GE Healthcare

Centricity Enterprise Archive V4.0
HL7 Conformance Statement

Document Number: DOC1030395, revision 2

1 CONFORMANCE STATEMENT OVERVIEW

The Centricity Enterprise Archive 4.0, or EA, product provides the necessary services to facilitate the archiving and image management role in a healthcare department. It provides HL7 services to integrate with other medical systems.

EA conforms to the HL7 2.5 specification. The following message types are supported:

Table 1. Supported inbound HL7 messages

Event	Message Type	Event Type	Description
Update Patient Information	ADT	A08	Update Patient Information
Merge Patient Information	ADT	A18	Merge Patient Information
Merge Patient Information – Patient ID Only	ADT	A34	Merge Patient Information - Patient ID Only
Marge Patient – Patient Identifier List	ADT	A40	Merge Patient - Patient Identifier List
Imaging Order – Study Update	OMI	Z01	General DICOM update at Study level
Imaging Order – Series Update	OMI	Z02	General DICOM update at Series level
Imaging Order – Image Update	OMI	Z03	General DICOM update at Instance level
Observation Message	ORU	R01	Unsolicited transmission of an observation message

Table 2. Supported inbound HL7 message (GE Centricity PACS format)

Event	Message Type	Event Type	Description
Order	ORM	O01	Order Message

Table 3. Supported outbound HL7 messages

Event	Message Type	Event Type	Description
Query	QBP	Q23	Get Corresponding Identifiers

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2 INTRODUCTION

2.1 Revision History

Revision	Comment
1	Initial revision.
2	Updated section 7.3.1(HL7 configurable parameters-Secure implementation) Updated section 5.1(HL7 secure port related info)

2.2 Audience and Purpose

The reader of this document is concerned with software design and/or system integration. It is assumed that the reader of this document is familiar with the HL7 Standard and with the terminology and concepts that are used in the HL7 standard.

Centricity Enterprise Archive features an implementation of an HL7 interface. Because HL7 implementations have many different approaches and versions, the interface is configurable to a certain amount. This document describes the requirements, features, limitations and recommendations for use of the HL7 interface.

2.3 Important Considerations for the Reader

This HL7 Conformance Statement by itself is not sufficient to guarantee successful connectivity between EA and equipment from other vendors. The following considerations should be made:
The integration of equipment from different vendors (including GE Healthcare) goes beyond the scope of the HL7 standard and the HL7 Conformance Statements from GE Healthcare and other vendors. It is the responsibility of the user (or user's agent) to assess the application requirements and to design a solution that integrates GE Healthcare equipment with equipment from other vendors.
When the comparison of this HL7 Conformance Statement with a HL7 Conformance Statement from another vendor indicates that connectivity should be possible it is the responsibility of the user (or user's agent) to verify this by carrying out validation tests and to check whether all required functionality is met.
With regard to the future evolution of the HL7 standard GE Healthcare reserves the right to make changes to the EA architecture described in this document. The user (or user's agent) should ensure that any equipment connected via HL7 to GE Healthcare equipment also follows the future evolution of the HL7 standard. Failure to do so may result in (partial) loss of connectivity.

2.4 Acknowledgement of Trade Names

All trade names mentioned in this document are recognized. Centricity Enterprise Archive is a registered trademark of GE Healthcare.

2.5 Definitions, Acronyms and Abbreviations

2.5.1 Definitions

When HL7 fields are described in this document the notation field.component.subcomponent is used. For example 'Patient Identifier List.4.2' designates the second subcomponent of the fourth component of the 'Patient Identifier List' field. If a component or subcomponent is not given, the entire field or component is indicated.

2.5.2 Abbreviations

HL7	Health Level 7
EA	Enterprise Archive
TCP/IP	Transmission Control Protocol/Internet Protocol
ADT	Admission, Discharge, and Transfer message
IHE	Integrating the Healthcare Enterprise
MRG	Merge Patient Information segment
MSH	Message Header segment
OBR	Observation Request segment
ORC	Common Order segment
ORM	Order Request Messages
PID	Patient ID segment
PV1	Patient Visit segment
RIS	Radiology Information System

3 Supported Inbound HL7 Messages

This chapter provides a detailed overview of all supported inbound HL7 events.

Table 4. Overview of supported inbound HL7 messages

Functional Area	Event Code	ADT Trigger Event
ADT	A08	Update Patient Information
ADT	A18	Merge Patient Information
ADT	A34	Merge Patient Information - Patient ID Only
ADT	A40	Merge Patient - Patient Identifier List
OMI	Z01	General DICOM update at Study level
OMI	Z02	General DICOM update at Series level
OMI	Z03	General DICOM update at Instance level
ORU	R01	Unsolicited transmission of an observation message

Table 5. Overview of supported inbound HL7 messages (GE Centricity PACS format)

Functional Area	Event Code	ADT Trigger Event
ORM	O01	Order Message

Table 6. HL7 Requirement Legend (used by the segment tables).

Abbreviation	Meaning
R	Required by HL7 Standard
R-IHE	Required by IHE Standard
C	Conditional, required under certain conditions
O	Optional

3.1   Update Patient Information (Event ADT^A08)

The Patient Update Event is used by EA to update the meta information stored in the system for that patient. Table 7 lists the message type used by EA to detect this message, Table 8 lists the HL7 segments of an ADT-A08 message. Segment that are identified by Table 8 as being used are described in detail in the sub sections of this paragraph.

EA will use the Patient Identifier List field from the PID segment to select the matching studies that need to be updated.

Table 7. ADT - A08: Patient Update

Message Type	Event Code	Action
ADT	A08	Update patient metadata from the supplied information

Table 8. ADT - A08 Segments

Segment	Segment Name	HL7 Requirement	Used by EA
MSH	Message Header	R	Yes
EVN	Event Type	R	No
PID	Patient Identification	R	Yes
PV1	Patient Visit	R	No
OBX	Observation Results	C	No
AL1	Allergy	C	No

3.1.1   Used Segments

3.1.1.1   Message Header (MSH)

See paragraph 3.10.1.1for the fields of this segment and the default processing of these fields. No special processing is done in the context of an ADT- A08 message.

3.1.1.2   Patient Identification (PID)

See paragraph 3.10.1.2 for the overview of supported fields of this segment and the mapping of these fields to the DICOM data model. No special processing is done in the context of an ADT- A08 message.

3.2   Merge Patient Information (Event ADT^A18)

The Merge Patient Information Event is used by EA to update the patient meta information of the selected studies to new values. Table 9 lists the message type used by EA to detect this message, Table 10 lists the HL7 segments of an ADT-A18 message. Segment that are identified by Table 10 as being used are described in detail in the sub sections of this paragraph.

