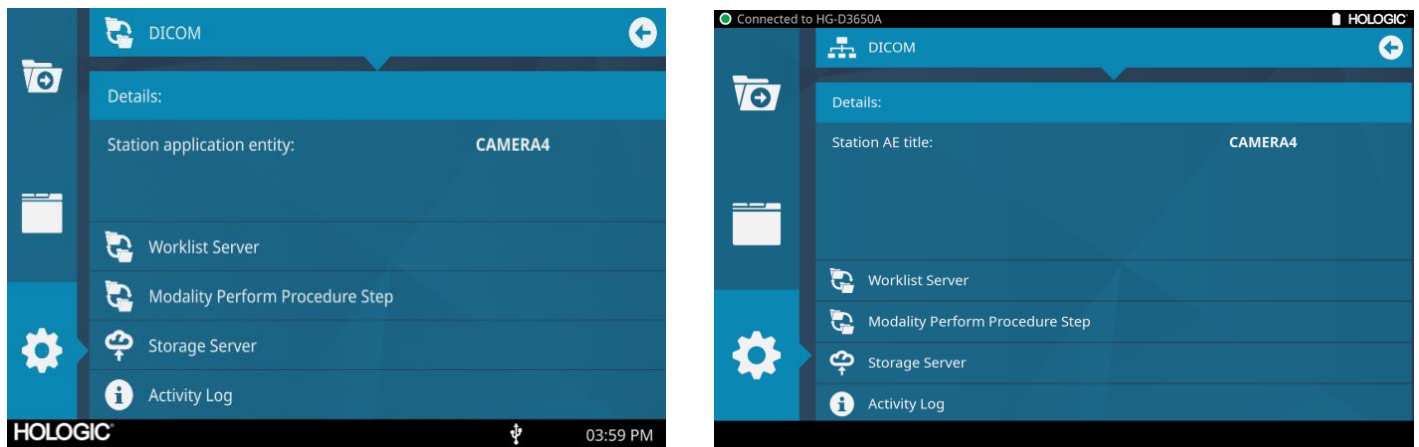


Figure 3 – DICOM Settings Pages on Console (left) and mobile tablet (right).

Worklist Server Setup

The DICOM Worklist server contains established patient cases with the demographic information completed so that the user can search the worklist for scheduled cases and quickly start a scheduled case. The Worklist Server page contains the following settings, which must be provided by the server Administrator:

- **Application entity** – Entry for the Application Entity title of the worklist server
- **IP Address** – Entry for the IP address of the Worklist server
- **Port** – Entry for the port number used to communicate with the Worklist server

The remaining two items on the Worklist Server page are part of the Omni 4K video system's DICOM functionality:

- **Filter search by station AE title** – When the box is checked, only cases assigned to the designated Station Application Entity (AE) title will display on Worklist Search results. Leave unchecked to see the complete list of work items when searching the worklist.
- **Test Connection** – When pressed, console attempts to verify connection with the facility worklist server using the settings on this page.

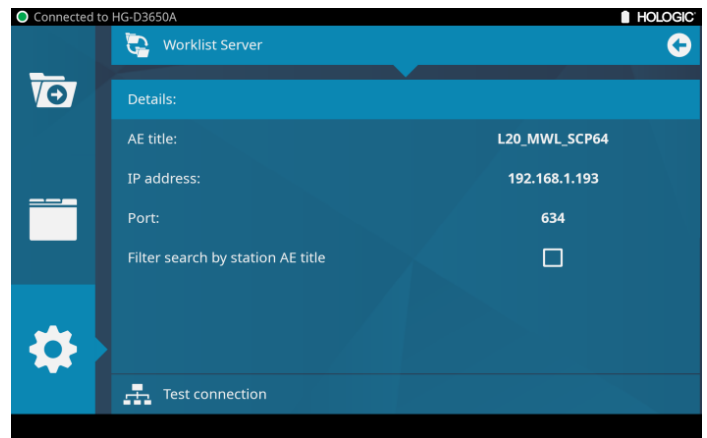
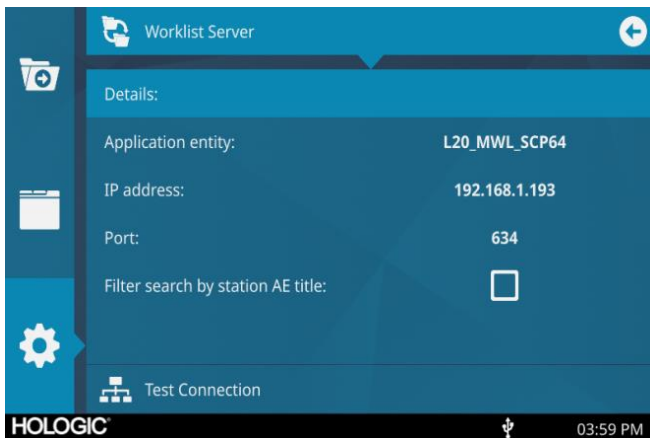


Figure 4 – Worklist Server Settings Pages on Console (left) and mobile tablet (right).

Storage Server Setup

The camera system can be setup to upload still image captures and videos to a PACS/VNA via DICOM. Media storage capability depends on the server used, so the **Test Connection** feature may be used to determine if stills, videos, or both are supported by the remote storage server. See the DICOM Conformance Statement to verify DICOM interoperability (Appendix 1).

The Storage Server page contains the following options:

- **Application entity** – Entry for the Application Entity title of the storage server.
- **IP Address** – Entry for the IP address of the storage server.
- **Port** – Entry for the port number used to communicate with the storage server.
- **Test Connection** – When pressed, attempts to verify connection with the storage server using the settings on this page. The test checks capability for both video and still storage and reports if only partial support is available.

The first three options are settings that must be obtained from the server Administrator, and the last option allows the user to determine if the credentials permit connection to the Storage Server.

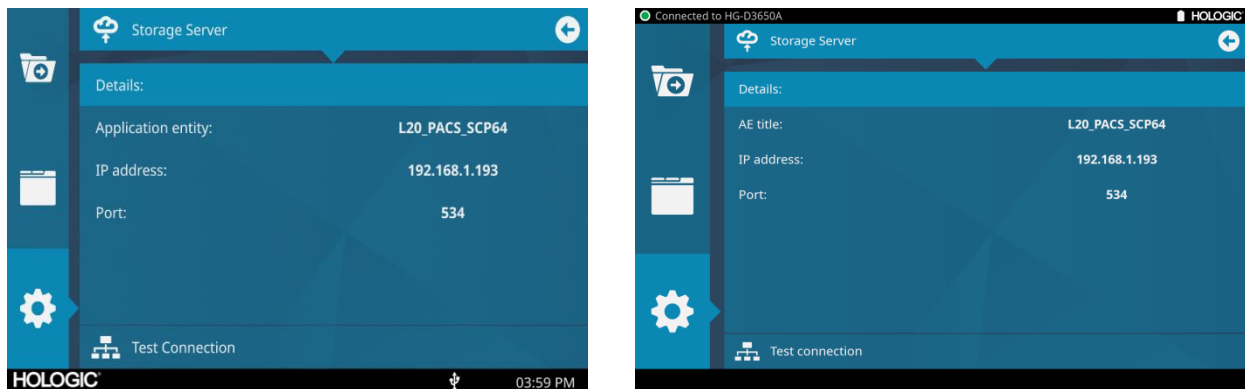


Figure 5 – Storage Server Settings Pages on Console (left) and mobile tablet (right).

Modality Perform Procedure Step Setup

Modality Perform Procedure Step is a DICOM feature in which the camera system informs a DICOM server when a case is started and when the operator ends the case. This allows the department scheduler to track the progress and completion of a case.

Just like the Storage Server page, the Modality Perform Procedure Step (MPPS) page contains the following options:

- **Application entity** – Entry for the Application Entity title of the MPPS server
- **IP Address** – Entry for the IP address of the MPPS server
- **Port** – Entry for the port number used to communicate with the MPPS server
- **Test Connection** – When pressed, attempts to verify connection with the MPPS server using the settings on this page.

Similar to the Worklist and Storage servers, the first three options are settings that must be obtained from the server Administrator, and the last option allows the user to determine if the credentials permit connection to the Storage Server.

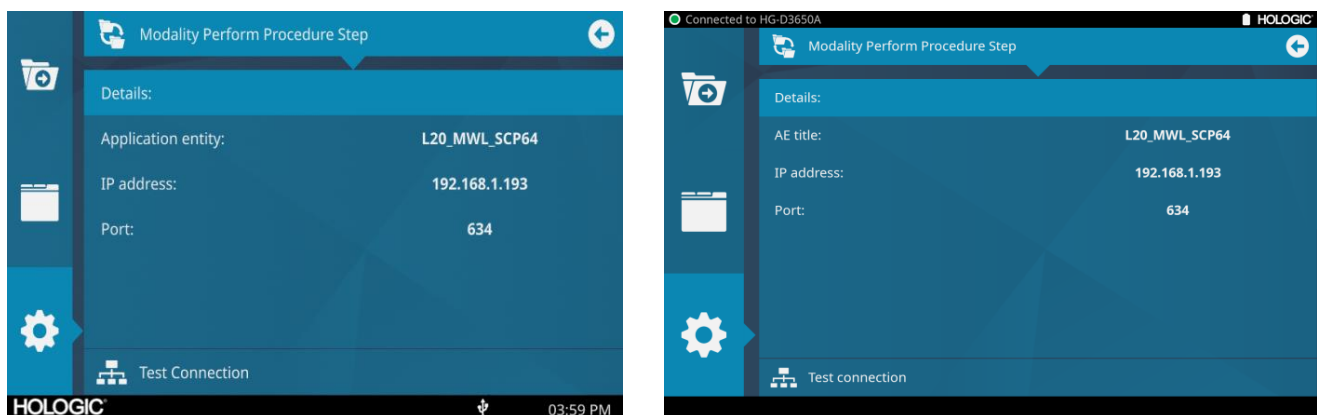


Figure 6 – MPPS Settings Pages on Console (left) and mobile tablet (right).

DICOM Server Connection Test

Each DICOM subpage (Worklist Server, Modality Perform Procedure Step, and Storage Server) has a button at the bottom labeled "Test connection." Pressing this button will alert you if the credentials (AE title, IP address, and Port) entered on the page are valid.

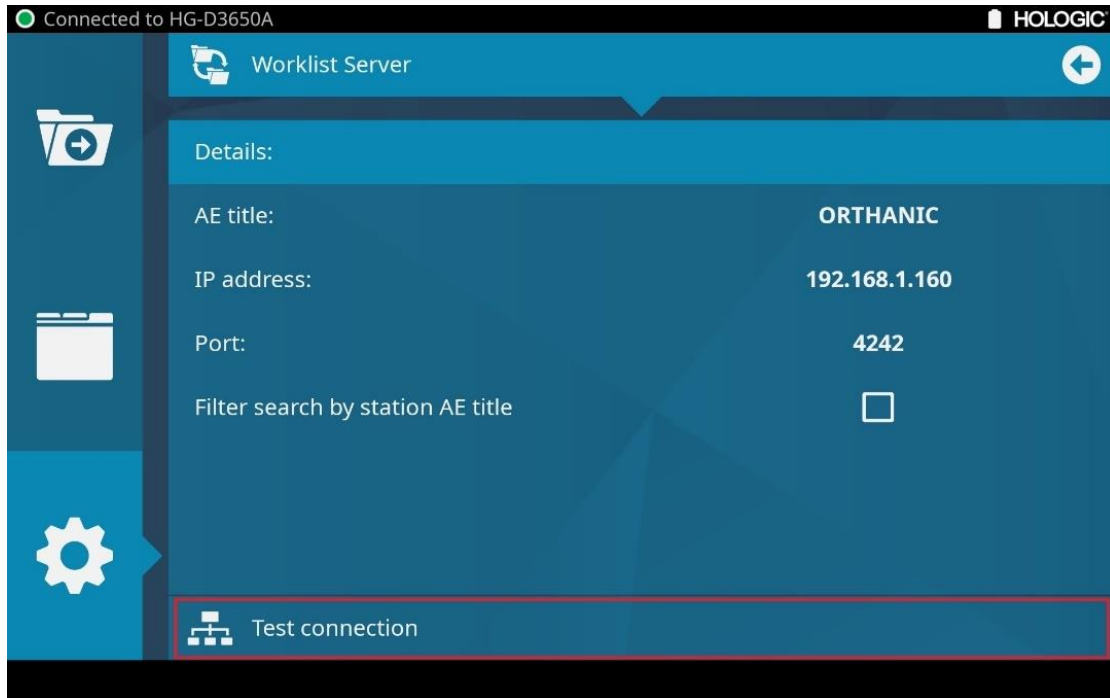


Figure 7 – Worklist server subpage with the Test Connection button highlighted.

If the credentials are valid, then after pressing the "Test connection" button, an alert saying that the "Server is compatible" will be displayed.

