

# Network Configuration Guide

## User Guide

Copyright © 2022 [Santesoft LTD](#), all rights reserved

### Contents

Definitions .....	2
Configure the DICOM Server .....	3
Automatic CD/DVD burning and printing of received studies .....	4
Delayed automatic CD/DVD burning and printing of received studies.....	5
Insert the information of the other DICOM nodes .....	6
Configure the Worklist Server .....	8
Configure the HTTP Server .....	9
Enable SSL Encryption .....	10
Troubleshooting .....	11
Check a port of the program .....	12

## Definitions

### DICOM Services

The DICOM protocol consists of many different services, most of which involve transmission of data over a network. The program supports the store, query/retrieve and echo services (C-STORE/C-FIND/C-MOVE/C-ECHO SCU).

### Store Service (C-STORE)

The DICOM Store service is used to send images or other persistent objects to a PACS or workstation.

### Query/Retrieve Service (C-FIND/C-MOVE/C-GET)

This service enables a workstation to find lists of images or other objects and then retrieve them from a PACS system.

### Echo Service (C-ECHO)

This service enables a workstation to verify the connection and the communication with another workstation or a PACS system.

### DICOM communication protocol

The communication protocol is an application protocol that uses TCP/IP to communicate between systems. DICOM files can be exchanged between two entities that can receive image and patient data in DICOM format.

### Communication between DICOM nodes

Two DICOM nodes (workstations, PACS systems) can communicate if they know each other. That means, each system must know the AE Title, the IP address or hostname and the IP port of the other system.

### AE Title

AE Title or AET is an abbreviation for Application Entity Title. An AE Title is used by an Application Entity (AE) to identify itself. AE Titles need to be locally unique and are typically managed by a system administrator. They are case-sensitive and 16 bytes long. They are to be configured prior to initializing a DICOM connection.

### IP Address

An Internet Protocol (IP) address is a numerical identification (logical address) that is assigned to devices participating in a computer network utilizing the Internet Protocol for communication between its nodes. Although IP addresses are stored as binary numbers, they are often displayed in more human-readable notations, such as 192.168.100.1. Usually can be translated into a hostname via the local hosts file, or the Domain Name System (DNS) resolver, and can be used instead of the hostname.

### Hostname

A hostname is a domain name assigned to a host computer, and is translated into an IP Address via the local hosts file, or the Domain Name System (DNS) resolver. It can be used instead of an IP Address.

### Port

TCP/IP protocol uses the notion of port numbers to identify sending and receiving application end-points on a host. Each side of a TCP connection has an associated 16-bit unsigned port number (1-65535) reserved by the sending or receiving application. Arriving TCP data packets are identified as belonging to a specific TCP connection by its sockets, that is, the combination of source host address, source port, destination host address, and destination port. Ports need to be locally unique and are typically managed by a system administrator. The numbers 104 and 11112 are usually used as IP Ports in DICOM networking, but any number between 1 and 65535 can be used, but it must be unique for the host (node/PC), and it must not be used from any other application.

### Firewall

A firewall is a dedicated software, which inspects network traffic passing through it, and denies or permits passage based on a set of rules. If there is a firewall in your computer, you must unblock the application.

## Configure the DICOM Server

Select the menu command "**Network** ➔ **Network Server Setup**".

A dialog box appears and lets the user to insert the AE Title and the port of Sante PACS Server PG.

The screenshot shows a dialog box titled "Sante PACS Server PG" with a close button (X) in the top right corner. The main title bar of the dialog is "Network Server Setup".

Under the heading "This DICOM Server", there are three input fields: "AE Title" containing "SANTESRVPG1", "Port" containing "11122", and "IP Address" containing "192.168.1.6".

Below this, there are two sections for automatic and delayed burning and printing of received series/studies. Each section provides instructions and lists AE titles for Epson and Primera robots.

At the bottom, there is a checkbox for "Enable Debug Mode" which is currently unchecked. Below the checkbox are three buttons: "OK", "Cancel", and "Help...".

