

Storage Peak

Version 5.7 and up

HL7 Interface Specification

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1. Introduction

1.1 Revision History

Document Version	Date	Description	Author
01.00	2010-07-15	Release for Storage Peak 4.3	Trautnitz
01.01	2010-12-07	Corrected mistake in handling unknown patients in MRG in A40 message	Sabin
02.00	2010-12-08	Release after review	Trautnitz
03.00	2011-06-15	Release for Storage Peak 4.4	Trautnitz
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04.02	2013-07-11	Storage Peak Version changed to 5.3	Sabin
05.00	2016-04-08	Digithurst Logo changed. Version 5.7 and up	Trautnitz

1.2 Audience

This document is intended for hospital staff, health system integrators, software designers or implementers. It is assumed that the reader has a working understanding of HL7.

1.3 Remarks

This document is the HL7 Interface Specification for StoragePeak.

HL7, by itself, does not guarantee interoperability. However, the Interface Specification facilitates a first-level validation for interoperability between different applications supporting the same HL7 functionality.

This Interface Specification is not intended to replace validation with other HL7 equipment to ensure proper exchange of information intended.

The scope of this Interface Specification is to facilitate communication between StoragePeak and other HL7 systems. The Interface Specification should be read and understood in conjunction with the HL7 Standard and the IHE Technical Framework. However, by itself it is not guaranteed to ensure the desired interoperability and a successful interconnectivity.

The user should be aware of the following important issues:

- The comparison of different Interface Specifications is the first step towards assessing interconnectivity between StoragePeak and other HL7 conformant equipment.
- Test procedures should be defined to validate the desired level of connectivity.

1.4 Abbreviations and Acronyms

ACK	Acknowledge
ADT	Admission, Discharge and Transfer
CS	Client/Server
DICOM	Digital Imaging and Communications in Medicine
DSS	Department System Scheduler
HL7	Health Level 7
IHE	Integrating the Healthcare Enterprise
IP	Internet Protocol
MLLP	Minimal Lower Layer Protocol
MSA	Message Acknowledgement (Segment)
MRG	Merge Patient Information (Segment)
MSH	Message Header (Segment)
LLP	Lower Layer Protocol
ORM	General Order Message
PACS	Picture Archiving and Communication System
PID	Patient Identification (Segment)
PIR	Patient Information Reconciliation
PV1	Patient Visit (Segment)
RIS	Radiology Information System
TCP	Transmission Control Protocol
UID	Unique Identifier
UTF	Unicode Transformation Format
VR	Value Representation

2. Functional Overview

2.1 General

The StoragePeak concept is based on a modular architecture for distributing medical images and reports within and outside of a clinical area. It allows external systems to send DICOM objects to it for temporary storage and long-term archiving.

This requires providing mechanisms for patient information reconciliation. Therefore StoragePeak implements a HL7 Interface which supports a subset of HL7 messages defined by the IHE transaction 'Patient Update'.

Storage Peak also handles ORU Messages for receiving reports.

The functionality which is provided with the HL7 module is:

- Reception of incoming HL7 trigger event messages.
- Converting information received with the HL7 messages into DICOM conformant data sets.
- Performing patient information reconciliation processes by modifying patient demographic data stored within StoragePeak according to the HL7 requests.
- Sending appropriate response messages to the sender of the request message.

2.2 Framework

The HL7 communication takes place between the ADT actor and StoragePeak which works as the Images Manager / Image Archive actor according to the IHE Standard. Actors are communication systems or components of information systems that produce, manage or act on information associated with operational activities in the enterprise. In the following the actors are described that are affected by the StoragePeak HL7 communication:

- **ADT System:**
A system responsible for adding and/or updating patient demographic and encounter information.
- **Department System Scheduler / Order Filler:**
A system that provides functions related to the management of orders received from external systems or through the departments system's user interface.
- **Image Manager:**
A system that provides functions related to safe storage and management of evidence objects.
- **Image Archive:**
A system that provides long term storage of evidence objects.

