

SIEMENS



HL7 Conformance Statement

syngo.plaza®

Software Version VB20A

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syngo.plaza **VB20A**

SY

HL7 Conformance Statement

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1 Introduction

1.1 Purpose

This document gives a compact overview to the HL7 interface provided by *syngo.plaza*. The HL7 interface of *syngo.plaza* is based on the requirements and suggestions of the IHE Framework [1] in regards to supported message types.

Hint: Messages, which do not 100% comply with the definition of IHE, but contain the minimum required information as per definition of *syngo.plaza*, will nevertheless be processed.

1.2 Audience

This document is intended for hospital IT staff and health system integrators, software designers or implementers. It is assumed that the reader has some basic understanding of HL7 and IHE.

1.3 Definitions, Terms and Abbreviations

1.3.1 Abbreviations

ADT	A dmission, D ischarge, T ransfer
DICOM	D igital I maging & C ommunication in Medicine
HL7	H ealth L evel S even
HIS	H ospital I nformation S ystem
IHE	I ntegrating the H ealthcare E nterprise
ISO	I nternational S tandards O rganization
IS	I nformation S ystem
NHS	N ational H ealth S ervice
OEM	O riginal E quipment M anufacturer
ORM	O rder R quest M essage
OSI	O pen S ystems I nterconnection
PACS	P icture A rchiving and C ommunication S ystem
PID	P atient I dentifier- segment within ADT and ORM
PPS	P erformed P rocedure S tep
RIS	R adiology I nformation S ystem
RP	R equested P rocedure
SPS	S cheduled P rocedure S tep
TCO	T otal C ost of O wnership
XML	E xtensible M ark-up L anguage

1.3.2 Definition and Terms

ADT	A dmission, D ischarge, T ransfer. A record type used by the HL7 standard for communication of admission of patients into the hospital, discharges from hospital or internal patient transfers inside the hospital.
EVN	The EVeNt segment is a part of a HL7 message. Its purpose is to communicate the pragmatic intention (called "event") of the message. Example: a transfer of a patient to a different location will have an event code "A02" which means in HL7 a "transfer".
HL7	HL7 is a standard for information exchange between medical applications. It is an abbreviation of " H ea L th L evel S even" which stands for the 7th OSI layer protocol for the health environment. The HL7 protocol defines the format and the content of the messages that applications have to pass to one another under various conditions. Example: a central information system sends a message to a subsystem that a patient has been admitted in a hospital.
IHE	I ntegrating the H ea L thcare E nterprise is an organisation designed to stimulate the integration of the information systems that support modern healthcare institutions.
IP	I nternet P rotocol (IP) is a wide spread network protocol and base of the internet. It defines the routing of the data communication from one computer through the network to another computer. It is working in the "network layer" which is level 3 of the ISO / OSI model.
MRG	The MeRGe segment is a part of an HL7 merge message. In this segment a second patient will be referenced which is to be merged with the first patient referenced in the PID segment. The patient from PID segment will inherit all information from the other patient while the patient from MRG segment will become obsolete.
MLP	MLP stands for M inimal L ayer P rotocol. See chapter 4.2.1 for details.
MSH	The M essage H ader segment is the starting part of each HL7 message.
OBR	The OB servation R equest segment is a part of an HL7 order message.
OEM	An O riginal E quipment M anufacturer is a company that produces a component that is used and resold by another company (a so called "retailer").
ORC	The OR der C ommon segment or sometimes called OR der C ontrol is a part of an HL7 order message.
ORM	An HL7 OR der M essage. It will also be referred to as an "Order" or "HL7 Order" in this document.
OSI	OSI is the abbreviation for the O pen S ystems I nterconnection Reference Model, which is a model to describe communication in a network. Communication will be abstracted in seven logical layers. Each layer has a description on its usage and purpose.
PV1	The P atient V isit 1 segment is a part of an HL7 patient related message.
RP	A R equested P rocedure is an instance of a Procedure of a given Procedure Type. An instance of a Requested Procedure includes all of the items of information that are specified by an instance of a Procedure Plan that is selected for the Requested Procedure by the imaging service provider. For further information please refer to [1], chapter 3.4.

SPS	A Modality S cheduled P rocedure S tep is an arbitrarily defined scheduled unit of service, which is specified by the Procedure Plan for a Requested Procedure. A Modality Scheduled Procedure Step prescribes the Protocol which may be identified by one or more protocol codes. A Modality Scheduled Procedure Step involves equipment (e.g. imaging Modality equipment, anesthesia equipment, surgical equipment, and transportation equipment), human resources, consumable supplies, location, and time (e.g. start time, stop time, duration). For further information please refer to [1], chapter 3.4.
TCO	T otal C ost of O wnership is a financial estimate whose purpose is to help consumers and enterprise managers determine direct and indirect costs of a product or system. TCO not only includes the cost of the initial purchase but same all costs of later use like energy, management, maintenance, training and costs of removal and final disposal of the system.
TCP	T ransmission C ontrol P rotocol TCP provides reliable, ordered delivery of a stream of bytes from a program on one computer to another program on another computer. It is working on the "transport layer" which is level 4 of the layers of the ISO/OSI model (see above).
ZDS	Is a proprietary HL7 segment. All segments starting with letter " Z " are vendor specific and not a part of the official HL7 standard. DS stands for " D ICOM S egment". ZDS is a custom "additional identification information" from IHE. See [1], chapter B1.1 and [2], tables 4.4-7 and 4.4-8.
ZPA	Is a SIEMENS specific HL7 segment. All segments starting with letter " Z " are vendor specific and not a part of the official HL7 standard. PA stands for " P riate A tttributes".
ZSC	Is a SIEMENS specific HL7 segment. All segments starting with letter " Z " are vendor specific and not a part of the official standard. SC stands for " S ervice C ommon".

1.4 References

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- [18] DICOM_PS3.4, "DICOM PS3.4 Service Class Specifications," in *DICOM - Digital Imaging and Communication in Medicine*, Rosslyn VA, USA, National Electrical Manufacturers Association (NEMA).

2 General information

Siemens offers modalities and advanced HIS, RIS, PACS, and Processing features for all imaging needs in radiology and cardiology:

- *syngo* Workflow drives the radiological workflow from order entry to image and report distribution.
- *syngo* Dynamics is a multi-modality, dynamic image review, diagnosis and archiving system for cardiology, general imaging and obstetrics/gynecology.
- *syngo.via* enables advanced visualization for routine reading, combines modalities while reading and stays ahead with lowest TCO.
- *syngo.plaza* is a modular, scalable PACS solution for highest customer demands with focus on workflow, speed and usability.

syngo.plaza, which is in focus of this Conformance Statement, provides a set of interfaces for tight integration with radiology information systems.

- The user interfaces of the RIS and the PACS can run on the same workplace. While the physician is reporting the images both systems should display the same patient context. An OEM interface can be used to realize this workplace frontend integration. The user will see RIS and PACS programs as one program which is tightly interacting with the other part.
If the user is working in the RIS on a patient exam list then the RIS can trigger the *syngo.plaza* via the *syngo.plaza* OEM interface to open the images for these exams. When the user is working in *syngo.plaza* and opening exams then it can trigger the RIS via RIS' OEM interface to open more information about the same patient.
- For backend communication there is a bi-directional interface via HL7 messages available. An external information system can inform *syngo.plaza* about changes of patient demographics, scheduled exams and reports. *syngo.plaza* can send notifications about newly received images to external systems.
- *syngo.plaza* can use a DICOM Basic Worklist Management Services³ to request planned exams from an information system (that is: HIS, RIS).

³ For detailed description of "DICOM Basic Worklist Management Services" see [18] Annex K.

3 Overview

syngo.plaza supports the following features and messages in regards to the HL7 communication:

- Patient Update messages: ADT^A02, ADT^A03, ADT^A06, ADT^A07, ADT^A08, ADT^A40
- Patient Merge messages: ADT^A40, ADT^A18
- Planned examinations messages: OMI^O23, ORM^O01, ORU^R01
- Study/image reconciliation message: ZPA^I05, ZPAS05
- Image Notifications message: ORU^R01
- Re-initiate image notification: ZPA^G01

For the definition of these interfaces, IHE was used as a basis, therefore syngo.plaza expects the Patient Update or Merge messages from the Information System to be compliant to IHE semantics.

For an overview about all supported IHE actors/profiles, please have a look at the IHE Integration Statement published at www.siemens.com/ihe.

3.1 Supported Messages

The table below provides an overview about all HL7 messages, which are supported by syngo.plaza.

Message	Description	Segment Decomposition
Supported inbound messages (RIS/HIS → syngo.plaza PACS)		
ADT^A02	Transfer a patient	MSH, [EVN], PID, PV1
ADT^A03	Discharge/end visit	MSH, [EVN], PID, PV1
ADT^A06	Change outpatient to inpatient	MSH, [EVN], PID, PV1
ADT^A07	Change inpatient to outpatient	MSH, [EVN], PID, PV1
ADT^A08	Update patient information	MSH, [EVN], PID, [PV1]
ADT^A40	Merge Patient – patient ID list	MSH, [EVN], PID, MRG
ADT^A18	Merge Patient Information (message retained for backward compatibility)	MSH, [EVN], PID, MRG
OMI^O23	Imaging Order Message	MSH, PID, [PV1], ORC, [TQ1], OBR, [NTE], IPC
ORM^O01	General Order Message	MSH, PID, [PV1], ORC, OBR, [NTE], ZDS
ORU^R01	Unsolicited Transmission of an observation	MSH, PID, [PV1], [ORC], OBR, [NTE], ZDS
ZPA^G01	Re-Initiate image notifications	MSH, [PID], ZPA
ZPA^I05	Order level correction message	MSH, PID, [MRG], [ZSP], ZPA

ZPA^S05	Study level correction message	MSH, PID, [MRG], [ZSP], ZPA
Supported outbound messages (syngo.plaza PACS → RIS/HIS)		
ORU^R01	Unsolicited Transmission of an observation	MSH, PID, ORC, OBR, ZSC

Table 1: Overview of supported messages

Table above shows minimum required (and used) segments.

Segments in [] are optional for usage in syngo.plaza.

Please note that some of these segments are “required” in IHE. Nevertheless syngo.plaza will accept those messages and perform them.

Additional segments will be ignored.

Note on ADT^A03 message

Syngo.plaza will accept ADT^A03 messages. However these messages will have no impact on the system or change patient-relevant data. For this reason these messages are not further discussed in the below chapters.

3.2 Acknowledgment behavior

syngo.plaza will commit each HL7 message with an acknowledgement message according to [3], chapter 2.13 ACK – Acknowledgement messages and [4], chapter 2.14 ACK – Acknowledgement messages.

This will happen for all HL7 messages received from sender. Even if the message is not supported or its syntax and contents have been found inconsistent the message will be acknowledged.

The HL7 standard does describe in table 0008 different acknowledgment codes for unsuccessful or unsupported messages. From best practices we found RIS interfaces behaving very differently when an error-code (MSA-1=“AE” or “CE”) or a reject-code (MSA-1=“AR” or “CR”) was sent. In several cases the RIS responded in repeating the “incorrect/unaccepted” message or the complete interface was stuck at the RIS.

For this reason, syngo.plaza will always acknowledge with acknowledgement code “accept” (MSA-1=“AA”) in order to avoid blocking the connection queues at RIS.

The unsupported message will be stored within the backlog of the HL7 communication gateway and can be used for further investigations.

4 Implementation Details

4.1 HL7 Version

Generally *syngo.plaza* will expect HL7 version 2.3.1 [3] and HL7 version 2.5.1 [5] [6] [7] [8] as these versions are required by IHE Radiology Framework (see [1] chapter 4.2.1, and same in [2] chapter 4.2.1).

In some cases all 3 standards (HL7 2.3.1, HL7 2.5.1 and IHE) are inconsistent or conflict each other. Those cases will therefore be specially highlighted in this document.

In such cases we tried to have *syngo.plaza* product “tolerant” by accepting as much messages as possible. The weaker conditions will apply. From this messages based on intermediate version 2.4 [9] [10] [11] and 2.5 will also be processed.

HL7 messages from higher HL7 versions 2.x (like 2.6, 2.7, etc.) are downward compatible (See IHE Volume 2 [2], chapter 2.4.1.3 “HL7 versioning”). Those messages can be handled by *syngo.plaza*.

Messages from the HL7 versions 3.x are XML based. They are not supported by the *syngo.plaza* mainline. Project specific implementations are possible. Please contact your local Siemens sales.

4.2 Configuration

4.2.1 Minimal Layer Protocol

The *syngo.plaza* HL7 interface uses HL7's Minimal Layer Protocol (MLP) over TCP/IP to receive and send messages. See in [12], chapter “C.4 Minimal Lower Layer Protocol” for details.

Briefly, the message body is encoded using transaction framing starting with 0xB (hexadecimal characters) and ending with 0x1C+0x0D (hexadecimal characters).

Transmission Start	Transmission Body											Transmission End	
0xB	A	B	C	D	E	...						0x1C	0x0D

Figure 1: Encoding message using MLP

Such encoded transactions are then sent to (or received from) a TCP/IP port at the *syngo.plaza* HL7 interface.

4.2.2 Sending HL7 Messages to syngo.plaza

MLP encoded HL7 messages have to be sent to the port⁴ number 2200 at the syngo.plaza HL7 interface. Note that the TCP connection is permanent and the interface port is blocked as long as the RIS/HIS is connected to it (dedicated connection). Multiple incoming connections from different RIS/HIS are not possible in standard product.

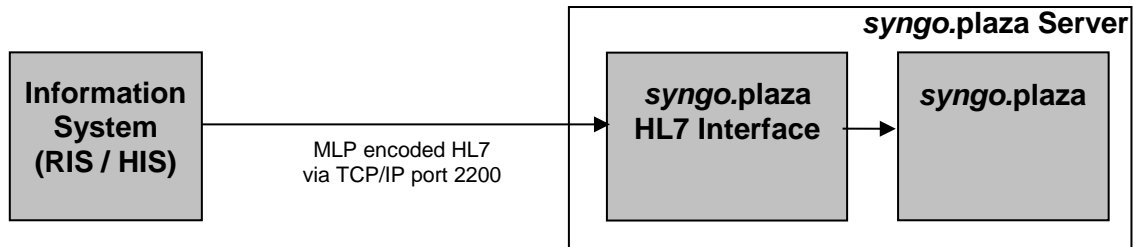


Figure 2: Incoming HL7 messages from information system to syngo.plaza

4.2.3 Sending HL7 Messages out of syngo.plaza

MLP encoded HL7 messages are sent to a receiving port of the information system.

The IP-address and the TCP port of the receiving system have to be defined by the manufacturer / implementer of the other system. Both have to be configured in the syngo.plaza HL7 interface.

syngo.plaza will establish the connection at the start of the HL7 interface. The socket will be kept until the HL7 interface is shut down.

Note that for this the TCP connection is permanent and the interface port is blocked at the IS as long as syngo.plaza is connected to the IS (dedicated connection). Multiple outgoing connections to different RIS/HIS are not possible in the standard product.

