To set the edge filter for the live image, do the following:

1. Press the **Filter** button.
   ⇨ The corresponding controls appear in the dynamic control area.

Fig. 64: Filter settings

2. Under Edge, select the desired edge filter level by pressing the corresponding button.
   ⇨ The filter setting becomes immediately visible in the live screen image. The selected level of the edge filter appears on the screen as **RTE Y** where **Y** is a placeholder for the selected values.

3. Press the **Filter** button.
   ⇨ The corresponding controls appear in the dynamic control area.

9.2.3 LIH filter

The LIH filter generates and adds a specified number of images after radiation has been terminated.

Noise suppression

The higher the number of images you select, the greater the noise suppression, but also the greater motion blurring if the patient moves during image generation. You can choose between the following number of images: 1 image (noise suppression Off), 2, 4, 8, 16 images.

Automatic Noise Filter Adjustment

An **Automatic Noise Filter Adjustment** function is activated by default in dedicated anatomical programs. The system detects whether the fluoroscopy object is moving or not and automatically readjusts recursive and LIH filter. If the object is moving, the filter levels are decreased. If the object is not moving, the filter levels are increased.

To set the LIH filter for the live image, do the following:

1. Press the **Filter** button.
   ⇨ The corresponding controls appear in the dynamic control area.

Fig. 65: Filter settings

2. Under LIH, select the desired LIH filter level by pressing the corresponding button.
   ⇨ The filter setting becomes immediately visible in the live screen image. The selected level of the LIH filter appears on the screen as **LIH Z** where **Z** is a placeholder for the selected values.

3. Press the **Filter** button.
   ⇨ The corresponding controls appear in the dynamic control area.

9.3 Contrast and brightness adjustment (Windowing)

Function

The **Windowing** function allows you to adjust the contrast and brightness of the image on the live screen. These settings affect any newly-acquired live image which is displayed on the live screen and remain in force until you make new windowing settings. When you save the live image, the corresponding windowing values are saved together with the image.

After activating the **Windowing** function, you can select a number of gray levels, which are then stretched over the entire range of 1024 gray levels of the original image on the live screen. To achieve this effect, you set the width and the level of the so-called contrast window.

The number of gray levels defines the width of the contrast window. The width of the contrast window affects the image contrast. 1024 gray levels correspond to the value W 100.

The position of the selected gray levels on the original image grayscale (ranging from 0 to 1024 gray levels) defines the level of the contrast window. The level of the contrast window affects the image brightness.

Example:

You select all gray levels between 325 and 875. These gray levels are then mapped (stretched) to the range of 0 to 1024 gray levels in the processed image. This enhances the contrast.

Gray levels 0 to 324 of the original image are displayed as black, and gray levels 876 to 1024 of the original image are displayed as white. This means that the processed image is darker than the original image.

The standard **Windowing** mode allows you to freely choose the level and width of the contrast window.

You change the level of the contrast window, by gliding your finger slightly up and down across the touchpad, or vice versa. Depending on the direction of your finger movement, the image brightness increases (up) or decreases (down).

You change the width of the contrast window, i.e. the number of gray levels, by gliding your finger slightly across the touchpad from left to right, or vice versa. Depending on the direction of your finger movement, the image contrast increases (left) or decreases (right).

If you activate the **Windowing** function, a scale is displayed on top of the SmartEye showing an entirely filled bar. Depending on the adjustments you make, the length of the bar changes and shows the degree of deviation to the original image and is an adjustment aid.

The chosen windowing values are shown on the screen as **W X** for the width and **L Y** for the level.

NOTE
When you change the windowing values of a single cine loop image, the change will apply to all images of the respective cine loop.

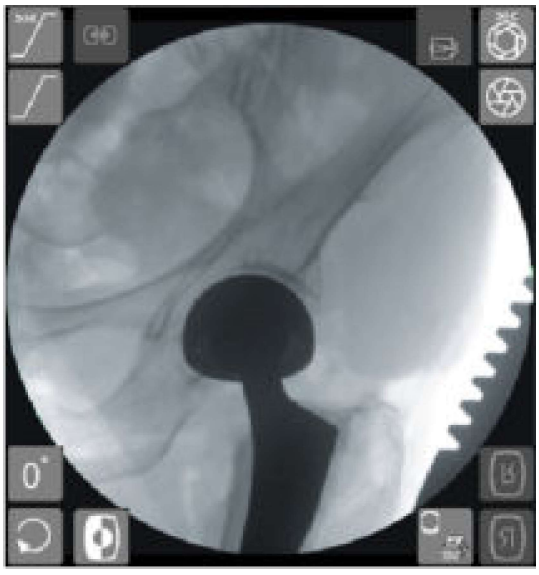


Fig. 66: SmartEye with active **Windowing** function

To set the brightness and contrast in windowing mode, do the following:

1. Press the **Contrast/Brightness** button.
   ⇨ The button is shown with yellow contours.
2. Adjust width (number of gray levels) and level (brightness) by gliding your finger across the touchpad accordingly.
   ⇨ This mode remains active for a time limit of 5 seconds, which allows you to make your adjustments. If no touchpad movement is perceived, the SmartEye automatically returns to its initial state.

   After making your last adjustment this mode remains active for another time frame of 5 seconds and then returns to its initial state.

   The changes become immediately visible in the live screen image.

3. Press the **Reset Contrast/Brightness** button once, to restore the original image before the changes.

4. Press the **Reset Contrast/Brightness** button twice, to restore the original image using the factory defaults (level 50, width 100).

9.4 Electronic image magnification

Function

The electronic image magnification allows you to magnify the fluoroscopic image without initiating radiation. The image resolution increases proportionally to the magnification factor once you initiate radiation again.

The following magnification levels are available:

System version	Magnification levels in cm
Ziehm Solo	23 / 15 / 10
Ziehm Solo FD	20 / 15 / 10

The current image magnification level is automatically shown on the **Magnify** button with the digits 1 and 2.

To select the image magnification level, do the following:

1. Press the **Magnify** button.
   ⇨ Magnification level 1 is activated and shown on the button label. The button is highlighted in yellow.

2. Press the **Magnify** button again.

   ⇨ The **Magnify** button now displays the selected image magnification level (e.g. 2).

3. Press the **Magnify** button again, to deactivate image magnification.

   ⇨ **Pre-Magnification (PreMag)**

   The setting becomes immediately visible in the live screen image. The fluoroscopic image last acquired is displayed in pre-magnification view with the selected magnification level.

   The PreMag image is displayed in the selected image magnification level with no need to initiate radiation again. Using the **Image Rotation** and **Image Reversal** functions you can modify the image as desired. When you initiate radiation, the fluoroscopic image is displayed on the screen as shown in the pre-magnification view.

   The chosen image magnification level is shown on the screen as **MAG X**, where **X** is a wildcard for numerical values from 0 to 2.

4. Re-press the **Magnify** button on the SmartEye until the button is deactivated.

   ⇨ The button for setting the image magnification level returns to its gray color.

9.5 Collimation

Function

The system is equipped with an iris and a slot collimator. These collimators allow you to limit the area of exposure of the patient just to the region of interest.

This offers the following advantages:

- Reduction of the radiation burden
- Less chance of flaring
- Better detail rendition and higher contrast

9.5.1 Iris collimator

The iris collimator can be adjusted steplessly. Normally, the iris collimator is completely open.

To adjust the iris collimator, do the following:

1. Press the **Iris Collimator** button.

   ⇨ The **Adjust Iris Collimator, Adjust Slot Collimator** and **Rotate Collimator** buttons appear in the SmartEye.

2. Press the **Iris Collimator** button.

3. Move the button across the touchpad until the desired setting is shown on the live screen.
4. Press the **Rotate Collimator** button.

5. Move the button across the touchpad until the desired setting is shown on the live screen.

   ⇨ This mode remains active for a time limit of 5 seconds, which allows you to make your adjustments. If no touchpad movement is perceived, the SmartEye automatically returns to its initial state.

   After making your last adjustment this mode remains active for another time frame of 5 seconds and then returns to its initial state.

6. Press the **Reset Collimator** button to restore the initial state of the iris collimator before the changes.

9.5.2 Slot collimator

The slot collimator can be adjusted steplessly. Normally, the slot collimator is completely open.

To adjust the slot collimator, do the following:

1. Press the **Iris Collimator** button.

   ⇨ The **Adjust Iris Collimator, Adjust Slot Collimator** and **Rotate Collimator** buttons appear in the SmartEye.
2. Press the **Adjust Slot Collimator** button.

3. Move the button across the touchpad until the desired setting is shown on the live screen.
4. Press the **Rotate Collimator** button.

5. Move the button across the touchpad until the desired setting is shown on the live screen.

   ⇨ This mode remains active for a time limit of 5 seconds, which allows you to make your adjustments. If no touchpad movement is perceived, the SmartEye automatically returns to its initial state.

   After making your last adjustment this mode remains active for another time frame of 5 seconds and then returns to its initial state.

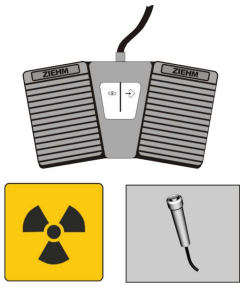
6. Press the **Reset Collimator** button to restore the initial state of the slot collimator before the changes.

Virtual collimator

You can adjust the collimators without initiating radiation. This is what you call a virtual collimator. Using this feature, you can significantly reduce patient exposure.

To perform a virtual collimation, do the following:

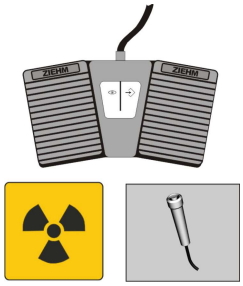
1. Select the desired anatomical program (→ *Chapter 8.5.1 "Anatomical programs" on page 115*).



2. Initiate radiation for a brief moment.
   ⇨ The generated image is displayed on the live screen.

> **CAUTION**
> **CAUTION**
> Risk of injury by X-rays!
> Put on X-ray protective clothing before you initiate radiation.

3. Adjust the iris and the slot collimator as desired without initiating radiation.
   ⇨ The areas of the image that will not be visible later are shown beneath a gray overlay. The collimator boundaries are represented by white edges.



4. Initiate radiation.

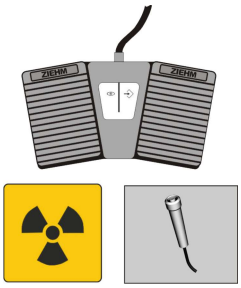
> **CAUTION**
> **CAUTION**
> Risk of injury by X-rays!
> Put on X-ray protective clothing before you initiate radiation.

9.6 Image swapping

Function

With the **Image Swapping** function, you can move an image from one screen to the other. This allows you to generate two images and to compare them directly to one another.

To compare an image with a live image, do the following:



1. Generate a live image.

CAUTION

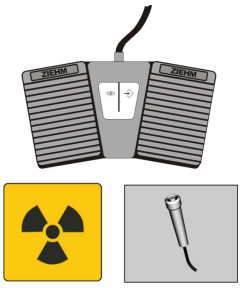
CAUTION

Risk of injury by X-rays!

Put on X-ray protective clothing before you initiate radiation.

2. Press the **Image Swapping** button.

⇨ The first image is moved to the reference screen. If the **Image swap with save** option has been activated in the **Configuration** operating mode under **Operation settings** (→ *Chapter 19.2.3 “Image swap with save” on page 303*), the image will be saved automatically before it is moved to the reference screen.



3. Generate a second live image.

CAUTION

CAUTION

Risk of injury by X-rays!

Put on X-ray protective clothing before you initiate radiation.

⇨ The image is displayed on the live screen. Now you can compare the images on the two screens to one another.

9.7 Image reversal and image rotation

Function

The **Image Reversal** and **Image Rotation** functions are used for individual adjustment of the image orientation on the live screen.

You can use these functions to align the image orientation with the patient orientation. To make orientation easier for the operator, label are attached to the system showing a patient in supine position. If the patient is positioned as illustrated by the label, then the image orientation on the live screen corresponds to the patient orientation.

Both image reversal and image rotation are produced digitally and without the need to initiate any further radiation.

9.7.1 Horizontal and vertical image reversal

To reverse an image in horizontal or vertical direction, do the following:

1. Press the **Reverse Up/Down** button.

   ⇨ The button is highlighted in yellow. On the live screen, the image appears with top and bottom reversed, and a symbol for up/down reversal is displayed.

2. Press the **Reverse Left/Right** button.

   ⇨ The button is highlighted in yellow. On the live screen, the image appears with left and right side reversed, and a symbol for left/right reversal is displayed.

   Image reversal is symbolized on the screen by an **R** which is either mirrored left-right or upside-down.

9.7.2 Image rotation

To rotate an image, do the following:

1. Press the **Image Rotation** button.

   ⇨ The button is shown with yellow contours.

2. Rotate the image by gliding your finger slightly across the touchpad (on the control panel) until the desired setting is shown on the live screen.

   ⇨ The changes become immediately visible in the live screen image.

   The rotation angle corresponds to the angle traced by your finger on the touchpad. This mode remains active for a time limit of 5 seconds, which allows you to make your adjustments. If no touchpad movement is perceived, the SmartEye automatically returns to its initial state.

   After making your last adjustment this mode remains active for another time frame of 5 seconds and then returns to its initial state.

   The chosen angle of rotation is shown on the screen as **R X**.

Systems with flat-panel detector

As soon as an image is rotated, it assumes a circular shape. The image has a square shape only when in the following angle positions: 0°/360°, 90°, 180°, 270°.

To reset the angle of rotation to 0°, do the following:

Press the **Reset Image Rotation** button.

⇨ The image is reset to the 0° position.

9.8 Grayscale inversion

Function

The **Grayscale Inversion** function allows you to view the active image with a negative grayscale.

To display an image with a negative (or positive) grayscale, do the following:

1. Press the **Grayscale Inversion** button.
   ⇨ The image is displayed with negative grayscale on the live screen.

2. Press the **Grayscale Inversion** button again.
   ⇨ The image is again displayed with a positive grayscale.

10 Data Management

10.1 Organization of patient and image data

Patient and image data is managed in the **Patient** and **Archive** operating modes. All data of a patient is stored in a patient folder on the hard disk. All image data is assigned to the corresponding patient folder.

When you switch on the system, it will automatically create a new patient folder.

10.1.1 Patient folders

Function

In order to be able to relate the fluoroscopic images to a certain patient, you must always create or activate a patient folder before acquiring an image or a cine loop.

Storage capacity

You can create as many patient folders as desired on the hard disk. In each patient folder, you can store as many images as you wish. The total number of images is limited only by the hard disk size ('image memory'). The size of the image memory depends on the chosen system configuration.

Auto-delete function (n/a for USA)

When you save an image for which there would be no more space on the hard disk otherwise, the oldest patient folder on the hard disk is automatically overwritten. However, if the oldest patient folder contains one or more protected images, only the unprotected images are deleted. The folder itself as well as the protected images are preserved.

Deactivated auto-delete function (USA)

The **Auto-delete** function is not activated. If there is not enough disk space for images, you must delete images manually to free up disk space.

10.2 Managing patient data

Patient data is managed in the **Patient** operating mode. When you create a new patient folder, you may retrieve the patient's data from a DICOM server under certain conditions (→ *Chapter 11.2 "Downloading patient data from a DICOM server" on page 192*).

Length of the patient ID

The length of the patient ID is limited by the system to 64 digits.

Display of the patient ID

In the read-only boxes in the **Archive** operating mode, only the first 13 digits of the patient ID are displayed. In the **Patient ID** input box in the **Patient** operating mode, you can scroll through the whole patient ID using the arrow button of the keypad.

Access. no.

You can manually enter a hospital-specific internal administrative number (Accession no.), or import it with the patient data.

Subject

You can enter a subject for each patient folder, which is saved together with the patient data.

Editing data

You can edit all data in an existing patient folder or add new data at any time.

Importing images from a DICOM server

When you have created a new patient folder or activated an existing patient folder, you can import one or more images or a series of images from a DICOM server into this patient folder (→ *Chapter 11.7 “Importing images and cine loops from a DICOM server” on page 207*).

NOTE

The date formats may vary, depending on the customer-specific settings. In the present document, all date formats appear in the format **DD.MM.YYYY**.

To activate the Patient operating mode, do the following:

Press the **Patient** tab.

⇨ The input boxes of the **Patient** operating mode as well as the alphanumeric keypad are now available on the control panel.

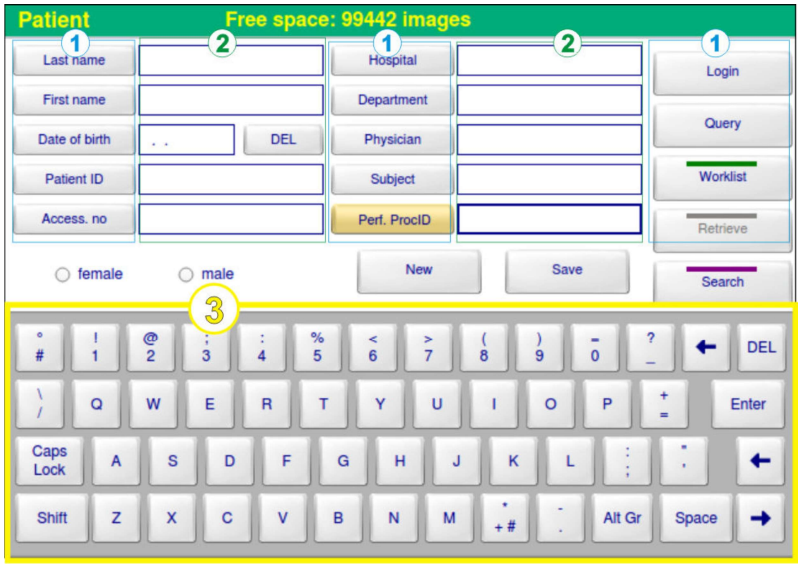


Fig. 67: **Patient** operating mode

1 Buttons for the input boxes
2 Input boxes
3 Alphanumeric keypad

If on your system the password-protected user administration (HIPAA) has been activated, on the control panel the **Login** button is also shown.

