# Sante PACS Server PG

## The Worklist Server Module

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## Overview

The built-in Worklist server module can receive via HL7 communication messages the patients' demographics and scheduling information of exams that are stored in a HIS/RIS system (Hospital Information System / Radiology Information System) and transfer them to any modality/medical scanner via DICOM communication protocols (C-FIND). The program offers an automated, error-free and reliable information transferring way from HL7 nodes (HIS/RIS) to DICOM nodes (medical scanners) without any human reaction.

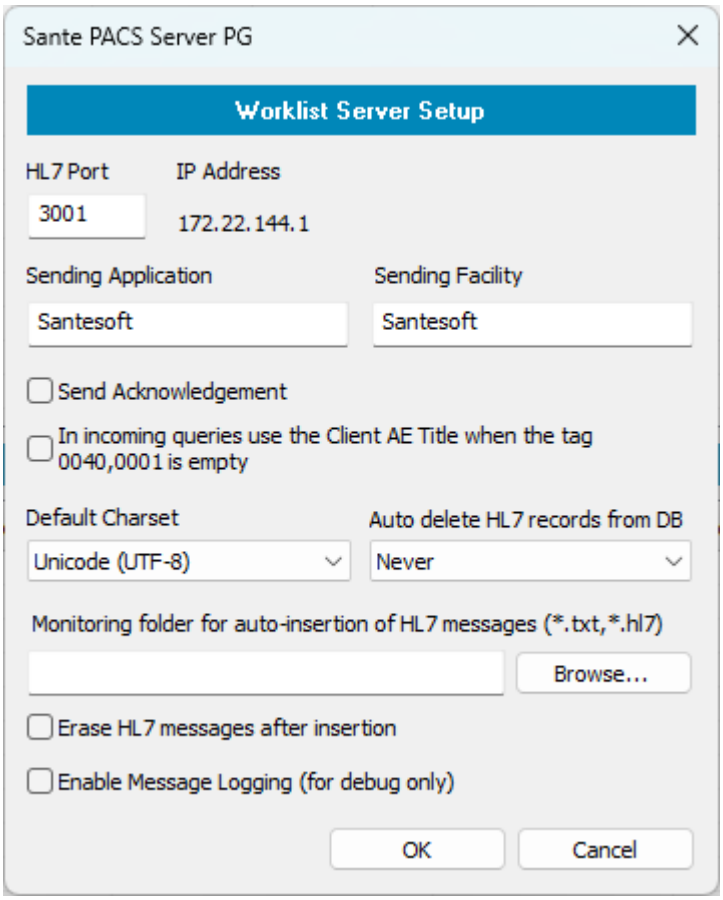
## The features of Worklist server module

- Supports unlimited number of patients/exams (it depends only on hard disk size)
- Supports unlimited number of connections with HL7 nodes
- Supports unlimited number of connections with DICOM nodes
- It can query other DICOM Worklist nodes
- Mapping of HL7 message fields to program's database fields to cover several HL7 message formats
- Supports all charsets (Latin, Chinese, Japanese, Korean, Cyrillic, Arabic, Greek, Turkish, etc.)
- Supports DICOM network services (C-FIND SCU/SCP, C-ECHO SCU/SCP)
- Compatible with all modalities (CT, MR, NM, US, XA, MG, CR etc.).

## Configuration

### Worklist Server Configuration

Before the first use of the Worklist, the user must configure it. The program can receive HL7 messages about the scheduled procedures from HIS/RIS programs and for that purpose must have an IP port for communication with other HL7 nodes. For the configuration the user must use the menu command **"Network ➡Worklist Server Setup"**. This command displays the following dialog box:




**HL7 Port**
The IP port for communication with other HL7 nodes like HIS/RIS software. If the number of the HL7 port is equal to 0 the program does not open the HL7 port and the program cannot receive HL7 messages. The port number 0 can be used if the user wants the Worklist server module to be disabled.

**IP Address**
This address is received automatically from Windows OS. The user can change this value only from the TCP/IP configuration of Windows.

**Sending Application / Sending Facility**
The program can send HL7 messages to other HL7 clients. The program will use these values in the corresponding fields MSH.3 and MSH.4 of the HL7 messages.

**Send Acknowledgement**
Some HL7 servers require to receive an acknowledgement as proof that the client received the message. With this option enabled, the program sends this acknowledgement to the server.

**In incoming queries use the Client AE Title when the tag 0040,0001 is empty**
Many DICOM nodes ask for station name, if this field does not have any value the program uses the AE Title as station name.

**Default Charset**
If the HL7 message does not contain any information about the used charset, the program uses the value of this box.

**Auto delete HL7 records**
The program can delete automatically from the database old messages that are not useful anymore. The messages to be deleted can be older than 7 days, 14 days, 1 month or 3 months.

**Monitoring folder for auto-insertion of HL7 messages**
The program scans the monitoring folder for HL7 messages and if they exist it inserts them into database. The messages must have the extension .txt or .hl7. After message processing the program adds to the file the extension .DON if the message was inserted successfully into database or the extension .ERR if not.

**Erase HL7 messages after insertion**
If this option is enabled, the program deletes the successfully inserted messages instead of adding in them the extension .DON. The program does not delete messages that were not inserted into the database.

**Enable Message Logging (for debug only)**
By default, the C-FIND requests from medical scanners to worklist are not logged in the log database of the program and they are not displayed in the SCP report lists. That is because many medical scanners send periodically C-FIND requests in very small timeframe (usually every 15 sec) and this way the log database becomes huge. The user must enable the C-FIND message logging of the worklist for debug reasons only and turn them off again after debugging.

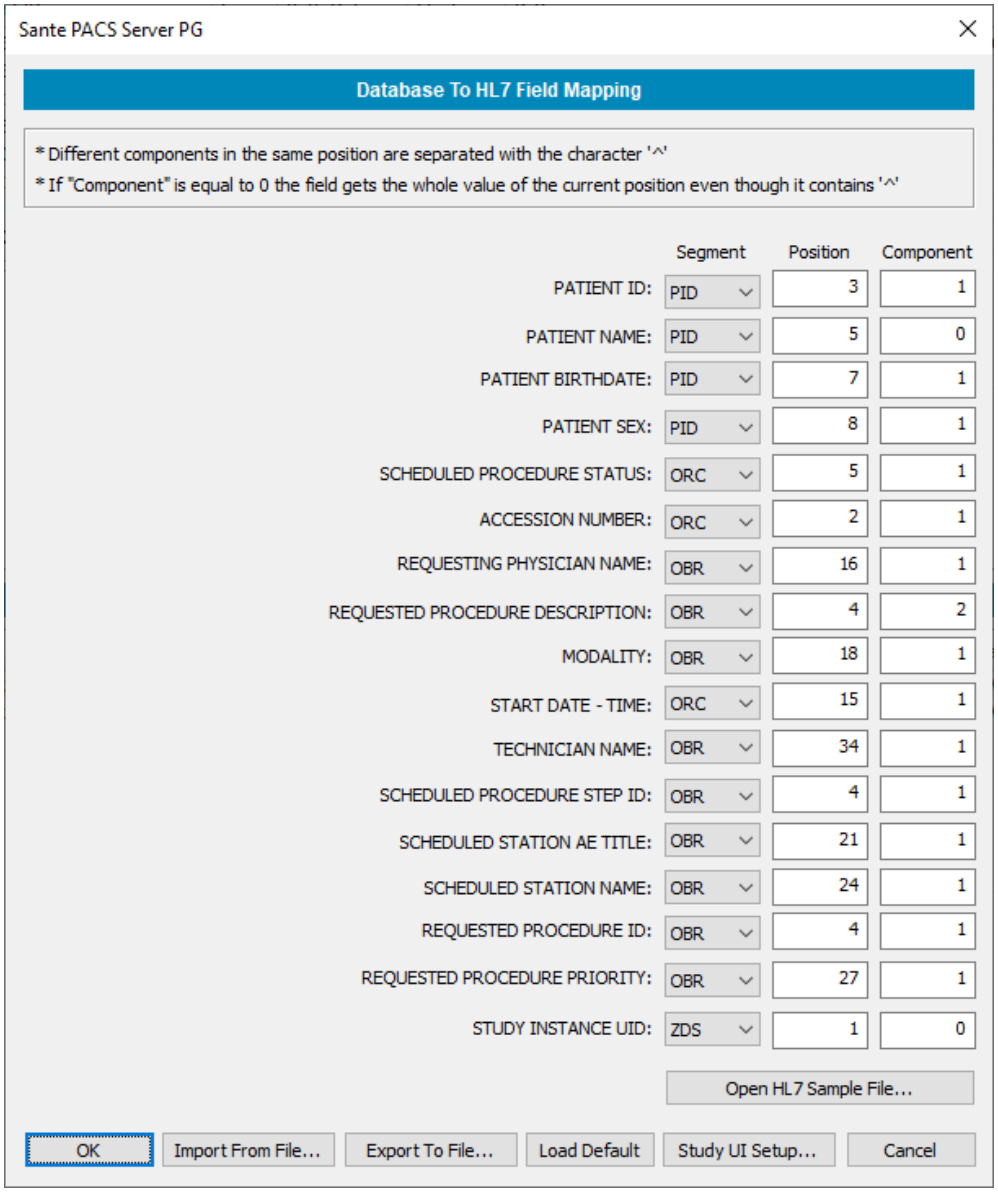
## Mapping HL7 message fields to Database fields