EA will select the studies that match the Patient Identifier List field from the PID segment together with the studies that match the Prior Patient Identifier List field from the MRG segment to determine the studies that need to be updated.

Table 9. ADT - A18: Patient Merge Information

Message Type	Event Code	Action
ADT	A18	Merge Patient Information

Table 10. ADT - A18 Segments

Segment	Segment Name	HL7 Requirement	Used by EA
MSH	Message Header	R	Yes
EVN	Event Type	R	No
PID	Patient Identification	R	Yes
PD1	Patient Additional Demographic	O	No
MRG	Merge Information	R	Yes
PV1	Patient Visit	O	No

3.2.1   Used Segments

3.2.1.1   Message Header (MSH)

See paragraph 3.10.1.1 for the fields of this segment and the default processing of these fields. No special processing is done in the context of an ADT- A18 message.

3.2.1.2   Patient Identification (PID)

See paragraph 3.10.1.2 for the overview of supported fields of this segment and the mapping of these fields to the DICOM data model. No special processing is done in the context of an ADT- A18 message.

3.2.1.3   Merge Information (MRG)

See paragraph 3.10.1.3 for the fields of this segment and the default processing of these fields. No special processing is done in the context of an ADT- A18 message.

3.2.2   Backward compatibility Comments

This message is maintained for backward compatibility with HL7 v2.3.1. It has been withdrawn from the HL7 v2.7 standard. Newer applications should use ADT – A40.

3.3   Merge Patient Information – Patient ID Only (Event ADT^A34)

The Merge Patient Information – Patient ID Only Event is used by EA to update the patient meta information of the selected studies to new values. Table 11 lists the message type used by EA to detect this message. Table 12 lists the HL7 segments of an ADT-A34 message. Segment that are identified by Table 12 as being used are described in detail in the sub sections of this paragraph.

EA will select the studies that match the Patient Identifier List field from the PID segment together with the studies that match the Prior Patient Identifier List field from the MRG segment to determine the studies that need to be updated.

Table 11. ADT - A34: Patient Merge Information - Patient ID Only

Message Type	Event Code	Action
ADT	A34	Merge Patient Information – Patient ID Only

Table 12. ADT - A34 Segments

Segment	Segment Name	HL7 Requirement	Used by EA
MSH	Message Header	R	Yes
EVN	Event Type	R	No
PID	Patient Identification	R	Yes
PD1	Patient Additional Demographic	O	No
MRG	Merge Information	R	Yes

3.3.1   Used Segments

3.3.1.1   Message Header (MSH)

See paragraph 3.10.1.1 for the fields of this segment and the default processing of these fields. No special processing is done in the context of an ADT- A34 message.

3.3.1.2   Patient Identification (PID)

See paragraph 3.10.1.2 for the overview of supported fields of this segment and the mapping of these fields to the DICOM data model. No special processing is done in the context of an ADT- A34 message.

3.3.1.3   Merge Information (MRG)

See paragraph 3.10.1.3 for the fields of this segment and the default processing of these fields. No special processing is done in the context of an ADT- A34 message.

3.3.2   Backward compatibility Comments

This message is maintained for backward compatibility with HL7 v2.3.1. It has been withdrawn from the HL7 v2.7 standard. Newer applications should use ADT – A40.

3.4   Merge Patient - Patient Identifier List (Event ADT^A40)

The Merge Patient Information – Patient Identifier List Event is used by EA to update the patient meta information of the selected studies to new values. Table 13 lists the message type used by EA to detect this message. Table 14 lists the HL7 segments of an ADT-A40 message. Segment that are identified by Table 14 as being used are described in detail in the sub sections of this paragraph.

EA will select the studies that match the Patient Identifier List field from the PID segment together with the studies that match the Prior Patient Identifier List field from the MRG segment to determine the studies that need to be updated.

Table 13. ADT - A40: Merge Patient - Patient Identifier List

Message Type	Event Code	Action
ADT	A40	Merge Patient – Patient Identifier List

Table 14. ADT - A40 Segments

Segment	Segment Name	HL7 Requirement	Used by EA
MSH	Message Header	R	Yes
EVN	Event Type	R	No
PID	Patient Identification	R	Yes
PD1	Patient Additional Demographic	O	No
MRG	Merge Information	R	Yes
PV1	Patient Visit	O	No

3.4.1   Used Segments

3.4.1.1   Message Header (MSH)

See paragraph 3.10.1.1 for the fields of this segment and the default processing of these fields. No special processing is done in the context of an ADT- A40 message.

3.4.1.2   Patient Identification (PID)

See paragraph 3.10.1.2 for the overview of supported fields of this segment and the mapping of these fields to the DICOM data model. No special processing is done in the context of an ADT- A40 message.

3.4.1.3   Merge Information (MRG)

See paragraph 3.10.1.3 for the fields of this segment and the default processing of these fields. No special processing is done in the context of an ADT- A40 message.

3.5   Imaging Order - Study Update (Event OMI^Z01)

The Imaging Order – Study Update event is used by EA to update the meta information stored in the system for the specified study.

Table 15. OMI - Z01: Imaging Order -Study Update

Message Type	Event Code	Action
OMI	Z01	Update specified study (Imaging Order)

Table 16. OMI - Z01 Segments

Segment	Segment Name	HL7 Requirement	Used by EA
MSH	Message Header	R	Yes
ZST	Study Update - Private	O	Yes

3.5.1   Used Segments

3.5.1.1   Message Header (MSH)

See paragraph 3.10.1.1 for the fields of this segment and the default processing of these fields. No special processing is done in the context of an OMI- Z01 message.

3.5.1.2   Study Update – Private (ZST)

This private segment is used to select and update a specific DICOM study. Table 17 shows which ZST fields are supported and used by EA. Table 18 shows the default mapping of the HL7 fields to the DICOM data model. All extracted DICOM values will be used to update the matching DICOM instances. Only the DICOM fields that are defined in the study table will be used for a study table update.

Table 17. Study Update - Private (ZST) Segment Supported Fields

Field Name	Sequence	HL7 Requirement	Used by EA
Study Instance UID	1	R	Yes
Accession Number	2	O	Yes (if present)
Study Description	3	O	Yes (if present)
Filler Order Number	4	O	Yes (if present)
Requesting Service	5	O	Yes (if present)
Requesting Physician	6	O	Yes (if present)
GEIIS Confidential Status	7	O	Yes (if present)
Study Date/Time	8	O	Yes (if present)

Patient Identifier List	9	O	Yes (if present)
Procedure Description	10	O	Yes (if present)
Procedure Code	11	O	Yes (if present)
Patient Name	12	O	Yes (if present)

Table 18. Mapping of the used ZST segment fields to DICOM tags.