When you have activated a patient folder, the corresponding data is displayed in the input boxes. Apart from the selected operating mode the title bar (highlighted in green) shows the remaining hard disk space.

10.2.1 Managing patient data securely (HIPAA)

In order to provide data security for patient data according to the "Health Insurance Portability and Accountability Act" (HIPAA), the system supports a password-protected user login (factory-set), if required. Depending on the type of user login with the **Login** button you can get full or restricted access to patient data in the **Patient** operating mode.

To log in as a user, do the following:

1. In the **Patient** operating mode, press the **Login** button.

   ⇨ On the control panel all login-related buttons and input boxes are displayed.

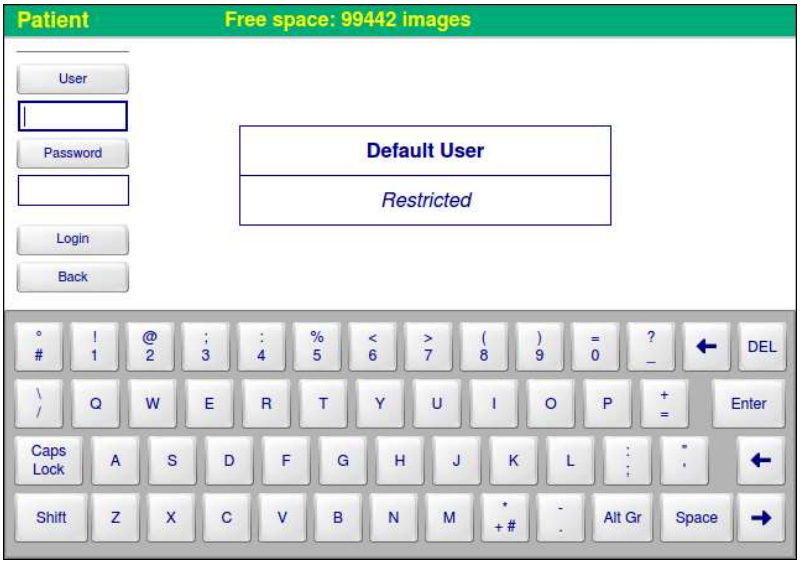


Fig. 68: Input boxes for the login

2. Press the **User** button.

   ⇨ Enter your User ID.

3. Press the **Password** button.

   ⇨ Enter your Password.

4. Press the **Login** button.

   ⇨ After you have logged in, the **Login** button is replaced by the **Logout** button.

   The user name used for logging in, appears next to the **User** input box.

5. Press the **Back** button to switch to the patient data input.

NOTE

If you do not get access to certain patient data, you may not be authorized due to the (user) group you are currently assigned to.

Refer to the following table (→ *Table 15 "(User) groups and related access rights" on page 153*) to check out your access rights, and contact your system administrator, in case you request any changes.

Initial administrator login

For patient data security reasons, you must immediately change your password after you have logged in as administrator for the first time.

To log in as administrator for the first time, do the following:

1. In the **Patient** operating mode, press the **Login** button.
   ⇨ On the control panel all login-related buttons and input boxes are displayed.

2. Press the **User** button.
   ⇨ For User ID enter **`Administrator`**.

3. Press the **Password** button.
   ⇨ For Password enter admin.

4. Press the **Login** button.

NOTICE **NOTICE**

You must now change your Password.

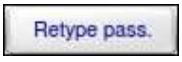
You can protect patient data from unauthorized access only by assigning a custom password.

⇨ The user name used for logging in, appears next to the **Name** input box.

5. From the user list select **Administrator** by pressing the respective item.
   ⇨ The related access data is shown in the input boxes next to the user list.

6. Press the **Password** button or the **Password** input box.

7. Enter the new password using the alphanumeric keypad.



8. Press the **Retype pass.** button or the **Retype pass.** (Retype password) input box.

9. Re-enter the new password using the alphanumeric keypad.

NOTE

When creating the password consider the currently applicable safety rules.

10. Press the **Refresh** button.

⇨ The new password is applied.

Initial administrator login

If you login as administrator, on the control panel, the list of users available in the system is displayed. Further all buttons and input boxes are displayed needed to setup User IDs or edit access data.

Fig. 69: Buttons and input boxes of the user administration

Creating a new User ID

If you are logged in as administrator, you can create new User IDs.

To create a new User ID, do the following:

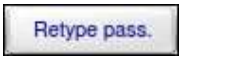
1. Press the **Last name** button or the **Last name** input box.

⇨ The button is highlighted in yellow. The cursor jumps to the corresponding input box.

2. Enter the new User ID (user name) using the alphanumeric keypad.

3. Press the **Password** button or the **Password** input box.

4. Enter the password for the new User ID using the alphanumeric keypad.



5. Press the **Retype pass.** button or the **Retype pass.** (Retype password) input box.

6. Re-enter the password for the new User ID using the alphanumeric keypad.

NOTE
When creating the password consider the currently applicable safety rules.

7. Press the **Down Arrow** button in the **Group** drop-down list box.
   ⇨ All available (user) groups are displayed in the drop-down list box.

8. Select the desired (user) group that you want to assign the user to by pressing the respective item. The (user) group determines the access rights to patient data and user access data.

Group	User	Effects/ Access Rights
Admin	Administrator	Login with password **Access Rights:** • Creating and changing users Access to patient data
Standard	Default User	Login with password **Access Rights:** • Access to patient data assigned to the (user) groups **Standard** and **Restricted**
Restricted	Users with restricted rights	Login without password • Access to patient data assigned to the (user) group **Restricted**
Tech	Technicians, service engineer	Login with password • Access to patient data assigned to the (user) group **Tech**

Table 15: (User) groups and related access rights

9. Press the **Add** button.
   ⇨ The newly created user is added to the list.

10. Press the **Logout** button, after you have completed the operation.

Changing the (user) group assignment of a user

If you are logged in as administrator, you can change the (user) group assignment of an existing user.

To change the (user) group assignment of a user, do the following:

1. From the user list select a user by pressing the respective item.

⇨ The related access data is shown in the input boxes next to the user list.

2. Press the **Down Arrow** button.

⇨ All available (user) groups are displayed in the drop-down list box.

3. Select the desired (user) group that you want to assign the user to by pressing the respective item.

4. Press the **Refresh** button.

⇨ The user is assigned to the selected (user) group.

Changing the (user) group assignment of patient data

If you are logged in as administrator, you can change the (user) group assignment of existing patient data.

To change the (user) group assignment of patient data, do the following:

Press the **Secure patient folders** button.

⇨ This operation moves all patient data of the (user) group **Restricted** to the group **Standard**. This (user) group requires a password-protected user login.

Export log file

If you are logged in as administrator, you can export a log file.

To export a log file, do the following:

Press the **Export log file** button.

⇨ This operation exports the log file HIPAA.log to a USB storage medium. You will find the log file in a folder indicating the system's serial number.

Delete log file

If you are logged in as administrator, you can export a log file.

To delete a log file, do the following:

Press the **Delete log file** button.

⇨ This operation deletes the log file HIPAA.log from the hard disk. A new log file is generated automatically.

Delete input boxes

If you are logged in as administrator, you can delete data in the input boxes of the user administration.

To delete access data from the input boxes, do the following:

1. Select a user from the user list by pressing the respective item.

   ⇨ The related user data is shown in the input boxes.

2. Press the **New** button.

   ⇨ All input boxes of the user administration are cleared.

10.2.2 Creating a new patient folder

When you create a new patient folder, you may choose between the following ways of entering the patient data:

- You enter the patient data manually using the alphanumeric keypad.
- You retrieve the patient data from the DICOM server (**Query** or **Worklist**, → *Chapter 11.2 “Downloading patient data from a DICOM server” on page 192*).

10.2.2.1 Entering patient data manually

To enter patient data manually, do the following:

1. Press the **Patient** tab.

   ⇨ The **Patient** operating mode is activated.

NOTE

You may predefine default data for the **Hospital, Department** and **Physician** input boxes. The respective data is entered in the **Configuration** operating mode under **Basic settings**.

2. Press the **New** button.

   ⇨ The input boxes are cleared (if any data has been displayed before in them), with the exception of those with default data.

   You may now enter the patient data.

3. Press the button of the desired input box, e.g. the **Last name** button.

⇨ The button is highlighted in yellow. The cursor jumps to the corresponding input box.

NOTE

When acquiring data the first letter in certain input boxes or following a space character automatically appears in upper case.

To generate lower case letters at the beginning of an input field or after a space character, press the **Shift** button before entering data.

To generate further upper case letters, press the **Caps Lock** button before entering data.

4. Enter the patient data using the alphanumeric keypad. To move to the next input box, always press the **Enter** button.

⇨ You must complete at least the **Last name** input box. The length of the patient number must not exceed 64 digits. If you do not enter any patient ID, the system automatically assigns a number (e.g. PAT123) in the **Patient ID** box.

5. Save the new patient folder and the data entered by pressing the **Save** button.

⇨ The new patient folder is automatically activated. A blank fluoroscopy mask with the newly-entered patient data appears on the live screen.

The display of the control panel automatically switches to the start screen.

You may now proceed to generating fluoroscopic images, which will be automatically assigned to the newly-created patient folder.

6. Switch to the **Fluoroscopy** operating mode and generate the desired fluoroscopic images.

10.2.3 Editing patient data

You may edit the patient data in any existing patient folder at any time. You can use the name of the patient, the patient ID or a subject to search for the patient folder whose data you want to edit.

Effects

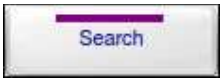
Any patient data changes affect all existing and future images as well as the active image.

NOTE
If you use the patient ID to search for a patient folder, please verify the search result by checking the patient name. It may happen occasionally that a patient ID is assigned more than once on a DICOM network.

To modify the data in an existing patient folder, do the following:

1. Press the **Patient** tab.
   ⇨ The **Patient** operating mode is activated.
   The input boxes may contain data you want to delete.

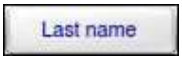
2. Press the **New** button.
   ⇨ All input boxes are cleared.



3. Press the **Search** button.
   ⇨ A thumbnail mosaic with all patient folders is displayed on the reference screen. Each patient folder is symbolized by the most recent image contained in it.
   The corresponding controls appear in the dynamic control area.

Fig. 70: Input boxes for searching and hit list

Now you can browse through the patient folder mosaic with the help of the arrow buttons or enter the desired search string:



4. Press the button of the desired input box, e.g. the **Last name** button.
   ⇨ The button is highlighted in yellow. The cursor jumps to the corresponding input box.

5. Enter the search string using the alphanumeric keypad.

NOTE
The search function is not case-sensitive.

⇨ With each letter you enter, the alphabetical hit list is more and more confined to match the search string.

The **All** button appears, allowing you to redisplay the entire list.

6. Select the desired item on the list using the arrow buttons and press the **OK** button.

⇨ The data of the selected patient appears in the input boxes. You may overwrite this data now.

7. Press the button of the input box whose data you want to edit.

⇨ The button is highlighted in yellow. The cursor jumps to the corresponding input box.

8. Overwrite the data you want to edit.

9. Press the **Save** button.

⇨ A confirmation prompt is displayed.

10. Press the **Overwrite** button.

⇨ The existing data in the patient folder is overwritten by the newly-entered ones.

or

11. Press the **New** button.

⇨ A new patient folder with the modified data is created.

10.3 Image data management

Image data is managed in the **Archive** operating mode.

NOTE
You must log in using your user data to get access to patient data of your (user) group and subordinate groups.

If you do not log in using your user data you only get access to patient data of the (user) group **Restricted**.

To activate the Archive operating mode, do the following:

Press the **Archive** tab.

⇨ The read-only boxes and controls for managing the patient folders appear on the control panel.

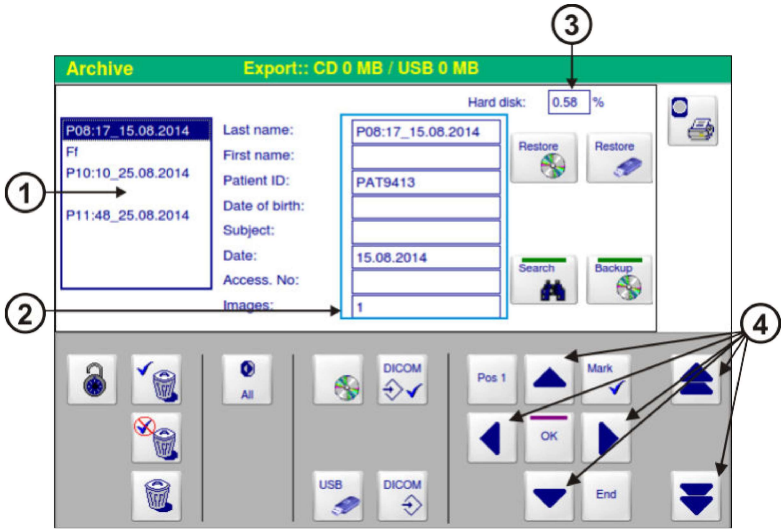


Fig. 71: **Archive** operating mode

Thumbnail mosaic

All patient folders on the hard disk are displayed as a thumbnail mosaic (up to 16 images at a time) on the reference screen, each folder being symbolized by its most recent image. In addition, the following information appears for each patient folder of the mosaic: name of the patient and number of images contained in the folder. You can browse through the thumbnail mosaic using the arrow buttons.

List of patient folders

The list (1) shows the names of all patient folders in the order in which they were created. The most recent folder appears at the bottom of the list, the oldest one at the top.

The name of the folder which is marked by the cursor on the reference screen is highlighted by a blue bar in the list, and the related data is displayed in the read-only boxes (2). You cannot enter or edit any data in these read-only boxes.

Arrow buttons

Using the arrow buttons you can move the cursor around the list and simultaneously from one patient folder or image to another on the reference screen.

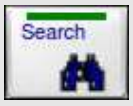
Cursor position

You can exit the active patient folder in the **Archive** operating mode and browse through another patient folder. If you exit the patient folder you are currently browsing through, by pressing the **Back** button, the cursor marker remains on this patient folder.

Hard Disk display The **Hard disk** display (3) indicates the percentage of used hard disk space.

10.3.1 Managing patient folders

The following functions for navigating and managing patient folders are available in the **Archive** operating mode:

Symbol(s)	Meaning
	**Search:** Searching for a patient folder
	**Pos 1:** To place the cursor on the first patient folder in the mosaic
	**End:** To place the cursor on the last patient folder in the mosaic
	**Mark:** To mark one or more patient folders
	**Delete:** Deleting patient folders
	**Inverting all images:** To invert the grayscale of all images on the hard disk (entire archive)
	**CD/DVD** To write marked patient folders to CD/DVD. Apart from the selected operating mode the title bar (highlighted in green) shows the remaining space on the CD/DVD.
	**USB** To save marked patient folders to a USB storage medium. Apart from the selected operating mode the title bar (highlighted in green) shows the remaining space on the USB storage medium.
	**DICOM Store:** To save marked images to a DICOM server

Symbol(s)	Meaning
	**DICOM Storage Commitment:** To search for previously stored images on a DICOM server
	**Backup:** To select patient folders and back them up to a USB storage medium or a CD/DVD.
	**Restore from CD/DVD:** To restore backed-up patient folders from a CD/DVD
	**Restore from USB storage medium:** To restore backed-up patient folders from a USB storage medium

10.3.1.1 Marking patient folders

To mark one or more patient folders, do the following:

1. Select the desired patient folder in the thumbnail mosaic on the reference screen using the arrow buttons.

2. Press the **Mark** button.
   ⇨ The patient folder is now marked and flagged with an **M**.
3. To mark additional patient folders, repeat the procedure.

To unmark a patient folder, do the following:

1. Select the desired marked patient folder on the reference screen using the arrow buttons.

2. Press the **Mark** button.
   ⇨ The patient folder becomes unmarked.

10.3.1.2 Deleting patient folders

You can delete either all marked patient folders, or all unmarked patient folders, or only the patient folder where the cursor is.

Patient folders containing protected images are not deleted. Only contained unprotected images are deleted. In order to delete images, deactivate image protection (→ *Further information on page 174*). If patient folders contain unprotected images only, you can delete them.

To delete one or more patient folders, do the following:

NOTE
Deleted patient folders are irretrievably lost.

Back up the patient folders you want to keep before deleting them, or make sure that they are really no longer needed (→ *Chapter 10.3.1.4 "Saving patient folders or images" on page 163*).

1. Mark the patient folders you want to delete and press the **Delete marked items** button.
   ⇨ A confirmation prompt is displayed.

   or

2. Mark the patient folders you want to keep and press the **Delete unmarked items** button.
   ⇨ A confirmation prompt is displayed.

   or

3. Use the arrow buttons to select an individual patient folder you want to delete and press the **Delete** button.
   ⇨ A confirmation prompt is displayed.

4. Confirm by pressing the **Yes** button.

10.3.1.3 Inverting the entire archive

If you are used to viewing negative images (e.g. because you are a radiologist), you can invert the grayscale of all images on the hard disk in one step. This function is not available for cine loops, DSA cine loops, MSA and RSA images. Images that have already been saved with a negative grayscale remain the way they are.

To invert the grayscale of all images or to undo the grayscale inversion, do the following:

1. Press the **Invert All** button.
   ⇨ The grayscale of all images on the hard disk is inverted. In the mosaic view, the images are always displayed with a positive grayscale. The negative grayscale will not become visible until you display an image at full size.
2. Terminate the **Archive** operating mode, or press the **Invert All** button again.
   ⇨ The grayscale inversion of all images is undone.

10.3.1.4 Saving patient folders or images

Storage formats

Depending on your chosen system configuration, you can save images from one or more patient folders in various storage formats to different storage media.

Some formats with reduced resolution and color depth are also available.

The desired storage format is defined in the **Configuration** operating mode under **Storage media** (→ *Chapter 19.5 “Storage media” on page 316*).

Formats	File type	Resolution	Color depth	File size/ image
16 bit TIF	∗.tif	1024 × 1024	16 Bit	2 MB
DICOM	-	1024 × 1024	16 Bit	2 MB
Multimedia (cine loop)	∗.avi	512 × 512	8 Bit	depends on the length of the cine loop
DICOM	-	512 × 512	8 Bit	256 kB
JPEG	∗.jpg	512 × 512	8 Bit	256 kB

Table 16: Formats for storage media CD/DVD and USB

NOTE

Saving image data with a resolution of 512 × 512 pixels may lead to information loss. If possible, save image data with a resolution of 1024 × 1024 pixels.

