DR Full Leg Full Spine

User Manual

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AGFA

Contents

Legal Notice

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Agfa NV, Septestraat 27, 2640 Mortsel - Belgium

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Introduction to this Manual

Topics:

Scope of this Manual

This manual contains information for the safe and effective operation of the DR Full Leg Full Spine application and the following accessories:

- DX Full Leg Full Spine Stand
- DX FLFS Horizontal Overlay
- DR 600 FLFS Horizontal Overlay

DX FLFS Horizontal Overlay and DR 600 FLFS Horizontal Overlay are further referred to as FLFS Horizontal Overlay, unless the information applies to a specific type.

About the safety notices in this document

The following samples show how warnings, cautions, instructions and notes appear in this document. The text explains their intended use.

DANGER:
A danger safety notice indicates a hazardous situation of direct, immediate danger for a potential serious injury to a user, engineer, patient or any other person.

WARNING:
A warning safety notice indicates a hazardous situation which can lead to a potential serious injury to a user, engineer, patient or any other person.

CAUTION:
A caution safety notice indicates a hazardous situation which can lead to a potential minor injury to a user, engineer, patient or any other person.

An instruction is a direction which, if it is not followed, can cause damage to the equipment described in this manual or any other equipment or goods and can cause environmental pollution.

A prohibition is a direction which, if it is not followed, can cause damage to the equipment described in this manual or any other equipment or goods and can cause environmental pollution.

Note: *Notes provide advice and highlight unusual points. A note is not intended as an instruction.*

Disclaimer

Agfa assumes no liability for use of this document if any unauthorized changes to the content or format have been made.

Every care has been taken to ensure the accuracy of the information in this document. However, Agfa assumes no responsibility or liability for errors, inaccuracies or omissions that may appear in this document. To improve reliability, function or design Agfa reserves the right to change the product without further notice. This manual is provided without warranty of any kind, implied or expressed, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

Note: *In the United States, Federal law restricts this device on order of a physician for prescription use only.*

Introduction to the Full Leg Full Spine application

Topics:

Intended Use

The intended use of the DR Full Leg Full Spine application is to provide a workflow to acquire images for measurements in the orthopedic field (skeleton).

Applications are performed with the patient in standing position using the DX Full Leg Full Spine Stand or in lying position using the FLFS Horizontal Overlay. The patient should not move during the examination to allow accurate alignment of the X-ray images.

The DX Full Leg Full Spine Stand and the FLFS Horizontal Overlay are tools to align multiple X-ray images during stitching by the image processing software.

The DX Full Leg Full Spine Stand will help the patient to stay in a fixed position during the FLFS examination and separate the patient from the moving DR detector.

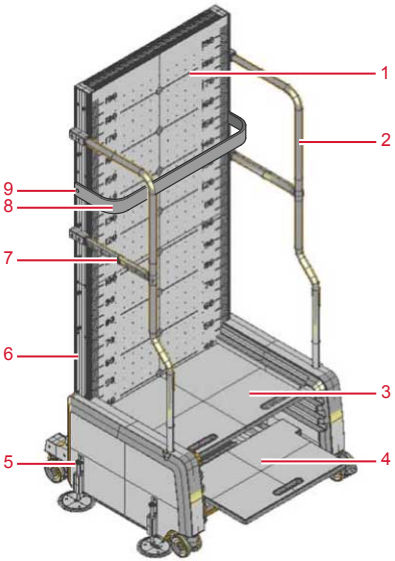
Intended User

This manual is written for trained users of Agfa products and trained clinical personnel. Users are considered as the persons who actually handle the equipment as well as the persons having authority over the equipment. Before attempting to work with this equipment, the user must read, understand, note and strictly observe all warnings, cautions and safety markings on the equipment.

Configuration

The DR Full Leg Full Spine application consists of following components:

- DR X-Ray system with automatic positioning
- NX Workstation
- DX Full Leg Full Spine Stand (type 6001/100)
- DX FLFS Horizontal Overlay (type 6001/200)
- DR 600 FLFS Horizontal Overlay (type 6001/220)



1. Stitching grid of the DX Full Leg Full Spine Stand
2. Handle of the DX Full Leg Full Spine Stand
3. Removable footstep
4. Collapsable footstep
5. Floor mount lock
6. Vertical ruler
7. Horizontal ruler
8. Patient belt
9. Knobs for attaching the patient belt

Figure 1: DX Full Leg Full Spine Stand

A protection shield must be added to the configuration in combination with DX-D 300, to protect the patient from moving parts of the X-Ray system.

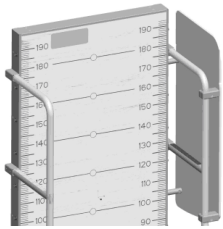
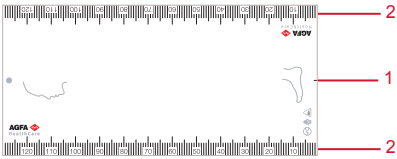


Figure 2: Protection shield



1. Stitching grid
2. Ruler

Figure 3: FLFS Horizontal Overlay

Compliance

General

- The DX Full Leg Full Spine Stand, DX FLFS Horizontal Overlay and DR 600 FLFS Horizontal Overlay have been designed in accordance with Regulation (EU) 2017/745 on medical devices (MDR)

System Documentation

The documentation shall be kept with the system for easy reference. The most extensive configuration is described within this manual, including the maximum number of options and accessories. Not every function, option or accessory described may have been purchased or licensed on a particular piece of equipment.

Refer to the System User Documentation before using the Full Leg Full Spine application:

- User Manual of the DR system and related user documentation
- NX User Manual

The most recent version of this document is available on *http://www.agfahealthcare.com/global/en/library/index.jsp*

Accuracy of Measurements

Distance measurements on DR Full Leg Full Spine images in NX are displayed with a resolution of one or more decimal places (such as 0.01 cm). You should be aware that the real measurement accuracy is generally considerably lower for a number of different reasons, many beyond the control of the product.

Distance measurements can be calibrated based on the Estimated Radiographic Magnification Factor.

The measurement accuracy is limited by at least four factors:

- The quality and nature of the input data, including but not limited to the accuracy of the calibration values.
- The user's ability to select appropriate points on the screen.
- The transformations inherent in generating images on a finite pixel display.
- The stability of the patient during the examination.

It is the user's responsibility to understand these limitations and to use the measurement tools responsibly.