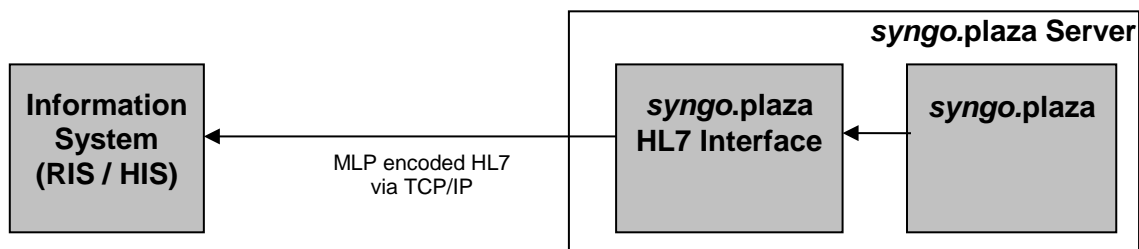


Figure 3: Outgoing HL7 messages from syngo.plaza to external Information System

4.2.4 General message syntax

HL7 message separators

The delimiters of fields and field components are defined in the first field of the message header (MSH-1).

From [3] and [4], chapter 2.5.4 “HL7 recommends the suggested values found in Figure 2-1 delimiter values”. These “suggested” values are considered fixed and not negotiable in syngo.plaza. Changing these to different delimiters will not be supported.

⁴ syngo.plaza can be customized to have a different port than 2200 for incoming messages

From this, syngo.plaza will expect the following delimiters:

Delimiter	Suggested Value	Encoding Character Position	Usage
Segment Terminator	<cr>	-	Terminates a segment record. This value cannot be changed by implementors.
Field Separator		-	Separates two adjacent data fields within a segment. It also separates the segment ID from the first data field in each segment.
Component Separator	^	1	Separates adjacent components of data fields where allowed.
Repetition Separator	~	2	Separates multiple occurrences of a field where allowed.
Escape Character	\	3	Escape character for use with any field represented by an ST, TX or FT data type, or for use with the data (fourth) component of the ED data type. If no escape characters are used in a message, this character may be omitted. However, it must be present if subcomponents are used in the message.
Subcomponent Separator	&	4	Separates adjacent subcomponents of data fields where allowed. If there are no subcomponents, this character may be omitted.

Table 2: Delimiter values ⁵

For syngo.plaza a typical message should start like this: "MSH|^~\&|".

Note on Japanese encoding "JIS X 0201"

From this, some restrictions do apply for HL7 messages which are using Japanese encoding "JIS X 0201". In encoding "JIS X 0201" the position 5-12 is occupied by the ¥ sign [13, p. 2]. In standard ASCII this character is the "\" sign – which is needed for HL7 communication. Additional tests are recommended to check whether received messages are encoded correctly.

Note on Segment terminator

All HL7 messages consist of a sequence of segments. As usual in HL7 communication syngo.plaza will expect a single "carriage return" character (that is ASCII character 13 in decimal, 0x0D in hex) to be the delimiter of segments (see [3] / [4], chapter 2.4.3, first paragraph).

Computers running Microsoft operating systems will have "carriage return (CR)" + "line feed (LF)" (that is ASCII 13+10 / 0x0d0a) as separator of lines in text files.

Messages containing CR+LF as delimiters of segments (like in text-files) are invalid according to HL7 definition.

Messages containing CR+LF will be skipped/ignored by syngo.plaza!

Handling of "line breaks" in examples in this document

Consider this example message:

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A02|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
EVN|A02|201202171139
PID|1|RAD001234|Långstrump^Pippilotta Viktualia Rullgardina Krusmynta ...
Efrainsdotter|19670511|M|Henkestr. 127^^91052^Erlangen^D
PV1|1|E|ONKO-C3|||||||001234/2012|||||||v
```

Line breaks will be treated as segment terminators inside example messages of this document. For some examples the segment might be too long to fit on one document line. If a segment breaks up to two lines then the line will end with "..." at the breaking position. The PID segment above (marked in underlined letters) is an example of a segment spreading on two lines.

⁵ Cited from [3] / [4], Figure 2-1, with modifications in order of rows

4.3 Restrictions

- Exactly one information system can connect to the HL7 interface provided by standard *syngo.plaza*.
- *syngo.plaza* does not support multiple assigning authorities.

4.4 Uniqueness of Patient ID

In healthcare facilities (hospitals, practices etc.) the identification of patients is based on identifiers attached to a patient. These identifiers are called “patient identifier” or “Patient ID” or sometimes “Medical Record Number”. They can be alphanumeric or just an ascending number. The institution that creates such an identifier is called “Assigning Authority”.

A patient identifier is considered “unique” if:

- For each patient identifier there is maximal one patient in real life.
- Each patient in real life shall have maximal one patient identifier.

In a heterogeneous system environment of multiple information systems and interchange with other hospitals and/or healthcare providers there are multiple sources for identifiers.

These sources (assigners) of identifiers can be:

- Hospital Information System (HIS) of the own institution
- Departmental systems like Radiology Information System⁶ (RIS) of the own institution
- External Information Systems (HIS / RIS) of other providers, in case
 - the patient brings in foreign images on CD
 - foreign images get sent via teleradiology
- Modalities, in case of manual registration of the patient at a modality

Each information system will assign its own identifiers. The range of identifiers from one system can overlap with the identifiers by a second system. This especially will happen if the identifiers are just an ascending number starting with number “1” for the first patient.

This means that there is a risk that the identifiers will **not** be unique and an identifier will reference two different patients (from/at different source systems). If information (e.g. images) is identified only by the patient identifier then it may happen that the images are stored under the wrong patient record.

Warning

This risk has to be mitigated by either:

- Setting up policies for importing foreign data (e.g. reconciliation of data) and manual registration at modalities (e.g. use a prefix for patient identifier) to ensure the uniqueness of the patient identifier, or
- Using additional attributes for patient identification (e.g. patient identifier together with patient-name)

⁶ Institution can have multiple RIS and/or other departmental information systems

Note

Siemens strongly advises to use the patient identifier plus the patient name to address a patient. See also next chapter.

4.5 Patient Identification Criteria

If patient records are either created or updated at the RIS, *syngo.plaza* tries to find a matching existing patient. If it finds either of that, it performs an update rather than creating a new patient record.

To match a patient record, the search mechanism can be configured to one of these two options:

- **Patient ID plus patient name matching (SIEMENS suggested setting)**
The patient ID from HL7 field PID-3 together with the patient name from field PID-5 will be used to find the patient record.
- **Patient ID only matching**
The patient ID from HL7 field PID-3 will be used to search for a patient record. This scenario is only possible if the patient ID is considered to be unique.

4.6 Patient Name

4.6.1 Name components

Patient names may consist of several different parts like family-name, given-name, academic and noble titles.

DICOM defines the "PN" (patient name) as⁷:

"For human use, the five components in their order of occurrence are:

- family name complex
- given name complex
- middle name
- name prefix
- name suffix. [..]

The component delimiter shall be the caret "^" character (5EH)"

There is a similar (but not same) name format XPN in the HL7 standards⁸

This defines name component 4 as prefix (in DICOM it is #5) and component 5 as suffix (in DICOM it is #4). Furthermore, there are some components not known to DICOM.

syngo.plaza will not interpret the components #4 and #5 of the name. If the components suffix and prefix are used then we will expect them to be mapped the same way in DICOM and HL7 communication. This complies with IHE requirements in [2], "Appendix B: HL7 Order Mapping to DICOM MWL", note number 10.

⁷ See in DICOM [14], chapter 6.2 Value Representation, table 6.2-1, where VR Name is "PN".

⁸ See for HL7 version 2.3.1 in [3] chapter "2.8.51 XPN - extended person name" and for HL7 2.5.1 in [4] chapter "2.A.88 XPN - extended person name".

4.6.2 Names in parallel writing systems

Some countries like China, Japan and Korea have different writing systems in parallel to write patient names.

Example:

The Japanese name which is written in Latin as “Yamada, Tarou” can be same written as □ □ □ □ using Kanji characters or with Hiragana characters as □ □ □ □ □ □. Kanji uses characters by their symbolic meaning – while Hiragana or Katakana uses character for the pronunciation.

Following to DICOM standard, syngo.plaza will use up to 3 so called “component groups” for the different writings of the same name. For details see in [14], chapter “6.2 Value representations”, where VR name is “PN” and in chapter 6.2.1.2). Component groups will be delimited by an equal-sign character “=” (0x3D). Delimiters are required even if a component group may be empty.

The used component groups will be in order of their appearance:

1. **alphabetic** / single-byte (For instance: Latin, Greek, Cyrillic or Katakana characters)
ISO 2022 escapes for Code Extension shall not be used in this component group
2. **ideographic** (Chinese characters, Japan: Kanji characters, Korea: Hanja characters)
3. **phonetic** (Korea: Hangul characters, Japan: Hiragana/Katakana characters)

The maximum length of each component group may be 64 characters, which includes the Component delimiters “^” and component group delimiters “=”.

Examples:

Japanese name containing Latin, Kanji and Hiragana characters

Yamada^Tarou=□ □ ^□ □ =□ □ □ ^□ □ □ (Example H.3-1 in [14])

Japanese name containing Katakana, Kanji and Hiragana characters

□ □ □ ^□ □ □ =□ □ ^□ □ □ (Example H.3-2 in [14])

Korean name containing Latin, Hanja (ideographic) and Hangul (phonetic) characters

Hong^Gildong=□ ^□ □ =홍길동 (Example I.2-1 in [14])

Chinese names containing Latin and Hanzi (ideographic) characters

Wang^XiaoDong=□ ^□ □ = (Example J.1-1 in [14])

Wú^Xiùlán^^=吴^ 婊^

Western / Other Names

Gómez Ibáñez^José Ramón

Adams^John Robert Quincy^^Rev.^B.A. M.Div. (Example from chapter 6.2.1.1 in [14])

Михайлов^Андрей^Абрамович

4.7 Supported character-sets

Characters from different languages outside English can use different encodings to transmit the same character from a foreign alphabet.

Example: The Russian character “Ю” (capital “JU”) can be transmitted with the following encodings:

	Unicode	8859-5	CP1251	MacCyr	KOI8
Ю (Ju)	0x042E (2 Bytes)	0xCE	0xDE	0x9E	0xE0

Table 3: Representations of Russian character “Ю” in different encodings

The ISO OSI model defines character encoding to be in level 6. HL7 works on ISO OSI model level 7 (HL7). Strictly seen HL7 does not give a standard on character encoding. So it is open for all character encodings that exist.

syngo.plaza has been carefully tested with some highly used character sets. Currently below listed character-sets are tested and will be supported for syngo.plaza’s HL7 communication. Some other not listed character-sets may work too but they were not explicitly tested. If needed in your project, please contact Siemens local sales representative or Siemens Healthcare Headquarter in Erlangen, Interoperability Competence Center (ICC).

Language(s)	HL7 message character encoding	Setting at HL7 Interface	Microsoft Code-page	DICOM equivalent ⁹	Re-mark
West European ¹⁰	ISO Latin-1 Western European	ISO-8859-1	28591	ISO_IR 100	See (1)
	Windows code page 1252	cp1252	1252	(ISO_IR 100)	
East-Europe Slavic ¹¹	ISO Latin-2 Central European	ISO-8859-2	28592	ISO_IR 101	
	Windows code page 1250	cp1250	1250	(ISO_IR 101)	
South European ¹²	ISO Latin-3 South European	ISO-8859-3	28593	ISO_IR 109	
North European ¹³	ISO Latin-4 North European	ISO-8859-4	28594	ISO_IR 110	
Russian / Slavic / Cyrillic ¹⁴	ISO Latin/Cyrillic	ISO-8859-5	28595	ISO_IR 144	
	Windows-1251	cp1251	1251	(ISO_IR 144)	
	KOI-8 (Russian KOI-8R)	KOI-8	20866	(ISO_IR 144)	

⁹ Character sets in () have a same set of chars in HL7 and in DICOM test, but listed in different orders

¹⁰ Albanian, Basque, Breton, Catalan, Corsican, Danish, English, German, Icelandic, Irish, Italian, Malay, Norwegian, Portuguese, Spanish, Scottish, Swedish
Outer-European: Afrikaans, Filipino, Indonesian, Malay, Somali, Swahili, Zulu
French without characters “œ”, “æ” and “ÿ” / Estonian, Finnish without Š, š, Ž, ž

¹¹ Bosnian (Latin script), Croatian, Czech, Hungarian, Polish, Slovene, Slovak
Romanian (if characters Ș ș Ț ț are replaced by Ş ş Ț ț)

¹² Afrikaans, Catalan, Galician, Italian, Maltese, Turkish

¹³ Danish, Greenlandic, Estonian, Latvian, Lithuanian, Sami, Norwegian, Swedish

¹⁴ Bulgarian, Belarusian, Macedonian, Montenegrin, Russian, Serbian, Ukrainian (without letters Ѓ, ʀ)

Arabic (High Arabic)	ISO Latin/Arabic	iso-8859-6	28596	ISO_IR 127	See (2)
	Windows-1256	cp1256	1256	(ISO_IR 127)	
Greek (monotonic)	ISO Latin/Greek	iso-8859-7	28597	ISO_IR 126	
	Windows-1253	cp1253	1253	(ISO_IR 126)	
Hebrew (without vowels)	ISO Latin/Hebrew	iso-8859-8	28598	ISO_IR 138	See (3)
	Windows-1255	cp1255	1255	(ISO_IR 138)	
Turkish	ISO Latin-5 Turkish resp. Windows-1254	ISO-8859-9	28599 1254	ISO_IR 148	See (4)
Thai	ISO Latin/Thai, ISO-8859-11 Thai norm TIS622-2533 [15]	windows-874	874	ISO_IR 166	See (5)
Chinese	Chinese standard GB18030 [16]	GB18030	54936	GB18030	
Japanese (Hiragana, Katakana, Kanji)	JIS X 0201:1969 resp. C 6220-1969 (ISO_IR 13 / ISO_IR 14) JIS X 0208:1983 resp. JIS C 6226-1983 (ISO 2022 IR 87) JIS X 0212:1990 (ISO 2022 IR 159)	ISO-2022- JP-2	50222	ISO_IR 13 ISO_IR 14 ISO 2022 IR 13 ISO 2022 IR 14 ISO 2022 IR 87 ISO 2022 IR 159	
Korean (Hangul, Hanja)	ISO-2022-KR (see note 6)	ibm-25546	50225	ISO 2022 IR 149	See notes (6) (7)
	Windows codepage 949	windows- 949-2000	949		
All known languages	Unicode UTF-8	UTF-8	65001	ISO_IR 196	

Table 4: Supported character sets for different languages

General remarks:

(General) All specific char-sets have been cross-checked for interaction with UTF-8 code-set. That means it has been tested that:

- Images received in UTF-8 (that is ISO_IR 196) can be updated with other char-sets (like ISO-8859-X, ISO-2022-KR etc.)
- Images received in other char-sets (ISO-8859-X, ISO-2022-JP etc.) can be updated by UTF-8 messages.

Limitations of specific char-sets for not existing characters may apply.

Example:

- A DICOM image will be sent with "ISO_IR 196" (UTF-8) with patient-Name "De Brøer, Tomáš". All characters exist in the UTF-8 char-set and can be updated by HL7 message in UTF-8.
- An HL7 update to name "De Brøer, Tomáš" in cp1252 char-set is possible because all characters exist in this char-set.
- An HL7 update to name "De Brøer, Tomáš" in char-set iso-8859-1 is NOT possible because the characters "ø" and "š" do not exist in this char-set.

Remarks in table:

- (1) Char-set ISO-8859-1 does not support French characters “œ”, “ø” and “ÿ”.
It does not support “š”, “š”, “ž”, “ž” needed for Estonian and Finnish foreign words.
Please use UTF-8 (ISO IR 196) encoding, if these characters are needed.
- (2) Arabic windows code-page 1256 (cp1256) is not equivalent to ISO-8859-6.
The char-set iso-8859-6 has all characters from high Arabic. The windows codepage cp1256 has some additional characters for local dialects and non-Arabic languages (like Pashtu and Farsi) which are missing in ISO-8859-6.
DICOM communication will support only ISO-8859-6 (ISO_IR 127).
You might face problems in your workflow if you use cp1256 and update names with characters which do not exist in ISO-8859-6.
Please use UTF-8 (ISO_IR 196) encoding if characters other than high Arabic need to be supported.
- (3) Hebrew in ISO-8859-8 (ISO_IR 138) does not support vowel-characters like in Hebrew word “דָּנִיֵּאֵל” (“Dāniyēl” / Daniel). This is not needed because in common writing vowels will be omitted and “דָּנִיֵּאֵל” (“Dnyel” / Daniel) will be written instead.
Windows code-page cp1255 will support vowel-letters, but this code-page is not defined for DICOM communication.
Please use UTF-8 (ISO_IR 196) encoding if Hebrew vowel-characters are explicitly used in your installation.
- (4) The char-sets ISO-8859-9 (Latin-5, Turkish) and Windows-1254 (cp1254) have differences in the area 0x80 to 0x9F. ISO-8859-9 defines it with control characters (C1 set), while Windows-1254 defines it with some additional characters which are not needed to display Turkish language.
Both sets have been tested for used Turkish characters and will both work.
- (5) For Thai HL7 encoding the value “windows-874” is to be used in HL7 interface configuration. The value “iso-8859-11” will not work.
- (6) For **Korean HL7 encoding** two standards will be supported.
 - a. For encoding “**ISO-2022-KR**” the value “ibm-25546” is to be used in HL7 interface configuration (the value “ISO-2022-KR” will **not** work.). This encoding is 7-bit safe, which means that G0 (ASCII) and G1 (ISO-2022-KR) are both used in the GR area (0x20-0x7E). Locking shifts have to be used to switch to Korean characters (Shift Out - 0x0E) respectively to switch back to ASCII7 (Shift In - 0x0F).
 - b. **Windows code-page 949** is an extension of **EUC-KR**; it contains Wansun KS X 1001 and Johab.
For this encoding the value “windows-949-2000” must be used in HL7 interface configuration.
ASCII7 characters are encoded within 1 byte with bit 7 not set (GL area) and EUC-KR/cp949 characters in 2 bytes with bit 7 are set (GR area).
Escape sequences are not used to switch.

Other values will not work.
- (7) **Korean DICOM encoding** will use “ISO 2022 IR 149” with G0 (ASCII7) in GL area (0x20-0x7E) and G1 (Korean) in GR area (0xA1-0xFE), see [17], "Table C.12-4. Defined Terms for Multi-Byte Character Sets with Code Extensions".
Locking Shifts (SI, SO) are not supported. See [14], Chapter "6.1.2.5.2 Restrictions for Code Extension".

5 Inbound messages RIS to PACS

5.1 Patient Administration Messages

The Patient Information Update and Patient Merge messages trigger changes to patient information, including patient demographics, patient identification, patient location/class changes, and patient data record merges. These changes may occur at any time on any patient record. These messages are used for both inpatients (i.e., those who are assigned a bed at the facility) and outpatients (i.e., those who are not assigned to a bed at the facility). *syngo.plaza* will modify the patient meta database of images on all patient update and merge messages mentioned in this document.

If there are currently no studies and images of this patient stored in the database then the message will be stored (cached) for later coming in images. Period to store these messages can be configured in the *syngo.plaza* web administration.

5.1.1 Transfer a patient (ADT^A02)

If a patient changes his physical location (that is for example: moved to another ward) then an ADT^A02 message should be send.

Syntax / Semantics

The table below indicates the message semantics of the ADT^A02 message.
For syntax details, please refer to [3] and [6].

Segments	Segment names	Chapter in HL7 v2.3.1
MSH	Message Header	2
[EVN] ¹⁵	Event Type (optional segment)	3
PID	Patient Identification	3
PV1	Patient Visit	3

Table 5: Message semantics of ADT^A02

The following fields will be used in the *syngo.plaza* interfaces:

Field	Element-Name	Required R=required O=optional		Remarks	DICOM attribute
		HL7	plaza		
MSH-1	Field separator	R	R	Constant " " (Pipe-sign)	
MSH-2	Encoding Characters	R	R	Constant "~\&"	
MSH-7	Date/Time Of Message	O/R	O ¹⁶		
MSH-9	Message type	R	R	Constant "ADT^A02"	
MSH-10	Message Control ID	R	R		

¹⁵ EVN segment is required in IHE.

¹⁶ O/R/O: The field is optional in HL7 standard 2.3.1 and in *syngo.plaza* but required in HL7 standard 2.5.1. The message will be processed by the interface if the field is empty.

MSH-11	Processing ID	R	O	Constant "P" (=Production)	
MSH-12	Version ID	R	R		
EVN-1	Event Type Code	B	O	Constant "A02"	
EVN-2	Recorded Date/Time	R	O ¹⁷		
PID-3	Patient Identifier List	R	R	Patient-ID and NHS number (if applicable)	(0010,0020) (0010,1000)
PID-4	Alternate Patient ID	O	O	Ignored by syngo.plaza	
PID-5	Patient Name	R	R	DICOM Name format A02 message will not modify the field "patient-name". Send an additional A08 or A40 instead.	(0010,0010)
PID-7	Date/Time of Birth	O	O	A02 message will not modify the field "date of birth". Send an additional A08 instead.	(0010,0030)
PID-8	Sex	O	O	A02 message will not modify the field "sex". Send an additional A08 instead.	(0010,0040)
PID-10	Race	O	O	Ignored by syngo.plaza	
PID-11	Patient Address	O	O	Ignored by syngo.plaza	
PID-13	Phone Number Home	O	O	Ignored by syngo.plaza	
PID-14	Phone Number Buiss.	O	O	Ignored by syngo.plaza	
PID-16	Marital Status	O	O	Ignored by syngo.plaza	
PID-18	Patient Account Number	O	O	Ignored by syngo.plaza	
PID-19	SSN Number - Patient	O	O	Ignored by syngo.plaza	
PV1-2	Patient Class	R	R	Supported values ¹⁸ are: E Emergency I Inpatient O Outpatient P Pre-admit R Recurring Patient B Obstetrics C Commercial Acc. N Not applicable U Unknown	

¹⁷ R / O: The field is required in HL7 standard but is allowed to be empty or missing in syngo.plaza. The message will be successfully processed even if this field is empty.

¹⁸ Accepted values are as of HL7 chapter 3, see [9] [6], suggested values from user defined table 0004.

PV1-3.1	Assigned Patient Location - sub-field 1: Point of care	O	O	Free text	
PV1-7	Attending Doctor	O	O	Ignored by syngo.plaza	
PV1-8	Referring Doctor	O	O	Ignored by syngo.plaza	
PV1-9	Consulting Doctor	O	O	Ignored by syngo.plaza	
PV1-10	Hospital Service	O	O	Ignored by syngo.plaza	
PV1-15	Ambulatory Status	O	O	Ignored by syngo.plaza	
PV1-17	Admitting Doctor	O	O	Ignored by syngo.plaza	
PV1-18	Patient Type	O	O	Ignored by syngo.plaza	
PV1-19	Visit Number	O	O	Ignored by syngo.plaza	
PV1-20	Financial Class	O	O	Ignored by syngo.plaza	
PV1-36	Discharge Disposition	O	O	Ignored by syngo.plaza	
PV1-39	Servicing Facility	O	O	Ignored by syngo.plaza	
PV1-44	Admit Date/Time	O	O	Ignored by syngo.plaza	
PV1-45	Discharge Date/Time	O	O	Ignored by syngo.plaza	

Table 6: Fields used in interface for A02 messages

Pragmatics

On an A02 message, syngo.plaza will only modify the field “patient location” (from PV1-3). All other fields remain unchanged. For changing these other fields please send an A08 message instead.

Examples of HL7 A02 messages that are accepted by syngo.plaza

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A02|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
PID|||RAD001234||Test^Name
PV1||I|ONKO-C3
```