**AE Title**  
The AE title of this DICOM node. The AE title must be up to 16 characters without any white character (space, enter, etc.).

**Port**  
The IP port for the communication with other DICOM nodes. If the number of the IP port is equal to 0 the program does not open the port and the program will cannot communicate with other DICOM nodes. The port number 0 can be used if the user wants the DICOM 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.

**Enable Debug Mode**  
This check box enables the debug mode of the program. The program in debug modes generates large debug data and it must be used if there is a problem and in consultation with the support team of Santesoft LTD.

## Automatic CD/DVD burning and printing of received studies

Sante PACS Server PG when receiving studies, except of storing them on the disk it can also send them automatically for CD/DVD burning and label printing to robotic disk publisher devices of EPSON and PRIMERA.



For this purpose it uses two additional AE Titles, one with the addition of "\_E" suffix in the original AE Title and one with the addition of "\_P" suffix. E.g. If the defined AE Title is **SANTESRV1**, the program creates the AE Titles **SANTESRV1\_P** and **SANTESRV1\_E** as well. These additional AE Titles are used for automatic CD/DVD burning and printing.

Sante PACS Server PG ✕

**Network Server Setup**

This DICOM Server

AE Title	Port
<input style="width: 90%;" type="text" value="SANTESRVPG1"/>	<input style="width: 90%;" type="text" value="11122"/>

IP Address : 192.168.1.6

---

Automatic burning and printing of received series/studies

If a client/scanner uses a single connection to send all the contents of a CD/DVD use the AE Titles below:

AE Title for automatic burning and printing on Epson robot:  
SANTESRVPG1\_E ←

AE Title for automatic burning and printing on Primera robot:  
SANTESRVPG1\_P ←

---

Delayed burning and printing of received series/studies

If a client/scanner uses multiple connections to send the contents of the same CD/DVD use the AE Titles below:

AE Title for delayed burning and printing on Epson robot:  
SANTESRVPG1\_TE

AE Title for delayed burning and printing on Primera robot:  
SANTESRVPG1\_TP

Delay Time (sec)

Enable Debug Mode

If a client DICOM node (a CT/MR/US/DX or other medical scanner, a DICOM workstation etc.) instead of using the original AE Title of Sante PACS Server PG it uses the AE Title with the "\_E" suffix, then Sante PACS Server PG stores the received series/studies on the database and automatically sends them for printing and burning to an **EPSON** producer.

If a client DICOM node (a CT/MR/US/DX or other medical scanner, a DICOM workstation etc.) instead of using the original AE Title of Sante PACS Server PG it uses the AE Title with the "\_P" suffix, then Sante PACS Server PG stores the received series/studies on the database and automatically sends them for printing and burning to an **PRIMERA** producer.

## Delayed automatic CD/DVD burning and printing of received studies

Some medical scanners use multiple connections to send a whole study (usually one connection per series of the study). In that case, the program by using the AE title with "\_E" and "\_P" suffixes that described in the previous paragraph, will create one CD/DVD per connection, that is one CD/DVD for every series, and not one CD/DVD for the whole study that contains all the series of the patient.

In that case the client DICOM node (a CT/MR/US/DX or other medical scanner, a DICOM workstation etc.) must use the AE Title with a "\_TE" or "\_TP" suffix. With these suffixes the program waits for a specific time before sending the received series of the study for printing and burning. If it receives a new series that belong to the study in delay, it waits again the specified time for the next series and so on. If it does not receive in the specified time a series that belong to the study in delay, it sends the study for burning and printing.

The user specifies the delay time in the control **Delay Time (sec)** control of the dialog box below. The default value is 120 sec.