Not all the HL7 applications use the same fields of an HL7 message to store the same piece of information. In the example below the two messages use different position of the OBR segment to store the modality:

```
MSH|^~_&|EUROMEDICA|EUROMEDICA|SYNGO.PLAZA|SYNGO.PLAZA|20190315090409||ORM^O01|201903150904097|P|2.3.1|
PID||7007|7007||NAME||19731215|M|||ADDRESS||6944600091|2107778888||||8833925|||||||||GR|||
PV1||I|15076600732|||||^EOPYY^A||||||15076600732|||||54847|||||||||||||||||||||||||201903150852||||||||
ORC|NW|54847|||IP||^^^20190315085226||201903150852||||||201903150852|||||
OBR|1|54847||21100^CT|R||20190315095000|20190315100000||||||||||CT||||||CTAWP73120|||201903150852|||||
```

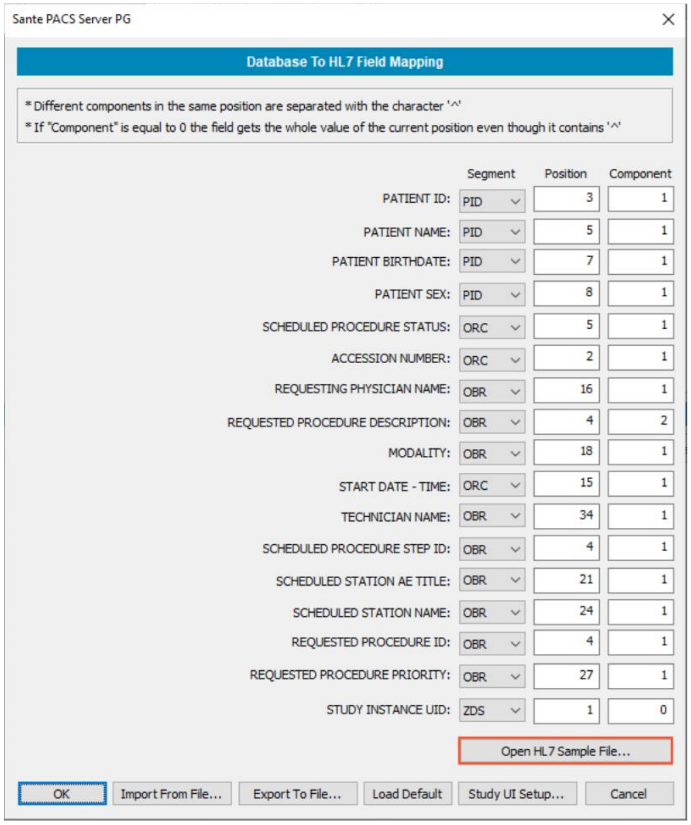
```
MSH|^~\&|application|application|REC_APP|REC_FAC|201912291543||ORM^O01||P|2.3.1|||||||||
PID|||1|1|Patient^Name||19591206|M|||||||||||||||||||||
PV1|||||||||||||||||||||||||||||||||||||||||||||||||||||
ORC|NW|||||||||||||||||||||||
OBR|||2005-9999|1234^BRAIN||200512301613529400||||||||||||||CT|||||||||||||||||||||
```

The first message uses the **ORB.18** field to store the modality while the second one uses the field **ORB.21**. For that reason, the user must map the fields of the HL7 message that generates a specific HL7 server to the database fields of Sante Worklist Server. The menu command **"Network ➡Worklist Database To HL7 Field Mapping"** lets the user do this mapping with the following dialog box:

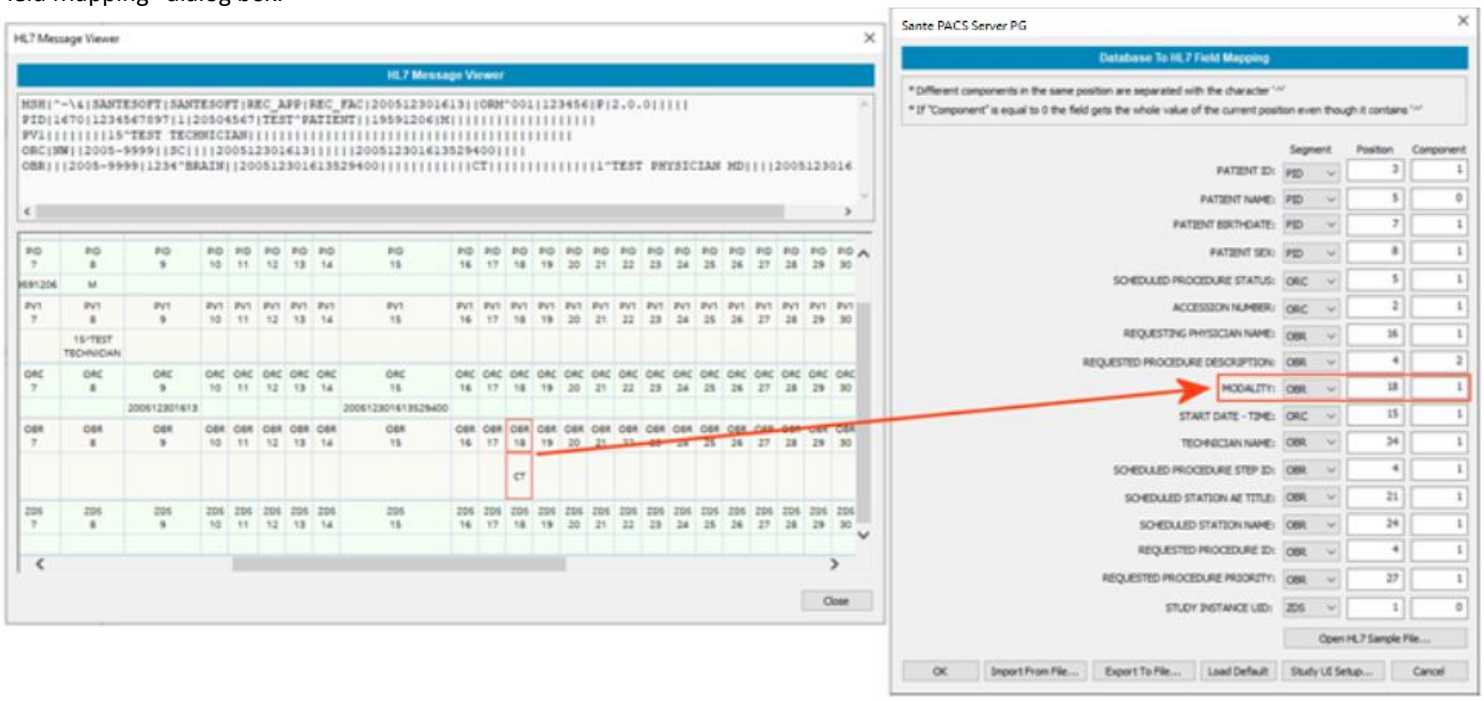


## Getting help on HL7 to Database field mapping

With the **“Open HL7 Sample File”** button, the program allows the user to open an HL7 message “side-by-side” with the **"Database To HL7 Field Mapping"** dialog box.




The user can view the position of a field in the HL7 message and put the correct value on corresponding field of the "Database To HL7 Field Mapping" dialog box.