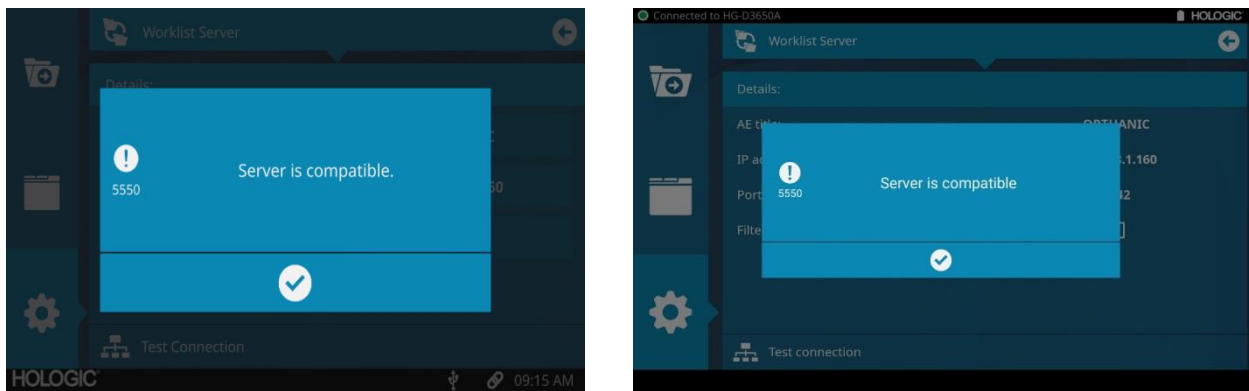


Figure 8 – Window that will display if connection test performed with valid credentials (shown on Console on left, mobile tablet on right).

If the connection test is unsuccessful for the selected DICOM server, then an error message will appear on the screen. This indicates that the credentials entered do not match the credentials of the desired server.

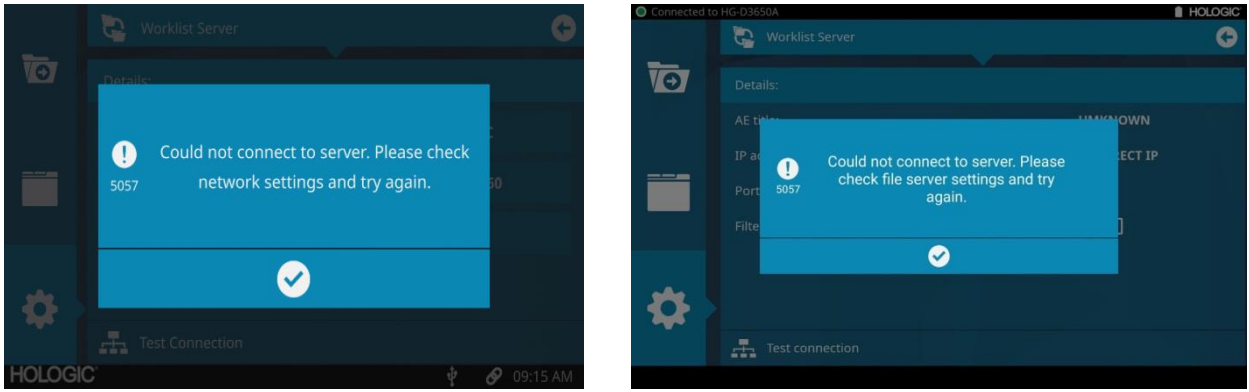


Figure 9 – Window that will display if connection test performed with invalid credentials (shown on a Console on left, mobile tablet on right).

When the “Test Connection” function is run on the Storage Server page, an error message will display if partial support for video or image storage is available.

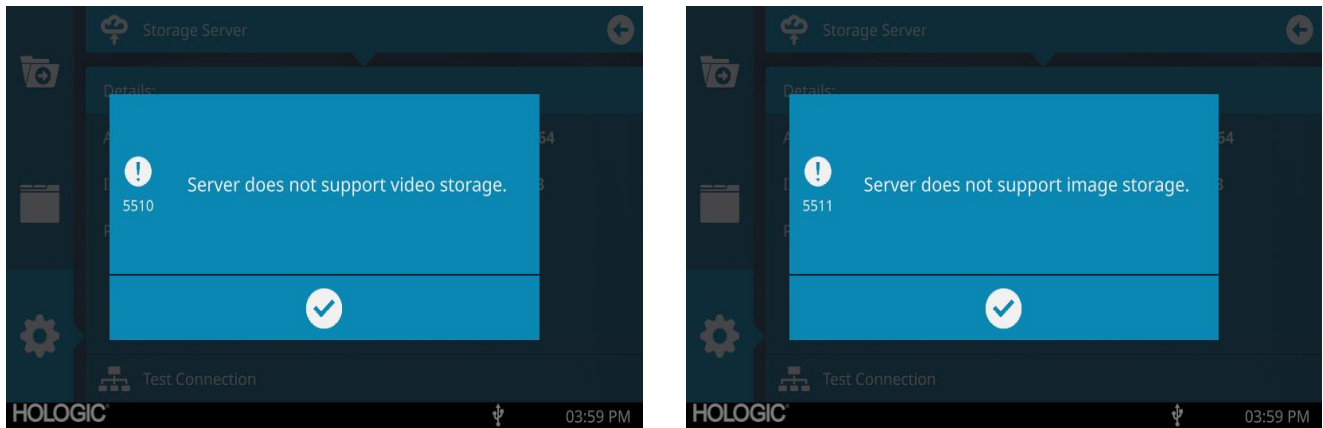


Figure 10 – Errors that will display if connection test performed with partial storage compatibility (shown here on Console).

If any of these error messages occur, navigate back to the Settings page of the designated server and verify that the credentials are correct before repeating the connection test. Your IT department or other Server Administrator should be consulted if error messages persist.

DICOM Activity Log

This page displays logging of all DICOM communication, including failures to connect. If a failure occurs during operation, the user is prompted to review this log. The DICOM log can be accessed from both the tablet and console interfaces. The log can be cleared by pressing the trash icon and confirming the deletion

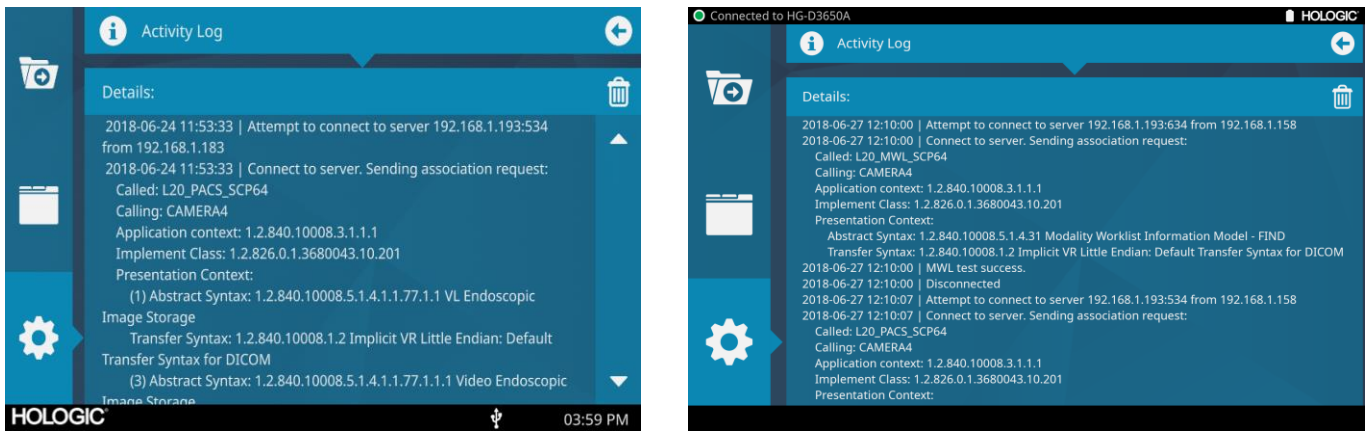


Figure 11 – DICOM Activity Log on Console (left) and mobile tablet (right).

DICOM Storage

If the camera system has been configured with valid DICOM storage server credentials, then the system automatically sends stills and/or videos to the Storage Server at the end of the case.

Media can also be manually sent to a number of locations — including the PACS Storage Server — from the “Send to” Menu.

Note: PDF transfer to a DICOM storage server is not supported.

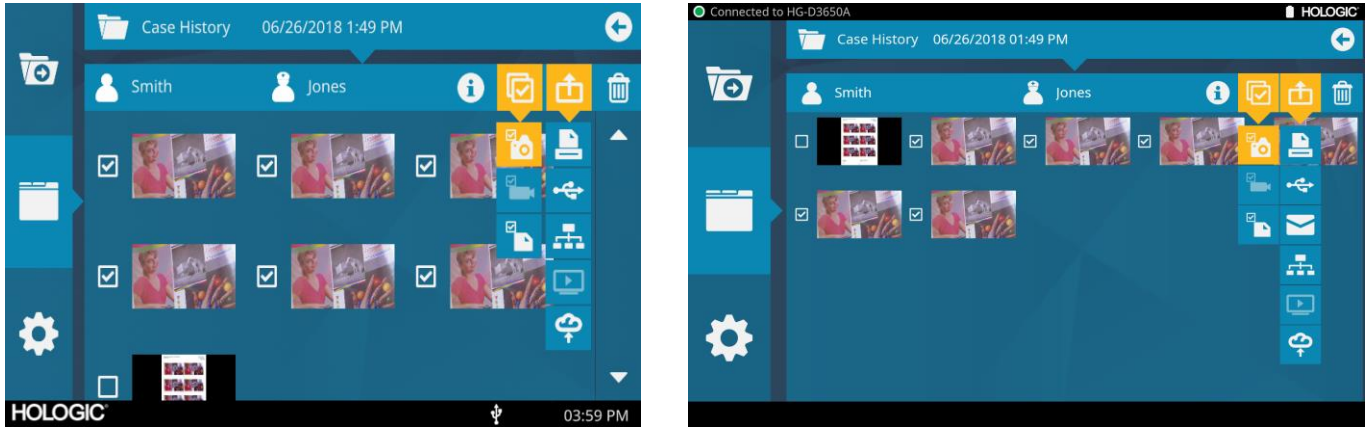













Figure 12 – Case Review Send to Menu on Console (left) and mobile tablet (right).

Menu Options

- | | | | |
|--|-------------------------|---|------------------------------------|
|  | Select Multiple Menu |  | Send to DICOM Storage Server |
|  | Select All Still Images |  | Send to Printer |
|  | Select All Videos |  | Send to Email (Mobile Tablet Only) |
|  | Select All PDFs |  | Send to Monitor |
|  | “Send to” Menu |  | Send to USB |
|  | Send to File Server | | |

After pressing the "Send to DICOM Storage" button, a confirmation to send to the storage server appears.

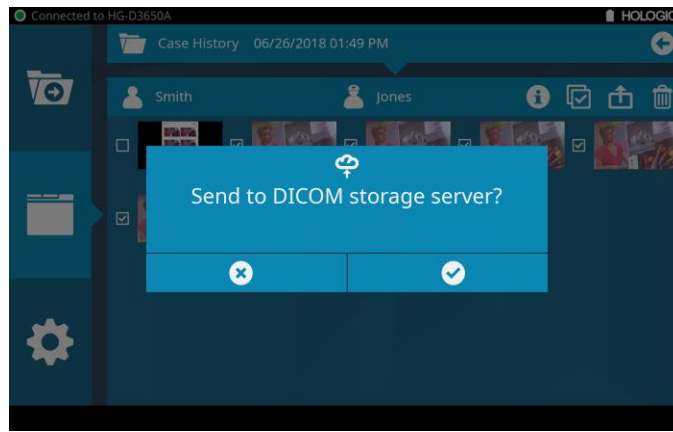


Figure 13 — Send to Storage Server Prompt (shown on mobile tablet).

When the confirmation checkbox is pressed, the progress of the transfer appears in a window.

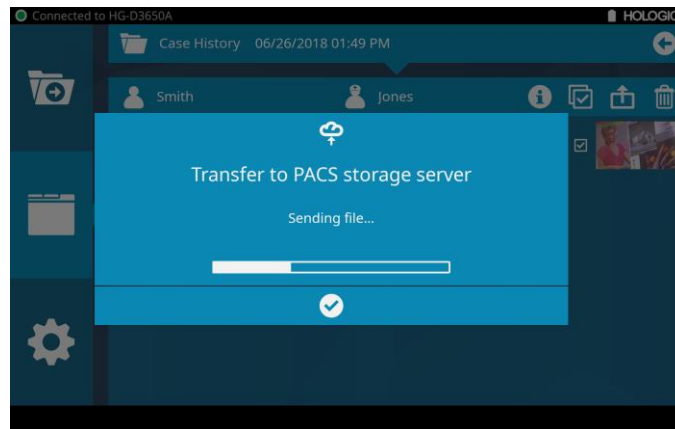


Figure 14 — Storage Server Transfer Progress (shown here on mobile tablet).

Once the transfer is complete, the window can be closed by pressing the checkmark button.

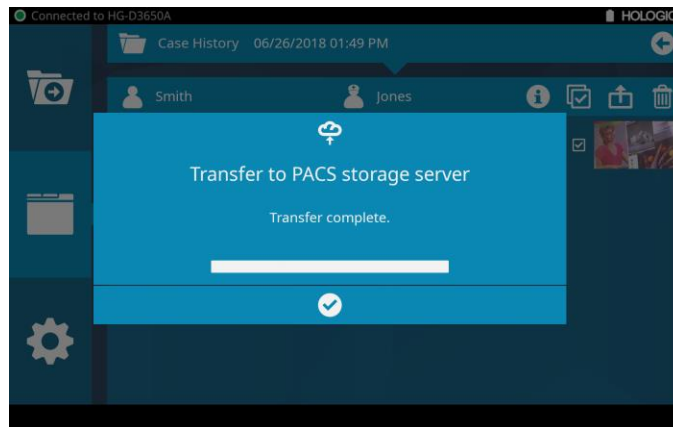


Figure 15 — Storage Server Transfer Complete (shown here on mobile tablet).

DICOM Worklist

The DICOM worklist can be accessed via the tablet or console Case Management menu. This is accessed by pressing the left menu on the home screen and pressing the case folder icon with a forward arrow.

