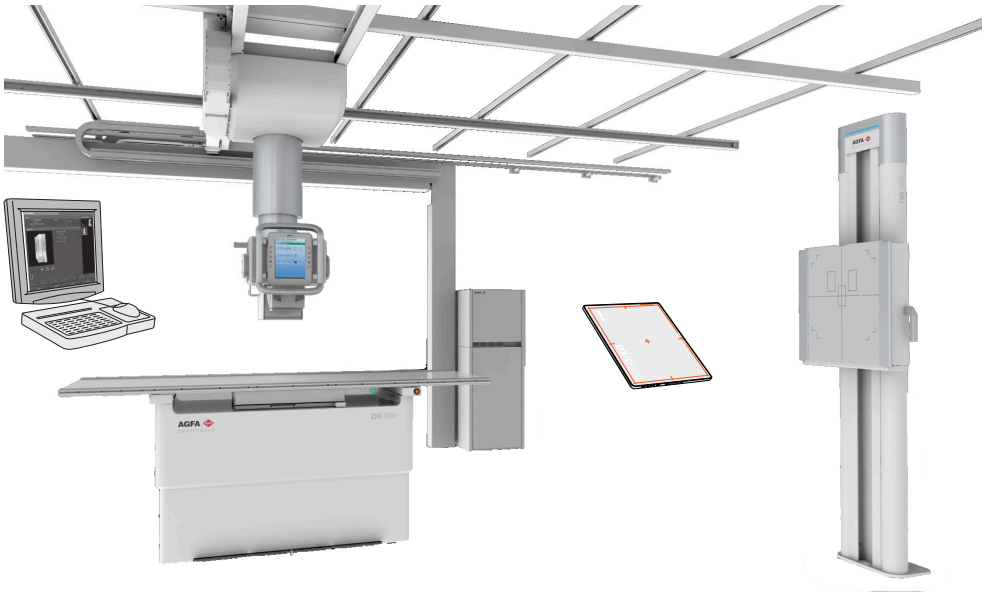
DR 600

5530/100

User Manual



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Contents

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CE 2862

UKCA 8532

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Published by Agfa NV

2640 Mortsel - Belgium.

Introduction to this Manual

Scope of this Manual

This User Manual describes the features of the DR 600 System, an integrated X-Ray imaging system. It explains how the different components of the DR 600 System work together.

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, service 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, service 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, service 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

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

Introduction

Intended Use

The DR 600 system is a General Radiography X-ray imaging system used in hospitals, clinics and medical practices by radiographers, radiologists and physicists to make, process and view static X-ray radiographic images of the skeleton (including skull, spinal column and extremities), chest, abdomen and other body parts on adults and pediatric patients.

In addition, the system provides the Agfa tomosynthesis option, which is intended to acquire tomographic slices of human anatomy and to be used with Agfa DR X-ray systems. Digital tomosynthesis is used to synthesize tomographic slices from a single tomographic sweep.

Applications can be performed with the patient in sitting, standing or lying position.

The system is not intended for use in Mammography applications.

Intended User

This manual has been written for trained users of Agfa products and trained diagnostic X–Ray clinical personnel who have received proper training.

Users are those persons who actually handle the equipment and those who have 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

DR 600 is a configurable DR (Direct Radiography X-ray system) and/or CR (Computed Radiography) X-ray system.

DR 600 has configurations for DR, for CR and for mixed use of DR and CR.

DR 600 supports following applications:

- General radiography, including pediatrics
- Full leg full spine radiography

The complete DR 600 consists of the following components:

- Ceiling suspension with X-ray tube, collimator and tube head display
- Radiographic table with a bucky.
- Radiographic wall stand with a bucky.
- Three bucky models:
  - Bucky for large format DR only, with optional battery charger for XD/XF detectors
  - Bucky for all formats CR and DR, with optional battery charger for DR 14s detector
  - Bucky for fixed DR detector
- X-ray generator
- X-ray generator mini console
- X-ray tube with collimator
- NX workstation
- DR Generator Sync Box
- Automatic Exposure Control (AEC)
- Dose Area Product Meter (DAP, optional)
- Remote control (optional)
- Collimator camera (Smart XR upgrade mounting kit, optional)

Limited DR 600 configurations can consist of a ceiling suspension with only a wall stand or only a radiographic table.

X-ray parameters are controlled using the Software Console on the NX workstation.

The Software Console is available on the NX workstation, to synchronize the X-ray exposure parameters between the NX application and the generator.

Depending on the configuration the following components are also available:

- Portable DR Detector

DR 600 can be used in combination with:

- DX-G
- DX-M
- CR 30-Xm
- CR 10-X
- CR 12-X
- CR 15-X

DR 600 includes following types of ceiling suspension:

- Standard ceiling suspension
- Ceiling suspension with reduced ceiling height

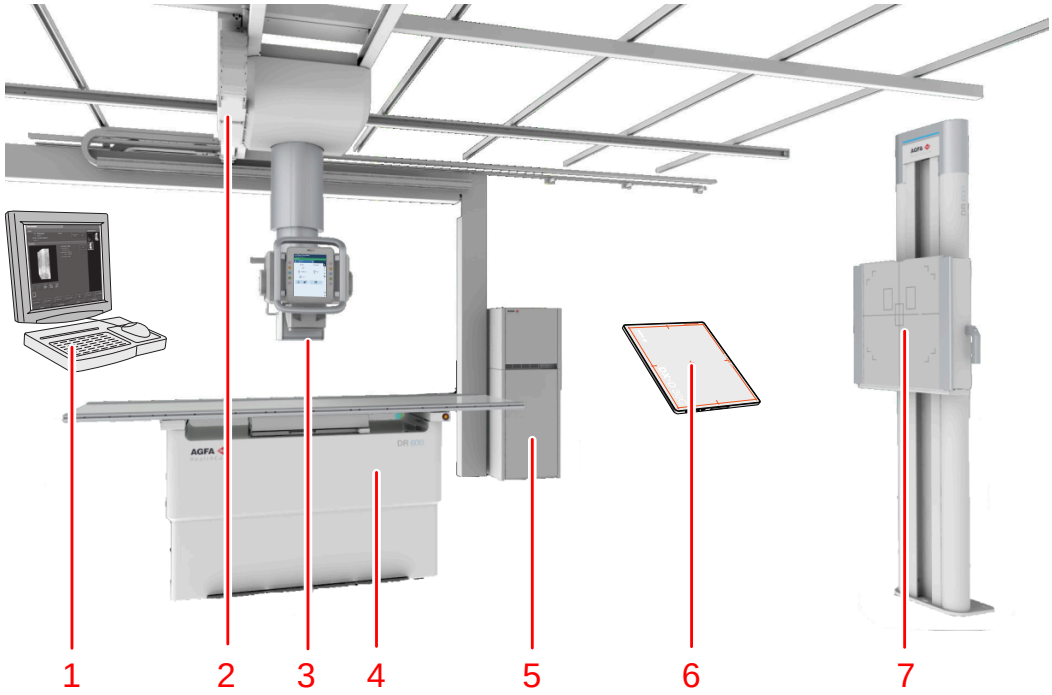
This configuration supports following functionality:

- automatic positioning

- automatic collimation
- auto-tracking functionality
- remote control (optional)
- DR Full Leg Full Spine application (optional)
- Digital tomosynthesis (optional)

Other configurable features include:

- Tube head display with controls for X-ray exposure and positioning parameters
- Position tracking for keeping constant SID on table and wall stand



1. NX workstation
2. Ceiling suspension
3. X-ray tube with collimator
4. Radiographic table
5. X-ray generator
6. DR detector
7. Radiographic wall stand

Figure 1: DR 600 configuration for DR

- Applied Parts on page 17

Applied Parts

Applied Parts refer to parts of the medical electrical equipment that in normal use necessarily comes into physical contact with the patient for the equipment to perform its function. This system includes the following Applied Parts:

Radiographic table

- Tabletop of the Radiographic table
- Patient hand grips (optional)
- Lateral cassette holder (optional)
- Mattress (optional)

- Compression belt (optional)

Radiographic wall stand

- Front panel of the radiographic wall stand
- Lateral arm rest (optional)
- Patient hand grips (optional)

DR Detector

- DR Detector

Options and Accessories

The system is delivered with a set of labels. When using multiple DR Detectors, on the labels a nickname is written to identify the DR Detector. An identical label is attached to the bucky of the X-ray system to identify the dedicated workspace of each DR Detector.

For information on options and accessories, refer to these manuals:

- User manuals for the supported DR Detectors.

Related information

Radiographic Table Accessories on page 191
Radiographic Wall Stand Accessories on page 202

Operation Controls

Radiographic table

The radiographic table is used for positioning of the patient lying or sitting over the detector or the cassette in the bucky for exposure.

The radiographic table supports the patient and the detector or the cassette for free exposure.

Figure 2: Radiographic table

Related information

Radiographic Table on page 185

Radiographic wall stand

The radiographic wall stand is used for positioning of patients standing upright or sitting towards the bucky for exposure.

Figure 3: Radiographic wall stand with vertical bucky

Related information

Radiographic Wall Stand on page 198

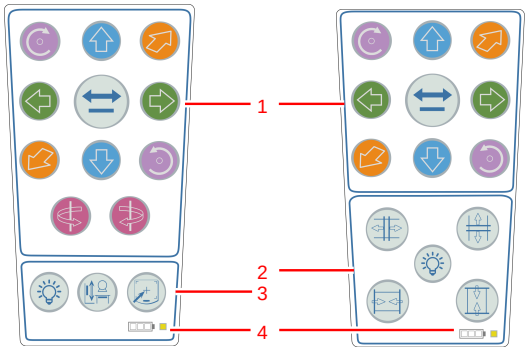
Control Panel of the X-Ray Tube Head Unit

Figure 4: Control Panel of the X-Ray Tube Head Unit with tube head display (controls for X-ray tube position and for X-ray exposure parameters)

Related information

Control Panel of the Tube Head Unit on page 169
Positioning the X-Ray Tube on page 170

Remote Control for the X-Ray Tube Head Unit



1. Buttons for positioning the X-Ray Tube
2. Buttons for collimator control
3. Buttons for collimator light, tracking and automatic centering
4. Indicators for battery charge level and yellow status indicator light

Figure 5: Remote Control the X-Ray Tube Head Unit

The remote control can be mounted on the wall using a holder. A typical mounting position is near the radiographic wall stand.

Related information

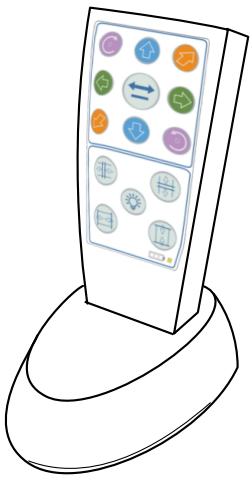
Positioning the X-Ray Tube using the Remote Control on page 176

Charging the battery of the remote control

The remote control has a rechargeable battery. The battery charge level is indicated on the remote control.

To charge the battery of the remote control:

Put the remote control in the charging stand.



The status indicator on the remote control is blinking slowly to indicate that battery charging is ongoing.

The status indicator on the remote control is unlit when the battery is fully charged.

Charging time	maximum 10 hours
Operation time when fully charged	2.5 hours continuous operation or 1 day normal use

Standby time when fully charged	7 days

Remote control status indicator light

Table 1: Status of the remote control

Blinking fast	communication with the X-ray system is interrupted
Lighting up while pressing any button	battery charge level is low

Table 2: Status of the remote control when it is in the charging stand

Blinking slow	battery charging is ongoing
Off	battery is fully charged

Tube head display

The tube head display can be used to control X-ray exposure and position parameters. It displays the system status.

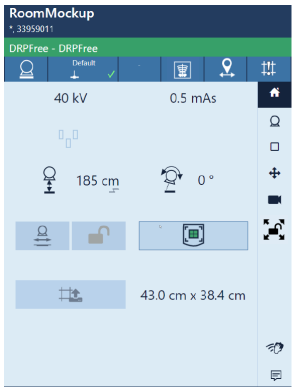


Figure 6: Example of the tube head display

Related information

Software Console and Tube Head Display on page 108

MUSICA Acquisition Workstation (NX)

The MUSICA Acquisition workstation is used to define patient information, select exposures and process images.

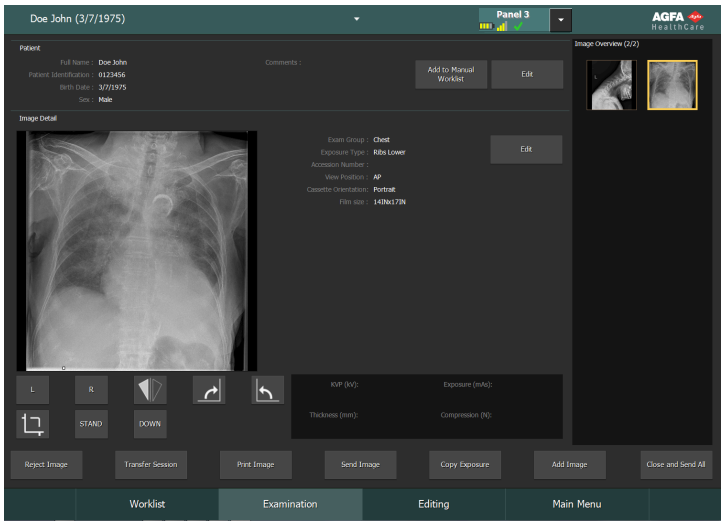


Figure 7: MUSICA Acquisition workstation software

The operation of the workstation application is described in the MUSICA Acquisition Workstation User Manual, document 4420.

The software is further referred to as "NX" and the PC on which it runs the "NX workstation".

Software Console

The Software Console is available to support X-ray exposure and position parameter control on the MUSICA Acquisition Workstation. It is displayed on the MUSICA Acquisition Workstation next to the NX application.

The Software Console is used to control the X-ray exposure settings.

The Software Console is used to adapt the parameters for automatic positioning.