Anonymizing patient data

NOTE

During the anonymization of patient data only the following meta data are anonymized.

Supplementary information stored together with the image data are not anonymized.

The anonymization works for all image formats.

Prior to the export, you can decide whether to anonymize the patient data. If you confirm this prompt the following patient data are anonymized:

- Identifier
- First name
- Patient ID
- Hospital name
- Department

- Physician
- Date of birth
  Note that the date of birth is set to January 1st of the original year of birth, since the patient age is often relevant to evaluate the image quality.

DICOM Viewer

Whenever you save images in standard DICOM format or 'reduced' DICOM format (with a resolution of 512 × 512 pixels and 8 bit color depth) to an external storage medium, a **DICOM Viewer** program is automatically saved to the storage medium as well. This program enables you to view the DICOM images on any PC with **Microsoft® Windows®** operating system (version **Microsoft® Windows® 98** or higher).

When residing on a CD or DVD, the **DICOM Viewer** starts automatically. When residing on a USB storage medium, the program must be launched manually.

Saving to USB storage medium

To save one or more patient folders to a USB storage medium, do the following:

NOTE
Only connect USB storage media with the USB port.

1. Mark the desired patient folder(s).
2. Plug a USB storage medium into the USB port.

3. Press the **USB** button.
   ⇨ The marked patient folders are saved to the USB storage medium. A progress indicator in a message window on the control panel informs you about the status of the save operation. The **Cancel** button appears, enabling you to interrupt the save operation.

   Once they have been saved, the patient folders become unmarked.

Writing to CD/DVD

With the DVD writer, data can be written to both CDs and DVDs. The selected patient folders are copied to a compilation file on the hard disk first.

To write one or more patient folders to CD/DVD, do the following:

1. Mark the desired patient folder(s).
2. Insert an empty CD or DVD into the DVD writer.

3. Press the **CD/DVD** button.

   ⇨ The following messages are displayed:

   Checking CD/DVD …

   Copying image xyz to CD/DVD mirror …

   Once they have been included in the compilation file, the patient folders become unmarked.

   Writing CD/DVD. Estimated time x minutes.

   A progress indicator informs you about the status of the write operation.

   Once the write operation has been completed successfully, the following message is displayed:

   Writing of CD/DVD completed successfully

4. Press the **OK** button.

10.3.2 Finding and displaying a patient folder

Search criteria

The following criteria can be used to search for a patient folder:

- Name of the patient (**Last name** box)
- Patient number (**Patient ID** box)
- Keyword (**Subject** box)

You can combine these search criteria using an AND operation. Thus, you could look e.g. for all patients called *Miller* with the subject *Knee*.

NOTE

If you use the patient ID to search for a patient folder, please verify the search result by checking the patient name. It may happen occasionally that a patient ID is assigned more than once on a DICOM network.

To find a patient folder, do the following:

1. Press the **Archive** tab.

   ⇨ The **Archive** operating mode is activated.

2. Press the **Search** button.

⇨ The corresponding controls appear in the dynamic control area. An alphabetically sorted list of all patient folders is displayed.

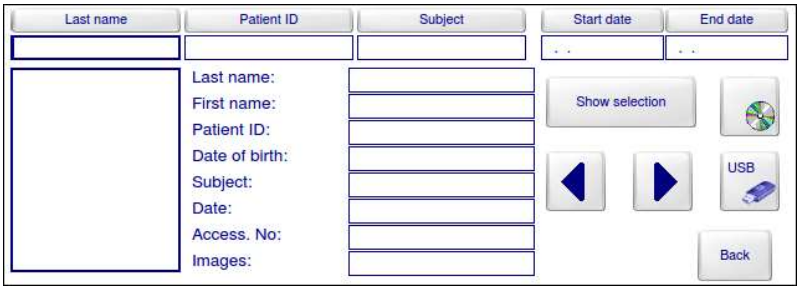


Fig. 72: Input boxes for searching and hit list

Now you can enter the desired search string(s).

3. Press the button of the desired input box, e.g. the **Last name** button.

⇨ The button is highlighted in yellow. The cursor jumps to the corresponding input box.

4. Enter the search string using the alphanumeric keypad.

NOTE

The search function is not case-sensitive.

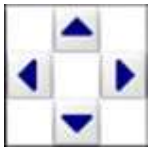
⇨ With each letter you enter, the alphabetical hit list is more and more confined to match the search string.

The **All** button appears, allowing you to redisplay the entire list.

5. Press the **Back** button.

⇨ You are returned to the **Archive** screen. The data of all patients who match the search string(s) is displayed in the list.

The **All** button appears, allowing you to redisplay the entire list.



6. Select the desired patient folder using the arrow keys.

7. Press the **OK** button.

   ⇨ All images contained in this patient folder are displayed as thumbnails on the reference screen. The most recent image is highlighted by a white frame. Cine loop sequences are flagged with **C**.

   Other buttons and read-only boxes for processing individual images or cine loops appear on the control panel (→ *Chapter 11.5 "Saving and printing images and cine loops from a patient folder" on page 204*).

Thumbnail display The thumbnails in the mosaic reflect all the modifications applied to them after fluoroscopy (e.g. contrast adjustment, rotation, zoom).

Image information The information pertaining to the image which is marked by the cursor on the reference screen is displayed on the control panel:

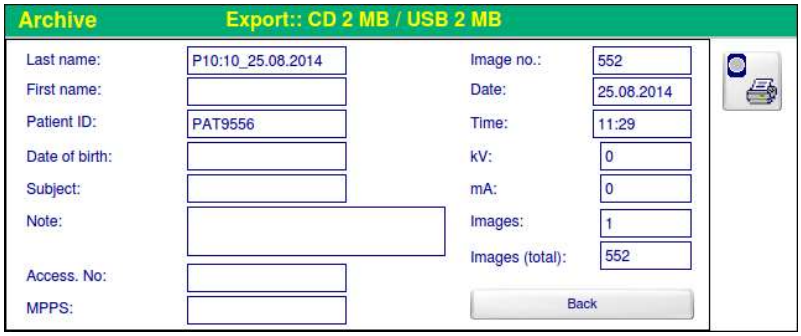


Fig. 73: **Archive** operating mode: Read-only boxes displaying image information

10.3.3 Activating a patient folder

To be able to save new images to an existing patient folder, you must activate this patient folder before switching to a fluoroscopy operating mode. You can activate an existing patient folder either in the **Patient** or **Archive** operating mode.

To activate a patient folder in the Patient operating mode, do the following:

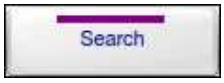
1. Press the **Patient** tab.

   ⇨ The **Patient** operating mode is activated.

   The input boxes may contain data you want to delete.

2. Press the **New** button.

   ⇨ All input boxes are cleared.



3. Press the **Search** button.

⇨ A thumbnail mosaic with all patient folders is displayed on the reference screen. Each patient folder is symbolized by the most recent image contained in it.

The corresponding controls appear in the dynamic control area. An alphabetically sorted list of all patient folders is displayed.

Fig. 74: Input boxes for searching and hit list

Now you can browse through the patient folder mosaic with the help of the arrow buttons or enter the desired search string:

4. Press the button of the desired input box, e.g. the **Last name** button.

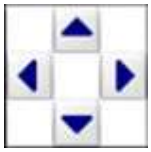
⇨ The button is highlighted in yellow. The cursor jumps to the corresponding input box.

5. Enter the search string using the alphanumeric keypad.

NOTE
The search function is not case-sensitive.

⇨ With each letter you enter, the alphabetical hit list is more and more confined to match the search string.

The **All** button appears, allowing you to redisplay the entire list.



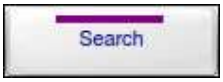
6. Select the desired item on the list using the arrow buttons.

7. Press the **OK** button.

⇨ The data of the selected patient appears in the input boxes, and the patient folder is activated. Now you can switch to the **Fluoroscopy** operating mode.

To activate a patient folder in the Archive operating mode, do the following:

1. Press the **Archive** tab.
   ⇨ The **Archive** operating mode is activated.



2. Press the **Search** button.
   ⇨ The corresponding controls appear in the dynamic control area. An alphabetically sorted list of all patient folders is displayed.

Fig. 75: Input boxes for searching and hit list

Now you can enter the desired search string(s).

3. Press the button of the desired input box, e.g. the **Last name** button.
   ⇨ The button is highlighted in yellow. The cursor jumps to the corresponding input box.
4. Enter the search string using the alphanumeric keypad.

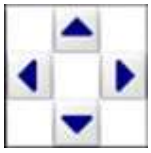
NOTE
The search function is not case-sensitive.

   ⇨ With each letter you enter, the alphabetical hit list is more and more confined to match the search string.

   The **All** button appears, allowing you to redisplay the entire list.

5. Press the **Back** button.
   ⇨ You are returned to the **Archive** screen. The data of all patients who match the search string(s) is displayed in the list.

   The **All** button appears, allowing you to redisplay the entire list.



6. Select the desired patient folder using the arrow keys.

7. Press the **OK** button.
   ⇨ The corresponding controls appear in the dynamic control area.

8. Press the **OK** button.
   ⇨ The patient folder is now active. Now you can switch to any fluoroscopy operating mode.

10.3.4 Browsing through the active patient folder

In the **Fluoroscopy** and **Post processing** operating modes, you can display all images of the active patient folder at full size without having to switch to the **Archive** operating mode.

To browse through the active patient folder, do the following:

1. Activate the desired patient folder.
2. Switch to the desired operating mode (**Fluoroscopy** or **Post processing**).
3. Use the arrow buttons to browse through the active patient folder.

   ⇨ The **Down Arrow** button moves you to the image with the next lower image number.

   The **Up Arrow** button moves you to the image with the next higher image number.

10.3.5 Processing and outputting images of a patient folder

Once you have displayed or activated a patient folder, you can process and output the images and the cine loops that are stored there. Different read-only boxes and controls are displayed on the control panel for that purpose.

Read-only boxes

The read-only boxes show patient data and image information. The **Images (Total):** box shows how many images or cine loops are stored in the patient folder. If the cursor is on a cine loop within the patient folder, the **Images** box shows the number of images that make up the cine loop. If the cursor is on an individual image, the number **1** appears there.

Image processing and output

In the following sections, we will describe how to process and output individual images. For information on how to process and output cine loops in a patient folder, please refer to → *Chapter 12.5 "Processing and outputting saved cine loops" on page 219*.

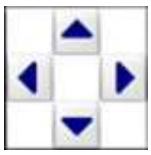
The following functions are available in a displayed or active patient folder for navigating within the folder and for displaying and processing individual images:

Symbol(s)	Meaning
	**OK** (with displayed patient folder only): To display an image at full size on the live screen and to activate the displayed patient folder
	**Full-Size image:** To display an image at full size on the reference screen
	**Mosaic:** To restore the mosaic view on the live screen The **Mosaic** button appears as soon as you have chosen the full-size image view on the reference screen.
	**Pos 1:** To place the cursor on the first image of the patient folder
	**End:** To place the cursor on the last image of the patient folder
	**Mark:** To mark one or more images
	**Protect:** To protect the image marked by the cursor against being deleted
	**Delete:** Deleting images
	**Delete Selection**: To delete selection of images and patient folders
	**DICOM Retrieve:** To import images from a DICOM server into the displayed or active patient folder

Symbol(s)	Meaning
	**Create dose protocol:** creates a dose protocol for the active patient (→ *Chapter 10.3.5.7 "Dose protocol details" on page 179*) stored in the active patient folder. It itemizes the radiation dose by fluoroscopy modes and shows the total dose, the patient was exposed to at the time the protocol was created.
	**Print:** To print marked images on the video printer
	**DICOM Print:** To print marked images on a DICOM network printer
	**CD/DVD** To write marked images to CD/DVD Apart from the selected operating mode the title bar (highlighted in green) shows the remaining space on the CD/DVD.
	**USB** To save marked images to a USB storage medium Apart from the selected operating mode the title bar (highlighted in green) shows the remaining space on the USB storage medium.
	**DICOM Store:** To save marked images to a DICOM server
	**DICOM Storage Commitment:** To search for previously stored images on a DICOM server.

10.3.5.1 Displaying an image at full size

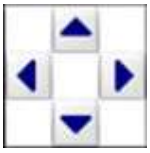
To display an image at full size on the live screen, do the following:



1. Select the desired image in the thumbnail mosaic on the reference screen using the arrow buttons.

2. Press the **OK** button.
   ⇨ The selected image is displayed at full size on the live screen. Simultaneously, the displayed patient folder is activated.

To display an image at full size on the reference screen, do the following:



1. Select the desired image in the thumbnail mosaic on the reference screen using the arrow buttons.

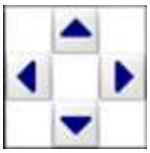
2. Press the **Full-Screen Image** button.
   ⇨ The selected image is displayed at full size on the reference screen. The **Mosaic** button appears, enabling you to restore the mosaic view on the reference screen.

10.3.5.2 Marking images

Before being able to print images or to save them to an external storage medium, you must mark the desired image(s).

Once you have printed the marked images or saved them to an external storage medium, they will automatically become unmarked.

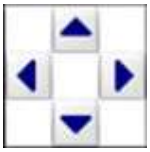
To mark one or more images, do the following:



1. Select the desired image on the live screen using the arrow buttons.

2. Press the **Mark** button.
   ⇨ The image is now marked and flagged with an **M**.
3. To mark additional images, repeat the procedure.

To unmark an image, do the following:



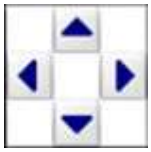
1. Select the desired marked image on the reference screen using the arrow buttons.

2. Press the **Mark** button.
   ⇨ The image becomes unmarked.

10.3.5.3 Protecting images

You can protect images against being deleted. When you try to delete a folder which contains protected images, the folder itself as well as the protected images remain on the hard disk.

To protect one or more images, do the following:



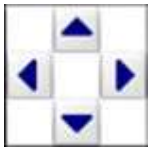
1. Select the desired image on the reference screen using the arrow buttons.

2. Press the **Protect** button.

   ⇨ The image is now protected and flagged with a **P**.

3. To protect additional images, repeat the procedure.

To unprotect an image, do the following:



1. Select the desired protected image using the arrow buttons.

2. Press the **Protect** button.

   ⇨ The image becomes unprotected.

NOTE

Patient folders containing protected images cannot be deleted automatically. If many folders on the hard disk contain protected images, the Auto-Delete function will not delete them, and you will be unable to save new images.

To avoid this situation, regularly back up the patient folders which are still needed to external storage media or to a DICOM server. You can then manually delete those patient folders or unprotect them and allow the Auto-Delete function to free up space on your hard disk.

10.3.5.4 Deleting images

You can delete either all marked images, or all unmarked images, or only the image where the cursor is.

To delete one or more images from a patient folder, do the following:

1. Mark the images you want to delete and press the **Delete marked items** button.

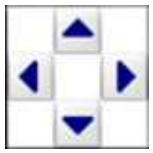
   ⇨ A confirmation prompt is displayed.

   or

2. Mark the images you want to keep and press the **Delete unmarked items** button.

   ⇨ A confirmation prompt is displayed.

   or



3. Select the individual image you want to delete using the arrow buttons.

NOTE

Deleted images are irretrievably lost.

Back up the images you want to keep before deleting them, or make sure that they are really no longer needed (→ *Chapter 10.3.1.4 "Saving patient folders or images" on page 163*).

4. Press the **Delete** button.

   ⇨ A confirmation prompt is displayed.

5. Confirm by pressing the **Yes** button.

   ⇨ The image is deleted from the patient folder.

   If there are any protected images among the ones you have selected, they will not be deleted.

10.3.5.5 Printing on video printer

You can mark one or more images in a patient folder and print them all in one go. Besides, you can print the image displayed on the live screen.

CAUTION

Risk of injury by cutting device!

You can hurt yourself when touching the cutting device.

Do not touch the cutting device when adding or removing paper.

Please refer to the *Operating Instructions* of the corresponding printer model.

NOTICE

NOTICE

On video printers with cutting function (characterized by **CUT** button) use the **CUT** button for cutting off the printer medium (paper or transparency film) in order to avoid damaging the video printer.

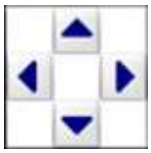
On video printers without cutting function you must always tear off the printer medium (paper).

Please refer to the **Operating Instructions** of the corresponding printer model.

NOTE

The **PRINT** key at the video printer is not functional. If you wish to initiate a print job, always press the corresponding button on the control panel.

To print images on the video printer, do the following:



1. Select the image you want to print.

   or

2. Mark the image or the images you want to print.

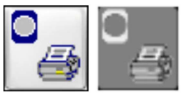
3. Press the **Print** button.

   ⇨ The marked cine loops are printed on the integrated video printer. A progress indicator in a message window on the control panel informs you about the status of the print operation.

   The **Cancel** button appears, enabling you to interrupt the print operation.

   Once they have been printed, the images become unmarked.

To print the live screen image on the video printer, do the following:



Press the **Print Live Screen Image** button.

⇨ The image displayed on the live screen is printed.

The text information that is displayed on the live screen together with the image (name of the patient, angle of rotation of the image, etc.) will appear as a text block on a gray background at the left margin of the printout.

If you have performed measurements in an image and saved them subsequently, the measured values are printed on a second page.

Further information For further information, refer to the video printer's separate operating instructions provided with this system.

10.3.5.6 Saving images

Storage formats Depending on your chosen system configuration, you can save images from one or more patient folders in various storage formats to different storage media.

Some formats with reduced resolution and color depth are also available.

The desired storage format is defined in the **Configuration** operating mode under **Storage media** (→ *Chapter 19.5 "Storage media" on page 316*).