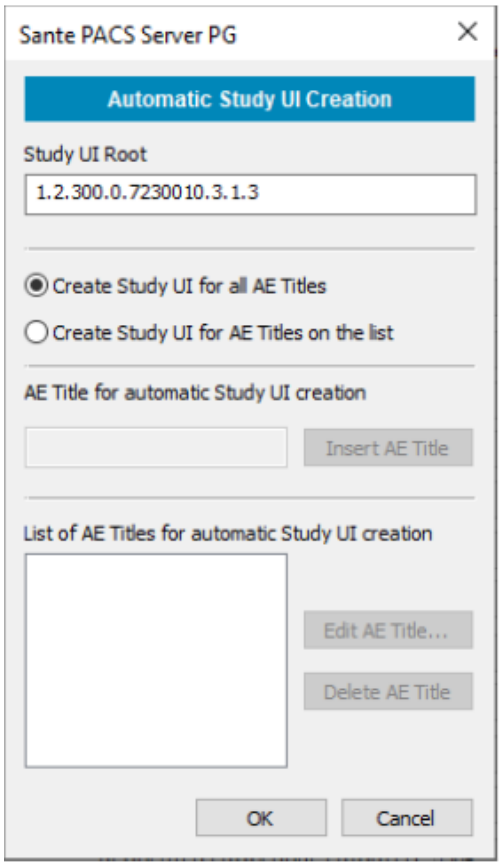

**Segment Position Component fields**

If a HL7 field does not contain the character **“^”**, the value of the **“Component”** must be equal to 1. If a HL7 field contains the character **“^”**, e.g. “1234^BRAIN”, for the first part of the value (1234) the “Component” must be equal to 1 and for the second part of the value (BRAIN) the “Component” must be equal to 2. If the value of “Component” is equal to 0, the program uses the whole value (1234^BRAIN), without splitting it into its parts.

**Export To File** button
The user can save the mapping to a disk file for backup and for use in another installation of the program.

**Import From File** button
It lets the user load from the disk drive a previously saved mapping.

**Study UI Setup** button
Some medical scanners do not accept worklist responses if those responses do not contain Study UI value and this field in the response is blank. With this button, the program can create Study UIs automatically for those scanners:

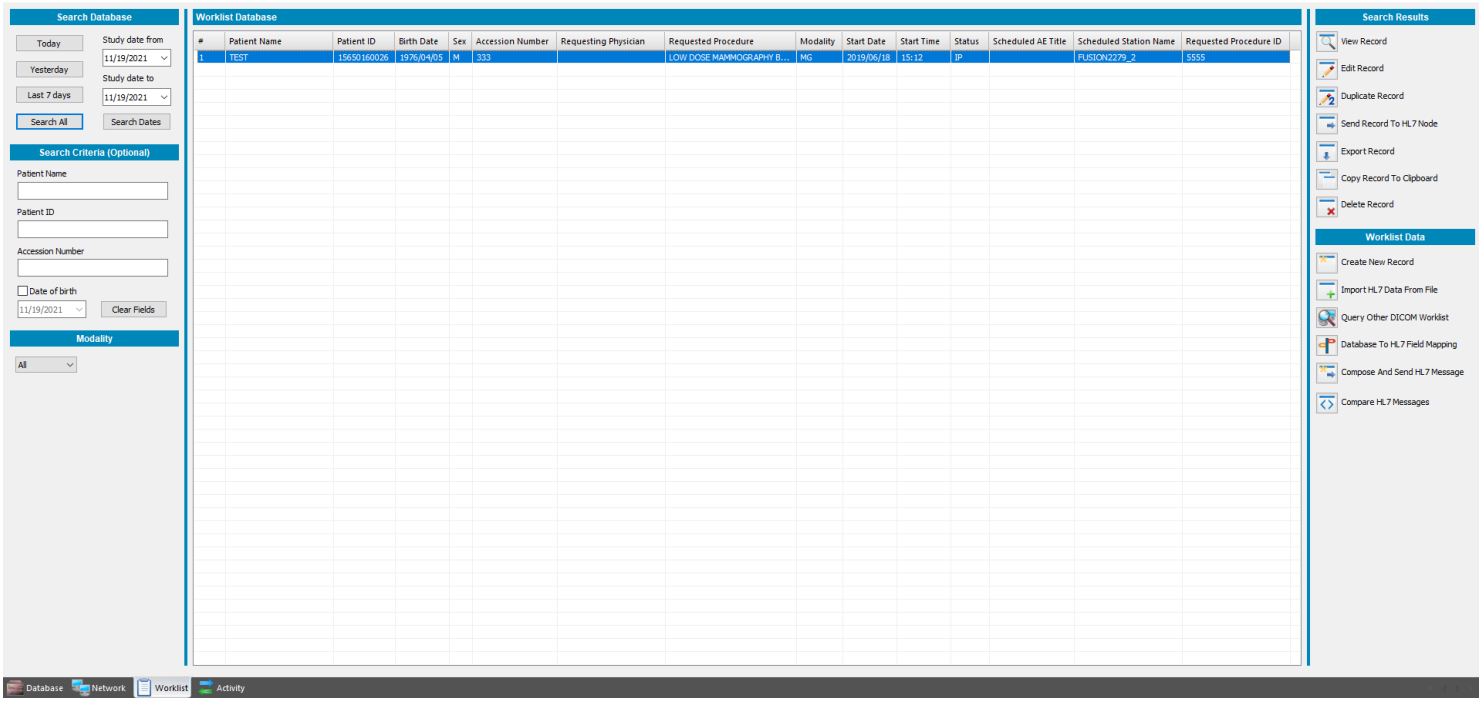



The program will create Study UIs only if the received HL7 message from HIS/RIS software does not contain any value for this field, as well as the target scanner exists in the list of the above dialog box.

## The User Interface

The window of the program is divided to 3 parts:

1. In the left part of the window there are the controls that let the user query the local database and view the records.
2. In the middle part of the window is the list that contains the records that the database engine returns after a query of the user of the program.
3. In the right of the window there are the controls for handling the results of a query.

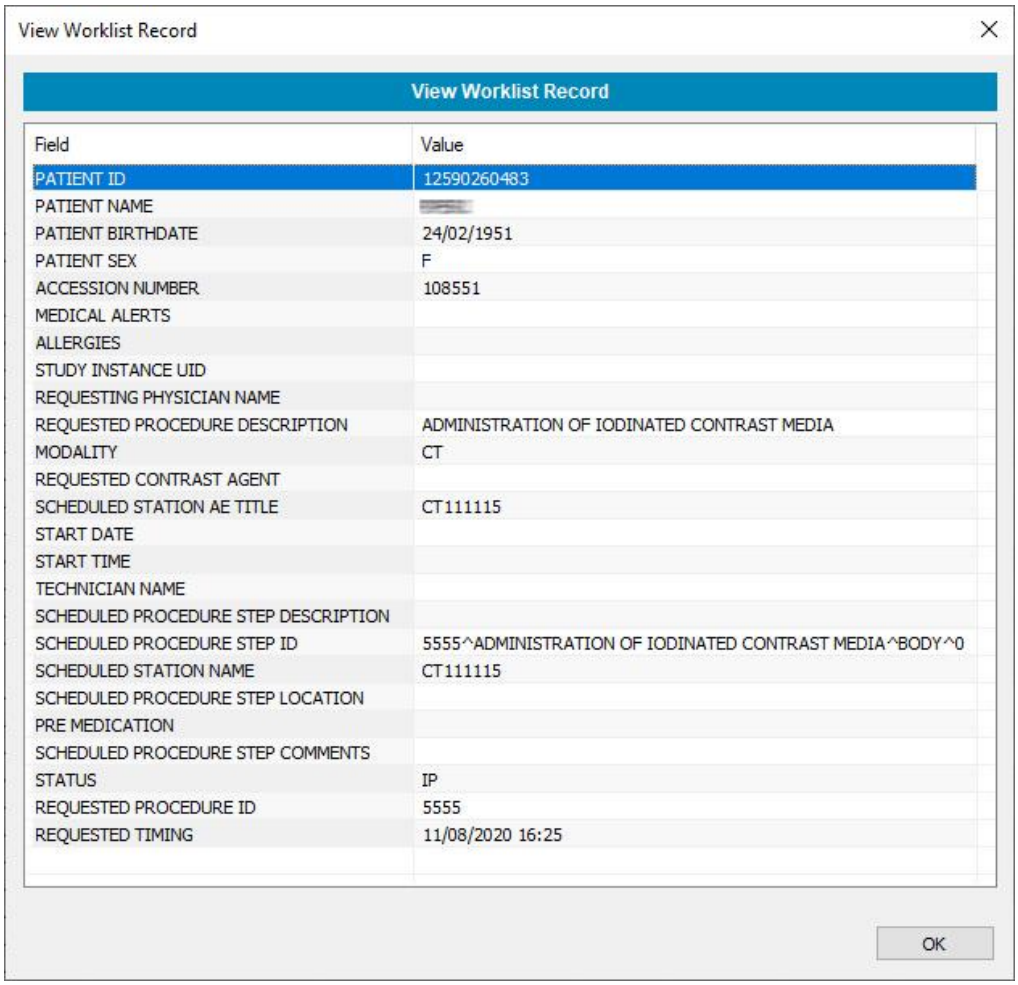


## The Command Buttons

| | |
|---|---|
| | View Record |
| | Edit Record |
| | Duplicate Record |
| | Send Record To HL7 Node |
| | Export Record |
| | Copy Record To Clipboard |
| | Delete Record |
| | |
|  | Create New Record |
| | Import HL7 Message From File |
| | Query DICOM Worklist Node |
| | Database To HL7 Field Mapping |
| | Compose And Send HL7 Message |
| | Compare HL7 Messages |