Sante PACS Server PG
✕

**Network Server Setup**

**This DICOM Server**

AE Title	Port
SANTESRVPG1	11122

IP Address : 192.168.1.6

**Automatic burning and printing of received series/studies**

If a client/scanner uses a single connection to send all the contents of a CD/DVD use the AE Titles below:

AE Title for automatic burning and printing on Epson robot:  
SANTESRVPG1\_E

AE Title for automatic burning and printing on Primera robot:  
SANTESRVPG1\_P

**Delayed burning and printing of received series/studies**

If a client/scanner uses multiple connections to send the contents of the same CD/DVD use the AE Titles below:

AE Title for delayed burning and printing on Epson robot:  
SANTESRVPG1\_TE ←

AE Title for delayed burning and printing on Primera robot:  
SANTESRVPG1\_TP ←

Delay Time (sec)  ←

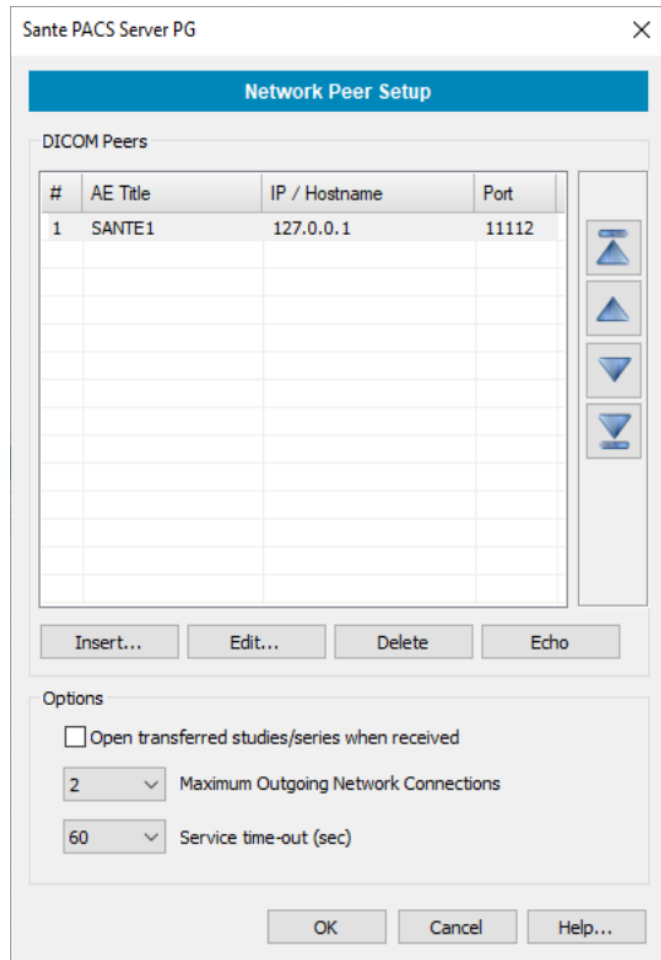
Enable Debug Mode

## Insert the information of the other DICOM nodes

Select the server menu command **"Network → Network Peer Setup"**.

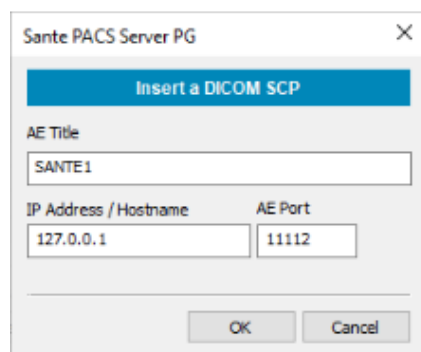
A dialog box appears and lets the user to insert the other DICOM servers and clients that exist in the network.

This command requires administrator privileges.



## Insert/Edit a PACS system

By pressing the **"Insert"** or **"Edit"** buttons of the above dialog box, a new dialog box appears and lets the user to insert the information of the PACS system.



Select a DICOM server row and press **"Echo"** button, to check the connection with the selected server.

Select a DICOM server row and press **"Delete"** button, to delete the selected server.

## Open transferred studies/series when received option

When the program receives studies and/or series it inserts them in the database.

If you wish to open them immediately after they have been received, check the checkbox **"Open transferred studies/series when received"**.

