

# **Digital Ultrasound Diagnostic System**

## **DICOM Quick Guide**

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**Note:** Before using DICOM, please read the electronic file DICOM CONFORMANCE STATEMENT along with the device. At the same time, please verify that the SCU services provided by ultrasound machine can be supported by the SCP services provided by the systems such like PACS/RIS/HIS and so on.

The chapter is confined to the preset, connection verification and DICOM services of the DICOM-configured ultrasound machine, not including SCP configurations like PACS/RIS/HIS.

The DICOM package is optional, so the description here is only applicable for the system configured with the DICOM package.

This system supports the following DICOM functions:

- Verify Connectivity
- Storage
- DICOM Print
- DICOM Worklist
- MPPS (Modality Performed Procedure Step)
- Storage Commitment
- Q/R
- DICOM Medium Storage (DICOMDIR Review)
- DICOM Task Management

Workflows of DICOM Applications are briefly described as follows:

1. DICOM preset (local TCP/IP, local preset, server preset, and service preset).
2. Verify connectivity.
3. DICOM application (Image storage, Print, MPPS, Worklist, Storage Commitment, DICOMDIR Review, Q/R and Task Management).

#### Abbreviation introduction:

The followings are the abbreviations in this chapter.

| Abbreviation | Description                                    |
|--------------|--|
| DICOM        | Digital Imaging and Communications in Medicine |
| AE           | Application Entity                             |
| MPPS         | Modality Performed Procedure Step              |
| PDU          | Protocol Data Unit                             |
| SCU          | Service Class User (DICOM client)              |
| SCP          | Service Class Provider (DICOM server)          |
| SOP          | Service-Object Pair                            |
| SR           | Structured Report                              |

# 1 Preset

## 1.1 Local TCP/IP Preset

To open the Local TCP/IP screen:

1. Press <Setup> key to show the Setup menu. Move the cursor onto [Network Preset] to show the submenu.
2. Navigate to select [Local TCP/IP] to open the screen, as shown in the Figure below

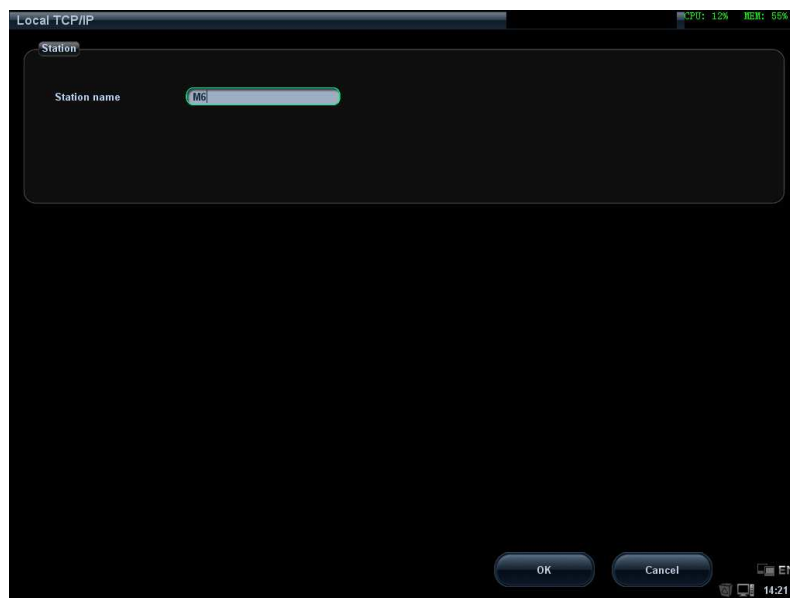


Figure 1 TCP/IP Preset Screen


3. Click  icon in the lower right corner of the screen to open the Local Area Connection, as shown in Figure 4 Task Management2:



Figure 2 TCP/IP Local Area Connection Preset Screen

Local TCP/IP preset items are described as follows:

| Name         | Description  |
|--------------|--|
| Station name | Name of the ultrasound system.   |
| DHCP/Static  | DHCP, Static: select between DHCP and Static; if DHCP is selected, IP address will be automatically obtained from DNS server; if Static is selected (Static refers to static IP address), you need to enter IP address subsequently. |
| IP Address   | IP address of the system.  |
| Subnet Mask  | Used to preset different network segment.  |
| Gateway      | Used to preset the gateway.  |

**Note:** IP address can't be the same as other IP of LAN, otherwise it will affect DICOM performance.

## 1.2 DICOM Local

1. Press < Setup > to enter into Setup menu, and select [Network Preset] -> [DICOM Local].
2. After entering into DICOM Local preset screen, you can preset the parameters, as shown in the Figure below:

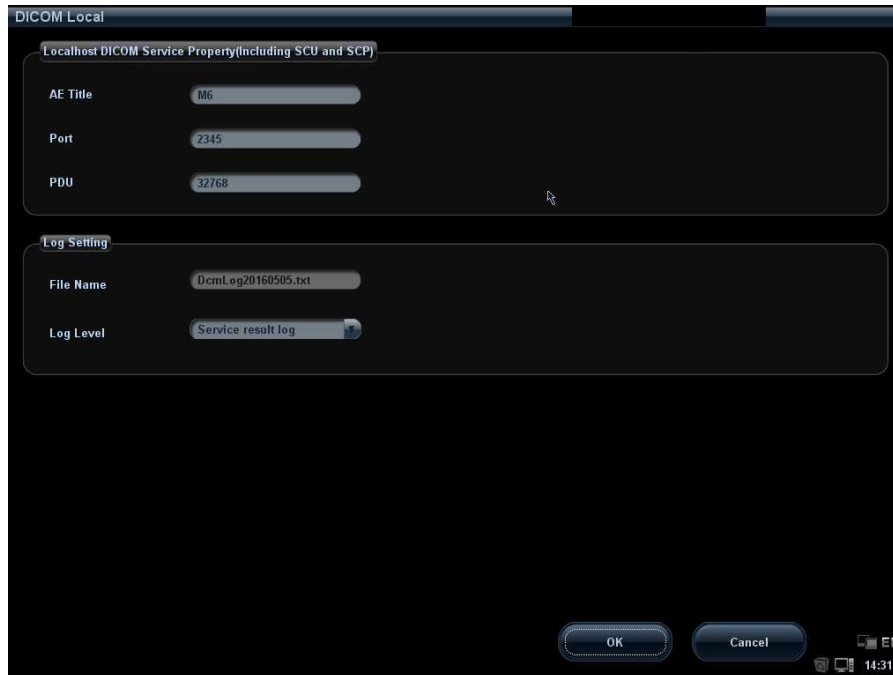


Figure 3 DICOM Local Preset Screen

The main parameters of DICOM Local are described as below:

| Name      | Description   |
|-----------|---|
| AE Title  | Application Entity title.   |
| Port      | DICOM communication port, 2345 is default.  |
| PDU       | Maximum PDU data package size, ranging from 16384 to 65536; if the value is less than 16384 or greater than 65536, the system automatically sets it to the value 32768. |
| File Name | System default can't be set. The user can review log content in D:\Product name\Log\DcmLog. Product Name means the specific product name such as M6, DC-7 and so on.    |
| Log Level | Set the log type.   |

In the above screen, please enter AE Title, Port, and PDU according to the actual situation, and then click [OK] to exit the screen.

Tip:

- AE Title should be the same with the SCU AE Title preset in the server (PACS/RIS/HIS), for example, if the AE Title of the server preset in the print server is Printer, and the AE Title of the accepted SCU is preset as Machine, then in the figure above, the AE Title of Local should be Machine, and the AE Title of storage server should be Printer.

## 1.3 DICOM Server

The DICOM Server screen is used to add or delete DICOM servers, or set IP address for the DICOM server.

To open the DICOM Server screen:



1. Press < Setup > key to show the Setup menu. Move the cursor onto the [Network Preset] item to show the submenu.
2. Navigate to select [DICOM Server] to open the screen, as shown in the Figure below.



**Figure 4 DICOM Server Preset Screen**

The main parameters of DICOM Server are described as below:

| Name       | Description   |
|------------|---|
| Device     | Name of the device supporting DICOM services.               |
| IP Address | IP address of the server.                                   |
| Ping       | Check whether IP Address can connect normally or not.       |
| Add        | Click to add server (s) to the Device List.                 |
| Delete     | Click to delete the selected server (s) in the device list. |

Tip:

- The device name can be entered to your preference, but IP address must be the actual IP address of the server.
- If the currently entered name has already existed, the system will show a tip: "The server name exists!" Click [OK] to enter another name.

## 1.4 DICOM Service

The DICOM Service screen is used to set attributes of Storage, Print, Worklist, MPSS, Q/R and Storage Commitment.

To open the DICOM Service screen:

1. Press < Setup > key to show the Setup menu. Move the cursor onto the [Network Preset] item to show the submenu.
2. Navigate to select [DICOM Service] to open the screen.

After DICOM is installed and DICOM Worklist, MPPS, DICOM Structured Reporting and Query/Retrieve are optionally configured, there will be related screen for presetting.