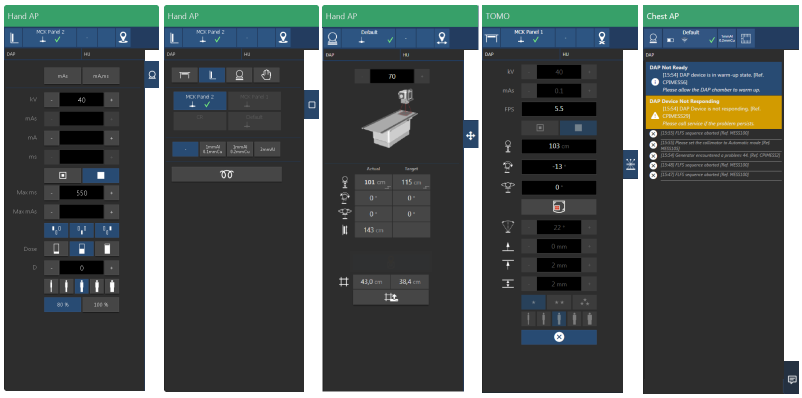


Figure 8: Software console controls for generator, X-ray modality, positioner, tomosynthesis and system messages

The Software Console contains the DR Detector Switch.

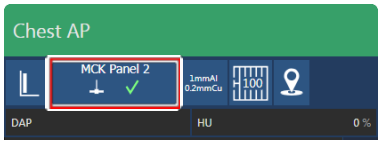


Figure 9: DR Detector Switch

Related information

Software Console and Tube Head Display on page 108

Extra monitor in the examination room

An optional monitor can be installed in the examination room, on which the screen of the MUSICA Acquisition Workstation is displayed. If the collimator is equipped with a camera, the extra monitor can be used to display the live camera image while positioning the patient.

Warning: Do not put extra weight on the arm that supports the monitor. Do not apply excessive force when repositioning the monitor. The load could break the material and the monitor may fall and cause an injury.

When repositioning the monitor, beware of the cable routing and make sure that no pinching or clamping by the arm occcurs.

The monitor has a touchscreen to interact with the MUSICA Acquisition Workstation. Take care not to cause erronous inputs when cleaning the monitor!

In case the optional monitor is not working, use the monitor of the MUSICA Acquisition Workstation.

DR Detector Switch

The DR Detector Switch shows which DR Detector is active and shows its status. The DR Detector Switch can be used to activate another DR Detector. The DR Detector Switch can be switched to CR, depending on the configuration.

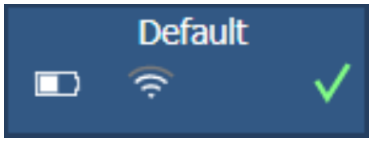


Figure 10: DR Detector Switch

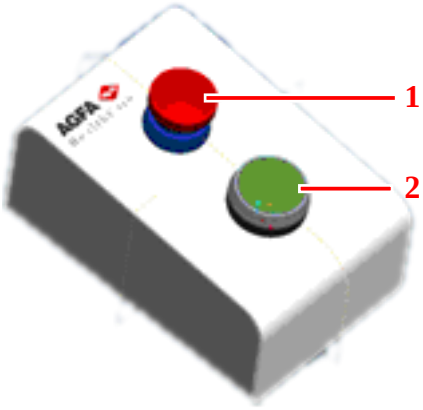
Related information

DR detector status on page 146
Header of the tube head display on page 111
Header of the software console on page 110
X-ray modality screen on page 114

Automatic positioning button

Press and hold the automatic positioning button to activate the automatic movement towards an automatic position or a center position.

The automatic positioning button is available in the operator room and in the examination room.



1. Emergency stop button
2. Automatic positioning button

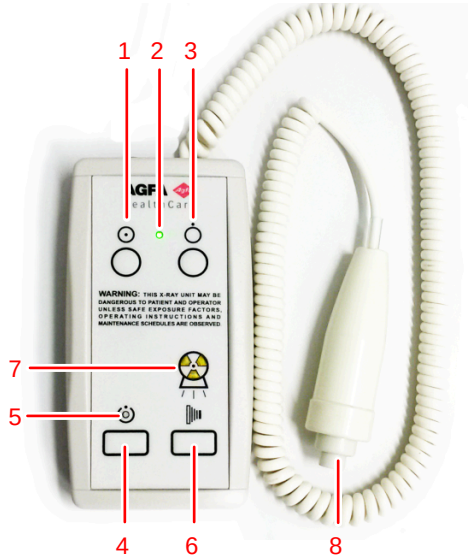
Figure 11: Automatic positioning button

Related information

Controls for positioning on page 130

X-ray generator mini console (Spellman)

The X-ray generator mini console is available in the operator room.



1. Power ON button
2. Power ON indicator
3. Power OFF button
4. Press and hold to prepare for exposure
5. Prepare ready indicator
6. Press and hold to start the exposure
7. Radiation indicator
8. Exposure button

Figure 12: X-ray generator mini console

Related information

Starting and stopping the generator on page 246
X-ray generator messages and warning signals (Spellman) on page 248

Exposure button

Preparing for exposure

Press the exposure button down to the first pressure point and hold it for approximately 0.5 s to 2 s.

The X-ray tube is prepared for performing an exposure.

Caution: Wear of X-ray tube due to prolonged preparing of the X-ray tube.

Starting the exposure

Before starting the exposure:

1. Check if the exposure settings displayed on the console are suitable for the exposure.
2. Check the Ready for Exposure status.

Press the exposure button down fully and keep it pressed until the exposure has ended.

The radiation indicator on the control console lights up and a signal sounds to indicate the exposure.

Caution: Releasing the exposure button ends the exposure immediately and the image can be underexposed.

Automatic collimator

The collimator sets the exposure field and displays it by means of a light field.

The collimator provides X-ray filtering using the integrated filters or by inserting a filter in the rails.

An integrated DAP meter (Dose Area Product Meter) in the collimator is available as an option.

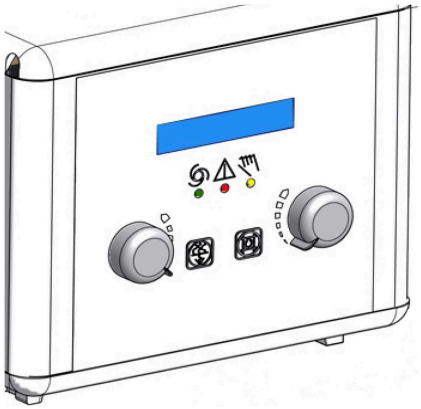


Figure 13: Collimator

Related information

Automatic Collimator on page 179
Automatic collimator technical data on page 286
Bucky for large format DR only, with optional battery charger for XD/XF detectors on page 209
Bucky for all formats CR and DR, with optional battery charger for DR 14s detector on page 225

Collimator camera

The collimator can be equipped with a camera to visualize the anatomical region of interest.

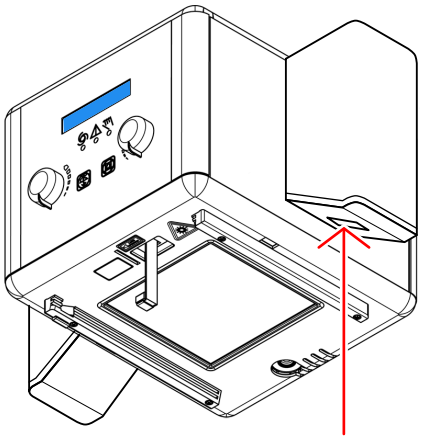
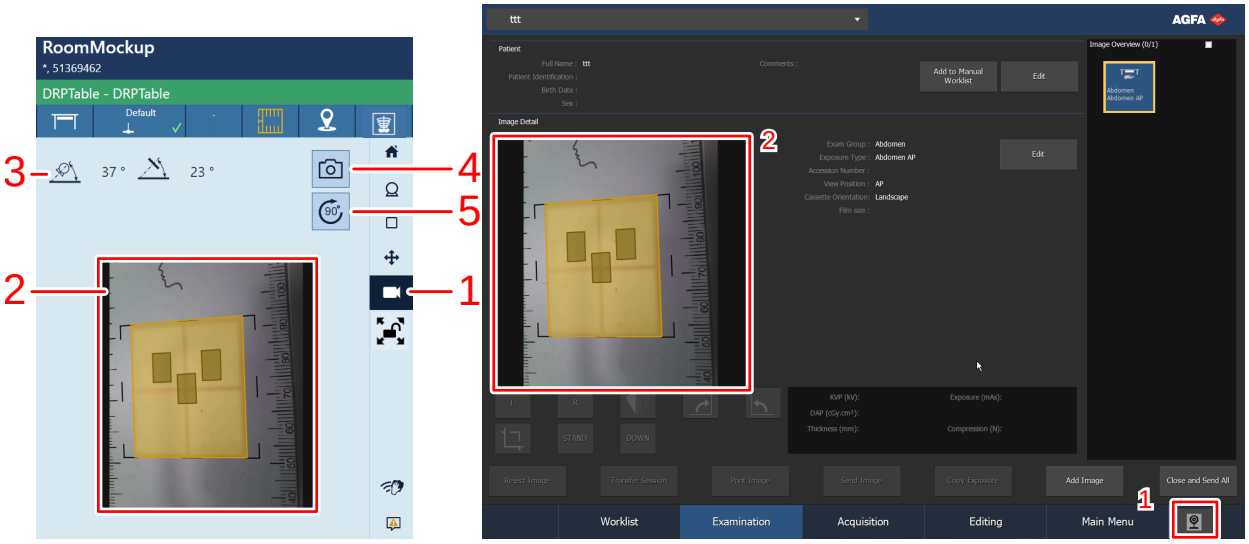


Figure 14: 3D depth sensing and visual image camera mounted on the collimator

The live camera image is visible on the tube head display or on the MUSICA Acquisition Workstation in the **Examination** window, the **Acquisition** window and the **Editing** window.

The camera combines visual images with 3D depth sensing. This data is used to accomplish following workflow automations:

- visualize the position of the collimation area and the AEC fields in the live camera image
- provide guidance for dose adaptation by monitoring the patient size
- store a photograph as a means to identify the patient or as a reference to the patient's position during the exposure



1. Camera button
2. Live camera image
3. DR detector and X-ray tube head alignment
4. Take a photograph
5. Rotate the live camera image

Figure 15: Live camera image on the tube head display and on the NX workstation

Related information

Live camera image and preview of collimation and AEC fields on page 122
Dose adaptation guidance on page 153

Portable DR detector

When performing an exposure, keep in mind the following detector orientation aids:

Table 3: Orientation aids

	Tube side icon, indicating the side that faces the X-ray tube
	Patient orientation marker, filled rectangle printed at the corner of the detector, for consistent orientation relative to the patient

For an overview of the operation controls of the DR detector, refer to the user manual of the DR detector.

The DR detector may come in contact with the patient.

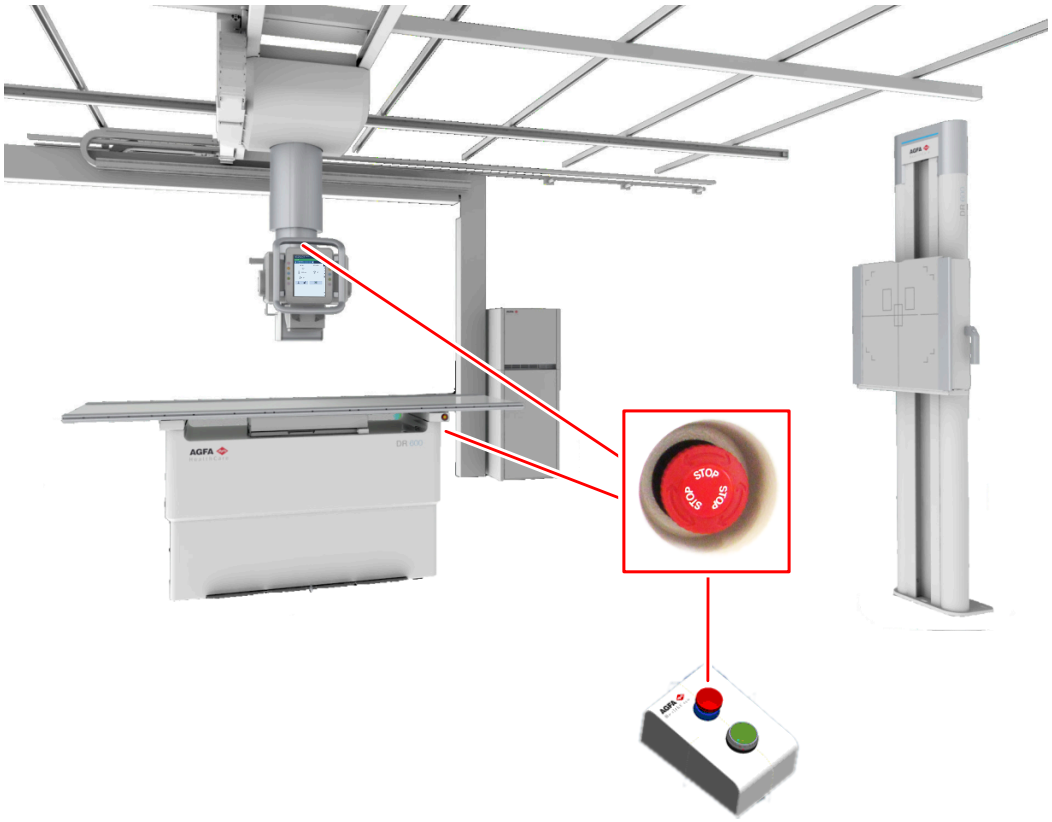
Note DR detectors that operate wireless contain an RF transmitter. For detailed information, refer to the DR detector user manual.

Related information

Bucky for large format DR only, with optional battery charger for XD/XF detectors on page 209
Bucky for all formats CR and DR, with optional battery charger for DR 14s detector on page 225

Emergency stop button

If a system malfunction causes an emergency situation involving the patient, operating personnel or any system component, activate the emergency stop button.



- On the front side of the radiographic table (right)
- On the rear side of the radiographic table (left)
- On the top side of the X-ray tube cover
- Close to the radiographic wall stand
- In the operator room

Figure 16: Multiple emergency stop buttons are available on the system

All motor driven movements will be stopped. Motor driven movements:

- Radiographic table
- Radiographic wall stand
- Ceiling suspension

To allow motorized movements again, turn the cap of the emergency switch in clockwise direction (default position) and restart the system using the X-ray generator mini console.

Caution: The emergency stop button does not switch off the voltage in the X-ray system.

Emergency shutdown power switch

Use the emergency shutdown power switch, if a dangerous situation cannot be eliminated by pressing the emergency stop button.

Warning: Use the emergency shutdown power switch in case of danger to patients, operators, third parties, or one of the units. The entire system will be shut down and the power supply will be disconnected.

The emergency shutdown power switch for the room is typically located on the wall and easy to access, often close to the power off switch of the X-ray system. It is installed and labeled by customer.