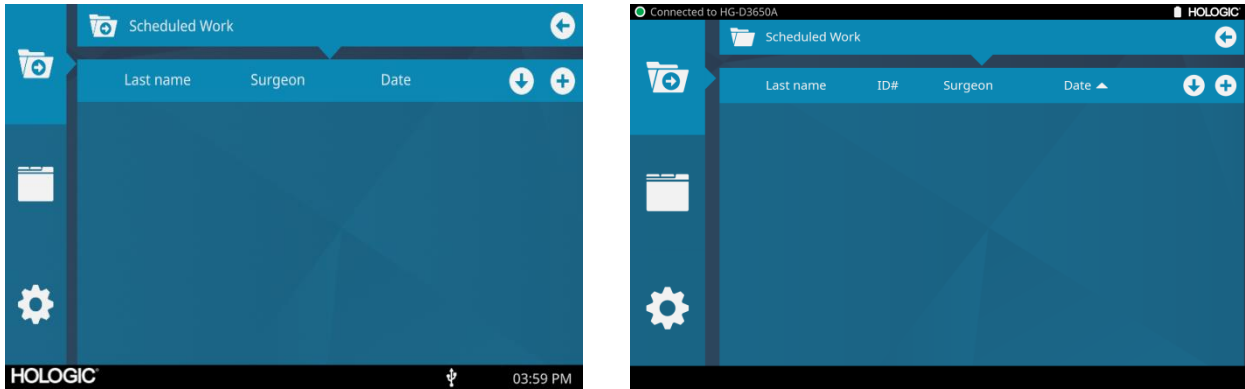


Figure 16 – Scheduled Work Pages on Console (left) and mobile tablet (right).

In the Scheduled Work page, the down arrow (↓) can be pressed to download all cases assigned to the current system date (“Download Today’s Work”). If a specific search is desired, pressing the “Add Case” button (plus button) displays a popup with the ability to create a local case (“Create New Case”) or search the worklist (“Search Worklist”).

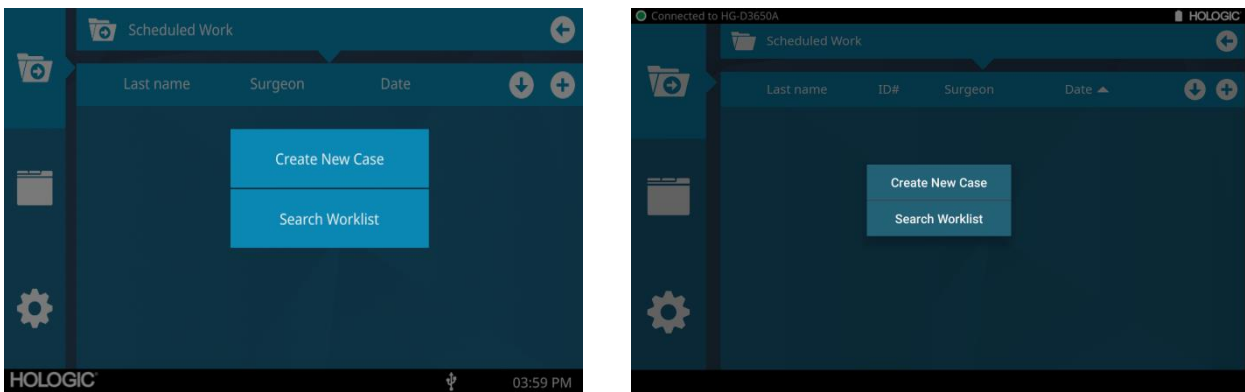


Figure 17 – Adding New Scheduled Work on Console (left) and mobile tablet (right).

Pressing “Search Worklist” opens a page where a specific case on the Worklist Server can be searched for using the performing physician’s last name, the scheduled procedure start date, the last name of the patient, and the patient ID. Enter in one or more of the fields and press the search button (Q) to search the worklist.

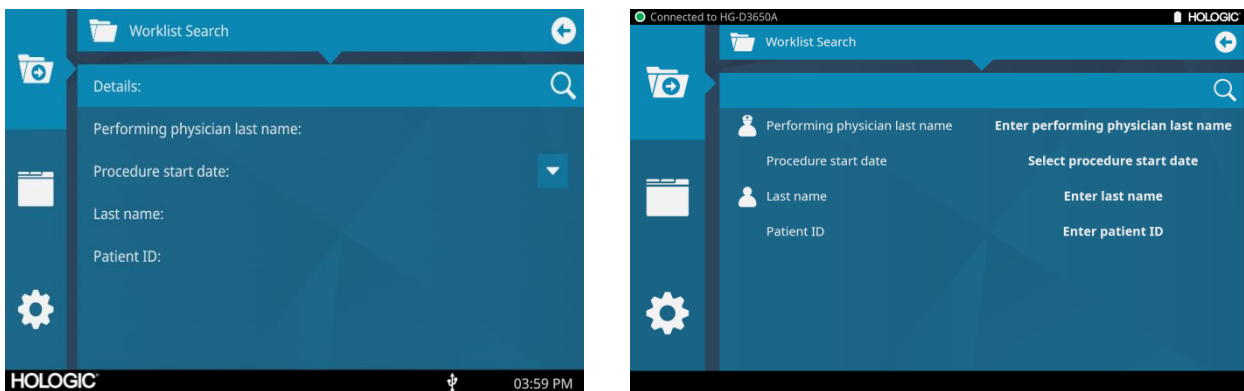


Figure 18 – Worklist Search on Console (left) and mobile tablet (right).

While searching the worklist, a busy indicator appears on the screen until the search completes.

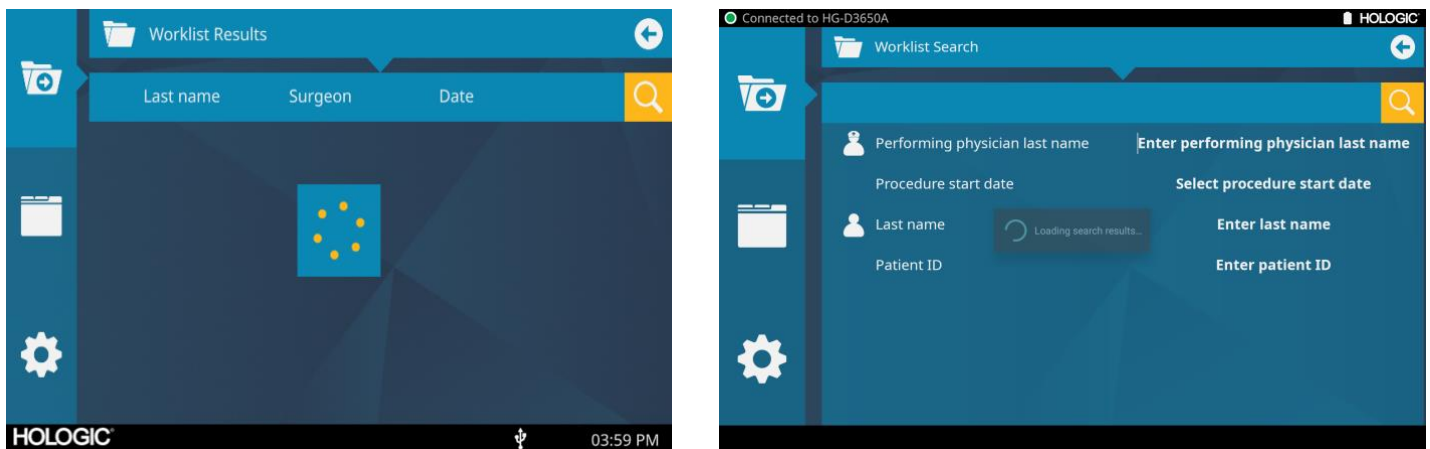


Figure 19 — Worklist Searching Indicators on Console (left) and mobile tablet (right).

If results are found, they are displayed on the Worklist Results page. If no search criterion is entered when the search button is pressed, the entire worklist from the server is displayed.

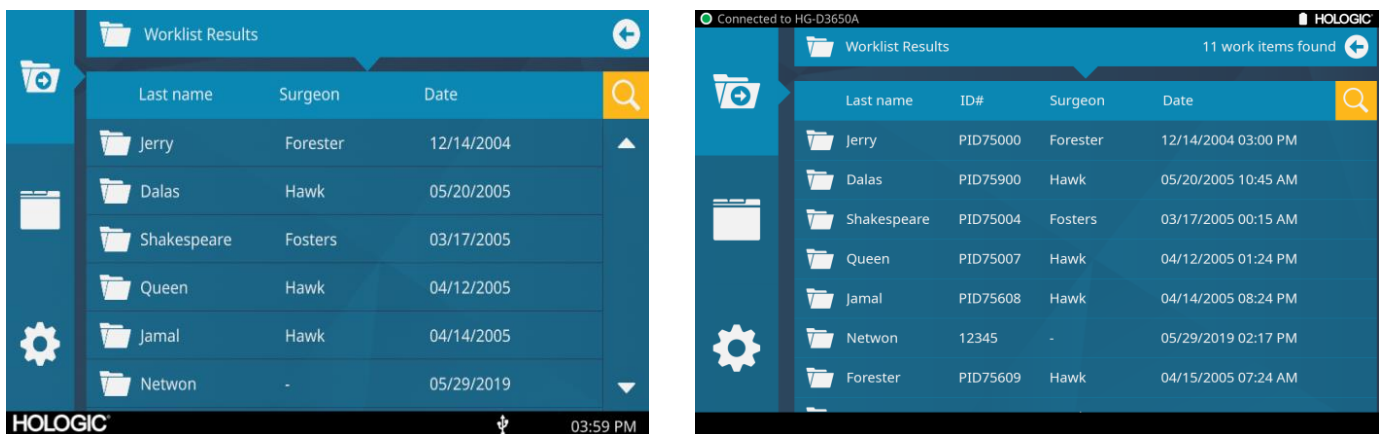


Figure 20 — Worklist Results on Console (left) and mobile tablet (right).

Searching for partial names or IDs displays all results that include the search criterion in the beginning. For example, searching patient last name “J” returns results for both “Jerry” and “Jamal”.

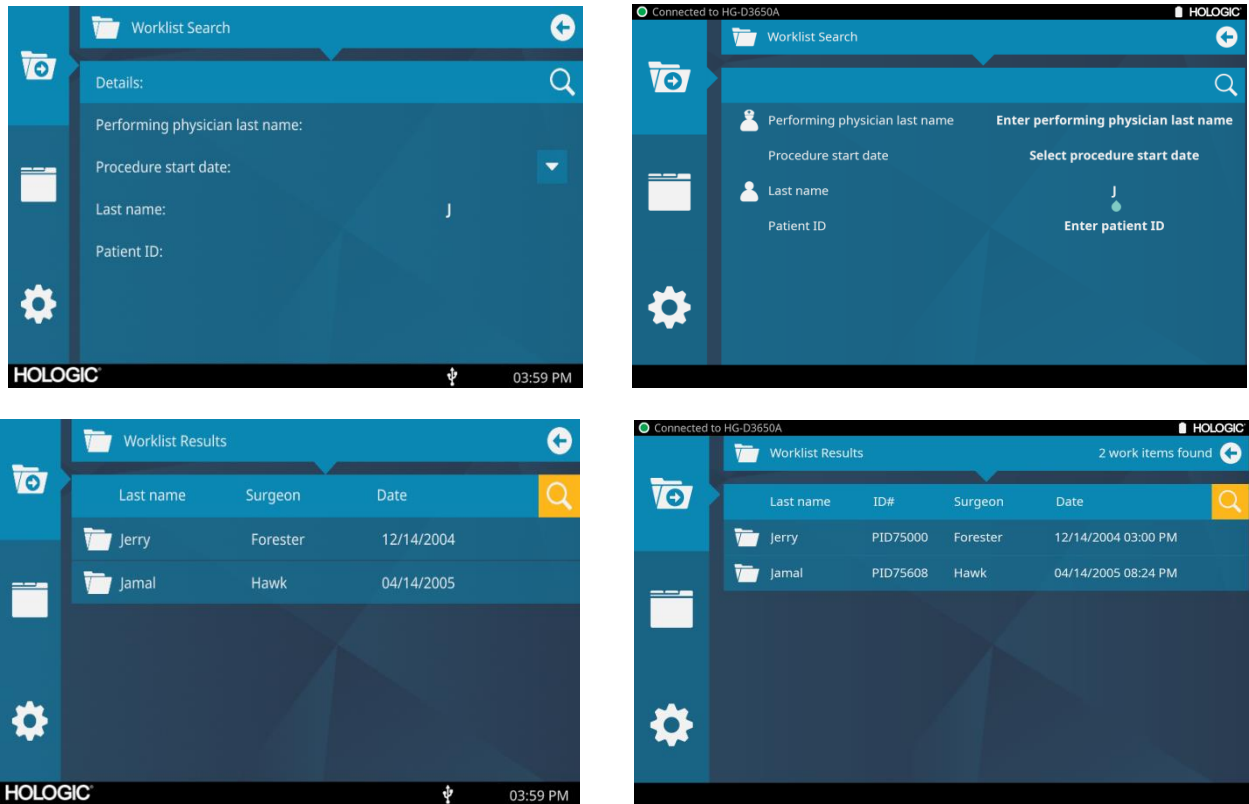


Figure 21 – Narrowed Search Results on Console (left) and mobile tablet (right). The upper panels illustrate the search window and the lower panels illustrate the results.

Once a worklist result is selected, more information about the case can be previewed by pressing the info button .