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A02|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
EVN|A02|201202171139
PID|||RAD001234||Test^Name||19670511|M||Henkestr. 127^91052^Erlangen^D
PV1||I|ONKO-C3|||001234/2012|||v
```

5.1.2 Transfer an Outpatient to Inpatient (ADT^A06)

Hospitals and medical institutions can treat patients that come on an ambulatory basis (so called “Outpatient patients”) as well as patients that will have a bed at a ward inside that hospital (so called “Inpatient patients”).

When a patient is hospitalized he will assigned to a ward and his status will change from “Outpatient” to “Inpatient”. In such cases the HIS/RIS should send an ADT^A06 message to the PACS.

Syntax / Semantics

The table below indicates the message semantics of the ADT^A06 message.

For syntax details, please refer to [3] and [6].

Segments	Segment names	Chapter in HL7 v2.3.1
MSH	Message Header	2
[EVN] ¹⁹	Event Type (optional segment)	3
PID	Patient Identification	3
PV1	Patient Visit	3

Table 7: Message semantics of ADT^A06

The following fields will be used in the syngo.plaza interfaces:

Field	Element-Name	Required R=required O=optional		Remarks	DICOM attribute
		HL7	plaza		
MSH-1	Field separator	R	R	Constant “ ” (Pipe-sign)	
MSH-2	Encoding Characters	R	R	Constant “^~\&”	
MSH-7	Date/Time Of Message	O/R	O ²⁰		
MSH-9	Message type	R	R	Constant “ADT^A06”	
MSH-10	Message Control ID	R	O ²¹		
MSH-11	Processing ID	R	O	Constant “P” (=Production)	
MSH-12	Version ID	R	R		
EVN-1	Event Type Code	B	O	Constant “A06”	
EVN-2	Recorded Date/Time	R	O		
PID-3	Patient Identifier List	R	R	Patient-ID and NHS number (if applicable)	(0010,0020) (0010,1000)
PID-4	Alternate Patient ID	O	O	Ignored by syngo.plaza	

¹⁹ EVN segment is required in IHE.

²⁰ O/R/O: The field is optional in HL7 standard 2.3.1 and in syngo.plaza but required in HL7 standard 2.5.1. The message will be processed by the interface if the field is empty.

²¹ R / O: The field is required in HL7 standard but is allowed to be empty or missing in syngo.plaza. The message will be successfully processed even if this field is empty.

PID-5	Patient Name	R	R	DICOM Name format A06 message will not modify the field "patient-name". Send an additional A08 or A40 instead.	(0010,0010)
PID-7	Date/Time of Birth	O	O	A06 message will not modify the field "date of birth". Send an additional A08 instead.	(0010,0030)
PID-8	Sex	O	O	A06 message will not modify the field "sex". Send an additional A08 instead.	(0010,0040)
PID-10	Race	O	O	Ignored by syngo.plaza	
PID-11	Patient Address	O	O	Ignored by syngo.plaza	
PID-13	Phone Number Home	O	O	Ignored by syngo.plaza	
PID-14	Phone Number Buiss.	O	O	Ignored by syngo.plaza	
PID-16	Marital Status	O	O	Ignored by syngo.plaza	
PID-18	Patient Account Nbr	O	O	Ignored by syngo.plaza	
PID-19	SSN Number - Patient	O	O	Ignored by syngo.plaza	
PV1-2	Patient Class	R	R	Expected value is: "I" = Inpatient.	
PV1-3.1	Assigned Patient Location - sub-field 1: Point of care	O	O	A06 messages will not modify the field "Patient Location". Send an additional A02 message instead.	
PV1-7	Attending Doctor	O	O	Ignored by syngo.plaza	
PV1-8	Referring Doctor	O	O	Ignored by syngo.plaza	
PV1-9	Consulting Doctor	O	O	Ignored by syngo.plaza	
PV1-10	Hospital Service	O	O	Ignored by syngo.plaza	
PV1-15	Ambulatory Status	O	O	Ignored by syngo.plaza	
PV1-17	Admitting Doctor	O	O	Ignored by syngo.plaza	
PV1-18	Patient Type	O	O	Ignored by syngo.plaza	
PV1-19	Visit Number	O	O	Ignored by syngo.plaza	
PV1-20	Financial Class	O	O	Ignored by syngo.plaza	
PV1-36	Discharge Disposition	O	O	Ignored by syngo.plaza	
PV1-39	Servicing Facility	O	O	Ignored by syngo.plaza	
PV1-44	Admit Date/Time	O	O	Ignored by syngo.plaza	
PV1-45	Discharge Date/Time	O	O	Ignored by syngo.plaza	

Table 8: Fields used in interface for A02 messages

Pragmatics

On an A06 message, syngo.plaza will only modify the field “patient class” (from PV1-2). All other fields remain unchanged. For changing these other fields please send an A08 respectively A02 message instead.

Examples of HL7 A06 messages that are accepted by syngo.plaza

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A06|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
PID|||RAD001234||Test^Name
PV1||I|ONKO-C3
```