Warning: It must be ensured that the emergency switches are always freely accessible.

Power off behaviour

After the system is stopped or if the emergency button is activated, this is the behaviour of the system:

Warning: The brakes for longitudinal and transversal movement of the tabletop are released. The tabletop can move freely in longitudinal and transversal direction when minimal force is applied. If the patient is still on the radiographic table, he may need help to step down from the table.

Warning: The brakes of the ceiling suspension movement are activated. If the ceiling suspension makes it impossible for the patient to step down from the table, the ceiling suspension can be moved when sufficient force is applied.

Moving the ceiling suspension when the power is off, can cause damage to the equipment.

Installation

Installation and configuration is performed by an Agfa trained and authorized service engineer. Contact your local support organization for more information.

On a configuration with multiple DR detectors of the same type, it is required to apply labeling to the DR detector containing a unique nickname for each DR detector. The nicknames must be configured on the MUSICA Acquisition Workstation. The **DR Detector Switch** shows which DR detector is active and shows its status, by means of the nickname of the DR detector.

An identical label is attached to the bucky of the X-ray system to identify the dedicated workspace of each DR detector.

- HF-emission and immunity on page 41

HF-emission and immunity

The HF-emission and immunity can be influenced by connected data cables depending on length and the manner of installation.

A specific installation environment may require special measures to put the system into operation according to the remarks for HF-emission and immunity.

Related information

Remarks for HF-emission and immunity on page 295

Radiation Protection

X-ray radiation can cause serious damage to the health, therefore observe great care and ensure that protection against X-ray exposure is always applied.

Some of the effects of X-ray radiation are cumulative and may extend over a period of time. Therefore the X-ray operator should avoid exposure by X-ray radiation at all times.

Objects in the path of the X-ray beam may produce scattered radiation. The intensity depends on the energy and intensity of the X-ray exposure, the material of the object and the distance to the object producing scattered radiation. Protective measures have to be taken to prevent exposure through scattered radiation.

Protective measures include:

- structural configuration of the X-ray room (e.g. lead shielded rooms)
- radiation protection for the operators (e.g. personal radiation dosimeters, lead aprons, radiation protection glasses, mobile lead screens, keep maximum distance from X-ray source and from the object producing scattered radiation, regular training, etc.)
- protection of patients against unnecessary radiation (e.g. limitation of X-ray field by collimation, lead shielding, lead aprons, etc.)

- Monitoring of Personnel on page 43
- Protected area and significant zones of occupancy on page 44
- Skin dose levels according to IEC 60601-2-54 on page 51
- Ongoing quality control in digital radiography on page 52

Monitoring of Personnel

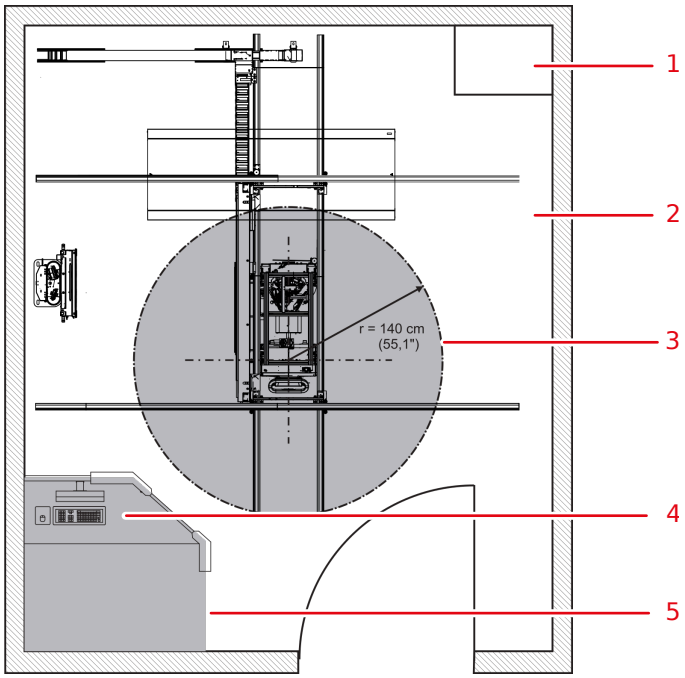
The monitoring checks the amount of X-ray radiation the personnel has been exposed to. It determines safety of the operators and it helps checking if safety measures of the X-ray environment are adequate. Inadequate or improper protection can lead to serious damage to the health.

To measure radiation, personal radiation dosimeters are typically used. They are worn on the body at all times during working in an environment where X-ray radiation is applied. They provide an indication for the amount of radiation the operator was exposed to.

Protected area and significant zones of occupancy

If the operator or staff does not need to be close to the patient during the exposure, the operator and staff use the protected area to control the following functions:

- selection of mode of operation
- selection of exposure settings (X-ray loading factors)
- actuation of the exposure button
- other necessary controls for the operator during exposure



1. X-ray generator
2. X-ray room
3. Patient environment
4. Workstation
5. Operator room: protected area

Figure 17: Protected area and significant zones of occupancy

Warning: The patient must wear appropriate radiation protection garments.

The position of the patient environment depends on the position of the X-ray tube.

Related information

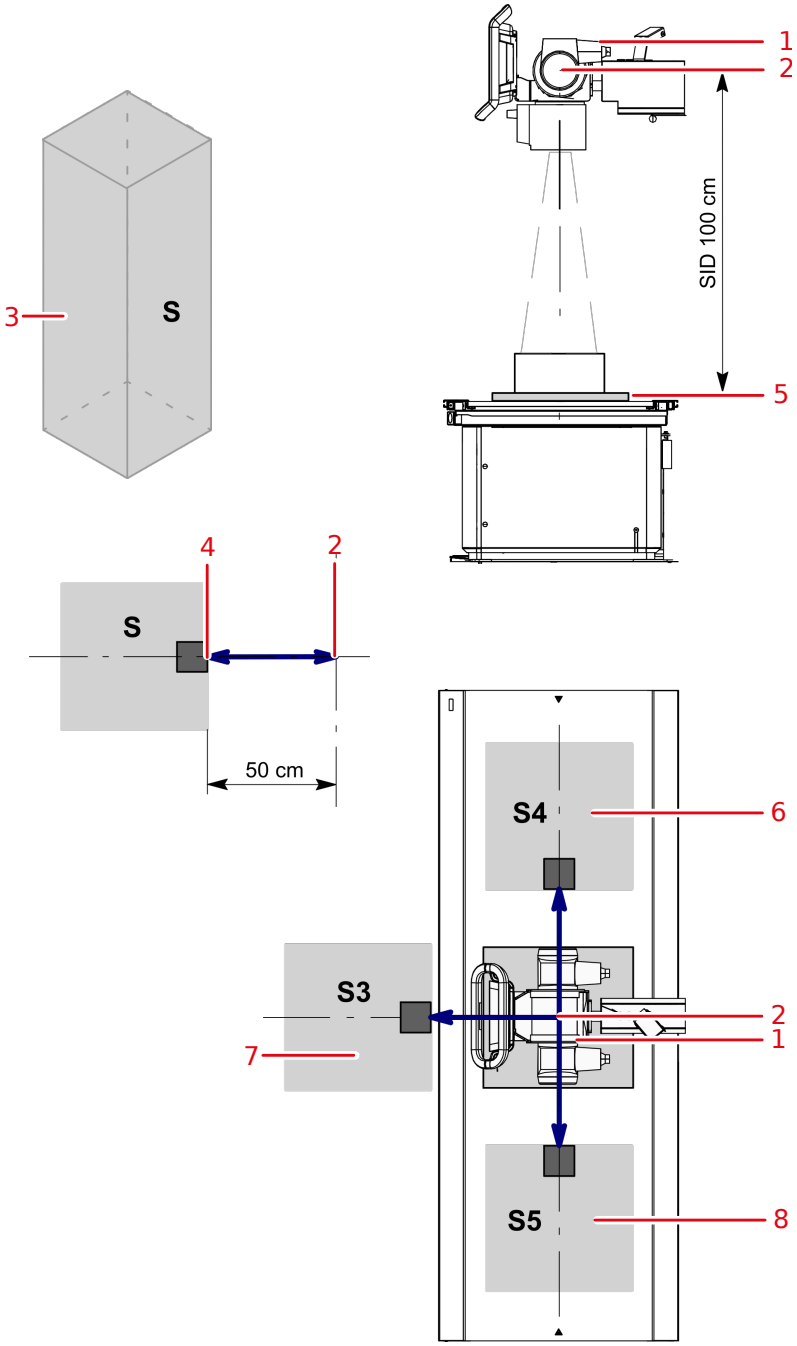
Radiation Protection on page 42

Significant zones of occupancy at the radiographic table

If operator or staff needs to be close to the patient during normal use (e.g. some pediatric examinations or types of examinations for which the patient requires assistance), the significant zone of occupancy applies for operator and staff.

Keep maximum distance from the X-ray source and from the object producing scattered radiation. The intensity of scattered radiation depends on the energy and intensity of the X-ray exposure, the material of the object and the distance to the object.

Warning: The patient and the operator must wear appropriate radiation protection garments.



1. X-ray tube
2. Focal spot label [—]
3. Significant zone of occupancy.

   Minimum area 60x60 cm.

   Minimum height above the floor 200 cm.
4. Dose meter
5. DR Detector or cassette
6. S4: Significant zone of occupancy at the left side of the radiographic table
7. S3: Significant zone of occupancy in front of the radiographic table
8. S5: Significant zone of occupancy at the right side of the radiographic table

Figure 18: Significant zones of occupancy at the radiographic table

Related information

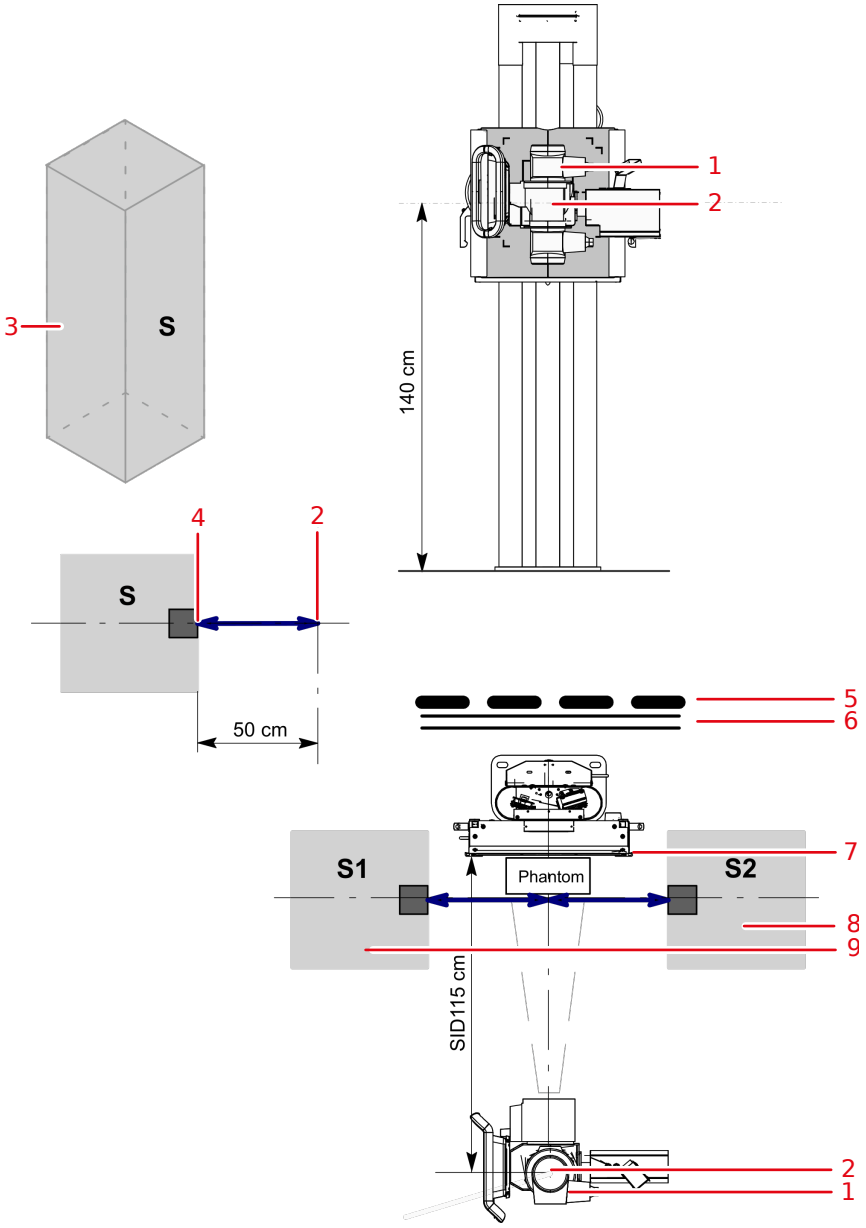
Radiation Protection on page 42
Scattered radiation (general radiography) on page 47

Significant zones of occupancy at the radiographic wall stand

If operator or staff needs to be close to the patient during normal use (e.g. some pediatric examinations or types of examinations for which the patient requires assistance), the significant zone of occupancy applies for operator and staff.

Keep maximum distance from the X-ray source and from the object producing scattered radiation. The intensity of scattered radiation depends on the energy and intensity of the X-ray exposure, the material of the object and the distance to the object.

Warning: The patient and the operator must wear appropriate radiation protection garments.



1. X-ray tube
2. Focal spot label [—]

3. Significant zone of occupancy.

   Minimum area 60x60 cm.

   Minimum height above the floor 200 cm.
4. Dose meter
5. Protective device
6. Wall
7. DR Detector or cassette
8. S2: Significant zone of occupancy at the right side of the radiographic wall stand
9. S1: Significant zone of occupancy at the left side of the radiographic wall stand

Figure 19: Significant zones of occupancy at the radiographic wall stand

Caution: The radiation protection has to be applied for the patient and for the operator.