### 1.4.1 DICOM Storage Preset



Figure 5 DICOM Storage Preset Screen

The main parameters of DICOM Storage are described as below:

| Name                | Description   |
|---------------------|---|
| Devices             | After you set the server (s) in DICOM Server screen, the name (s) will appear in the drop-down list, select the name of the storage server.                                     |
| Service name        | Default is xxx-Storage, user-changeable.  |
| AE Title            | Application Entity title, here, it should be consistent with that of the storage server.  |
| Port                | DICOM communication port, 104 is default. Here, the port should be consistent with that of the storage server port.   |
| Maximum Retries     | 0—9 times are optional, the default is 3, if the DICOM storage task that is sent to this server is failed, the task will be retried automatically, the retry times is set here. |
| Interval Time (Sec) | 5—1800 seconds, 15 seconds is default. (Reserved)   |
| Timeout (Sec)       | Refers to the amount of time after which the system will stop trying to establish a connection to the service.<br>Value: 5-60s, in increments of 5s, and 15 is default.         |
| Cine Zoom           | Original, 640*480 are optional, the default is Original.  |

|                   |  |
|-------------------|--|
| Mode              |  |
| Compression Mode  | Uncompressed(The image is uncompressed),RLE(The image is lossless compressed),JPEG,JPEG2000(Please refer to the information of provider to confirm whether SCP can support JPGE, JPEG2000 compression. If not, please don't select it) are optional, the default is Uncompressed.  |
| Compression Ratio | Lossless, High, Middle and Low, three kinds of Compression Ratio are optional. Compression Ratio is in inverse proportion to image quality.  |
| Color Mode        | Three options are available, Color means the images sent from system to server will be coded by 24bit, Mixed means the images sent from system to server will be coded by 8bit or 24 bit depends on whether the images themselves are captured in color imaging mode or colorize switch is in "on" state or not, if they do so, will be coded by 24bit, else 8bit. Gray means the images sent from system to server will be coded by 8bit.The images will contain DICOM tags window center (0028, 1050) and window width (0028, 1051) if they are coded by 8bit. The default is Color. |
| Allow Multiframe  | If SCP supports this function, then select it.   |
| Max Framerate     | 25,30,35, Full are available, user-changeable  |
| SR Storage Option | Five options are available when Structured Reporting is needed to send. You can select attach SR when storage images, attach SR when storage images and SR Contains User-defined Measurements,, Only store SR, Only store SR and It Contains User-defined Measurements and not store SR.   |
| Add               | Add the DICOM service to the service list.   |
| Cancel            | Click to cancel parameter preset.  |
| Update            | Select an item in the service list, change the parameters in the above area, and click [Update] to update the item in the service list.  |
| Delete            | Click to delete the selected service in the service list.  |
| Verify            | Click to verify if the two DICOM application entities are normally connected.  |
| Default           | Select an item in the service list, click [Default] and you can see "Y" in the Default column.   |
| Exit              | Click to exit the screen.  |

## Tip:

- JPEG and JPEG are storage types, but not all SCPs can support them. Please refer to the electronic file DICOM CONFORMANCE STATEMENT to check whether SCP supports this function.
- AE Title and Port must be consistent with those of server.
- Click the item in Service List to modify the parameters and click [Update] to update them.
- You can click [Delete] to delete the item in Service List.

## 1.4.2 DICOM Print Preset



Figure 6 DICOM Storage Preset Screen

The main parameters of DICOM Print are described as below:

| Name                | Description   |
|---------------------|---|
| Devices             | After you set the server (s) in DICOM Server screen, the name (s) will appear in the drop-down list, select the name of the print server.                                       |
| Service name        | Default is xxx-Print, user-changeable.  |
| AE Title            | Application Entity title, here, it should be consistent with that of the print server.  |
| Port                | DICOM communication port, 104 is default. Here, the port should be consistent with that of the print server port.   |
| Maximum Retries     | 0–9 times are optional, the default is 3. if the DICOM storage task that is sent to this server is failed, the task will be retried automatically, the retry times is set here. |
| Interval Time (Sec) | 5–1800 seconds, 15 seconds is default. (Reserved)   |
| Timeout (Sec)       | Refers to timeout during association establishment. Value: 5-60s, in increments of 5s, and 15 is default.   |
| Copies              | Refer to copies of printed files. You can select among 1 through 5, or directly enter the numeral.  |
| Settings            | The system supports RGB (color printing) and MONOCHROME2 (black and white printing). Please select the type the printer supports.   |

|                    |   |
|--------------------|---|
| Film Orientation   | Select between LANDSCAPE and PORTRAIT.  |
| Priority           | HIGH、MED、LOW  |
| Film Size          | Select film size among the selections listed in the drop down list.   |
| Display Format     | Specify quantity of printed files, e.g. STANDARD\2, 3 indicates 6 images are printed for each page.   |
| Media Type         | Specify print medium: PAPER, CLEAR FILM, BLUE FILM; select BLUE FILM or CLEAR FILM for black and white printing; select PAPER for color printing.   |
| Destination        | Specify where the file is exposed: MAGAZINE (stored in the magazine), or, PROCESSOR (exposed in the processor).   |
| Min Density        | Enter the minimum density of the film. The default is 0.  |
| Max Density        | Enter the maximum density of the film. The default is 300.  |
| Magnification Type | Select how the printer magnifies an image to fit the film.<br>REPLICATE: interpolated pixels belong to duplicate of adjacent pixels);<br>BILINEAR: interpolated pixels are generated from bilinear interpolations between adjacent pixels;<br>CUBIC: interpolated pixels are generated from cubic interpolations between adjacent pixels;<br>NONE: without interpolation. |
| Trim               | Specify whether you want a trim box to be printed around each image on the film: Yes or No.   |
| Configuration Info | Enter configuration information in the field.   |
| Add                | Add the DICOM service to the service list.  |
| Delete             | Click to delete the selected service in the service list.   |
| Cancel             | Click to cancel parameter preset  |
| Update             | Select an item in the service list, change the parameters in the above area, and click [Update] to update the item in the service list.。  |
| Verify             | Click to verify if the two DICOM application entities are normally connected.   |
| Default            | Select an item in the service list, click [Default] and you can see "Y" in the Default column.  |
| Exit               | Click to exit the screen.   |

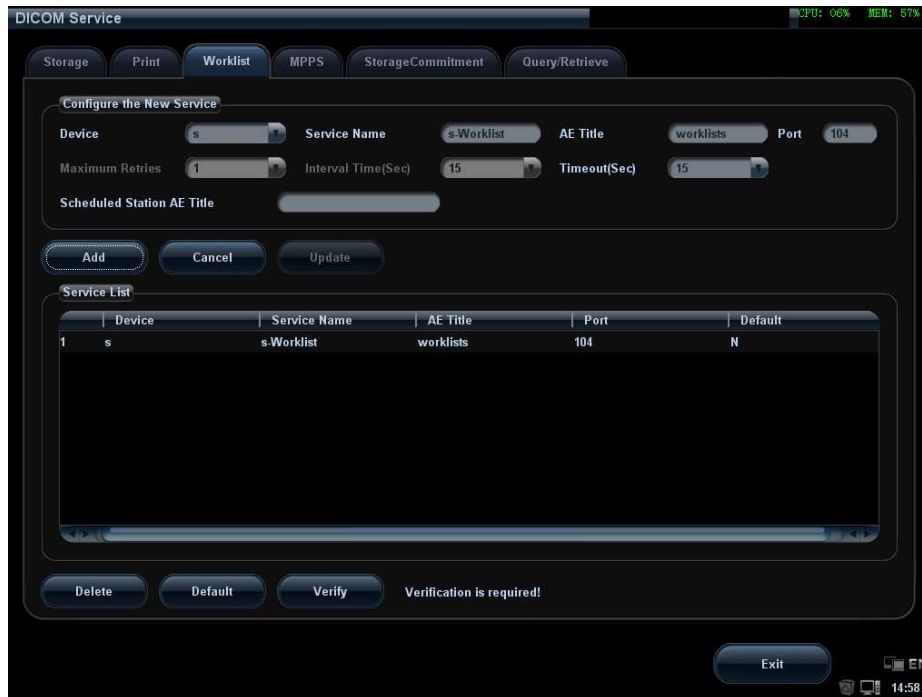
**Tips:**

The parameters preset should be meet the requirements of printer, for instances:

1. If the printer cannot support the [Film Size] of 8INX10IN, please modify it that the printer can support.

2. It will implement color printing when [Settings] is set as RGB, black and white printing when it is set as MONOCHROME2.
3. For [Media Type], select BLUE FILM or CLEAR FILM for black and white printing; select Paper for color printing.
4. Other parameters can use defaulted values. If there are special requirements for printer, please modify it.

### 1.4.3 Worklist Preset



**Figure 7 DICOM Worklist Preset Screen**

The main parameters of DICOM Worklist are described as below:

| Name                | Description  |
|---------------------|--|
| Devices             | After you set the server (s) in DICOM Server screen, the name (s) will appear in the drop-down list, select the name of the Worklist server. |
| Service name        | Default is xxx-Worklist, user-changeable.  |
| AE Title            | Application Entity title, here, it should be consistent with that of the Worklist server.  |
| Port                | DICOM communication port, 104 is default. Here, the port should be consistent with that of the Worklist server port.                         |
| Maximum Retries     | 0—9 times are optional, the default is 3. (Reserved)   |
| Interval Time (Sec) | 5—1800 seconds, 15 seconds is default. (Reserved)  |
| Timeout (Sec)       | 5-60s, in increments of 5s, and 15 is default. Timeout is the overtime of connecting Association.  |

|                            |   |
|----------------------------|---|
| Scheduled Station AE Title | To set the AE Title of the scheduled station is optional. If the Scheduled Station of the Worklist server is the ultrasound system, then AE Title here, AE Title of the scheduled station should be the consistent with the one set in the ultrasound system. |
| Add                        | Click it to add the Worklist service to the service list.   |
| Cancel                     | Click to cancel parameter preset.   |
| Update                     | Select an item in the service list, change the parameters in the above area, and click [Update] to update the item in the service list.   |
| Delete                     | Click to delete the selected service in the service list.   |
| Verify                     | Click to verify if the two DICOM application entities are normally connected.   |
| Default                    | Select an item in the service list, click [Default] and you can see "Y" in the Default column.  |
| Exit                       | Click to exit the setup screen.   |

Tip:

In terms of "Scheduled Station AE Title", if you set this item in the Worklist server, then "Scheduled Station AE Title" configured here should be consistent with the one set in the server. For example, when you set "Scheduled Station AE Title" in the Worklist server as "Mindray" (this means you assigned the scheduled exam to "Mindray"), then both "Scheduled Station AE Title" and "AE Title" in the ultrasound system configuration should be "Mindray".