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A06|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
EVN|A06|201202171139
PID|||RAD001234||Test^Name||19670511|M|||Henkestr. 127^^91052^Erlangen^D
PV1||I|ONKO-C3|||001234/2012|||v
```

5.1.3 Transfer an Inpatient to Outpatient (ADT^A07)

When a patient is released from hospital to home or other institutions he will lose his assignment to ward/bed and his status will change from "Inpatient" back to "Outpatient". In such cases the HIS/RIS should send an ADT^A07 message to the PACS.

In this ADT^A06 and ADT^A07 messages can be seen as "opponents" taking back the effects of the other message.

Syntax / Semantics

The table below indicates the message semantics of the ADT^A07 message.

For syntax details, please refer to [3] and [6].

Segments	Segment names	Chapter in HL7 v2.3.1
MSH	Message Header	2
[EVN] ²²	Event Type (optional segment)	3
PID	Patient Identification	3
PV1	Patient Visit	3

Table 9: Message semantics of ADT^A07

The following fields will be used in the syngo.plaza interfaces:

Field	Element-Name	Required		Remarks	DICOM attribute
		R=required O=optional HL7	plaza		
MSH-1	Field separator	R	R	Constant " " (Pipe-sign)	
MSH-2	Encoding Characters	R	R	Constant "^~\&"	
MSH-7	Date/Time Of Message	O/R	O ²³		
MSH-9	Message type	R	R	Constant "ADT^A07"	
MSH-10	Message Control ID	R	O ²⁴		
MSH-11	Processing ID	R	O	Constant "P" (=Production)	
MSH-12	Version ID	R	R		
EVN-1	Event Type Code	B	O	Constant "A07"	
EVN-2	Recorded Date/Time	R	O		
PID-3	Patient Identifier List	R	R	Patient-ID and NHS number (if applicable)	(0010,0020) (0010,1000)
PID-4	Alternate Patient ID	O	O	Ignored by syngo.plaza	

²² EVN segment is required in IHE.

²³ O/R/O: The field is optional in HL7 standard 2.3.1 and in syngo.plaza but required in HL7 standard 2.5.1. The message will be processed by the interface if the field is empty.

²⁴ R / O: The field is required in HL7 standard but is allowed to be empty or missing in syngo.plaza. The message will be successfully processed even if this field is empty.

PID-5	Patient Name	R	R	DICOM Name format A07 message will not modify the field "patient-name". Send an additional A08 or A40 instead.	(0010,0010)
PID-7	Date/Time of Birth	O	O	A07 message will not modify the field "date of birth". Send an additional A08 instead.	(0010,0030)
PID-8	Sex	O	O	A07 message will not modify the field "sex". Send an additional A08 instead.	(0010,0040)
PID-10	Race	O	O	Ignored by syngo.plaza	
PID-11	Patient Address	O	O	Ignored by syngo.plaza	
PID-13	Phone Number Home	O	O	Ignored by syngo.plaza	
PID-14	Phone Number Buiss.	O	O	Ignored by syngo.plaza	
PID-16	Marital Status	O	O	Ignored by syngo.plaza	
PID-18	Patient Account Number	O	O	Ignored by syngo.plaza	
PID-19	SSN Number - Patient	O	O	Ignored by syngo.plaza	
PV1-2	Patient Class	R	R	Expected value is: "O" = Outpatient.	
PV1-3.1	Assigned Patient Location - sub-field 1: Point of care	O	O	A07 messages will not modify the field "Patient Location". Send an additional A02 message instead.	
PV1-7	Attending Doctor	O	O	Ignored by syngo.plaza	
PV1-8	Referring Doctor	O	O	Ignored by syngo.plaza	
PV1-9	Consulting Doctor	O	O	Ignored by syngo.plaza	
PV1-10	Hospital Service	O	O	Ignored by syngo.plaza	
PV1-15	Ambulatory Status	O	O	Ignored by syngo.plaza	
PV1-17	Admitting Doctor	O	O	Ignored by syngo.plaza	
PV1-18	Patient Type	O	O	Ignored by syngo.plaza	
PV1-19	Visit Number	O	O	Ignored by syngo.plaza	
PV1-20	Financial Class	O	O	Ignored by syngo.plaza	
PV1-36	Discharge Disposition	O	O	Ignored by syngo.plaza	
PV1-39	Servicing Facility	O	O	Ignored by syngo.plaza	
PV1-44	Admit Date/Time	O	O	Ignored by syngo.plaza	
PV1-45	Discharge Date/Time	O	O	Ignored by syngo.plaza	

Table 10: Fields used in interface for A02 messages

Pragmatics

On an A07 message, syngo.plaza will only modify the field “patient class” (from PV1-2).
All other fields remain unchanged. For changing these other fields please send an A08
respectively A02 message instead.

Examples of HL7 A07 messages that are accepted by syngo.plaza

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A07|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
PID|||RAD001234||Test^Name
PV1||O|ONKO-C3
```

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A07|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
EVN|A07|201202171139
PID|||RAD001234||Test^Name||19670511|M|||Henkestr. 127^^91052^Erlangen^D
PV1||O|ONKO-C3|||001234/2012|||v
```

5.1.4 Patient Information Update (ADT^A08)

Changes to patient demographics and account information (e.g. change in patient name, patient address, etc.) shall trigger an ADT^A08 Update Patient message.

Syntax / Semantics

The table below indicates the message semantics of the ADT^A08 message. Only segments used by syngo.plaza will be displayed. For syntax please refer to [3] and [6].

Segments	Segment names	Chapter in HL7 v2.3.1
MSH	Message Header	2
[EVN] ²⁵	Event Type (optional segment)	3
PID	Patient Identification	3
[PV1] ²⁶	Patient Visit (optional segment)	3

Table 11: Message semantics of ADT^A08

The following fields will be used in the syngo.plaza interfaces:

Field	Element-Name	Required R=required O=optional		Remarks	DICOM attribute
		HL7	plaza		
MSH-1	Field separator	R	R	Constant “ ” (Pipe-sign)	
MSH-2	Encoding Characters	R	R	Constant “^~\&”	
MSH-7	Date/Time Of Message	O/R	O ²⁷	See footnote	
MSH-9	Message type	R	R	Constant “ADT^A08”	
MSH-10	Message Control ID	R	O ²⁸		
MSH-11	Processing ID	R	O	Constant “P” (=Production)	
MSH-12	Version ID	R	R		
EVN-1	Event Type Code	B	O	Constant “A08”	
EVN-2	Recorded Date/Time	R	O		
PID-3	Patient Identifier List	R	R	Patient-ID and NHS number (if applicable)	(0010,0020) (0010,1000)
PID-4	Alternate Patient ID	O	O	Ignored by syngo.plaza	
PID-5	Patient Name	R	R	DICOM Name format	(0010,0010)

²⁵ EVN segment is required in IHE.

²⁶ PV1 segment is required in IHE.

²⁷ O/R/O: The field is optional in HL7 standard 2.3.1 and in syngo.plaza but required in HL7 standard 2.5.1. The message will be processed by the interface if the field is empty.

²⁸ R / O: The field is required in HL7 standard but is allowed to be empty or missing in syngo.plaza. The message will be successfully processed even if this field is empty.

PID-7	Date/Time of Birth	O	O	D.O.B should be a valid date in format YYYYMMDD. Time of Birth will be ignored.	(0010,0030)
PID-8	Sex	O	O	Values "M" / "F" / "O"	(0010,0040)
PID-10	Race	O	O	Ignored by syngo.plaza	
PID-11	Patient Address	O	O	Ignored by syngo.plaza	
PID-13	Phone Number Home	O	O	Ignored by syngo.plaza	
PID-14	Phone Number Buiss.	O	O	Ignored by syngo.plaza	
PID-16	Marital Status	O	O	Ignored by syngo.plaza	
PID-18	Patient Account Number	O	O	Ignored by syngo.plaza	
PID-19	SSN Number - Patient	O	O	Ignored by syngo.plaza	
PV1-2	Patient Class	R	O	An A08 message will not modify the field "patient class". Send an A06/A07 instead.	
PV1-3	Assigned Patient Location	O	O	An A08 message will not modify the field "patient location". Send an A02 instead.	
PV1-7	Attending Doctor	O	O	Ignored by syngo.plaza	
PV1-8	Referring Doctor	O	O	Ignored by syngo.plaza	
PV1-9	Consulting Doctor	O	O	Ignored by syngo.plaza	
PV1-10	Hospital Service	O	O	Ignored by syngo.plaza	
PV1-15	Ambulatory Status	O	O	Ignored by syngo.plaza	
PV1-17	Admitting Doctor	O	O	Ignored by syngo.plaza	
PV1-18	Patient Type	O	O	Ignored by syngo.plaza	
PV1-19	Visit Number	O	O	Ignored by syngo.plaza	
PV1-20	Financial Class	O	O	Ignored by syngo.plaza	
PV1-36	Discharge Disposition	O	O	Ignored by syngo.plaza	
PV1-39	Servicing Facility	O	O	Ignored by syngo.plaza	
PV1-44	Admit Date/Time	O	O	Ignored by syngo.plaza	
PV1-45	Discharge Date/Time	O	O	Ignored by syngo.plaza	

Table 12: Fields used in interface for A08 messages

Pragmatics

syngo.plaza will behave on A08 messages like this:

- Check if all required fields are presented. If not the message will be ignored.
- It will try to find the patient, based on the key attributes:
 - a) PID-3 (Patient Identifier List); that is called a “patient ID only scenario”
or
 - b) PID-3 (Patient Identifier List) and PID-5 (Patient name).
- All non-key attributes specified in table above whose values are not empty will be updated.
- All additional fields and segments will be ignored.
- The message will be cached for studies/images that come in later.

Note:

- This patient update message can be used to update only non-key attributes.
- To change a key attribute, a “Patient Merge – ADT^A40” message has to be issued by the sending application.
This is especially relevant in PID+Patient-Name identification scenario when trying to change the name or trying to change the ID.

Examples of HL7 A08 messages that are accepted by syngo.plaza

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A08|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
PID|||RAD001234||Test^Name||19670511|M
```

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A08|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
EVN|A08|201202171139
PID|1||RAD001234||Test^Name||19670511|M||Henkestr. 127^^91052^Erlangen^D
```

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A08|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
EVN|A08|201202171139
PID|1||RAD001234||Test^Name||19670511|M||Henkestr. 127^^91052^Erlangen^D
PV1|1|E|ONKO-C3|||||||001234/2012|||||||v
```

5.1.5 Patient Merge (ADT^A40)

In clinical workflow it can happen that one person in real world is multiple registered as a patient in an information system. If such a duplicate patient is found then it must be possible to merge both patient records to a single patient record. For a PACS the resulting patient record should have all studies and images the former separate patient records had.

A patient merge triggered by an ADT^A40 message indicates that a merge has been done at the internal identifier level. That is, the patient identified by Patient ID in field MRG-1 has been merged to a patient identified by patient ID in field PID-3. Former patient under patient-ID from field MRG-1 does not exist anymore and his studies/images have been moved to patient identified by field PID-3.

If the target patient does not exist then the ADT^A40 message will be interpreted as a "change patient". This includes especially change of the key attributes (patient ID).

Syntax / Semantics

Note: Be aware that the RIS has to send all the attributes which are configured in syngo.plaza to identify a patient in order to merge the patient.

The table below indicates the message semantics of the ADT^A40 message:

Segments	Segment names	Chapter in HL7 v2.3.1
MSH	Message Header	2
[EVN] ²⁹	Event Type (optional segment)	3
PID	Patient Identification	3
MRG	Merge Information	3

Table 13: Message semantics of ADT^A40

The following fields will be used in the syngo.plaza interfaces:

Field	Element-Name	Required R=required O=optional		Remarks	DICOM attribute
		HL7	plaza		
MSH-1	Field separator	R	R	Constant " " (Pipe-sign)	
MSH-2	Encoding Characters	R	R	Constant "^~\&"	
MSH-7	Date/Time Of Message	O/R	O ³⁰		
MSH-9	Message type	R	R	Constant "ADT^A40"	
MSH-10	Message Control ID	R	O ³¹		
MSH-11	Processing ID	R	O	Constant "P"	

²⁹ EVN segment is required in IHE.

³⁰ O/R/O: The field is optional in HL7 standard 2.3.1 and in syngo.plaza but required in HL7 standard 2.5.1. The message will be processed by the interface if the field is empty.

³¹ R / O: The field is required in HL7 standard but is allowed to be empty or missing in syngo.plaza. The message will be successfully processed even if this field is empty.

				(=Production)	
MSH-12	Version ID	R	R		
EVN-1	Event Type Code	B	O	Constant "A40"	
EVN-2	Recorded Date/Time	R	O		
PID-3	Patient Identifier List	R	R	Patient-ID and NHS number (if applicable)	(0010,0020) (0010,1000)
PID-4	Alternate Patient ID	O	O	Ignored by syngo.plaza	
PID-5	Patient Name	R	R	DICOM Name format	(0010,0010)
PID-7	Date/Time of Birth	O	O	D.O.B should be a valid date in format YYYYMMDD. Time of Birth will be ignored.	(0010,0030)
PID-8	Sex	O	O	Values "M" / "F" / "O"	(0010,0040)
PID-10	Race	O	O	Ignored by syngo.plaza	
PID-11	Patient Address	O	O	Ignored by syngo.plaza	
PID-13	Phone Number Home	O	O	Ignored by syngo.plaza	
PID-14	Phone Number Buiss.	O	O	Ignored by syngo.plaza	
PID-16	Marital Status	O	O	Ignored by syngo.plaza	
PID-18	Patient Account Number	O	O	Ignored by syngo.plaza	
PID-19	SSN Number - Patient	O	O	Ignored by syngo.plaza	
MRG-1	Prior Patient Identifier List	R	R	MRG-1 or MRG-4 must have a value. If both are filled then they must have the same value.	
MRG-4	Prior Patient ID	O			
MRG-7	Prior Patient Name	R	R (O)	Required by HL7 standard. If patient-name is not part of key attributes then the field can be empty for syngo.plaza	

Table 14: Fields used in interface for A40 messages

Pragmatics

syngo.plaza will behave on A40 messages like this:

- Check if all required fields are presented. If not the message will be ignored.
- It will try to find the target patient(s) represented by the PID-segment, based on the key attributes:
 - a) PID-3 (Patient Identifier List), that called a "patient-ID-only scenario"
 - or
 - b) PID-3 (Patient Identifier List) and PID-5 (Patient-Name).

- It will try to find the source patient represented by the MRG segment, based on the key attributes:
 - c) MRG-1 (Prior Patient Identifier List), that called a “patient-ID-only scenario”
 - Or
 - d) MRG-1 (Prior Patient Identifier List) and MRG-7 (Prior Patient Name).
- There are four use cases for the patient merge message:

	Target patient found by PID	No target patient found by PID
Source Patient found by MRG	Merge patients found (1)	Change source patient to have PID key attributes (2)
No source patient found by MRG	Update the patient like an A08 message (3)	Cache the message for later usage

1) Merging patients

In this case the PID segment (target patient) and MRG segment (source-patient) represent two existing patients in the database.

All studies and images from the patients found are moved to the target patient.

The target patient will get the key attributes from the fields PID-3 (Patient Identifier List) and PID-5 (Patient-Name).

After that further attributes are updated based on the remaining fields from PID-segment.

2) Change patient's key attributes

In this case the target patient (PID segment) is not found. Only the merge patient (MRG segment) exists.

A new patient data record is created with the attributes from PID segment.

All studies and images from the patients identified by MRG segment are moved to the new target patient.

3) Update patient

In this case only the target patient specified by the PID segment can be found.

The patient-data will be updated with the data from the PID segment.

- The message will be cached for studies/images that come in later.