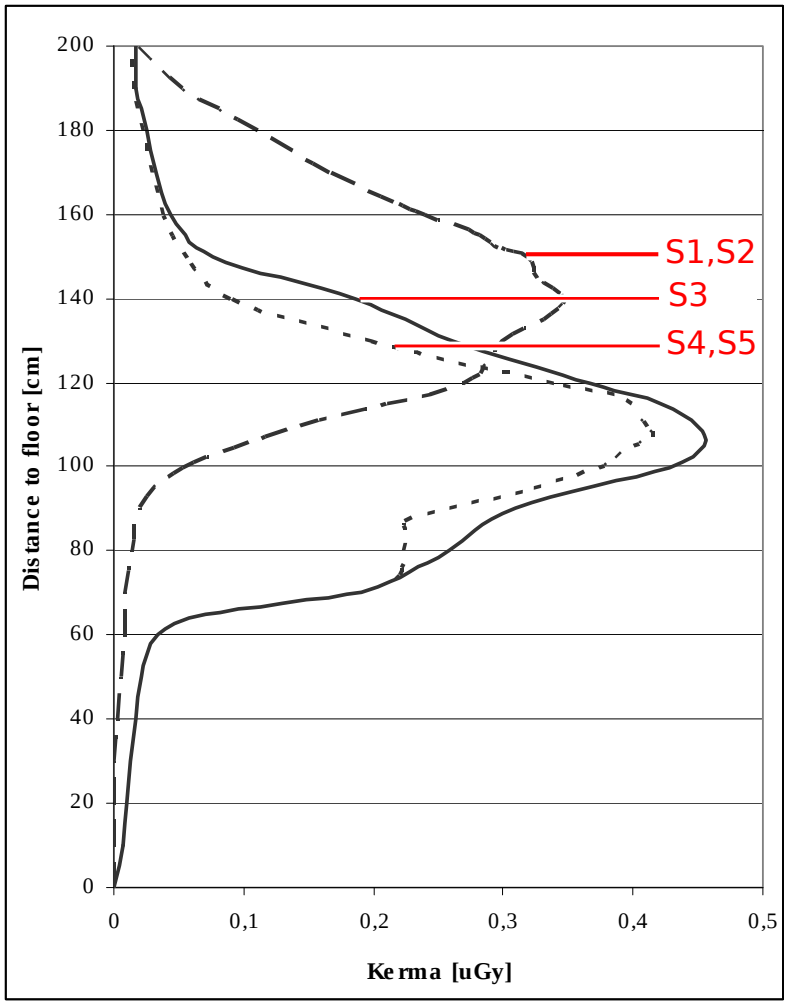
Related information

Radiation Protection on page 42
Scattered radiation (general radiography) on page 47

Scattered radiation (general radiography)

The diagram represents the amount of stray radiation that is measured in the significant zone of occupancy.

1. Vertical axis representing the operator positioned in the significant zone of occupation and height range of stray radiation measurement (0 cm - 200 cm)
2. Horizontal axis indicating the stray radiation in mGy measured at a specific height



- S1: Significant zone of occupancy at the left side of the radiographic wall stand
- S2: Significant zone of occupancy at the right side of the radiographic wall stand
- S3: Significant zone of occupancy in front of the radiographic table
- S4: Significant zone of occupancy at the left side of the radiographic table
- S5: Significant zone of occupancy at the right side of the radiographic table

Figure 20: Measurement of scattered radiation in zones of occupancy (Sx)

Table 4: Conditions for measuring stray radiation values represented in the illustrations

Workflow	General radiography
SID	100 cm (radiographic table) 110cm (radiographic wall stand)
Table height	70 cm
Wall stand position (distance between center of the bucky and the floor)	140 cm
Exposure parameters	100 kV

Total exposure time	For the diagram above a maximum throughput of 30 exposures/hour was used. This complies with a throughput of 15 patients/hour with typically 2 exposures done per patient. The measurement results in the figure above refer to one exposure.

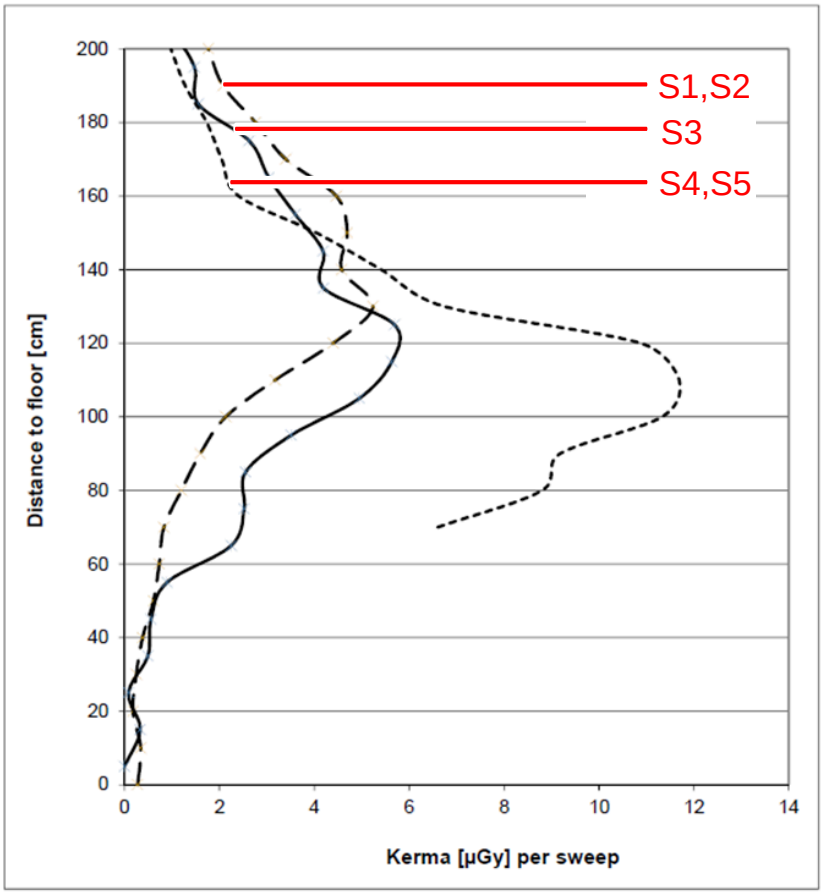
Related information

Significant zones of occupancy at the radiographic table on page 44
Significant zones of occupancy at the radiographic wall stand on page 46

Scattered radiation (digital tomosynthesis)

The diagram represents the amount of stray radiation that is measured in the significant zone of occupancy.

1. Vertical axis representing the operator positioned in the significant zone of occupation and height range of stray radiation measurement (0 cm - 200 cm)
2. Horizontal axis indicating the stray radiation in mGy measured at a specific height



- S1: Significant zone of occupancy at the left side of the radiographic wall stand
- S2: Significant zone of occupancy at the right side of the radiographic wall stand
- S3: Significant zone of occupancy in front of the radiographic table
- S4: Significant zone of occupancy at the left side of the radiographic table
- S5: Significant zone of occupancy at the right side of the radiographic table

Figure 21: Measurement of scattered radiation in zones of occupancy (Sx)

Table 5: Conditions for measuring stray radiation values represented in the illustrations

Workflow	Digital tomosynthesis
SID	100 cm (radiographic table) 110cm (radiographic wall stand)
Table height	70 cm
Wall stand position (distance between center of the bucky and the floor)	140 cm
Exposure parameters	100 kV
Total exposure time	For the diagram above a maximum throughput of 30 digital tomosynthesis examinations/hour was used with a maximum X-ray source angle of 22° and a large collimation focus. One digital tomosynthesis examination consists of 30 single exposures, which are triggered within a timeframe of 5.2 seconds. This complies with a throughput of 30 patients/hour. The measurement results in the figure above refer to one digital tomosynthesis exposure.

Related information

Significant zones of occupancy at the radiographic table on page 44
Significant zones of occupancy at the radiographic wall stand on page 46

Skin dose levels according to IEC 60601-2-54

Dosimetric information:

Skin dose values have been measured according to IEC 60601-2-54 chapter 203.5.2.4.101. Selected settings: SID: 115cm; Filter 1 mm AL and 0.1mm Cu; Pulse repetition frequency (duration) per DTS 5.2 seconds; Focal spot and angle depends on the body part. Measuring setup includes a dosimeter, which is positioned on top of an empty polymethyl-methacrylate (PMMA) phantom according to IEC 60601-2-54 chapter 203.5.2.4.5.102.

The user documentation of this product contains a set of skin dose value measurements. Refer to document "Exposure Techniques for pediatric and adult use with DR 600".

Ongoing quality control in digital radiography

In the US and depending on state regulations, specific requirements are applicable for radiation control. Refer to the AAPM guideline for appropriate physicist testing on the DR 600. Contact Agfa for more details.

https://www.aapm.org/pubs/reports/detail.asp?docid=130

Labels

Mark	Meaning
CE	This mark shows compliance of the equipment with Regulation 2017/745 (for European Union).
	This mark indicates that this is a Type B Equipment
SN	Serial number
	Manufacturer
	Date of manufacture

Label	Meaning
	Dangerous voltage
	Ionizing radiation
	Pinch Points.
	Risk of stumbling.

Further labels are listed and explained in the relevant modules of the System Documentation.

- Warning labels on the radiographic table on page 55
- Warning labels on the radiographic wall stand on page 56
- Type label on page 57
- DR Detector identification label on page 58
- Labeling of the Tube Head Unit on page 59
- Labeling of the Radiographic Table on page 60
- Labeling of the Radiographic Wall Stand on page 61
- Labeling of the bucky on page 62

Warning labels on the radiographic table

Figure 22: Warning labels on the radiographic table

Warning labels on the radiographic wall stand

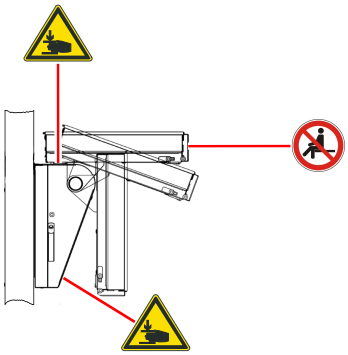
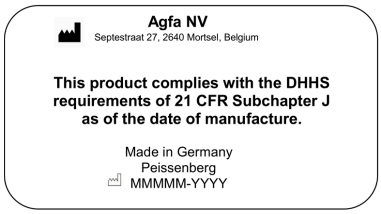


Figure 23: Warning labels on the radiographic wall stand

Type label

Mark	Meaning
 **Figure 24: Example of type label for 5530/100** **Note** The CE sign and safety signs are only valid at time of product release.	Type label on the side of the X-ray generator. The type label information for each combination of X-ray tube and X-ray generator is available in the technical data.
	Type B applied part
	The 21 CFR Subchapter J label is positioned close to the type label.

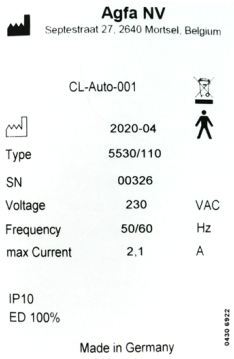
Related information

DR 600 Technical Data on page 277

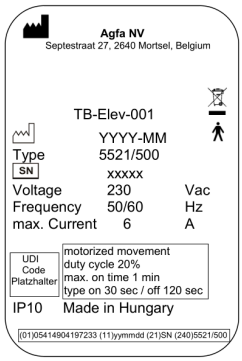
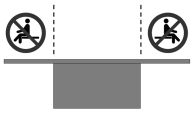
DR Detector identification label

Label	Meaning
	Writable label to identify and dedicate a DR Detector to an X-ray system bucky.

Labeling of the Tube Head Unit

 **Figure 25: Example of label**	Label on the rear side of the ceiling suspension.
	This mark indicates that this is a Type B Equipment
	Pinch point labels are located on the left and on the right side of the X-ray tube head unit, close to the telescopic column.

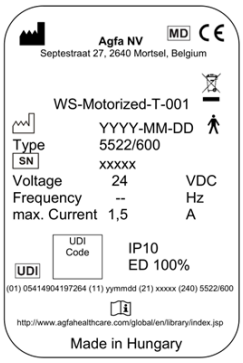
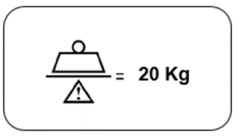
Labeling of the Radiographic Table

 **Figure 26: Example of label**	Label on the right hand side of the upper table cover.
	This mark indicates that this is a Type B Equipment
	Top side according to patient orientation to indicate the orientation of the AEC sensors (optional)
	The patient must not sit on the end of the tabletop, since the weight load can lead to table deformations and damage to the product.

Related information

Warning labels on the radiographic table on page 55
Radiographic Table Technical Data on page 280

Labeling of the Radiographic Wall Stand

 **Figure 27: Example of type label**	Type label on the rear side of the bucky. The type label information for each combination of X-ray tube and X-ray generator is available in the technical data.
	Type B applied part
	Earth (ground)
	The bucky can be tilted to horizontal position. Do not use the bucky as a seat.
	The maximum load for the bucky movement in vertical direction is 20 kg.
	A pinch point label is located on top of the tilting extension. Additional pinch point labels are located at the top and at the bottom of the rail in the Wall Stand column.

Related information

Warning labels on the radiographic wall stand on page 56
Wall Stand Technical Data on page 281

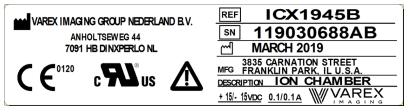
Labeling of the bucky

	Pinch Points. The label is positioned on the lateral cover of the bucky or on the rotating platform.
	Maximum load capacity is 10 kg on the bucky drawer when it is pulled out. Do not lean or sit on the bucky. The label is positioned on the lateral cover of the bucky or on the rotating platform.
	Refer to instruction manual/booklet. The label is positioned on the lateral cover of the bucky or on the rotating platform.

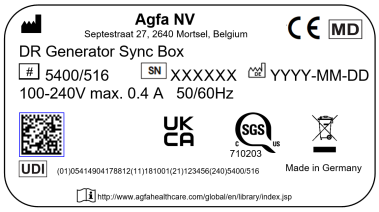
Related information

Bucky Unit Technical Data on page 284

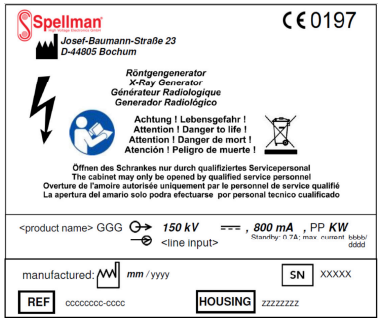
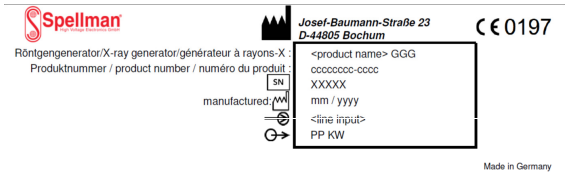
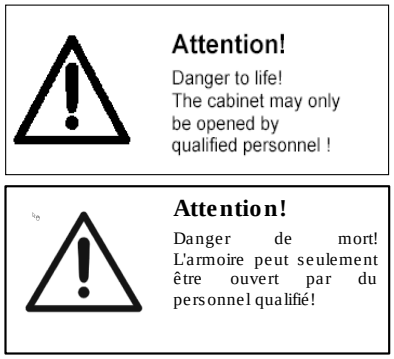
Labeling of the Automatic Exposure Control (AEC)

 **Figure 28: Example of type label**	The type label is located on the AEC ionization chamber. The label is not visible without disassembling the component.