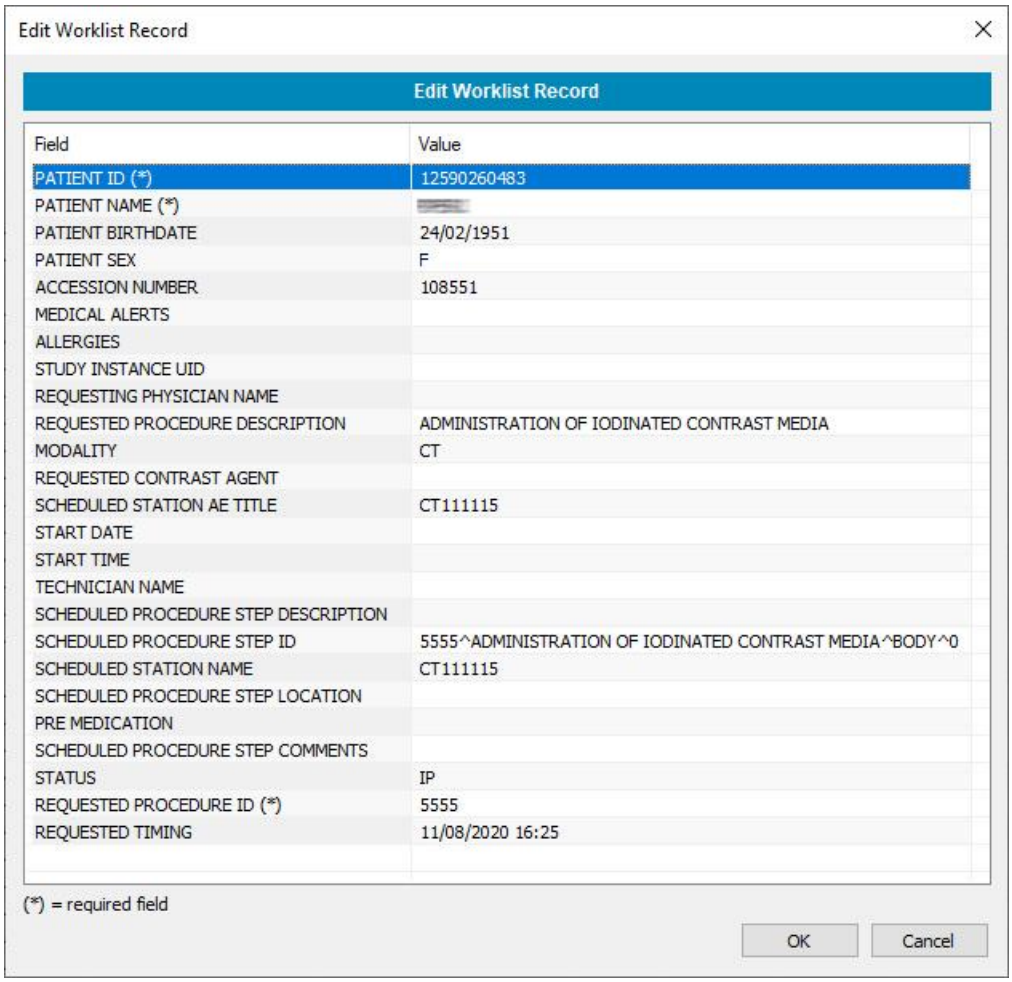
## View Record

This command lets the user review a database entry. The command is enabled when one record at least has been selected in the list of the records of the database. Otherwise, the command is grayed out.



## Edit Record

This command lets the user edit and modify a database entry. The fields that are pointed out with a star (*) are mandatory fields and they cannot be deleted. The command is enabled when one record at least has been selected in the list of the records of the database. Otherwise, the command is grayed out.

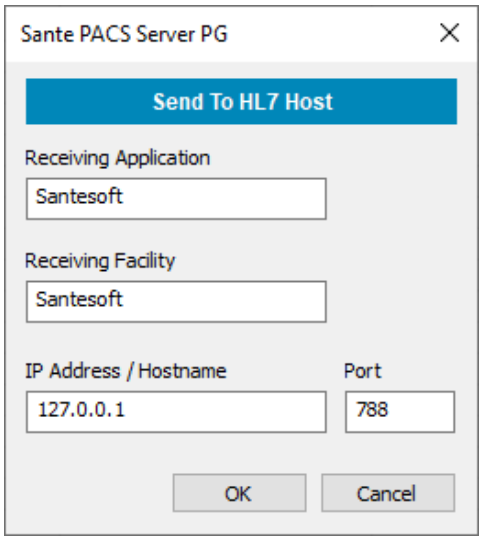



## Duplicate Record

This command lets the user create a second instance of a record and it is useful when the user wishes to create a new record that has many common fields with another record. The command is enabled when one record at least has been selected in the list of the records of the database. Otherwise, the command is grayed out.

## Send Record

This command lets the user send to a specific HL7 node a database entry, in the form of an HL7 message. The command is enabled when one record at least has been selected in the list of the records of the database. Otherwise, the command is grayed out.




## Export Record

This command lets the user save in a disk file a database entry in the form of HL7 message. The command is enabled when one record at least has been selected in the list of the records of the database. Otherwise, the command is grayed out.

## Copy Record To Clipboard

This command lets the user copy to clipboard a database entry in the form of HL7 message. The command is enabled when one record at least has been selected in the list of the records of the database. Otherwise, the command is grayed out.

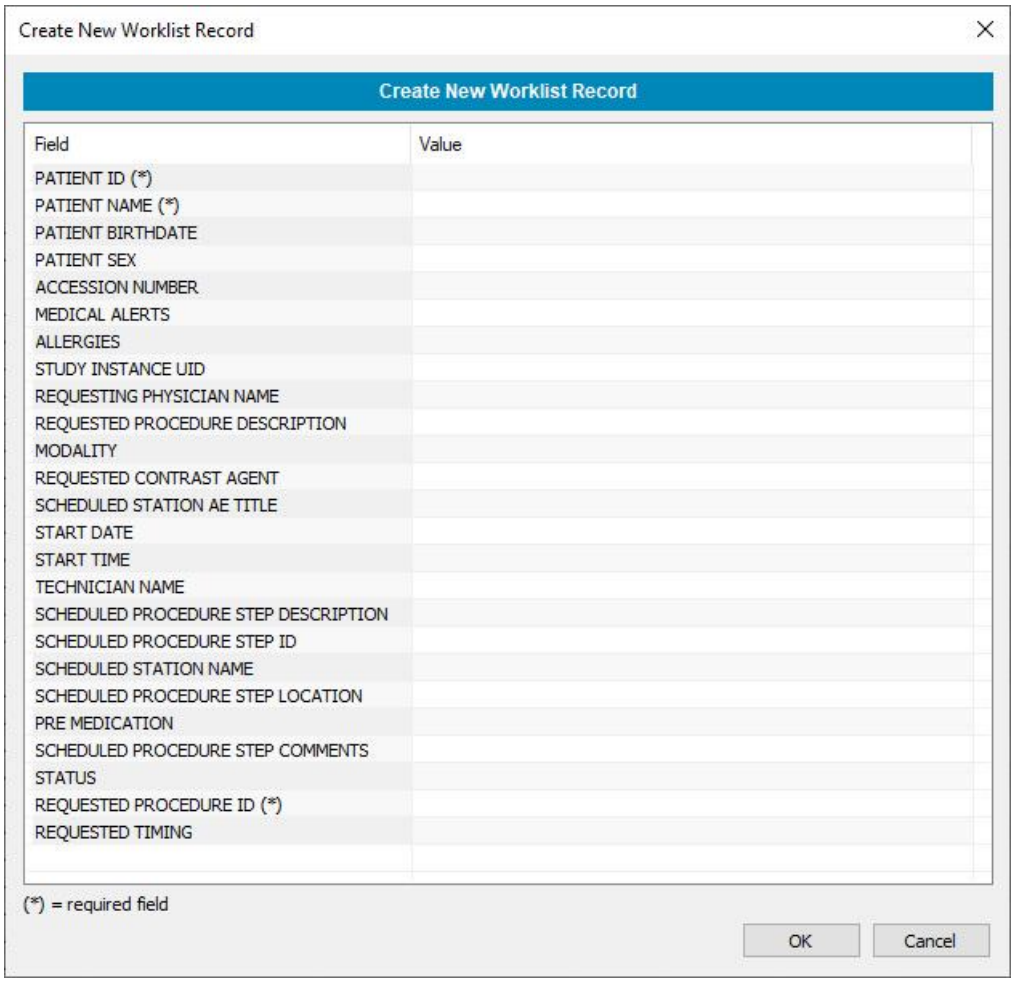
## Delete Record

This command lets the user delete one or more database entries that are not useful anymore. The command is enabled when one record at least has been selected in the list of the records of the database. Otherwise, the command is grayed out.