3. Communication Interface

The HL7 Standard recommends the Minimal Lower Layer Protocol (MLLP) for the communication between HL7 systems. For this purpose the HL7 Interface of StoragePeak provides a unidirectional TCP/IP socket interface. The Lower Layer Protocol defined by the HL7 Standard is implemented as follows:

- Default TCP/IP Port: 18015 (configurable)
- Message Start Character: 0x0B
- Segment End Character: 0x0D
- Message Stop Characters: 0x1C and 0x0D
- Character Encoding: ISO 8859-1

4. Message Description

4.1 Overview

StoragePeak is able to handle a subset of ADT messages which are used to transmit portions of the Patient Administration data from one system to another.

This chapter informs about the supported HL7 versions and message types and describes the expected message contents and in which way the received data is used for further processing.

4.1.1 Supported HL7 Versions

The HL7 interface of StoragePeak supports messages which conform to the subset of HL7 version 2.3.

4.1.2 Supported Message Types

The HL7 interface of StoragePeak supports the reception of the subset of ADT, ORM and ORU message types which is listed below.

- ADT A02 (Transfer a Patient)
- ADT A03 (Discharge/End Visit)
- ADT A08 (Update Patient Information)
- ADT A40 (Merge Patient – Patient Identifier List)
- ORM O01 (Procedure scheduled/updated)
- ORU R01 (Observation Result)

4.2 ADT Messages

4.2.1 ADT A02 - Patient Transfer

The message segments and elements in the following tables are necessary to perform the patient visit update process and to generate an appropriate acknowledge message. The last column of the tables specifies the expected values and their intended use.

StoragePeak accepts ADT A02 messages without further processing.

MSH Segment

Item	Element Name	Data Type	Value
0001	Field Separator	ST	For this element ' ' is expected.
0002	Encoding Characters	ST	For this element '^~\&' is expected.
0009	Message Type	CM	For this element 'ADT^A02' is expected.
0010	Message Control ID	ST	Used to fill the acknowledge message.
0011	Processing ID	PT	Used to fill the acknowledge message.
0012	Version ID	VIT	Used for HL7 version check and to fill the acknowledge message.

PID Segment

Item	Element Name	Data Type	Value
0003	Patient Identifier List	CX	Used to identify the patient for the update process. <u>Note:</u> If this field contains more than one identifier only the first one is used for patient identification.

PV1 Segment

Item	Element Name	Data Type	Value
0003	Assigned Patient Location	PL	New assigned location for the specified patient.

Constraints:

- A PIR process can only be performed for patients with a valid Patient ID.
- PIR requests for patients which are not available in StoragePeak are ignored
- For PIR jobs no retry and visualization mechanisms are provided.

4.2.2 ADT A03 - Patient Discharge

This message type is used to signal the end of a patient's stay in a healthcare facility by updating the location of a specific patient.

StoragePeak accepts ADT A03 messages without further processing.

MSH Segment

Item	Element Name	Data Type	Value
0001	Field Separator	ST	For this element ' ' is expected.
0002	Encoding Characters	ST	For this element '^~\&' is expected.
0009	Message Type	CM	For this element 'ADT^A03' is expected.
0010	Message Control ID	ST	Used to fill the acknowledge message.
0011	Processing ID	PT	Used to fill the acknowledge message.
0012	Version ID	VIT	Used for HL7 version check and to fill the acknowledge message.

PID Segment

Item	Element Name	Data Type	Value
0003	Patient Identifier List	CX	Used to identify the patient for the update process. <u>Note:</u> If this field contains more than one identifier only the first one is used for patient identification.

PV1 Segment

Item	Element Name	Data Type	Value
0003	Assigned Patient Location	PL	New assigned location for the specified patient.

Constraints:

- A PIR process can only be performed for patients with a valid Patient ID.
- PIR requests for patients which are not available in StoragePeak are ignored

4.2.3 ADT A08 - Update Patient Information

This message type is used to update demographic and visit information of a specific patient.

MSH Segment

Item	Element Name	Data Type	Value
0001	Field Separator	ST	For this element ' ' is expected.
0002	Encoding Characters	ST	For this element '^~\&' is expected.
0009	Message Type	CM	For this element 'ADT^A08' is expected.
0010	Message Control ID	ST	Used to fill the acknowledge message.
0011	Processing ID	PT	Used to fill the acknowledge message.
0012	Version ID	VIT	Used for HL7 version check and to fill the acknowledge message.