Formats	File type	Resolution	Color depth	File size/ image
16 bit TIF	∗.tif	1024 × 1024	16 Bit	2 MB
DICOM	-	1024 × 1024	16 Bit	2 MB
Multimedia (cine loop)	∗.avi	512 × 512	8 Bit	depends on the length of the cine loop
DICOM	-	512 × 512	8 Bit	256 kB
JPEG	∗.jpg	512 × 512	8 Bit	256 kB

Table 17: Formats for storage media CD/DVD and USB

NOTE
Saving image data with a resolution of 512 × 512 pixels may lead to information loss. If possible, save image data with a resolution of 1024 × 1024 pixels.

DICOM Viewer

Whenever you save images in standard DICOM format or 'reduced' DICOM format (with a resolution of 512 × 512 pixels and 8 bit color depth) to an external storage medium, a **DICOM Viewer** program is automatically saved to the storage medium as well. This program enables you to view the DICOM images on any PC with **Microsoft® Windows®** operating system (version **Microsoft® Windows® 98** or higher).

When residing on a CD or DVD, the **DICOM Viewer** starts automatically. When residing on a USB storage medium, the program must be launched manually.

Saving to USB storage medium

To save images to a USB storage medium, do the following:

NOTE
Only connect USB storage media with the USB port.

1. Position the cursor on the desired image, or mark the images you want to save.
2. Plug a USB storage medium into the USB port.

3. Press the **USB** button.

   ⇨ The marked images are saved to the USB stick. A progress indicator in a message window on the control panel informs you about the status of the save operation. The **Cancel** button appears, enabling you to interrupt the save operation.

   Once they have been saved, the images become unmarked.

Writing to CD/DVD

With the DVD writer, data can be written to both CDs and DVDs. The selected images are copied to a compilation file on the hard disk first.

To write one or more images to CD/DVD, do the following:

1. Mark the desired image(s).
2. Insert an empty CD or DVD into the DVD writer.

3. Press the **CD/DVD** button.

   ⇨ The following messages are displayed:

   Checking CD/DVD …

   Copying image xyz to CD/DVD mirror …

   Once they have been included in the compilation file, the images become unmarked.

   Writing CD/DVD. Estimated time x minutes.

   A progress indicator informs you about the status of the write operation.

   Once the write operation has been completed successfully, the following message is displayed:

   Writing of CD/DVD completed successfully

4. Press the **OK** button.

10.3.5.7 Dose protocol details

The dose protocol shows the radiation dose of the active patient. Depending on the applicable radiation mode it is assigned to the categories **Fluoroscopy Mode**, **Magnification** and **Pulsing** (pulsed/continuous radiation).

The line **Totals** summarizes the radiation dose for the patient at the time the dose protocol was created.

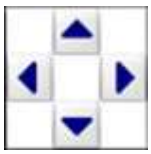
Fig. 76: Dose protocol display (inverted)

10.3.6 Comparing saved images

You may display saved images either from one patient folder or from several different patient folders at full size on the live and reference screen and compare them to each other.

To compare two images from the same patient folder, do the following:

1. Activate the **Archive** operating mode.
2. Select the desired patient folder.



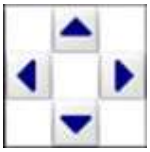
3. Select the desired image on the reference screen using the arrow buttons.
4. Press the **OK** button.

⇨ The image is displayed at full size on the live screen.

5. Using the arrow buttons, select the second desired image and press the **Full-Screen Image** button.
   ⇨ The second image is displayed at full size on the reference screen. The **Mosaic** button appears, enabling you to restore the mosaic view.
   You may compare the two images now.

To compare two images from different patient folders, do the following:

1. Activate the **Archive** operating mode.
2. Select the desired patient folder.



3. Select the desired image on the reference screen using the arrow buttons.

4. Press the **OK** button.
   ⇨ The image is displayed at full size on the live screen.

5. Press the **Back** button.
6. Select the desired patient folder.

7. Using the arrow buttons, select the second desired image and press the **Full-Screen Image** button.
   ⇨ The second image is displayed at full size on the reference screen. The **Mosaic** button appears, enabling you to restore the mosaic view.
   You may compare the two images now.

10.3.7 Delete selection

If images or patient folders are marked and the following action, such as saving to an USB stick, is not executed, the selections are not deleted.

Ton ensure, that only currently selected images or patient folders are marked, you can delete existing selections.

The **Delete Selections** button is displayed only, if one or more images or patient folders are marked.

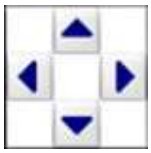
To delete existing selections of patient folders, do the following:

1. Press the **Archive** tab.
   ⇨ The **Archive** operating mode is activated.

2. Press the **Delete Selections** button.
   ⇨ The selections of patient folders are deleted.
   The **Delete Selections** button is hidden.

To delete existing selections of images, do the following:

1. Press the **Archive** tab.
   ⇨ The **Archive** operating mode is activated.



2. Select the desired patient folder using the arrow keys.

3. Press the **OK** button.
   ⇨ The corresponding controls appear in the dynamic control area.

4. Press the **OK** button.
   ⇨ The patient folder is now active.

5. Press the **Delete Selections** button.
   ⇨ The selections of images are deleted.
   The **Delete Selections** button is hidden.

10.3.8 Making backup copies of patient folders

You can back up the patient folders stored on the hard disk to a USB storage medium or a CD/DVD. To select the patient folders you want to back up, you can use different search criteria (**Last name**, **Patient ID**, **Subject**) and/or the image creation date. You can combine all these search criteria and also the image creation date (if desired) using an AND operation. Thus, you could e.g. search for and back up all patients called *Miller* with the subject *Knee*.

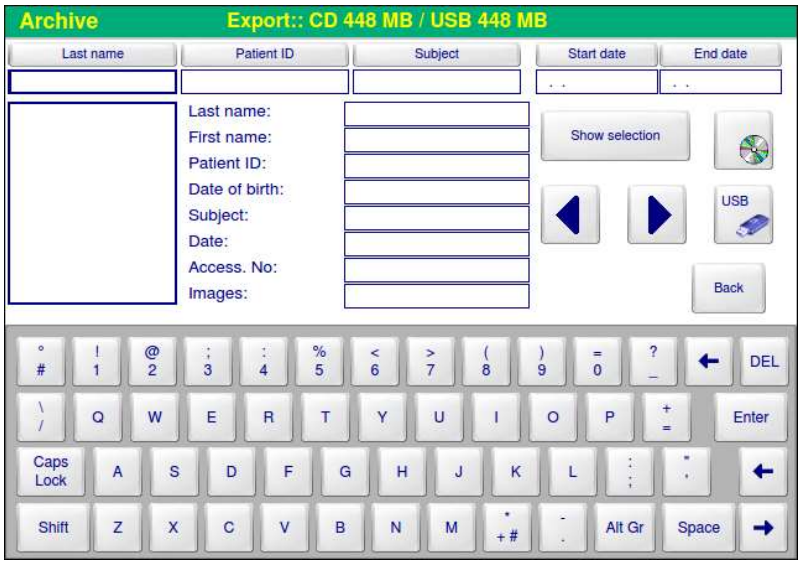


Fig. 77: **Archive – Backup** operating mode

Selecting patient folders

You can back up only entire patient folders with all images contained in them. To determine which folders are to be backed up, you use the image creation date and certain search criteria:

- **Selection using the image creation date**
  When you enter e.g. a period between 01-01-YYYY and 01-31-YYYY, all patient folders containing images that were created between January 1, YYYY and January 31, YYYY are backed up. These folders are backed up in their entirety, including the images that were not generated within the specified period of time.
- **Selection using search criteria**
  You can specify the patient folders you want to back up by entering the patient name (**Last name**), patient number (**Patient ID**) and/or a **Subject** as search criteria.

All search criteria as well as the time period are automatically combined by an AND operation.

In addition, you can back up all patient folders to the chosen storage medium.

10.3.8.1 Backup to USB storage medium

Storage capacity

To be able to back up images on a USB storage medium, the latter must be empty.

During backup, the system checks automatically whether the remaining disk space is sufficient for the next folder to be backed up. If the folder is too large to fit on the connected USB storage medium, you will be prompted to plug another USB storage medium into the USB port.

NOTE
Only connect USB storage media with the USB port.

Restoring backed-up data

You can restore the data which has been backed up to a USB storage medium to the system's hard disk at any time. If the backup copy has been distributed to several USB storage media, you must plug them into the USB port in the same order as during the backup procedure for restoring the data.

To back up selected patient folders to a USB storage medium, do the following:

1. Press the **Archive** tab.
   ⇨ The **Archive** operating mode is activated.

2. Press the **Backup** button.
   ⇨ The corresponding controls appear in the dynamic control area. The **Start date** input box contains by default the date 01.01.1970. The **End date** input box contains by default the current date.
3. Plug a USB storage medium into the USB port.
   ⇨ Now you can enter the desired search string(s).

4. Press the **Last name** button and enter a search string in the related input box.

NOTE
The search function is not case-sensitive.

   ⇨ With each letter you enter, the alphabetical hit list is more and more confined to match the search string.

   The **All** button appears, allowing you to redisplay the entire list.

5. If desired, press the **Patient ID** button and enter a patient number in the related input box.

6. If desired, press the **Subject** button and enter a search string in the related input box.

7. To further confine the image creation period, press the **Start date** button and enter another date in the related input box.

8. To further confine the image creation period, press the **End date** button and enter another date in the related input box.

⇨ Press the **Show selection** button.

9. Press the **USB** button.

⇨ All patient folders shown on the list are backed up to the USB storage medium. A progress indicator in a message window informs you about the status of the backup operation.

If there is not enough disk space left on the connected USB storage medium, the following message appears:

Please insert new USB stick.

10. Plug another USB storage medium into the USB port. Make sure to label the USB storage media so that you can later identify the order in which they were used.

NOTE
Only connect USB storage media with the USB port.

To back up all patient folders to a USB storage medium, do the following:

1. Press the **Archive** tab.

⇨ The **Archive** operating mode is activated.

2. Press the **Backup** button.

⇨ The corresponding controls appear in the dynamic control area.

The **Start date** input box contains by default the date 01.01.1970. The **End date** input box contains by default the current date. This period covers all possible image creation dates.

3. Plug a USB storage medium into the USB port.

4. Press the **USB** button.

   ⇨ All patient folders are backed up to the USB storage medium. A progress indicator in a message window informs you about the status of the backup operation.

   If there is not enough disk space left on the connected USB storage medium, the following message appears:

   Please insert new USB stick.

5. Plug another USB storage medium into the USB port. Make sure to label the USB storage media so that you can later identify the order in which they were used.

NOTE
Only connect USB storage media with the USB port.

To restore backed-up data from a USB storage medium to the hard disk, do the following:

1. Press the **Archive** tab.

   ⇨ The **Archive** operating mode is activated.

2. Plug the USB storage medium that contains the first part of the backup copy into the USB port.

3. Press the **Restore from USB Stick** button.

   ⇨ All patient folders and images that have been backed up to the USB storage medium before are restored and saved to the system's hard disk. All restored patient folders are recreated on the hard disk, in addition to the already existing ones.

4. Plug all further USB storage media used for the backup into the USB port (if applicable). Make sure to keep to the same order as during the backup procedure.

NOTE
Only connect USB storage media with the USB port.

10.3.8.2 Backup copy to CD/DVD

CD writer or DVD writer

With the DVD writer, data can be written to or retrieved from both CDs and DVDs.

Storage capacity

The contents of a patient folder cannot be distributed to several CDs or DVDs.

During backup, the system checks automatically whether the remaining disk space is sufficient for the next folder to be backed up. If the folder is too large to fit on the inserted CD/DVD, you will be prompted by a message to insert another CD/DVD into the drive.

Restoring backed-up data

You can restore the data which has been backed up to CD/DVD to the system's hard disk at any time. If the backup copy has been distributed to several CDs or DVDs, you must insert the CDs or DVDs in the same order as during the backup procedure for restoring the data.

To back up selected patient folders to CD/DVD, do the following:

1. Press the **Archive** tab.
   ⇨ The **Archive** operating mode is activated.

2. Press the **Backup** button.
   ⇨ The corresponding controls appear in the dynamic control area. The **Start date** input box contains by default the date 01.01.1970. The **End date** input box contains by default the current date.
3. Insert an empty CD or DVD into the DVD writer.
   ⇨ Now you can enter the desired search string(s).

4. Press the **Last name** button and enter a search string in the related input box.

NOTE
The search function is not case-sensitive.

   ⇨ With each letter you enter, the alphabetical hit list is more and more confined to match the search string.
   The **All** button appears, allowing you to redisplay the entire list.

5. If desired, press the **Patient ID** button and enter a patient number in the related input box.

6. If desired, press the **Subject** button and enter a search string in the related input box.

7. To further confine the image creation period, press the **Start date** button and enter another date in the related input box.

8. To further confine the image creation period, press the **End date** button and enter another date in the related input box.

⇨ Press the **Show selection** button.

9. Press the **CD/DVD** button.

⇨ The following messages are displayed:

Checking CD/DVD …

Copying image xyz to CD/DVD mirror …

Writing CD/DVD. Estimated time x minutes.

All patient folders shown on the list are backed up to the CD/DVD. A progress indicator in a message window informs you about the status of the backup operation.

If there is not enough space left on the inserted CD/DVD, the following message appears:

Please insert new CD/DVD.

10. Insert another CD or DVD. Make sure to label the CDs or DVDs so that you can later identify the order in which they were used.

⇨ Once the write operation has been completed successfully, the following message is displayed:

Writing of CD/DVD completed successfully

11. Press the **OK** button.

To back up all patient folders to CD/DVD, do the following:

1. Press the **Archive** tab.

⇨ The **Archive** operating mode is activated.

2. Press the **Backup** button.

⇨ The corresponding controls appear in the dynamic control area. The **Start date** input box contains by default the date 01.01.1970. The **End date** input box contains by default the current date. This period covers all possible image creation dates.

3. Insert an empty CD or DVD into the DVD writer.

4. Press the **CD/DVD** button.

   ⇨ The following messages are displayed:

   Checking CD/DVD …

   Copying image xyz to CD/DVD mirror …

   Writing CD/DVD. Estimated time x minutes.

   All patient folders will be backed up to the CD/DVD. A progress indicator in a message window informs you about the status of the backup operation.

   If there is not enough disk space left on the inserted CD/DVD, you will be prompted to insert another CD/DVD into the drive:

   Please insert new CD/DVD.

5. Insert another CD or DVD. Make sure to label the CDs or DVDs so that you can later identify the order in which they were used.

   ⇨ Once the write operation has been completed successfully, the following message is displayed:

   Writing of CD/DVD completed successfully

6. Press the **OK** button.

To restore backed-up data from a CD/DVD to the hard disk, do the following:

1. Press the **Archive** tab.

   ⇨ The **Archive** operating mode is activated.

2. Insert the CD or DVD that contains the first part of the backup copy into the DVD drive.

3. Press the **Restore from CD/DVD** button.

   ⇨ All patient folders and images which have been backed up to the CD/DVD before are restored and saved to the system's hard disk. All restored patient folders are recreated on the hard disk, in addition to the already existing ones.

4. Insert all further CDs or DVDs used for the backup into the corresponding drive (if applicable). Make sure to keep to the same order as during the backup procedure.

11 DICOM Functions

11.1 Requirements

Depending on the DICOM classes integrated in the system, you can use certain DICOM functions. The system must be connected to a DICOM network via cable or WLAN for that purpose.

Functions

Depending on the system configuration, you can use the following DICOM functions:

- Downloading patient data from a DICOM server: Query or Worklist
- Saving all images from one or several patient folders
- Saving and printing images and cine loops from a patient folder
- Saving or printing single cine loop images
- Importing images and cine loops from a DICOM server
- Processing scheduled procedure steps of a Worklist (MPPS)
- Checking whether images are stored on the DICOM server (Storage Commitment)
- Transferring dose report to DICOM server

  You can automatically transfer the dose report and/or the DICOM Structured Report to a DICOM server. The transfer starts as soon as you create a new patient folder.

  Please contact your in-house service engineer if you wish to enable this function.

Safety measures

To operate the system within a hospital network, you must comply with the following safety measures:

- Network connection is only required for data exchange with servers, printers or navigation systems within a hospital network.
- Within the hospital network, limit system operation to the minimum extent that your requirements allow.
- The only way to avoid obstructions to the operational procedure resulting from the hospital network is, to disconnect system and navigation systems from the hospital network.
- If you have connected the system with the hospital network deliberately, e. g. for data exchange with DICOM servers, after completion conduct the following safety measures:
  - Disconnect the system from the hospital network.
  - If required, deactivate WLAN by disconnecting the cable for the WLAN module from the network connection socket.
  - Prior to the next operation, switch the system on and off again.

  Conducting these safety measures, you can avoid obstructions to the operational procedure resulting from the hospital network.
- For data exchange with DICOM servers, comply with current requirements for integrity and patient data protection.
- The system is protected against unauthorized external intrusion by means of software.

- Regularly comply with the following instructions:
  - Current safety instructions of the Ziehm Imaging GmbH (*see corresponding Technical Manual, System and Data Security*)
  - Keep up system maintenance, especially safety devices, by qualified service engineers only
- Protect the system against unauthorized external intrusion.
- Limit system operation to trustworthy personnel, especially trained in safety issues.

NOTE
To change your IT network, contact your authorized service engineer to adapt your system according to the requirements of the corresponding Service Manuals.

11.2 Downloading patient data from a DICOM server

When creating a new patient folder, you can download the patient data from the DICOM server (using **Query** or **Worklist**).

Requirements

The following prerequisites must be given:

- The system must be connected to a DICOM server.
- The respective patient data must be stored on the DICOM server already.
- You must know the patient ID of the respective patient.

11.2.1 Query

The **Query** DICOM function enables you to download a patient's data (e.g. first name, last name) from the DICOM server.

NOTE
If you use the patient ID to search for a patient folder, please verify the search result by checking the patient name. It may happen occasionally that a patient ID is assigned more than once on a DICOM network.

To download patient data from a DICOM server, do the following:

1. Press the **Patient** tab.
   ⇨ The **Patient** operating mode is activated.

NOTE
You may predefine default data for the **Hospital, Department** and **Physician** input boxes. The respective data is entered in the **Configuration** operating mode under **Basic settings**.