Examples of an HL7 A40 messages that are accepted by syngo.plaza

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A40|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
PID|||RAD001234||Name^to be kept||19670511|M
MRG|RAD009876||||Name^to be dropped
```

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A40|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
PID|||RAD001234||Name^to be kept||19670511|M
MRG|||RAD009876||Name^to be dropped
```

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A40|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
EVN|A40|201202171139
PID|1||RAD001234||Name^to be kept||19670511|M||Henkestr. 127^^91052^Erlangen^D
MRG|RAD009876|||RAD009876||Name^to be dropped
```

5.1.6 Merge Patient Information (ADT^A18)

Although IHE specifies, that the ADT^A40 message shall be used for Patient Merge messages, several older systems still use the ADT^A18 ("Merge patient information") message for this purpose. If possible, prefer to use A40 messages. Support for A18 messages may be discontinued by syngo.plaza in future versions.

syngo.plaza will treat the ADT^A18 messages internally in exactly the same way as the ADT^A40 messages.

The differences between A18 and A40 messages are:

Field	Element-Name	Required R=required O=optional		Remarks	DICOM attribute
		HL7	plaza		
MSH-9	Message type	R	R	Constant "ADT^A18"	
EVN-1	Event Type Code	B	O	Constant "A18"	

Table 15: Fields used in interface for A18 messages

5.2 Order Messages

5.2.1 General order message (ORM^O01)

A RIS / HIS system can inform syngo.plaza PACS on planned / scheduled examinations. syngo.plaza can use this information to prepare for images to be received and to be reported. For instance a prefetch of older examinations can be done.

An ORM^O01 message should be sent from HIS / RIS for that purpose.

Syntax / Semantics

The table below indicates the message semantics of the ORM^O01 message:

Segments	Segment names	Chapter in HL7 v2.3.1
MSH	Message Header	2
PID	Patient Identification	3
[PV1]	Patient Visit (optional segment)	3
ORC	Common Order	4
OBR	Observation Request	4
[NTE]	Notes and comments (optional segment)	2
ZDS	DICOM Segment	specific

Table 16: Message semantics of ORM^O01

The following fields will be used in the syngo.plaza interfaces:

Field	Element-Name	Required R=required O=optional		Remarks	DICOM attribute
		HL7	plaza		
MSH-1	Field separator	R	R	Constant " " (Pipe-sign)	
MSH-2	Encoding Characters	R	R	Constant "^~\&"	
MSH-7	Date/Time Of Message	O/R	O ³²		
MSH-9	Message type	R	R	Constant "ORM^O01"	
MSH-10	Message Control ID	R	O ³³		
MSH-11	Processing ID	R	O	Constant "P" (=Production)	
MSH-12	Version ID	R	R		
PID-3	Patient Identifier List	R	R	Patient-ID and NHS number (if applicable)	(0010,0020) (0010,1000)
PID-5	Patient Name	R	R	DICOM Name format	(0010,0010)

³² O/R/O: The field is optional in HL7 standard 2.3.1 and in syngo.plaza but required in HL7 standard 2.5.1. The message will be processed by the interface if the field is empty.

³³ R / O: The field is required in HL7 standard but is allowed to be missing in syngo.plaza. The message will be successfully processed even if this field is empty.

PID-7	Date/Time of Birth	O	O	Order message will not modify the field "date of birth". Send an additional A08 instead.	(0010,0030)
PID-8	Sex	O	O	Order message will not modify the field "sex-code". Send an additional A08 instead.	(0010,0040)
PV1-2	Patient Class	R	O	Order message will not modify the field "patient class". Send an A06 / A07 instead.	
PV1-3.4	Assigned Patient Location - sub-field 4: Facility	O	O	"Resource"	
ORC-1	Order Control	R	R	Constant ³⁴ "NW" = "new order" "XO" = "change order" "SC" = "status change"	
ORC-2	Placer Order Number	O	O	Ignored by syngo.plaza	
ORC-3	Filler Order Number	O	O	Ignored by syngo.plaza	
ORC-5	Order Status	O	O	"RIS Exam Status"	
ORC-7.6	Quantity/Timing - sub-field 6: Priority	O	O	Priority	
ORC-10	Entered By	O	O	Ignored by syngo.plaza	
ORC-12	Ordering Physician	O	O	"Referring Physician" / "Ordering Physician"	(0008,0090)
ORC-13	Enterer's Location	O	O	"Location" (of person entering the order)	
ORC-17	Entering Organization	O	O	Ignored by syngo.plaza	
OBR-2	Placer Order Number	O	O	Ignored by syngo.plaza	
OBR-3	Filler Order Number	O	O	Ignored by syngo.plaza	
OBR-4.2	Universal Service ID - sub-field 2: Text	R	O	Used for Requested "Procedure Description"	(0032,1060)
OBR-7	Observation Date/Time	O	O	Examination Completion Date/Time	
OBR-10	Collector Identifier	O	O	Ignored by syngo.plaza	
OBR-13	Relevant Clinical Info.	O	O	Used for "Department"	
OBR-	Specimen Source	O	O	"Body part"	

³⁴ Be sure to always send "NW" (new order), "XO" (change order) or "SC" (status change). Other possible codes from HL7, chapter 4, table 0119 like "RO" (replacement order) will not be spotted and message will be ignored.

15.4	- sub-field 4: "Body-Site"				
OBR-15.5	Specimen Source - sub-field 5: "Site Modifier"	O	O	"LR Indicator"	
OBR-18	Placer Field 1	O	O	Used for DICOM "Accession number"	(0008,0050)
OBR-19	Placer Field 2	O	O	Used for DICOM "Requested procedure ID"	(0040,1001)
OBR-21	Filler Field 2	O	O	Performed Procedure ID	
OBR-24	Diagnostic Service Section ID	O	O	Used for: DICOM modality	(0008,0060)
OBR-25	Result Status	C	C	"RIS Report Status" Required in case of ORC="SC" (status change)	
OBR-27	Quantity/Timing	O	O	Ignored by syngo.plaza	
OBR-30	Transportation Mode	O	O	Ignored by syngo.plaza	
OBR-31	Reason for Study	O	O	Ignored by syngo.plaza	
OBR-32	Principal Result Interpreter	O	O	"Reporting physician"	(0008,1060)
OBR-44	Ordering Facility Name	O	O	Ignored by syngo.plaza	
OBR-46	Ordering Facility Address	O	O	Ignored by syngo.plaza	
OBR-47	Ordering Facility Phone	O	O	Used for "Sub-Specialty"	
NTE-2	Source of comment	O	O	Must be constant "TECHNOTE" to set the comment	
NTE-3	Comment	O	O	Will be used as technicians note on the examination	
ZDS-1.1	Study instance UID - sub-field 1: UID	O	O	Used for: DICOM study instance UID	(0020,000D)

Table 17: Fields used in interface for ORM^O01 messages

Pragmatics*New Order (ORC-1 = "NW")*

- If an order message with order control "new order" (field ORC-1 has value "NW") is received, then syngo.plaza will pre-fetch older examinations for this patient from an archive. Rules for de-archive must be configured inside syngo.plaza for this purpose.
- Furthermore, the message will be cached to be applied when further images receive.

Change Order (ORC-1 = "XO")

- An order with order control "change order" (field ORC-1 has value "XO") will update the fields with data from segment ORC and OBR in the table above.
- Furthermore, the message will be cached to be applied when further (late) images are received.

Status Change (ORC-1 = "SC")

An order with order control "status change" (field ORC-1 has value "SC") will:

- Change the order status and report status
- Update the fields with data from segment ORC and OBR in the table above.
- Furthermore, the message will be cached to be applied when further (late) images are received.

The following values from HL7, chapter 4, table 0038 are supported for the order status in field ORC-5:

Possible interpretation by RIS	ORC-5 Result status	HL7 description of value	Interpretation by syngo.plaza
Exam scheduled	SC	In process, scheduled	SC
Exam has started / waiting for exam	HD	Order is on hold	HD
Exam is currently running	A	Some, but not all, results available	A
Exam is currently running	IP	In process, unspecified	IP
Exam is finished	CM	Order is completed	CM
Exam was changed	RP	Order has been replaced	RP

Table 18: Order status in ORM^O01 messages supported by syngo.plaza

Please note that all other values from HL7, chapter 4, table 0038 will also be supported. However values like "C (Order was cancelled)" will not be processed by syngo.plaza.

The following values from HL7, chapter 4, table 0123 are supported for the result status in field OBR-25:

OBR-25 Result status	HL7 description of value	Possible interpretation by RIS	Interpretation by syngo.plaza
A	Some, but not all, results available	Exam is finished and dictated	Exam has status "reported"
R	Results stored; not yet verified	Exam is finished and report is written	Exam has status "reported"
P	Preliminary: A verified early result is available, final results not yet obtained	Exam is finished and a) preliminary report sent b) report is preliminarily signed	Exam has status "reported"

F	Final results; results stored and verified. Can only be changed with a corrected result.	Exam is finished and report is validated/signed	Exam has status "finalized".
C	Correction of results:	Two interpretations depending on manufacturer: a) Finished report is replaced by another finished report b) Finished report replaced by another report (status reported) which will later be finished.	Finished report is replaced by new report with status reported. Later message with status "F" expected.
X	No results available; order canceled.	Report and/or exam are deleted.	Exam has status "reported" ³⁵
CM ³⁶	(see footnote; value for SIEMENS legacy systems)	Exam is finished and report is validated/signed	Report is validated/signed in RIS

Table 19: Result status in ORM^O01 messages supported by syngo.plaza

Please note that other values from HL7, chapter 4, table 0123 like "P" (Preliminary) will not be supported and message will be ignored.

Example of a "new order" message accepted by syngo.plaza

```
MSH|^~\&|Test|Test|PLAZA|PLAZA|20151216085709||ORM^O01|pJJwvsRps0dGc+LrCs9LwA|P|2.4
PID|1||RAD00123456||Lastname^Firstname||19620427|M||Henkestr. 127^^91052^Erlangen^D
ORC|NW|||IP
OBR|||^ABDOMEN||201512160857|||||PLA4567000579566|8720252|PLA4567000579566|||CT|...
|||||Lorem ipsum dolor sit amet, consectetur adipiscing elit.|Schmidt, Dr. Christian, ...
Oberarzt
ZDS|1.3.12.2.1107.5.8.3.807665.525354.55565748.2015121611525786^^APPLICATION^DICOM
```

5.2.2 Unsolicited Observation Message (ORU^R01)

If the result (report) status of an examination changes in the RIS then this change should be communicated to PACS. This can be done either by:

- Sending an order message (ORM^O01) from RIS to PACS with control-code (ORC-1) value "SC" = "Status change"
→ see previous chapter
- Sending an unsolicited observation message (ORU^R01) from RIS to PACS
→ this chapter

Syngo.plaza does support both ways.

³⁵ If the examination was not performed by now then it will not appear in syngo.plaza's examination lists.

It should not happen that a performed order (with existing images) will be deleted in RIS. syngo.plaza will never delete by RIS-request/message an examination with existing images.

On HL7 message with status "X" the report status of the exam will be reset from "finalized" to "reported" but images will be left in place.

Additional corrective actions by administrator are highly advised to clarify the case.

³⁶ Value "CM" does not exist in HL7, chapter 4, table 0123.

This value is supported to archive compatibility to SIEMENS own legacy product systems.

Syntax / Semantics

The table below indicates the message semantics of the ORU^R01 message:

Segments	Segment names	Chapter in HL7 v2.3.1
MSH	Message Header	2
PID ³⁷	Patient Identification	3
[PV1]	Patient Visit (optional segment)	3
[ORC]	Common Order (optional segment)	4
OBR	Observation Request	7, (4)
[NTE]	Notes and comments (optional segment)	2
([ZDS] [ZSC])	DICOM Segment (required one of ZDS or ZSC segment)	specific

Table 20: Message semantics of ORU^R01

The following fields will be used in the syngo.plaza interfaces:

Field	Element-Name	Required R=required O=optional		Remarks	DICOM attribute
		HL7	plaza		
MSH-1	Field separator	R	R	Constant “ ” (Pipe-sign)	
MSH-2	Encoding Characters	R	R	Constant “^~\&”	
MSH-7	Date/Time Of Message	O/R	O ³⁸		
MSH-9	Message type	R	R	Constant “ORU^R01”	
MSH-10	Message Control ID	R	O ³⁹		
MSH-11	Processing ID	R	O	Constant “P” (=Production)	
MSH-12	Version ID	R	R		
PID-3	Patient Identifier List	R	R	Patient-ID and NHS number (if applicable) Field is used in cross- check	(0010,0020) (0010,1000)
PID-5	Patient Name	R	R	DICOM Name format Field is used in cross- check if name is part of patient-identifier	(0010,0010)
PID-7	Date/Time of Birth	O	O	Order message will not	(0010,0030)

³⁷ Segment PID is optional in HL7 standard 2.3.1 [3] / 2.5.1 [8], chapter 7.3.1, but it is required by syngo.plaza

³⁸ O/R/O: The field is optional in HL7 standard 2.3.1 and in syngo.plaza but required in HL7 standard 2.5.1. The message will be processed by the interface if the field is empty.

³⁹ R / O: The field is required in HL7 standard but is allowed to be missing in syngo.plaza. The message will be successfully processed even if this field is empty.

				modify the field "date of birth". Send an additional A08 instead.	
PID-8	Sex	O	O	Order message will not modify the field "sex-code". Send an additional A08 instead.	(0010,0040)
PV1-2	Patient Class	R	O	Order message will not modify the field "patient class". Send an A06 / A07 instead.	
PV1-3.4	Assigned Patient Location - sub-field 4: Facility	O	O	"Resource"	
PV1-3	Assigned Patient Location	O	O	An ORU^R01 message will not modify the field "patient location". Send an A02 instead.	
ORC-1	Order Control	R	R	Constant ⁴⁰ "NW" = "new order" "XO" = "change order" "SC" = "status change"	
ORC-2	Placer Order Number	O	O	Ignored by syngo.plaza	
ORC-3	Filler Order Number - sub-field 1: UID	O	O ⁴¹	Used for DICOM study instance UID to identify the study	
ORC-5	Order Status	O	O	"RIS Exam Status"	
ORC-7.6	Quantity/Timing - sub-field 6: Priority	O	O	Priority	
ORC-10	Entered By	O	O	Ignored by syngo.plaza	
ORC-12	Ordering Physician	O	O	"Referring Physician" / "Ordering Physician"	(0008,0090)
ORC-13	Enterer's Location	O	O	"Location" (of person entering the order)	
ORC-17	Entering Organization	O	O	Ignored by syngo.plaza	
OBR-2	Placer Order Number	O	O	Ignored by syngo.plaza	
OBR-3	Filler Order Number	O	O	DICOM Study-instance-UID; used to identify the study	(0020,000D)
OBR-4.2	Universal Service ID - sub-field 2: Text	R	O	Used for Requested "Procedure Description"	(0032,1060)

⁴⁰ Be sure to always send "NW" (new order), "XO" (change order) or "SC" (status change). Other possible codes from HL7, chapter 4, table 0119 like "RO" (replacement order) will not be spotted and message will be ignored.

⁴¹ One of ORC-3, ZDS-1 or ZSC-1 must be filled with a study-instance-UID

OBR-7	Observation Date/Time	O	O	Examination Completion Date/Time	
OBR-10	Collector Identifier	O	O	Ignored by syngo.plaza	
OBR-13	Relevant Clinical Info.	O	O	Used for "Department"	
OBR-15.4	Specimen Source - sub-field 4: "Body-Site"	O	O	"Body part"	
OBR-15.5	Specimen Source - sub-field 5: "Site Modifier"	O	O	"LR Indicator"	
OBR-18	Placer Field 1	O	O	Used for DICOM "Accession number"	(0008,0050)
OBR-19	Placer Field 2	O	O	Used for DICOM "Requested procedure ID"	(0040,1001)
OBR-21	Filler Field 2	O	O	Performed Procedure ID	
OBR-24	Diagnostic Service Section ID	O	O	Used for: DICOM modality	(0008,0060)
OBR-25	Result Status	C	C	"RIS Report Status" Required in case of ORC="SC" (status change)	
OBR-27	Quantity/Timing	O	O	Ignored by syngo.plaza	
OBR-30	Transportation Mode	O	O	Ignored by syngo.plaza	
OBR-31	Reason for Study	O	O	Ignored by syngo.plaza	
OBR-32	Principal Result Interpreter	O	O	"Reporting physician"	(0008,1060)
OBR-44	Ordering Facility Name	O	O	Ignored by syngo.plaza	
OBR-46	Ordering Facility Address	O	O	Ignored by syngo.plaza	
OBR-47	Ordering Facility Phone	O	O	Used for "Sub-Specialty"	
NTE-2	Source of comment	O	O	Must be constant "TECHNOTE" to set the comment	
NTE-3	Comment	O	O	Will be used as technicians note on the examination	
ZDS-1.1	Study instance UID - sub-field 1: UID	O	O	Used for DICOM study instance UID to identify the study	(0020,000D)
ZSC-1.1	Study instance UID - sub-field 1: UID	O	O ⁴¹		(0020,000D)

Table 21: Fields used in interface for ORU^R01 messages (RIS → PACS)

Pragmatics

- If ZDS-1 field is filled then use this field as study-instance-UID to identify the study.
- Else if ZSC-1 field is filled then use this field as study-instance-UID to identify the study.
- Else if OBR-3 field is filled then use this field as study-instance-UID to identify the study.
- Else skip the message
- Update the report status and procedure attributes of the study found.
- The report itself will not be stored in syngo.plaza.
- The message will be cached for (further) studies/images that come in later.

The following values from HL7, chapter 4, table 0038 are supported for the order status in field ORC-5:

Possible interpretation by RIS	ORC-5 Result status	HL7 description of value	Interpretation by syngo.plaza
Exam scheduled	SC	In process, scheduled	SC
Exam has started / waiting for exam	HD	Order is on hold	HD
Exam is currently running	A	Some, but not all, results available	A
Exam is currently running	IP	In process, unspecified	IP
Exam is finished	CM	Order is completed	CM
Exam was changed	RP	Order has been replaced	RP

Table 22: Order status in ORU^R01 messages (RIS → PACS) supported by syngo.plaza

Please note that all other values from HL7, chapter 4, table 0038 will be supported too. But values like “C (Order was cancelled)” will have no special processing inside syngo.plaza.

The following values from HL7, chapter 4, table 0123 are supported for the result status in field OBR-25:

OBR-25 Result status	HL7 description of value	Possible interpretation by RIS	Interpretation by syngo.plaza
A	some, but not all, results available	Exam is finished and dictated	Exam has status “reported”
R	Results stored; not yet verified	Exam is finished and report is written	Exam has status “reported”
P	Preliminary: A verified early result is available, final results not yet obtained	Exam is finished and a) preliminary report sent b) report is preliminarily signed	Exam has status “reported”

F	Final results; results stored and verified. Can only be changed with a corrected result.	Exam is finished and report is validated/signed	Exam has status "finalized".
C	Correction of results:	Two interpretations depending on manufacturer: a) Finished report is replaced by another finished report b) Finished report replaced by another report (status reported) which will later be finished.	Finished report is replaced by new report with status reported. Later message with status "F" expected.
X	No results available; order canceled.	Report and/or exam are deleted.	Exam has status "reported" ⁴²
CM ⁴³	(see footnote; value for SIEMENS legacy systems)	Exam is finished and report is validated/signed	Report is validated/signed in RIS

Table 23: Result status in ORU^R01 messages (RIS → PACS) supported by syngo.plaza

Please note that other values from HL7, chapter 4, table 0123 like "C" (Correction to results) will not be supported and message will be ignored.

Example of a "Change result status" message accepted by syngo.plaza