HL7 Segment Field Name	DICOM Tag	DICOM Name	Level	Notes
Accession Number	(0008, 0050)	Accession Number	Study	
Study Description	(0008, 1030)	Study Description	Study	
Filler Order Number	(0040, 2017)	Filler Order Number / Imaging Service Request	Study	Tag not indexed in default configuration
Requesting Service	(0032, 1033)	Requesting Service	Study	Tag not indexed in default configuration
Requesting Physician	(0032, 1032)	Requesting Physician	Study	Tag not indexed in default configuration
GEIIS Confidential Status	(0903, 1012)	GEIIS Confidential Status	Study	See EA DICOM conformance statement for details of this private tag
Study Date/Time	(0008, 0020), (0008, 0030)	Study Date, Study Time	Study	
Patient Identifier List	(0010, 0020)	Patient ID	Study	
Procedure Description	(0008, 0104)	Code Meaning	Study	Tag not indexed in default configuration
Procedure Code	(0008, 0100)	Code Value	Study	Tag not indexed in default configuration
Patient Name	(0010, 0010)	Patient's Name	Study	

3.6 Imaging Order – Series Update (Event OMI^Z02)

The Imaging Order event is used by EA to update the meta information stored in the system for the specified series.

Table 19. OMI - Z02: Imaging Order - Series Update

Message Type	Event Code	Action
OMI	Z02	Update specified series (Imaging Order)

Table 20. OMI - Z02 Segments

Segment	Segment Name	HL7 Requirement	Used by EA
MSH	Message Header	R	Yes
ZSE	Series Update - Private	O	Yes

3.6.1 Used Segments

3.6.1.1 Message Header (MSH)

See paragraph 3.10.1.1 for the fields of this segment and the default processing of these fields. No special processing is done in the context of an OMI- Z02 message.

3.6.1.2 Series Update – Private (ZSE)

This private segment is used to select and update a specific DICOM study. Table 21 shows which ZSE fields are supported and used by EA. Table 22 shows the default mapping of the HL7 fields to the DICOM data model. All extracted DICOM values will be used to update the matching DICOM instances. Only the DICOM fields that are defined in the series table will be used for a series table update.

Table 21. Series Update - Private (ZSE) Segment Supported Fields

Field Name	Sequence	HL7 Requirement	Used by EA
Series Instance UID	1	R	Yes
Study Instance UID	2	R	Yes
Series Description	3	O	Yes (if present)

Table 22. Mapping of the used ZSE segment fields to DICOM tags.

HL7 Segment Field Name	DICOM Tag	DICOM Name	Level	Notes
Series Description	(0008, 103E)	Series Description	Series	

3.7   Imaging Order – Image Update (Event OMI^Z03)

The Imaging Order – Image Update event is used by EA to update the meta information stored in the system for the specified instance.

Table 23. OMI - Z03: Imaging Order - Image Update

Message Type	Event Code	Action
OMI	Z03	Update specified instance (Imaging Order)

Table 24. OMI - Z03 Segments

Segment	Segment Name	HL7 Requirement	Used by EA
MSH	Message Header	R	Yes
ZIM	Image Update - Private	O	Yes

3.7.1   Used Segments

3.7.1.1   Message Header (MSH)

See paragraph 3.10.1.1 for the fields of this segment and the default processing of these fields. No special processing is done in the context of an OMI- Z03 message.

3.7.1.2   Image Update – Private (ZIM)

This private segment is used to select and update a specific DICOM instance. Table 25 shows which ZIM fields are supported and used by EA. Table 26 shows the default mapping of the HL7 fields to the DICOM data model. All extracted DICOM values will be used to update the matching DICOM instances. Only the DICOM fields that are defined in the image table will be used for an image table update.

Table 25. Image Update - Private (ZIM) Segment Supported Fields

Field Name	Sequence	HL7 Requirement	Used by EA
SOP Instance UID	1	R	Yes
GEIIS Reject Status	2	O	Yes (if present)
GEIIS Significant Status	3	O	Yes (if present)
GEIIS Presentation State Type	4	O	Yes (if present)

Table 26. Mapping of the used ZIM segment fields to DICOM tags.

HL7 Segment Field Name	DICOM Tag	DICOM Name	Level	Notes

GEIIS Reject Status	(0903, 1010)	GEIIS Reject Status	Image	
GEIIS Significant Status	(0903, 1011)	GEIIS Significant Status	Image	Tag not indexed in default configuration
GEIIS Presentation State Type	(0903, 1020)	GEIIS Presentation State Type	Image	Tag not indexed in default configuration

3.8   Observation Message (Event ORU^R01)

Upon receiving an ORU message the system will create a DICOM Structured Report instance (SR) and store it in the configured virtual archive. The system will use the patient ID and Order Filler number to match against existing studies in the target archive (patient ID and Accession number). In case of a single (unambiguous) match, the new SR will be added to the study. Otherwise, the SR will be assigned to a newly created study. Even in the latter case, this mechanism ensures that multiple SR's with the same Order filler number and Patient ID land up in the same study.

Table 27. ORU - R01: Observation Message

Message Type	Event Code	Action
ORU	R01	Create DICOM Structured Report and store it

Table 28. ORU - R01 Segments

Segment	Segment Name	HL7 Requirement	Used by EA
MSH	Message Header	R	Yes
SFT	Software	O	No
PID	Patient Identification	R	Yes
PD1	Patient Demographics	O	No
NTE	Notes and Comments	O	Yes (if present)
PV1	Patient Visit	R	No
PV2	Patient Visit – additional info	O	No
ORC	Common Order	O	Yes (if present)
OBR	Observation Request	R	Yes
NTE	Notes and Comments	O	Yes (if present)
OBX	Observation	O	Yes (needs to be present)
NTE	Notes and Comments	O	Yes (if present)
CTI	Clinical Trial Identification	O	No
DSC	Continuation Pointer	O	No
ZDS	Study Instance UID	O	Yes (if present)

3.8.1   Used Segments

3.8.1.1   Message Header (MSH)

See paragraph 3.10.1.1 for the fields of this segment and the default processing of these fields. No special processing is done in the context of an ORU- R01 message.