2. Press the **New** button.
   ⇨ The input boxes are cleared (if any data has been displayed before in them), with the exception of those with default data.

3. Press the **Patient ID** button and enter the patient ID of the patient you are looking for.
   ⇨ The patient ID is displayed in the Patient ID box.

4. Press the **Query** button.
   ⇨ The patient data record is downloaded from the DICOM server and appears automatically in the input boxes.
5. If necessary, complete any missing data.

6. Save the new patient folder and the downloaded data by pressing the **Save** button.
   ⇨ The new patient folder is automatically activated. A blank fluoroscopy mask with the downloaded patient data appears on the live screen.

11.2.2 Retrieving a Worklist

Contents of the Worklist

You can download a specific Worklist from the DICOM server. The Worklist contains the patient data as well as the examinations which are scheduled for the patient.

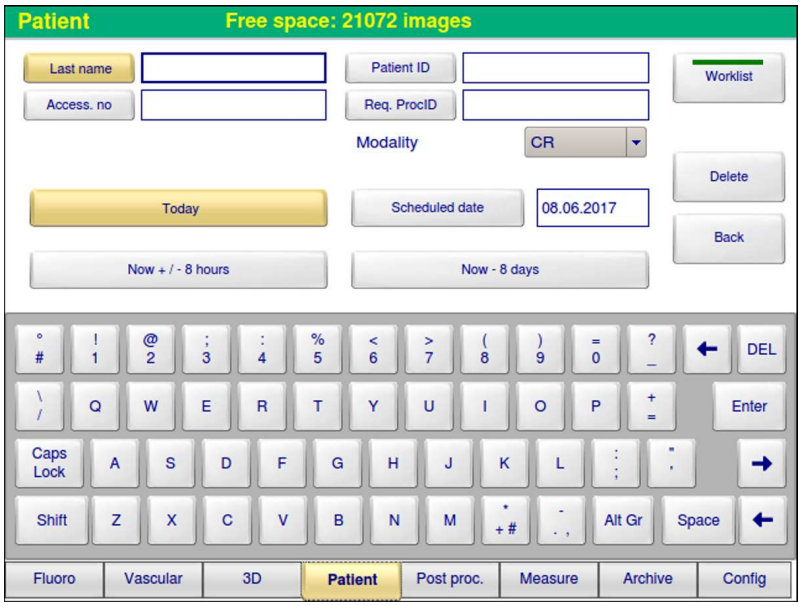


Fig. 78: Downloading patient data

Time span of the Worklist

You can use a filter to determine the time span that is covered by the Worklist. The following filter criteria are available for that purpose:

- Default setting: **Today** (0:00 – 24:00 o'clock)
- **Now +/– 8 hours**
- **Scheduled date**: DD.MM.YYYY
- **Now - 8 days**

Filters for Worklist download

Besides you can limit the contents of the Worklist to be downloaded using the following criteria:

- Patient name (Last name)
- Patient ID (Patient ID)
- Hospital-specific internal administrative number (Access. no)
- Specific procedure step (Req. Proc. ID)
- Object class of patient data (Modality)

The abbreviations displayed under **Modality** have the following meaning:

Abbreviation	Meaning
CR	Computed Radiography
CT	Computed Tomography
CT_E	Computed Tomography Enhanced
DX	Digital Radiography

Abbreviation	Meaning
ES	Endoscopy
OT	Other
PX	Programme X-ray
RF	Radio Fluoroscopy
RG	Radiographic Imaging
RT	Radiotherapy
SC	Secondary Capture
XA	X-ray Angiography

Sorting by columns

To sort items in the Worklist, do the following:

You can sort the items in the **Last name**, **First Name**, **Patient ID**, **Date** and **Time** columns in ascending or descending order. You can use the column headers (which are designed as buttons) for sorting the items.

1. Press e.g. the **Last name** button.
   ⇨ The arrow on the button points downwards. The name items are sorted alphabetically in ascending order.

2. Press e.g. the **Last name** button once again.
   ⇨ The arrow on the button points upwards. The name items are sorted alphabetically in descending order.

Opening the Worklist offline

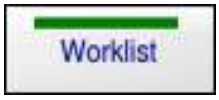
Once you have downloaded a Worklist on a certain day, you can open it as often as you like, even if the system is no longer connected to the DICOM server. In this case, the word **OFFLINE** appears in the Worklist on the screen.

When you try to open a Worklist in offline mode although no Worklist has been downloaded on that day from the DICOM server yet, the message **No connection to server** appears, and no Worklist is displayed.

11.2.2.1 Downloading a Worklist for a specific time span

To download a Worklist that covers a specific time span from a DICOM server, do the following:

1. Press the **Patient** tab.
   ⇨ The **Patient** operating mode is activated.



2. Press the **Worklist** button.

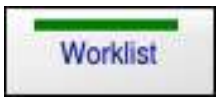
   ⇨ The filter criteria for limiting the contents of the Worklist to be downloaded are displayed.

3. Select the time span to be covered by the Worklist.

   ⇨ If you want to confine the worklist data for a special patient (Last name or Patient ID), a certain examination (Accession Number or Performed Procedure Step ID), then enter the data in the corresponding input boxes.

4. If there is any data displayed in the **Last name, Patient ID** and/or **Access. no** boxes, you can delete them.

   ⇨ The **Last name, Patient ID** and/or **Access. no** boxes are cleared.



5. Press the **Worklist** button.

   ⇨ The data of all patients who are scheduled for the specified time span is downloaded from the DICOM server. A list of all downloaded data appears on the control panel.

Worklist item

To select an item from the Worklist, do the following:

1. Select the desired item on the list using the arrow buttons.

2. Press the **OK** button.

   ⇨ The downloaded patient data appears in the input boxes of the **Patient** operating mode. The new patient folder is automatically activated. A blank fluoroscopy mask with the downloaded patient data appears on the live screen.

Overwrite function

To overwrite an active patient folder with data from a Worklist item, do the following:

You can overwrite the data in an active patient folder with data from the Worklist (e.g. in emergency cases, in order to correct or complete the emergency patient's data at a later moment).

CAUTION

CAUTION

When you overwrite a patient folder with the personal data from the Worklist, the original personal data of the patient folder is irretrievably lost and cannot be restored.

Only overwrite the personal data of the patient folder with the personal data of the Worklist, if the patient folder contains the images of the patient concerned!

1. Use the arrow buttons to select the list item with which you want to overwrite the active patient folder.

2. Press the **Overwrite** button.
   ⇨ The active patient folder is updated.

11.2.2.2 Downloading a patient-specific Worklist

NOTE

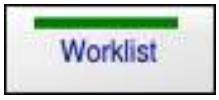
If you use the patient ID to search for a patient folder, please verify the search result by checking the patient name. It may happen occasionally that a patient ID is assigned more than once on a DICOM network.

To download a patient-specific Worklist from a DICOM server, do the following:

1. Press the **Patient** tab.
   ⇨ The **Patient** operating mode is activated.

2. Press the **Worklist** button.
   ⇨ The filter criteria for limiting the contents of the Worklist to be downloaded are displayed.
3. To limit the time span covered by the Worklist to be downloaded, select the desired time span.

4. If you want to confine the worklist data for a special patient (Last name or Patient ID), a certain examination (Accession Number or Performed Procedure Step ID), then enter the data in the corresponding input boxes.



5. Press the **Worklist** button.

   ⇨ The data of the selected patient is downloaded from the DICOM server. A list with all patient-specific data downloaded appears on the control panel. If you have specified a name or the first letter(s) of a name as filter criterion, all matching items are listed.

Worklist item

To select an item from the Worklist, do the following:

1. Select the desired item on the list using the arrow buttons.

2. Press the **OK** button.

   ⇨ The downloaded patient data appears in the input boxes of the **Patient** operating mode. The new patient folder is automatically activated. A blank fluoroscopy mask with the downloaded patient data appears on the live screen.

Overwrite function

To overwrite an active patient folder with data from a Worklist item, do the following:

You can overwrite the data in an active patient folder with data from the Worklist (e.g. in emergency cases, in order to correct or complete the emergency patient's data at a later moment).

CAUTION

When you overwrite a patient folder with the personal data from the Worklist, the original personal data of the patient folder is irretrievably lost and cannot be restored.

Only overwrite the personal data of the patient folder with the personal data of the Worklist, if the patient folder contains the images of the patient concerned!

1. Use the arrow buttons to select the list item with which you want to overwrite the active patient folder.

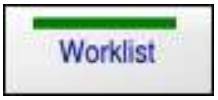
2. Press the **Overwrite** button.

   ⇨ The active patient folder is updated.

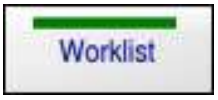
11.2.2.3 Downloading a Worklist for a procedure step

To download a Worklist that refers to a specific procedure step from a DICOM server, do the following:

1. Press the **Patient** tab.
   ⇨ The **Patient** operating mode is activated.



2. Press the **Worklist** button.
   ⇨ The filter criteria for limiting the contents of the Worklist to be downloaded are displayed.
3. If you want to confine the worklist data for a special patient (Last name or Patient ID), a certain examination (Accession Number or Performed Procedure Step ID), then enter the data in the corresponding input boxes.



4. Press the **Worklist** button.
   ⇨ The data of the specified procedure step is downloaded from the DICOM server. The cursor is automatically positioned on the list item.

Worklist item

To select an item from the Worklist, do the following:

1. Select the desired item on the list using the arrow buttons.

2. Press the **OK** button.
   ⇨ The downloaded patient data appears in the input boxes of the **Patient** operating mode. The new patient folder is automatically activated. A blank fluoroscopy mask with the downloaded patient data appears on the live screen.

Overwrite function

To overwrite an active patient folder with data from a Worklist item, do the following:

You can overwrite the data in an active patient folder with data from the Worklist (e.g. in emergency cases, in order to correct or complete the emergency patient's data at a later moment).

CAUTION

CAUTION

When you overwrite a patient folder with the personal data from the Worklist, the original personal data of the patient folder is irretrievably lost and cannot be restored.

Only overwrite the personal data of the patient folder with the personal data of the Worklist, if the patient folder contains the images of the patient concerned!

1. Use the arrow buttons to select the list item with which you want to overwrite the active patient folder.

2. Press the **Overwrite** button.
   ⇨ The active patient folder is updated.

11.3 Processing scheduled procedure steps of a Worklist (MPPS)

Function

The DICOM function **MPPS** (Modality Performed Procedure Step) allows you to open a procedure step (job) scheduled in a Worklist, process it and then report it as being completed to the MPPS server. The corresponding function must be enabled in the DICOM settings for that purpose.

Please contact your in-house service engineer if you wish to enable the **MPPS** function.

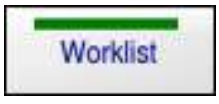
NOTE

You can use the **MPPS** function also when you create a patient folder manually. In this case, a procedure step is automatically generated and started when you save the patient data, provided that the **MPPS** function is enabled.

To process a procedure step scheduled in a Worklist, do the following:

1. Make sure that the **MPPS** function is enabled.

2. Press the **Patient** tab.
   ⇨ The **Patient** operating mode is activated.

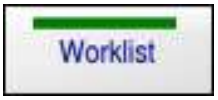


3. Press the **Worklist** button.
   ⇨ The filter criteria for limiting the contents of the Worklist to be downloaded are displayed.
4. If you want to confine the worklist data for a special patient (Last name or Patient ID), a certain examination (Accession Number or Performed Procedure Step ID), then enter the data in the corresponding input boxes.

5. Select the time span to be covered by the Worklist.

6. If there is any data displayed in the **Last name, Patient ID** and/or **Access. no**, press the **Delete** button.

   ⇨ The **Last name, Patient ID** and/or **Access. no** boxes are cleared.



7. Press the **Worklist** button.

   ⇨ The data of all patients who are scheduled for the specified time span is downloaded from the DICOM server. A list of all downloaded data appears on the control panel.

Worklist item

To select an item from the Worklist, do the following:

1. Select the desired item on the list using the arrow buttons.

2. Press the **OK** button.

   ⇨ The downloaded patient data appears in the input boxes of the **Patient** operating mode. The new patient folder is automatically activated. A blank fluoroscopy mask with the downloaded patient data appears on the live screen.

Overwrite function

To overwrite an active patient folder with data from a Worklist item, do the following:

You can overwrite the data in an active patient folder with data from the Worklist (e.g. in emergency cases, in order to correct or complete the emergency patient's data at a later moment).

CAUTION

When you overwrite a patient folder with the personal data from the Worklist, the original personal data of the patient folder is irretrievably lost and cannot be restored.

Only overwrite the personal data of the patient folder with the personal data of the Worklist, if the patient folder contains the images of the patient concerned!

1. Use the arrow buttons to select the list item with which you want to overwrite the active patient folder.

2. Press the **Overwrite** button.

   ⇨ The active patient folder is updated.

The MPPS server is notified that the selected procedure step has been started. The message **IN PROGRESS** appears in the **MPPS** box.

If an error message is displayed, please contact your in-house service engineer.

To transfer images to a DICOM server, do the following:

1. Perform the required examination, generating and saving as many fluoroscopic images as you like.

2. Mark the images you want to save.

NOTE
The message and the image list can be sent only once to the MPPS server. Therefore make sure that you have marked all relevant images.

3. Press the **DICOM Store** button.

   ⇨ The marked images or cine loops are transferred to the DICOM server and saved there.

   The procedure step is reported as being completed to the MPPS server:

   A list of the images that have been transferred to the DICOM server is sent to the MPPS server. The message **COMPLETED** appears in the **MPPS** box.

To cancel the procedure step, do the following:

Press the **MPPS Discontinue** button.

⇨ The procedure step is canceled: The message **INCOMPLETED** appears in the **MPPS** box.

11.4 Saving all images from one or several patient folders

DICOM Store

If the system is connected to a DICOM network, you can save images from one or more patient folders to a DICOM server.

Saving options

When transferring images to a DICOM server, you can choose between the following saving options:

- Save images without text information and attributes (such as rotation, reversal, etc.).
- Save images with their attributes.
- Save images with their text information and their attributes.

Resolution and color depth

You can save the images in the following formats:

Resolution	Color depth
1024 × 1024	16/8 bit
512 × 512	8 Bit

Table 18: Image resolution and color depth

One of these three formats is always preset as default. Please contact your in-house service engineer if you need one of the other two formats.

Transferring images

If you send only images to the DICOM server which are not stored there already, all images are actually transferred and saved. Images that are already stored on the DICOM server are not saved there again. Images which have been downloaded from the DICOM server with the **Retrieve** function are never retransferred to the DICOM server.

To save all images from one or several patient folders to a DICOM server, do the following:

1. Press the **Archive** tab.
   ⇨ The **Archive** operating mode is activated.

2. Position the cursor on the desired patient folder, or mark the desired patient folders.

3. Press the **DICOM Store** button.
   ⇨ The images of the marked patient folder(s) are transferred to the DICOM server and saved there.

   A progress indicator in a message window on the control panel informs you about the status of the save operation. The **Cancel** button appears, enabling you to interrupt the save operation.

   Images that have been successfully transferred are flagged with a **D**. Once all images have been transferred, the patient folders become unmarked.

Editing patient data

You can edit the patient data of images that have already been stored on the DICOM server at any moment. Once you have edited the patient data, the **D** flag is removed from the images. You may retransfer them to the DICOM server with the new patient data afterwards.

Modifying archived images

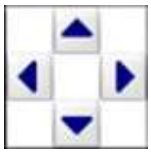
You can modify the attributes of images that have already been stored on the DICOM server at any moment. Once you have modified the attributes, the **D** flag is removed from the images. You may retransfer them to the DICOM server with the new attributes afterwards.

11.5 Saving and printing images and cine loops from a patient folder

Once you have displayed or activated a patient folder, you can save the images and cine loops which are stored there to a connected DICOM server and/or print them on a connected DICOM network printer.

To print images or cine loops from a patient folder on a DICOM network printer, do the following:

1. Press the **Archive** tab.
   ⇨ The **Archive** operating mode is activated.
2. Display the desired patient folder.
   or
3. Activate the desired patient folder.



4. Position the cursor on the desired image or cine loop.
   or

5. Mark the images or cine loops you want to print.

6. Press the **DICOM Print** button.
   ⇨ The marked images or cine loops are printed on the DICOM network printer.

   A progress indicator in a message window on the control panel informs you about the status of the printing operation. The **Cancel** button appears, enabling you to interrupt the print operation.

   Once they have been printed, the images or cine loops become unmarked.

Transferring images

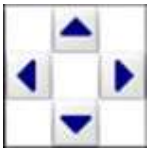
If you send only images to the DICOM server which are not stored there already, all images are actually transferred and saved. Images that are already stored on the DICOM server are not saved there again. Images which have been downloaded from the DICOM server with the **Retrieve** function are never retransferred to the DICOM server.

NOTE
Never modify any patient data in a patient folder after having transferred images from this patient folder to the DICOM server!

To save images or cine loops to a DICOM server, do the following:

1. Press the **Archive** tab.
   ⇨ The **Archive** operating mode is activated.
2. Display the desired patient folder.

   or
3. Activate the desired patient folder.



4. Position the cursor on the desired image or cine loop.

   or

5. Mark the images or cine loops you want to save.

6. Press the **DICOM Store** button.
   ⇨ The marked images or cine loops are transferred to the DICOM server and saved there.

   A progress indicator in a message window on the control panel informs you about the status of the save operation. The **Cancel** button appears, enabling you to interrupt the save operation.

   Images that have been successfully transferred are flagged with a **D**. Once they have been saved, the images or cine loops become unmarked.

NOTE

If the cine loops to be transferred (in DICOM format) exceed the size limit, they are limited in size and are transferred only up to this size.

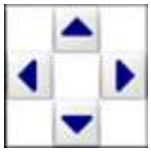
A message window with a confirmation prompt is displayed, which allows you to accept this operation or cancel saving.

11.6 Saving or printing single cine loop images

If the system is connected to a DICOM network, you can save one or several single images from an open cine loop to the DICOM server and/or print them on a DICOM network printer.