Labeling of the DR Generator Sync Box

 **Figure 29: Example of type label**	The type label is located on the DR Generator Sync Box
	Earth (ground)
	Equipotential connector: Provides a connection between the equipment and the potential bus bar of the electrical system as found in medical environments. It is recommended to use the equipotential connection as additional safety measure.

Labeling of the X-ray generator (Spellman)

 **Figure 30: Example of type label**	Type label positioned on the left side of the X-ray generator cabinet. Generator type and rating: the type label information for each X-ray generator model is available in the technical data.
Bitte Lüftungsschlitze freihalten. Please keep free the venting slots. Attention, laisser les trous d´aération libres.	Instruction label for keeping free the venting slots, on the top side of the X-ray generator cabinet.
Fuses inside of the generator All fuse types and ratings are listed in chapter **8.3.2 Fuse Tables** of the technical manual 06220010 Fuses may be only replaced with fuses of identical ratings.	Instruction label for replacing fuses, inside the X-ray generator cabinet.
	Prohibition sign for dropping fluids, on the top side of the X-ray generator cabinet.
	Label with electrical data, inside the X-ray generator cabinet on the right side behind the upper electronic rack.
	Label identifying the high voltage generator, inside the X-ray generator cabinet, on the front side of the high voltage generator.
	Label with warning for high voltage, on the front side of each generator.

External voltages may exist with main power off. P21 System On Lockout ALL sources before servicing ! P23 Prep. Exposure	Label inside the X-ray generator cabinet, at the rear side.
	Moving parts
	Dangerous voltage
	Certification mark

Labeling of the X-ray generator mini console

	If the system has just been stopped, wait at least 10 seconds before starting it again.

Labeling of the Remote Control

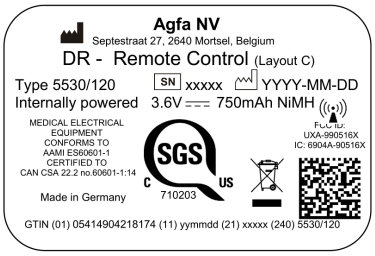


Figure 31: Example of label

The label is located on the bottom side of the remote control.

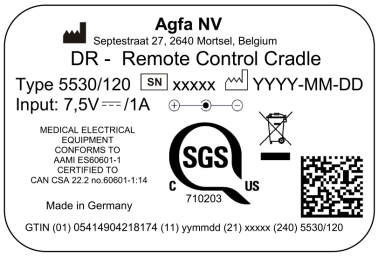


Figure 32: Example of label for the remote control charging stand

The label is located on the bottom side of the remote control charging stand.

Cleaning and Disinfecting

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

Cleaning

To clean the exterior of the equipment:

1. Stop the system

   Warning: When the equipment is going to be cleaned, be sure to turn off the main power of the system. Never use anhydrous or high solvency alcohols, benzine, thinner or any other flammable cleaning agent. Otherwise, it may result in fire or electric shock.
2. Wipe the exterior of the system with a cloth slightly moistened with a neutral detergent.

   Caution: Make sure no liquid gets in the device.

   Caution: Clean the equipment with only a little moisture. Do not spray disinfectants or detergents directly on the equipment. Do not pour liquid directly on the equipment.

   Caution:

   Do not use solvents such as anhydrous or high solvency alcohols, thinner or benzine. Do not use any corrosive, dissolving or abrasive cleaning or polishing detergents.

   Doing so may damage the surface of the equipment. Using unsuitable cleaning agents or methods can damage the property when surface becomes dull and brittle (e.g. by using alcohol-containing agents).

   Note Do not open the equipment for cleaning. No components inside the device require cleaning by the user.
3. Start up the system.

Related information

Stopping the System on page 105
Starting the System on page 83
Moving the system to cleaning position on page 141

Cleaning the tube head unit during operation

To clean the tube head unit during operation

1. Press and hold the cleaning button for 2 seconds.

Figure 33: Cleaning button

A black screen hides the screen and shows a number counting down. The tube head display and the touch sensitive handle is disabled.
2. Clean the display.
   The operation is not affected.
3. The display and the touch sensitive handle can be used again after the countdown has finished.

Disinfecting

Warning: To disinfect the device, use only disinfectants and disinfection methods that are approved by Agfa and that correspond to the national regulation and guidelines as well as explosion protection.

If you plan to use other disinfectants, approval of Agfa is needed before use, as most disinfectants can damage the device. UV disinfection is also not allowed.

Perform the procedure following the instructions for use, the disposal instructions and the safety instructions of the selected disinfectants and tools and of the hospital.

Items contaminated with blood or body fluids, which may contain blood-borne pathogens, should be cleaned and then receive intermediate level disinfection with a product having an EPA-registered claim for activity against hepatitis B.

Disinfecting safety directions

Warning: Using a disinfectant that can form an explosive or flammable gas mixtures is hazard to life and health because of explosion risk. Switch the equipment off before disinfecting. Allow the gas mixture to evaporate before switching the x-ray system back on.

Caution: Using unsuitable disinfectants can cause discoloration and damage of the surface of the equipment. If a functional degradation or malfunctioning of the product is noticed due to disinfection, contact the medical device manufacturer.

To disinfect the device:

- Do not use any corrosive, soluble or gaseous disinfectants.
- Consult the manufacturer's Material Safety Data Sheets (MSDS) and recommendations on the product label for additional information prior to use.
- Use of spray disinfection can cause malfunctions due to ingress of the disinfectant into the equipment. Disinfect all parts of the unit, including the accessories and connection cables by just wiping them. Switch off the system and cover the cooled system carefully before performing a room disinfection using nebuliser.

Approved disinfectants

Refer to the Agfa website for specifications on the disinfectants that have been found compatible with the cover material of the device and can be used on the outer surface of the device.

https://www.agfa.com/he/global/en/internet/library/overview.jsp?ID=41651138

Maintenance

Complete maintenance schedules are available in the Agfa service documentation for consultation by an Agfa trained and authorized service engineer.

Maintenance of the DR Detector

The DR Detector requires regular calibration. Calibration instructions are described in the DR Detector Calibration Key User Manual (doc 0134).

- Maintenance of the radiographic table, radiographic wall stand and X-Ray Tube Head Unit on page 74

Maintenance of the radiographic table, radiographic wall stand and X-Ray Tube Head Unit

The X-ray unit and all components require regular maintenance to ensure the equipment is safe and reliable for operation.

Warning: Operation in unsafe condition includes the risk of radiological exposure and injury of the patient and/or the operator. The customer is responsible to ensure the fault-free condition of the equipment.

Warning: Wear of equipment due to excessively long intervals between service may lead to personal injury and property damage due to worn and unsafe parts.

Warning: Incorrect or defective spare parts may adversely affect the safety of the system and lead to damages, malfunctions or total failure. Use only original spare parts provided by the manufacturer.

Warning: Improper changes, additions, maintenance or repair of the equipment or the software can lead to personal injury, electrical shock and damage to the equipment. Safety is only guaranteed when changes, additions, maintenance or repairs are carried out by an Agfa certified field service engineer. A non certified engineer performing a modification or service intervention on a medical device, acts on his own responsibility and makes the warranty void.

Table 6: Lifetime and maintenance

Lifetime	
Expected lifetime for the X-ray unit	10 years
Periodic maintenance	
The equipment shall have a technical maintenance to maintain fault-free operation and ensure safety for patient and operator.	Every 12 months or after 75.000 cycles, whatever comes first
All steel cables of X-ray tube head unit and radiographic wall stand shall be checked	
All steel cables of radiographic wall stand shall be exchanged to maintain fault-free operation and ensure safety for patient and operator	Every 36 months
Replacing the coin cell battery of the X-ray generator	
Perform electrical safety testing according to IEC 62353	

The balancer shall be exchanged.	Every 5 years or after 375.000 cycles, whatever comes first
Maintenance by the user	
Check constant smooth movements	Daily
Check ease of movements	Daily
Check secure release and locking of brakes	Daily
Check functioning of operating controls	Daily
Check markers and warning signs	Daily
Warm-up of X-ray tube	Daily
Check all electric cables and connections for damage or broken cables.	Weekly
Conditioning of the X-ray tube	After the X-ray tube has not been used for more than a week
Conditioning of the X-ray tube	Before making exposures using voltages of 120 kV or higher

Caution: In case of functional defects or other deviations from normal operation behavior the unit has to be switched off immediately and the service to be informed. The equipment must only be put back into operation when the fault has been repaired.

Warming-up of X-ray tube

The X-ray tube needs to be warmed-up before making X-ray exposures at the start of each day and when the X-ray tube has not been in use for more than an hour. This extends the X-ray tube lifetime.

To warm-up the X-ray tube

1. Close the collimator blades fully
2. Set exposure settings: 70 kV, 100 mAs, 200 mA, 500 ms and large focus
3. Ensure that no one will be exposed
4. Make a total of three exposures, 15 seconds apart

This procedure is used for a typical X-ray tube. Consult the X-ray tube manufacturer instructions for the actual X-ray tube in use and comply with the instructions if there is conflict with this procedure.

Related information

Automated workflow for daily warming-up of X-ray tube on page 143

Conditioning procedure for the X-ray tube

If the X-ray tube has not been used for more than a week or if exposure techniques are to be used with energies above 120 kV, it is recommended to perform the conditioning procedure for the X-ray tube.

A sequence of gradually increasing loads on the X-ray tube will cause a redistribution of the electrical charges inside the tube, which in turn will result in a stable output of the tube.

The procedure takes approximately 30 minutes.

1. On the software console, select the manual modality positon.
   No image will be acquired on the NX workstation.

2. Select the three point radiographic working mode.

3. Set the radiographic parameters to 125 mA (current) and 100 ms (exposure time).
4. Select the large focal spot.

5. Take a sequence of exposures with the following kV values. Take one exposure per 30 seconds.

Table 7: Sequence of exposures

Time (minutes)	kV	Time (minutes)	kV	Time (minutes)	kV
0.0	50	4.0	90	8.0	130
0.5	50	4.5	90	8.5	130
1.0	60	5.0	100	9.0	140
1.5	60	5.5	100	9.5	140
2.0	70	6.0	110	10.0	150
2.5	70	6.5	110	10.5	150
3.0	80	7.0	120		
3.5	80	7.5	120		

Safety Directions

General Safety Directions

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

Warning: The product must only be installed using released components and in released configurations.

Warning: To avoid risk of electric shock, this equipment must only be connected to a supply mains with protective earth.

Warning: Ionizing radiation can lead to radiation injuries if handled incorrectly. When radiation is applied, the required protective measures must be complied with.

Warning: The operator must take precautions to protect himself against dangerous X-ray exposure when using the DR detector in the X-ray beam path of an X-ray source.

Warning: The DR Detector is not intended to be used as a primary barrier to X-rays. The user is responsible for ensuring the safety of the operator, bystanders, and the subjects being radiographed.

Warning: Operating the equipment when it is faulty includes the risk of radiological exposure and injury to the patient and to the operator. Operate the equipment only in safe and fault-free conditions.

Warning: System unavailability due to hardware or software failure. If the product is used in critical clinical workflows, a backup system has to be foreseen.

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

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

Safety Directions for the X-Ray System

Warning: Avoid unnecessary dose by checking the workstation selection on the X-ray generator console before exposing.

Warning: Repeated exposures to a patient with high doses can lead to deterministic effects. Therefore exposure settings shall be selected carefully and in accordance to the patient and the object to expose and balanced in such a way that patient dose is as low as possible while image quality is usable for diagnosis.

Warning: Even if the generator is switched off, parts on the inside of the generator cabinet and connected controls are still powered! Ensure that only trained service personnel open the generator cabinet and the housing of connected devices! Improper handling may cause a lethal hazard!

Caution: Avoid unnecessary dose by checking before exposure if the DR Detector Switch displays the name of the DR Detector that is being used and if the status of the DR Detector is ready for exposure.

Caution: When operating the DR detector, the calculated exposure time (ms) or manual overrides should never exceed the maximum exposure time (Max ms) specified as integration time of the DR detector.

Warning: Damaged grid. Reduced image quality. Please handle the grids with special care.

Warning: When inserting the anti-scatter grids, it is essential that the grid corresponds to the intended source-image-distance (SID) to which the grid is focussed. Because of the focussing of the grids, the tube head unit must be centered onto the bucky.

Caution: Excessive ambient temperature may impact performance of DR Detectors and cause permanent damage to the equipment. Refer to the related user manual for environmental conditions for the DR detector. If ambient temperature and humidity is outside the specified range, do not operate the system or use air conditioning. Frost due to low temperatures can damage internal circuits. Warranty will be void if it is obvious that operating conditions are not met.

Caution: To avoid images being lost due to a power failure, the workstation and the Digitizer have to be connected to uninterruptable power supply (UPS) or an institutional standby generator. In case of a power failure, the UPS will allow to finalize exposed images that are being scanned.

Caution: Install the NX workstation and CR digitizer at a minimum (safe) distance of 2 m from the X-Ray System components or provide a wall or window to separate both systems.

Safety Directions for the radiographic table

Warning: The system is not intended for operation in explosion-prone areas. Such an operation is hazardous to life and health because of explosion risk. Please note the applicable regulations on formation of explosive gas mixtures when cleaning and using in combination with patients.

Warning: Unauthorized manipulation or opening of the equipment housing may lead to personal injuries and to property damage. Take all necessary precautions with respect to the applicable level of safety.

Warning: The system is installed with components that emit radiation or can be triggered to emit radiation. Ionizing radiation can result in radiation damage or injury if not handled properly.

Warning: Portable and mobile HF communication devices may affect medical electrical equipment.

Warning: Using soft covers, sheets, mattresses, etc. may lead to visual image artifacts. If such shall be used, make sure that they are x-ray transparent and do not influence image quality.