```
MSH|^~\&|Test|Test|PLAZA|PLAZA|20151216171559||ORU^R01|pJjWwsRps0dGc+LrCs9LwA|P|2.4
PID|||RAD00123456||Lastname^Firstname||19620427|M|||Henkestr. 127^^91052^Erlangen^D
OBR|||^ABDOMEN||201512171559|||||||PLA4567000579566|8720252|PLA4567000579566|||CT|...
|||||Lorem ipsum dolor sit amet, consectetur adipiscing elit.|Schmidt, Dr. Christian, ...
Oberarzt
ZDS|1.3.12.2.1107.5.8.3.807665.525354.55565748.2015121611525786^^APPLICATION^DICOM
```

⁴² If the examination was not performed by now then it will not appear in syngo.plaza's examination lists.

It should not happen that a performed order (with existing images) will be deleted in RIS. syngo.plaza will never delete by RIS-request/message an examination with existing images.

On HL7 message with status "X" the report status of the exam will be reset from "finalized" to "reported" but images will be left in place.

Additional corrective actions by administrator are highly advised to clarify the case.

⁴³ Value "CM" does not exist in HL7, chapter 4, table 0123 (see [3], [7]).

This value is supported to archive compatibility to SIEMENS own legacy product systems.

5.2.3 Imaging Order Message (OMI^O23)

Another way the RIS/HIS can inform syngo.plaza PACS on planned / scheduled examinations is by using OMI^O23. This is the preferred way from IHE (see [1], chapter „B.1 HL7 Topics“).

In order to comply with HL7 standards when the OMI message is used the sending system must support HL7 version 2.5 (better 2.5.1) or higher (see [7], chapter 4.4.12). HL7 version 2.4 and prior do not support this message.

Syntax / Semantics

The table below indicates the message semantics of the OMI^O23 message:

Segments	Segment names	Chapter in HL7 v2.5.1
MSH	Message Header	2
PID	Patient Identification	3
[PV1]	Patient Visit (optional segment)	3
ORC	Common Order	4
TQ1	Timing / Quantity	4
OBR	Observation Request	4
[NTE]	Notes and Comments (optional segment)	2
IPC	Imaging Procedure Control	4

Table 24: Message semantics of OMI^O23

The following fields will be used in the syngo.plaza interfaces:

Field	Element-Name	Required R=required O=optional		Remarks	DICOM attribute
		HL7	plaza		
MSH-1	Field separator	R	R	Constant “ ” (Pipe-sign)	
MSH-2	Encoding Characters	R	R	Constant “^~\&”	
MSH-7	Date/Time Of Message	O/R	O ⁴⁴		
MSH-9	Message type	R	R	Constant “OMI^O23”	
MSH-10	Message Control ID	R	O ⁴⁵		
MSH-11	Processing ID	R	O	Constant “P” (=Production)	
MSH-12	Version ID	R	R		
PID-3	Patient Identifier List	R	R	Patient-ID and NHS number (if applicable)	(0010,0020) (0010,1000)

⁴⁴ O/R/O: The field is optional in HL7 standard 2.3.1 and in syngo.plaza but required in HL7 standard 2.5.1. The message will be processed by the interface if the field is empty.

⁴⁵ R / O: The field is required in HL7 standard but is allowed to be missing in syngo.plaza. The message will be successfully processed even if this field is empty.

PID-5	Patient Name	R	R	DICOM Name format	(0010,0010)
PID-7	Date/Time of Birth	O	O	Order message will not modify the field "date of birth". Send an additional A08 instead.	(0010,0030)
PID-8	Sex	O	O	Order message will not modify the field "sex-code". Send an additional A08 instead.	(0010,0040)
PV1-2	Patient Class	R	O	Order message will not modify the field "patient class". Send an A06 / A07 instead.	
PV1-3.4	Assigned Patient Location - sub-field 4: Facility	O	O	"Resource"	
ORC-1	Order Control	R	R	Constant ⁴⁶ "NW" = "new order" "XO" = "change order" "SC" = "status change"	
ORC-2	Placer Order Number	O	O	Ignored by syngo.plaza	
ORC-3	Filler Order Number	O	O	Ignored by syngo.plaza	
ORC-5	Order Status	O	O	"RIS Exam Status"	
ORC-7.6	Quantity/Timing - sub-field 6: Priority	O	O	Priority (in case TQ1-9 is not filled)	
ORC-10	Entered By	O	O	Ignored by syngo.plaza	
ORC-12	Ordering Physician	O	O	"Referring Physician" / "Ordering Physician"	(0008,0090)
ORC-13	Enterer's Location	O	O	"Location" (of person entering the order)	
ORC-17	Entering Organization	O	O	Ignored by syngo.plaza	
TQ-9.1	Priority	O	O	Priority	
OBR-2	Placer Order Number	O	O	Ignored by syngo.plaza	
OBR-3	Filler Order Number	O	O	Ignored by syngo.plaza	
OBR-4.2	Universal Service ID - sub-field 2: Text	R	O	Used for Requested "Procedure Description" (if OBR-44.5 is missing)	(0032,1060)
OBR-7	Observation Date/Time	O	O	Examination Completion Date/Time	
OBR-10	Collector Identifier	O	O	Ignored by syngo.plaza	

⁴⁶ Be sure to always send "NW" (new order), "XO" (change order) or "SC" (status change). Other possible codes from HL7, chapter 4, table 0119 like "RO" (replacement order) will not be spotted and message will be ignored.

OBR-13	Relevant Clinical Info.	O	O	Used for "Department"	
OBR-15.4	Specimen Source - sub-field 4: "Body-Site"	O	O	"Body part"	
OBR-18	Placer Field 1	O	O	Ignored by syngo.plaza	
OBR-19	Placer Field 2	O	O	Ignored by syngo.plaza	
OBR-21	Filler Field 2	O	O	Performed Procedure ID	
OBR-24	Diagnostic Service Section ID	O	O	Ignored by syngo.plaza	
OBR-25	Result Status	C	C	"RIS Report Status" Required in case of ORC="SC" (status change)	
OBR-27	Quantity/Timing	O	O	Ignored by syngo.plaza	
OBR-30	Transportation Mode	O	O	Ignored by syngo.plaza	
OBR-31	Reason for Study	O	O		
OBR-32	Principal Result Interpreter	O	O	"Reporting physician"	(0008,1060)
OBR-44.5	Procedure Code - sub-field 5: Alternate Text	O	O	Used for Requested "Procedure Description"	(0032,1060)
OBR-46	Placer Supplemental Service Information - sub-field 1: Identifier	O	O	"LR Indicator"	
OBR-47	Ordering Facility Phone	O	O	Used for "Sub-Specialty"	
NTE-2	Source of comment	O	O	Must be constant "TECHNOTE" to set the comment	
NTE-3	Comment	O	O	Technicians note on the examination	
IPC-1.1	Accession Identifier - sub-field 1: Entity ID	R	O	DICOM Accession-Number	(0008,0050)
IPC-2.1	Requested Procedure ID - sub-field 1: Entity ID	R	O	DICOM Requested Procedure ID	(0040,1001)
IPC-3.1	Study instance UID - sub-field 1: UID	R	R	DICOM study instance UID	(0020,000D)
IPC-4.1	Scheduled Procedure Step ID	R	O	Unused by syngo.plaza	(0040,0009)
IPC-5.1	Modality Identifier	O	O	Modality Type	(0008,0060)

Table 25: Fields used in interface for OMI^O23 messages

Pragmatics*New Order (ORC-1 = "NW")*

- If an order message with order control "new order" (field ORC-1 has value "NW") is received, then *syngo.plaza* will pre-fetch older examinations for this patient from an archive. Rules for de-archive must be configured inside *syngo.plaza* for this purpose.
- Furthermore, the message will be cached to be applied when further (late) images are received.

Change Order (ORC-1 = "XO")

- An order with order control "change order" (field ORC-1 has value "XO") will update the fields from segment ORC and OBR in the table above.
- Furthermore, the message will be cached to be applied when further (late) images are received.

Status Change (ORC-1 = "SC")

An order with order control "status change" (field ORC-1 has value "SC") will:

- Change the order status and report status
- Update the fields from segment ORC and OBR in the table above.
- Furthermore, the message will be cached to be applied when further (late) images are received.

The following values from HL7, chapter 4, table 0038 are supported for the order status in field ORC-5:

Possible interpretation by RIS	ORC-5 Result status	HL7 description of value	Interpretation by <i>syngo.plaza</i>
Exam scheduled	SC	In process, scheduled	SC
Exam has started / waiting for exam	HD	Order is on hold	HD
Exam is currently running	A	Some, but not all, results available	A
Exam is currently running	IP	In process, unspecified	IP
Exam is finished	CM	Order is completed	CM
Exam was changed	RP	Order has been replaced	RP

Table 26: Order status in OMI^O23 messages supported by *syngo.plaza*

Please note that all other values from HL7, chapter 4, table 0038 will be supported as well. But values like "C (Order was cancelled) will have no special processing inside *syngo.plaza*.

The following values from HL7, chapter 4, table 0123 are supported for the result status in field OBR-25:

OBR-25 Result status	HL7 description of value	Possible interpretation by RIS	Interpretation by syngo.plaza
A	some, but not all, results available	Exam is finished and dictated	Exam has status "reported"
R	Results stored; not yet verified	Exam is finished and report is written	Exam has status "reported"
P	Preliminary: A verified early result is available, final results not yet obtained	Exam is finished and a) preliminary report sent b) report is preliminarily signed	Exam has status "reported"
F	Final results; results stored and verified. Can only be changed with a corrected result.	Exam is finished and report is validated/signed	Exam has status "finalized".
C	Correction of results:	Two interpretations depending on manufacturer: a) Finished report is replaced by another finished report b) Finished report replaced by another report (status reported) which will later be finished.	Finished report is replaced by new report with status reported. Later message with status "F" expected.
X	No results available; order canceled.	Report and/or exam are deleted.	Exam has status "reported" ⁴⁷
CM ⁴⁸	(see footnote; value for SIEMENS legacy systems)	Exam is finished and report is validated/signed	Report is validated/signed in RIS

Table 27: Result status in OMI^O23 messages supported by syngo.plaza

⁴⁷ If the examination was not performed by now then it will not appear in syngo.plaza's examination lists.

It should not happen that a performed order (with existing images) will be deleted in RIS. syngo.plaza will never delete by RIS-request/message an examination with existing images.

On HL7 message with status "X" the report status of the exam will be reset from "finalized" to "reported" but images will be left in place.

Additional corrective actions by administrator are highly advised to clarify the case.

⁴⁸ Value "CM" does not exist in HL7, chapter 4, table 0123.

This value is supported to archive compatibility to SIEMENS own legacy product systems.

Please note that other values from HL7, chapter 4, table 0123 like “P” (Preliminary) will not be supported and message will be ignored.

Example of a “new order” message accepted by syngo.plaza