For the distance measurements on DR Full Leg Full Spine images, the accuracy is 0.2 cm. The accuracy applies to the difference between the size of the projection of the object on the stitching grid and that measured with the product, on these conditions:

- The image is stitched based on the grid markers.
- The object has not moved during the examination.
- No pressure is applied on the stitching grid, causing it to bend.

WARNING:
If the patient leans against the stitching grid, the bending of the grid will decrease the accuracy of length measurements.

WARNING:
The system cannot predict the impact of patient movement or of inaccurate input data on the accuracy of a measurement done on anatomical parts.

The user is responsible for observation of the movement of the patient during the examination. Such movement influences the accuracy of measurements when using the anatomical stitching. Perform the quality control of stitched image as described in the basic workflow and take into account vertical and horizontal correction in stitching zones when performing measurements.

Related Links

Making measurements on page 64
Perform a quality control on page 39

Product Complaints

Any health care professional (for example a customer or a user) who has any complaints or has experienced any dissatisfaction with the quality, durability, reliability, safety, effectiveness, or performance of this product must notify Agfa.

If, during the use of this device or as a result of its use, a serious incident has occurred, please report it to the manufacturer and/or its authorised representative and to your national authority.

Manufacturer address:

Agfa Service Support - local support addresses and phone numbers are listed on www.agfa.com

Agfa - Septestraat 27, 2640 Mortsel, Belgium

Agfa - Fax +32 3 444 7094

Labels

	Date of manufacture
	Manufacturer
	Medical device
	Serial number
	Production lot number
	Unique device identifier, in text format and in machine readable format
	The most recent version of this document is available on *http://www.agfahealthcare.com/global/en/library/index.jsp*

Table 1: DX Full Leg Full Spine Stand (type 6001/100)

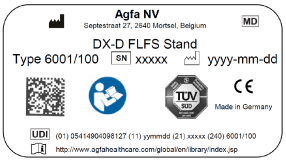
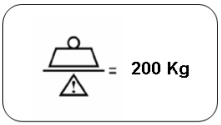
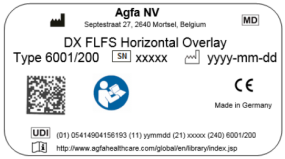
Label	Meaning
 **Figure 4: Example of the type label**	Type label
	Maximum patient weight

Table 2: DX FLFS Horizontal Overlay (type 6001/200), DR 600 FLFS Horizontal Overlay (type 6001/220)

Label	Meaning
 **Figure 5: Example of the type label**  **Figure 6: Example of the type label**	Type label
	Maximum patient weight
	Handle with care
	Tube side
	Top side according to patient orientation
	Bottom side according to patient orientation

Cleaning and Disinfection

All appropriate policies and procedures should be followed to avoid contamination of the user/staff, patients and other equipment. All existing universal precautions should be extended to avoid coming into contact with patient or close contact with patient or potential contaminations. The user is responsible for selecting a disinfection procedure.

- If required, wipe the patient contact surfaces of the DX Full Leg Full Spine Stand or of the FLFS Horizontal Overlay using disinfectants such as ethanol (70%), to prevent the risk of infection.
- Do not spray the equipment directly with disinfectants or detergents.
- Wipe it with a cloth slightly damped with a neutral detergent. Do not use solvents such as anhydrous or high solvency alcohols, thinner or benzine. Doing so may damage the surface of the equipment.
- Take care that by using disinfectants, the skin of the user or of the patient cannot be irritated.

Maintenance

The DX Full Leg Full Spine Stand and the FLFS Horizontal Overlay do not require maintenance.

Environmental protection

The stitching grid contains lead, can be taken out, and disposed separately.

For more detailed information about disposal of this product, please contact your local Agfa service organization.

Safety Directions

WARNING:
Safety is only guaranteed when an Agfa certified field service engineer has installed the product.

WARNING:
The following actions may lead to serious risk of injury and damage to the equipment as well as making the warranty void:

Changes, additions or maintenance to the Agfa products carried out by persons without appropriate qualifications and training.

Using unapproved spare parts

WARNING:
Do not move or position the DX Full Leg Full Spine Stand on ramps with an inclination exceeding 10°. Moving or positioning the DX Full Leg Full Spine Stand on ramps with higher inclination can cause serious damage to the equipment and represents a danger for the user and the patient.

WARNING:
Handle the FLFS Horizontal Overlay with care to avoid damage.

WARNING:
Do not use the FLFS Horizontal Overlay if it is damaged to avoid injury.

WARNING:
Monitor the system movements with special care. Avoid any impact of the system with walls, furniture or other elements in the room that may cause damage to the equipment.

WARNING:
The patient can fall from the DX Full Leg Full Spine Stand. Make the patient aware of the step and provide assistance to climb or descend from the DX Full Leg Full Spine Stand.

CAUTION:
All Agfa medical products must be used by trained and qualified personnel.

CAUTION:
Strictly observe all warnings, cautions, notes and safety markings within this document and on the product.

Getting started

Topics:

Basic Features

- **Automatic workflow**. To create a DR Full Leg Full Spine image, a set of partial images is acquired in a completely automated workflow, using the automatic positioning of the X-Ray system.
- **Automatic stitching.** The partial images are automatically stitched to create the DR Full Leg Full Spine image. Stitching is applied based on grid markers in the stitching grid of the DX Full Leg Full Spine Stand or the DX FLFS Horizontal Overlay and a correction is applied based on the alignment of the anatomical information in the image.
- **Calibration of distance measurements on NX**. For accurate length measurements, the DR Full Leg Full Spine image is calibrated based on the Estimated Radiographic Magnification Factor.

Basic Workflow using the DX Full Leg Full Spine Stand

Topics:

Retrieve the patient info

In the operator room at the NX workstation:

1. When a new patient comes in, define the patient info for the exam.
2. Start the exam.

Select the exposure

In the operator room at the NX workstation:

1. In the Image Overview pane of the Examination window, select the thumbnail for the DR Full Leg Full Spine (FLFS) examination.
2. In the Image Detail pane, click **Start FLFS**.

Prepare the Full Leg Full Spine configuration

In the examination room, position the X-Ray system and the DX Full Leg Full Spine Stand:

1. To use a portable DR Detector, insert it in the radiographic wall stand DR bucky.

   Depending on the configuration, the DR Detector can be inserted in portrait or landscape position.