Caution: Make sure that the patient hand grips are securely mounted.

Safety Directions for the Ceiling Suspension

DANGER: In case of uncontrolled movement of the ceiling suspension, press the nearest emergency stop button and contact your local service organization.

DANGER: Make sure that no persons or objects are within the movement area of the system where they can collide with moving parts of the system.

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: Make sure that no clothes of the patient or the operator get caught by moving parts of the system.

If the radiographic table is installed in the movement range of the ceiling suspension, make sure that the X-ray tube, collimator or X-ray tube arm do not collide with the tabletop, especially when the X-ray tube moves under the tabletop.

If the radiographic wall stand is installed in the movement range of the ceiling suspension, make sure that the X-ray tube, collimator or X-ray tube arm do not collide with the radiographic wall stand.

Basic Workflow

Starting the System

Allow the DR detector to warm up before the system is used for clinical purposes. The warming-up time starts as soon as the DR detector has been powered on and the MUSICA Acquisition Workstation is running. To check if a warming-up time is required, refer to the DR detector technical data.

For using the fixed DR Detector, the temperature difference between calibration and usage must be within the recommended range of +/-6°C (for a DR Detector with CsI conversion screen) or +/-10°C (for a DR Detector with GOS conversion screen). Check the environmental conditions and observe the warming-up time of the DR Detector.

To start the system:

1. Switch on the electrical room switch.

   Check that neither the emergency shutdown power switch for the system nor any of the emergency stop buttons for the radiographic table is activated.
2. Press the Power ON button on the X-ray generator mini console to switch on the system.
3. Start the MUSICA Acquisition Workstation.

   For detailed information, refer to the MUSICA Acquisition Workstation User Manual, document 4420.

   The NX application and the software console are available on the MUSICA Acquisition Workstation.
4. Switch on the DR Generator Sync Box (if applicable).
5. In a configuration with a wireless DR detector, power on the DR detector:
   a) attach a fully charged battery pack to the DR detector.
   b) turn on the DR detector.
   c) if needed, register the DR detector to the MUSICA Acquisition Workstation.

   For detailed information about starting up the DR detector, refer to the DR Detector User Manual.

Performing an exposure using the DR Detector

Step 1: retrieve the patient info

At the MUSICA Acquisition Workstation:

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

If the workstation is connected to a second monitor that is positioned outside the operator room, make sure that the patient data is not exposed to unauthorized persons.

Step 2: select the exposure

In the operator room:

1. At the NX workstation, select the thumbnail for the exposure in the Image Overview pane of the Examination window.

   The default X-Ray exposure parameters for the selected exposure are sent to the modality and displayed on the Software Console.

   The selected DR Detector is activated.

   The DR Detector Switch shows which DR Detector is active and shows its status.

   - Flashing: starting up
   - Green (constant): ready for exposure

   The radiographic table or wall stand lights up in blue, indicating the selected modality position.

   The default X-Ray system position for the selected exposure is sent to the modality and displayed on the software console and on the tube head display, for automatic positioning of the X-Ray system.
2. To position the X-Ray system automatically, press and hold the **automatic movement** button. The X-Ray system moves to the default position for the selected exposure.

Related information

Automatic positioning on page 136

Step 3: Prepare the exposure

1. In the examination room, position the X-Ray system:

   To position the X-Ray system manually, use the control buttons on the control panel.
2. Position the DR Detector either in the DR bucky or on the radiographic table. The DR Detector Switch shows which DR Detector is active and shows its status.

   When using the bucky, check that the identification labels on the DR Detector and on the bucky match. Do not use a DR Detector that is dedicated to another bucky.
3. Position the patient:
   a) Position the patient.
   b) Check if the X-Ray system position is suitable for the exposure.
   c) Make final adjustments to the position of the X-Ray system using the control buttons on the control panel.
   d) Switch on the light localizer on the collimator. Adapt collimation if required.
   e) Apply radiation protective measures for the patient if needed.

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: Avoid unnecessary dose by always checking the exposed area using the collimator light, by limiting the exposed area using the collimator and lead shielding and by wearing radiation protection garments.

Warning: An inappropriate selection of AEC cells can lead to additional dose to the patient or a retake.

Warning: Liquids ingressing the DR Detector may cause malfunction and contamination.

If there is a chance that the detector comes in contact with liquids (bodily fluids, disinfectants, ...), the DR Detector must be wrapped in a protective plastic bag while performing the examination.

Related information

Positioning the X-Ray Tube on page 170

Step 4: Check the exposure settings

Related information

Generator screen on page 113

On the NX application:

1. Check if the DR Detector Switch displays the name of the DR Detector that's being used
2. If a wrong DR Detector is displayed, select the right DR Detector by clicking the drop down arrow on the DR Detector Switch.
3. Check if the status of the DR Detector is ready for exposure.

On a DR Detector that has a status indicator:

Check if the status of the DR Detector is ready for exposure. If the status is not ready for exposure, the DR Detector cannot be used for making an exposure.

In the operator room at the X-ray generator console:

1. Check if the exposure settings displayed on the console are suitable for the exposure.
2. If other exposure values are required than those defined in the NX exam, use the console to overwrite the default defined exposure settings.

Step 5: execute the exposure

In the operator room:

Press the exposure button to execute the exposure.

Make sure the generator is ready for exposure before you press the exposure button.

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.

Warning: Do not select another thumbnail until the preview image is visible in the active thumbnail.

In the operator room at the NX workstation:

- The image is acquired from the DR detector and displayed in the thumbnail.
- The actual X-Ray exposure parameters are sent back from the generator to the NX workstation and are shown in the Image Detail pane.
- If collimation is applied, the image is automatically cropped at the collimation borders.

Step 6: perform a quality control

At the MUSICA Acquisition Workstation:

1. Select the image on which quality control is to be performed.
2. Prepare the image for diagnosis by using e.g. L/R markers or annotations.
3. If the image is OK, send the image to a hardcopy printer and/or PACS (Picture Archiving and Communication System).

Performing a digital tomosynthesis examination

This workflow is available only on DR systems that support digital tomosynthesis and that have a DR detector capable of dynamic imaging.

The result of a digital tomosynthesis examination is an acquisition sequence and a reconstruction sequence.

The acquisition sequence is a sequence of static images that is acquired during the tomographic movement of the X-ray tube around the center of the region of interest. The images of the acquisition sequence are not of diagnostic quality. The acquisition sequence is the input for calculating the reconstruction sequence.

The reconstruction sequence is a set of slices, representing the 3D volume of the examined body-part within a specified region of interest.

Warning: The presence of metal structures in the exposed area might affect the image quality of the reconstruction sequence.

To perform a digital tomosynthesis examination:

- Step 1: prepare the examination on page 91
- Step 2: position the X-ray system and the patient on page 93
- Step 3: check the exposure settings on page 94
- Step 4: execute the digital tomosynthesis exposure sequence on page 95
- Step 5: perform a quality control on page 97
- Digital tomosynthesis with the patient lying on a stretcher on page 98

Step 1: prepare the examination

1. Insert the dynamic DR detector in the bucky at the radiographic table or at the radiographic wall stand.

   Remove the anti-scatter grid from the bucky. The position of the detector in the bucky must be centered.

2. Add a digital tomosynthesis group to the **Image Overview** pane.

   If a digital tomosynthesis group has already been added based on data from the RIS, this step can be skipped.

   a) In the **Examination** window, click **Add Image**.

   The **Add Image** window appears.

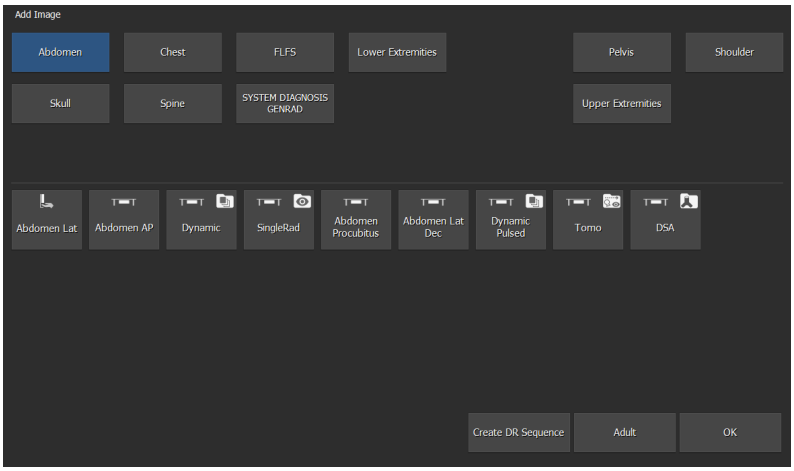


Figure 34: Add Image

   b) Specify the exam group and exam type by clicking on the buttons.

   c) Select an exam type that is configured as a digital tomosynthesis group and click **OK**.

   The digital tomosynthesis group thumbnail is added to the **Image Overview** pane.

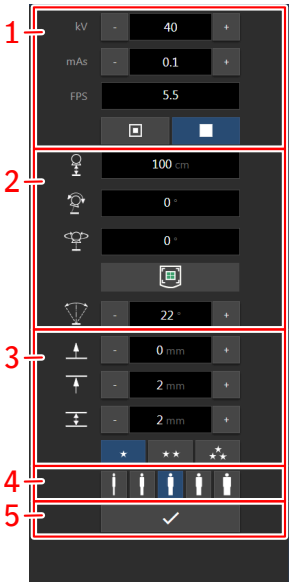
   A digital tomosynthesis group thumbnail is indicated with an icon in the top right corner of the thumbnail.

Figure 35: Thumbnail for a digital tomosynthesis group

3. Select the thumbnail for the digital tomosynthesis group in the **Image Overview** pane of the **Acquisition** window.

   The selected DR detector is activated. The default X-ray exposure parameters and X-ray system position for the selected examination are sent to the modality. The software console displays these settings in the tomosynthesis screen.

   The digital tomosynthesis group contains X-ray modality settings to control the X-ray system movement, the X-ray exposure parameters and the image processing for the reconstruction.



1. Radiographic parameters for acquisition
2. Positioning controls for acquisition
3. Recontruction parameters
4. Dose adaptation for patient size
5. Button to start the digital tomosynthesis workflow

Figure 36: Controls for digital tomosynthesis

Warning: The negative effect of movement on the quality of the reconstruction sequence can be recuded by selecting the narrower X-ray tube sweep angle.

The X-ray tube sweep angle can be set to 15 degrees or 22 degrees. If the bodypart that is examined is likely to move (e.g. by breathing), a narrower sweep angle is recommended, as its workflow has a shorter duration. Below are recommended settings of SID and sweep angle for typical examinations:

Table 8: Recommended settings of SID and sweep angle

	SID	Sweep angle
Chest	150 mm	15 degrees
Hand, foot	115 mm	22 degrees
Knee	115 mm	22 degrees
Pelvis	115 mm	22 degrees

4. Select the appropriate patient size setting.

Warning: Image quality of the reconstruction sequence is low if the dose is not adjusted to the patient size. The mAs setting is used for each exposure in the sequence. Use an appropriate patient size setting to adjust the mAs setting accordingly. The maximum value is 16 mAs.

Related information

Digital tomosynthesis screen on page 117

Step 2: position the X-ray system and the patient

1. Move the X-ray system to the right position.
   a) Check if a correct automatic position is selected.

Figure 37: Positioning controls

   b) Move the X-ray system to the selected automatic position.
   The actual and target position parameters are displayed on the software console. Use the automatic positioning button to move the system to the target position. When the target position is reached, the movement stops.
2. Position the patient.

Warning: Warn the patient that the X-ray tube will perform a sweeping movement during the examination. Give instructions to avoid that the patient looses balance and to avoid injuries in patient hands or fingers.

   Keep the position tracking activated when further adjusting the position.
3. On the collimator, switch on the light localizer. Apply collimation.

Warning: Image artifacts may be visible in the reconstruction sequence if the collimation area is too small. Use a collimation area that is larger than would be required for acquiring a static image.

   After the next step, the collimation controls are disabled.

Related information

Automatic positioning on page 136
Positioning the X-Ray Tube on page 170

Step 3: check the exposure settings

In the operator room at the X-ray generator console:

1. Check if the exposure settings displayed on the console are suitable for the exposure.
2. If other exposure values are required than those defined in the NX exam, use the console to overwrite the default defined exposure settings.

Step 4: execute the digital tomosynthesis exposure sequence

1. In the digital tomosynthesis screen of the software console, click the button to start the digital tomosynthesis workflow.

   If the X-ray system position is not suitable to perform the examination, the button is disabled. Try adjusting the X-ray system to enable the button.

   During the tomosynthesis workflow, restrict operation to the prescribed steps. In particular, do not use the remote control and do not adjust the table height.
2. Press and hold down the automatic positioning button.
   The X-ray tube is moved to the start position of the digital tomosynthesis exposure. The ready for exposure status is indicated.
3. Press and hold down the exposure button to make a digital tomosynthesis acquisition sequence.

   Hold the exposure button pressed until three beeps are heard to indicate that the examination has finished.

   Warning: No reconstruction is possible if the exposure button is released too early.

   Together with the auditory signal, messages are displayed on the software console to indicate that the examination has finished.

   When the exposure button is released before the movement has finished, the exposure sequence is aborted and the reconstruction may fail.

   Warning: Image transmission may be interrupted if the DR detector is reset or moved away from the system. Do not use the DR detector until the thumbnail of the acquisition sequence becomes visible.

   The acquisition sequence is stored and displayed as an acquisition sequence thumbnail in the lower half of the **Image Overview** pane.

   The last image of the sequence is visible in the thumbnail. An acquisition sequence thumbnail is indicated with a white **Play** icon in the center.

Figure 38: Thumbnail of an acquisition sequence for digital tomosynthesis

The image processing to create the reconstruction sequence is started automatically and may take at least a minute.