```
MSH|^~\&|Test|Test|PLAZA|PLAZA|20151216151859||OMI^O23|20151216QrPh|P|2.5.1|||UNICODE UTF-8
PID|||123456||Lastname^Firstname||19870719|M
ORC|NW|||IP
TQ1|||S
OBR|||^X-Ray pelvis||201212312359|||ICU|^P^PELVIS^R||000352121|1127252358|...
||CR^X|I|||P^PELVIS^R|
NTE|TECHNOTE|Please adjust same as on prior image|
IPC|000352121|112725235|1.3.12.2.1107.5.8.2.9999.7276.7.797773.8367.826981707668.3.3...
^SHC_PLAZA_VB20A^APPLICATION^DICOM||CR
```

5.3 Order Administration Messages (proprietary)

In clinical routine it can happen that a planned exam was scheduled or performed for the wrong patient. This happens in following conditions:

- An exam was scheduled for a patient called “John Miller”. The exam was performed and shows up in the exam history of “John Miller”.
Later the physician detects that correct patient name spelling is “John Muller”. There is already an exam history for “John Muller” but this is of cause missing the current exam.
- An exam was scheduled for “Henry Smith”. However “Paul Adams” was examined.

All above mentioned situations are about two persons in real life. Therefore they already have separate patient records. A patient merge is not possible in this case because it would merge both patient records to one patient record.

For legal reasons the exam cannot be canceled and repeated⁴⁹. If the exam has already been done then it must be stored and documented into the correct person record.

In these cases a single order or examination shall be “moved” from one patient to another patient. Most RIS do have methods to do so.

HL7 standard does not provide appropriate HL7 messages to move an examination (or parts of an examination) from one patient to a different patient. Thus syngo.plaza defines proprietary messages using Z-segments.

5.3.1 Order Level Correction Message (ZPA^I05)

The message ZPA^I05 described in this chapter can be used to move a study which is identified by an accession-number from one patient to a different patient. In addition the accession-number can also be changed using this message.

This is a SIEMENS proprietary message as HL7 standard does not have messages defined for this purpose.

Syntax / Semantics

The table below indicates the message semantics of the ZPA^I05 message:

Segments	Segment names	Chapter in HL7 v2.3.1
MSH	Message Header	2
EVN	Event Type	3
PID	Patient Identification	3
[MRG]	Merge Information (optional cross-check)	3
[ZSP]	Merge Information (optional cross-check)	proprietary
ZPA	Study Identification	proprietary

Table 28: Message semantics of ZPA^I05

⁴⁹ German law on X-ray (“Röntgenverordnung”) outlaws performing unnecessary examinations with X-ray exposure. Thus repeating the same exam for administrative reasons is considered to be a malicious injury and may face legal consequences.

The following fields will be used in the syngo.plaza interfaces:

Field	Element-Name	Required R=required O=optional		Remarks	DICOM attribute
		HL7	plaza		
MSH-1	Field separator	R	R	Constant " " (Pipe-sign)	
MSH-2	Encoding Characters	R	R	Constant "^~\&"	
MSH-7	Date/Time Of Message	O/R	O ⁵⁰		
MSH-9	Message type	R	R	Constant "ZPA^I05"	
MSH-10	Message Control ID	R	O ⁵¹		
MSH-11	Processing ID	R	O	Constant "P" (=Production)	
MSH-12	Version ID	R	R		
PID-3	Patient Identifier List	R	R	Patient-ID and NHS number (if applicable)	(0010,0020) (0010,1000)
PID-5	Patient Name	R	R	DICOM Name format	(0010,0010)
PID-7	Date/Time of Birth	O	O	D.O.B should be a valid date in format YYYYMMDD. Time of Birth will be ignored.	(0010,0030)
PID-8	Sex	O	O	Values "M" / "F" / "O"	(0010,0040)
MRG-4	Prior Patient ID	O	R	Cross-check	
MRG-7	Prior Patient Name	O	R	Cross-check	
ZSP-3	Prior Patient ID	n.a.	R	Cross-check (works same as MRG-4)	
ZSP-5	Prior Patient Name	n.a.	R	Cross-check (works same as MRG-7)	
ZPA-2.1	Source Accession Number	n.a.	R	Used to identify the studies to be moved	(0008,0050)
ZPA-2.2	Target Accession Number	n.a.	O	New Accession-Number (if to be changed else empty)	(0008,0050)

Table 29: Fields used in interface for ZPA^I05 messages

Pragmatics

syngo.plaza will behave on ZPA^I05 messages like this:

- Check if all required fields are present. If not the message will be ignored.
- It will try to find the source patient/studies which are identified by source accession-

⁵⁰ O/R/O: The field is optional in HL7 standard 2.3.1 and in syngo.plaza but required in HL7 standard 2.5.1. The message will be processed by the interface if the field is empty.

⁵¹ R / O: The field is required in HL7 standard but is allowed to be missing in syngo.plaza. The message will be successfully processed even if this field is empty.

number (ZPA-2, 1st subfield). The accession-number must not be empty.

If no examination is found then the message will be skipped.

If more than one patient is found that has the accession-number then the message will be skipped.

- If an MRG-segment is present then Prior Patient ID (MRG-4) and Prior Patient-Name (MRG-7) must not be empty and will be cross-checked against the patient-data of the study found. If this check fails the message will be skipped.
- If a ZPA-segment is present then Prior Patient ID (ZSP-3) and Prior Patient-Name (ZSP-5) must not be empty and will be cross-checked against the patient-data of the studies found. If this check fails the message will be skipped.
- It will try to find the target patient represented by the PID-segment, based on the key attributes. Depending on identification scheme this can be either field Patient ID (PID-3) or fields Patient ID (PID-3) and Patient Name (PID-5).
- If the target patient does not exist then it will be created. Patient ID (PID-3), Patient Name (PID-5), D.o.B. (PID-7) and sex-code (PID-8) will be used in this case.
- After this the studies found will be moved to the target patient (existing or newly created). This is a MOVE, not a COPY action.
- If the field "Target Accession Number" (ZPA-2, 2nd subcomponent) is filled then the accession-number of the studies found will be changed to that number.

Examples of "move order" messages accepted by syngo.plaza

1) Move studies (identified by accession-number) from one patient to another patient

```
MSH|^~\&|RIS|RIS|ANY PACS|PACS|20120417085709||ZPA^S05|1234567|P|2.4
PID|1||RAD001001||Testname^Target||19620427|M|
MRG|||RAD001000||Testname^Source|
ZPA||049S0700729815
```

Use case: Correction of a patient transposition error

2) Move studies to a (new) patient, change the accession-number

```
MSH|^~\&|RIS|RIS|ANY PACS|PACS|20120417085711||ZPA^S05|1234569|P|2.4
PID|1||RAD009876||Smith^John||19431208|M|
MRG|||CT-50174-2013-02-18-05:34:24.1342 CET||Emergency^|
ZPA||CT50175.8461^049S0700728256
```

Use case: Correction of a study that was hand-entered at a modality

3) Change the accession-number

```
MSH|^~\&|RIS|RIS|ANY PACS|PACS|20120417085710||ZPA^S05|1234568|P|2.4
PID|1||RAD001234||Testname^Unchanged|||
MRG|||RAD001234||Testname^Unchanged|
ZPA||049S0700729384^049S0700728952
```

Use case: Link two studies to run under same accession-number

5.3.2 Study Level Correction Message (ZPA^S05)

The message ZPA^S05 described in this chapter can be used to move a study which is identified by study-instance-UID from one patient to a different patient. In addition the accession-number and study-instance-UID can also be changed using this message.

This is a SIEMENS proprietary message as HL7 standard does not have messages defined for that purpose.

Syntax / Semantics

The table below indicates the message semantics of the ZPA^S05 message:

Segments	Segment names	Chapter in HL7 v2.3.1
MSH	Message Header	2
EVN	Event Type	3
PID	Patient Identification	3
[MRG]	Merge Information (optional cross-check)	3
[ZSP]	Merge Information (optional cross-check)	proprietary
ZPA	Study Identification	proprietary

Table 30: Message semantics of ZPA^S05

The following fields will be used in the syngo.plaza interfaces:

Field	Element-Name	Required R=required O=optional		Remarks	DICOM attribute
		HL7	plaza		
MSH-1	Field separator	R	R	Constant “ ” (Pipe-sign)	
MSH-2	Encoding Characters	R	R	Constant “^~\&”	
MSH-7	Date/Time Of Message	O/R	O ⁵²		
MSH-9	Message type	R	R	Constant “ZPA^S05”	
MSH-10	Message Control ID	R	O ⁵³		
MSH-11	Processing ID	R	O	Constant “P” (=Production)	
MSH-12	Version ID	R	R		
PID-3	Patient Identifier List	R	R	Patient-ID and NHS number (if applicable)	(0010,0020) (0010,1000)
PID-4	Alternate Patient ID	O	O	Ignored by syngo.plaza	
PID-5	Patient Name	R	R	DICOM Name format	(0010,0010)

⁵² O/R/O: The field is optional in HL7 standard 2.3.1 and in syngo.plaza but required in HL7 standard 2.5.1. The message will be processed by the interface if the field is empty.

⁵³ R / O: The field is required in HL7 standard but is allowed to be missing in syngo.plaza. The message will be successfully processed even if this field is empty.

PID-7	Date/Time of Birth	O	O	D.O.B should be a valid date in format YYYYMMDD. Time of Birth will be ignored.	(0010,0030)
PID-8	Sex	O	O	Values "M" / "F" / "O"	(0010,0040)
MRG-4	Prior Patient ID	O	R	Cross-check	
MRG-7	Prior Patient Name	O	R	Cross-check	
ZSP-3	Prior Patient ID	n.a.	R	Cross-check (works same as MRG-4)	
ZSP-5	Prior Patient Name	n.a.	R	Cross-check (works same as MRG-7)	
ZPA-1-1	Source Study Instance UID	n.a.	R	Used to identify the study to be moved	(0020,000D)
ZPA-1-2	Target Study Instance UID	n.a.	O	New Study Instance UID (if to be changed else empty)	(0020,000D)
ZPA-2-2	Target Accession Number	n.a.	O	New Accession-Number (if to be changed else empty)	(0008,0050)

Table 31: Fields used in interface for ZPA^S05 messages

Pragmatics

syngo.plaza will behave on ZPA^S05 messages like this:

- Check if all required fields are present. If not then the message will be ignored.
- It will try to find the source patient/examination which is identified by source study-instance-UID (ZPA-1, 1st subfield). If this is not found then the message will be skipped.
- If an MRG-segment is present then Prior Patient ID (MRG-4) and Prior Patient-Name (MRG-7) must not be empty and will be cross-checked against the patient-data of the study found. If this check fails the message will be skipped.
- If a ZSP-segment is present then Prior Patient ID (ZSP-3) and Prior Patient-Name (ZSP-5) must not be empty and will be cross-checked against the patient-data of the study found. If this check fails the message will be skipped.
- It will try to find the target patient represented by the PID-segment, based on the key attributes. Depending on identification scheme this can be either field Patient ID (PID-3) or fields Patient ID (PID-3) and Patient Name (PID-5).
- If the target patient does not exist then it will be created. Patient ID (PID-3), Patient Name (PID-5), D.o.B. (PID-7) and sex-code (PID-8) will be used in this case.
- After this the study found will be moved to the target patient (existing or new created). This is a MOVE, not a COPY action.

- If the field “Target Accession Number” (ZPA-2, 2nd subcomponent) is filled then the accession-number of the study found will be changed to that number.
- If the field “Target Study Instance UID” (ZPA-1, 2nd subfield) is filled then the study instance UID of the study found will be changed to that number.

Examples of “move study” messages accepted by syngo.plaza

1) Move a study (identified by instance-UID) from one patient to another patient

```
MSH|^~\&|RIS|RIS|ANY PACS|PACS|20120417085709||ZPA^S05|1234567|P|2.4
PID|1||RAD001001||Testname^Target||19620427|M|
MRG|||RAD001000||Testname^Source|
ZPA|1.3.12.2.1107.5.8.3.9999.727655.908065.2012041211525786
```

Use case: Correction of a patient transposition error

2) Move a study to a (new) patient, change the accession-number

```
MSH|^~\&|RIS|RIS|ANY PACS|PACS|20120417085711||ZPA^S05|1234569|P|2.4
PID|1||RAD009876||Smith^John||19431208|M|
MRG|||CT-50174-2013-02-18-05:34:24.1342 CET||Emergency^|
ZPA|1.2.840.113619.2.1.1.318791001.532.737296081.502^|^93269
```

Use case: Correction of a study that was hand-entered at a modality

3) Change the study-instance-UID

```
MSH|^~\&|RIS|RIS|ANY PACS|PACS|20120417085710||ZPA^S05|1234568|P|2.4
PID|1||RAD001234||Testname^Unchanged|||
MRG|||RAD001234||Testname^Unchanged|
ZPA|1.2.840.113619.2.1.1.318791001.532.737296081.502^...
1.3.12.2.1107.5.8.3.9999.727655.908065.834853.2013041211525786
```

Use case: Merge of two studies

5.4 Image Notification Resent Trigger (ZPA^G01)

The PACS *syngo.plaza* will inform the RIS/HIS on changes of the study/images database. This is done via ORU^R01 messages, which are described in chapter “6.1”. Each event in the PACS (new images / further images in study / move from and to archive / delete study) will be automatically signaled to RIS. By this the RIS will always have the current status of images that belong to a RIS requested procedure.

However there may be special conditions when RIS and PACS can be “out of sync” on the images / studies and the RIS is missing some information needed.

Typical situations like this can be:

- PACS is running since some legacy period, but RIS is newly introduced into the department. The new RIS is missing image information for patients/studies/images which were done in the past.
- Upload of legacy data to RIS and or PACS
- Due to interfacing failures some messages have not been transmitted or could not be successfully evaluated in the RIS
- RIS is not able to store the image availability and needs to request this “on the fly” when user wants to see it

In these situations it can be helpful to request the current status of patient / study / images. The proprietary ZPA^G01 messages described in this chapter can be used to do so.

Workflow will be like this:

1. RIS sends ZPA^G01 messages to PACS
2. PACS will respond with one or several ORU^R01 image notifications (see chapter 6.1).

Syntax / Semantics

The table below indicates the message semantics of the ZPA^G01 message:

Segments	Segment names	Chapter in HL7 v2.3.1
MSH	Message Header	2
[PID]	Patient Identification	3
[ZPA]	Study Filter	specific

Table 32: Message semantics of ZPA^G01

The following fields will be used in the *syngo.plaza* interfaces:

Field	Element-Name	Required R=required O=optional		Remarks	DICOM attribute
		HL7	plaza		
MSH-1	Field separator	R	R	Constant “ ” (Pipe-sign)	
MSH-2	Encoding Characters	R	R	Constant “^~\&”	
MSH-7	Date/Time Of Message	O/R	R ⁵⁴		

⁵⁴ O/R/R: The field is optional in HL7 standard 2.3.1 but required in HL7 standard 2.5.1 and by *syngo.plaza*. The message will be skipped by the interface if the field is empty.

MSH-9	Message type	R	R	Constant "ZPA^G01"	
MSH-10	Message Control ID	R	O ⁵⁵		
MSH-11	Processing ID	R	O	Constant "P" (=Production)	
MSH-12	Version ID	R	R		
PID-3	Patient Identifier List	R	R	Patient-ID	(0010,0020)
PID-5	Patient Name	R	R	DICOM Name format	(0010,0010)
PID-7	Date/Time of Birth	O	O	Ignored for ZPA^G01 messages	(0010,0030)
PID-8	Sex	O	O	Ignored for ZPA^G01 messages	(0010,0040)
ZPA-2.1	Start Date/Time for interval	n.a.	O	Both fields define a time frame for cached the messages to be resent	
ZPA-2.2	End Date/Time for interval	n.a.	O		

Table 33: Fields used in interface for ZPA^G01 messages

Pragmatics

There are two different ways ZPA^G01 can be used in syngo.plaza:

- a) **Patient level resent of notifications for all studies of the patient**
for this variant a PID-segment **must** be provided.

In this case the patient will be identified

- by the patient-ID in PID-3 (PID-ONLY-Scenario)
- or by Patient-ID in PID-3 and patient-name in PID-5 (PID+PNAME scenario).

The system will generate new image notifications for each study found on the patient. This will be independent of examination/study date. All notifications are generated from currently found patient/study data.

By this it is **possible to generate notification messages even for legacy data**.

If the message does have an interval provided in "Start date/time" in ZPA-2.1 and "End date/time" in ZPA-2.2 then this interval will be ignored.

⁵⁵ R / O: The field is required in HL7 standard but is allowed to be missing in syngo.plaza. The message will be successfully processed even if this field is empty.

b) Time interval based resent

For this variant a PID-message **must not** be provided.

This variant will re-send image notifications which are still in the notification cache and are in the specified time interval. By this it can happen that several messages will be sent when the study was multiple updated.

The image notification cache will be automatically cleaned by the system after a defined period (standard: 24 hours). If a notification is already removed from the cache **then it will not be re-created** from a ZPA^G01 trigger.

For this reason this message will help only in case of needs for resent in case of short-time interface failures. It **cannot be used for history upload of legacy data**.

Examples of “move study” messages accepted by syngo.plaza

1) Re-create and send image notifications for all studies for patient with ID “RAD001001” and patient name “Lastname^Firstname”

```
MSH|^~\&|RIS|RIS|ANY PACS|PACS|20120417085710||ZPA^G01||P|2.4
PID|1||RAD001001||Lastname^Firstname
```

Use case: Sync of patient's image availability information for a given patient

2) Re-send all image-notifications of 2015-10-22 18:00 to 2015-10-23 09:00