   WARNING:
   Wrong image orientation will cause the stitching to fail. Follow the instructions in the user manual of the DR detector for positioning the detector in the bucky.

2. On the X-Ray system control panel or remote control, press and hold the button that moves the X-ray system to the automatic position.

   The X-Ray system moves to the default position for preparing the DR Full Leg Full Spine examination. The default position of the X-ray tube, is such that the touch screen console is easy to reach.

3. Position and fixate the DX Full Leg Full Spine Stand.

   Before moving the stand from its parking position, release the brakes on the four wheels.

   When moving the stand over a longer distance, turn the stand to its lateral direction so it will not block your sight.

   Two floor mount locks are located at the side of the DX Full Leg Full Spine Stand. The exact position depends on the configuration. Position the locks right above the indicated position on the floor. Push the upper lever to fixate the lock.

   WARNING:
   Fixate both floor mount locks before positioning the patient.

   WARNING:
   The housings of the floor mount locks can cause a tripping hazard.

   When the DX Full Leg Full Spine Stand is not used, position it in such a way that tripping over the floor mount locks is avoided.

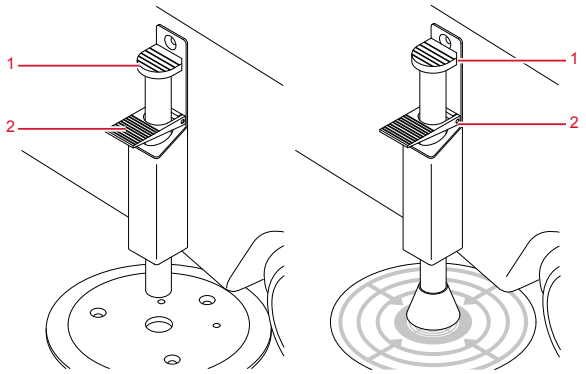


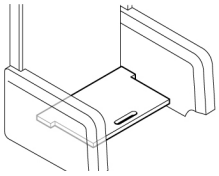
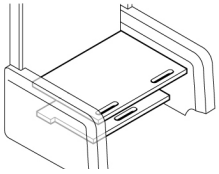
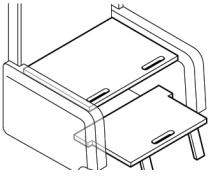
Figure 7: Fixation locks

1. Locking lever
2. Unlocking lever

4. Position the footsteps as required for the application.

   The footsteps can be positioned in three configurations:

Table 3: Footsteps configurations

Minimum height (approx. 10 cm) Remove the top footstep and put the bottom footstep in its collapsed position.	
Medium height (variable) Unfold the bottom footstep if needed. Slide the top footstep into one of the slots of the footstep unit.	
Maximum height (approx. 45 cm) Unfold the bottom footstep and lay the top footstep in the slot on top of the footstep unit.	

When performing a FLFS examination, the system imposes limits to the bottom and the top of the region of interest, depending on the X-Ray system installation.

When performing a Full Leg examination, the footsteps must be positioned to accommodate for the system limitations to the region of interest.

1. On DX-D 300, the region of interest on the vertical ruler cannot go lower than ±40 cm.
2. On DX-D 600, the region of interest on the vertical ruler cannot go lower than ±25 cm.
3. On DR 600, the region of interest on the vertical ruler cannot go lower than ±20 cm.

These values may be slightly different depending on the relative installation position of the X-Ray system and the DX Full Leg Full Spine Stand.

Prepare the examination

In the examination room, position the patient and specify the region of interest for the examination:

1. Position the patient.

WARNING:
Monitor the patient position (hands, feet, fingers, etc.) with special care to avoid injury to the patient caused by unit movements. Patient hands must be kept away from mobile components of the unit. Intravenous tubing, catheters and other patient connected lines should be routed away from moving equipment.

The patient must be made aware of the step and may need help to step on the DX Full Leg Full Spine Stand.

Positioning instructions:

1. The patient should use the handles to obtain a stable position.
2. Use the patient belt to stabilize the patient or to apply compression.
3. The patient should be standing against the stitching grid, but not leaning against it.
4. When performing a Full Leg examination, the patient's feet should be as close as possible to the stitching grid.

2. Enter the values for the region of interest by using the up and down arrows at the touch screen console:

- Top: read the top of the region of interest on the vertical ruler of the DX Full Leg Full Spine Stand. This is the start position.
- Bottom: read the bottom of the region of interest on the vertical ruler of the DX Full Leg Full Spine Stand. This is the end position.
- Distance/OID: if the image is used for making length measurements in NX or on true size printed images, read the distance between the stitching grid of the DX Full Leg Full Spine Stand and the plane in which measurements are to be made from the horizontal ruler on the handle of the DX Full Leg Full Spine Stand. This distance is used for calibrating distance measurements on the image in NX. If no calibration is required, enter zero.

On DR 600, to change a value, use the + and - buttons. The values increase or decrease step by step each time the corresponding button is pushed. To change a value without repeatedly pushing the buttons, push the value twice. The buttons change into fast-forward and fast-backward buttons. Push and hold the button to change the value.

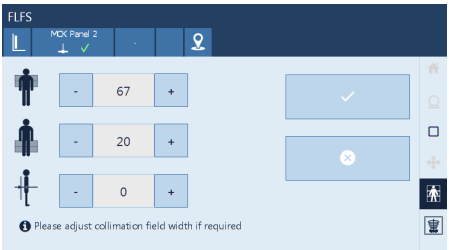


Figure 8: Values for region of interest on DR 600

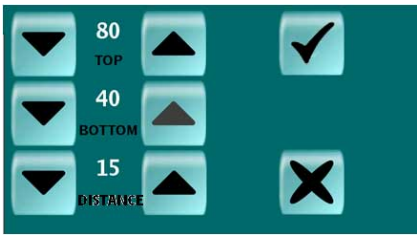


Figure 9: Values for region of interest on DX-D 600

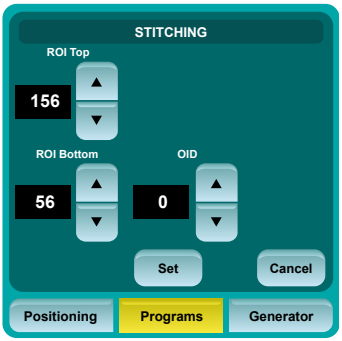


Figure 10: Values for region of interest on DX-D 300

Note: The system imposes limits to the bottom and the top of the region of interest, depending on the X-Ray system installation.