To print images from a cine loop on a DICOM network printer, do the following:

1. Press the **Archive** tab.
   ⇨ The **Archive** operating mode is activated.
2. Open the desired cine loop.
   ⇨ The individual images of the cine loop are displayed as a thumbnail image mosaic on the reference screen.



3. Position the cursor on the desired image.

   or

4. Mark the images you want to print.

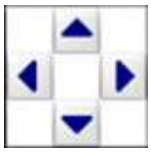
5. Press the **DICOM Print** button.
   ⇨ The marked images are printed on the DICOM network printer.

   A progress indicator in a message window on the control panel informs you about the status of the printing operation. The **Cancel** button appears, enabling you to interrupt the print operation.

   Once they have been printed, the images become unmarked.

To save cine loop images to a DICOM server, do the following:

1. Press the **Archive** tab.
   ⇨ The **Archive** operating mode is activated.
2. Open the desired cine loop.
   ⇨ The individual images of the cine loop are displayed as a thumbnail image mosaic on the reference screen.



3. Position the cursor on the desired image or cine loop.

   or

4. Mark the images or cine loops you want to save.

5. Press the **DICOM Store** button.

   ⇨ The marked images or cine loops are transferred to the DICOM server and saved there.

   A progress indicator in a message window on the control panel informs you about the status of the save operation. The **Cancel** button appears, enabling you to interrupt the save operation.

   Images that have been successfully transferred are flagged with a **D**. Once they have been saved, the images or cine loops become unmarked.

11.7 Importing images and cine loops from a DICOM server

After displaying or activating a patient folder in the **Archive** or **Patient** operating mode, you can download images and cine loops (image level query/retrieve) or entire series of images and cine loops (series level query/retrieve) from the connected DICOM server and save them to the displayed or active patient folder.

The maximum number of images in each patient folder is not limited as long as the overall storage capacity of the system is not exceeded.

To import one or more images from the DICOM server into a patient folder, do the following:

1. Press the **Archive** tab.

   ⇨ The **Archive** operating mode is activated.

   or

2. Press the **Patient** tab.

   ⇨ The **Patient** operating mode is activated.

3. Display the desired patient folder.

   or

4. Activate the desired patient folder.

5. Press the **Retrieve** or **DICOM Retrieve** button.

⇨ The **Studies, Series** and **Images** lists with the related controls appear on the control panel. The **Studies** list contains all studies which are available on the server.

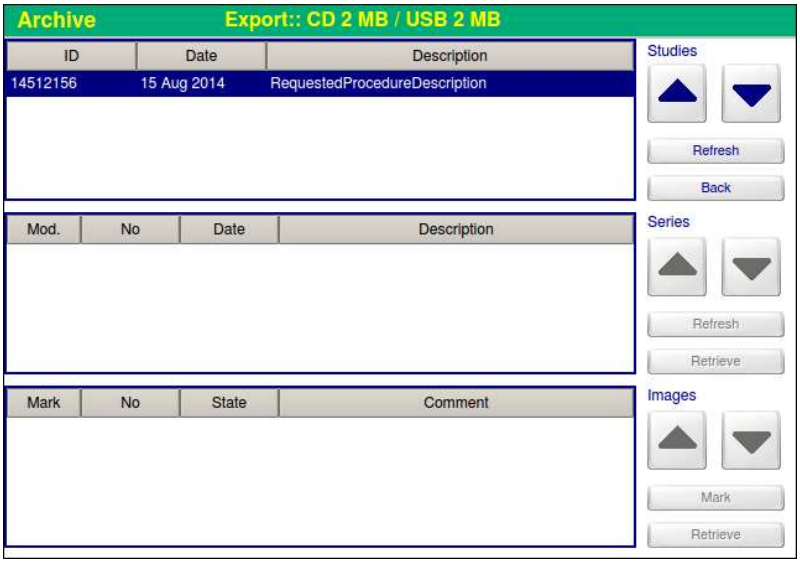


Fig. 79: **Studies**, **Series** and **Images** retrieval lists

6. Select the desired study from the **Studies** list using the arrow buttons.

7. Press the **Refresh** button next to the **Studies** list.

⇨ All series of the selected study appear in the **Series** list.

8. Using the arrow buttons, position the cursor on the desired series in the **Series** list.

9. Press the **Refresh** button next to the **Series** list.

⇨ All images of the selected series are displayed in the **Images** list.

10. Using the arrow buttons, position the cursor on the image of the **Images** list you want to import.

or

11. Mark the images you want to import in the **Images** list.

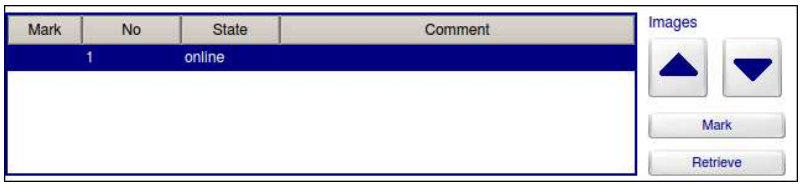


Fig. 80: Images list with marked item

12. Press the **Retrieve** button next to the **Images** list.

⇨ The marked images are downloaded from the DICOM server to the patient folder. A progress indicator in a message window on the control panel informs you about the status of the transfer operation.

Images that have been successfully downloaded are flagged with an **R**.

NOTE

Do not switch off the system during image data transfer!

The transfer time depends on the network interface card and the network load.

To import a series of images from the DICOM server into a patient folder, do the following:

1. Press the **Archive** tab.

⇨ The **Archive** operating mode is activated.

or

2. Press the **Patient** tab.

⇨ The **Patient** operating mode is activated.

3. Display the desired patient folder.

or

4. Activate the desired patient folder.

5. Press the **Retrieve** or **DICOM Retrieve** button.

⇨ The **Studies, Series** and **Images** lists with the related controls appear on the control panel. The **Studies** list contains all studies which are available on the server.

6. Select the desired study from the **Studies** list using the arrow buttons.

7. Press the **Refresh** button next to the **Studies** list.
   ⇨ All series of the selected study appear in the **Series** list.

8. Using the arrow buttons, position the cursor in the **Series** list on the series whose images you want to import.

9. Press the **Retrieve** button.
   ⇨ All images of the series are downloaded from the DICOM server to the patient folder. A progress indicator in a message window on the control panel informs you about the status of the transfer operation.

   Images that have been successfully downloaded are flagged with an **R**.

NOTE
Do not switch off the system during image data transfer!

The transfer time depends on the network interface card and the network load.

11.8 Storage formats

Formats	File type	Resolution	Color depth	File size/ image
16 bit TIF	∗.tif	1024 × 1024	16 Bit	2 MB
DICOM	-	1024 × 1024	16 Bit	2 MB
Multimedia (cine loop)	∗.avi	512 × 512	8 Bit	depends on the length of the cine loop
DICOM	-	512 × 512	8 Bit	256 kB
JPEG	∗.jpg	512 × 512	8 Bit	256 kB

Table 19: Formats for storage media CD/DVD and USB

NOTE
Saving image data with a resolution of 512 × 512 pixels may lead to information loss. If possible, save image data with a resolution of 1024 × 1024 pixels.

The desired storage format is defined in the **Configuration** operating mode under **Storage media** (→ *Chapter 19.5 “Storage media” on page 316*).

DICOM Viewer

Whenever you save images in standard DICOM format or 'reduced' DICOM format (with a resolution of 512 × 512 pixels and 8 bit color depth) to an external storage medium, a **DICOM Viewer** program is automatically saved to the storage medium as well. This program enables you to view the DICOM images on any PC with **Microsoft® Windows®** operating system (version **Microsoft® Windows® 98** or higher).

When residing on a CD or DVD, the **DICOM Viewer** starts automatically. When residing on a USB storage medium, the program must be launched manually.

11.9 Storage Commitment

Storage Commitment function

You can check whether the images that are flagged with a **D** have actually been stored on the DICOM server, e.g. before you proceed to deleting them from the hard disk of the system. The **Storage Commitment** function must be enabled in the DICOM settings for that purpose.

Please contact your in-house service engineer if you wish to enable the **Storage Commitment** function.

To check whether the images are stored on the DICOM server, do the following:

1. Make sure that the **Storage Commitment** function is enabled.

2. Press the **Archive** tab.
   ⇨ The **Archive** operating mode is activated.

3. Press the **DICOM Storage Commitment** button.
   ⇨ The system searches the hard disk for images which have already been saved to the DICOM Storage server, i.e., the ones flagged with a **D**. Then the system verifies for each one of these images whether it is actually stored on the DICOM server. A progress indicator informs you about the status of the verification process.

   All images which are present on the DICOM server are flagged with a **C** in the thumbnail mosaic.

Automatic Storage Commitment function

If the **Automatic Storage Commitment** function is enabled in the DICOM settings, the system automatically performs a **Storage Commitment** operation after each successful saving procedure.

Please contact your in-house service engineer if you wish to enable the **Automatic Storage Commitment** function.

12 Cine Loops

12.1 Overview

General

A cine loop consists of several fluoroscopic images that are acquired in sequence. It can be replayed like a movie later and also post-edited.

Applications

Cine loops are useful whenever dynamic movement needs to be visualized. Typical fields of application are:

- Orthopedics:
  You can acquire a cine loop for visualizing movements of the skeletal system.
- Vascular surgery:
  You can combine a cine loop with DSA (→ *Chapter 13.2 “Acquiring a DSA cine loop” on page 236*) to visualize a contrast medium flow.

12.2 Acquiring a cine loop

Settings

You can define the frame rate (speed) and the number of frames (length) for each cine loop you acquire. With a maximum system configuration, the following values are available:

- Frame rate:
  1, 2, 4, 8 frames per second (fps)
  (on systems with 50 Hz)
  1, 2, 5, 10 frames per second (fps)
  (on systems with 60 Hz)
  1, 2, 4, 8, 12.5, 25 frames per second (fps)
  (Ziehm Solo FD only)

You can preset the frame rate (speed) and the number of frames (length) of the cine loop in the **Config – Cine/DSA/Dose** operating mode under Cine/DSA/Dose (→ *Chapter 19.4.1 “Cine loop settings” on page 312*). You can, however, modify these settings during operation for each individual cine loop you acquire. By default unlimited acquisition length is set. Furthermore, you can preset the acquisition mode.

Saving a cine loop

The cine loop images are automatically saved during radiation. The first image of the cine loop is saved as the start image, the last one as the stop image.

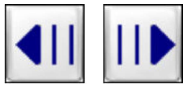
The number of images that are actually saved depends on the cine loop length you have chosen:

- If you terminate radiation before reaching the selected cine loop length, only the images generated during the time of exposure will be saved.
- If radiation is continued beyond the selected cine loop length, only the most recent images will be saved; the first images are lost.

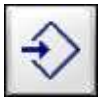
Saving single cine loop images

To save single images of a cine loop playback, do the following:

1. To stop cine loop playback, press the **Stop** button.
   ⇨ The **Play** button appears.



2. To scroll through the cine loop, press the **Forward** or **Backward** arrow button.



3. Press the **Save** button.
   ⇨ The currently display cine loop image is stored.

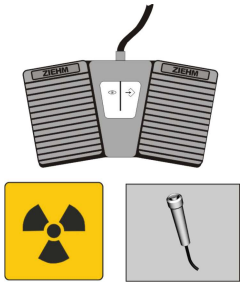
Storage capacity

To free up disk space for a cine loop, do the following:

1. Unprotect all protected images of a stored patient folder (→ *Chapter 10.3.5.3 “Protecting images” on page 174*) and then delete the patient folder from the hard disk.
2. Make a backup to a USB storage medium or a CD/DVD as soon as possible and then delete the patient folders you have backed up before from the hard disk.

To acquire a cine loop, do the following:

1. Press the **Cine** button.
   ⇨ The corresponding controls appear in the dynamic control area.
2. Select the desired frame rate under **Frames/s**.



3. Initiate radiation.

CAUTION

CAUTION

Risk of injury by X-rays!

Put on X-ray protective clothing before you initiate radiation.

   ⇨ The cine loop is acquired and automatically saved.
4. Terminate radiation.
   ⇨ The new cine loop is now automatically replayed at the preset frame rate in an endless loop on the live screen. You can playback and edit the cine loop (→ *Chapter 12.4 “Controlling and editing a cine loop during playback” on page 217*).

12.3 Opening a saved cine loop

You can reopen and replay a cine loop saved on the hard disk at any time.

To open a cine loop saved on the hard disk, do the following:

1. Press the **Archive** tab.
   ⇨ The **Archive** operating mode is activated.

2. Press the **Search** button.
   ⇨ The corresponding controls appear in the dynamic control area. An alphabetically sorted list of all patient folders is displayed.

   Now you can enter the desired search string(s).

3. Press the button of the desired input box, e.g. the **Last name** button.
   ⇨ The button is highlighted in yellow. The cursor jumps to the corresponding input box.
4. Enter the search string using the alphanumeric keypad.

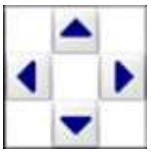
NOTE
The search function is not case-sensitive.

   ⇨ With each letter you enter, the alphabetical hit list is more and more confined to match the search string.

   The **All** button appears, allowing you to redisplay the entire list.

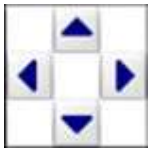
5. Press the **Back** button.
   ⇨ You are returned to the **Archive** screen. The data of all patients who match the search string(s) is displayed in the list.

   The **All** button appears, allowing you to redisplay the entire list.



6. Select the desired patient folder using the arrow buttons.

7. Press the **OK** button.
   ⇨ All images contained in this patient folder are displayed as thumbnails on the reference screen. The most recent image is highlighted by a white frame. Cine loop sequences are flagged with **C**.



8. Select the desired cine loop in the patient folder using the arrow buttons.

9. Press the **OK** button.

   ⇨ The first image of the cine loop is displayed at full size on the live screen. The cine loop number in the patient folder is shown in the image as **CINE XY**.

   The individual images of the cine loop are displayed as a thumbnail mosaic on the reference screen.

   The controls for playback and editing of the cine loop (1) as well as those for processing and outputting individual cine loop images (2) appear on the control panel:

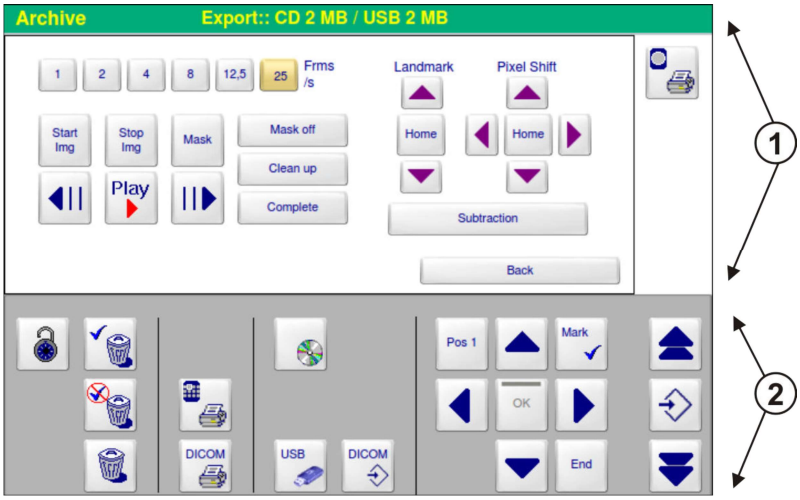


Fig. 81: **Archive** operating mode when cine loop has been stopped before

10. Press the **Play** button.

    ⇨ If configured accordingly, the cine loop is replayed in an endless loop on the live screen During playback, a moving indicator shows the position of the currently displayed image within the cine loop.

    The buttons in the dynamic control area are used to control and edit the cine loop which is replayed on the live screen (→ *Chapter 12.4 “Controlling and editing a cine loop during playback” on page 217*). When you open a DSA cine loop, additional controls are displayed in the dynamic control area. The buttons in the lower half of the control panel are used to process and output the individual images of the cine loop (→ *Chapter 12.6 “Processing and outputting single cine loop images” on page 226*).

12.4 Controlling and editing a cine loop during playback

As soon as a newly-acquired or saved cine loop is replayed on the live screen, the cine loop playback and editing controls appear in the dynamic control area.

When you replay a DSA cine loop, additional controls for the following functions appear in the dynamic control area:

- Mask image control (→ *Chapter 13.7 "Trim DSA cine loops" on page 243*)

Fig. 82: Controlling and editing a cine loop (without DSA)

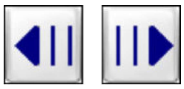
All the settings that you make in the dynamic control area always affect the cine loop which is marked by a white frame on the reference screen.

Changing the playback speed

You can control cine loop playback in the following ways:

1. To change the playback speed of the cine loop, choose another value under **Frms/s**.

2. To stop cine loop playback, press the **Stop** button.
   ⇨ The **Play** button appears.



3. To scroll through the cine loop, press the **Forward** or **Backward** arrow button.
   ⇨ The longer you press the button, the faster the cine loop images are consecutively displayed.

4. To continue cine loop playback, press the **Play** button.
   ⇨ The **Stop** button appears.

Editing options

The following options are available for editing a cine loop during playback:

- Trimming the cine loop
- Cleaning up the cine loop

To activate the editing mode for cine loops, do the following:

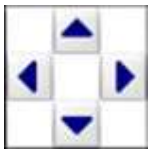
Press the **Edit** button.

Trimming the cine loop

You can trim the cine loop for playback, e.g. if the contrast medium has been injected too late, thus making the first images of the cine loop useless. This is done by defining a new start image and a new stop image for the current cine loop playback.

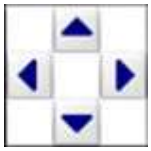
To trim the cine loop, do the following:

1. Press the **Stop** button.
   ⇨ Now you can scroll through the individual images of the cine loop with the help of the arrow buttons.



2. Select the desired start image using the arrow buttons.

3. Press the **Start Img** button.



4. Select the desired stop image using the arrow buttons.

5. Press the **Stop Img** button.
   ⇨ The cine loop sequence is trimmed.

6. Press the **Play** button.
   ⇨ The trimmed cine loop sequence is replayed in an endless loop.

7. To replay the entire original cine loop, press the **Complete** button.

Cleaning up the cine loop

You can use the **Clean up** function to delete all inadequate or useless images outside the trimmed cine loop, i.e. those before the start image and those after the stop image.