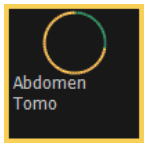


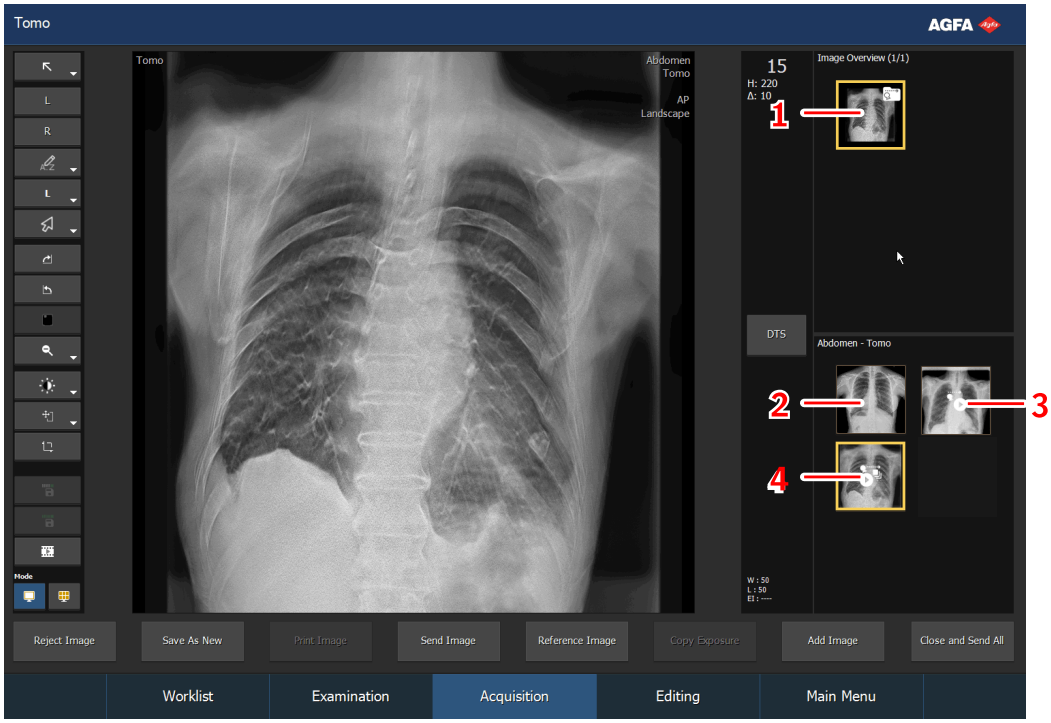
Figure 39: Progress indicator for the image processing to create the reconstruction sequence

The reconstruction sequence is displayed as a reconstruction sequence thumbnail in the lower half of the Image Overview pane.

The middle slice of the sequence is visible in the thumbnail. An acquisition sequence thumbnail is indicated with a white **Play** icon in the center.

Figure 40: Thumbnail of the reconstruction sequence

After the reconstruction sequence becomes available, the Acquisition window looks as follows:



1. Digital tomosynthesis group thumbnail
2. Image thumbnail (if a reference image is acquired)
3. Acquisition sequence
4. Reconstruction sequence

Figure 41: Result of the exposure

After making the digital tomosynthesis exposure, no more static images or digital tomosynthesis sequences can be added to the digital tomosynthesis group.

Related information

Digital tomosynthesis screen on page 117

Step 5: perform a quality control

1. Perform quality control.

   The reconstruction sequence can be viewed in the Acquisition window as a dynamic image. The slices of the reconstruction sequence are the frames of the dynamic image. The first frame is the lowest slice (closest to the tabletop).

   In the dynamic image player, a dynamic image is played that is composed of all slices.

   In the mosaic viewer all slices are displayed as separate images.
2. If all images in the examination are OK, click **Close and Send All**.

   If configured, the static images and reconstruction sequence are sent to the printer and/or PACS archive. The exam is placed in the **Closed Exams** pane.

   Acquisition sequences are not sent to a PACS archive. To archive a selected acquisition sequence, click the **Store Sequence** button before clicking **Close and Send All**.

Related information

Adjusting the reconstruction settings for digital tomosynthesis on page 121

Digital tomosynthesis with the patient lying on a stretcher

The digital tomosynthesis examination can also be performed with the patient lying on a stretcher next to the radiographic table.

The detector must be positioned under the patient. The detector must be positioned horizontally (not tilted) and straight (parallel to the table, not rotated).

Warning: Digital tomosynthesis with an incorrectly positioned detector (tilted or rotated more than 3 degrees) results in bad image quality and potential retake.

Optimze the workflow to obtain optimal positioning of the detector, e.g. by using a stretcher that contains a bucky for inserting the detector in a fixed position or by applying reference marks on the floor for positioning the stretcher.

The X-ray tube head must be positioned at the predefined source-image-distance (SID). Use the measurement tape to confirm the SID before starting the examination.

Warning: Digital tomosynthesis with an incorrect SID (deviation of more than 10 cm) results in bad image quality and potential retake.

Performing an exposure using a CR cassette

Note Using an ID Tablet to identify cassettes before the exposure will break the communication of X-ray parameters between the NX workstation and the X-ray generator console. It is advised to identify cassettes after the exposure, as described in this workflow.

Note Depending on the model of the bucky, CR cassettes are not supported in the bucky.

- Step 1: retrieve the patient info on page 85
- Step 2: select the exposure on page 101
- Step 3: prepare the exposure on page 102
- Step 4: check the exposure settings on page 102
- Step 5: execute the exposure on page 103
- Step 6: repeat steps 2 to 5 for the next subexposures on page 103
- Step 7: digitize the image on page 103
- Step 8: perform a quality control on page 103

Related information

Bucky for large format DR only, with optional battery charger for XD/XF detectors on page 209
Bucky for all formats CR and DR, with optional battery charger for DR 14s detector on page 225

Step 1: retrieve the patient info

At the MUSICA Acquisition Workstation:

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

If the workstation is connected to a second monitor that is positioned outside the operator room, make sure that the patient data is not exposed to unauthorized persons.

Step 2: select the exposure

In the operator room at the NX workstation:

1. Select the thumbnail for the exposure in the Image Overview pane of the Examination window.
2. Select CR in the Detector Switch.
3. Select the Modality Position (radiographic table, wall stand, free exposure) in the Software Console.

   The default X-Ray exposure parameters for the selected exposure are sent to the modality and displayed on the software console.

   The radiographic table or the wall stand lights up in blue, indicating the selected modality position.

   The default X-Ray system position for the selected exposure is sent to the modality and displayed on the software console and on the tube head display, for automatic positioning of the X-Ray system.
4. Select the subexposure if more than one image is required for the same cassette.
   If an image thumbnail is configured for multiple exposures on a single cassette, another set of thumbnails is shown in the image detail pane. Now you have to select one of these thumbnails to send the proper default X-Ray exposure parameters to the modality for each exposure.
5. To position the X-Ray system automatically, press and hold the **automatic movement** button.
   The X-Ray system moves to the default position for the selected exposure.

Note When working in a PACS environment, the preferred workflow is to have only one image per cassette. This is needed for optimal use of hanging protocols. However, in particular cases (e.g. printing sites) it is supported to make more than one exposure per cassette.

Related information

Automatic positioning on page 136

Step 3: prepare the exposure

In the examination room:

1. Position the cassette.

   Note For a free exposure, partial lead covering of the cassette may be required if multiple images are taken on one cassette.

   Note For a bucky exposure, always insert an unexposed cassette in the bucky.

2. Position the patient.

   Apply radiation protective measures for the patient if needed.
3. Check if the X-Ray system position is suitable for the exposure.
4. Position the X-Ray tube with respect to the cassette and the patient.
5. Set the correct distance between cassette and X-Ray tube.
6. Switch on the light on the collimator. Adapt collimation if required.

   Take care that the collimated area is not larger than the cassette.

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.

Related information

Positioning the X-Ray Tube on page 170

Step 4: check the exposure settings

In the operator room on the Software Console:

1. Check if the exposure settings displayed on the console are suitable for the exposure.
2. Check the Ready for Exposure status.

Related information

Generator screen on page 113

Step 5: execute the exposure

In the operator room:

Press the exposure button to execute the exposure.

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.

- The actual X-Ray exposure parameters are sent back from the generator to the NX workstation and are shown in the Image Detail pane.
- The actual X-Ray exposure parameters and the Exposure Index (EI) value on the NX workstation can be used to monitor the performance of the Automatic Exposure Control of the X-Ray system.
- A green OK mark appears on all thumbnails for which the exposures are made and for which exposure settings are sent back to the NX workstation.

Step 6: repeat steps 2 to 5 for the next subexposures

Step 7: digitize the image

In the examination room:

Take the exposed cassette.

In the operator room:

1. Insert the cassette in the digitizer.
2. Click ID in the examination window of NX.

Note You can also use an ID Tablet to identify the cassette and digitize it using any digitizer.

The image will appear in the image overview pane of the examination window.

Step 8: perform a quality control

In the operator room at the NX workstation:

1. Select the image on which quality control is to be performed.
2. Prepare the image for diagnosis by using e.g. L/R markers or annotations.
3. If the image is OK, send the image to a hardcopy printer and/or PACS (Picture Archiving and Communication System).

Performing a Full Leg Full Spine examination

Refer to the DR Full Leg Full Spine User Manual (document 0179).

The availability of DR Full Leg Full Spine depends on the configuration of the system.

Refer to the CR Full Leg Full Spine User Manual (document 4408, part of the NX User Documentation).

Stopping the System

To stop the system:

1. Stop the MUSICA Acquisition workstation.

   The MUSICA Acquisition workstation can be stopped in two ways, either by logging out of Windows or without logging out of Windows.

   For detailed information, refer to the MUSICA Acquisition workstation User Manual, document 4420.

   Note Stopping the NX workstation does not stop the DR detector. If the power of the DR detector remains on, no warming-up time will be needed after starting the MUSICA Acquisition workstation.
2. Press the Power OFF button on the X-ray generator mini console to switch off the generator.
3. In a configuration with a wireless DR detector, power off the DR detector:
   - turn off the DR detector.
   - remove the battery pack.
   - charge the battery.
4. Switch off the DR Generator Sync Box.

Note If the DR detector is powered down, a warming-up may be required on the next start-up.

Warning: If the system has just been stopped, wait at least 10 seconds before starting it again.

Related information

Moving the system to parking position on page 140
Power off behaviour on page 40

Guidelines for pediatric applications

Caution: Use special care when imaging patients outside the typical adult size range.

Children are more radiosensitive than adults. Reducing dose for radiographic procedures while maintaining acceptable clinical image quality will benefit patients. The user documentation of this product contains a set of guidelines for pediatric applications, applicable in the U.S.A. Refer to document "Exposure Techniques for pediatric and adult use with DR 600".

- Guidelines for Pediatric Applications on page 106

Guidelines for Pediatric Applications

Caution: Use special care when imaging patients outside the typical adult size range. Children are more radiosensitive than adults.

Reducing dose for radiographic procedures while maintaining acceptable clinical image quality will benefit patients.

Adopting the Image Gently campaign guidelines and reducing dose for radiographic procedures while maintaining acceptable clinical image quality will benefit patients. Please review the following link and reduce pediatric technique factors accordingly: http://www.imagegently.org

As a general rule, next recommendations shall be observed in pediatrics:

- X-Ray Generator must have short exposures times.
- AEC must be used carefully, preferably use manual technique setting, applying lower doses.
- If possible, use high kVp techniques.

Positioning the pediatric patient: Pediatric patients are not as likely as adults to understand the need to remain still during the procedure. Therefore it makes sense to provide aids to maintaining stable positioning. It is strongly recommended the use of immobilizing devices such as bean bags and restraint systems (foam wedges, adhesive tapes, etc.) to avoid the need of repeating exposures due to the movement of the pediatric patients. Whenever possible use techniques based on the lowest exposure times.

Shielding: We recommend you provide extra shielding of radiosensitive organs or tissues such as eyes, gonads and thyroid glands. Applying a correct collimation will help to protect the patient against excessive radiation as well. Please review the following scientific literature regarding pediatric radiosensitivity: GROSSMAN, Herman. “Radiation Protection in Diagnostic Radiography of Children”. Pediatric Radiology, Vol. 51, (No. 1): 141--144, January, 1973:

http://pediatrics.aappublications.org/cgi/reprint/51/1/141.

Technique factors: You should take steps to reduce technique factors to the lowest possible levels consistent with good image acquisition and to limit the duration of fluoroscopy sequences and rapid sequences.

For example if your adult abdomen settings are: 70--85 kVp, 200--400 mA, 15--80 mAs, consider starting at 65--75 kVp, 100--160 mA, 2.5--10 mAs for a pediatric patient. Whenever possible use high kVp techniques and large SID (Source Image Distance).

Summary:

- Image only when there is a clear medical benefit.
- Image only the indicated area.
- Use the lowest amount of radiation for adequate imaging based on size of the child (reducing tube output -- kVp and mAs, limiting the duration of dynamic imaging).
- Try to use always short exposure times, large SID values and immobilizing devices.

- Avoid multiple scans and use alternative diagnostic studies (such as ultrasound or MRI) when possible.

Software Console and Tube Head Display

The software console is displayed on the NX workstation.

On a configuration with tube head display, the software console is displayed on the tube head display as well. The arrangement and availability of the controls may be different.

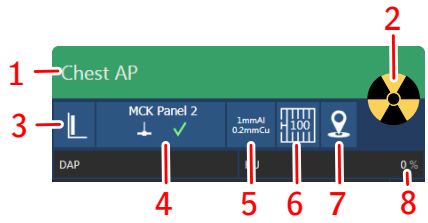
Table 9: Navigation

Navigation button	Software console screen
	Main screen of the tube head display
	Generator screen
	X-ray modality screen
	Positioning screen
	Digital tomosynthesis screen (optional)
	Live camera image and preview of collimation and AEC fields (optional)
	Disable touch sensitive handle during the ongoing exposure
	Cleaning the tube head display
	System messages screen

- Header of the software console on page 110
- Header of the tube head display on page 111
- Main screen of the tube head display on page 112
- Generator screen on page 113
- X-ray modality screen on page 114
- Positioning screen on page 115
- Digital tomosynthesis screen on page 117
- Live camera image and preview of collimation and AEC fields on page 122
- X-ray image preview screen on page 126
- Cleaning the tube head unit on page 127
- System messages screen on page 128

- Controls for positioning on page 130
- Controls for X-ray exposure on page 142
- Status readouts on page 157

Header of the software console



1. Ready for exposure status

   The status bar displays the exam type.
2. Radiation status

   Power status
3. Modality position
4. DR detector switch
5. Filter status
6. Grid status
7. Automatic positioning status
8. DAP value

   Heat units

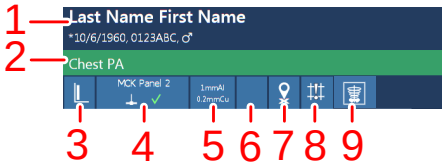
Figure 42: X-ray modality status frame

Touch the modality status icons to navigate to the X-ray modality screen, where the status can be modified.