3. Set the X-Ray tube angle to 0 degrees.
4. On the collimator, switch on the light localizer.

   If required, collimate in transversal direction.

*Instruction***:** *For automatic stitching, the width of the collimated area must be more than 15 cm.*

Related Links

Making measurements on page 64

Prepare the X-Ray system for the examination

Prepare the X-Ray system for the examination:

1. On the touch screen console, touch the Set button.

CAUTION:
Before initiating automatic movement, check the position of the floor mount locks of the DX Full Leg Full Spine Stand. Locks with rubber feet can move out of position when positioning the patient and cause the stand to collide with the X-ray system during the examination. If needed, let the patient step down from the stand and repeat the positioning of the stand and of the patient.

2. Press and hold the auto positioning button that moves the X-ray system to the automatic position.

   The X-Ray system moves to the starting position for the examination. When the position is reached the position status in the Software Console is changed to ‘on target’.

Check the exposure settings

The availability of following controls depends on the configuration.

In the operator room at the software console:

The NX **Image Overview** pane displays the empty thumbnails for the exposures that are required for the examination.

1. Check if the setting for patient size, that is displayed on the console, is suitable for the examination.

Figure 11: Settings for patient size

Setting the patient size only affects exposures with AEC.

2. If other exposure values are required, edit the settings.
   a) Touch the displayed setting.
   The editing screen is displayed.
   b) Select the partial image for which settings must be changed.
   c) Adapt the exposure values of the individual images if necessary.
   d) Confirm the settings.

1. Partial images

2. Confirmation button

Figure 12: Edit exposure settings for partial images

Execute the exposure

In the operator room:

Press the exposure button to execute the examination. Hold the exposure button pressed until three beeps are heard from the NX Workstation to indicate that the examination has finished.

Depending on the configuration, the system will perform the series of exposures starting at the top most position or at the bottom most position.

Together with the auditory signal, messages are displayed on the software console and on the X-Ray system control panel to indicate that the examination has finished.

The partial images are sent to the NX workstation.

WARNING:
During exposure ionizing radiation is emitted by the X-ray system. To indicate the presence of ionizing radiation, the radiation indicator on the control console lights up.

In the operator room at the NX workstation:

- A green OK mark appears on all thumbnails for which exposures are going to be made during the examination.
- The image is acquired from the DR detector and displayed in the thumbnail.
- If collimation is applied, the image is automatically cropped at the collimation borders.
- The actual X-Ray exposure parameters are sent back from the console to the NX workstation.

Perform a quality control

In the operator room at the NX workstation, the DR Full Leg Full Spine image is displayed in the Stitching pane.

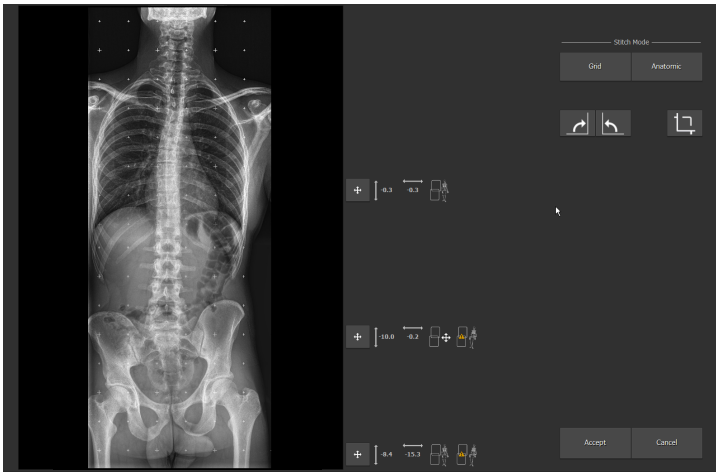


Figure 13: Stitching pane

Stitching is applied based on grid markers in the stitching grid and a correction is applied based on the alignment of the anatomical information in the image.

The stitching parameters are displayed on the right side of the image:

Table 4: Stitching parameters

Button	Parameter
	Vertical correction, in respect to the stitching grid, for the alignment of the anatomical information in the image.
	Horizontal correction, in respect to the stitching grid, for the alignment of the anatomical information in the image.
	Indication that automatic stitching has been performed based on the alignment of the anatomical information in the image.

Button	Parameter
	
	Indication that patient movement is detected.
	Indication that automatic stitching has been performed based on the stitching grid.
	Indication that manual corrections have been applied to the alignment of the partial images.

CAUTION:
Patient movement can cause inaccurate alignment of the partial images. Patient movement is not always detected by the system. The user is responsible for observation of the movement of the patient during the examination.

To perform quality control:

1. If required, adjust the stitching.
2. Click **Accept**.

   Depending on the configuration settings, the stitching parameters are added to the image as a text annotation.

   The text annotation contains following information:

Table 5: Annotations

V	Vertical correction, in respect to the stitching grid, for the alignment of the anatomical information in the image.
H	Horizontal correction, in respect to the stitching grid, for the alignment of the anatomical information in the image.

M	Indication that manual corrections have been applied to the alignment of the partial images.
G	Indication that automatic stitching has been performed based on the stitching grid.
A	Indication that automatic stitching has been performed based on the alignment of the anatomical information in the image.
Y	Indication that patient movement is detected.
N	Indication that no patient movement is detected.

Figure 14: Example of a text annotation containing stitching parameters

3. Prepare the image for diagnosis by using e.g. L/R markers or annotations.
4. If the image is OK, send the image to a hardcopy printer and/or PACS (Picture Archiving and Communication System).

Related Links

To stitch a set of partial images on page 59
Manually adjusting a DR Full Leg Full Spine image on page 59
Rejecting a DR Full Leg Full Spine image on page 63

Finalize the examination

In the operator room:

1. Let the patient step down from the DX Full Leg Full Spine Stand.

   If needed, release the patient belt.

   The patient may need help to step down from the DX Full Leg Full Spine Stand.
2. Put the bottom footstep in its collapsed position.
3. Unlock the DX Full Leg Full Spine Stand by pushing the lower lever of the floor mount locks.
4. Move the stand to its parking position and activate the brakes on the wheels to prevent unintended movement.