3.8.1.2   Patient Identification (PID)

See paragraph 3.10.1.2 for the fields. The PID.3 Patient Identifier List item is used to select the study in combination with the OBR.

3.8.1.3   Notes and Comments (NTE)

This segment is used to extract data from that will be added to the DICOM structured report. Table 29 shows which NTE fields are supported and used by EA. Table 30 shows which fields are used and how they are mapped to the DICOM structured report.

Table 29. Notes and Comments (NTE) Segment Supported Fields

Field Name	Sequence	HL7 Requirement	Used by EA
Set ID - NTE	1	O	No
Source of Comment	2	O	No
Comment	3	O	Yes (if present)
Comment Type	4	O	No

Table 30. Usage of the NTE segment fields

HL7 Segment Field Name	Concept Name	Description
Comment	DCM\121070\Findings, DCM\121106\Comment	A Container will be created at top level if necessary, using the Concept Code Name "Findings" A Text field will be added to this container, using the Concept Code Name "Comment" All subcomponents will be merged, using the CR/LF insertion, and will be copied to the Comment text field.

3.8.1.4   Common Order (ORC)

This segment is used to extract data from that will be added to the DICOM structured report. Table 31 shows which ORC fields are supported and used by EA. Table 32 shows which fields are used and how they are mapped to the DICOM structured report.

Table 31. Common Order (ORC) Segment Supported Fields

Field Name	Sequence	HL7 Requirement	Used by EA
Order Control	1	R	No
Placer Order Number	2	O	No

Filler Order Number	3	O	No
Placer Group Number	4	O	No
Order Status	5	O	No
Response Flag	6	O	No
Quantity/Timing	7	O	No
Parent	8	O	No
Date/Time of Transaction	9	O	Yes (if present)
Entered By	10	O	No
Verified By	11	O	No
Ordering Provider	12	O	No
Enterer's Location	13	O	No
Call Back Phone Number	14	O	No
Order Effective Date/Time	15	O	No
Order Control Code Reason	16	O	No
Entering Organization	17	O	No
Entering Device	18	O	No
Action By	19	O	No
Advanced Beneficiary Notice Code	20	O	No
Ordering Facility Name	21	O	No
Ordering Facility Address	22	O	No
Ordering Facility Phone Number	23	O	No
Ordering Provider Address	24	O	No
Order Status Modifier	25	O	No
Advanced Beneficiary Notice Override Reason	26	O	No
Filler's Expected Availability Date/Time	27	O	No
Confidentiality Code	28	O	No
Order Type	29	O	No
Enterer Authorization Mode	30	O	No

Table 32. Usage of the ORC segment fields

HL7 Segment Field Name	Concept Name	Description
Date/Time of Transaction	HL7.2.5\00223\Date/Time of Transaction	A Text field will be added using the Concept Code Name.

3.8.1.5   Observation Request (OBR)

This segment is used to extract data from that will be added to the DICOM structured report. Table 33 shows which NTE fields are supported and used by EA. Table 34 shows which fields are used and how they are mapped to the DICOM structured report.

Table 33. Observation Request (OBR) Segment Supported Fields

Field Name	Sequence	HL7 Requirement	Used by EA
Set ID OBR	1	O	No
Placer Order Number	2	O	No
Filler Order Number	3	O	No
Universal Service Identifier	4	O	No
Priority – OBR	5	O	No
Requested Date/Time	6	O	No
Observation Date/Time	7	O	No
Observation End Date/Time	8	O	No
Collection Volume	9	O	Yes (if present)
Collector Identifier	10	O	No
Specimen Action Code	11	O	No
Danger Code	12	O	No
Relevant Clinical Information	13	O	No
Specimen Received Date/Time	14	O	No
Specimen Source	15	O	No
Ordering Provider	16	O	No
Order Callback Phone Number	17	O	No
Placer Field 1	18	O	No
Placer Field 2	19	O	No
Filler Field 1	20	O	No
Filler Field 2	21	O	No
Results Rpt/Status Chng - Date/Time	22	C	No
Charge to Practice	23	O	No
Diagnostic Serv Sect ID	24	O	No
Result Status	25	C	No
Parent Result	26	O	No
Quantity/Timing	27	O	No

Result Copies To	28	O	No
Parent	29	O	No
Transportation Mode	30	O	No
Reason for Study	31	O	No
Principal Result Interpreter	32	O	No
Assistant Result Interpreter	33	O	No
Technician	34	O	No
Transcriptionist	35	O	No
Scheduled Date/Time	36	O	No
Number of Sample Containers *	37	O	No
Transport Logistics of Collected Sample	38	O	No
Collector's Comment *	39	O	No
Transport Arrangement Responsibility	40	O	No
Transport Arranged	41	O	No
Escort Required	42	O	No
Planned Patient Transport Comment	43	O	No
Procedure Code	44	O	No
Procedure Code Modifier	45	O	No
Placer Supplemental Service Information	46	O	No
Filler Supplemental Service Information	47	O	No
Medically Necessary Duplicate Procedure Reason.	48	C	No
Result Handling	49	O	No

Table 34. Usage of the OBR segment fields

HL7 Segment Field Name	Concept Name	Description
Filler Order Number	Filler Order Number	Copied to Element (0008,0050) Accession Number
Requested Date/Time	HL7.2.5\00240\Requested Date/Time	A Date/Time field will be added using the Concept Code Name.
Observation Date/Time	HL7.2.5\00241\Observation Date/Time	A Date/Time will be added using the Concept Code Name.
Observation End Date/Time	HL7.2.5\00242\Observation End Date/Time	A Date/Time will be added using the Concept Code Name.
Results Rpt/Status Chng -	HL7.2.5\00255\Results	A Date/Time field will be added

Date/Time	Rpt/Status Change - Date/Time	using the Concept Code Name.
Principal Result Interpreter	HL7.2.5\00264\Principal Result Interpreter	A Text field will be added using the Concept Code Name.
Assistant Result Interpreter	HL7.2.5\00265\Assistant Result Interpreter	A Text field will be added using the Concept Code Name.
Technician	HL7.2.5\00266\Technician	A Text field will be added using the Concept Code Name.
Transcriptionist	HL7.2.5\00267\Transcriptionist	A Text field will be added using the Concept Code Name.

3.8.1.6   Observation (OBX)

This segment is used to extract data from that will be added to the DICOM structured report. Table 35 shows which NTE fields are supported and used by EA. Table 36 shows which fields are used and how they are mapped to the DICOM structured report.