```
MSH|^~\&|RIS|RIS|ANY PACS|PACS|20120417085710||ZPA^G01||P|2.4
ZPA||20151022180000^20151023085959|
```

Use case: Interface failure during system update, some messages have been lost

6 Outbound messages PACS to RIS

6.1 Image Notifications (via Report Export)

The Unsolicited Observation Message (ORU^R01) message is used for transmitting observation results to other systems.

In syngo.plaza these messages are used to communicate details on studies/images received to the image storage.

Syntax / Semantics

The table below indicates the message semantics of the ORU^R01 message:

Segments	Segment names	Chapter in HL7 standard
MSH	Message Header	2
PID	Patient Identification	3
ORC	Order common	4
OBR	Observations Report ID	7
ZSC	Z-Segment for Study-Details	-

Table 34: Message semantics of ORU^R01 (PACS → RIS)

Syntax / Semantics

The table below indicates the message semantics of the ORU^R01 message.
For syntax details, please refer to [3], [7] and [8].

Field	Element-Name	Remarks	DICOM TAG
MSH-1	Field separator	Constant " " (Pipe-sign)	
MSH-2	Encoding Characters	Constant "^~\&"	
MSH-3	Sending Application	Constant "syngo.plaza"	
MSH-4	Sending Facility	Constant "PACS"	
MSH-5	Receiving Application	Constant "RIS"	
MSH-6	Receiving Facility	Constant "RIS"	
MSH-7	Date/Time Of Message	In format YYYYMMDDhhmm Example: 201508131237	
MSH-9	Message type	Constant "ORU^R01"	
MSH-10	Message Control ID	Will be filled with an identifier	
MSH-11	Processing ID	Constant "P" (=Production)	
MSH-12	Version ID	Constant "2.4"	
MSH-12	Character Set	Constant "UNICODE"	
PID-2	Patient Identifier	patient ID (field is used for backward compatibility)	(0010,0020)

PID-3	Patient ID List	Patient ID list	(0010,0020)
PID-5	Patient Name	Patient Name in DICOM Name Format	(0010,0010)
PID-7	Date/Time of Birth	In format YYYYMMDD Empty values for D.o.B. are allowed in syngo.plaza	(0010,0030)
PID-8	Sex	Values "M" / "F" / "O", or empty	(0010,0040)
ORC-1	Order Control	Constants SC=Status Changed CA = All images deleted	
ORC-2	Placer Order Number	Used for: Requested Procedure ID	(0040,1001)
ORC-3	Filler Order Number	Used for: Performed Procedure ID	(0040,0253)
OBR-2	Placer Order Number	Used for: Requested Procedure ID	(0040,1001)
OBR-3	Filler Order Number	Used for: Performed Procedure ID	(0040,0253)
OBR-4.2	Universal Service ID - sub-field 2: Text	Used for Requested "Procedure Description"	(0032,1060)
OBR-7	Observation Date/Time	Used for: DICOM study date / DICOM study time	(0008,0020) (0008,0030)
OBR-18	Placer Field 1	Used for: DICOM accession number	(0008,0050)
OBR-19	Placer Field 2	Used for: DICOM study ID	(0020,0010)
OBR-21	Filler Field 2	Used for: DICOM Requested Procedure ID (if available) or Performed Procedure ID	(0040,1001) or (0040,0253)
OBR-24	Diagnostic Service Section ID	Used for: DICOM modality-code	(0008,0060)
OBR-31	Reason for study	Used for: DICOM reason of requested procedure	(0040,1002)
OBR-32	Principal Result Interpreter	Used for: DICOM reporting physician	(0008,1060)
ZSC-1.1	Study-Instance-UID of examination (study-component)	Used for: DICOM study instance UID	(0020,000D)
ZSC-1.2	Plaza Version	Constant containing version number Example: SHC_PLAZA_VB20A	
ZSC-1.3		Constant "APPLICATION"	
ZSC-1.4		Constant "DICOM"	
ZSC-2	Receive Status	COMPLETED = All images received from Modality MOVED = All images have been moved to archive DELETED = Images have been deleted from online and archive UPDATED = Single images were deleted	

ZSC-3	Study description	DICOM Study Description	(0008,1030)
ZSC-5	Node-Name	DICOM Retrieve AET Title (that is: AET of PACS)	(0008,0054)
ZSC-7	Archive Status	DICOM Instance Availability, with values: ONLINE = available in online area of archive NEARLINE = images available in archive only now DELETED = Images have been deleted from online and archive	(0008,0056)
ZSC-9	Number of images (study-component)	DICOM number of images in acquisition	(0020,1002)
ZSC-10	Number of objects (study-component)	DICOM number of DICOM objects in acquisition	(0020,1002)
ZSC-11	Notification status	PRELIMINARY = First image received and available FINAL = All images received (empty) = a) for notifications on changes in archive b) in response to a ZPA^G01 message received from RIS to PACS	

Table 35: Fields used in interface for ORU^R01 messages

Pragmatics on “new images”

syngo.plaza will send two ORU^R01 “image notification” messages for every examination (study-component) received into the system.

1. Preliminary “fast” image notification

Immediately after the first image received syngo.plaza will send out a notification with ZSC-11=“PRELIMINARY”. This notification will not be sent if images are received in short-time-storage (STS) due to local retrieve from an archive.

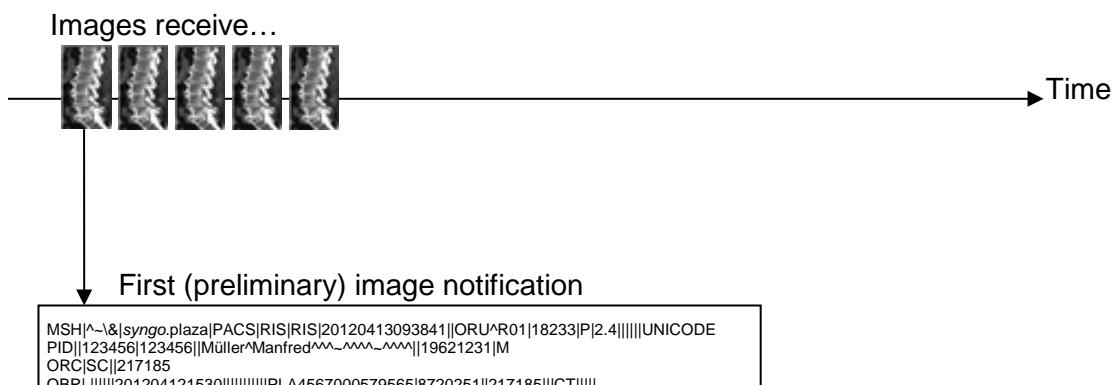
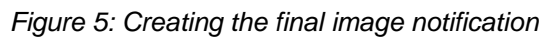


Figure 4: Creating the preliminary (fast) image notification

After the DICOM association was closed *syngo.plaza* will wait for a fixed time. If further images are received for the same study (identified by study-instance-UID) they will be notified as one event having the total number of images received by now. If no further images are received during this time then the receive-operation will be regarded as “finished” and the “final” image notification will be sent out.



For some examination types the modality will send a bunch of images and then after let's say 30 minutes it will send some more images (so called "late images"). If this "second bunch" is after the time-out then *syngo.plaza* will send out a second set of preliminary and final image-notifications for the same study.

The final image notification is will have the total number of all images received by now for this study.



Pragmatics on other actions

Syngo.plaza will send immediate send notifications when examinations are moved to archive or images have been deleted. The notification will be send directly after the action in the storage completed.

Example of an image notification exported by syngo.plaza
(see chapter 7.2 for more examples):

```
MSH|^~\&|syngo.plaza|PACS|RIS|RIS|201508131240||ORU^R01|91618872|P|2.4|||||UNICODE
PID||123456|123456||Müller^Manfred^^^^^^^^^^|19621231|M
ORC|SC|8720251|217185
OBR||42634|217185|||||20141231235958|||||||287364|8720251||217185|||CT|||||Lorem ipsum ...
dolor sit amet, consectetur adipiscing elit. Nulla gravida, lacus ac nonummy pretium, arcu ...
urna tincidunt quam, ac ultricies eros velit at neque. Mauris ornare sodales eros. Etiam ...
faucibus mauris ac orci. Morbi dui. Integer a nisi vel augue egestas tristique. ...
|||||||Sensation 4
ZSC|1.3.12.2.1107.5.8.2.9999.7276.7.194415.776588.9.2.2^SHC_PLAZA_VB20A^APPLICATION^DICOM|...
COMPLETED||DEERLN1TBL35V14||ONLINE||1|1|PRELIMINARY
```

7 Appendix: Some more examples for HL7 messages

7.1 ADT messages from RIS to syngo.plaza

7.1.1 Change of patient's demographic data

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A08|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
EVN|A08|201202171139
PID|||RAD001234||Test^Name||19670511|M|||Henkestr. 127^^91052^Erlangen^D
```

Remark: The patient with this patient ID should exist. If not, the message will be skipped.

7.1.2 Change of patient name

An A08 or an A40 message can be used to change the patient name.

If the patient ID together with the patient-name is search key criteria (see chapter “4.5 Patient”) an A40 has to be send.

If patient ID only is the search key criteria an A08 or A40 message may be sent.

Examples:

Change patient name for patient with ID “RAD001234” from “Test^Name” to “Test^Name-changed”

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A08|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
EVN|A08|201202171139
PID|||RAD001234||Test^Name-Changed||19670510|M|||Henkestr. 127^^91052^Erlangen^D
MRG|RAD001234|||RAD001234|||Test^Name
```

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A40|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
EVN|A40|201202171139
PID|||RAD001234||Test^Name-Changed||19670510|M|||Henkestr. 127^^91052^Erlangen^D
MRG|RAD001234|||RAD001234|||Test^Name
```

7.1.3 Change of a patient ID

A change of a patient ID can be initiated via sending an A40 message. If the target patient ID from field PID-3 does already exist, then the two patients identified by PID-3 (Patient-ID List and MRG-4 (Prior Patient ID) will be merged together.

Examples:

Changing Patient ID “RAD001234” to “RAD002345”

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A40|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
EVN|A40|201202171139
PID|||RAD002345||Test^Name||19670510|M|||Henkestr. 127^^91052^Erlangen^D
MRG|RAD001234|||RAD001234|||Test^Name
```

7.1.4 Merge of two patients

An A40 message will be used to merge two patient records into one patient record.

Alternatively an A18 message can be used.

Examples:

Merge Patient with ID "RAD001234" and "RAD002345" together. Resulting patient shall have ID "RAD001234" and name "Test^Name A".

a) With A40 message

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A40|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
EVN|A40|201202171139
PID|||RAD001234|Test^Name A||19670510|M||Henkestr. 127^^91052^Erlangen^D
MRG|RAD002345|||RAD002345|||Test^Name B
```

b) Analogous with an A18 message (retired message)

```
MSH|^~\&|RIS|RIS|PACS|PACS|20120205224440||ADT^A18|Nos81uQgoJ4wVJ9nuOgoUw|P|2.3.1
EVN|A18|201202171139
PID|||RAD001234|Test^Name A||19670510|M||Henkestr. 127^^91052^Erlangen^D
MRG|RAD002345|||RAD002345|||Test^Name B
```

Remarks:

- If the patient with target ID from PID-3 (here: "RAD001234") does not exist then existing patients with MRG-4 (Prior patient ID) (here: "RAD002345") will have the ID changed to the target ID (here: "RAD001234").
- Currently we support the A18 message format which is being retained in the HL7 standard for backward compatibility. If possible, please send an A40 message instead. A18 messages may be unsupported in future versions.

7.2 ORU messages from syngo.plaza to RIS

ORU messages will be used to inform RIS/HIS on changes of the image database.

Examples:

New images received in online DB (preliminary notification)

```
MSH|^~\&|syngo.plaza|PACS|RIS|RIS|20120507150958||ORU^R01|18467|P|2.4|||||UNICODE
PID||RAD00123456|RAD00123456|Test^HL7^~~~~~^~~~~^~~~~|20081001|O
ORC|SC|2025720|049KKLR000032665
OBR||2025720|049KKLR000032665|^Chest 2 Views|||200809300818|||049KKLR000032665...
|2025720|049KKLR000032665||CR|||SIEMENS FD-X
ZSC|1.3.12.2.1107.5.8.2.0027.20125715840150338949950338.63568024^^SHC_PLAZA_VB20A^APPLICATION...
^DICOM|COMPLETED||DEERLN1TBL35V14|ONLINE|1|1|PRELIMINARY
```

New images received in online DB (final notification)

```
MSH|^~\&|syngo.plaza|PACS|RIS|RIS|20120507150958||ORU^R01|18467|P|2.4|||||UNICODE
PID||RAD00123456|RAD00123456|Test^HL7^~~~~~^~~~~^~~~~|20081001|O
ORC|SC|2025720|049KKLR000032665
OBR||2025720|049KKLR000032665|^Chest 2 Views|||200809300818|||049KKLR000032665...
|2025720|049KKLR000032665||CR|||SIEMENS FD-X
ZSC|1.3.12.2.1107.5.8.2.0027.20125715840150338949950338.63568024^^SHC_PLAZA_VB20A^APPLICATION...
^DICOM|COMPLETED||DEERLN1TBL35V14|ONLINE|5|5|FINAL
```

Some images have been deleted

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MSH|^~\&|syngo.plaza|PACS|RIS|RIS|20120507153041||ORU^R01|11478|P|2.4|||||UNICODE
PID|RAD00123456|RAD00123456||Test^HL7^^^^^^^^^^^^^|20081001|O
ORC|SC|2025720|049KKLR000032665
OBR||2025720|049KKLR000032665|^Chest 2 Views|||200809300818|||||||049KKLR000032665...
|2025720||049KKLR000032665||CR|||||||||||||||||SIEMENS FD-X
ZSC|1.3.12.2.1107.5.99.3.30000008100113093635900010061^SHC_PLAZA_VB20A^APPLICATION^DICOM...
|UPDATED|CR DX Chest CAD||DEERLN1TSK10SRV||ONLINE||2|2
```

Images have been migrated to archive

```
MSH|^~\&|syngo.plaza|PACS|RIS|RIS|20120507151036||ORU^R01|6334|P|2.4|||||UNICODE
PID|RAD00123456|RAD00123456||Test^HL7^^^^^^^^^^^^^|20081001|O
ORC|SC|2025720|049KKLR000032665
OBR||2025720|049KKLR000032665|^Chest 2 Views|||200809300818|||||||049KKLR000032665...
|2025720||049KKLR000032665||CR|||||||||||||||||SIEMENS FD-X
ZSC|1.3.12.2.1107.5.99.3.30000008100113093635900010061^SHC_PLAZA_VB20A^APPLICATION^DICOM...
|MOVED|CR DX Chest CAD||DEERLN1TSK10SRV||NEARLINE||2|2
```

All images were deleted in archive

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MSH|^~\&|syngo.plaza|PACS|RIS|RIS|20120507152358||ORU^R01|26500|P|2.4|||||UNICODE
PID|RAD00123456|RAD00123456||Test^HL7^^^^^^^^^^^^^|20081001|O
ORC|CA|2025720|049KKLR000032665
OBR||2025720|049KKLR000032665|^Chest 2 Views|||200809300818|||||||049KKLR000032665...
|2025720||049KKLR000032665||CR|||||||||||||||||SIEMENS FD-X
ZSC|1.3.12.2.1107.5.99.3.30000008100113093635900010061^SHC_PLAZA_VB20A^APPLICATION^DICOM...
|DELETED|CR DX Chest CAD||DEERLN1TSK10SRV||DELETED||2|2
```