Basic Workflow using the FLFS Horizontal Overlay

Topics:

Retrieve the patient info

In the operator room at the NX workstation:

1. When a new patient comes in, define the patient info for the exam.
2. Start the exam.

Select the exposure

In the operator room at the NX workstation:

1. In the Image Overview pane of the Examination window, select the thumbnail for the DR Full Leg Full Spine (FLFS) examination.
2. In the Image Detail pane, click **Start FLFS**.

Prepare the Full Leg Full Spine configuration

In the examination room, position the X-Ray system and the FLFS Horizontal Overlay:

1. To use a portable DR Detector, insert it in the radiographic table DR bucky.

   Depending on the configuration, the DR Detector can be inserted in portrait or landscape position.

   WARNING:
   Wrong image orientation will cause the stitching to fail. Follow the instructions in the user manual of the DR detector for positioning the detector in the bucky.

2. On the X-Ray system control panel or remote control, press and hold the button that moves the X-ray system to the automatic position.

   The X-Ray system moves to the default position for preparing the DR Full Leg Full Spine examination. The default position of the X-ray tube, is such that the touch screen console is easy to reach.

3. Position the FLFS Horizontal Overlay on the radiographic table.

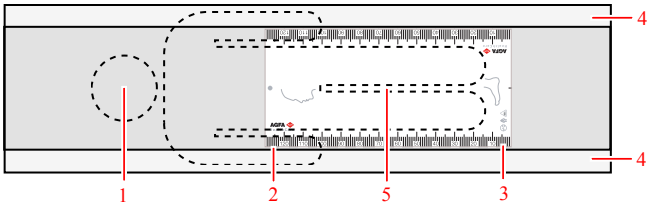
   If the patient is positioned with the head on the left side, the values on the ruler must increment from right to left and if the patient is positioned with the head on the right side, the values must increment from left to right.

   Note: NX is configured for a specific patient orientation, either head left (default) or head right.

   In transversal direction the overlay fits between the radiographic table borders.

   In longitudinal direction the position of the overlay on the tabletop can be chosen depending on the reqion of interest of the planned examination.

   The overlay should not protrude from the sides of the tabletop.



1. Patient orientation head left
2. Overlay ruler end
3. Overlay ruler start
4. Radiographic table borders

5. FLFS Horizontal Overlay

Figure 15: FLFS Horizontal Overlay on radiographic table

Prepare the examination

In the examination room, position the patient and specify the region of interest for the examination:

1. Center the tabletop in transversal direction. It is recommended to adjust the height of the radiographic table to its lowest position.
2. Position the patient on the radiographic table relative to the FLFS Horizontal Overlay and make sure that the region of interest for the planned examination is within the range of the overlay.

WARNING:
Monitor the patient position (hands, feet, fingers, etc.) with special care to avoid injury to the patient caused by unit movements. Patient hands must be kept away from mobile components of the unit. Intravenous tubing, catheters and other patient connected lines should be routed away from moving equipment.

WARNING:
Use always the hand grips to avoid injuries in patient hands or fingers when the tabletop is in movement. Patient's hands must be kept far away from the tabletop edges in every moment.

3. Move the tabletop longitudinally and make sure that the region of interest is within the travel area of the DR bucky.
4. Enter the values for the region of interest by using the up and down arrows at the touch screen console:

   - Top: read the top of the region of interest on the ruler of the FLFS Horizontal Overlay. This is the start position.
   - Tube Position: on the collimator, switch on the light localizer and read the position of the centerline on the ruler of the FLFS Horizontal Overlay.
   - Bottom: read the bottom of the region of interest on the ruler of the FLFS Horizontal Overlay. This is the end position.
   - Distance/OID: if the image is used for making length measurements in NX or on true size printed images, estimate the distance between the FLFS Horizontal Overlay and the horizontal plane in which measurements are to be made. This distance is used for calibrating distance measurements on the image in NX. If no calibration is required, enter zero.

   On DR 600, to change a value, use the + and - buttons. The values increase or decrease step by step each time the corresponding button is pushed. To change a value without repeatedly pushing the buttons, push the value twice. The buttons change into fast-forward and fast-backward buttons. Push and hold the button to change the value.

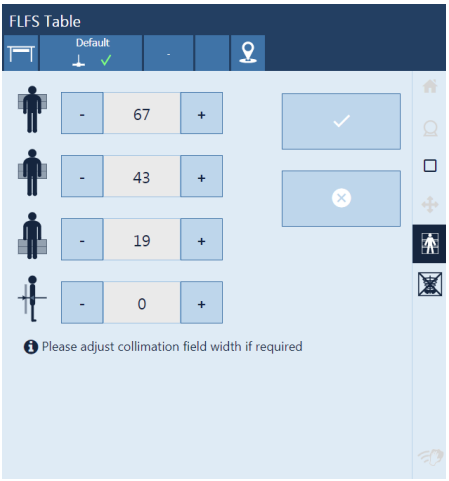


Figure 16: Values for region of interest on DR 600

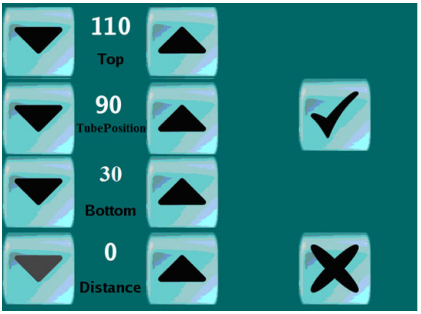


Figure 17: Values for region of interest on DX-D 600

Note: The maximum size of the region of interest is approximately 95 cm. For using the maximum region of interest, the tabletop must be positioned such that the tube position is exactly in the middle of the region of interest.

5. Set the X-Ray tube angle to 0 degrees.
6. On the collimator, switch on the light localizer.

   If required, collimate in transversal direction.

Instruction: *For automatic stitching, the width of the collimated area must be more than 15 cm.*

Related Links

Making measurements on page 64

Prepare the X-Ray system for the examination

Prepare the X-Ray system for the examination:

1. On the touch screen console, touch the Set button.

2. Press and hold the button that moves the X-ray system to the automatic position.

   The X-Ray system moves to the starting position for the examination. When the position is reached the position status in the Software Console is changed to ‘on target’.

Check the exposure settings

The availability of following controls depends on the configuration.

In the operator room at the software console:

The NX **Image Overview** pane displays the empty thumbnails for the exposures that are required for the examination.

1. Check if the setting for patient size, that is displayed on the console, is suitable for the examination.

Figure 18: Settings for patient size

Setting the patient size only affects exposures with AEC.