NOTE
Once you have cleaned up the cine loop, you can no longer restore the original cine loop.

To clean up a cine loop, do the following:

1. Press the **Stop** button.

2. Press the **Clean up** button.

NOTE
All unprotected images which are not enclosed between the start image and the stop image are deleted without confirmation prompt.

12.5 Processing and outputting saved cine loops

Once you have displayed or activated a patient folder, you can process the images and the cine loops that are stored there. Different read-only boxes and controls are displayed on the control panel for that purpose. In the mosaic thumbnail on the reference screen, cine loops are flagged with **C**.

In the following sections, we will describe how to process and output cine loops. For information on how to process and output individual images in a patient folder, please refer to → *"Image processing and output" on page 171*.

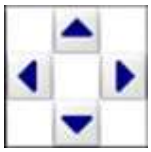
The following cine loop processing functions are available in a displayed or active patient folder:

Symbol(s)	Meaning
	**Mark:** To mark one or more cine loops
	**Protect:** To protect marked cine loops against being deleted

Symbol(s)	Meaning
	**Delete:** To delete cine loops
	**DICOM Retrieve:** Importing cine loop from a DICOM server
	**Print:** To print marked cine loops on the video printer
	**DICOM Print:** To print marked cine loops on a DICOM network printer
	**CD/DVD** To write marked cine loops to CD/DVD Apart from the selected operating mode the title bar (highlighted in green) shows the remaining space on the CD/DVD.
	**USB** To save marked cine loops to a USB storage medium Apart from the selected operating mode the title bar (highlighted in green) shows the remaining space on the USB storage medium.
	**DICOM Store:** To save marked cine loops to a DICOM server

12.5.1 Replaying a cine loop

To replay a cine loop, do the following:



1. Select the desired cine loop in the thumbnail mosaic on the reference screen using the arrow buttons.

2. Press the **OK** button.

   ⇨ The start image of the cine loop is displayed on the live screen.

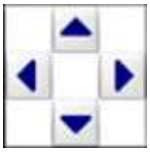
   The individual images of the cine loop are displayed as a thumbnail mosaic on the reference screen.

   The controls for playback and editing of the selected cine loop as well as those for processing and outputting individual cine loop images appear on the control panel.

3. Press the **Play** button.
   ⇨ The cine loop is replayed on the live screen.

12.5.2 Marking cine loops

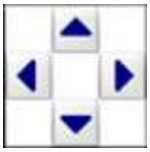
To mark one or more cine loops, do the following:



1. Select the desired cine loop on the reference screen using the arrow buttons.

2. Press the **Mark** button.
   ⇨ The cine loop is now marked and flagged with an **M**.
3. To mark additional cine loops, repeat the procedure.

To unmark a cine loop, do the following:



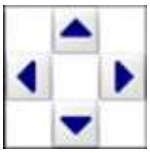
1. Select the desired marked cine loop on the reference screen using the arrow buttons.

2. Press the **Mark** button.
   ⇨ The cine loop becomes unmarked.

12.5.3 Protecting cine loops

You can protect cine loops against being deleted. When you try to delete a folder which contains protected cine loops, the folder itself as well as the protected cine loops remain on the hard disk.

To protect one or more cine loops, do the following:



1. Select the desired cine loop on the reference screen using the arrow buttons.

2. Press the **Protect** button.
   ⇨ The cine loop is now protected and flagged with a **P**.
3. To protect additional cine loops, repeat the procedure.

To unprotect a cine loop, do the following:

1. Select the desired protected cine loop using the arrow buttons.

2. Press the **Protect** button.
   ⇨ The cine loop becomes unprotected.

NOTE
Patient folders containing protected cine loops or images cannot be deleted automatically. If many folders on the hard disk contain protected cine loops or images, the Auto-Delete function will not delete them, and you will be unable to save new images.

To avoid this situation, regularly back up the patient folders which are still needed to external storage media or to a DICOM server. You can then manually delete those patient folders or unprotect them and allow the Auto-Delete function to free up space on your hard disk.

12.5.4 Deleting cine loops

You can delete either all marked cine loops, or all unmarked cine loops, or only the cine loop where the cursor is.

To delete one or more cine loops from a patient folder, do the following:

NOTE
Deleted cine loops are irretrievably lost.

Back up the cine loops you want to keep before deleting them, or make sure that they are really no longer needed.

1. Mark the cine loops you want to delete and press the **Delete marked items** button.
   ⇨ A confirmation prompt is displayed.

   or

2. Mark the cine loops you want to keep and press the **Delete unmarked items** button.
   ⇨ A confirmation prompt is displayed.

   or

3. Using the arrow buttons, position the cursor on the cine loop you want to delete, and then press the **Delete** button.

   ⇨ A confirmation prompt is displayed.

4. Confirm by pressing the **Yes** button.

   ⇨ The cine loops are deleted from the patient folder.

12.5.5 Printing on video printer

You can mark one or more cine loops and print all images contained in them in one go.

To print a cine loop on the video printer, do the following:

1. Position the cursor on the desired cine loop or mark the cine loops you want to print.

2. Press the **Print** button.

   ⇨ The marked cine loops are printed on the integrated video printer. A progress indicator in a message window on the control panel informs you about the status of the print operation. The **Cancel** button appears, enabling you to interrupt the print operation.

   Once they have been printed, the cine loops become unmarked.

CAUTION

CAUTION

Risk of injury by cutting device!

You can hurt yourself when touching the cutting device.

Do not touch the cutting device when adding or removing paper.

Please refer to the *Operating Instructions* of the corresponding printer model.

NOTICE

NOTICE

On video printers with cutting function (characterized by **CUT** button) use the **CUT** button for cutting off the printer medium (paper or transparency film) in order to avoid damaging the video printer.

On video printers without cutting function you must always tear off the printer medium (paper).

Please refer to the **Operating Instructions** of the corresponding printer model.

NOTE

The **PRINT** key at the video printer is not functional. If you wish to initiate a print job, always press the corresponding button on the control panel.

12.5.6 Saving cine loops

Depending on your chosen system configuration, you can save the images of one or more cine loops in various storage formats to different storage media. Some formats with reduced resolution and color depth are also available.

For further information refer to → *Chapter 11.8 “Storage formats” on page 210*.

Saving to USB storage medium

To save cine loops to a USB stick, do the following:

1. Position the cursor on the desired cine loop or mark the cine loops you want to save.
2. Plug a USB storage medium into the USB port.

3. Press the **USB** button.

   ⇨ The marked cine loops are saved to the USB storage medium. A progress indicator in a message window on the control panel informs you about the status of the save operation. The **Cancel** button appears, enabling you to interrupt the save operation.

   Once they have been saved, the cine loops become unmarked.

NOTE

If the cine loops to be transferred (in DICOM format) exceed the size limit, they are limited in size and are transferred only up to this size.

A message window with a confirmation prompt is displayed, which allows you to accept this operation or cancel saving.

Writing to CD/DVD

The DVD writer allows you to write data to a CD or DVD. The selected cine loops are copied to a compilation file on the hard disk first. You can write cine loops, patient folders and individual images from patient folders or from cine loops to CD/DVD.

To write one or more cine loops to CD/DVD, do the following:

1. Mark the desired cine loop(s).
2. Insert an empty CD or DVD into the DVD writer.

3. Press the **CD/DVD** button.

   ⇨ The following messages are displayed:

   Checking CD/DVD …

   Copying cine xyz to CD/DVD mirror …

   Once they have been included in the compilation file, the cine loops become unmarked.

   NOTE

   If the cine loops to be transferred (in DICOM format) exceed the size limit, they are limited in size and are transferred only up to this size.

   A message window with a confirmation prompt is displayed, which allows you to accept this operation or cancel saving.

   Writing CD/DVD. Estimated time x minutes.

   A progress indicator informs you about the status of the write operation.

   Once the write operation has been completed successfully, the following message is displayed:

   Writing of CD/DVD completed successfully

4. Press the **OK** button.

12.6 Processing and outputting single cine loop images

As soon as you open a saved cine loop in the **Archive** operating mode, the individual images of the cine loop are displayed as a thumbnail mosaic on the reference screen.

When you place the cursor on an individual image of the thumbnail mosaic, this image is automatically displayed at full size on the live screen.

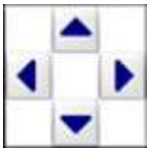
The following functions are available for processing single cine loop images:

Symbol(s)	Meaning
	**Mark:** To mark one or more cine loops
	**Protect:** To protect the image marked by the cursor against being deleted

Symbol(s)	Meaning
	**Delete:** Deleting images
	**Print:** To print marked images on the video printer
	**DICOM Print:** To print marked images on a DICOM network printer
	**CD/DVD** To write marked images to CD/DVD
	**USB** To save marked images to a USB storage medium
	**DICOM Store:** To save marked images to a DICOM server

12.6.1 Marking cine loop images

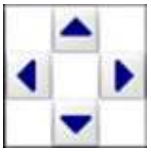
To mark one or more images of a cine loop, do the following:



1. Select the desired image in the thumbnail mosaic on the reference screen using the arrow keys.

2. Press the **Mark** button.
   ⇨ The image is now marked and flagged with an **M**.
3. To mark additional images, repeat the procedure.

To unmark an image, do the following:



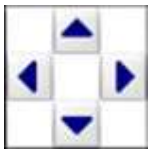
1. Select the desired marked image on the reference screen using the arrow buttons.

2. Press the **Mark** button.

12.6.2 Protecting cine loop images

You can protect cine loop images against being deleted. When you try to delete a folder which contains cine loops with protected images, the folder itself as well as the respective cine loops remain on the hard disk.

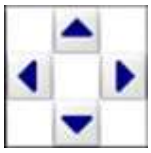
To protect one or more images of a cine loop, do the following:



1. Select the desired image in the thumbnail mosaic on the reference screen using the arrow keys.

2. Press the **Protect** button.
   ⇨ The image is now delete-protected and flagged with a **P**.
3. To protect additional images, repeat the procedure.

To unprotect an image, do the following:



1. Select the desired protected image using the arrow buttons.

2. Press the **Protect** button.
   ⇨ The image becomes unprotected.

NOTE

Patient folders containing protected images cannot be deleted automatically. If many folders on the hard disk contain protected images, the Auto-Delete function will not delete them, and you will be unable to save new images.

To avoid this situation, regularly back up the patient folders which are still needed to external storage media or to a DICOM server. You can then manually delete those patient folders or unprotect them and allow the Auto-Delete function to free up space on your hard disk.

12.6.3 Deleting cine loop images

You can delete either all marked images, or all unmarked images, or only the image where the cursor is.

To delete one or more images of a cine loop, do the following:

NOTE
Deleted images are irretrievably lost.

Back up the images you want to keep before deleting them, or make sure that they are really no longer needed.

1. Mark the images you want to delete.

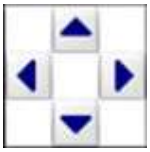
2. Press the **Delete marked items** button.
   ⇨ A confirmation prompt is displayed.

   or

3. Mark the images you want keep.

4. Press the **Delete unmarked items** button.
   ⇨ A confirmation prompt is displayed.

   or



5. Select the individual image you want to delete using the arrow buttons.

6. Press the **Delete** button.
   ⇨ A confirmation prompt is displayed.

7. Confirm by pressing the **Yes** button.
   ⇨ The images are deleted from the patient folder.

12.6.4 Printing cine loop images on the video printer

You can mark one or more images of the cine loop and print them all in one go. Besides, you can print the image displayed on the live screen.

CAUTION

CAUTION

Risk of injury by cutting device!

You can hurt yourself when touching the cutting device.

Do not touch the cutting device when adding or removing paper.

Please refer to the *Operating Instructions* of the corresponding printer model.

NOTICE

NOTICE

On video printers with cutting function (characterized by **CUT** button) use the **CUT** button for cutting off the printer medium (paper or transparency film) in order to avoid damaging the video printer.

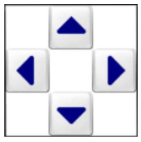
On video printers without cutting function you must always tear off the printer medium (paper).

Please refer to the **Operating Instructions** of the corresponding printer model.

NOTE

The **PRINT** key at the video printer is not functional. If you wish to initiate a print job, always press the corresponding button on the control panel.

To print images from a cine loop on the video printer, do the following:



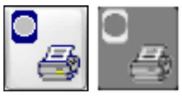
1. Position the cursor on the desired image, or mark the images you want to print.

2. Press the **Print** button.

   ⇨ The marked cine loops are printed on the integrated video printer. A progress indicator in a message window on the control panel informs you about the status of the print operation. The **Cancel** button appears, enabling you to interrupt the print operation.

   Once they have been printed, the cine loop images become unmarked.

To print the live screen image on the video printer, do the following:



Press the **Print Live Screen Image** button.

⇨ The image displayed on the live screen is printed.

The text information that is displayed on the live screen together with the image (name of the patient, angle of rotation of the image, etc.) will appear as a text block on a gray background at the left margin of the printout.

If you have performed measurements in an image and saved them subsequently, the measured values are printed on a second page.

Further information

For further information, refer to the video printer's separate operating instructions provided with this system.

12.6.5 Saving cine loop images

Depending on your chosen system configuration, you can save cine loop images in various storage formats to different storage media. Some formats with reduced resolution and color depth are also available.

For further information refer to → *Chapter 11.8 "Storage formats" on page 210*.

Saving to USB storage medium

To save cine loop images to a USB storage medium, do the following:

1. Position the cursor on the desired image, or mark the images you want to save.
2. Plug a USB storage medium into the USB port.

3. Press the **USB** button.

   ⇨ The marked images are saved to the USB stick. A progress indicator in a message window on the control panel informs you about the status of the save operation. The **Cancel** button appears, enabling you to interrupt the save operation.

   Once they have been saved, the cine loop images become unmarked.

Writing to CD/DVD

The DVD writer allows you to write data to a CD or DVD. The selected images are copied to a compilation file on the hard disk first. You can write images from various cine loops and patient folders as well as entire patient folders and cine loops to CD/DVD.

To write cine loop images to CD/DVD, do the following:

1. Mark the desired image(s).
2. Insert an empty CD or DVD into the DVD writer.

3. Press the **CD/DVD** button.

   ⇨ The following messages are displayed:

   Checking CD/DVD …

   Copying image xyz to CD/DVD mirror …

   Once they have been included in the compilation file, the images become unmarked.

   Writing CD/DVD. Estimated time x minutes.

   A progress indicator informs you about the status of the write operation.

   Once the write operation has been completed successfully, the following message is displayed:

   Writing of CD/DVD completed successfully

4. Press the **OK** button.

13 Subtraction Operating Mode

13.1 Overview

Fields of application

The **Subtraction** operating mode provides three modes **DSA**, **MSA** and **RSA**, mainly used in vascular surgery. As the generation of MSA and/or RSA images requires a DSA cine loop, MSA and RSA can be performed exclusively in conjunction with a DSA cine loop.

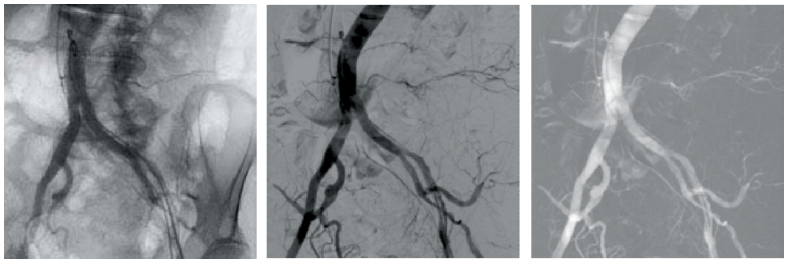


Fig. 83: Native, DSA/MSA and RSA image (example)

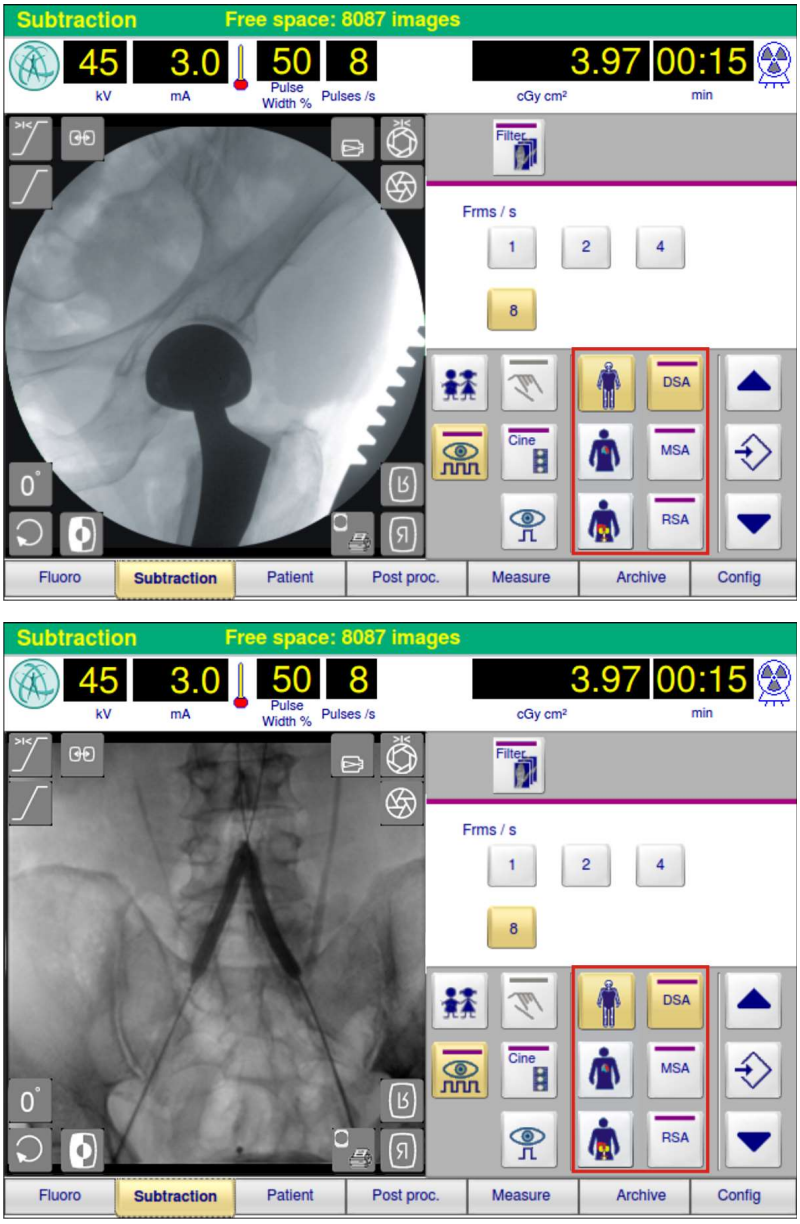


Fig. 84: Control panel in the **Subtraction** operating mode

DSA

DSA (**D**igital **S**ubtraction **A**ngiography) mode generates a conventional subtracted image. This means that one image is subtracted from the other, so that only the differences between the images become visible.