PID Segment

Item	Element Name	Data Type	Value
0003	Patient Identifier List	CX	Used to identify the patient for the update process. <u>Note:</u> If this field contains more than one identifier only the first one is used for patient identification.
0005	Patient Name	XPN	New name for the specified patient. <u>Note:</u> If this field contains more than one name only the first one is used for the update process.
0007	Date/Time Of Birth	TS	New date/time of birth for the specified patient.
0008	Sex	IS	New sex for the specified patient.

PV1 Segment

Item	Element Name	Data Type	Value
0003	Assigned Patient Location	PL	New assigned location for the specified patient.

Constraints:

- A PIR process can only be performed for patients with a valid Patient ID.
- PIR requests for patients which are not available in StoragePeak are ignored.
- StoragePeak cannot perform a PIR process if it results in two or more identical patients.
- For PIR jobs no retry and visualization mechanisms are provided.

4.2.4 ADT A40 - Merge Patient (Patient Identifier List)

This message type is used to merge two patients identified by the Patient ID or to modify the Patient ID value of a specific patient.

MSH Segment

Item	Element Name	Data Type	Value
0001	Field Separator	ST	For this element ' ' is expected.
0002	Encoding Characters	ST	For this element '^~\&' is expected.
0009	Message Type	CM	For this element 'ADT^A40' is expected.
0010	Message Control ID	ST	Used to fill the acknowledge message.
0011	Processing ID	PT	Used to fill the acknowledge message.
0012	Version ID	VIT	Used for HL7 version check and to fill the acknowledge message.

PID Segment

Item	Element Name	Data Type	Value
0003	Patient Identifier List	CX	Used to identify the resulting patient of the merge process.

MRG Segment

Item	Element Name	Data Type	Value
0001	Prior Patient Identifier List	CX	Used to identify the patient to be merged into the resulting patient.

Notes:

- StoragePeak can handle only one merge request contained in an ADT A40 message.
- The message is discarded without further processing if the patient specified by 'Prior Patient Identifier List' element of the MRG segment is not known to the StoragePeak database
- The patient demographics (Patient ID) of the patient specified by the 'Prior Patient Identifier List' element of the MRG segment are updated if the patient specified by the 'Patient Identifier List' element of the PID segment doesn't exist in StoragePeak.

Constraints:

- A PIR process can only be performed for patients with a valid Patient ID.
- PIR requests for patients which are not available in StoragePeak are ignored.
- StoragePeak cannot perform a PIR process if it results in two or more identical patients.
- A patient cannot be merged into another patient with the same Patient ID.
- For PIR jobs no retry and visualization mechanisms are provided.

4.3 ORM Messages

4.3.1 ORM 001 – Procedure Scheduled/Updated

This message type is used to convey and update a scheduled procedure for a specific patient. StoragePeak accepts ORM 001 messages without further processing.

MSH Segment

Item	Element Name	Data Type	Value
0001	Field Separator	ST	For this element ' ' is expected.
0002	Encoding Characters	ST	For this element '^~\&' is expected.
0009	Message Type	CM	For this element 'ORM^O01' is expected.
0010	Message Control ID	ST	Used to fill the acknowledge message.
0011	Processing ID	PT	Used to fill the acknowledge message.
0012	Version ID	VIT	Used for HL7 version check and to fill the acknowledge message.

PID Segment

Item	Element Name	Data Type	Value
0003	Patient Identifier List	CX	Used to identify the patient for the scheduled procedure. <u>Note:</u> If this field contains more than one identifier only the first one is used for patient identification.
0005	Patient Name	XPN	Name of the patient. <u>Note:</u> If this field contains more than one name only the first one is used for the update process.
0007	Date/Time Of Birth	TS	Date/time of birth of the patient.
0008	Sex	IS	Sex of the specified patient.