2. If other exposure values are required, edit the settings.
   a) Touch the displayed setting.
   The editing screen is displayed.
   b) Select the partial image for which settings must be changed.
   c) Adapt the exposure values of the individual images if necessary.
   d) Confirm the settings.

1. Partial images

2. Confirmation button

Figure 19: Edit exposure settings for partial images

Execute the exposure

In the operator room:

Press the exposure button to execute the examination. Hold the exposure button pressed until three beeps are heard from the NX Workstation to indicate that the examination has finished.

Depending on the configuration, the system will perform the series of exposures starting at the top most position or at the bottom most position.

Together with the auditory signal, messages are displayed on the software console and on the X-Ray system control panel to indicate that the examination has finished.

The partial images are sent to the NX workstation.

WARNING:
During exposure ionizing radiation is emitted by the X-ray system. To indicate the presence of ionizing radiation, the radiation indicator on the control console lights up.

In the operator room at the NX workstation:

- A green OK mark appears on all thumbnails for which exposures are going to be made during the examination.
- The image is acquired from the DR detector and displayed in the thumbnail.
- If collimation is applied, the image is automatically cropped at the collimation borders.
- The actual X-Ray exposure parameters are sent back from the console to the NX workstation.

Perform a quality control

In the operator room at the NX workstation, the DR Full Leg Full Spine image is displayed in the Stitching pane.

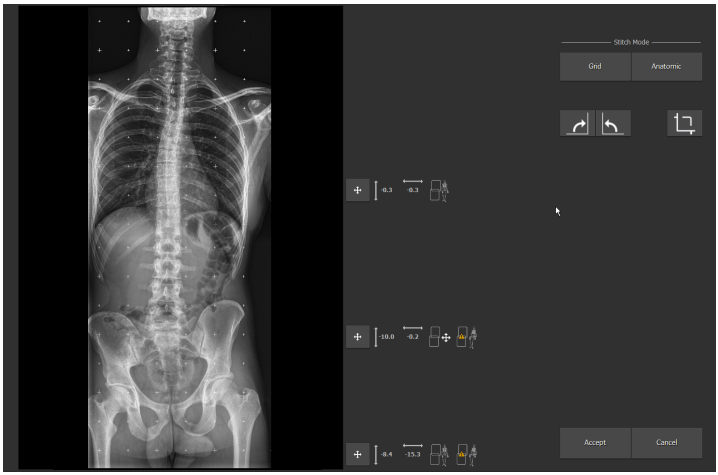


Figure 20: Stitching pane

Stitching is applied based on grid markers in the stitching grid and a correction is applied based on the alignment of the anatomical information in the image.

The stitching parameters are displayed on the right side of the image:

Table 6: Stitching parameters

Button	Parameter
	Vertical correction, in respect to the stitching grid, for the alignment of the anatomical information in the image.
	Horizontal correction, in respect to the stitching grid, for the alignment of the anatomical information in the image.
	Indication that automatic stitching has been performed based on the alignment of the anatomical information in the image.

Button	Parameter
	
	Indication that patient movement is detected.
	Indication that automatic stitching has been performed based on the stitching grid.
	Indication that manual corrections have been applied to the alignment of the partial images.

CAUTION:
Patient movement can cause inaccurate alignment of the partial images. Patient movement is not always detected by the system. The user is responsible for observation of the movement of the patient during the examination.

To perform quality control:

1. If required, adjust the stitching.
2. Click **Accept**.

   Depending on the configuration settings, the stitching parameters are added to the image as a text annotation.

   The text annotation contains following information:

Table 7: Annotations

V	Vertical correction, in respect to the stitching grid, for the alignment of the anatomical information in the image.
H	Horizontal correction, in respect to the stitching grid, for the alignment of the anatomical information in the image.

M	Indication that manual corrections have been applied to the alignment of the partial images.
G	Indication that automatic stitching has been performed based on the stitching grid.
A	Indication that automatic stitching has been performed based on the alignment of the anatomical information in the image.
Y	Indication that patient movement is detected.
N	Indication that no patient movement is detected.

Figure 21: Example of a text annotation containing stitching parameters

3. Prepare the image for diagnosis by using e.g. L/R markers or annotations.
4. If the image is OK, send the image to a hardcopy printer and/or PACS (Picture Archiving and Communication System).

Related Links

To stitch a set of partial images on page 59
Manually adjusting a DR Full Leg Full Spine image on page 59
Rejecting a DR Full Leg Full Spine image on page 63

Finalize the examination

In the operator room:

1. Let the patient step down from the radiographic table.

   The patient may need help to step down from the radiographic table.
2. Remove the FLFS Horizontal Overlay from the radiographic table and store it.

Storing the FLFS Horizontal Overlay

To safely store the FLFS Horizontal Overlay while it is not in use:

Hang the FLFS Horizontal Overlay on the hook on the wall or on a flat surface.

When the overlay stays askew at a wall or is not fully supported on a table, the overlay will be bent after some time. A bent overlay cannot be used anymore due to possible distortions in the resulting image.

Advanced Operation

Topics:

Manually adjusting a DR Full Leg Full Spine image

Topics:

To rotate all partial images

Rotate all partial images

- Click the following button to rotate 90° clockwise:

Figure 22: Rotate clockwise

- Click the following button to rotate 90° counterclockwise:

Figure 23: Rotate counterclockwise

To stitch a set of partial images

To stitch a set of partial images:

1. In NX, go to the **Examination** window.
2. In the Image Overview pane, select the thumbnail of one of the partial images.
3. Click **Stitch Images**.

   The Stitching pane is displayed.

   Stitching is applied based on grid markers in the stitching grid and a correction is applied based on the alignment of the anatomical information in the image.

   The area of the image where two partial images are stitched together is indicated by the stitching tools displayed on the right side of the image. In this area, the two partial images slightly overlap. If the anatomical

structures in the overlapping area are not aligned, stitching can be adjusted manually.

To align the partial images based on their projection on the stitching grid

To align the partial images based on their projection on the stitching grid:

Click **Grid**.

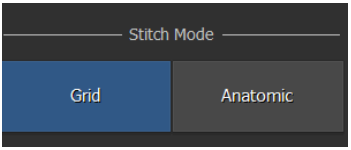


Figure 24: Stitch mode: grid

The anatomical structure in the partial images may not be aligned, due to patient movement during the examination.