**Maximum Connections option**

When the program acts as a client and the user searches and retrieves studies/series from other servers, this option determines the maximum number of outgoing connections. The program starts transferring as many studies/series as the maximum connections number indicates and the rest of them are putted in a queue. The program waits a transfer to finish and then opens another until the queue is empty.

When the program acts as a server the number of incoming connections are unlimited.

That means, any number of remote clients can connect with the program and transfer files, without any limitation.

**Service time-out option**

This option determines how long the program waits for a response from the peer. If this time passes the program interrupts the connection.

## Configure the Worklist Server

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 the 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:

The screenshot shows a dialog box titled "Sante PACS Server PG" with a close button (X) in the top right corner. The main title of the dialog is "Worklist HL7 Network Setup".

The dialog contains the following fields and options:

- HL7 Port:** A text box containing the value "3001".
- IP Address:** A text box containing the value "192.168.1.6".
- Sending Application:** A text box containing the value "Santesoft".
- Sending Facility:** A text box containing the value "Santesoft".
- Send Acknowledgement:** An unchecked checkbox.
- In incoming queries use the Client AE Title when the tag 0040,0001 is empty:** An unchecked checkbox.
- Default Charset:** A dropdown menu currently set to "Unicode (UTF-8)".

At the bottom of the dialog are two buttons: "OK" and "Cancel".

### HL7 Port

The IP port for the 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 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 a proof that the client received the message. With this option enabled, the program sends this acknowledgement to the server.

### Default Charset

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

### Rest of configuration

For the rest of configuration and for the usage of Worklist server module, please read the manual “**Built-in Worklist Guide**”.



## Configure the HTTP Server

Select the menu command "Network → HTTP Server Setup".

A dialog box appears and lets the user to configure the HTTP server module.

The screenshot shows the "HTTP Server Configuration" dialog box. It has a title bar "Sante PACS Server PG" and a close button. The main area is titled "HTTP Server Configuration" and is divided into two sections: "This Web Server" and "Web Server Usage".

**This Web Server**

Institution	Department	Internet IP Address (True IP)
Santesoft LTD	R&D Department	77.49.159.15

Web IP Port: 3000 (The Web IP port must be forwarded by the router)

Enable SSL Encryption

Update Web Server

**Web Server Usage**

Send to web client zip files that contain:

Web Server Users...	DICOM files JPEG2000 lossy compressed	Web Server Log...
---------------------	---------------------------------------	-------------------

Close

## Institution, Department

This information appears on the web page of the server and informs the user with which server he has been connected.

The screenshot shows the web interface of the Sante PACS Server PG. The browser address bar shows "127.0.0.1:3000". The page header includes the Santesoft logo and "PACS and DICOM software". The main content area displays the following information:

Santesoft LTD - R&D Department

Client IP: 77.49.159.15

To use this system you must login

Continue

**Downloads**

- Download Sante Web Downloader (suitable for use with this server only)
- Download Sante DICOM Web Viewer (suitable for use with this server only)

Copyright © 2021 Santesoft LTD, all rights reserved

**Internet IP Address (True IP)**

The internet IP address is received automatically from the internet service provider and it is the address with which the HTTP server goes to the internet. The user cannot change it.

**Web IP Port**

With this port the HTTP server goes to the internet. If the number of the Web port is equal to 0 the program does not open the port and the program cannot communicate with web clients. The port number 0 can be used if the user wants the HTTP server module to be disabled.