#### 1.4.4 MPPS Preset



Figure 8 DICOM MPPS Preset Screen

The main parameters of DICOM MPPS are described as below:

| Name                | Description  |
|---------------------|--|
| Devices             | After you set the server (s) in DICOM Server screen, the name (s) will appear in the drop-down list, select the name of the MPPS server. |
| Service name        | Default is xxx-MPPS, user-changeable.  |
| AE Title            | Application Entity title, here, it should be consistent with that of the MPPS server.  |
| Port                | DICOM communication port, 104 is default. Here, the port should be consistent with that of the MPPS server port.                         |
| Maximum Retries     | 0—9 times are optional, the default is 3. (Reserved)   |
| Interval Time (Sec) | 5—1800 seconds, 15 seconds is default. (Reserved)  |
| Timeout (Sec)       | 5-60s, in increments of 5s, and 15 is default. After user sending MPPS for 15 seconds, the connection will be closed.                    |
| Add                 | Add the DICOM service to the service list.   |
| Cancel              | Click to cancel parameter preset.  |
| Update              | Select an item in the service list, change the parameters in the above area, and click [Update] to update the item in the service list.  |
| Delete              | Click to delete the selected service in the service list.  |
| Verify              | Click to verify if the two DICOM application entities are normally connected.  |
| Default             | Select an item in the service list, click [Default] and you can see “Y” in the Default column.   |
| Exit                | Click to exit the preset screen.   |

**Tip:** You should set MPPS as default server when you use it.



## 1.4.5 Storage Commitment Preset

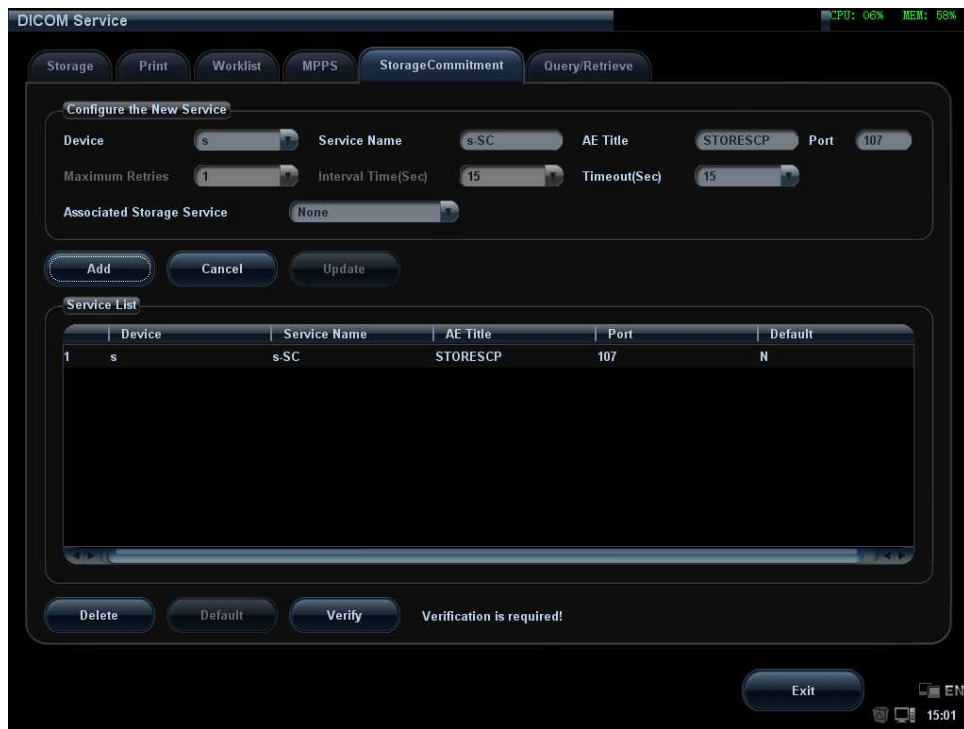


Figure 9 Storage Commitment Preset Screen

The main parameters of storage commitment are described as below:

| Name                       | Description  |
|----------------------------|--|
| Devices                    | After you set the server (s) in DICOM Server Preset screen, the name (s) will appear in the drop-down list, select the name of the server. |
| Service name               | Default is xxx-SC, user-changeable.  |
| AE Title                   | Application Entity title, here, it should be consistent with that of the storage commitment server.  |
| Port                       | DICOM communication port, 104 is default. Here, the port should be consistent with that of the storage commitment server port.             |
| Maximum Retries            | 0–9 times are optional, the default is 3. (Reserved)   |
| Interval Time              | 5–1800 seconds, 15 seconds is default. (Reserved)  |
| Timeout                    | Value: 5-60s, in increments of 5s, and 15 is default. After user sending storage commitment for 15 seconds, the connection is closed.      |
| Associated Storage Service | The associated storage server is preset before storage commitment, only after the exam is sent out, can storage commitment be created.     |
| Add                        | Add the DICOM service to the service list.   |
| Cancel                     | Click to cancel parameter preset.  |

|         |   |
|---------|---|
| Update  | Select an item in the service list, change the parameters in the above area, and click [Update] to update the item in the service list. |
| Delete  | Click to delete the selected service in the service list.   |
| Verify  | Click to verify if the two DICOM application entities are normally connected.   |
| Default | Unavailable   |
| Exit    | Click to exit the setup screen.   |

**Tips:**

You should set storage commitment as default server when you use it.

## 1.4.6 Query/Retrieve Preset

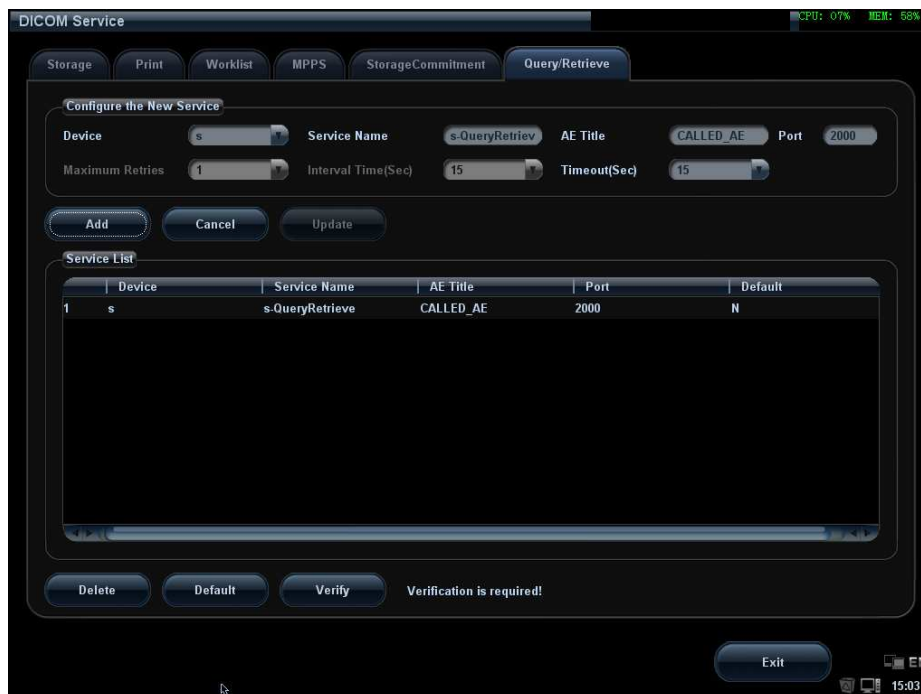


Figure 10 Query/Retrieve Preset Screen

The main parameters of Query/Retrieve are described as below:

| Name    | Description   |
|---------|---|
| Devices | After you set the server (s) in DICOM Server Preset screen, the name (s) will appear in the drop-down list, select the name of the Query Retrieve server. |

|                 |   |
|-----------------|---|
| Service name    | Default is xxx-QueryRetrieve, user-changeable.  |
| AE Title        | Application Entity title, here, it should be consistent with that of the Query Retrieve server.   |
| Port            | DICOM communication port, 104 is default. Here, the port should be consistent with that of the Query Retrieve server port.              |
| Maximum Retries | 0—9 times are optional, the default is 3. (Reserved)  |
| Interval Time   | 5—1800 seconds, 15 seconds is default. (Reserved)   |
| Timeout         | Value: 5-60s, in increments of 5s, and 15 is default. After user sending storage commitment for 15 seconds, the connection is closed.   |
| Add             | Add the DICOM service to the service list.  |
| Cancel          | Click to cancel parameter preset.   |
| Update          | Select an item in the service list, change the parameters in the above area, and click [Update] to update the item in the service list. |
| Delete          | Click to delete the selected service in the service list.   |
| Verify          | Click to verify if the two DICOM application entities are normally connected.   |
| Default         | Select an item in the service list, click [Default] and you can see “Y” in the Default column.  |
| Exit            | Click to exit the preset screen.  |

# 2 Services

## 2.1 Verify Connectivity

If you want to verify connectivity (it is not a must), you can click [Verify] button on Storage, Print or Worklist, MPPS, Storage Commitment and Query/Retrieve pages respectively. If the verification succeeded, the system prompts “xxx Verify Succeed”. Otherwise, it prompts “xxx Verify Failed”, which means the connection is wrong. Please reconfirm it.

Tip:

Not all the SCPs can support verification; please consult SCP belongings to confirm whether SCP can support this service. If not, the verification won't pass.

## 2.2 DICOM Storage

DICOM Storage is used to send images (and SR) to DICOM storage server for remote storage. The entrances of storage include:

- ◆ Patient information management (iStation)
- ◆ Review status (Review)
- ◆ Real time/Freeze status (auto workflow)
- ◆ Thumbnail area in main screen

DICOM storage supports:

- ◆ Single file transfer
- ◆ Exam transfer
- ◆ Batch transfer
- ◆ Static image and Cine file

Batch transfer means multiple exam records can be selected and sent for storage with one DICOM task for each exam. Multiple files in one exam will be sent in one DICOM connection.

The auto send function can be triggered by:

- ◆ Ending the exam (send to default storage service)
- ◆ Saving an image by pressing the user-defined save key (image is sent to the default DICOM storage server as well as saved).
- ◆ Associated operation: send image (cine) to DICOM storage when saving image (cine).

### 2.2.1 Send to DICOM Storage Manually

Take “send to DICOM storage” in iStation page as an example, the operations are:

1. Configure the storage server according to the above descriptions about service preset.
2. Press <iStation> on the control panel to enter the patient information management page.
3. Select one or more exam records (that contain images. If not, the system will prompt) in exam list, or select one or more images in an exam, as shown in Figure 2 iStation Screen.



Figure 2 iStation Screen

4. Click [Send To] to pop up the [Send To] dialog box, select the remote DICOM Server, click [OK] to send, as shown in Figure 3.