The values of the horizontal and vertical correction are set to zero. Next to the stitching areas the following label is displayed.

Figure 25: Stitching tools: align partial images

To align the partial images based on the analysis of the anatomical information in the image

To align the partial images based on the analysis of the anatomical information in the image:

Click **Anatomic**.

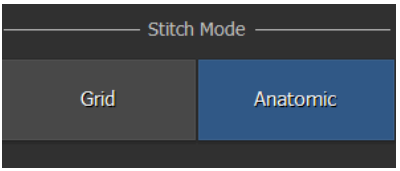


Figure 26: Stitch mode: anatomic

The anatomical structures in the overlapping areas are aligned by automatically shifting the partial images in vertical and horizontal direction.

The new alignment is applied to each stitching area. Next to the stitching areas this label is displayed, as well as the vertical and horizontal relative position of the partial images.

Figure 27: Stitching tools: align partial images (via anatomical information)

To manually align two partial images

To manually align two partial images:

1. Click the **Alignment** button.

Figure 28: Alignment button

A detail of the overlapping area is displayed.

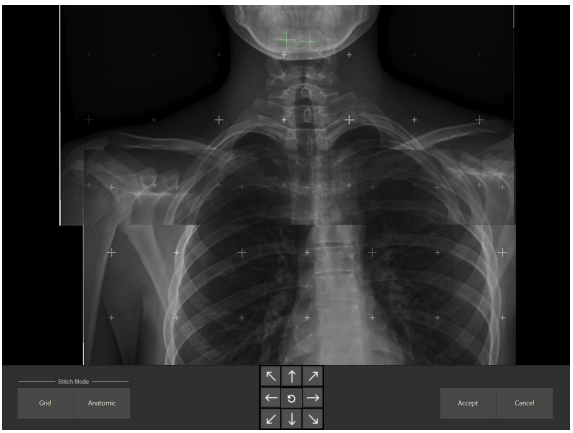


Figure 29: Detail overlapping area

2. Align the two partial images:

Table 8: Manual alignment

Adjusting the position of the lower image	Right click-hold the image and drag the mouse arrow to any direction. Press the SHIFT or CTRL button while dragging the mouse arrow to adjust the vertical or horizontal alignment only. Use the arrow keys on the keyboard. Click the arrow buttons on the screen.
Roaming over the images	Left click-hold the image and drag the mouse arrow to any direction.
Zooming in/out on the images	Use the scroll wheel on the mouse.
Restoring the original alignment	Click the **Revert** button.  **Figure 30: Revert button**

The relative position of the partial images, compared to their initial relative position, is illustrated by two crosshairs displayed in the image, each of which is locked to the position of one of the partial images.

3. If the anatomical structures in the partial images are aligned, click **Accept** to confirm.

   Next to the stitching areas this label is displayed, as well as the vertical and horizontal relative position of the partial images.

Figure 31: Stitching tools: manual alignment

To turn the black borders or cropping on or off

To turn the black borders or cropping on or off:

Click the following icon:

Figure 32: Crop/uncrop button

To save the stitched image

To save the stitched image:

Click Accept.

The DR Full Leg Full Spine image is available in the examination. Depending on the configuration settings, the stitching parameters are added to the image as a text annotation.

Note: *After saving, the DR Full Leg Full Spine image cannot be adjusted. The same set of partial images can be used to create another DR Full Leg Full Spine image.*

Rejecting a DR Full Leg Full Spine image

By rejecting an image you indicate that the image is not suitable for diagnosis and that a retake is needed. Rejecting an image does not remove the image from the exam.

To reject a DR Full Leg Full Spine image:

1. Reject each partial image.
2. If the DR Full Leg Full Spine image was created, reject this image also.

   No images will be sent and a thumbnail for a new DR Full Leg Full Spine examination is created.

Making measurements

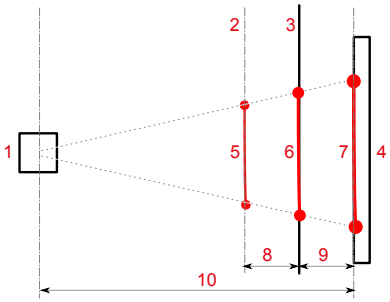
Distance measurements on DR Full Leg Full Spine images in NX are calibrated based on the Estimated Radiographic Magnification Factor. The calibration factor is calculated based on:

1. the distance between the patient and the stitching grid. This distance is entered during the acquisition workflow.
2. the Source Image Distance (SID). This distance is received together with the X-Ray generator parameters.

Note: If the distance between the patient and the stitching grid is not entered (or entered as zero), no calibration is applied on NX. Measurements on the DR Full Leg Full Spine image are based on the projection of the object on the stitching grid.

To make measurements, see the NX User Manual on Adding annotations to an image and using the measurement tools.

To modify the Estimated Radiographic Magnification Factor, see the NX User Manual on Adding an Estimated Radiographic Magnification Factor (ERMF).



1. X-ray tube
2. Patient location
3. Stitching grid
4. DR Detector
5. Distance to be measured on the object, in a plane parallel to the stitching grid
6. Projection of the object on the stitching grid. This is the measured distance on the DR Full Leg Full Spine image on NX if no calibration is applied.
7. Projection of the object on the DR Detector. This is the measured distance on a partial image on NX.
8. Distance between the plane in which the measurement is made and the stitching grid. This distance is estimated by the user and entered at the touch screen console while preparing the examination.
9. Distance between the stitching grid and the DR Detector. This distance is configured during installation of the system.

10. Source image distance (SID). This distance is received together with the X-Ray generator parameters.

Figure 33: Making measurements on DR Full Leg Full Spine images

The respective distances between the plane in which the measurement is made, the stitching grid, the DR Detector and the X-ray tube are used to calculate the Estimated Radiographic Magnification Factor to calibrate the distance measurement on NX.

Related Links

Accuracy of Measurements on page 16
Prepare the examination on page 32
Prepare the examination on page 47

Problem solving

Topics:

Anatomical stitching is not optimal

Table 9: Problem: Anatomical stitching is not optimal

Details	The anatomic information in the partial images cannot be automatically fully aligned. If the result of automatic stitching based on the alignment of the anatomical information in the image is suspicious because of possible movement of the patient during the examination, this icon is displayed in the Stitching pane: 
Cause	The patient has changed position during the examination.
Brief Solution	Manually adjust the DR Full Leg Full Spine image. If the partial images cannot be manually adjusted, click **Cancel** in the Stitching pane. No DR Full Leg Full Spine image is available.