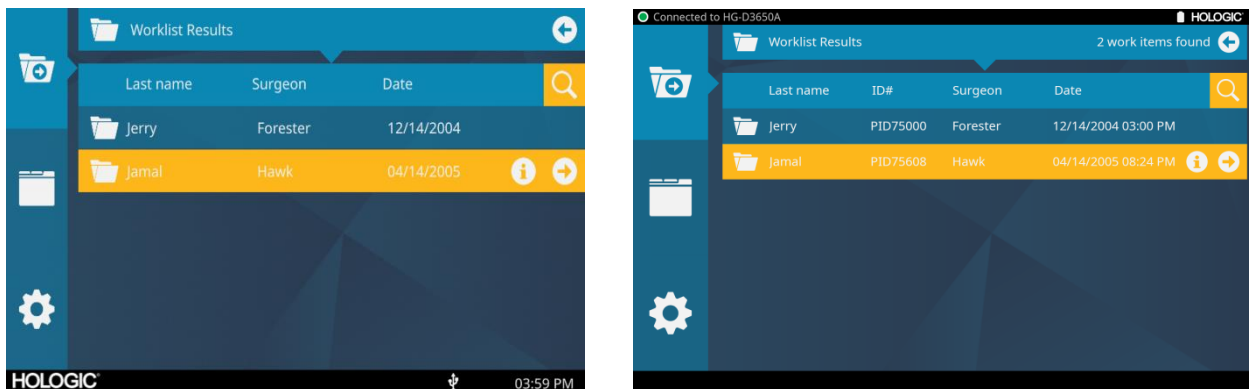


Figure 22 – Highlighted Worklist Result on Console (left) and mobile tablet (right).

The worklist item details page displays all informational fields about the case. The case can be started from this page by pressing the forward arrow and confirming the action. The case can also be started from the worklist results page.

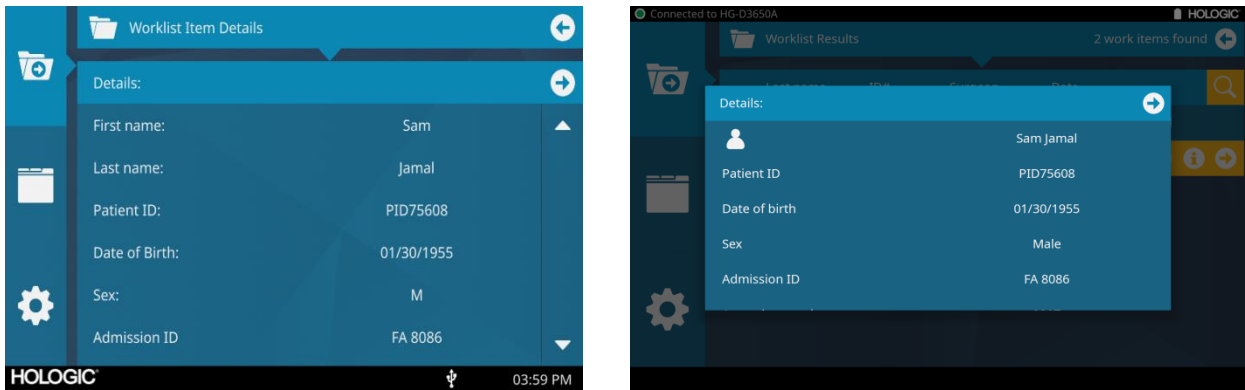


Figure 23 – Worklist Item Details on Console (left) and mobile tablet (right).

When the checkmark on the “Start case?” confirmation is pressed, the case begins.

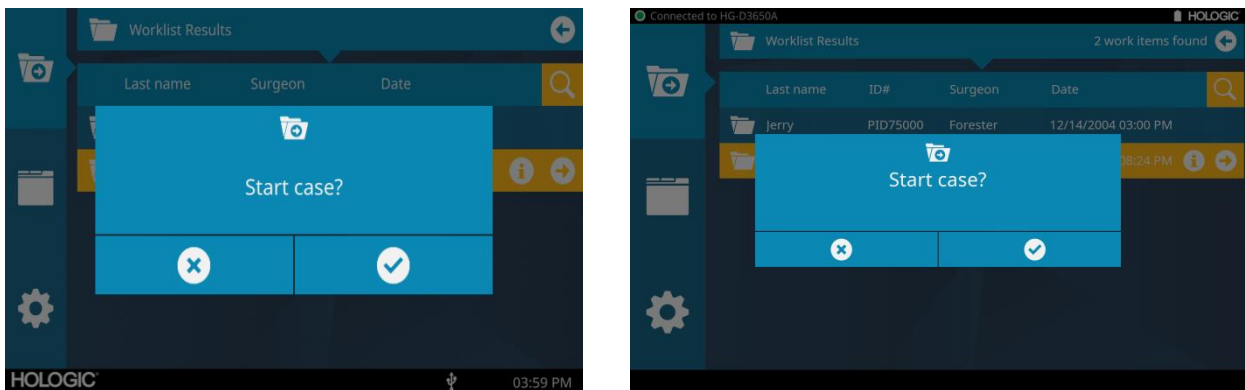


Figure 24 – Start Case Confirmation on Console (left) and mobile tablet (right).

After the case is complete, the case button can be pressed to show the details of the case. For worklist cases, only some fields may be edited from this screen. This includes **Accession Number**, **Performing Physician**, **Operator**, **Procedure ID**, **Procedure Description**, **Series Description**, and **Comments**. Other patient identifying fields such as **Name**, **Patient ID**, **Date of Birth**, **Referring Physician**, and **Sex** can only be modified by the Worklist Server. This restriction only applies for worklist started cases; all fields in local cases can be edited after the case is started.

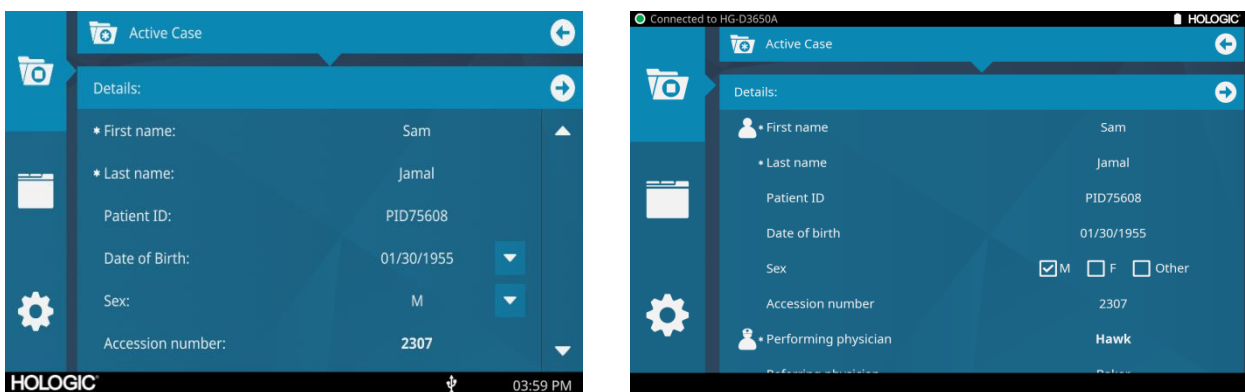


Figure 25 – Active Case Page on Console (left) and mobile tablet (right).

The case can be ended from the active case page by pressing the forward arrow and selecting the check to confirm.

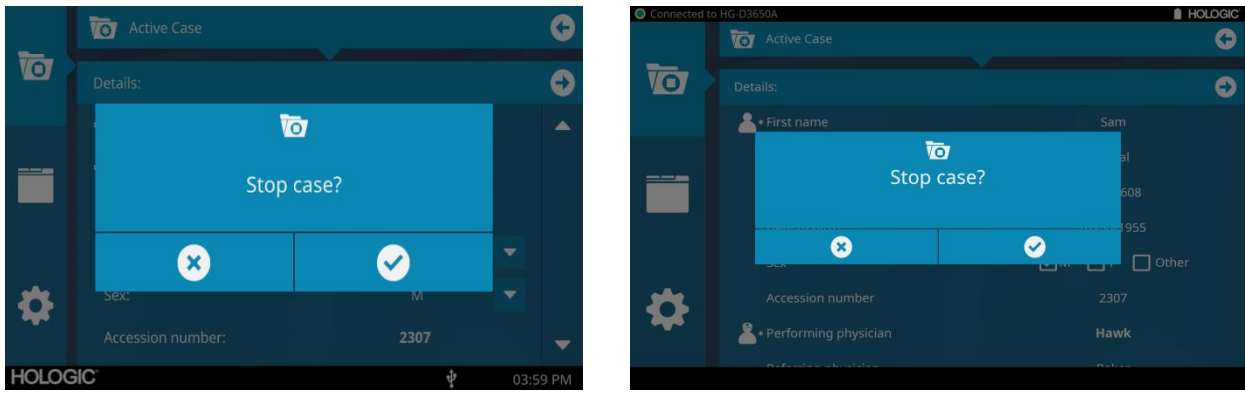


Figure 26 – Stop Case Confirmation on Console (left) and mobile tablet (right).

Troubleshooting

The following sections refer to actions that can be taken if there are issues with DICOM integration. Should there be any difficulty with the white balance, video quality, camera head operation, or the camera control unit, please refer to the Troubleshooting section of document 720-00041 *User Manual, Omni™ 4K Video System*.

Problem	Potential Solutions
I cannot access the DICOM page under the Settings->Network folder.	<ul style="list-style-type: none"> • Insert the License Key USB into the front face of the Console. • If this does not work, please contact your local Sales Representative
The video capture from a case will not send.	<ul style="list-style-type: none"> • Ensure that the CCU is connected to the Network • Verify that the desired DICOM server information (AE Title, IP address, and Port) is correct. • If the previous steps do not address the issue, contact the server administrator and confirm that the server supports the video transfer syntax.
The server information is correct, but I cannot transfer data to the PACS Server.	<ul style="list-style-type: none"> • Ensure that the CCU is connected to the Network • Contact the server Administrator to verify the server credentials and supported storage functions.
The search function retrieves more Worklist Items than are assigned to my Station Application Entity Title.	<ul style="list-style-type: none"> • Navigate to Settings—>Network—>DICOM and ensure that the Station Application Entity title is correct • Ensure that the Worklist Server settings are correct and verify with the “Test Connection” function • Check the box on the Worklist Server settings page • Contact the Scheduling Administrator and verify scheduled worklist assigned to CCU’s SAE • Contact Server Administrator and verify credentials.

Note: If this Troubleshooting guide does not resolve the problem, please contact your local sales representative.

Appendix 1: DICOM Conformance Statement

1 Conformance Statement Overview

This document serves as the DICOM conformance statement for the Omni 4K video system and is structured according to the DICOM standard (PS 3.2, 2018). The Omni 4K video system implements the necessary DICOM services for downloading worklists, reporting work done, and storage of endoscopic images and video.

Table 1-1 Network Services

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
VL Endoscopic Image Storage	Yes	No
Video Endoscopic Image Storage	Yes	No
Workflow Management		
Modality Worklist	Yes	No
Modality Performed Procedure Step	Yes	No

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3 Introduction

3.1 Revision History

Document Version	Description
Rev A	Initial Release

3.2 Audience

This document is written for those that need to understand how the Omni 4K video system will integrate into their healthcare facility. This includes those responsible for the overall imaging network policy and architecture, as well as integrators that need a detailed understanding of the product. While this document included definitions for some of the relevant DICOM terminology for convenience, integrators are expected to understand how the information herein relates to this product’s functionality and how it can be connected to the DICOM ecosystem.

3.3 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between the Omni 4K video system 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 Statements 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 (AET)	The externally known name of an <i>Application Entity</i> , used to identify a DICOM application to other DICOM applications on the network.
Application Context	The specification of the type of communication used between <i>Application Entities</i> . Example: DICOM network protocol.
Association	A network communication channel set up between <i>Application Entities</i> .
Attribute	A unit of information in an object definition; a data element identified by a <i>tag</i> . 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 <i>Attributes</i> 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 <i>Attributes</i> 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 (e.g., CDs).
Module	A set of <i>Attributes</i> within an <i>Information Object Definition</i> 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 <i>Association</i> establishment that allows <i>Application Entities</i> 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 <i>Association</i> , as negotiated between <i>Application Entities</i> ; includes <i>Abstract Syntaxes</i> and <i>Transfer Syntaxes</i> .
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 <i>Application Entity</i> to ensure confidentiality, integrity, and/or availability of exchanged DICOM data.
Service Class Provider (SCP)	Role of an <i>Application Entity</i> that provides a DICOM network service; typically, a server that performs operations requested by another <i>Application Entity</i> (<i>Service Class User</i>). 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 <i>Application Entity</i> 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 Instance (SOP Instance)	An information object; a specific occurrence of information exchanged in a <i>SOP Class</i> . 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: <i>JPEG</i> 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 meanings 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 specifies "pre-negotiated" exchange media format, Abstract Syntax, and Transfer Syntax.