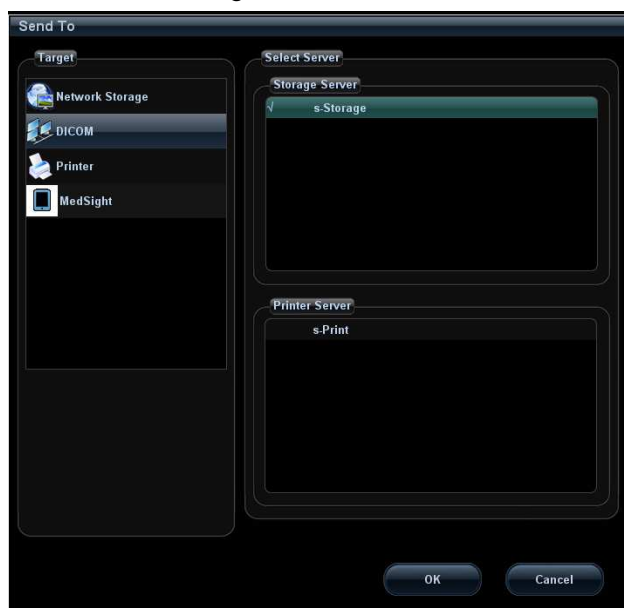



Figure 3 DICOM Send To Screen

5. Click  in the right corner of the screen to open Management, in which, you can review sending status. Select one record, and there is sending result in prompt dialog box, as shown in Figure 4.

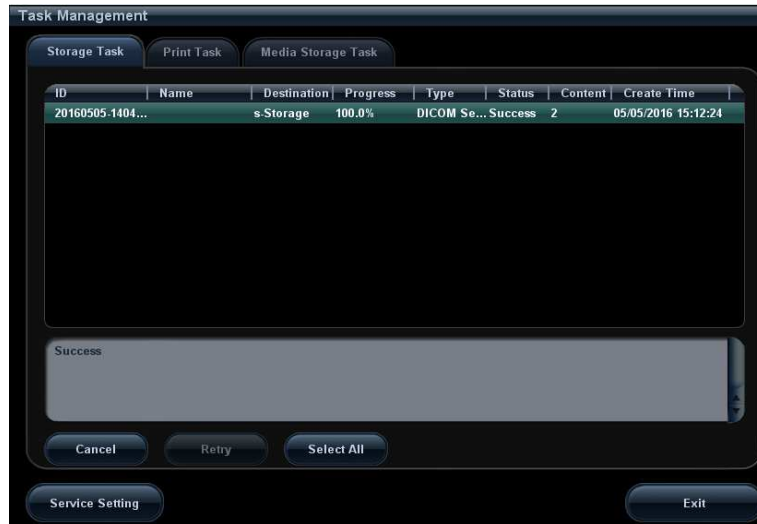


Figure 4 Task Management

## 2.2.2 Send to DICOM Storage Automatically

Function paths of sending image to DICOM storage and sending images by user-defined key after ending exam automatically:

- A. Send Image after end exam:

Steps:

1. In System Preset -> General, select "Send/print Images after End Exam", as shown in Figure 5.

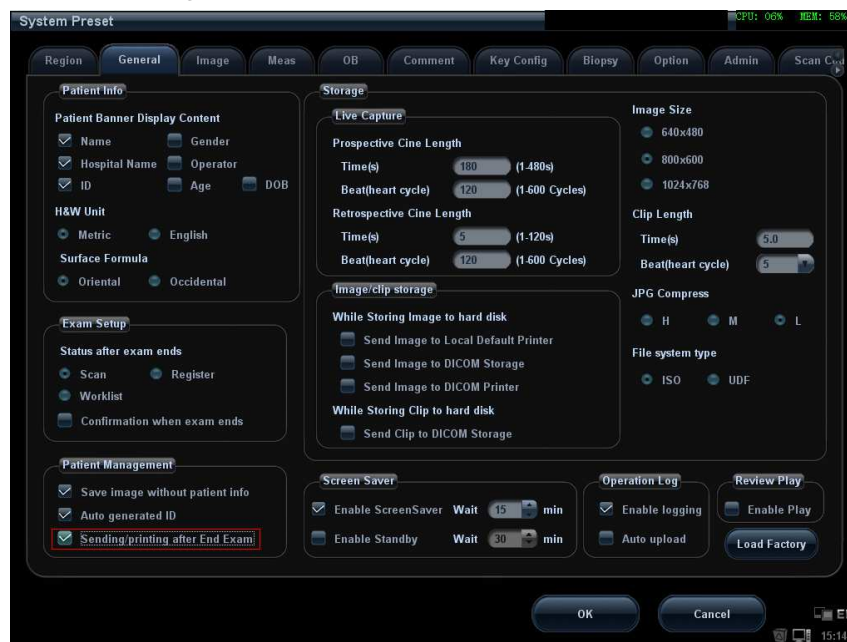
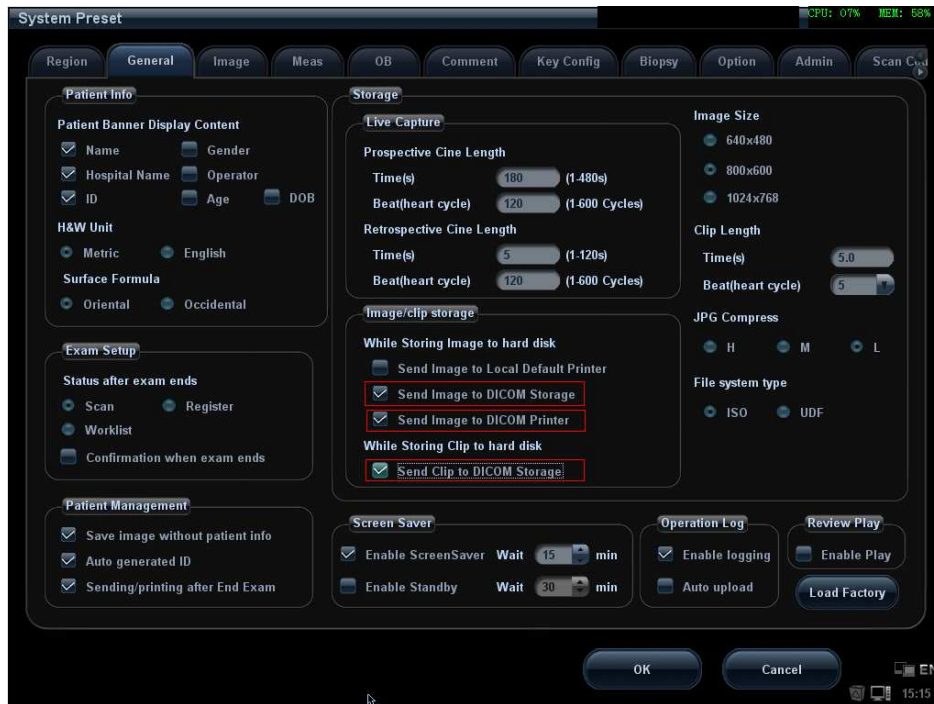


Figure 5 Send Image after End Exam

2. In Storage Preset -> DICOM Service, set the default storage server (one or more).
  3. When pressing <End Exam> with the current exam being active, all images (and SR) of the current exam are sent to the default DICOM storage server.
- B. Send to DICOM Storage when archiving
1. In System Preset -> General, select “Send Image to DICOM Storage” (Or Send Clip to DICOM Storage), as shown in Figure 6.



**Figure 6 Send Image to DICOM Storage**

2. In Storage Preset -> DICOM Service, set the default Storage server (one or more).
  3. If <Save> on control panel is preset as saving single-frame image, the system will save and send a single-frame image to remote DICOM storage when <Save> is pressed. If <Save> on control panel is preset as saving multi-frame image, the system will save and send a multi-frame image to remote DICOM storage when <Save> is pressed.
- C. Send to DICOM Storage by user-defined shortcut key
1. In System Preset -> Key Config, the NULL key can be set as “Send Image to DICOM storage”, as shown in Figure 7.

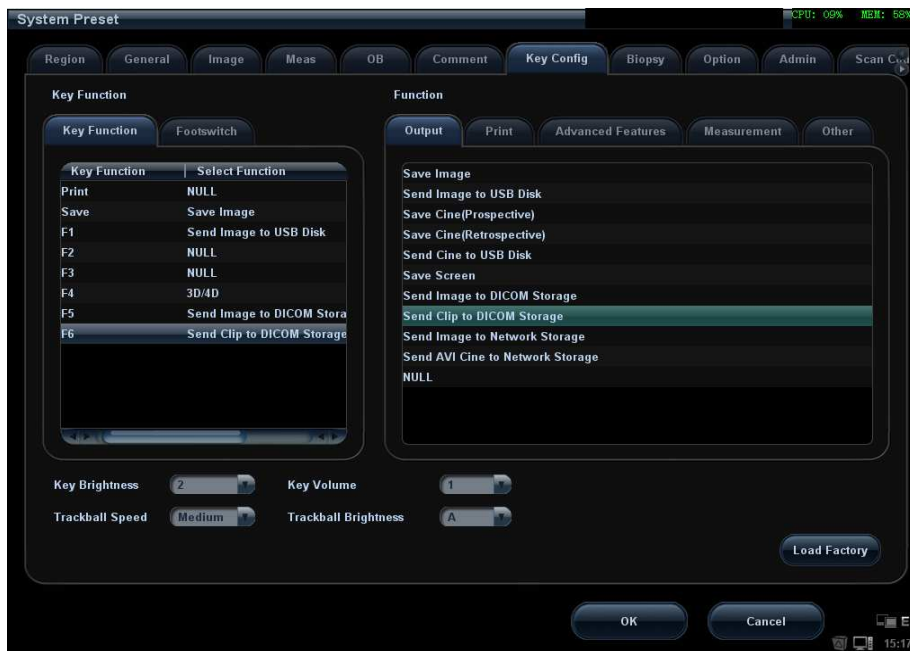


Figure 7 Send to DICOM Storage by User-defined Key

2. In Storage Preset -> DICOM Service, set the default storage server (one or more).
3. In current exam, press <F5> (according to the user preset), the system will save and send a single-frame image to remote DICOM storage automatically. When pressing <F6>, the system will save and send a multi-frame image to remote DICOM storage.

When the system is connected to external storage media, it allows saving the image as DCM format. The detailed operations are as follows:

1. Select images or exams (with image) in iStation, click [Send].
2. In the dialog box popped up, select the [Destination] as connected external media.
3. Select "Export Image" and "DCM"; after confirming, click [OK], the selected exam or the image(s) of the exam can be sent to the specified external media with the format of DCM, as shown in Figure 8.





Figure 8 Save as DCM Format

## 2.2.3 Common Reasons of Failure and Troubleshooting

### ■ Failure:

The server disconnects to the system automatically.

#### ● Potential Reasons:

The storage service of connected server cannot support JPEG/JPEG2000 compression, while which is selected in storage service zoom mode in the system.