DSA is always combined with a cine loop.

MSA

With an MSA image (**M**aximum Opacification **S**ubtraction **A**ngiography) the entire path of the contrast medium flow during the acquisition run is displayed. The MSA image is generated from the DSA cine loop without any additional radiation.

RSA

An RSA image (**R**oadmapping **S**ubtraction **A**ngiography) is generated in two steps:

- The MSA image is inverted, i.e. the contrast medium flow appears white.
- A new fluoroscopic image is generated.

During the next fluoroscopy, similar to the DSA cine loop, another mask image is generated, the so-called difference image. All changes of the live image to this mask are superimposed on the RSA image. As a result, only the differences between both images become visible. You can use the generated difference image as often as desired, e.g. in order to place guide wires and catheters adequately.

If the difference image is no longer usable as a cause of moving patient or system, you can generate a new difference image by using the **RSA I new** function, without acquiring a new DSA cine loop and using contrast medium injection again.

Subtraction mode (Germany only)

For further information refer to the *Addendum Subtraction Mode*.

Save operation

The DSA cine loop is saved to the active patient folder and may be reopened or post-processed later.

Image types

During a subtraction, four types of images are generated:

- **Native image**
  Generally speaking, a native image is an original fluoroscopic image without any modification. In the subtraction modes, the native image is the image from which the mask image is subtracted to obtain the subtracted image.
- **Mask image**
  The mask image is the fluoroscopic image which is subsequently subtracted from the native image(s). The mask image is always acquired first.
- **Subtracted image**
  A subtracted image is the result of the subtraction process: native image minus mask image.
- **Difference image**
  The difference image is the result of the subtraction process: native image minus MSA image.

Showing or hiding the native image

In the **Configuration** operating mode under **Operation settings** (→ *Chapter 19.4.2 “Showing or hiding the native image” on page 313*) you can preset whether you want the native image to appear on the reference screen in the following situations:

- during acquisition of a DSA cine loop, an MSA or RSA image
- during playback of a DSA cine loop
- when working in RSA mode

If you deactivate the **DSA native on** function, you may display a reference image on the reference screen during the subtraction procedure. If you activate the option **DSA native on**, any image displayed on the reference screen will be replaced when you switch to DSA or RSA mode.

Cine loop

Each DSA is automatically combined with a cine loop. The first image of the cine loop is saved as the mask image that is subtracted from all subsequent native images.

Presettings

In the **Configuration** operating mode you can preset values for the DSA workflow:

- Under **Cine / DSA / Dose** you can preset values for DSA workflow, frame rate (speed) and number of frames (length) of the DSA cine loop.
- Under **Accessories** you can preset values for injector systems. If you select **With DSA** under **Injection**, the injector system is automatically triggered during the acquisition of a DSA cine loop after generating the DSA mask image. Configuring a delayed injection initiation is not needed.

13.2 Acquiring a DSA cine loop

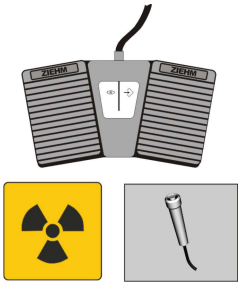
Fig. 85: DSA cine loop settings

Prerequisite

DSA cine loops are automatically saved to the active patient folder. This is the folder you have created last or selected in the archive or that the system has created automatically after power-up. The live screen always shows the patient data of the active patient folder.

To acquire a DSA cine loop, do the following:

1. Press the **DSA** button.
   ⇨ The button is highlighted in yellow and the subtraction mode is activated.
2. Set the desired frame rate for the DSA cine loop under Frms/s.



3. Initiate radiation.

> **CAUTION**
> **CAUTION**
> Risk of injury by X-rays!
> Put on X-ray protective clothing before you initiate radiation.

A progress bar appears on the control panel.

A countdown of 3 s is performed on the live screen, where each second initiates an audible alarm.

The cine loop acquisition continues. The subtracted images are displayed on the live screen. If you have activated the **DSA native on** option, the native images are displayed on the reference screen.

4. Terminate radiation.
   ⇨ The cine loop is automatically saved to the active patient folder. It is replayed in an endless loop on the live screen, if configured accordingly. If you have activated the **DSA native on** option, the native images are displayed on the reference screen.

   The cine loop playback and editing controls for the DSA cine loop appear in the dynamic control area.

> **NOTE**
> If you terminate radiation before the countdown has elapsed, the cine loop is not generated. No controls appear in the dynamic control area.
>
> Initiate radiation again in order to generate a new cine loop.

Settings in the dynamic control area only affect the active cine loop.

13.3 Controlling and editing a DSA cine loop

As soon as a newly-acquired or saved cine loop is replayed on the live screen, the cine loop playback and editing controls appear in the dynamic control area.

Press the **Cine** button to control and edit the cine loop.

⇨ The button is highlighted in yellow. The buttons controlling cine loop playback appear on the screen.

Fig. 86: Controlling and editing a DSA cine loop

Changing the playback speed

To change the playback speed of a DSA cine loop, do the following:

Select another value under **Frames/s**.

To stop DSA cine loop playback, do the following:

Press the **Stop** button.

⇨ The **Play** button appears.

To continue DSA cine loop playback, do the following:

Press the **Play** button.

⇨ The **Stop** button appears.

Additional editing functions:

Trimming the cine loop

Press the **Edit** button to trim the cine loop (→ *Chapter 13.7 “Trim DSA cine loops” on page 243*).

Pixel Shift/ Landmark 	Press the **P-Sh/LM** button to adjust the position of the mask image (→ *"Function" on page 245*) and the transparency of the native image within the subtracted image (→ *"Function" on page 246*).

Table 20: Overview of buttons

13.4 Generate MSA image

To generate an MSA image, do the following:

1. Acquire a DSA cine loop.

2. Press the **MSA** button.

⇨ An MSA image is generated without any further initiation of radiation.

The MSA image is automatically saved to the active patient folder.

The corresponding controls appear in the dynamic control area.

Fig. 87: Dynamic control area in **MSA** mode

Functions in MSA mode

Deactivate mask image 	By pressing the **Mask off** button the native cine loop is replayed, i.e. no mask image is subtracted from the respective images of the cine loop. The button is highlighted in yellow.
Activate mask image 	By pressing the active **Mask off** button the currently defined mask image is subtracted from each image of the cine loop during cine loop playback. The button is highlighted in gray.
Generate new MSA 	Press the **MSA new** button to return to the starting condition of the DSA mode. You can acquire a new DSA cine loop, from which an MSA image is generated automatically, without replaying the cine loop. The previously acquired DSA cine loop is saved and can be opened and edited by switching to the **Archive** operating mode (→ *Chapter 12.3 “Opening a saved cine loop” on page 214*). When you initiate radiation again, a new DSA cine loop is acquired with the current settings.
Acquire new DSA 	Press the **DSA new** button to return to the starting condition of the DSA mode and to acquire a new DSA cine loop. The previously acquired DSA cine loop is saved and can be edited by switching to the **Archive** operating mode (→ *Chapter 12.3 “Opening a saved cine loop” on page 214*). When you initiate radiation again, a new DSA cine loop is acquired with the current settings.

Table 21: Overview of buttons

13.5 Generate RSA image

To generate an RSA image, do the following:

1. Acquire a DSA cine loop.

2. Press the **RSA** button.
   ⇨ The corresponding controls appear in the dynamic control area.

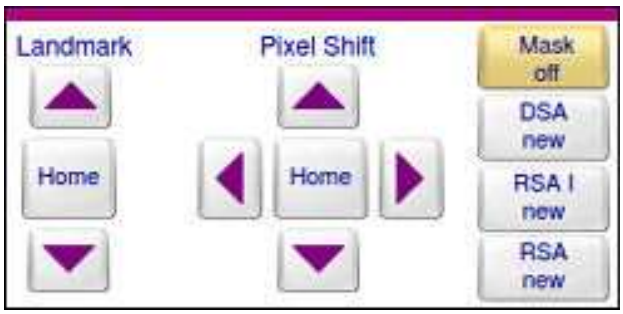
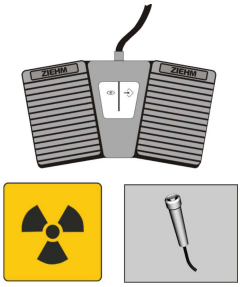


Fig. 88: Dynamic control area in **RSA** mode



3. Initiate radiation.

> **CAUTION**
> Risk of injury by X-rays!
> Put on X-ray protective clothing before you initiate radiation.

   ⇨ The MSA image is inverted.

   An RSA difference image is generated by subtracting the current native image from the inverted MSA image.

   The contrast medium flow remains visible in white. All changes within the image (e.g. inserting a catheter) are instantly visible.

5. Terminate radiation.
   ⇨ RSA image are not saved automatically.

   If the function **Autosave** is activated, upon terminating the radiation only the last image is save automatically.

6. To acquire a new RSA image, initiate radiation again.

Functions in RSA mode

Deactivate mask image 	Press the **Mask off** button to display the native image on the live screen instead of the Roadmap. The button is highlighted in yellow.
Activate mask image 	Press the **Mask off** button to display the Roadmap on the live screen instead of the native image. The button is highlighted in gray.
Acquire new DSA 	Press the **DSA new** button to return to the starting condition of the DSA mode and to acquire a new DSA cine loop. When you initiate radiation again, a new DSA cine loop is acquired with the current settings.
Replace existing RSA 	Press the **RSA I new** button to recreate the last step of the RSA mask without acquiring a new DSA cine loop. The same DSA cine loop is used, which you used last in the RSA mode.
Generate new RSA 	Press the **RSA new** button to return to the starting condition of the DSA mode. You can now acquire a new DSA cine loop. From this DSA cine loop an MSA image is generated and saved automatically without replaying the cine loop. This MSA image is inverted and displayed as RSA image. You can continue working in Roadmap mode.

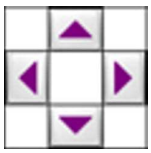
Table 22: Overview of buttons

13.6 Generating MSA and RSA images from a saved DSA cine loop

You can open a saved DSA cine loop and generate an MSA image or RSA images at a later moment without further contrast medium injection. You can open the DSA cine loop either in the currently active patient folder or display the desired patient folder and open the desired cine loop.

To generate MSA or RSA images from any saved DSA cine loop, do the following:

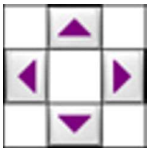
1. Press the **Archive** tab.
   ⇨ The **Archive** operating mode is activated.



2. Select the desired patient folder using the arrow keys.

3. Press the **OK** button.

   ⇨ The selected patient folder is opened and its images are displayed.



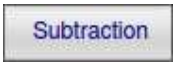
4. Select the desired DSA cine loop in the patient folder using the arrow buttons.

   ⇨ The selected image is highlighted by a white frame.

5. Press the **OK** button.

   ⇨ The cine loop playback and editing controls as well as the **Subtraction** button appear in on the control panel.

Fig. 89: Controlling and editing a DSA cine loop



6. Press the **Subtraction** button to switch to the **Subtraction** operating mode.

   ⇨ The control panel switches to the **Subtraction** operating mode and directly to the subtraction mode.

Further information on generating an MSA (→ *Chapter 13.4 “Generate MSA image” on page 239*) or RSA (→ *Chapter 13.5 “Generate RSA image” on page 241*).

13.7 Trim DSA cine loops

Press the **Edit** button to trim the cine loop.

Fig. 90: Trim DSA cine loops

Editing options

The following options are available for editing a cine loop during playback:

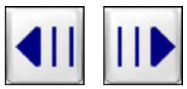
- Trimming the cine loop
- Cleaning up the cine loop
- Defining another mask image

Trimming the cine loop

You can trim the cine loop for playback, e.g. if the contrast medium has been injected too late, thus making the first images of the cine loop useless. For this purpose define a new start image and/or stop image for the cine loop.

To trim the DSA cine loop, do the following:

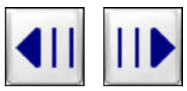
1. Press the **Stop** button.



2. Select the desired start image using the arrow buttons.

⇨ The selected image is highlighted by a white frame.and is displayed on the live screen after a short delay.

3. Press the **Start Img** button.



4. Select the desired stop image using the arrow buttons.

5. Press the **Stop Img** button.

⇨ The cine loop sequence is trimmed.

6. Press the **Play** button.

⇨ The trimmed cine loop sequence is replayed in an endless loop.

7. To avoid deleting the images excluded from the cine loop and to replay the original cine loop, press the **Complete** button.

Cleaning up the cine loop

You can use the **Clean up** function to delete all inadequate or useless images outside the trimmed cine loop, i.e. those before the start image and those after the stop image.

NOTE
Once you have cleaned up the cine loop, you can no longer restore the original cine loop.

To clean up a cine loop, do the following:

1. Press the **Stop** button.

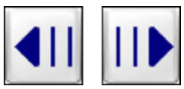
2. Press the **Clean up** button.
   ⇨ All images excluded from the trimmed cine loop are deleted.

Defining a mask image

You can define a mask image (→ *"Image types" on page 235*) different from the original one for a DSA cine loop.

To define an image of the cine loop as mask image, do the following:

1. Press the **Stop** button.



2. Use the arrow buttons to select the desired image you want to use as mask image.

3. Press the **Mask** button.
   ⇨ The currently selected image is defined as mask image.

4. Press the **Play** button.
   ⇨ The cine loop is replayed. During playback, all images of the cine loop are subtracted from the defined mask image.

13.8 Pixel Shift

Function

Moving patient or system after mask image acquisition generates motion artifacts within the subtracted image. Using the **Pixel Shift** function, you can move the mask image and possibly bring both images into line again.

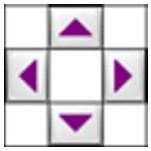
You can use the **Pixel Shift** function in the following situations:

- After the acquisition of a DSA cine loop in the **Subtraction** operating mode
- During playback of a saved DSA cine loop in the **Archive** operating mode
- When working in **RSA** mode

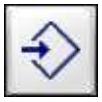
As long as you have not saved the modified image, you can undo the mask image shift with the **Home** button.

To correct motion artifacts in a subtracted image, do the following:

1. Press the **P-Sh/LM** button.



2. Using the four arrow buttons below **Pixel Shift**, move the mask image pixel by pixel until it has reached the desired position. You can move the image max. 8 pixels into each direction.



3. Press the **Save** button.
   ⇨ The corrected image is saved.

13.9 Landmarking

Function

Using the **Landmarking** function you can display the native image with a certain transparency degree (max. 70 %) within the subtracted image for the benefit of orientation.

You can use the **Landmarking** function in the following situations:

- After the acquisition of a DSA cine loop in the **Subtraction** operating mode
- During playback of a saved DSA cine loop in the **Archive** operating mode
- when working in RSA mode

As long as you have not saved the modified image, you can undo the display of the native image with the **Home** button.

To determine the transparency degree of the native image within the subtracted image (Landmarking), do the following:

1. Press the **P-Sh/LM** button.

2. To increase the transparency degree of the native image within the subtracted image, press the **Up Arrow** button below **Landmark** until the desired level is reached.

3. To increase the transparency degree of the native image within the subtracted image, press the **Up Arrow** button below **Landmark** until the desired level is reached.

4. Press the **Save** button.

   ⇨ The combined image is saved.

14 Post-Processing Images

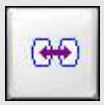
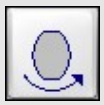
14.1 Overview

General

Saved images can be post-processed at any time in the **Post processing** operating mode. Any adjustments that you make in the **Post processing** operating mode affect only the selected image (exception: screen settings). Screen settings

Post-processing functions

The following post-processing functions are available:

Symbol(s)	Meaning
	**Print Live Screen image:** Prints the image displayed on the live screen on the video printer
	**Filter:** Edge filter
	**Zoom:** To enlarge a selected image area
	**Text:** Text Functions
	**Contrast/Brightness:** To adjust contrast and brightness of individual images (**Windowing**)
	**Grayscale Inversion:** To display an image with negative grayscale
	**Image Swapping:** Swaps the images of live and reference screens.
	**Rotate Image CCW:** Rotates the image in counter-clockwise direction.
	**Rotate Image CW:** Rotates the image in clockwise direction.

Symbol(s)	Meaning
	**Reverse Up/Down:** Vertical image reversal
	**Reverse Left/Right:** Horizontal image reversal
	**Vertical Slot Collimator:** Digital collimation (image crop)
	**Horizontal Slot Collimator:** Digital collimation (image crop)

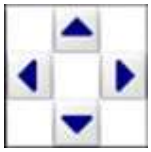
Saving the changes

Any modification becomes immediately visible in the live screen image. When you save an image, any modifications are saved as well and will be visible both when you reopen the image and in mosaic view. However, you can post-process an image as often as desired, thus undoing any changes you have made before.

14.2 Activating the post-processing functions

To activate an image for subsequent post-processing, do the following:

1. Locate the desired patient folder in the **Archive** operating mode and display it.



2. Select the patient folder in which you want to post-process an image using the arrow buttons.

3. Press the **OK** button.
   ⇨ The individual images are displayed on the reference screen.

4. Press the **OK** button again.
   ⇨ The selected image is displayed at full size on the live screen.