PV1 Segment

Item	Element Name	Data Type	Value
0003	Assigned Patient Location	PL	Assigned location of the specified patient.
0007	Attending Doctor	XCN	Maps to DICOM Attending Physician
0008	Referring Doctor	XCN	Maps to DICOM Referring Physician
0015	Ambulatory Status	IS	
0019	Visit Number	CX	

ORC Segment

Item	Element Name	Data Type	Value
0001	Order Control	ID	Order Control code, which is one of "NW" for scheduling new procedures "CA" for canceled procedures "XA" for updating procedures "DC" for discontinuing procedures
0002	Placer Order Number	EI	
0003	Filler Order Number	EI	
0005	Order Status	ID	
0012	Ordering Provider	XCN	
0017	Entering Organization	CE	

OBR Segment

Item	Element Name	Data Type	Value
0004	Universal Service ID	CE	
0005	Priority	ID	
0018	Placer Field 1	ST	Maps to the DICOM Accession Number
0019	Placer Field 2	ST	Maps to the DICOM Requested Procedure ID
0020	Filler Field 1	ST	Maps to the DICOM Scheduled Procedure ID
0024	Diagnostic Serv Sect ID	ID	
0031	Reason For Study	CE	
0044	Procedure Code	CE	Maps to DICOM Study Description

ZDS Segment

Item	Element Name	Data Type	Value
0001	Study Instance UID	RP	Study Instance UID of the procedure, according to the IHE Technical Framework. The Study Instance UID is contained in the first component of the first field of the ZDS Segment actually.

4.4 ORU Messages

4.4.1 ORU R01 – Observation Result

This message type is used to convey an observation result for a specific procedure.

StoragePeak accepts ORU R01 messages containing plain ASCII results in order to store them in the database.

MSH Segment

Item	Element Name	Data Type	Value
0001	Field Separator	ST	For this element ' ' is expected.
0002	Encoding Characters	ST	For this element '^~\&' is expected.
0009	Message Type	CM	For this element 'ORU^R01' is expected.
0010	Message Control ID	ST	Used to fill the acknowledge message.
0011	Processing ID	PT	Used to fill the acknowledge message.
0012	Version ID	VIT	Used for HL7 version check and to fill the acknowledge message.

PID Segment

Item	Element Name	Data Type	Value
0003	Patient Identifier List	CX	ID of the patient. <u>Note:</u> If this field contains more than one identifier only the first one is used for patient identification.
0005	Patient Name	XPN	Name of the patient. <u>Note:</u> If this field contains more than one name only the first one is used for the update process.
0007	Date/Time Of Birth	TS	Date/time of birth of the patient.
0008	Sex	IS	Sex of the specified patient.

PV1 Segment

Item	Element Name	Data Type	Value
0003	Assigned Patient Location	PL	Assigned location of the specified patient.
0007	Attending Doctor	XCN	Maps to DICOM Attending Physician
0008	Referring Doctor	XCN	Maps to DICOM Referring Physician
0015	Ambulatory Status	IS	
0019	Visit Number	CX	

ORC Segment

Item	Element Name	Data Type	Value
0001	Order Control	ID	Order Control code, which is one of "NW" for scheduling new procedures "CA" for canceled procedures "XA" for updating procedures "DC" for discontinuing procedures
0002	Placer Order Number	EI	
0003	Filler Order Number	EI	
0005	Order Status	ID	
0012	Ordering Provider	XCN	
0017	Entering Organization	CE	

OBR Segment

Item	Element Name	Data Type	Value
0001	Set-ID OBR	SI	Sequence number of the OBR, which increments up by one for each observation segment in the group.
0002	Placer Order Number	EI	Maps to the DICOM Accession Number
0006	Requested Date/Time	TS	

OBX Segment

Item	Element Name	Data Type	Value
0001	Set-ID OBX	SI	Sequence number of the OBX, which increments up by one for each observation segment in the group.
0002	Value Type	ID	"TX" (Text, for alphanumeric responses that the program indicated may exceed 199 characters);
0005	Observation Value	TX	Actual result value or observation. The data type in OBX-2 Value Type indicates the format of the observation. The length of the observation field is variable, depending upon the value type.
0014	Date/Time of the Observation	TS	Date and Time

Notes:

- StoragePeak can handle more than one observation results in one ORU R01 message. These multiple results are specified by separate OBR and OCX segment pairs.
- New results always overwrite previous versions.

Constraints:

- Transporting observation results generally needs a unique order number. If this is not available, StoragePeak cannot process a procedure.