3.6 Abbreviations

AE	Application Entity
AET	Application Entity Title
CSE	Customer Service Engineer
DHCP	Dynamic Host Configuration Protocol
DICOM	Digital Imaging and Communications in Medicine
DNS	Domain Name System
ES	Endoscopy
HIS	Hospital Information System
IOD	Information Object Definition
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISO	International Organization for Standards
JPEG	Joint Photographic Experts Group
MPPS	Modality Performed Procedure Step
MSPS	Modality Scheduled Procedure Step
MTU	Maximum Transmission Unit (IP)
MWL	Modality Worklist
NTP	Network Time Protocol
O	Optional (Key Attribute)
PACS	Picture Archive and Communication System
R	Required (Key Attribute)
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
SPS	Scheduled Procedure Step
TCP/IP	Transmission Control Protocol/Internet Protocol
U	Unique (Key Attribute)

VL	Visible Light
VR	Value Representation

3.7 References

[DICOM] Digital Imaging and Communications in Medicine (DICOM), NEMA PS 3.1-3.18, 2018. This is available for free at <https://www.dicomstandard.org/>

4 Networking

4.1 Implementation Model

4.1.1 Application Data Flow

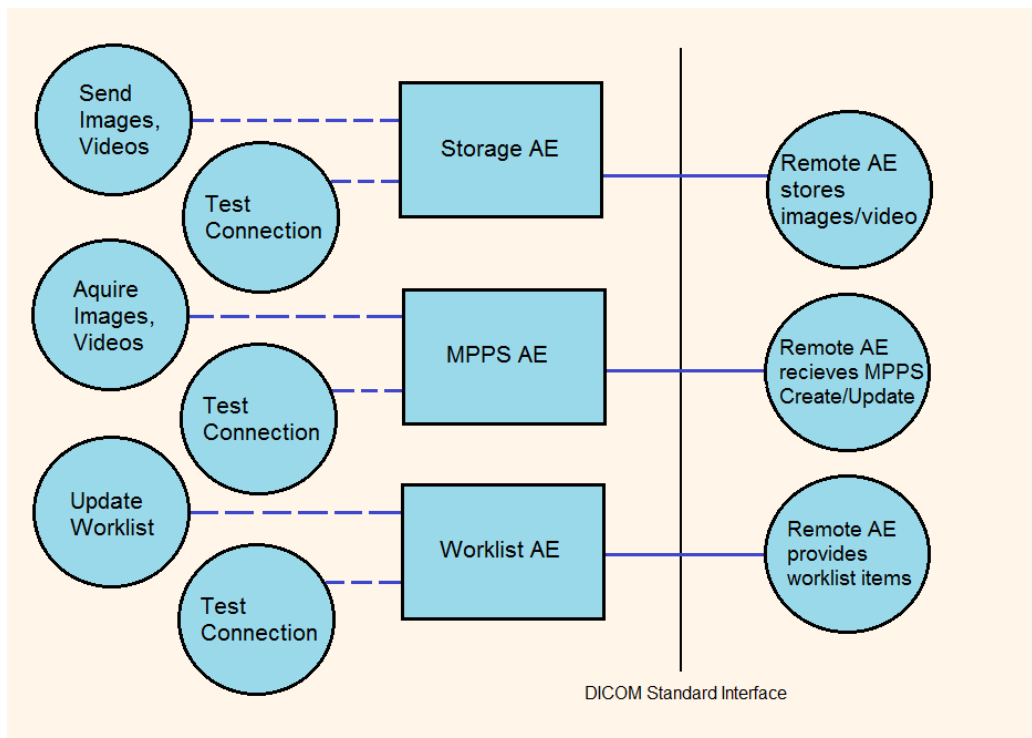


Figure 1 Application Data Flow Diagram

- The Storage Application Entity sends images and Presentation States to a remote AE. It is associated with the local real-world activity "Send Images" and "Send Videos". "Send Images" and "Send Videos" are performed upon user request for images/videos selected. They are also automatically performed when a case is ended if credentials for a PACS server are available.
- The Worklist Application Entity receives Worklist information from a remote AE. It is associated with the local real-world activity "Update Worklist". When the "Update Worklist" local real-world activity is performed the Worklist Application Entity queries a remote AE for worklist items and provides the set of worklist items matching the query request. "Update Worklist" is performed when a user performs a query on the Scheduled Work page.
- The MPPS Application Entity sends MPPS information to a remote AE. It is associated with the local real-world activity "Acquire Images". When the "Acquire Images" local real-world activity is performed the MPPS Application Entity creates and updates Modality Performed Procedure Step instances managed by a remote AE. Acquisition of images will result in automated creation of an MPPS Instance. Completion of the MPPS is performed as the result of an operator action (ending a case).
- Each Application Entity has a "Test Connection" local real-world activity. When a "Test Connection" button is pressed, the corresponding AE attempts to form an association with the remote entity to determine both the connectivity and compatibility of the remote entity.

4.1.2 Functional Definitions of AEs

4.1.2.1 Functional Definition of Storage AE

The Send-to PACS option on the Case History Review page or ending a case while PACS server credentials are available will activate the Storage AE. An association request is sent to the destination AE and upon successful negotiation of a Presentation Context the image/video transfer is started. If the association cannot be opened, the error is logged and reported to the user.

4.1.2.2 Functional Definition of Worklist AE

Worklist Update attempts to download a Worklist from a remote AE. If the Worklist AE establishes an Association to a remote AE, it will transfer all worklist items via the open Association. The results will be displayed on the Work List Result page.

4.1.2.2 Functional Definition of MPPS AE

The MPPS AE performs the creation of a MPPS Instance automatically whenever the first image or video of a case is captured and at the end of a case.

4.1.3 Sequencing of Real World Activities

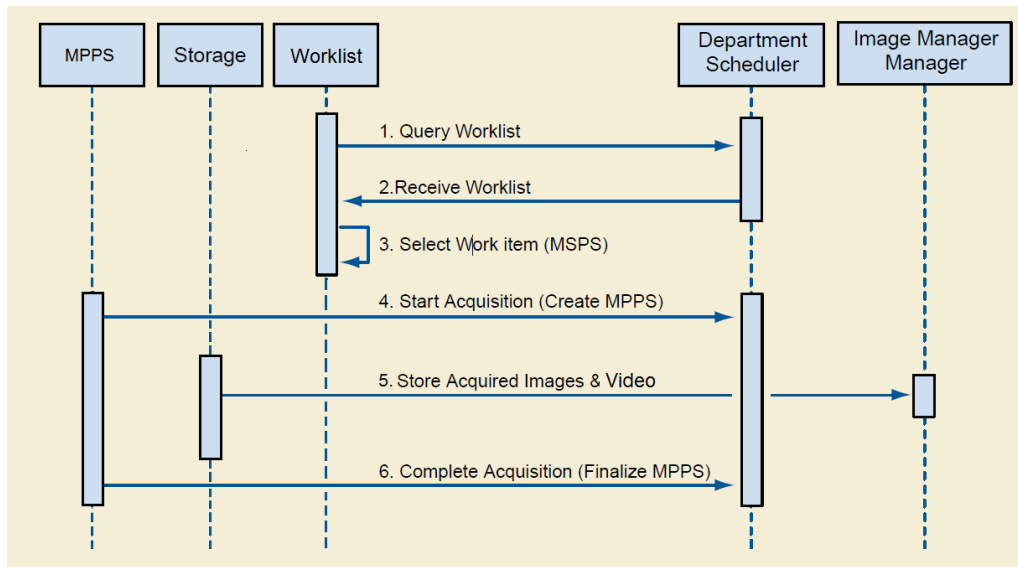


Figure 2 Sequencing Constraints

Under normal scheduled workflow conditions the sequencing constraints illustrated in Figure 2 Sequencing Constraints apply:

1. Query Worklist
2. Receive Worklist of Modality Scheduled Procedure Steps (MSPS)
3. Select Work item (MSPS) from Worklist
4. Start acquisition and create MPPS
5. Store acquired images and video (images and videos are stored at end of case)
6. Complete acquisition and finalize MPPS

Other workflow situations (e.g., unscheduled procedure steps) will have other sequencing constraints.

4.2 AE Specifications:

4.2.1 Storage Application Entity Specification

4.2.1.1 SOP Classes

The Omni 4K video system provides Standard Conformance to the following SOP Classes

SOP Class Name	SOP Class UID	SCU	SCP
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	No
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	Yes	No

4.2.1.2 Association Policies

4.2.1.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed:

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

4.2.1.2.2 Number of Associations

The Omni 4K video system initiates one Association at a time for each destination to which a transfer request is being processed in the active job queue list. Only one job will be active at a time, the other remains pending until the active job is complete.

Maximum number of simultaneous Associations	1
---	---

4.2.1.2.3 Asynchronous Nature

The Omni 4K video system does not support asynchronous communication (multiple outstanding transactions over a single Association).

Maximum number of outstanding asynchronous transactions	1
---	---

4.2.1.2.4 Implementing Identifying Information

The implementation information for the AE is:

Implementation Class UID	1.2.826.0.1.3680043.10.201
Implementation Version Name	1

4.2.1.3 Association Initiation Policy

4.2.1.3.1 Activity – Send Images/Videos

4.2.1.3.1.1 Description and Sequencing of Activities

The Storage AE is invoked by Send-to PACS option on the Case History Review page or automatically when a case is closed if the PACS server credentials are available. These trigger C-STORE request to store images/videos. If the process successfully establishes an Association to a remote Application Entity, it will transfer the selected images/videos one after another via the open Association. Status of the transfer is reported through an Information popup containing a progress bar. Only one image/video will be sent at a time. If the C-STORE Response from the remote Application contains a status other than Success or Warning, the Association is aborted and the images/videos fail to send.

The Storage AE attempts to initiate a new Association in order to issue a C-STORE request. If the job contains multiple images and/or videos then multiple C-STORE requests will be issued over the same Association.

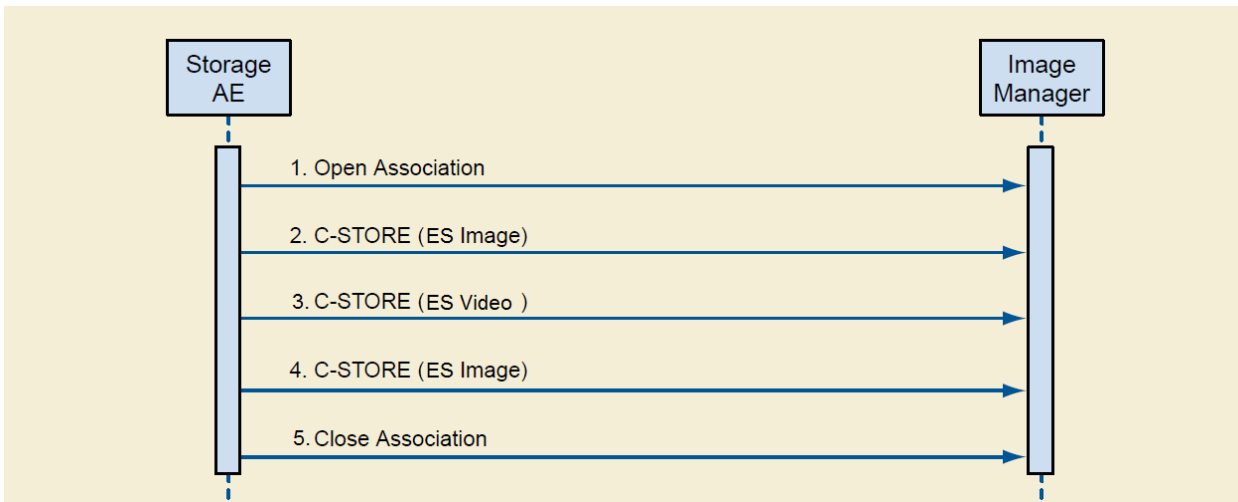


Figure 3 Sequencing of Activity – Send Images and/or Video

A possible sequence of interactions between the Storage AE and an Image Manager (e.g., a storage or archive device supporting the Storage SOP Class as an SCP) is illustrated in Figure 3 Sequencing of Activity – Send Images and/or Video:

1. The Storage AE opens an association with the Image Manager
2. An acquired ES image is transmitted to the Image Manager using a C-STORE request and the Image Manager replies with a C-STORE response (status success).
3. An acquired ES video is transmitted to the Image Manager using a C-STORE request and the Image Manager replies with a C-STORE response (status success).
4. Another acquired ES image is transmitted to the Image Manager using a C-STORE request and the Image Manager replies with a C-STORE response (status success).
5. The Storage AE closes the association with the Image Manager.

Note: Many other message sequences are possible depending on the number of image and video instances to be stored.

4.2.1.3.1.2 Proposed Presentation Contexts

The Omni 4K video system is capable of proposing the Presentation Contexts shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
VL Endoscopic Image Storage	1.2.840.10008.5.1.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
	.1.1.77.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1		
Video Endoscopic Image Storage	1.2.840.10008.5.1.4	MPEG-4 AVC/H.264 High Profile / Level 4.1	1.2.840.10008.1.2.4.1	SCU	None
	.1.1.77.1.1.1		02		

Presentation Contexts for VL Endoscopic Image Storage and Video Endoscopic Image Storage will both be proposed for every association.

4.2.1.3.1.3 SOP Specific Conformance Image & Presentation State Storage SOP Classes

All Image & Presentation State Storage SOP Classes supported by the Storage AE exhibit the same behavior, except where stated, and are described together in this section.

If VL Endoscopic Image Storage or Video Endoscopic Image Storage SOP Instances are sent and a corresponding Presentation Context is not accepted then the Association is aborted using AP-ABORT and the send job is reported as failed. The job failure is logged and reported to the user via alert.