Table 35. Observation (OBX) Segment Supported Fields

Field Name	Sequence	HL7 Requirement	Used by EA
Set ID – OBX	1	O	No
Value Type	2	O	No
Observation Identifier	3	R	No
Observation Sub-ID	4	C	No
Observation Value	5	C	No
Units	6	O	No
References Range	7	O	No
Abnormal Flags	8	O	No
Probability	9	O	Yes (if present)
Nature of Abnormal Test	10	O	No
Observation Result Status	11	R	No
Effective Date of Reference Range	12	O	No
User Defined Access Checks	13	O	No
Date/Time of the Observation	14	O	No
Producer's ID	15	O	No
Responsible Observer	16	O	No
Observation Method	17	O	No

| Equipment Instance Identifier | 18 | O | No |
| Date/Time of the Analysis | 19 | O | No |

Table 36. Usage of the OBX segment fields

HL7 Segment Field Name	Concept Name	Description
Value Type	Value Type	This field is used to determine whether this message can be processed. In case the Value Type is other than "TX", the message cannot be processed, and no Structured report will be created. The value type TX is not stored in the Structured report.
Observation Value	DCM\121070\Findings DCM\121071\Finding	A Container will be created at top level if necessary, using the Concept Code Name "Findings" A Text field will be added to this container, using the Concept Code Name "Finding" All subcomponents will be merged, using the CR/LF insertion, and will be copied to the Finding text field.

3.8.1.7   Study Instance UID (ZDS)

This segment is used to extract data from that will be added to the DICOM structured report. Table 37 shows which NTE fields are supported and used by EA.

Table 37. Study Instance UID (ZDS) Segment Supported Fields

Field Name	Sequence	HL7 Requirement	Used by EA
Study Instance UID	1	O	Yes (if present)
Study Status	2	O	No
IP Address of the study source	3	O	No
Number of Images	4	O	No
Study URL	5	O	No
Unused	6	O	No
Series Instance UID	7	O	Yes (if present)
SOP Instance UID	8	O	Yes (if present)

When present the Study Instance UID, Series Instance UID and SOP Instance UID will be used in the created SR. When not present EA will use the Study Instance UID of the selected study and generate new series and instance UIDs.

3.9   Order (Event ORM^O01)

The Imaging Order event is used between Centricity PACS and EA. It is not conform to the ORM – O01 as defined in the HL7 standard. Centricity PACS uses this event to update the private Centricity PACS tags "Confidential Patient" and "Rejected Instances". This message not intended to be used by 3rd party systems.

Table 38. ORM - A01: Order

Message Type	Event Code	Action
ORM	O01	TODO

3.10   Common Segments

This paragraph list the common segment that are used by more than HL7 message. EA only supports 1 definition and DICOM mapping per segment.

3.10.1.1   Message Header (MSH) Segment

Table 39. MSH Segment Supported Fields

Field Name	Sequence	HL7 Requirement	Used by EA
Field Separator	1	R	Yes
Encoding	2	R	Yes
Sending Application	3	R	Yes
Sending Facility	4	R	Yes
Receiving Application	5	R	Yes
Receiving Facility	6	R	Yes
Date/Time of Message	7	O	No
Security	8	O	No
Message Type	9	R	Yes
Message Control ID	10	R	Yes
Processing ID	11	R	Yes
Version ID	12	R	Yes
Sequence Number	13	O	No
Continuation Pointer	14	O	No
Accept Acknowledgement Type	15	O	No

	16	O	No
Application Acknowledgement Type	16	O	No
Country Code	17	O	No
Character Set	18	O	Yes (if present)
Principal Language of Message	19	O	No
Alternate Character Set Handling Scheme	20	O	Yes (if present)
Conformance Statement ID	21	O	No

3.10.1.2   Patient Identification (PID) Segment

Table 40 shows which PID fields are supported, required or optional and which fields from the PID segment are used by EA. Table 41 shows the mapping of the HL7 fields that are extracted from the PID segment to the DICOM data model. Note that EA has no explicit Patient model, all patient attributes are maintained at study level. All extracted DICOM values will be used to update the matching DICOM instances. Only the DICOM fields that are defined in the study table will be used for a study table update.

Table 40. PID Segment Supported Fields

HL7 Field Name	Sequence	HL7 Requirement	Used by EA
SET ID – Patient ID	1	C	No
Patient ID	2	C	No
Patient Identifier List	3	R	Yes
Alternate Patient ID	4	C	Yes (if present)
Patient Name	5	R	Yes
Mother's Maiden Name	6	O	Yes (if present)
Date of Birth	7	O	Yes (if present)
Sex	8	O	Yes (if present)
Patient Alias	9	O	Yes (if present)
Race	10	O	No
Patient Address	11	O	Yes (if present)
Country Code	12	O	No
Phone Number – Home	13	O	Yes (if present)
Phone Number – Business	14	O	No
Primary Language	15	O	No
Martial Language	16	O	No

Religion	17	O	Yes (if present)
Patient Account Number	18	O	Yes (if present)
Patient Social Security Number	19	O	No
Driver's License Number	20	O	No
Mother's Identifier	21	O	No
Ethnic Group	22	O	Yes (if present)
Birth Place	23	O	No
Multiple Birth Indicator	22	O	No
Birth Order	23	O	No
Multiple Birth Indicator	24	O	No
Birth Order	25	O	No
Citizenship	26	O	Yes (if present)
Veterans Military Status	27	O	Yes (if present)
Nationality	28	O	No
Patient Death Date/Time	29	O	No
Patient Death Indicator	30	O	No
Identity Unknown Indicator	31	O	No
Identity Reliability Code	32	O	No
Last Update Date/Time	33	O	No
Last Update Facility	34	O	No
Species Code	35	O	No
Strain	36	O	No
Production Class Code	37	O	No
Tribal Citizenship	38	O	No

Table 41. Mapping of the used PID segment fields to DICOM tags.

HL7 Segment Field Name	DICOM Tag	DICOM Name	Level	Notes
Patient Identifier List	(0010, 0020)	Patient ID	Study	
Alternate Patient ID	(0010, 1000)	Other Patient IDs	Study	
Patient Name	(0010, 0010)	Patient's Name	Study	
Mother's Maiden Name	(0010, 1060)	Patient's Mother's Birth Name	Study	Tag not indexed in default configuration
Date of Birth	(0010, 0030)	Patient's Birth Date	Study	

Sex	(0010, 0040)	Patient's Sex	Study	
Patient Alias	(0010, 1001)	Other Patient Names	Study	Tag not indexed in default configuration
Patient Address	(0010, 1040)	Patient's Address	Study	Tag not indexed in default configuration
Phone Number – Home	00102154	Patient's Telephone Numbers	Study	Tag not indexed in default configuration
Religion	001021F0	Patient's Religious Preference	Study	Tag not indexed in default configuration
Patient Account Number	00380010, 00380011	Admission ID, Issuer of Admission ID	Study	Tag not indexed in default configuration
Ethnic Group	00102160	Ethnic Group	Study	Tag not indexed in default configuration
Citizenship	00102152	Region of Residence	Study	Tag not indexed in default configuration
Veterans Military Status	00101080	Military Rank	Study	Tag not indexed in default configuration

3.10.1.3   Merge Information (MRG) Segment

Table 42 shows which PID fields are supported, required or optional and which fields from the PID segment are used by EA.