4.5 Acknowledge Messages

4.5.1 Message Contents

StoragePeak responds to each received HL7 message with an appropriate acknowledge message. StoragePeak generated acknowledge messages contain the segments whose contents are listed in the following tables.

MSH Segment

Item	Element Name	Data Type	Value
00001	Field Separator	ST	This element is always set to ' '.
00002	Encoding Characters	ST	This element is always set to '^~\&'.
00007	Date/Time Of Message	TS	Current date and time when the acknowledge message is created.
00009	Message Type	CM	This element is always set to 'ACK'.
00010	Message Control ID	ST	Message Control ID value from the received message.
00011	Processing ID	PT	Processing ID value from the received message.
00012	Version ID	VIT	Version ID value from the received message.

MSA Segment

Item	Element Name	Data Type	Value
00018	Acknowledgement Code	ID	see section Message Status for the used values.
00010	Message Control ID	ST	Message Control ID value from the received message.

4.5.2 Message Status

The acknowledge message tells the sender of the HL7 request message the final processing status of the message. For this the acknowledge message contains status information in form of an Acknowledge Code and an Error Condition. The values in the following table are used by the HL7 Interface of StoragePeak.

Status	Acknowledge Code	Description
Success	AA	Message accepted
Reject	AR	Message rejected (could not be stored in StoragePeak)

4.6 Attribute Mapping

The attributes received with the HL7 messages are used to modify the DICOM objects which are stored within StoragePeak. This requires the mapping of the HL7 attributes into DICOM conform data types. In this chapter all the attributes are listed which are converted for the patient information reconciliation process and/or for scheduling procedures.

If not mentioned otherwise, the following applied to all mappings: If the resulting value is longer than the maximum length allowed for the respective DICOM attribute, the value will be truncated.

4.6.1 Patient Information Reconciliation

Patient Identifier List / Prior Patient Identifier List

The HL7 'Patient Identifier' attributes are mapped to the DICOM attribute 'Patient ID'.

HL7			DICOM		
Item	Element Name	Type	Tag	Attribute Name	VR
00106	Patient Identifier List Prior Patient Identifier List	CX	0010,0020	Patient ID	LO

The resulting DICOM value contains the 'ID Number' part of the Patient Identifier List / Prior Patient Identifier List element.

If the resulting value is longer than the maximum length allowed for the DICOM attribute 'Patient ID' (max. 64 characters per element) the value will be truncated.

Patient Name

The HL7 'Patient Name' attribute is mapped to the DICOM attribute 'Patient's Name'.

HL7			DICOM		
Item	Element Name	Type	Tag	Attribute Name	VR
00108	Patient Name	XPN	0010,0010	Patient's Name	PN

The resulting DICOM value consists of the following parts of the Patient Name element. The character '^' is used as delimiter. Trailing delimiters will be deleted.

- Family Name
- Given Name
- Middle Initial Or Name
- Prefix
- Suffix

Example:

"Smith^John^J^III^DR

If the resulting value is longer than the maximum length allowed for the DICOM attribute 'Patient's Name' (max. 64 characters per element) the value will be truncated.

Date/Time Of Birth

The HL7 'Date/Time Of Birth' attribute is mapped to the DICOM attributes 'Patient's Birth Date' and 'Patient's Birth Time'.

HL7			DICOM		
Item	Element Name	Type	Tag	Attribute Name	VR
00110	Date/Time Of Birth	TS	0010,0030	Patient's Birth Date	DA

The resulting DICOM birth date value consists of year, month and day information in the format yyyymmdd. Following conditions must be kept to make further processing with this value possible:

- Year (yyyy) > 1752 (database constraint)
- Month (mm) between 1 and 12
- Day (dd) between 1 and 31

Sex

The HL7 'Sex' attribute is mapped to the DICOM attribute 'Patient's Sex'.

HL7			DICOM		
Item	Element Name	Type	Tag	Attribute Name	VR
00111	Sex	PL	0010,0040	Patient's Sex	CS

If the resulting value is longer than the maximum length allowed for the DICOM attribute 'Patient's Sex' (max. 16 characters) the value will be truncated.

Note:

The HL7 values will not be mapped to appropriate DICOM values if the HL7 element contains 'U', 'A' or 'N' which are not defined in the DICOM standard.