The behavior of Storage AE when encountering status codes in a C-STORE response is summarized in the Table below:

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has successfully stores the SOP Instance. If All SOP Instances in a send job have status success then the job is marked as complete.
Refused	Out of Resources	A700-A7FF	The Association is aborted using A-ABORT and the send job is marked as failed. The status meaning is logged and the job failure

			is reported to the user with an alert. This is a transient failure.
Error	Data Set does not match SOP Class	A900-A9FF	See A700-A7FF
Error	Cannot Understand	C000-CFFF	See A700-A7FF
Warning	Coercion of Data Elements	B000	Image transmission is considered successful but the status meaning is logged.
Warning	Data Set does not match SOP Class	B007	Image transmission is considered successful but the status meaning is logged.
Warning	Elements Discarded	B0006	Image transmission is considered successful but the status meaning is logged.
*	*	Any other status code	See A700-A7FF

The behavior of Storage AE during communication failure is summarized in the Table below:

Exception	Behavior
Timeout	The Association is aborted using A-ABORT and the send job is marked as failed. The reason is logged and the job failure is reported to the user with an alert.
Association aborted by the SCP or network layers	The send job is marked as failed. The reason is logged and the job failure is reported to the user with an alert.

The contents of VL Endoscopic Image Storage and Video Endoscopic Image Storage SOP Instances created by the Omni 4K video system conform to the DICOM VL Endoscopic Image Storage and Video Endoscopic Image Storage IOD definition and are described in Section 8.1.

4.2.1.3.2 Activity – Test Connection

4.2.1.3.2.1 Description and Sequencing of Activities

Pressing the “Test Connection” button on the DICOM “Storage Server” page causes the Storage AE attempt to form an association with the remote AE. If the association request was successful, the transaction is canceled and the success is reported to the user.

4.2.1.3.2.2 Proposed Presentation Contexts

See 4.2.1.3.1.2 Proposed Presentation Contexts 4.2.1.3.1.3 SOP Specific Conformance Image & Presentation State Storage SOP Classes

4.2.1.3.2.3 SOP Specific Conformance Image & Presentation State Storage SOP Classes

See 4.2.1.3.1.3 SOP Specific Conformance Image & Presentation State Storage SOP Classes

4.2.1.4 Association Acceptance Policy

The Omni 4K video system accepts no associations.

4.2.2 Worklist Application Entity Specification

4.2.2.1 SOP Classes

The Omni 4K video system provides Standard Conformance to the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Modality Worklist Information Model –FIND	1.2.840.10008.5.1.4.31	Yes	No

4.2.2.2 Association Policies

4.2.2.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed:

Application Context Name	1.2.840.10008.3.1.1.1
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4.2.2.2.2 Number of Associations

The Omni 4K video system initiates one Association at a time for a Worklist request.

Maximum number of simultaneous Associations	1
---	---

4.2.2.2.3 Asynchronous Nature

The Omni 4K video system does not support asynchronous communication (multiple outstanding transactions over a single Association).

Maximum number of outstanding asynchronous transactions	1
---	---

4.2.2.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.826.0.1.3680043.10.201
Implementation Version Name	1

4.2.2.3 Association Initiation Policy

4.2.2.3.1 Activity - Worklist Update

4.2.2.3.1.1 Description and Sequencing of Activities

The request for a Worklist Update is initiated by user interaction, i.e., by pressing the Download Today's Work button on the Scheduled Work page. This performs a query using Scheduled Procedure Step Start Date (actual date), Modality (ES) and Scheduled Station AE Title (if configured) as the search keys.

Worklist Update can also be initiated via the Search Work List button on the Scheduled Work page. This opens the "Patient Worklist Query" page where other search keys can be applied in addition to the default: Scheduled Procedure Step Start Date (actual date), Modality (ES) and Scheduled Station AE Title (if configured).

The Scheduled Station AE Title used by the Omni 4K video system is configurable by a Service Engineer.

Upon initiation of the request, the Omni 4K video system will build an Identifier for the C-FIND request, will initiate an Association to send the request and will wait for Worklist responses. After retrieval of all responses, the user can select the desired work from the Work List Results page.

The Omni 4K video system will initiate an Association in order to issue a C-FIND request according to the Modality Worklist Information Model.

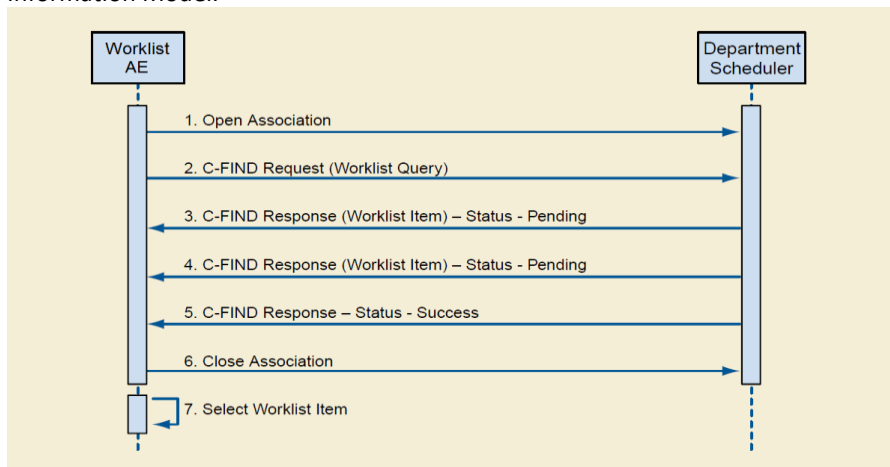


Figure 4 Sequencing of Activity – Worklist Update

A possible sequence of interactions between the Worklist AE and a Departmental Scheduler (e.g., a device such as a RIS or HIS that supports the Modality Worklist SOP Class as an SCP) is illustrated in Figure 4 Sequencing of Activity – Worklist Update:

1. The Worklist AE opens an association with the Departmental Scheduler
2. The Worklist AE sends a C-FIND request to the Departmental Scheduler containing the Worklist Query attributes.
3. The Departmental Scheduler returns a C-FIND response containing the requested attributes of the first matching Worklist Item.
4. The Departmental Scheduler returns another C-FIND response containing the requested attributes of the second matching worklist Item.

5. The Departmental Scheduler returns another C-FIND response with status Success indicating that no further matching Worklist Items exist. This example assumes that only 2 Worklist items match the Worklist Query.
6. The Worklist AE closes the association with the Departmental Scheduler.
7. The user selects a Worklist Item from the Worklist and prepares to acquire new images.

4.2.2.3.1.2 Proposed Presentation Contexts

The Omni 4K video system will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4 .31	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None

4.2.2.3.1.3 SOP Specific Conformance for Modality Worklist

The behavior of the Omni 4K video system when encountering status codes in a Modality Worklist C-FIND response is summarized in the Table below. If any other SCP response status than "Success" or "Pending" is received by the Omni 4K video system, a message indicating the failed query will appear on the user interface.

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	The SCP has completed the matches. Worklist items are available for display or further processing.
Refuse	Out of Resources	A700	The Association is aborted using A-ABORT and the worklist query is reported as failed. The status meaning is logged and reported to the user if a manual query. Any additional error information in the Response will be logged.
Failed	Identifier does not match SOP Class	A900	See error code "A700"
Failed	Unable to Process	C000-CFFF	See error code "A700"
Cancel	Matching terminated due to Cancel request	FE00	Worklist items are available for display or further processing. Otherwise, the Association is aborted using A-ABORT and the worklist query is marked as failed. The status meaning is logged and reported to the user if an interactive query.
Pending	Matches are continuing	FF00	The worklist item contained in the Identifier is collected for later display or further processing.
Pending	Matches are continuing – Waning that one or more Optional Keys were not supported	FF01	The worklist item contained in the Identifier is collected for later display or further processing. The status meaning is logged only once for each C-FIND operation.
*	*	Any other status code	See error code "A700"

The behavior of the Omni 4K video system during communication failure is summarized in the Table below.

Exception	Behavior
Timeout	The Association is aborted using A-ABORT and the worklist query marked as failed. The reason is logged and reported to the user if an interactive query.
Association aborted by the SCP or network layers	The worklist query is marked as failed. The reason is logged and reported to the user if an interactive query.

Acquired images will always use the Study Instance UID specified for the Scheduled Procedure Step (if available). If an acquisition is unscheduled, a Study Instance UID will be generated locally.

The Table below provides a description of the Omni 4K video system Worklist Request Identifier and specifies the attributes that are copied into the images. Unexpected attributes returned in a C-FIND response are ignored.

Requested return attributes not supported by the SCP are set to have no value. Non-matching responses returned by the SCP due to unsupported optional matching keys are ignored. No attempt is made it filter out possible duplicate entries.

Module Name								
Attribute Name	Tag	VR	M	R	Q	D	IOD	

Scheduled Procedure Step							
Scheduled Procedure Step Sequence	(0040,0100)	SQ		X			
>Scheduled Station AE Title	(0040,0001)	AE	(S)				
>Scheduled Procedure Step Start Date	(0040,0002)	DA		X	X	X	
>Scheduled Procedure Step Start Time	(0040,0003)	TM		X		X	
>Modality	(0008,0060)	CS	S	X			X
>Scheduled Performing Physician's Name	(0040,0006)	PN		X	X	X	X
>Scheduled Procedure Step Description	(0040,0007)	LO		X		X	X
>Scheduled Station Name	(0040,0010)	SH		X			
>Scheduled Procedure Step Location	(0040,0011)	SH		X		X	
>Scheduled Procedure Step ID	(0040,0009)	SH		X		X	X
Requested Procedure							
Requested Procedure ID	(0040,1001)	SH		X			X
Requested Procedure Description	(0032,1060)	LO		X			X
Study Instance UID	(0020,000D)	UI		X			X
Imaging Service Request							
Accession Number	(0008,0050)	SH		X		X	X
Referring Physician's Name	(0008,0090)	PN		X		X	X
Visit Identification							
Admission ID	(0038,0300)	LO		X		X	
Patient Identification							
Patient's Name	(0010,0010)	PN		X	X	X	X
Patient ID	(0010,0020)	LO		X	X	X	X
Patient Demographic							
Patient's Birth Date	(0010,0030)	PN		X		X	X
Patient's Sex	(0010,0040)	CS		X		X	X

Note: Specific Character Set (0008,0005) will be included in the Identifier with the value "ISO_IR 192" (see Section 6). The above tables should be read as follows:

Module Name	The name of the associated module for supported worklist attributes
Attribute Name	Attributes supported to build a Omni 4K video system Worklist Request Identifier.
Tag	DICOM tag for this attribute.
VR	DICOM VR for this attribute.
M	Matching keys for every worklist query. An "S" will indicate that the Omni 4K video system will supply an attribute value for Single Value Matching, an "R" will indicate Range Matching and a "*" will denote wild card matching.
R	Return keys. An "x" will indicate that the Omni 4K video system will supply this attribute as Return Key with zero length for Universal Matching. The Omni 4K video system will support retired date format (yyyy.mm.dd) for "Patient's Birth Date" and "Scheduled Procedure Step Start Date" in the response identifiers. For "Scheduled Procedure Step Start Time" also retired time format as well as unspecified time components are supported.
Q	Interactive Query Key. An "x" will indicate that the Omni 4K video system will supply this attribute as matching key, if entered in the Query Patient Worklist dialog. For example, the Patient Name can be entered thereby restricting Worklist responses to Procedure Steps scheduled for the patient.
D	Displayed keys. An "x" indicates that this worklist attribute is displayed to the user on the Work List Results Details popup
IOD	An "x" indicates that this Worklist attribute is included into all Object Instances created during performance of the related Procedure Step.

All queries automatically have "Modality" (ES), and (optionally according to configuration) AET as matching criteria in addition to any manual matching criteria. Queries performed by selecting the Download Today's Work button also automatically use today's date to match the scheduled procedure start date.

4.2.2.3.2 Activity – Test Connection

4.2.2.3.2.1 Description and Sequencing of Activities

Pressing the "Test Connection" button on the DICOM "Worklist Server" page causes the Worklist AE attempt to form an association with the remote AE. If the association request was successful, the transaction is canceled and the success is reported to the user.

4.2.2.3.2.2 Proposed Presentation Contexts

See 4.2.2.3.1.2 Proposed Presentation Contexts

4.2.2.3.2.3 SOP Specific Conformance for Modality Worklist

See 4.2.2.3.1.3 SOP Specific Conformance for Modality Worklist

4.2.2.4 Association Acceptance Policy

The MPPS Application Entity does not accept Associations.

4.2.3 MPPS Application Entity Specification

4.2.3.1 SOP Classes

The Omni 4K video system provides Standard Conformance to the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Yes	No

4.2.3.2 Association Policies

4.2.3.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed:

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

4.2.3.2.2 Number of Associations

The Omni 4K video system initiates one Association at a time for a Worklist request.

Maximum number of simultaneous Associations	1
---	---

4.2.3.2.3 Asynchronous Nature

The Omni 4K video system does not support asynchronous communication (multiple outstanding transactions over a single Association).

Maximum number of outstanding asynchronous transactions	1
---	---

4.2.3.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.826.0.1.3680043.10.201
Implementation Version Name	1

4.2.3.3 Association Initiation Policy

4.2.3.3.1 Activity - Acquire Images

4.2.3.3.1.1 Description and Sequencing of Activities

After registering a patient (selecting a local or MWL case from the Work List Result page) and starting the case, the Omni 4K video system is awaiting the image or video capture. The trigger to create a MPPS SOP Instance is derived from this event. An Association to the configured MPPS SCP system is established immediately and the related MPPS SOP Instance will be created.

An MPPS request is sent with the value "COMPLETED" by ending the case from the Active Case page. A MPPS Instance that has been sent with a state of "COMPLETED" can no longer be updated.

The Omni 4K video system will support creation of "unscheduled cases" by allowing MPPS Instances to be communicated for locally

registered Patients.