Table 42. Merge Information (MRG) Segment Supported Fields

Field Name	Sequence	HL7 Requirement	Used by EA
Prior Patient Identifier List	1	R	Yes
Prior Alternate Patient ID	2	O	No
Prior Patient Account Number	3	O	No
Prior Patient ID	4	O	No
Prior Visit Number	5	O	No
Prior Alternate Visit ID	6	O	No
Prior Patient Name	7	O	No

4   Supported Outbound HL7 Messages

This chapter provides a detailed overview of all supported outbound HL7 events.

Functional Area	Event Code	ADT Trigger Event
QBP	Q23	Get Corresponding Identifiers

4.1　Get Corresponding Identifiers (Event QBP^Q23)

This message is used by EA to perform a PIX lookup on a Master Person Index (MPI). . Table 43 lists the message type used by EA to create this message. Table 44 lists the HL7 segments of an QBP-Q23 message.

Table 43. QBP - Q23: Get Corresponding Identifiers

Message Type	Event Code	Action
QBP	Q23	Get Corresponding Identifiers

Table 44. QBP - Q23 Segments

Segment	Segment Name	HL7 Requirement	Used by EA
MSH	Message Header	R	Yes
QPD	Query Parameter Definition	R	Yes
RCP	Response Control Parameters	R	Yes

4.1.1　Used Segments

4.1.1.1　Message Header (MSH)

See paragraph 3.10.1.1 for the fields of this segment and the default processing of these fields. No special processing is done in the context of a QBP – Q23 message.

4.1.1.2　Query Parameter Definition (QPD)

Table 45 shows which fields are used by EA for the QPD segment.

Table 45. QPD Segment Supported Fields

Field Name	Sequence	HL7 Requirement	Used by EA
Message Query Name	1	R	Yes
Query Tag	2	C	Yes (fixed to value 'QRY001')
UP-PersonIdentifier	3	O	Yes
UP-WhatDomainsReturned	4	O	Yes

4.1.1.3　Response Control Parameters (RCP)

Table 46 shows which fields are used by EA for the RCP segment.

Table 46. RCP Segment Supported Fields

| Field Name	Sequence	HL7 Requirement	Used by EA
Query Priority	1	O	Yes (fixed value 'I')
Quantity Limited Request	2	O	No
Response Modality	3	O	No
Execution and Delivery Time	4	C	No
Modify Indicator	5	O	No
Sort-by Field	6	O	No
Segment group inclusion	7	O	No

5   HL7 Message Pipeline

5.1   Overview

HL7 messages go through a 'fictional' pipeline in the Enterprise Archive system. The pipeline is entered when Enterprise Archive receives a HL7 event message on a configured TCP/IP secure/unsecure port. When a message is received on a port, the following events occur:

- EA establishes a secure/unsecure connection with the host depending upon the type of port on which the message is received.
- EA verifies that the host is configured to send messages to the specific port.
- EA loads the specification file that is configured for the host, if it hasn't been loaded yet.
- The message is parsed based on the specification. This results in an internal message. Note that the specification only specifies the format that is used to validate the message and to convert the message to the internal format. The specification does not define requirements for handling the message; these requirements are described in detail in sections below.
- The internal message is passed to the virtual archive that is configured to receive messages based on the application name and facility name. If either the application name or the facility name is left empty the default virtual archive will be selected.
- An acknowledgment message is sent back to the sending host over the same connection. If the connection was aborted, no acknowledgment message is sent. If any of the handlers failed, an error acknowledgment is sent, even though the majority of archives might have handled the message correctly.
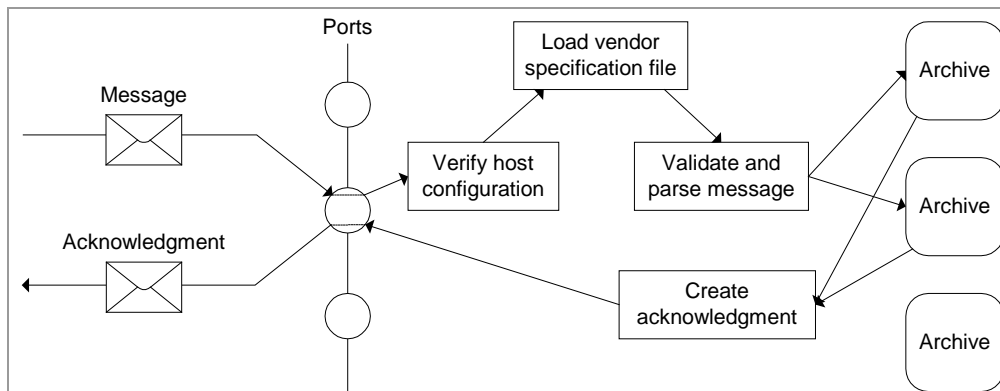
It is also assumed that a connection is closed when it is idle. For example a connection may be set up for the sending of one message and one acknowledgment and can be closed. The current implementation closes a connection if it has been idle for more than 300 seconds, resulting in a time-out message in the log. There is no upper limit to the number of simultaneous connections that can be opened.

5.2   Format Specification Files

The parsing of the incoming messages into an understandable format is a rather important step. Every vendor might have its own interpretations of the HL7 standard, as does Centricity Archive. For this purpose the format specification files have been designed. The files allow for instructing the parsing engine about

the used message format. For each different implementation a file can be created, with a default 2.5 version already being available.