#### ● Troubleshooting:

Modify the storage configuration of this server in Storage screen in the system. Select the service and select "Uncompressed", and then click [Update] to update the latest configuration information.

### ■ Failure:

The net is disconnected during transmission.

#### ● Potential Reasons:

The connected net wire is plugged out during transmission.

#### ● Troubleshooting:

Reconnect net wire to ensure normal net connection status.

### ■ Failure:

Multi-frame transmission is failed, but single frame is succeeded.

#### ● Potential Reasons:

Enable multi-frame image storage is not selected in the dialog box of Storage preset.

#### ● Troubleshooting:

Enable multi-frame image storage is selected in the dialog box of Storage preset.

## 2.3 DICOM Print

DICOM print provides local image printing via the remote DICOM service or printer that supports the DICOM standard. The image displayed on screen can be printed via the selected DICOM print device during exam or image browsing. Print function entrances:

- Patient information management (iStation)
- Review status (Review)
- Real time/ freeze status (auto workflow)
- Thumbnail area in main screen

DICOM print supports:

- Single file transfer
- Exam transfer
- Batch transfer
- Static image
- Succeeding frames printing is available if more than one frame is being sent for printing.

Batch transfer means multiple exam records can be selected and sent for printing with one DICOM task for each exam. Multiple files in one exam will be sent in one DICOM connection.

The auto send function can be triggered by (Presettable):

- Ending the exam (send to default print service)
- Saving an image by pressing the user-defined save key (image is sent to the default DICOM service as well as saved)
- Associated operation: send image to DICOM print when saving image

### 2.3.1 Send to DICOM Print Manually

Take “send to DICOM print” in iStation screen as an example, the operation steps are:

1. Configure the print server according to the upper descriptions of service preset.
2. Press <iStation> on the control panel to enter the patient information management screen.
3. Select one or more exam records (that contain images) in exam list, or select one or more images in an exam, as shown in Figure 2.
4. Click [Send To] to pop up the [Send To] dialog box, select the Printer Server, and click [OK] to print. As shown in Figure 3.

### 2.3.2 Send to DICOM Print Automatically

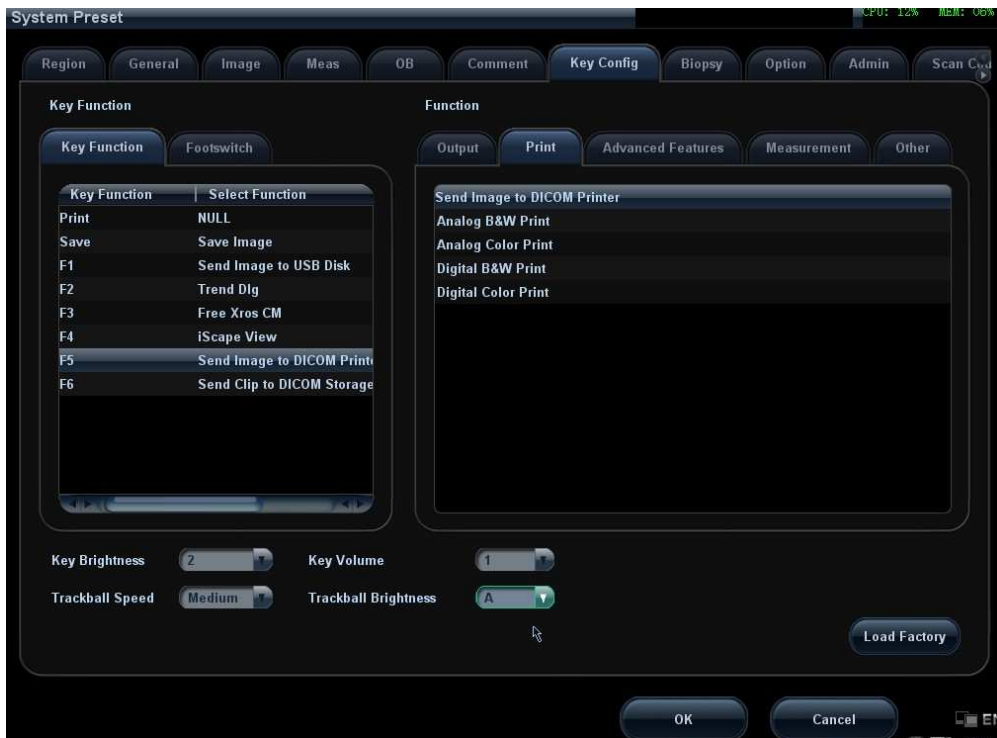
Function paths of sending to DICOM print automatically:

- Send to DICOM print when ending the exam

Steps:

1. System Preset -> General, select “Send/ print Image after End Exam”, as shown in Figure 5.

2. In Network Preset -> DICOM Service, set the default print server.
  3. When pressing <End Exam> with the current exam being active, all single-frame images of the current exam are sent to the default DICOM print server.
- Send to DICOM print when saving the file
    1. In System Preset -> General, select “Send Image to DICOM Printer”, as shown in Figure 6.
    2. In Network Preset -> DICOM Service, set the default print server.
    3. If <Save> on control panel is preset as saving single-frame image, the system will save and send a single-frame image to remote DICOM printer when <Save> is pressed.
  - Send to DICOM print when pressing user-defined key
    1. In System Preset -> Key Config, the NULL key can be set as “Send Image to DICOM print”, as shown in figure below.



**Figure 9 Send to DICOM print when pressing user-defined key**

2. In Network Preset -> DICOM Service, set the default print server.
3. In current exam, press <F5> (according to the user preset), the system will save and send a single-frame image to remote DICOM printer automatically.
4. View the print status in the DICOM Task Management, check the DICOM preset and network connection if a print error occurs.

## 2.4 DICOM WorkList

The user can set query conditions when finding exam record(s) from the RIS or other worklist server, and import the patient information selected in the query result.

Steps:

1. Press < Patient > to open the Patient Info screen.
2. Click [WorkList] to enter the WorkList screen.
3. Query the patient information by setting conditions such as patient ID, Name, Search Key, the WorkList Server, Exam Date, or Modality Type. The default Exam Date is “today” of the system time. The default Modality type is “US”, user also can input the value, and System will record the value automatically. Patient records will be listed after clicking [Query].

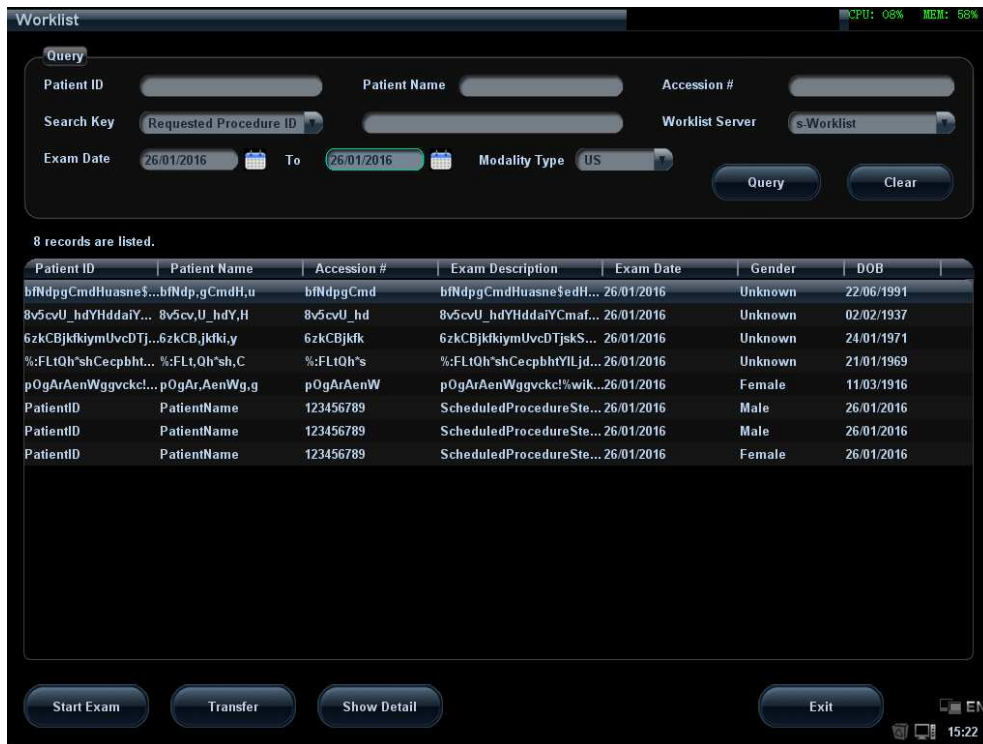


Figure 10 Query in WorkList

4. After the first query is finished, you can perform the second query within the range of the scheduled patients in the first time. The scheduled patients in the list will change in real time.
5. Select a patient record, click [Start Exam], the system import this patient and start the exam; Click [Transfer] will launch the patient record selected into the Patient Info screen to edit and restart the exam; Click [Show Detail] to view the detailed information of the patient. As shown in Figure below

| Attribute Name                                 | Value                       |
|--|-----------------------------|
| Patient Name                                   | bfNdp,gCmdH,u               |
| Patient ID                                     | bfNdp,gCmdHuasne\$edHbUfke  |
| Other Patient IDs                              | bfNdp,gCmdHuasne\$edHbUfke  |
| Patient's Birth Date                           | 22/06/1991                  |
| Patient's Birth Time                           |                             |
| Patient's Sex                                  | Unknown                     |
| Patient's Size                                 | 46900.00cm                  |
| Patient's Weight                               | 469.00kg                    |
| Patient Comments                               | bfNdp,gCmdHuasne\$edHbUfke  |
| Ethnic Group                                   | bfNdp,gCmd                  |
| Confidentiality constraint on patient data ... | bfNdp,gCmdHuasne\$edHbUfke  |
| Medical Alerts                                 | bfNdp,gCmdHuasne\$edHbUfke  |
| Contrast Allergies                             | bfNdp,gCmdHuasne\$edHbUfke  |
| Pregnancy Status                               | 21448                       |
| Additional Patient's History                   | bfNdp,gCmdHuasne\$edHbUfke  |
| Last Menstrual Date                            | 22/06/1991                  |
| Patient State                                  | bfNdp,gCmdHuasne\$edHbUfke  |
| Special Needs                                  | bfNdp,gCmdHuasne\$edHbUfke  |
| Referenced Patient Sequence                    |                             |
| >Referenced SOP Class UID                      | 1.2.840.10008.3.1.2.1.1     |
| >Referenced SOP Instance UID                   | 1.2.840.48.0.445.1211765340 |
| Admission ID                                   | bfNdp,gCmdHuasne\$edHbUfke  |
| Current Patient Location                       | bfNdp,gCmdHuasne\$edHbUfke  |
| Admitting Diagnosis Description                | bfNdp,gCmdHuasne\$edHbUfke  |

OK

Figure 20 Detailed Information

**NOTE:**

The modality type can be entered by the user.