The Omni 4K video system will initiate an Association to issue an:

- N-CREATE request according to the CREATE Modality Performed Procedure Step SOP Instance operation or a
- N-SET request to update the contents and state of the MPPS according to the SET Modality Performed Procedure Step Information operation.

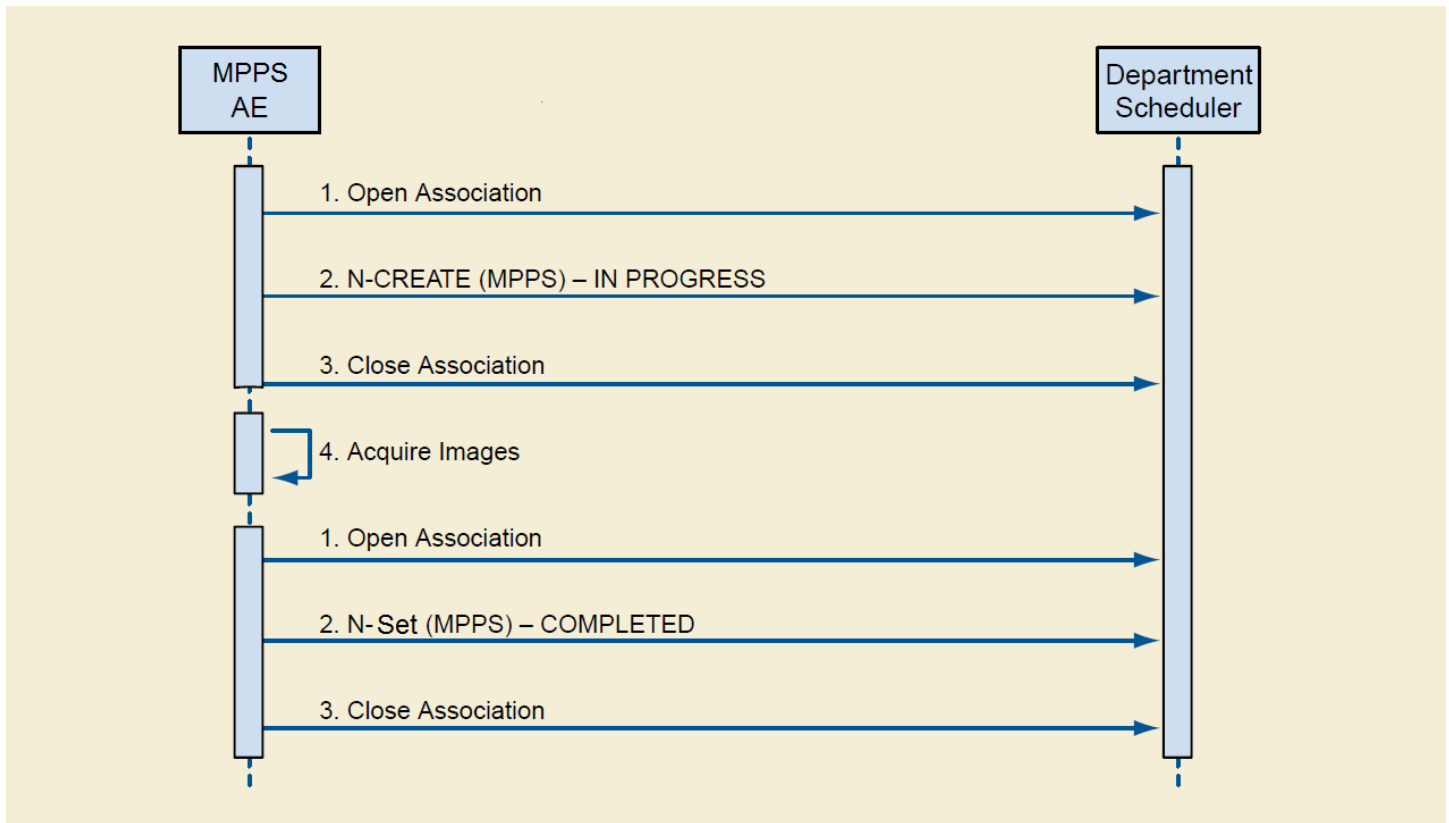


Figure 5 Sequencing of Activity – Acquire Images

A possible sequence of interactions between the MPPS AE and a Departmental Scheduler (e.g., a device such as a RIS or HIS that supports the MPPS SOP Class as an SCP) is illustrated in Figure 5 Sequencing of Activity – Acquire Images:

1. The Worklist AE opens an association with the Departmental Scheduler
2. The Worklist AE sends an N-CREATE request to the Departmental Scheduler to create an MPPS instance with status of "IN PROGRESS" and create all necessary attributes. The Departmental Scheduler acknowledges the MPPS creation with an N-CREATE response (status success).
3. The Worklist AE closes the association with the Departmental Scheduler.
4. All images are acquired and stored in the local database.
5. The Worklist AE opens an association with the Departmental Scheduler.
6. The Worklist AE sends an N-SET request to the Departmental Scheduler to update the MPPS instance with status of "COMPLETED" and set all necessary attributes. The Departmental Scheduler acknowledges the MPPS update with an N-SET response (status success).
7. The Worklist AE closes the association with the Departmental Scheduler.

4.2.3.3.1.2 Proposed Presentation Contexts

The Omni 4K video system will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Performed Procedure Step	1.2.840.10008.3.1.2 .3.3	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None

4.2.3.3.1.3 SOP Specific Conformance for MPPS

The behavior of the Omni 4K video system when encountering status codes in an MPPS N-CREATE or N-SET response is summarized in the table below. If any other SCP response status than "Success" or "Warning" is received by the Omni 4K video system, a message indication an MPPS failure will appear on the user interface.

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
Failure	Processing Failure – Performed Procedure Step Object may no longer be updated	0110	The Association is aborted using A-ABORT and the MPPS is marked as failed. The status meaning is logged and reported to the user. Additional information in the Response will be logged (i.e., Error Comment and Error ID).
Warning	Attribute Value Out of Range	0116H	The MPPS operation is considered successful but the status meaning is logged. Additional information in the Response identifying the attributes out of range will be logged (i.e., Elements in the Modification List/Attribute List)
*	*	Any other status code	The Association is aborted using A-ABORT and the MPPS is marked as failed. The status meaning is logged and reported to the user.

The behavior of the Omni 4K video system during communication failure is summarized in the Table below:

Exception	Behavior
Timeout	The Association is aborted using A-ABORT and MPPS marked as failed. The reason is logged and reported to the user.
Association aborted by the SCP or network layers	The MPPS is marked as failed. The reason is logged and reported to the user.

The “MPPS Request Identifiers” table provides a description of the MPPS N-CREATE and N-SET request identifiers sent by the Omni 4K video system. Empty cells in the N-CREATE and N-SET columns indicate that the attribute is not sent. The following table contains the meaning of several common entries indicating what is put in different attributes.

Entry	Meaning
X	The appropriate value will be sent
Zero length	The attribute will be sent with zero length
MWL	The attribute’s value is pulled from the Modality Work List
MWL/User	The attribute’s value is pulled from the Modality Work List and then possibly edited by the user

MPPS Request Identifiers				
Attribute Name	Tag	VR	N-CREATE	N-SET
Specific Character Set	(0008,0005)	CS	ISO_IR 192	ISO_IR 192
Performed Procedure Step Relationship				
Scheduled Step Attributes Sequence	(0040,0270)	SQ	1 st capture taken results in instance	
> Study Instance UID	(0020,000D)	UI	MWL	
> Referenced Study Sequence	(0008,1110)	SQ	Zero length	
> Accession Number	(0008,0050)	SH	MWL/User	
> Requested Procedure ID	(0040,1001)	SH	MWL	
> Requested Procedure Description	(0032,1060)	LO	MWL	
> Scheduled Procedure Step ID	(0040,0009)	SH	MWL	
> Scheduled Procedure Step Description	(0040,0007)	LO	MWL	
> Scheduled Protocol Code Sequence	(0040,0008)	SQ	MWL	
Patient's Name	(0010,0010)	PN	MWL/User	
Patient ID	(0010,0020)	LO	MWL/User	
Patient's Birth Date	(0010,0030)	DA	MWL/User	
Patient's Sex	(0010,0040)	CS	MWL/User	
Referenced Patient Sequence	(0008,1120)	SQ	Zero length	

Performed Procedure Step Information				
Performed Procedure Step ID	(0040,0253)	SH	Automatically created but can be modified by the user.	
Performed Station AE Title	(0040,0241)	AE	MPPS AE Title	
Performed Station Name	(0040,0242)	SH	From configuration	
Performed Location	(0040,0243)	SH	From configuration	
Performed Procedure Step Start Date	(0040,0244)	DA	Actual start date	
Performed Procedure Step Start Time	(0040,0245)	TM	Actual start time	
Performed Procedure Step Status	(0040,0252)	CS	IN PROGRESS	COMPLETED
Comments on the Performed Procedure Step	(0040,0280)	LO	User	User
Performed Procedure Step Description	(0040,0254)	LO	MWL/User	
Performed Procedure Type Description	(0040,0255)	LO	Zero length	
Procedure Code Sequence	(0008,1032)	SQ	Zero length	Zero length
Performed Procedure Step End Date	(0040,0250)	DA	Zero length	Actual end date
Performed Procedure Step End Time	(0040,0251)	TM	Zero length	Actual end time
Image Acquisition Results				
Modality	(0008,0060)	CS	ES	ES
Study ID	(0020,0010)	SH	MWL/User	
Performed Protocol Code Sequence	(0040,0260)	SQ	Zero length	Zero or more items
Performed Series Sequence	(0040,0340)	SQ	One item	One item
>Performing Physician's Name	(0008,1050)	PN	X	X
>Protocol Name	(0018,1030)	LO	X	X
>Operator's Name	(0008,1070)	PN	X	X
>Series Instance UID	(0020,000E)	UI	X	X
>Series Description	(0008,103E)	LO	X	X
>Retrieve AE Title	(0008,0054)	AE	X	X
>Referenced Image Sequence	(0008,1140)	SQ	One or more items	One or more items
>>Referenced SOP Class UID	(0008,1150)	UI	X	X
>>Referenced SOP Instance UID	(0008,1155)	UI	X	X
>Referenced Standalone SOP Instance Sequence	(0040,0220)	SQ	Zero length	Zero length

4.2.3.3.2 Activity – Test Connection

4.2.3.3.2.1 Description and Sequencing of Activities

Pressing the “Test Connection” button on the DICOM “Modality Performed Procedure Step” page causes the MPPS AE attempt to form an association with the remote AE. If the association request was successful, the transaction is canceled and the success is reported to the user.

4.2.3.3.2.2 Proposed Presentation Contexts

See 4.2.3.3.1.2 Proposed Presentation Contexts

4.2.3.3.2.3 SOP Specific Conformance for MPPS

See 4.2.3.3.1.3 SOP Specific Conformance for MPPS

4.2.3.4 Association Acceptance Policy

The MPPS Application Entity does not accept Associations.

4.3 Network Interfaces

4.3.1 Physical Network Interface

The Omni 4K video system supports a single network interface labeled “Network”.

Ethernet 100BaseT

4.3.2 Additional Protocols

EXAMPLE-INTEGRATED-MODLALITY conforms to the System Management Profiles listed in the Table below. All requested transactions for the listed profiles and actors are supported. Support for optional transactions are listed in the Table below:

Profile Name	Actor	Protocols Used	Optional Transactions	Security Support
Network Address Management	DHCP Client	DHCP	N/A	

4.3.2.1 DHCP

DHCP is used to obtain TCP/IP network configuration information. There is currently no manual method of network configuration. The network parameters obtainable via DHCP are shown in the Table below. The Default Value column of the table shows the default used if the DHCP server does not provide a value.

DHCP Parameter
IP Address
Subnet mask
Default router

If the DHCP server refuses to renew a lease on the assigned IP address all active DICOM Associations will be aborted.

4.3.3 IPv4 and IPv6 Support

This product only supports IPv4 connections.

4.4 Configuration

4.4.1 AE Title/Presentation Address Mapping

4.4.1.1 Local AE Titles

All local applications use the AE Titles and TCP/IP Ports configured via the Network page. The Field Service Engineer can configure the TCP Port via the Network page. No Default AE Titles are provided. The AE Titles must be configured via the Network page. The local AE Title used by each individual application can be configured independently of the AE Title used by other local applications. If so configured, all local AEs are capable of using the same AE Title.

Application Entity	Default AE Title	Default TCP/IP Port
Storage	None	N/A
Worklist	None	N/A
MPPS	None	N/A

4.4.1.2 Remote AE Title/Presentation Address Mapping

The AE Title, host names and port numbers of remote applications are configured using the Omni 4K video system Network page.

4.4.1.2.1 Storage

The Omni 4K video system Network page must be used to set the AE Titles, port-numbers, host-names and capabilities for the remote Storage SCP. Associations will only be accepted from known AE Titles and associations from unknown AE Titles will be rejected (an AE Title is known if it is configured within the Network page).

4.4.1.2.2 Worklist

The Omni 4K video system Network page must be used to set the AE Titles, port-numbers, host-names and capabilities for the remote Modality Worklist SCP. Only a single remote Modality Worklist SCP can be defined.

4.4.1.2.3 MPPS

The Omni 4K video system Network page must be used to set the AE Titles, port-numbers, host-names and capabilities for the remote MPPS SCP. Only a single remote MPPS SCP can be defined.

4.4.2 Parameters

A large number of parameters related to acquisition and general operation can be configured using the Network page. The Table below only shows those configuration parameters relevant to DICOM communication. See the Omni 4K video system Service Manual for details on general configuration capabilities.