## Create New Record

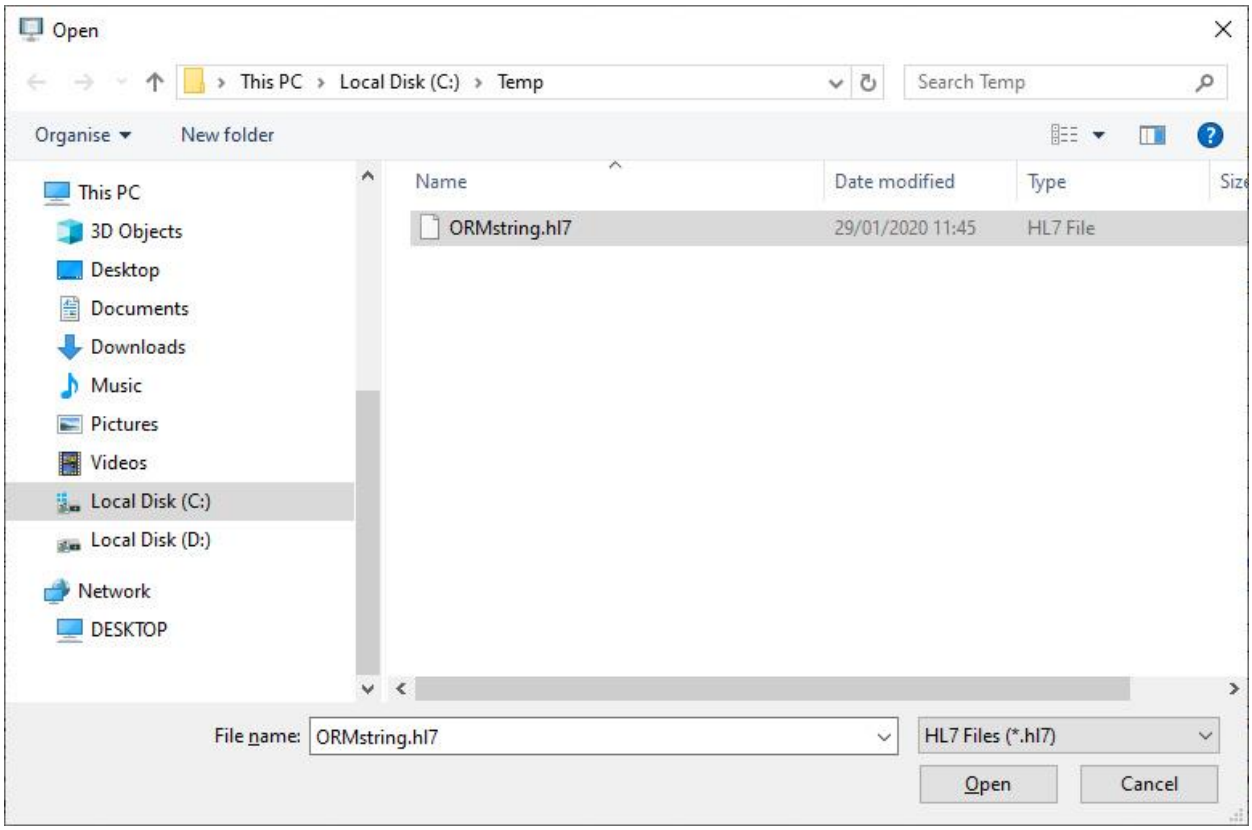


Although the HL7 data are usually created by HIS/RIS software and they are sent to Worklist server via an HL7 message, the program offers to user the ability to create new worklist records from scratch. The fields that are pointed out with a star (*) are mandatory fields.



## Import HL7 Message From File

This command lets the user insert into database an HL7 message that has been saved in a text file.

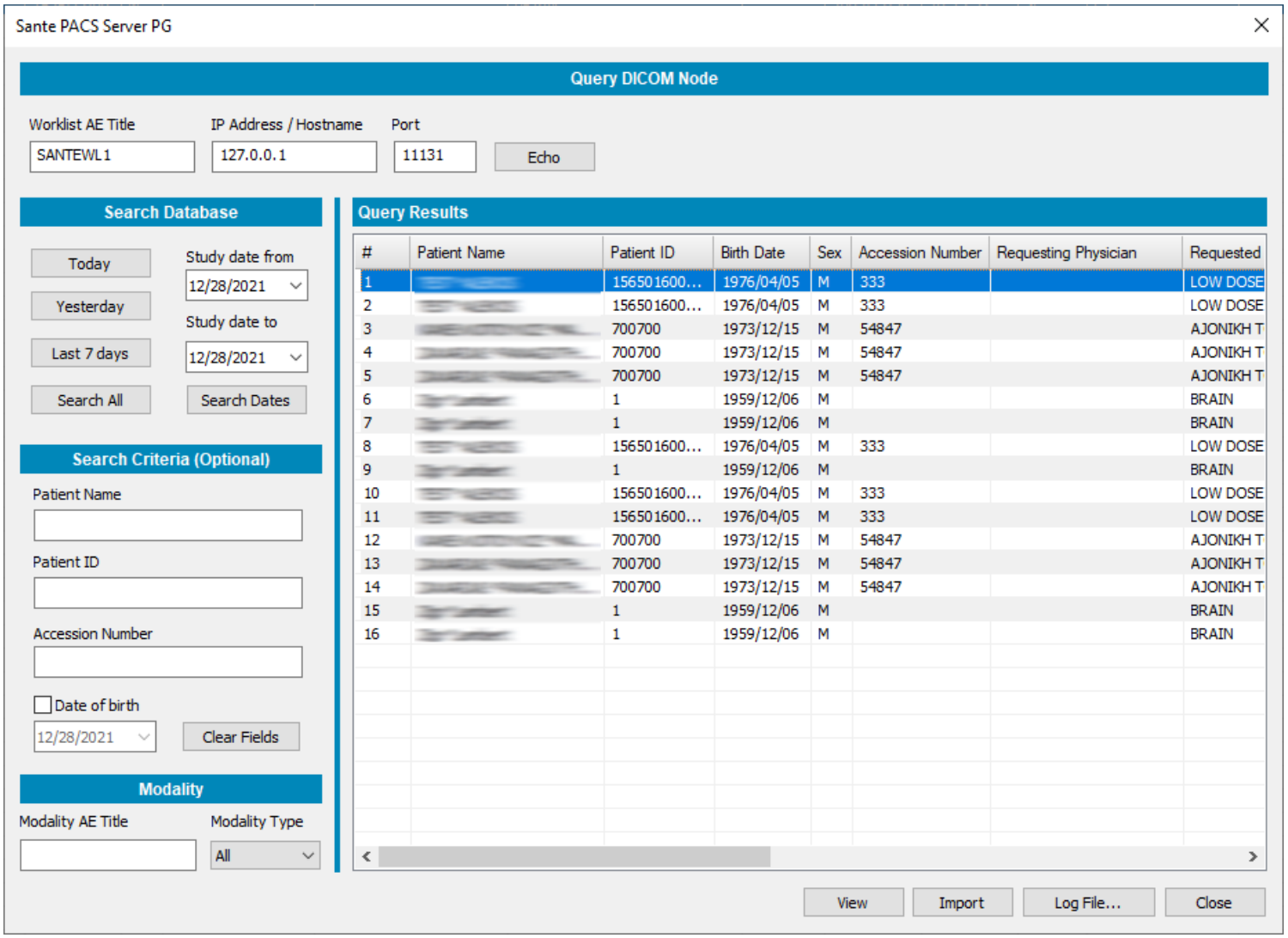



The file must be a text file that contains an HL7 formatted message like this example:

```
MSH|^~_&|EUROMEDICA|EUROMEDICA|SYNGO.PLAZA|SYNGO.PLAZA|20190315090409||ORM^O01|201903150904097|P|2.3.1|
PID||7007|7007||NAME||19731215|M|||ADDRESS||6944600091|2107778888||||8833925|||||||||GR|||
PV1||I|15076600732|||||^EOPYY^A||||||15076600732|||||54847|||||||||||||||||||||||||201903150852||||||||
ORC|NW|54847|||IP||^^^20190315085226||201903150852||||||201903150852|||||
OBR|1|54847||21100^CT|R||20190315095000|201903150100000|||||||||CT||||||CTAWP73120|||201903150852|||||
```

## Query DICOM Worklist Node

With this command, the program lets the user query other Worklist Servers of the network and import their records into the database of the program.