**ATTENTION!**

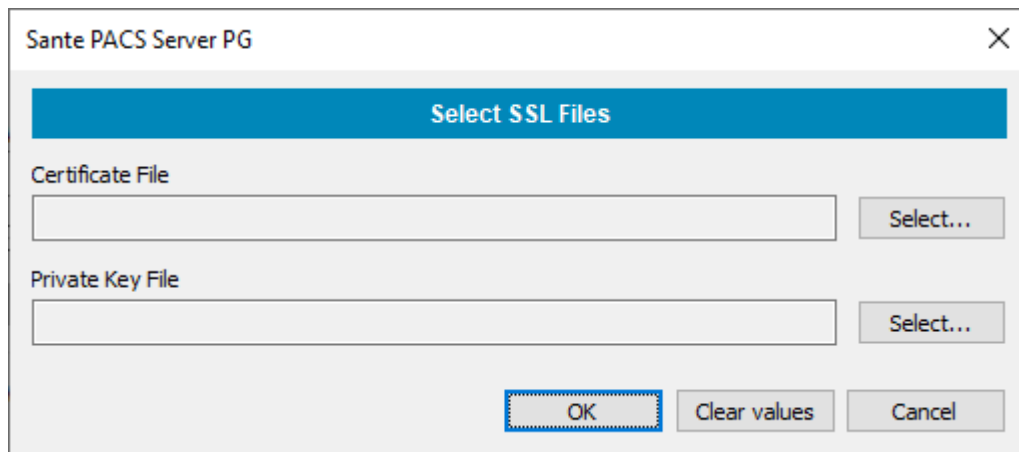
The Web IP port of the HTTP server must be forwarded by the router!

**Enable SSL Encryption**

Because of the critical data contained in the server it is **strongly** recommended the HTTP server module to be used with the SSL encryption enabled and if it is possible only within VPN connections.

To get an SSL Certificate, the user must have a valid **ICAN** (Internet Corporation for Assigned Names) server name like **santesoft.com**.

When the user checks the “**Enable SSL Encryption**” checkbox, the program asks for the certificate file (.crt) and the private key file (.key) that the user has received from the SSL Certificate provider of his choice.



The screenshot shows a dialog box titled "Sante PACS Server PG" with a close button (X) in the top right corner. The main title of the dialog is "Select SSL Files". Below this title, there are two sections for file selection:

- Certificate File:** A text input field followed by a "Select..." button.
- Private Key File:** A text input field followed by a "Select..." button.

At the bottom of the dialog, there are three buttons: "OK", "Clear values", and "Cancel". The "OK" button is highlighted with a blue dashed border.

**Update Web Server button**

If one or more of above information has been changed, the user must restart the HTTP server module by pressing the “**Update Web Server**” button.