Stitching fails

Table 10: Problem: Stitching fails

Details	The partial images cannot be stitched because the grid markers in the stitching grid are not visible in the partial images.
Cause	The stiching grid was not used for the examination.
Brief Solution	Click **Cancel** in the Stitching pane. No DR Full Leg Full Spine image is available.

Full Leg Full Spine examination is interrupted

Table 11: Problem: Examination is interrupted

Details	The DR Full Leg Full Spine examination is aborted before it has completely finished.
Cause	The exposure button is released by the user before the complete examination has finished.
Brief Solution	If you release the exposure button by accident, you can press it again to continue the examination. If the exposure button remains released for more than 2 seconds, the examination is aborted. You can use the available partial images to create a DR Full Leg Full Spine image.

Part of the image is masked by the black border

Details	During the automatic collimation process, NX normally applies black borders to the image. These black borders are intended to mask non relevant areas of the images. Nevertheless it can occur that the black borders do mask useful diagnostic information. In this case you must be able to either hide the black border or re-collimate the image manually.
Cause	Failing auto collimation.
Brief Solution	This problem is solved by: • Hiding the black border. • Applying manual collimation. To prevent this problem, use the ROI detection exposure techniques as described in “Working with collimation”.
Solution Steps	To show/hide black borders: **1.** The **Image Detail** pane in the **Examination** window has a set of buttons to perform basic operations on an image. With this button you can remove the black border in case of failed collimation. Click the button to show/hide black borders.  To draw a rectangular collimation area: **1.** Select an image in the **Image Overview** pane. **2.** In the **Editing** window, from the first drop-down list in the **Image Processing** tool section, select the icon below.  **3.** Click once to define one corner of the rectangle. **4.** Move the pointer. **5.** Click again to define the opposite corner.

6. To display the collimation area, select the icon below.

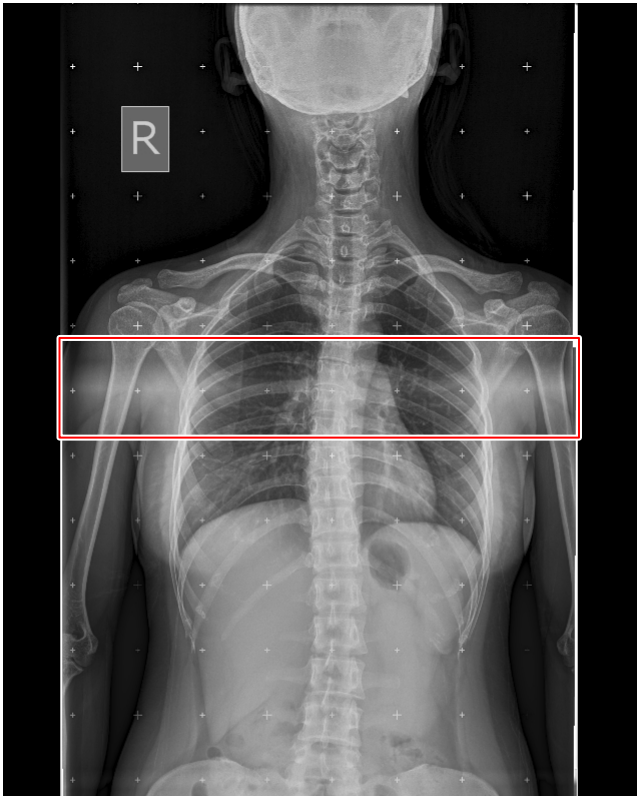
To draw a polygonal collimation area:

1. Select an image in the **Image Overview** pane.
2. In the **Editing** window, from the first drop-down list in the **Image Processing** tool section, select the icon below.

3. Click to define the starting point.
4. Move the pointer and click to define each corner.
5. Click the starting point to close the polygon.
6. To display the collimation area, select the icon below.

Bright area where partial images overlap

Table 12: Problem: Bright area where partial images overlap

Details	The stitched image may show a bright area where the partial images overlap. 
Cause	The increased brightness is a result of the image processing that is applied when combining the partial images.
Brief Solution	This effect of the image processing cannot be avoided.

Technical Data

Topics:

DX Full Leg Full Spine Stand

Table 13: DX Full Leg Full Spine Stand technical data

Labeling	IEC 60601-1 chapter 9 TÜV SÜD Test program non-electrical medical support system
Dimensions	Width: 990 mm Height: 1985 mm Depth: 870 mm
Weight approx.	151 kg (225 kg including packaging)
Mylar Back X-ray Absorption	< 0.1 mm Al
Max. allowable patient weight	200 kg
Environmental requirements	
Room temperature	recommended: 20 °C to 25 °C allowed: 15 °C to 30 °C
Maximum temperature change	0.5 °C/min.
Relative humidity	recommended: 30 % to 60 % allowed: 15 % to 80 %
Environmental requirements (storage)	
Temperature	-25 °C to +55 °C
Environmental requirements (transport)	
Temperature	-25 °C to +55 °C

DX FLFS Horizontal Overlay

Table 14: DX FLFS Horizontal Overlay technical data

Dimensions	Width: 615 mm Length: 1300 mm Thickness: < 4 mm
Weight approx.	< 5 kg
Mylar Back X-ray Absorption	< 0.1 mm Al
Maximum patient weight	300 kg
Environmental requirements	
Room temperature	5 °C to 40 °C
Maximum temperature change	0.5 °C/min.
Relative humidity	5 % to 85 %
Environmental requirements (storage)	
Temperature	-25 °C to +55 °C
Environmental requirements (transport)	
Temperature	-25 °C to +55 °C

DR 600 FLFS Horizontal Overlay

Table 15: DR 600 FLFS Horizontal Overlay technical data

Dimensions	Width: 632 mm Length: 1300 mm Thickness: < 4.5 mm
Weight approx.	< 5 kg
Mylar Back X-ray Absorption	< 0.1 mm Al
Maximum patient weight	300 kg
Environmental requirements	
Room temperature	5 °C to 40 °C
Maximum temperature change	0.5 °C/min.
Relative humidity	5 % to 85 %
Environmental requirements (storage)	
Temperature	-25 °C to +55 °C
Environmental requirements (transport)	
Temperature	-25 °C to +55 °C