Second query and detail information are still available during off-line. The query will be started automatically according to the default query conditions each time entering the [WorkList] screen if a default WorkList Server is set.

Check the DICOM preset and network connection if a query error occurs.

## 2.5 MPPS

MPPS is to send the states information of exams to the configured server. Thus the exam states can be known and edited by other systems. Prerequisite: a default MPPS server is needed.

The MPPS function will be started by:

- Starting a new exam
- Canceling an exam

- Ending an exam
- Activating an exam


The states are listed in the [Exam State] column in iStation screen. MPPS sending is hidden to the user.

## 2.6 Storage Commitment

Storage commitment is to ensure that the image data will be stored into the server correctly.

Prerequisite: a default Storage Commitment server is needed, and a relative storage server must be set.

Steps:

1. A default storage commitment server is preset.
2. Send image (and SR) to the storage server, the storage commitments are sent to the commitment server automatically.
3. The state of the committed service will be returned with the  column in iStation screen marked with a tick if the commitment is succeeded. Otherwise the column will not be marked.

## 2.7 Query/ Retrieve

The query/ retrieve function is to query and get the patient exam record from a specified server.

Steps:

1. A query/ retrieve server is preset.
2. Path1: press <iStation> ->[Query/ Retrieve].
3. Path2: press <Patient> -> <iStation> -> [Query/ Retrieve].
4. Select the Source server, enter Search Key words and click [Query]. As shown in figure below.

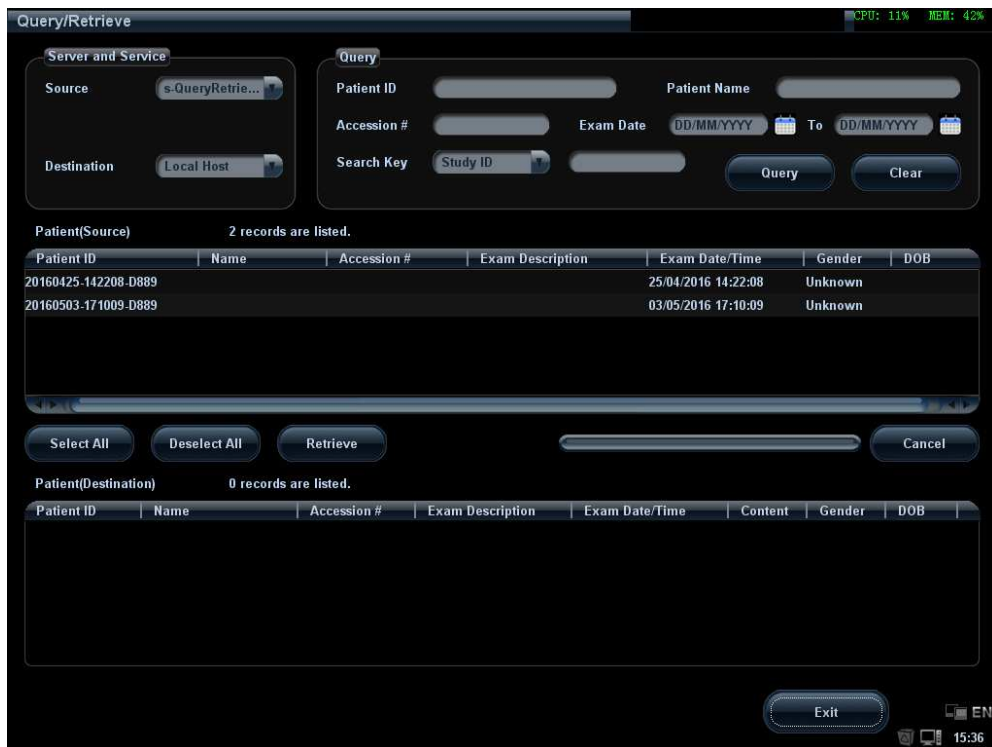


Figure 11 Query

5. Select one or more records and click [Retrieve] to get the records down to local system, as shown in Figure below.

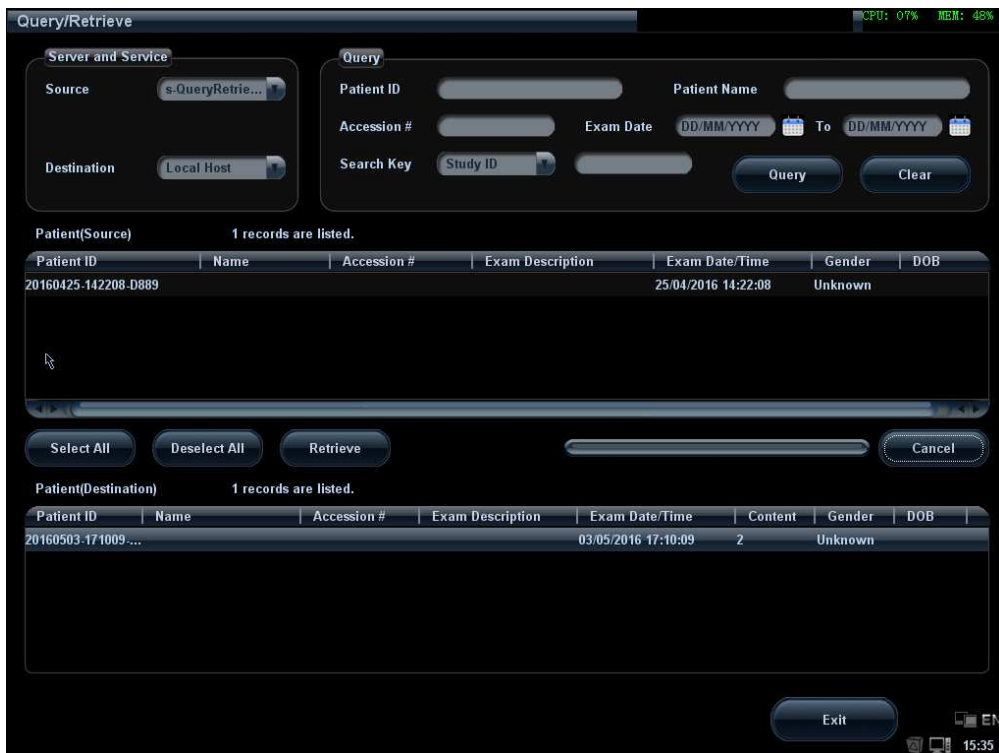


Figure 12 Retrieve

6. Click [Exit], the obtained patient records can be viewed in iStation screen.



## 2.8 Structured Report (SR)

The system provides SRs in gynecology, obstetric, cardiac and vascular exams that specified in the DICOM standard. The SR can not only be sent alone to a DICOM server but also can be sent along with an exam record that has image(s) saved. The type of SR to be sent is determined by the application region of the exam:

- Send obstetric SR: gynecology and obstetrics exam;
- Send cardiac SR: cardiac exam;
- Send Vascular SR: vascular, abdomen and urology exam. (The vascular SR contains the superficial, abdominal and kidney vascular, application region of which corresponds to the vascular, abdomen and urology exam respectively.)

### 2.8.1 Attach SR When Storage Images

- Send image and gynecology and obstetric SR (or cardiac, vascular SR) in iStation screen
1. Open the storage preset screen, select “Attach SR When Storage Images” on SR Storage Option (See 1.4.1).
  2. Start a new patient:
    - Press <Patient>, enter the Patient ID, Patient Name etc, select [OB] (or GYN, CAR or VAS) application region, click [OK].
    - Or, load a patient from the WorkList, click [Start Exam] (commonly used in hospital).
  3. Perform obstetric (gynecology, cardiac or vascular) measurements:
  4. Save image(s)
    - Freeze the image, press <Save> (a user-defined key, maybe preset for other function) on the control panel to save single-frame file.
  5. End the exam.
  6. Enter iStation screen; select the patient, click [Send To]. A dialog box pops up, as shown in Figure below.

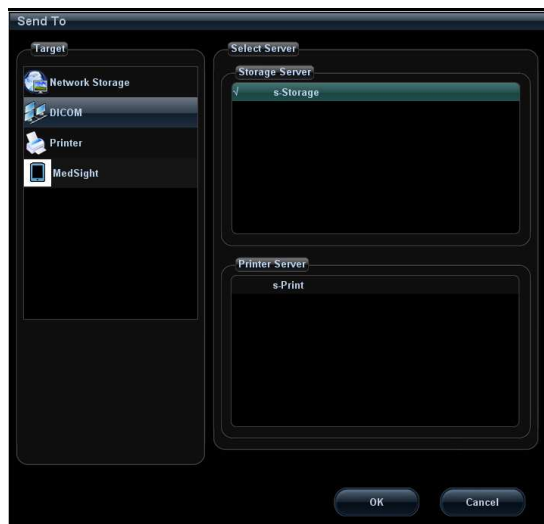


Figure 13 Send To



6. Select DICOM in the [Target] list; select a server in the [Storage Server] list.
7. Click [OK], the status of sending task can be viewed in DICOM task management.

NOTE: For sending SR automatically, the same procedures are followed as in “2.2.2 Send to DICOM Storage Automatically”.

## 2.8.2 Only Store SR

The same procedures are shown in “Attach SR when Storage Images” (See 2.8.1).

Select “Only Store SR” in DICOM Storage Preset -> SR Store Option (See 1.4.1)

## 2.8.3 Send User-defined measurements

Config of Storage Service, with SR Storage Option selected “Attach SR When Store Images and SR Contains User-defined Measurements” or “Only Store SR and It Contains User-defined Measurements”, and User-defined Measurements will be send to server as private element.

The same procedures are shown in “Attach SR when Storage Images” (See 2.8.1).

Note: The SR should be generated in English system if selected contain User-defined Measurements item.