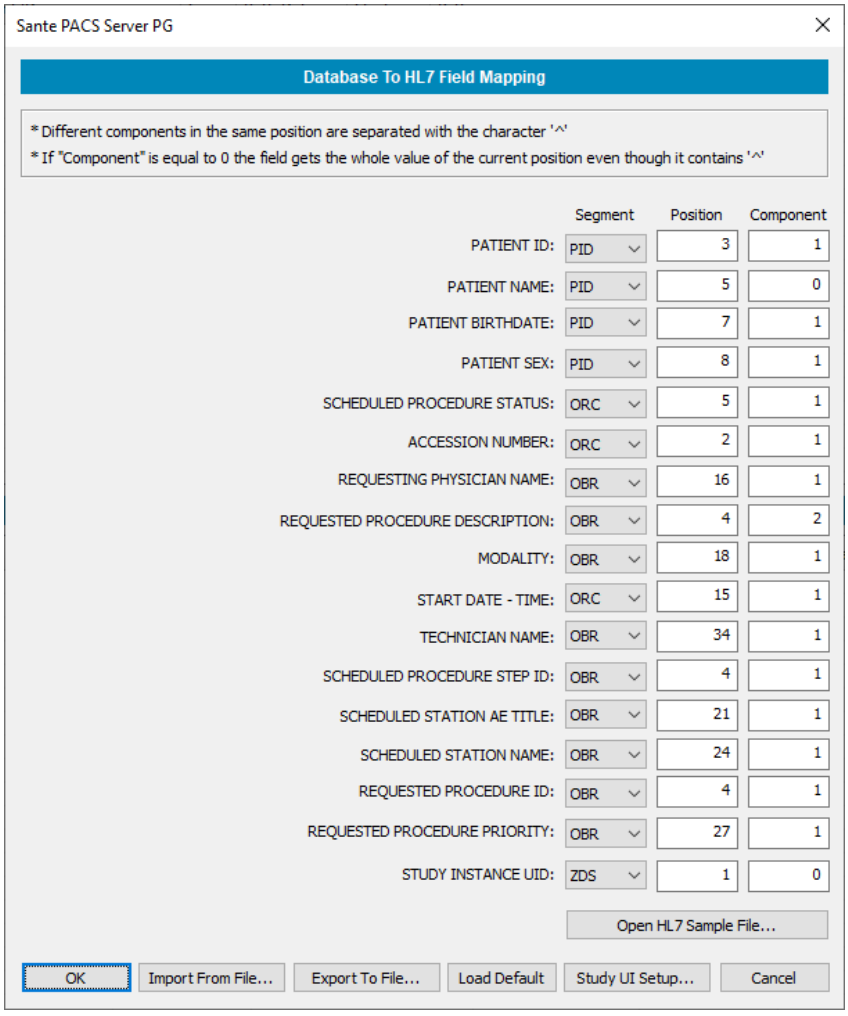
## Database To HL7 Field Mapping

Not all the HL7 applications use the same fields of an HL7 message to store the same piece of information. In the example below the two messages use different position of the OBR segment to store the modality:

```
MSH|^~_&|EUROMEDICA|EUROMEDICA|SYNGO.PLAZA|SYNGO.PLAZA|20190315090409||ORM^O01|20190315090409
7|P|2.3.1|
PID||7007|7007||NAME||19731215|M|||ADDRESS||6944600091|2107778888||||8833925|||||||||GR|||
PV1||I|15076600732|||||^EOPYY^A||||||15076600732|||||54847|||||||||||||||||||||||||2019031508
52||||||||
ORC|NW|54847|||IP||^^^20190315085226||201903150852||||||201903150852|||||
OBR|1|54847||21100^CT|R||20190315095000|20190315100000|||||||||CT||||||CTAWP73120|||20190315
0852|||||
```

```
MSH|^~\&|application|application|REC_APP|REC_FAC|201912291543||ORM^O01||P|2.3.1|||||||||
PID|||1|1|Patient^Name||19591206|M|||||||||||||||||||
PV1|||||||||||||||||||||||||||||||||||||||||||||||||||||
ORC|NW|||||||||||||||||||||||
OBR|||2005-9999|1234^BRAIN||200512301613529400|||||||||||||||CT|||||||||||||||||||
```

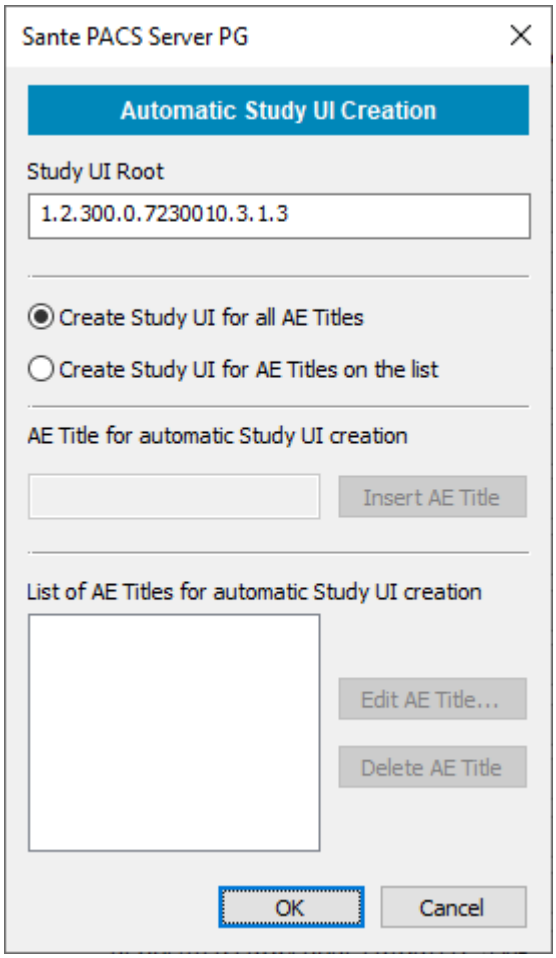
The first message uses the **ORB.18** field to store the modality (CT) while the second one uses the field **ORB.21**. For that reason, the user must map the fields of the HL7 message that generates a specific HL7 server to the database fields of Sante Worklist Server. This can be done with the use of the command **"Database To HL7 Field Mapping"**. This command displays the following dialog box that lets the user do this mapping:



**Export To File** button
The user can save the mapping to a disk file for backup and for use in another installation of the program.