5.2.1   Protocol Section

First of all, HL7 implementations use character-sequences that indicate the start and end of a message. The ASCII codes for these sequences can be configured in the protocol section of the files. The same goes for the separator character of the HL7 segments. These codes should be set to match the implementation of the sending systems, as otherwise messages cannot be recognized.

```
<protocol>
      <startchars>0x0B</startchars>
      <endchars>0x1C;0x0D</endchars>
      <segmentsep>0x0D</segmentsep>
      <fieldsep>0x7C</fieldsep>
      <componentchar>0x5E</componentchar>
      <repeatchar>0x7E</repeatchar>
      <escapechar>0x5C</escapechar>
      <subcomponentchar>0x26</subcomponentchar>
</protocol>
```

The field separator character and encoding characters in the protocol section are only used for sending out messages (such as acknowledgements), as these characters are to be determined by the sending system. To allow for maximum flexibility these are made configurable.

5.2.2   Messages Section

When messages are received, the message header (or MSH) segment is parsed. The message type is retrieved from this header, and the according <message> section in the specification file is loaded. For example, when the message header denotes an ADT^A40 message, the following section is retrieved.

```
<messages>
      <message event="ADT" type="A40">
            <expseg name="EVN"/>
            <sequence cardinalityMin="1" cardinalityMax="*">
                  <expseg name="PID"/>
                  <expseg name="PD1" required="false"/>
                  <expseg name="MRG"/>
                  <expseg name="PV1" required="false"/>
            </sequence>
      </message>
</messages>
```

This section allows the parsing engine to perform an initial message validation. In this example, it specifies that at least the EVN segments is required, and that the following sequence is expected at least once, up to an unlimited (*) amount of times. This sequence should at least contain a PID and a MRG segment; PD1 and PV1 segments are optional. If a RIS implementation does not send the EVN segment, it can be removed from this section, and the parsing engine will accept messages without such a segment.

Note that the validation according to this section does not make the final validation. The handling code for an ADT^A40 message still requires the PID and MRG segment to be available, even if the specification file would not specify this requirement.

5.2.3   Segments Section

For each of the segments found in the message, the fields are named. The naming takes place to allow the handling code to work with fields even if they're not specified in the standard order. For example, a RIS implementation might not use three different Patient ID fields and therefore omit one or two. Centricity Enterprise Archive allows handling of such messages through the <segments> section of the specification

file. The specification file should uniquely name the fields of incoming messages. For example the following part of a possible specification names the fifth field in the "EXA" segment to "Name". It also specifies that the message is considered invalid if this field (the third field) is missing in that segment (the field is required). And it specifies that the field is a "ST" data type (which means it contains a string).

```
<segments>
      <segment name="EXA">
            <field index= "1" name="IgnoredField" datatype="ignore"/>
            <field index= "2" name="ExampleField" datatype="generic">
                  <dicom tag="12345678" type="Generic"/>
            </field>
            <field index= "3" name="StringField" datatype="ST"
required="true"/>
            <field index= "5" name="Name" datatype="XPN"/>
            <field index= "7" name="TimeStamp" datatype="TS">
                  <dicom tag="00080020" type="Date">
                  <dicom tag="00080030" type="Time">
            </field>
      </segment>
</segments>
```

The value of an HL7 field can be mapped to a DICOM field. This mapping is also defined by the "dicom" elements in the XML definition above. The attribute "tag" specifies the DICOM tag that will be affected and the "type" attributes specifies the data conversion that will be performed. The details on this can be found in chapter 6.

To be able to perform the requested functionality each event requires a minimum amount of input data. The following list specifies the required input data for the different HL7 events. Note that the names for the *required fields for data selection* are fixed and are recognized by the implementation. By using the *name* in the implementation instead of the *index* each HL7 implementation can define its own field order in each event as long as the required name is defined in the HL7 specification file.

- **All events**
  - Required MSH-segment fields:
    - 'Encoding Characters' as field '1' (after the first field separator).
    - 'Message Type' as field '8'
    - 'Message Control ID' as field '9'
    - 'Processing ID' as field '10' (should always be 'P' for production)
    - 'Version ID' as field '11' (should always match specification version)
- **'Patient Update' event**
  - Supported messages: ADT^A08
  - Required fields for data selection:
    - PID.Patient Identifier List.1: "Patient Identifier List"
  - Segments used for updates if available and depending on the DICOM mapping in the definition file.
    - PID (required)
    - PV1 (optional)
    - AL1 (optional)
    - OBX (optional)
- **'Patient Merge' event**
  - Supported messages: ADT^A18, ADT^A34, ADT^A40
  - Required fields for data selection:
    - PID.Patient Identifier List.1: "Patient Identifier List"
    - MRG.Prior Patient Identifier List.1: "Prior Patient Identifier List"
  - Segments used for updates: if available and depending on the DICOM mapping in the definition file.
    - PID (required)
    - PV1 (optional)

- AL1 (optional)
- OBX (optional)

- **'Study Update' event**
  - o Supported messages: OMI^Z01
  - o Required fields for data selection:
    - ZST.1: "Study Instance UID"
  - o Segments used for updates
    - ZST.2 and following: depending on the DICOM mapping in the definition file.

- **'Series Update' event**
  - o Supported messages: OMI^Z02:
  - o Required fields for data selection: For the ZSE segment there are 2 key fields. This gives extra certainty that the correct series is adjusted. This is done because with PGP series could end up under and alternative study as before.
    - ZSE.1: "Series Instance UID"
    - ZSE.2: "Study Instance UID"
  - o Segments used for updates
    - ZSE.3 and following: depending on the DICOM mapping in the definition file.

- **'Instance Update' event**
  - o Supported messages: OMI^Z03
  - o Required fields for data selection:
    - ZIM.1: "SOP Instance UID"
  - o Segments used for updates
    - ZIM.2 and following: depending on the DICOM mapping in the definition file.

6   Supported Field Types

The HL7 standard specifies a large amount of field types. Because most field types are only used in a specific domain, those field types are not all handled by the archive. This chapter defines which field types are recognized by the archive and to what amount.

Note that information in the HL7 messages is not thoroughly validated, but treated as valid. Thus if the DICOM data is to be kept consistent, the HL7 messages must specify the data correctly.

6.1   'generic' type

This type is the second 'Centricity Archive'-specific type. It tells the parsing engine that the field is to be treated as a composite type, which is not further specified. Any data in the field's components is treated as a string type and is used for updating the archive as such.

DICOM type 'Generic' will return the HL7 value.

6.2   'CE' type: coded element

This type is handled as specified in the HL7 Standard, Version 2.5 chapter 2.A.6.

DICOM type 'Generic' will return the value of field 1: Identifier.

DICOM type 'PublicityCode': The identifier field 1 is interpreted as the Centricity PACS publicity code. A value of 'N' will be converted to a '1' and a value of 'U' will be converted to a '0'. Other values are not allowed, making this field type only suitable for the legacy ORM message.