## 2.9 DICOM Media Storage and Review

DICOM media storage supports storing ultrasonic diagnostic data (patient and image information) into the media (USB flash drive, optical disk or removable hard disk). DICOM media review (DICOMDIR) function supports viewing DCM image(s) stored in external media.

Prerequisites for DICOM media storage and DICOMDIR:

- Configured with DVD recorder that working normally
- Normally read/ write of the USB ports on the ultrasound system
- File system format of CD/ DVD optical file should be ISO9660, and the optical disk should not be damaged
- File system format of DVD optical file should be UDF, and the optical disk should not be damaged
- File system format of removable device (USB flash drive) is FAT32 and the media should not be damaged

### 2.9.1 DICOM Media Storage

Steps:

1. Press <i>iStation</i> on the control panel to enter the patient information screen.
2. Select one or more exams (with image) that is not active, click [Backup].
3. In the dialog box popped up, select the [Destination], and select “DICOM Format” as shown in Figure below.



Figure 14 DICOM Format Backup

4. Click [OK], to backup the image in current exam to the external media in DICOM format
5. If the backup is succeeded, [Backup] in the iStation screen will be marked with ✓; otherwise no ✓ is marked

NOTE:

1. Make sure enough space on the media; otherwise the media storage process will be failed due to insufficient space.
2. If you set compression mode or ratio, may can reach the purpose to improve performance and reduce file capability after backup.


## 2.9.2 DICOMDIR Review

Steps:




1. Press <iStation> on the control panel to enter the patient information screen.
2. Select the external media from “Data Source”.
3. The exam(s) and image(s) will display in the iStation screen if the media is read successfully.

## 2.10 Task Management

The task management is a platform for the user to manage, view, delete or restart the background task, including DICOM tasks.

Click  icon in the lower right corner of the screen to open the DICOM Task Management dialog box, as shown in Figure 4 Task Management.

Task progress and status of storage task, print task and media storage task can be viewed in this dialog box. The task management icon indicates the status of the task:

1. Task in progress, the icon indicates in green. 
2. No task is in progress with failed task exists, the icon indicates in yellow. 
3. No task is in progress without failed task, the icon is .

# 3 Common Failures and Troubleshooting

## 3.1 Common Failure: Service Verification Failed

Potential Reasons:

- Failed network connect, please check the network cable and connection;
- Verification service is not supported by the server;
- The verification is supported but not activated on the server; check the server setting if the verification service is activated.

Troubleshooting:

- Check the networks normally;
- Check the DICOM Conformance Statement if the SCP is supported;
- Enable the SCP service referring to the Server Manual or DICOM Conformance Statement.
- If the verification is still failed after all above steps and the operating system is Windows, please add the server program and the port to the “Exceptions” in Control Panel -> Windows Firewall. As shown in Figure below:

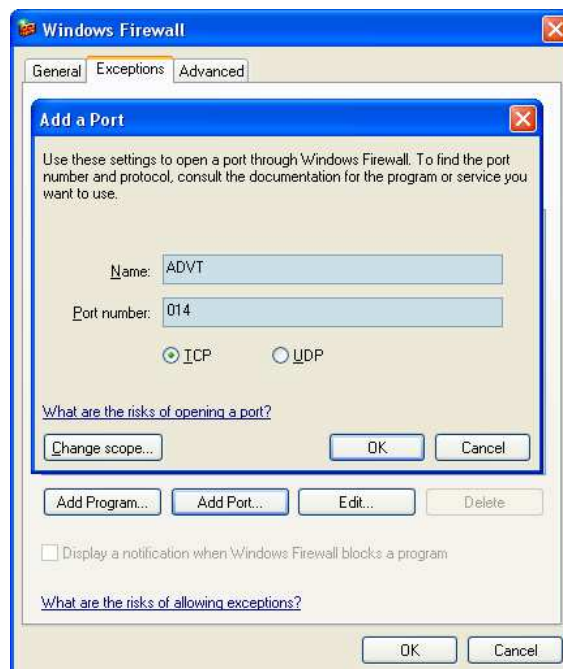


Figure 15 Add a Port

## 3.2 Common Failure: Server disconnects the ultrasound system during implementing storage

Potential Reasons:

- The JPG compression is enabled on local device but is not supported on the server;
- Wrong AE\_TITLE settings on local device and the server.

Troubleshooting:

- Select “uncompressed” in DICOM Service -> Storage;
- Set the correct local AE\_TITLE and server AE\_TITLE on local device according to the DICOM Conformance Statement or settings of the server.

## 3.3 Common Failure: Network disconnected (shown by network icon) during transmission

Potential Reasons:

- The network cable is disconnected during transmission;
- The connected switch, router or hub is down or in failure;

Troubleshooting:

- Connect the network cable;
- Reset the switch, router or hub; or replace a network device with higher performance.

## 3.4 Common failure: Worklist query succeeded, but no patient is shown

Potential Reasons:

- Scheduled Station AE Title in the preset is not consistent with the setting on server;
- Records on the server database are not accordant with the query conditions on local ultrasound system

Troubleshooting:

- Preset the right Scheduled Station AE Title on local ultrasound system according to the server settings.
- The ultrasound system is defaulted only to inquire the patient information that the Modality is US, and the patient needs the server to provide US attribute. Change the query conditions (e.g. date or patient name) to make the server find the record accordingly.

### 3.5 Common failure: Printing succeeded but the film is blank

Potential Reasons:

- The printer doesn't support color printing which is performed by the ultrasound system;
- The film or paper of the printer doesn't support color printing.

Troubleshooting:

- Check the printer conformance statement if the printer can support color printing; if not, modify the "Settings" in DICOM Service -> Print to B/W type (MONOCHROME2);
- Generally, the "Medium Type" is set to "BLUE FILM" for B/W printing while "PAPER" or "CLEAR FILM" for color printing

### 3.6 Common Failure: Verification of connecting DICOM printer is succeed but printing is failed

Potential Reasons:

- Wrong AE\_TITLE settings on local device and the server.
- The parameters set in DICOM Service -> Print are not supported

Troubleshooting:

- Set the correct local AE\_TITLE and server AE\_TITLE on local device according to the DICOM Conformance Statement or settings of the printer.
- Refer to the printer conformance statement for the printing parameters (Format, Film Size) value that supported. Check film size and type, and then correctly set Film Size, Format, Medium Type etc. in print service preset in ultrasound system.

### 3.7 Common Failure: Printed image is too small

Potential Reasons:

The Magnification Type of local ultrasound system is set to NONE while this parameter on printer is set to same with the local ultrasound system.

Troubleshooting:

- Set the right Magnification Type in local ultrasound DICOM Service preset according to the Magnification Type specified in the printer conformance statement.
- If there is no printer conformance statement for reference, set the Magnification Type as BILINEAR, CUBIC or REPLICATE.

### 3.8 Common Failure: MPPS message is not sent out correctly or not received by the server

Potential Reasons:

The MPPS server is not set as default.

Troubleshooting:

Set the MPPS server as default after setting the Port and AE Title correctly.

### 3.9 Common Failure: Storage commitment is failed


Potential Reasons:

1. The associated storage commitment server is incorrect;
2. The port and IP address settings on the commitment server are inconsistent with the local preset.

Troubleshooting:

1. Check if the associated storage commitment server is correct;
2. Check if the port and IP address settings on the commitment server are consistent with the local preset.

NOTE:

The storage commitment icon  in [iStation] screen is refreshed in realtime. [iStation] screen will refresh the commitment icon if a storage commitment is succeeded.

### 3.10 Common Failure: Query is succeeded, but retrieve is failed, with the prompting that the remote server is wrong

Potential Reasons: The setting of the local storage SCP port is wrong.

Troubleshooting: Some servers only support the specified port as the storage SCP port. Please confirm whether the server has this restriction. If it has, please modify the serial number of local port. See the Figure below:

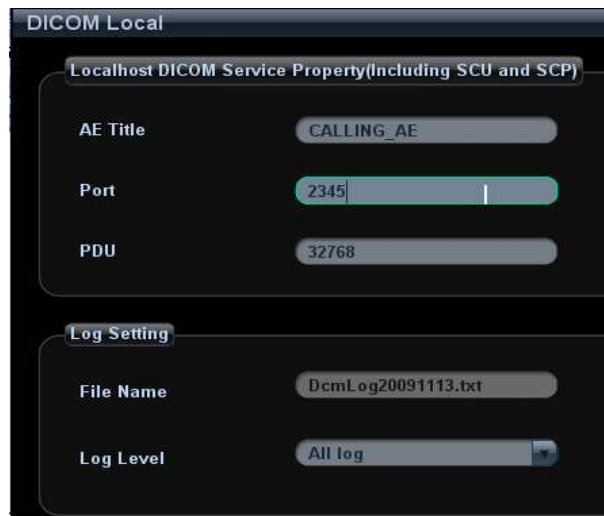


Figure 16 DICOM Local Preset

## 3.11 Common Failure: Error messages in DICOM Task Management

### 3.11.1 Association aborts

Potential Reasons: The association is denied by the SCP due to incorrect setting of AE\_TITLE on the SCU. See the Figure below.



Figure 17 Association aborts



### 3.11.2 Network error: Socket sending error

Potential Reasons: Network cable unplugged or network equipment is failed during data transmission. See the Figure below.