**Import From File** button
It lets the user load from the disk drive a previously saved mapping.

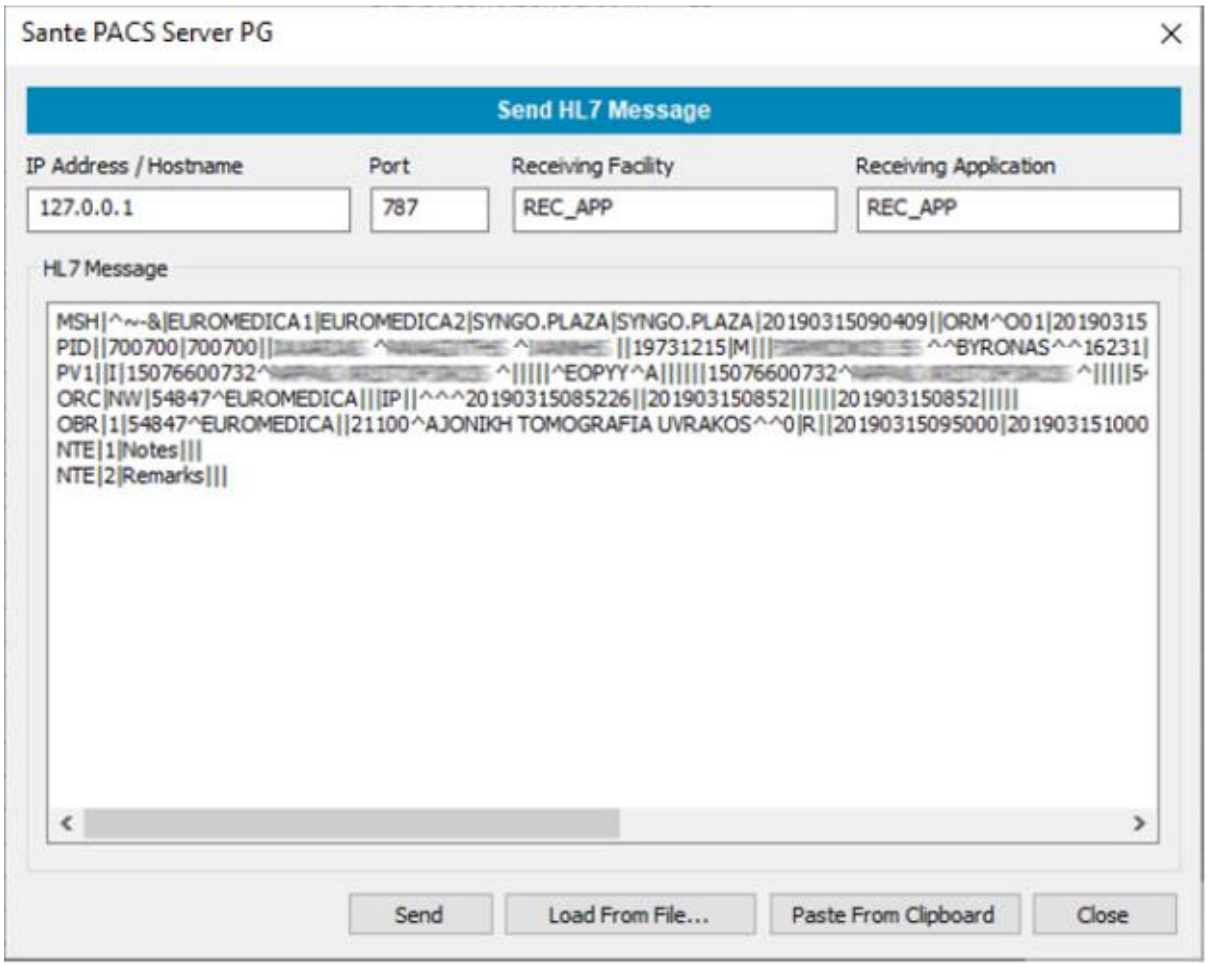
**Study UI Setup** button
Some medical scanners do not accept worklist responses if those responses do not contain Study UI value and this field in the response is blank. With this button, the program can create Study UIs automatically for those scanners:




The program will create Study UIs only if the received HL7 message from HIS/RIS software does not contain any value for this field, as well as the target scanner exists in the list of the above dialog box.

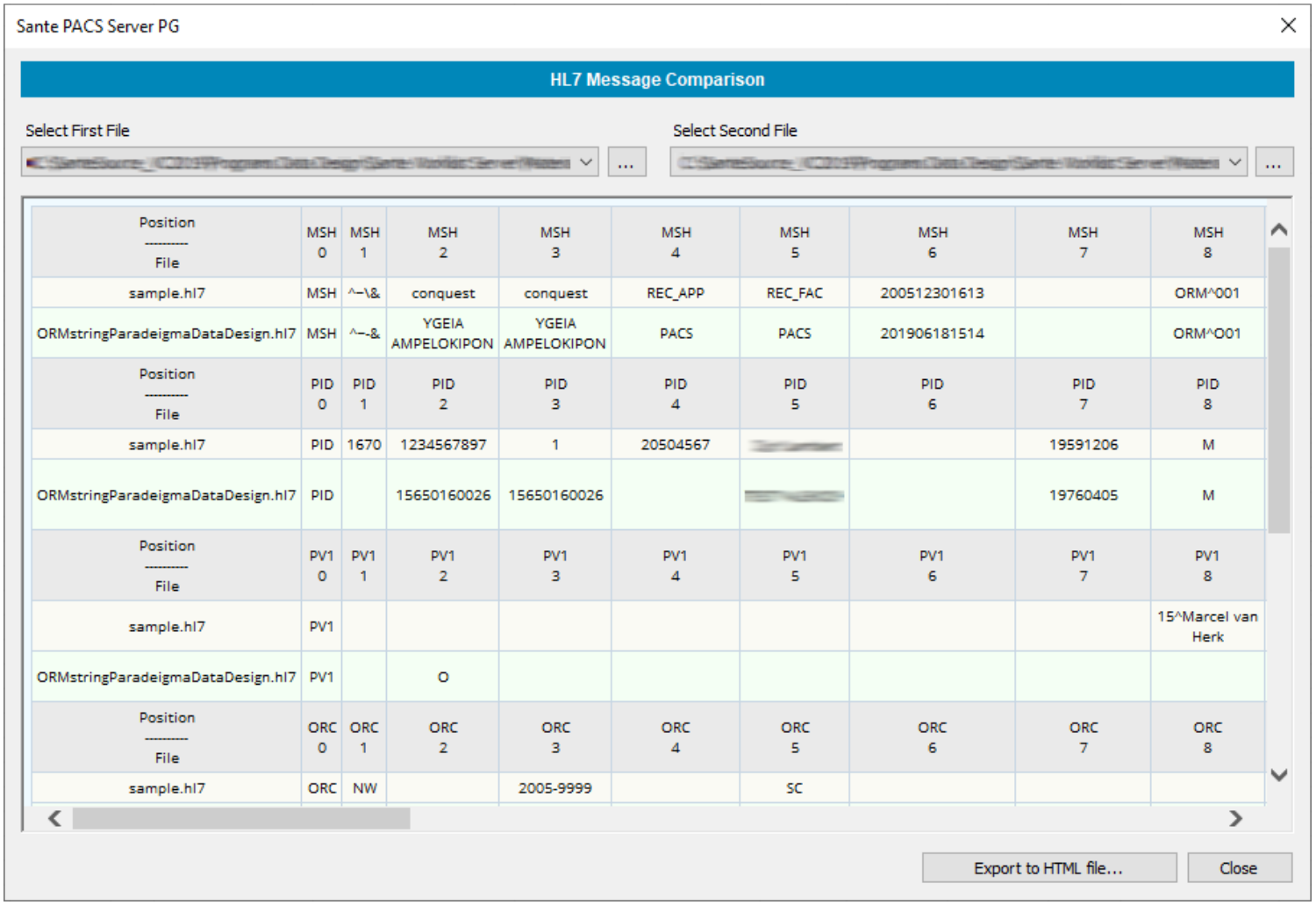
## Compose And Send HL7 Message

This command lets the user compose or load an HL7 message from a file, edit it and send it to a specific HL7 node.



## Compare HL7 Messages

This command lets the user compare two HL7 messages. It is useful in cases where one message works fine with the current field mapping of the program and another does not, and the user wishes to find the differences between the two messages.




| Position<br>---<br>File | MSH<br>0 | MSH<br>1 | MSH<br>2 | MSH<br>3 | MSH<br>4 | MSH<br>5 | MSH<br>6 | MSH<br>7 | MSH<br>8 |
|---|---|---|---|---|---|---|---|---|---|
| sample.hl7 | MSH | ^~\& | conquest | conquest | REC_APP | REC_FAC | 200512301613 | | ORM^001 |
| ORMstringParadeigmaDataDesign.hl7 | MSH | ^~-& | YGEIA AMPELOKIPON | YGEIA AMPELOKIPON | PACS | PACS | 201906181514 | | ORM^O01 |
| Position<br>---<br>File | PID<br>0 | PID<br>1 | PID<br>2 | PID<br>3 | PID<br>4 | PID<br>5 | PID<br>6 | PID<br>7 | PID<br>8 |
| sample.hl7 | PID | 1670 | 1234567897 | 1 | 20504567 | | | 19591206 | M |
| ORMstringParadeigmaDataDesign.hl7 | PID | | 15650160026 | 15650160026 | | | | 19760405 | M |
| Position<br>---<br>File | PV1<br>0 | PV1<br>1 | PV1<br>2 | PV1<br>3 | PV1<br>4 | PV1<br>5 | PV1<br>6 | PV1<br>7 | PV1<br>8 |
| sample.hl7 | PV1 | | | | | | | | 15^Marcel van Herk |
| ORMstringParadeigmaDataDesign.hl7 | PV1 | | O | | | | | | |
| Position<br>---<br>File | ORC<br>0 | ORC<br>1 | ORC<br>2 | ORC<br>3 | ORC<br>4 | ORC<br>5 | ORC<br>6 | ORC<br>7 | ORC<br>8 |
| sample.hl7 | ORC | NW | | 2005-9999 | | SC | | | |

## Integration with HIS/RIS software

The program lets the HIS/RIS programs open the studies of a patient to Sante DICOM Web Viewer for reviewing. The HIS/RIS software must query Sante PACS Server PG to get the tokens of the study and then must open Sante DICOM Web Viewer with these tokens as command line parameter.