Parameter	Configurable	Default
General Parameters		
Max PDU Receive Size	No	16384 Bytes(16 kB)
Max PDU Send Size	No	16384 Bytes(16 kB)
Time-out waiting for completion of a connect request (Application Level Timeout)	No	5 seconds
Time-out waiting for an acceptance or rejection response to an Association Request (Application Level Timeout)	No	none
Time-out waiting for a response to an Association release request (Application Level Timeout)	No	none
Storage Parameters		
Storage SCU time-out waiting for a response to a C-STORE-RQ	No	No timeout
Number of times a failed send job may be retried	No	0 (Failed send jobs are not retired)
Delay between retrying failed send jobs	No	Failed send jobs are not retired
Maximum number of simultaneously initiated Associations by the Storage AE	No	1
Supported Transfer Syntaxes	No	Implicit VR Little Endian MPEG-4 AVC/H.264 High Profile / Level 4.1
Modality Worklist Parameters		
Modality Worklist SCU time-out waiting for the final response to a C-FIND-RQ	No	No timeout
Supported Transfer Syntaxes for Modality Worklist	No	Implicit VR Little Endian
Query Worklist for specific Scheduled Station AE Title	Yes	Configurable on the Worklist Server page.
Query Worklist for specific Modality Value	No	ES
MPPS Parameters		
MPPS SCU time-out waiting for a response to a N-CREATE-RQ	No	No timeout
MPPS SCU time-out waiting for a response to a N-SET-RQ	No	No timeout
Supported Transfer Syntaxes for MPPS	No	Implicit VR Little Endian

5 Media Interchange

The Omni 4K video system does not support media interchange.

6 Support of Character Sets

The Omni 4K video system supports ISO_IR 192 (Unicode in UTF-8)

7 Security

It is assumed that the Omni 4K video system is used within a secured environment. It is assumed that a secured environment includes at a minimum:

1. Firewall or router protections to ensure that only approved external hosts have network access to the Omni 4K video system.
2. Firewall or router protections to ensure that the Omni 4K video system only has network access to approved external hosts and services.
3. Any communication with external hosts and services outside the locally secured environment use appropriate secure network channels (e.g., such as a Virtual Private Network (VPN))

Other network security procedures such as automated intrusion detection may be appropriate in some environments. Additional security features may be established by the local security policy and are beyond the scope of this conformance statement.

8 Annexes

8.1 IOD Contents

8.1.1 Created SOP Instance(s)

Below is the IOD table key:

VNAP	Value Not Always Present (attribute sent zero length if no value is present)
ANAP	Attribute Not Always Present
ALWAYS	Always Present
EMPTY	Attribute is sent without a value
MWL	the attribute value source Modality Worklist
USER	the attribute value source is from User input
AUTO	the attribute value is generated automatically
MPPS	the attribute value is the same as that use for Modality Performed Procedure Step
CONFIG	the attribute value source is a configurable parameter

8.1.1.1 VL Endoscopy Image IOD

Attribute	Tag	VR	Value	Presence of Value	Source
Media Storage SOP Class UID	(0002,0002)	UI	1.2.840.10008.5.1.4.1.1.77.1.1	ALWAYS	AUTO
Transfer Syntax UID	(0002,0010)	UI	1.2.840.10008.1.2.1	ALWAYS	AUTO
Source Application Entity Title	(0002,0016)	AE		ALWAYS	CONFIG
SOP Class UID	(0008,0016)	UI	1.2.840.10008.5.1.4.1.1.77.1.1	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI		ALWAYS	AUTO
Character Set	(0008,0005)	CS	ISO_IR 192	ALWAYS	AUTO
Table "8.1.1.3 General Endoscopic Image Storage" Included here.					
Image Pixel					
Samples per Pixel	(0028,0002)	US	3	ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	CS	RGB	ALWAYS	AUTO
Planar Configuration	(0028,0006)	US	0	ALWAYS	AUTO
Rows	(0028,0010)	US	1080	ALWAYS	AUTO
Columns	(0028,0011)	US	1920	ALWAYS	AUTO
Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO
High Bit	(0028,0102)	US	7	ALWAYS	AUTO
Pixel Representation	(0028,0103)	US	0	ALWAYS	AUTO
Smallest Image Pixel Value	(0028,0106)	US	0	ALWAYS	AUTO
Largest Image Pixel Value	(0028,0107)	US	255	ALWAYS	AUTO
Pixel Data	(7FE0,0010)	OW	Contains data for full image	ALWAYS	AUTO

8.1.1.2 Video Endoscopic Image Storage

Attribute	Tag	VR	Value	Presence of Value	Source
Media Storage SOP Class UID	(0002,0002)	UI	1.2.840.10008.5.1.4.1.1.77.1.1.1	ALWAYS	AUTO
Transfer Syntax UID	(0002,0010)	UI	1.2.840.10008.1.2.1	ALWAYS	AUTO
Source Application Entity Title	(0002,0016)	AE		ALWAYS	CONFIG
SOP Class UID	(0008,0016)	UI	1.2.840.10008.5.1.4.1.1.77.1.1.1	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI		ALWAYS	AUTO
Character Set	(0008,0005)	CS	ISO_IR 192	ALWAYS	AUTO
Table "8.1.1.3 General Endoscopic Image Storage" Included here.					

Cine					
Frame Time	(0018,1063)	DS	16.17	ALWAYS	AUTO
Cine Rate	(0018,0040)	IS	60	ALWAYS	AUTO
Multi-frame					
Number of Frames	(0028,0008)	IS		ALWAYS	AUTO
Frame Increment Pointer	(0028,0009)	AT	(0018,1063) Frame Time	ALWAYS	AUTO
Image Pixel					
Samples per Pixel	(0028,0002)	US	3	ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	CS	YBR_PARTIAL_420	ALWAYS	AUTO
Planar Configuration	(0028,0006)	US	0	ALWAYS	AUTO
Rows	(0028,0010)	US	1080	ALWAYS	AUTO
Columns	(0028,0011)	US	1920	ALWAYS	AUTO
Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO
High Bit	(0028,0102)	US	7	ALWAYS	AUTO
Pixel Representation	(0028,0103)	US	0	ALWAYS	AUTO
Pixel Data	(7FE0,0010)	OW	.	ALWAYS	AUTO

8.1.1.3 General Endoscopic Image Storage

This table includes attributes used in both “VL Endoscopic Image Storage” and “Video Endoscopic Image Storage”.

General Endoscopic Image Storage					
Attribute	Tag	VR	Value	Presence of Value	Source
Patient					
Patient Name	(0010,0010)	PN		ALWAYS	MWL/USER
Patient ID	(0010,0020)	LO		ALWAYS	MWL/USER
Patient Sex	(0010,0040)	CS		ALWAYS	MWL/USER
Patient Birth Date	(0010,0030)	DA		ALWAYS	MWL/USER
General Study					
Study Instance UID	(0020,000D)	UI	Generated by device or MWL	ALWAYS	MWL/AUTO
Study ID	(0020,0010)	SH		VNAP	MWL/USER
Study Date	(0008,0020)	DA		ALWAYS	AUTO
Study Time	(0008,0030)	TM		ALWAYS	AUTO
Referring Physician’s Name	(0008,0090)	PN		VNAP	MWL
Accession Number	(0008,0050)	SH		VNAP	MWL/USER
Referenced Study Sequence	(0008,1110)	SQ		VNAP	MWL
>Referenced SOP Class UID	(0008,1150)	UI		VNAP	MWL
>Referenced SOP Instance UID	(0008,1155)	UI		VNAP	MWL
General Series					
Modality	(0008,0060)	CS	ES	ALWAYS	AUTO
Series Number	(0020,0011)	IS	Generated by device	ALWAYS	AUTO
Series Instance UID	(0020,000E)	UI	Generated by device	ALWAYS	AUTO
Series Date	(0008,0021)	DA	<yyymmdd>	ALWAYS	AUTO
Series Time	(0008,0031)	TM	<hhmmss>	ALWAYS	AUTO
Performing Physician’s Name	(0008,1050)	PN	Physician field in Case list. Maximum 64 characters	VNAP	USER
Protocol	(0018,1030)	LO		ALWAYS	AUTO
Series Description	(0008,103E)	LO	Maximum 512 characters	VNAP	USER
Operator’s Name	(0008,1070)	PN	Operator field in Case list. Maximum 64 characters.	VNAP	USER
Referenced Performed Procedure Step Sequence	(0008,1111)	SQ	Identifies MPPS SOP Instance to which this image is related.	ALWAYS	MPPS
>Referenced SOP Class UID	(0008,1150)	UI	MPPS SOP Class UID	ALWAYS	MPPS
>Referenced SOP Instance	(0008,1155)	UI	MPPS SOP Instance UID	ALWAYS	MPPS

UID					
Requested Attribute Sequence	(0040,0275)	SQ	Zero or 1 item will be present	ALWAYS	AUTO
>Requested Procedure ID	(0040,1001)	SH		VNAP	MWL
>Scheduled Procedure Step ID	(0040,0009)	SH		VNAP	MWL
>Scheduled Procedure Step Description	(0040,0007)	LO		VNAP	MWL
>Scheduled Protocol Code Sequence	(0040,0008)	SQ		VNAP	MWL
Performed Procedure Step ID	(0040,0253)	SH	Same as MPPS	ALWAYS	MPPS
Performed Procedure Step Start Date	(0040,0244)	DA	Same as MPPS	ALWAYS	MPPS
Performed Procedure Step Start Time	(0040,0245)	TM	Same as MPPS	ALWAYS	MPPS
Performed Procedure Step Description	(0040,0254)	LO	Same as MPPS. From user input. Maximum 64 characters	VNAP	MPPS
Performed Protocol Code Sequence	(0040,0260)	SQ	Same as MPPS.	ALWAYS	MPPS
Comments on the Performed Procedure Step	(0040,0280)	LO	Same as MPPS. From use input. Maximum 64 characters	VNAP	MPPS
General Image					
Image Type	(0008,0008)	CS	ORIGINAL PRIMARY	ALWAYS	AUTO
Instance Number	(0020,0013)	IS	Generated by device	ALWAYS	AUTO
Lossy Image Compression	(0028,2110)	CS	00	ALWAYS	AUTO
Content Date	(0008,0023)	DA	<yyyymmdd>	ALWAYS	AUTO
Content Time	(0008,0033)	TM	<hhmmss>	ALWAYS	AUTO
General Equipment					
Manufacturer	(0008,0070)	LO	Santa Barbara Imaging Systems	ALWAYS	AUTO
Institution Name	(0008,0080)	LO		VNAP	CONFIG
Station Name	(0008,1010)	SH		ALWAYS	CONFIG
Manufacturer's Model Name	(0008,1090)	LO		ALWAYS	AUTO
Device Serial Number	(0018,1000)	LO		ALWAYS	CONFIG
Software Version	(0018,1020)	LO		ALWAYS	CONFIG
Acquisition Context					
Acquisition Context	(0040,0555)	SQ	Zero length		

8.1.2 Usage of Attributes From received IODs

The Omni 4K video system storage application does not receive SOP Instances. The usage of attributes received via Modality Worklist is described in Section 4.2.2.3.1.3 SOP Specific Conformance for Modality Worklist.

8.1.3 Attributes Mapping

The relationships between attributes received via Modality Worklist, stored in acquired images and communicated via MPPS are summarized in Table B.8.1-31. The format and conventions used in the table below are the same as the corresponding table in Section J.6 in PS3.17.

Modality Worklist	Image IOD	MPPS IOD
Patient Name	Patient Name	Patient Name
Patient ID	Patient ID	Patient ID
Patient's Birth Date	Patient's Birth Date	Patient's Birth Date
Patient's Sex	Patient's Sex	Patient's Sex
Referring Physician's Name	Referring Physician's Name	
----	----	Scheduled Step Attributes Sequence
Study Instance UID	Study Instance UID	>Study Instance UID
		>Referenced Study Sequence

Accession Number	Accession Number	>Accession Number
----	Request Attributes Sequence	----
Requested Procedure ID	>Requested Procedure ID	>Requested Procedure ID
Requested Procedure Description		>Requested Procedure Description
Scheduled Procedure Step ID	>Scheduled Procedure Step ID	>Scheduled Procedure Step ID
Scheduled Procedure Step Description	>Scheduled Procedure Step Description	>Scheduled Procedure Step Description
----	----	Performed Protocol Code Sequence
----	Study ID	Study ID
----	Performed Procedure Step ID	Performed Procedure Step ID
----	Performed Procedure Step Start Date	Performed Procedure Start Date
----	Performed Procedure Step Start Time	Performed Procedure Step Start Time
----	Performed Procedure Step Description	Performed Procedure Step Description
----	----	Performed Series Sequence
Scheduled Performing Physician's Name	Performing Physician's Name	>Performing Physician's Name
----	Protocol Name	>Protocol Name
	Operator's Name	>Operator's Name
	Series Instance UID	>Series Instance UID
	Series Description	>Series Description

8.1.4 Coerced/Modified Fields

The Modality Worklist AE will truncate attribute values received in the response to a Modality Worklist Query if the value length is longer than the maximum length permitted by the attribute's VR.

8.2 Data Dictionary of Private Attributes

No private attributes are supported.

8.3 Coded Terminology and Templates

No coded terminology or templates are used.

8.4 Grayscale Image Consistency

Grayscale Image Consistency is not supported. The Omni 4K video system produces colored images rather than grayscale.

8.5 Standard Extended/Specialized/Private SOP

No Extended, Specialized, or Private SOPs are supported.

8.6 Private Transfer Syntaxes

No Private Transfer Syntaxes are supported.

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