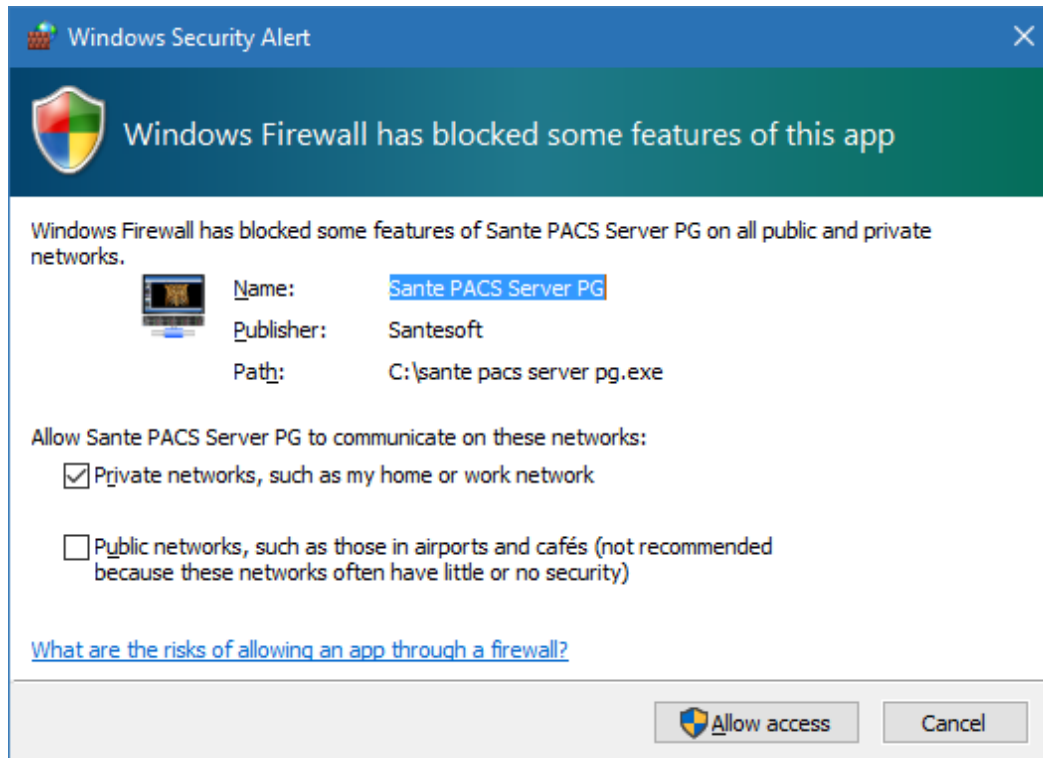
**Rest of configuration**

For the rest of configuration and for the usage of HTTP server module, please read the manual “**Built-in Web Server Guide**”.

## Troubleshooting

If the program cannot communicate with other DICOM nodes or it cannot transfer files from other DICOM nodes, please check the following checklist:

- Ensure that the port of the program is not used by any other program.
- Ensure that the port of the program is not blocked from a firewall or an antivirus.
- When the program starts it asks for to be added in firewall exception list. If you answered no you must add it manually.



- If the two nodes (server and client) belong to different subnetworks, ensure that the port of the program is forwarded by the router.
- If the program can "ECHO" the other node (client/server) but it cannot transfer files: Both machines (server and client) must know each other. You must insert the AE Title, IP address and port of the application into "Known DICOM Nodes" list of the other node (client/server). Without this information the client/server does not know where to send the files.

## Check a port of the program

The IP Address that the program displays is the IP Address of the system, it is provided and indicated by the OS and the program cannot change it. If the system has many network interfaces (physical or virtual network cards), it is possible the program to display a wrong IP address, although it opens its port in all the available network interfaces and not only in the indicated IP address. In cases like that, you can use the netstat utility to check if the port of the program is opened and at which IP address.

Use the menu command:

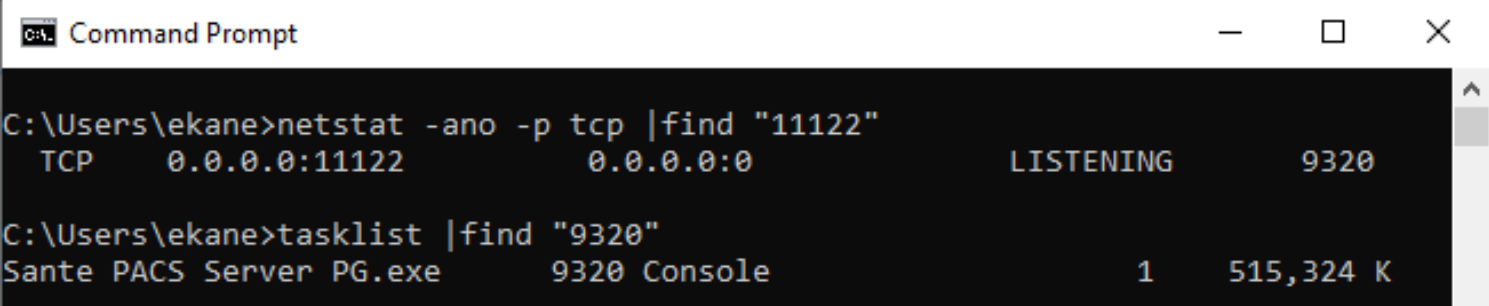
```
C:\>netstat -ano -p tcp |find "11122"
```

to check if the port 11121 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.

Use the menu command:

```
C:\>tasklist |find "9320"
```

to find which is this application.



```
Command Prompt
C:\Users\ekane>netstat -ano -p tcp |find "11122"
TCP    0.0.0.0:11122    0.0.0.0:0      LISTENING      9320

C:\Users\ekane>tasklist |find "9320"
Sante PACS Server PG.exe    9320 Console    1    515,324 K
```

With these commands you can check any one of the ports of the program, like the port of Worklist server module or the port of HTTP server module.