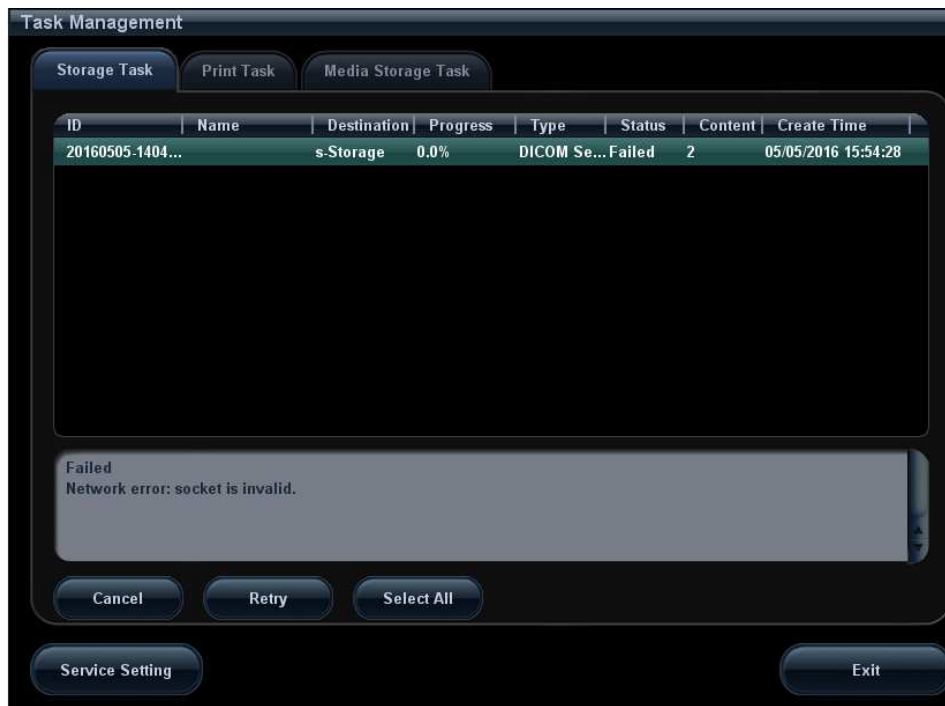


Figure 18 Network error

## 3.12 Print Service Examples

Whether the printing will be succeeded is determined by:

1. Printer settings on local ultrasound system should consist with that specified on printer conformance statement;
2. The operations being performed are supported by the printer.

The following are two examples.

### 3.12.1 Example 1

The medium type supported by the Horizon CI DICOM printer in color and B/W printing is shown in table below:

| Medium Type (standard values) | Grayscale negotiated | PMM | SOP | Color negotiated | PMM | SOP |
|-------------------------------|----------------------|-----|-----|------------------|-----|-----|
| PAPER                         | DV Paper             |     |     | CV Paper         |     |     |
| Blue Film                     | DV Blue Film         |     |     | CV Film (clear)  |     |     |
| CLEAR FILM                    | DV Clear Film        |     |     | CV Film (clear)  |     |     |

The MAGNIFICATION TYPEs supported by Horizon CI DICOM printer conformance statement are listed in table below:

|                       |  |
|-----------------------|--|
| MAGNIFICATION<br>TYPE | NONE<br>REPLICATE<br>BILINEAR<br>CUBIC<br><i>BICUBIC</i><br><i>MITCHELL</i><br><i>LANCZOS</i><br><i>SHARP1</i><br><i>SHARP2</i><br><i>SHARP3</i> |
|-----------------------|--|

AE TITLE settings that specified in Horizon CI DICOM printer conformance statement are listed in table below:

| System Job Settings File | Corresponding Use   |
|--------------------------|---|
| Print_SCP                | Used for DICOM. Does not contain any print parameter settings.<br>If the media type or size is not included in the DICOM attributes sent to the imager, the imager detects the image type and selects the media type and size as follows:<br>For grayscale images, uses the media set for Grayscale in the Default Media menu at the control panel.<br>For color images, uses the media set for Color in the Default Media menu at the control panel. |
| DefaultGrayscale         | Imager uses the media set for Grayscale in the Default Media menu at the control panel  |
| DefaultColor             | Imager uses the media set for Color in the Default Media menu at the control panel  |
| 8x10-dvf                 | 8x10 DirectVista film (blue)  |
| 8x10-dvfb                | 8x10 DirectVista film (blue)  |
| 8x10-dvfc                | 8x10 DirectVista film (clear)   |
| 8x10-dvp                 | 8x10 DirectVista paper  |
| 8x10-cvf                 | 8x10 ChromaVista film   |
| 8x10-cvt                 | 8x10 ChromaVista film   |
| 11x14-dvf                | 11x14 DirectVista film (blue)   |
| 11x14-dvfb               | 11x14 DirectVista film (blue)   |
| 11x14-dvfc               | 11x14 DirectVista film (clear)  |

|                 |                                       |
|-----------------|---------------------------------------|
| 11x14-dvp       | 11x14 DirectVista paper               |
| 11x14-dvp       | 11x14 DirectVista paper               |
| 14x17-dvf       | 14x17 DirectVista film (blue)         |
| 14x17-dvfb      | 14x17 DirectVista film (blue)         |
| 14x17-dvfc      | 14x17 DirectVista film (clear)        |
| 14x17-dvp       | 14x17 DirectVista paper               |
| a-dvp           | A-size DirectVista paper              |
| a-cvf           | A-size ChromaVista film               |
| a-cvt           | A-size ChromaVista film               |
| a4-dvp          | A4-size DirectVista paper             |
| a4-cvp          | A4-size ChromaVista paper             |
| a4-cvf          | A4-size ChromaVista film              |
| a4-cvt          | A4-size ChromaVista film              |
| priority-high   | Sets print job priority to high       |
| priority-medium | Sets print job priority to medium     |
| priority-low    | Sets print job priority to low        |
| receive-1       | Forces sheet output to receive tray 1 |
| receive-2       | Forces sheet output to receive tray 2 |
| receive-3       | Forces sheet output to receive tray 3 |
| syngofilm       | Special OEM-specific job settings     |

The Horizon CI DICOM printer screen displays:

A4 CV PAPER

8X10 DV Blue

14X17 DV Blue

**The following are the correct settings of the ultrasound system DICOM print preset:**

- Color printing:
  - (1) Settings: RGB
  - (2) Medium Type: Paper
  - (3) Film Size: A4
  - (4) MAGNIFICATION TYPE: NONE/CUBIC/ REPLICATE/BILINEAR
  - (5) AE Title: Print\_Scp (Recommended)

■ B/W printing

1. Method 1

- (1) Settings: MONOCHROME2
- (2) Medium Type: Blue Film
- (3) Film Size: 8X10
- (4) MAGNIFICATION TYPE: NONE/CUBIC/ REPLICATE/BILINEAR
- (5) AE Title: Print\_Scp (recommended)

2. Method 2

- (1) Settings: MONOCHROME2
- (2) Medium Type: Blue Film
- (3) Film Size: 14X17
- (4) MAGNIFICATION TYPE: NONE/CUBIC/ REPLICATE/BILINEAR
- (5) AE Title: Print\_Scp (recommended)

**The following are the incorrect settings of the ultrasound system DICOM print preset:**

■ Color printing:

- |                             |   |
|-----------------------------|---|
| 1) Settings:<br>MONOCHROME2 | Incorrect.<br>"RGB" should be selected in color printing while "MONOCHROME2" for B/W printing   |
| 2) Medium Type: Blue Film   | Incorrect.<br>Paper and Clear file are supported by color printer according to the printer conformance statement; but only Paper is available as displayed in the printer screen. |
| 3) Film Size: A3            | Incorrect.<br>Only three film size are available according to printer screen display:<br>A4<br>14X17<br>8X10  |
| 4) MAGNIFICATION TYPE       | Can be set as: NONE/ CUBIC/ REPLICATE/ BILINEAR   |
| 5) AE Title: 14x17-dvfb     | Incorrect.<br>Setting AE Title as "14x17-dvfb" will enforce the 14x17 DirectVista film (blue) printing.   |

### 3.12.2 Example 2

This example is being performed with FUJIFilm drypix4000 printer connected with the ultrasound system.

■ DICOM print settings on ultrasound system:

- 1) Settings: MONOCHROME2
  - 2) Medium Type: Blue Film
  - 3) Film Size: 14X17
  - 4) FORMAT: STANDARD\3, 5
  - 5) Film Orientation: Landscape
- Result: failed

■ Modify the DICOM print settings:

- 1) Settings: MONOCHROME2
  - 2) Medium Type: Blue Film
  - 3) Film Size: 14X17
  - 4) FORMAT: STANDARD\3,5
  - 5) Film Orientation: Portrait
- Result: succeeded.

■ Reasons:

Settings of Film orientation along with the FORMAT that supported by FUJIFilm drypix4000 printer are specified in the conformance statement. The print setting of 14X17 Landscape STANDARD\3, 5 is unavailable.

According to the printer conformance statement, Film orientation and FORMAT table supported by FUJIFilm drypix4000 are listed in table below:

| Film Size and Orientation | FORMAT |
|---------------------------|--------|
|---------------------------|--------|

|                  |   |
|------------------|---|
| 14".17" Portrait | STANDARD\1,1<br>STANDARD\1,2<br>STANDARD\1,3<br>STANDARD\2,1<br>STANDARD\2,2<br>STANDARD\2,3<br>STANDARD\2,4<br>STANDARD\3,3<br>STANDARD\3,4<br>STANDARD\3,5<br>STANDARD\3,6<br>STANDARD\4,4<br>STANDARD\4,5<br>STANDARD\4,6<br>STANDARD\4,7<br>STANDARD\4,8<br>STANDARD\5,5<br>STANDARD\5,6<br>STANDARD\5,7<br>STANDARD\5,8<br>STANDARD\6,6<br>STANDARD\6,7<br>STANDARD\6,8<br>STANDARD\6,9<br>STANDARD\6,10<br>STANDARD\7,7<br>STANDARD\7,8<br>STANDARD\7,9<br>STANDARD\7,10<br>STANDARD\8,8<br>STANDARD\8,9<br>STANDARD\8,10 |
|------------------|---|

|                          |              |
|--------------------------|--------------|
| <p>14"·17" Landscape</p> | STANDARD\1,1 |
|                          | STANDARD\2,1 |
|                          | STANDARD\3,1 |
|                          | STANDARD\1,2 |
|                          | STANDARD\2,2 |
|                          | STANDARD\3,2 |
|                          | STANDARD\4,2 |
|                          | STANDARD\3,3 |
|                          | STANDARD\4,3 |
|                          | STANDARD\5,3 |
|                          | STANDARD\6,3 |
|                          | STANDARD\4,4 |
|                          | STANDARD\5,4 |
|                          | STANDARD\6,4 |
|                          | STANDARD\7,4 |
|                          | STANDARD\8,4 |
|                          | STANDARD\5,5 |
|                          | STANDARD\6,5 |
|                          | STANDARD\7,5 |
|                          | STANDARD\8,5 |
| STANDARD\6,6             |              |
| STANDARD\7,6             |              |
| STANDARD\8,6             |              |
| STANDARD\9,6             |              |
| STANDARD\10,6            |              |
| STANDARD\7,7             |              |
| STANDARD\8,7             |              |
| STANDARD\9,7             |              |
| STANDARD\10,7            |              |
| STANDARD\8,8             |              |
| STANDARD\9,8             |              |
| STANDARD\10,8            |              |