### Retrieve the token of a study

The HIS/RIS software must send to **HL7 port** of Sante PACS Server PG a message that contains the Study Instance UID of the desired study. The message must start with the character 10H and it must finish with the character 0DH. Sante PACS Server PG will answer with a message that contains the token of the study. This message will start with character 10H and it will finish with the character 0DH as well. The token of a study is permanent and it can be stored from HIS/RIS software for later use.

**Examples**
The HIS/RIS software sends the message that contains the Study Instance UID:
**10H**1.2.826.0.1.3748527.1.4.2.0.20181120.185921.384642**0DH**

and it receives from Sante PACS Server PG the answer that contains the token of the study:
**10H**JHJ89ZQBkySrgt9f38OYic5wyC8YVO41pLPNesa5shYnmsI1DOXVF9eNK5SVwlg6**0DH**

### Retrieve the token of the studies of a patient

The HIS/RIS software must send to **HL7 port** of Sante PACS Server a message that contains the Patient ID of the desired patient. The message must start with the character 10H and it must finish with the character 0DH. Sante PACS Server will answer with a message that contains the Study Instance UID, the study date, the study description and the token of every study of the patient. Every Study Instance UID, study date, study description and every study token in the list ends with the character 0DH. This message will start with character 10H and it will finish with the character 0DH as well. Because every token ends with the character 0DH, the message ends with **two 0DH characters**.

**Examples**
The HIS/RIS software sends the message that contains the Patient UID:
**10H**ID200631zw609**0DH**

and it receives from Sante PACS Server the answer that contains the Study Instance UID, the study date, the study description and the token of the studies:

**10H**1.2.840.113619.2.55.3.2831173124.78.1375418120.812**0DH**
20190603**0DH**
THORAX**0DH**
H4sTZJQ7OqsxO9M633kSm9ES8wUexlW5auoZqJuuot88Cu1QLklYe38fR4R42lR4**0DH**
1.2.840.113619.2.55.3.2831173124.78.1375418120.813**0DH**
20190603**0DH**
THORAX**0DH**
H0QHLkW2RbpyVCTSrmP4xni2U0IgcEfogLK5bKaEV6Gg655ru1Kr76X770eIRhhL**0DH**
1.2.840.113619.2.55.3.2831173124.78.1375418120.814**0DH**
20190603**0DH**
THORAX**0DH**
HKx1erewwPpyBhAygMTmKHBFvLwCuqkT78r3fjiVUcM4gbB9XhsojgOA15Qj9MWM**0DH0DH**

### Usage of a token for loading of the study in Sante DICOM Web Viewer

Sante DICOM Web Viewer accepts in the command line a parameter of the form:
**sante://download?url=[server url]:[server port]&ssl=[yes|no]&token=[token of the study]**

**where:**
**server url:** it can be an IP address like 127.0.0.1, 192.168.1.2, or a valid ICANN name like mycompany.com
**server port:** the port of the built-in web server of Sante PACS Server PG, the default port is 3000
**ssl:** this parameter can have on of two values, **yes** if the server supports ssl connections or **no** if it does not
**token:** the token of the study

### Examples of usage of the token:

**Direct call of Sante DICOM Web Viewer:**
"C:\Program Files\Santesoft\Sante DICOM Web Viewer\Sante DICOM Web Viewer.exe"
"sante://download?url=127.0.0.1:3000&ssl=no&token=rXpIcx6FHk9KlrZs18j1p77rGy881TAOmsjAyLwSW3gRauyKNGwrVvhagXaK69Gs"

"C:\Program Files\Santesoft\Sante DICOM Web Viewer\Sante DICOM Web Viewer.exe" "sante://download?url=192.168.1.2:3000&ssl=no&token=rXpIcx6FHk9KlrZs18j1p77rGy881TAOmsjAyLwSW3gRauyKNGwrVvhagXaK69Gs"

"C:\Program Files\Santesoft\Sante DICOM Web Viewer\Sante DICOM Web Viewer.exe" "sante://download?url=mycompany.com:3000&ssl=yes&token=rXpIcx6FHk9KlrZs18j1p77rGy881TAOmsjAyLwSW3gRauyKNGwrVvhagXaK69Gs"

**As a link within a web page**

<a href="sante://download?url=127.0.0.1:3000&ssl=no&token=rXpIcx6FHk9KlrZs18j1p77rGy881TAOmsjAyLwSW3gRauyKNGwrVvhagXaK69Gs">Open this study</a>

<a href="sante://download?url=192.168.1.2:3000&ssl=no&token=rXpIcx6FHk9KlrZs18j1p77rGy881TAOmsjAyLwSW3gRauyKNGwrVvhagXaK69Gs">Open this study</a>

<a href="sante://download?url=mycompany.com:3000&ssl=yes&token=rXpIcx6FHk9KlrZs18j1p77rGy881TAOmsjAyLwSW3gRauyKNGwrVvhagXaK69Gs">Open this study</a>

## Troubleshooting

### Starting and ending characters of a message

HL7 messages, when they are transferred with a socket, they must start with the character 0B (HEX) and they must end with the characters 1C 0D (HEX). Please ensure that you use these characters in your messages.

### Check the HL7 port of the program

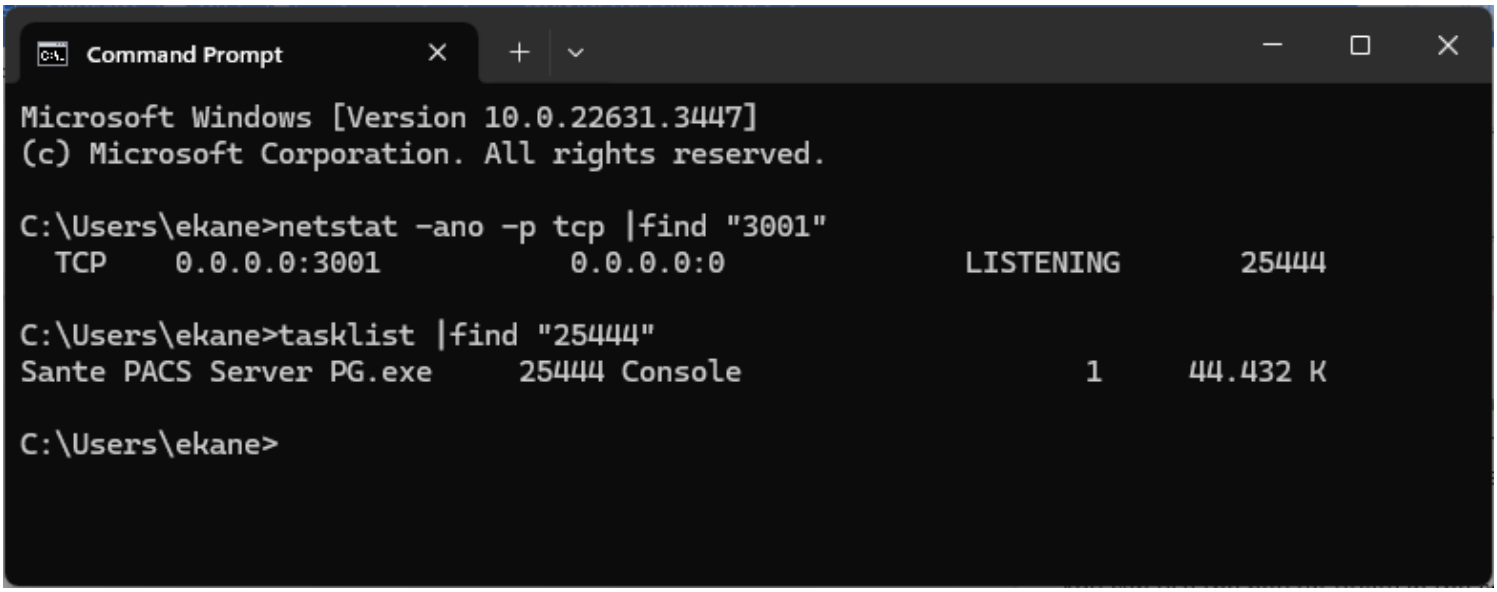
You can use the netstat utility in the command prompt to check if the port of the program is opened and at which IP address.

In the command prompt, use the command:

**C:\>netstat -ano -p tcp |find "3001"**

to check if the HL7 port 3001 of the program is opened and at which IP Address.
The last number that the program prints is the PID of the application that has opened the port.

In the command prompt, use the command to find which is this application:

**C:\>tasklist |find "<PID>"**

(where <PID> is the actual number of the application, in this example it is 25444)