6.3   'CX' type: extended composite ID with check digit

This type is handled as specified in the HL7 Standard, Version 2.5 chapter 2.A.14.

DICOM type 'PersonID' will return the value of field 1: ID Number.
DICOM type 'DomainID' will return the value of field 4: Assigning Authority.

6.4   'DT' type: date

This type is handled as specified in the HL7 Standard, Version 2.5 chapter 2.A.21.

This field type cannot be mapped to DICOM.

6.5   'FN' type: family name

This type is handled as specified in the HL7 Standard, Version 2.5 chapter 2.A.30.
This field type cannot be mapped to DICOM.

6.6   'HD' type: hierarchic designator

This type is handled as specified in the HL7 Standard, Version 2.5 chapter 2.A.33.

This field type cannot be mapped to DICOM.

6.7   'ID' type: coded values for HL7 tables

This type is handled as specified in the HL7 Standard, Version 2.5 chapter 2.A.35.
This field type cannot be mapped to DICOM.

6.8   'IS' type: coded value for user-defined tables

This type is handled as specified in the HL7 Standard, Version 2.5 chapter 2.A.36.

DICOM type 'Gender' will return the DICOM equivalent of the HL7 gender value:
- 'M' -> 'M'
- 'F' -> 'F'
- 'O', 'U', 'A', 'N' ->'O'
- Other values are illegal

6.9   'ST' type: string

This type is handled as specified in the HL7 Standard, Version 2.5 chapter 2.A.40.

This field type cannot be mapped to DICOM.

6.10   'TS' type: time stamp

This type is handled as specified in the HL7 Standard, Version 2.5 chapter 2.A.77, with the exception of 'Time Zone' and 'Degree of Precision'. The 'Time Zone' and 'Degree of Precision' values are currently ignored.

DICOM type 'Date' will return the interpreted date.
DICOM type 'Time' will return the interpreted time.

6.11   'XAD' type: extended address

This type is handled as specified in the HL7 Standard, Version 2.5 chapter 2.A.85.

DICOM type 'Address' will return the interpreted address in DICOM format.

6.12   'XCN' type: extended composite ID number and name

This type is handled as specified in the HL7 Standard, Version 2.5 chapter 2.A.86.
This field type cannot be mapped to DICOM.

6.13   'XPN' type: extended person name

This type is handled as specified in the HL7 Standard, Version 2.5 chapter 2.A.88.

DICOM type 'PersonName' will return the interpreted person name in DICOM format.
 Only the first five components (Family Name, Given Name, Middle Name, Suffix, Prefix) are used. The other components are ignored.

If the Family Name component contains a 'Last Name Prefix' subcomponent, this subcomponent is prefixed to the family name upon handling. Thus, in a field such as 'Buuren&van^Jaap^Jan', the family name is treated as being: 'van Buuren'.

6.14   Limitations

This release has a number of known limitations:
- NULL-fields (fields with content "") are not supported. This means that HL7 messages cannot be used to remove data from the DICOM objects.
- The repeating characters are ignored. Therefore repeating fields will not be recognized and will be treated as part of the first field.
- For data-selection only the ID of the Patient Identifier List field is used. The issuer of the ID is optional in DICOM and is therefore not used in selection. If specified however it is used in updating, so if the issuer is to be stored it can be.

7   Network Interface

7.1   Lower Layer Network Protocol

EA support the HL7 Minimal Lower Layer Protocol using TCP/IP.

7.2   IPv4 and IPv6 Support

This product supports IPv4.

7.3   Configuration

The configuration of the EA HL7 services can be changed. The mechanism how to change the configuration is documented in the Enterprise Archive Reference Guide. Only accounts with the right level of security will be able to change the configuration; support personnel will typically do this.

7.3.1   Parameters

The following general parameters are configurable for EA.

Name	Default Value	Description
Local IP address	<automatic>	IP address
Local IP netmask	<automatic>	IP netmask
Unsecure Communication enabled	Checked	Enables unsecure communication for Incoming HL7 messages
Local port number	2575	Listening port number for Unsecure HL7 interface
Secure Communication enabled	Unchecked	Enables secure communication for Incoming HL7 messages
Secure port	None	Listening port number for Secure HL7 interface
Server certificate name	None	EA server certificate name for secure inbound/outbound communication
Application Name	None	Mapping of application name to Virtual DICOM archive
Facility Name	None	Mapping of application name to Virtual DICOM archive
Idle connection timeout	300 seconds	Default timeout after which a TCP/IP connection will be closed if no messages has been received.
Accept unsupported HL7 events	false	Flag option that controls if EA accept unsupported HL7 events or rejects them with an error ACK.
Log Messages	false	Flag option that controls if EA will log every received HL7 message to a log file. This option can be used to troubleshoot interoperability issues.

Remove Trailing Separators	false	Flag option that controls is EA will remove trailing separators from HL7 fields.

The following general parameters are configurable for EA HL7 Hosts:

Name	Default Value	Description
Name	None	Administrative Host name
Host name	None	Host DNS name or IP address
HL7 Port	None	Host port for Outbound secure/unsecure communication
HL7 Application name	None	Host application name
HL7 Facility name	None	Host facility name
Format file	HL7Specification V2x.xml	Format file for HL7
HL7 Character Sets	ASCII;8859/1;8859/2;8859/3;8859/4;8859/5;8859/6;8859/7;8859/8;8859/9;ISO IR14;ISO IR87;ISO IR159;KS X 1001	Supported alternate Character sets for HL7 communication
Default Archive	None	Default Archive name for HL7 messages when no Facility name is provided in the message
Secure Profile	Unsecure	Profile to be used for communication- Unsecure, AES Encryption, RSA Authentication, or 3DES Encryption
Certificate name	None	Host certificate name. Used for remote certificate validation in secure communication.

8   Supported Character Sets

Enterprise Archive supports the following alternate character sets:

Value	Description
8859/1	The printable characters from the ISO 8859/1 Character set
8859/2	The printable characters from the ISO 8859/2 Character set
8859/3	The printable characters from the ISO 8859/3 Character set
8859/4	The printable characters from the ISO 8859/4 Character set
8859/5	The printable characters from the ISO 8859/5 Character set
8859/6	The printable characters from the ISO 8859/6 Character set
8859/7	The printable characters from the ISO 8859/7 Character set
8859/8	The printable characters from the ISO 8859/8 Character set
8859/9	The printable characters from the ISO 8859/9 Character set
GB 18030-2000	Code for Chinese Character Set (GB 18030-2000)
UNICODE UTF-8	UCS Transformation Format, 8-bit form