Related information

Ready for exposure status on page 159
Radiation status on page 158
Modality Position on page 145
DR Detector Switch on page 30
X-ray filter on page 156
Anti-scatter grid status on page 160
Positioning status on page 161
DAP Value on page 166
Heat Units on page 167

Header of the tube head display



1. Patient information
2. Ready for exposure status

   The status bar displays the exam type.

   Touch the status bar to display the planned exposures.
3. Modality position
4. DR detector Switch
5. Filter status
6. Grid status
7. Automatic positioning status
8. Collimator status
9. X-ray image preview

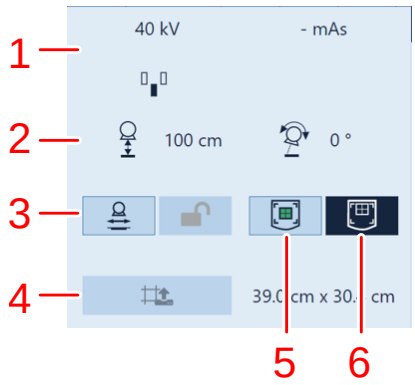
Figure 43: Example of the tube head display

Touch the modality status icons to navigate to the X-ray modality screen, where the status can be modified.

Related information

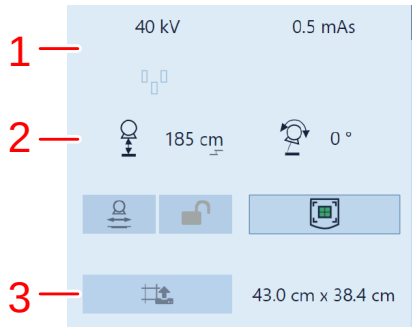
Ready for exposure status on page 159
Planned exposures on page 144
Radiation status on page 158
Modality Position on page 145
DR Detector Switch on page 30
X-ray filter on page 156
Anti-scatter grid status on page 160
Positioning status on page 161
Collimator status on page 162

Main screen of the tube head display



1. Radiographic parameters
2. Position parameters
3. Position tracking
4. Collimation controls
5. Automatic centering
6. Alignment to top, center or bottom of the DR detector in the bucky of the radiographic wall stand

Figure 44: Example of the tube head display for an exposure with the detector in the bucky



1. Radiographic parameters
2. Position parameters
3. Collimation controls

Figure 45: Example of the tube head display for a free exposure with the detector on the table-top

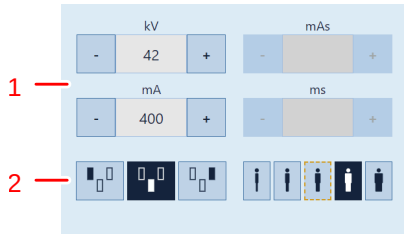
Related information

Generator screen on page 113
Positioning screen on page 115
Actual and target position parameters on page 131
DR detector and X-ray tube head alignment on page 163
Tracking the radiographic table on page 132
Tracking the radiographic wall stand on page 134
Automatic positioning on page 136
Automatically centering and alignment with DR detector in bucky on page 138
Collimator Parameters on page 155

Generator screen

1. Radiographic working mode
2. Radiographic parameters
3. Automatic exposure control
4. X-ray tube load

Figure 46: Operation screen on the software console



1. Radiographic parameters
2. Automatic exposure control

Figure 47: Operation screen on the tube head display

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.

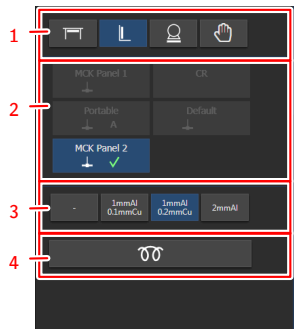
After exposure all values reflect the settings actually used by the generator.

The tube head display only has a subset of the generator controls.

Related information

Heat Units on page 167
DAP Value on page 166
One point, two point and three point working modes on page 147
Radiographic Parameters on page 149
Focal Spot Indicator on page 150
Automatic Exposure Control (AEC) on page 151
X-ray tube load on page 165

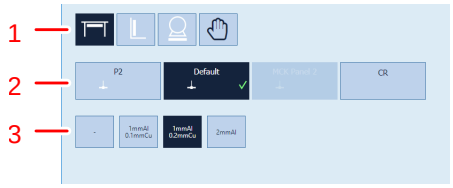
X-ray modality screen



1. Modality position.
2. DR detector switch

   All configured detectors are displayed. Only the detectors that can be used with the selected modality position, can be selected.
3. X-ray filter
4. Automated workflow for warming-up of the X-ray tube

Figure 48: X-ray modality screen on the software console



1. Modality position.
2. DR detector switch

   All configured detectors are displayed. Only the detectors that can be used with the selected modality position, can be selected.
3. X-ray filter

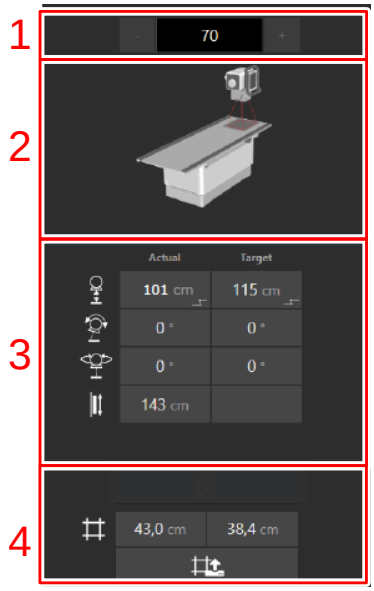
Figure 49: X-ray modality screen on the tube head display

The X-ray modality screen is also available on the tube head display.

Related information

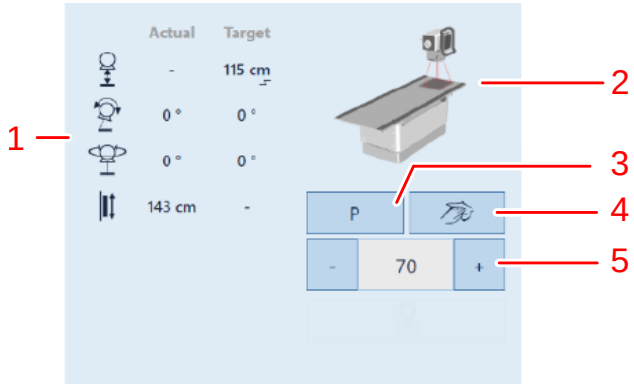
Modality Position on page 145
DR Detector Switch on page 30
X-ray filter on page 156
Automated workflow for daily warming-up of X-ray tube on page 143

Positioning screen



1. Automatic position selector
2. Selected automatic position
3. Actual and target position parameters
4. Collimation controls

Figure 50: Positioning screen on the software console



1. Selected automatic position
2. Actual and target position parameters
3. Parking position
4. Cleaning position
5. Automatic position selector

Figure 51: Positioning screen on the tube head display

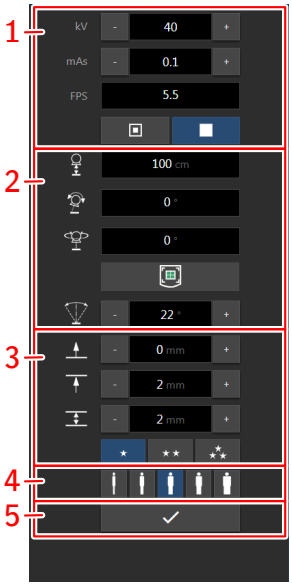
Note The contents of the graphical user interface depends on the configuration of the X-ray system. The screenshots in this chapter are examples.

Related information

Automatic positioning on page 136
Actual and target position parameters on page 131
Collimator Parameters on page 155

Moving the system to parking position on page 140
Moving the system to cleaning position on page 141

Digital tomosynthesis screen



1. Radiographic parameters for acquisition
2. Positioning controls for acquisition
3. Recontruction parameters
4. Dose adaptation for patient size
5. Button to start the digital tomosynthesis workflow

Figure 52: Controls for digital tomosynthesis

The two point working mode applies to the radiographic parameters. The value of kV and mAs can be adjusted. Other working modes are not available.

- Radiographic Parameters for digital tomosynthesis on page 118
- Position parameters for digital tomosynthesis on page 119
- Reconstruction parameters on page 120
- Adjusting the reconstruction settings for digital tomosynthesis on page 121

Related information

Performing a digital tomosynthesis examination on page 90

Radiographic Parameters for digital tomosynthesis

You can set up following radiographic parameters for the exposures in the digital tomosynthesis acquisition sequence:

- **kV**: shows the radiographic kV value (X-ray tube voltage) for the exposure.
- **mAs**: shows the radiographic mAs value for the exposure.
- **FPS**: frames per second. This value is fixed.

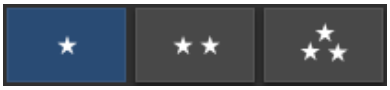
Position parameters for digital tomosynthesis

Table 10: Position parameters

	Source image distance (SID) The actual SID is displayed. A warning sign is displayed if the acquisition cannot be performed using the actual SID.
	X-ray tube tilting angle (alpha) The actual angle is displayed. A warning sign is displayed if the acquisition cannot be performed using the actual angle.
	X-ray tube rotation (beta) The actual angle is displayed. A warning sign is displayed if the acquisition cannot be performed using the actual angle.
	Indication if the X-ray tube is aligned to the center of the DR detector. A warning sign is displayed if the acquisition cannot be performed because the X-ray tube is not centered.
	X-ray tube sweep angle The range of the X-ray tube tilting angle during the tomographic movement. To select another angle, use the + and - buttons.

Reconstruction parameters

Table 11: Reconstruction parameters

	Start Height (cm) The height of the first slice of the reconstruction sequence, relative to the tabletop or the wall stand front panel.
	End Height (cm) The height of the last slice of the reconstruction sequence, relative to the tabletop or the wall stand front panel.
	Slice Thickness (mm) The thickness of the slices.
	Sharpness Increasing the sharpness will improve the quality of the image but the image processing will take longer

Adjusting the reconstruction settings for digital tomosynthesis

An acquisition sequence can be used to create more than one digital tomosynthesis reconstruction. Different reconstruction parameters can be used than those used for the initial reconstruction, e.g. to adjust the region of interest or the processing quality.

1. In the **Image Overview** pane of the **Examination** window or of the **Acquisition** window, select a digital tomosynthesis group.
2. Inside the digital tomosynthesis group, select the acquisition sequence.
   The **DTS** button is displayed.
3. Click the **DTS** button.

   The **DTS Parameters** dialog is displayed.

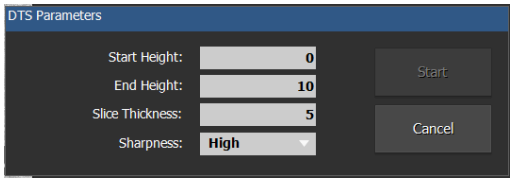


Figure 53: DTS Paramters

4. Fill in the parameters for the reconstruction.

Table 12: DTS Parameters

Start Height (cm)	The height of the first slice of the reconstruction sequence, relative to the tabletop.
End Height (cm)	The height of the last slice of the reconstruction sequence, relative to the tabletop.
Slice Thickness (mm)	The thickness of the slides.
Sharpness	Increasing the sharpness will improve the quality of the image but the image processing will take longer

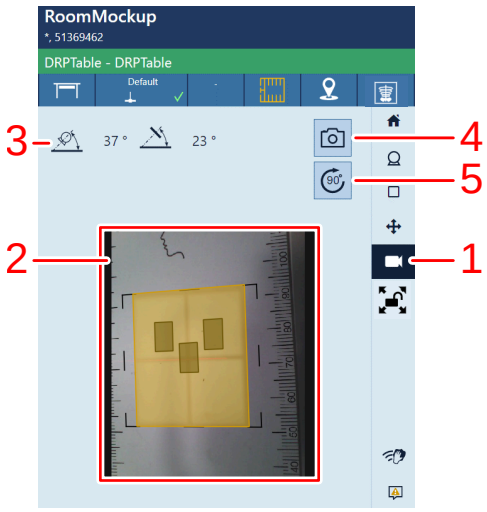
5. Click **Start**

A new reconstruction sequence is added to the digital tomosynthesis group.

Live camera image and preview of collimation and AEC fields

By clicking an empty thumbnail in the **Image Overview** pane of the **Examination** window, the live camera image is displayed on the tube head display.

To display the live camera image, push the **Camera** button.



1. Camera button
2. Live camera image
3. DR detector and X-ray tube head alignment
4. Take a photograph
5. Rotate the live camera image

Figure 54: Live camera image on the tube head display

The controls for taking a photograph are explained in detail in the user manual of the MUSICA Acquisition Workstation.

- Previewing the position of the collimation area and the AEC fields on page 123
- Prerequisites for previewing collimation and AEC fields on page 124
- Non-perpendicular angles on page 125

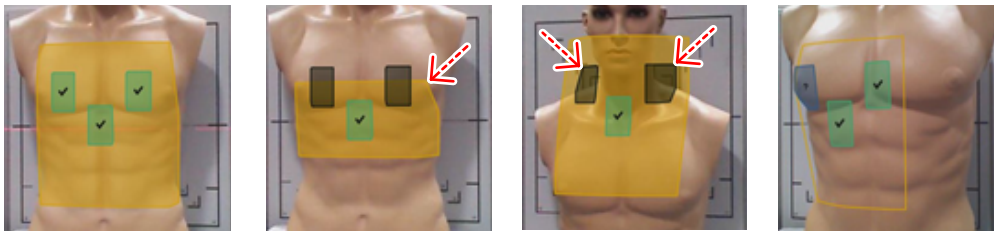
Related information

Collimator camera on page 35

Previewing the position of the collimation area and the AEC fields

The collimation area is visualized on the live camera image on the NX workstation as a semi-transparant yellow area that is virtually projected on the surface of the patient's body.

The active AEC fields are visualized on the live camera image on the NX workstation as semi-transparant green rectangles, indicating the position of the AEC fields.



1. All AEC fields are colored green.
2. The yellow collimation area is blinking.

   One or more of the active AEC fields are colored gray instead of green.

   The gray AEC fields are outside of the collimation area.
3. One or more of the active AEC fields are blinking and colored gray instead of green.

   The gray AEC fields are not fully covered by a body part.
4. The collimation area is visualized as an outline without the yellow shading.

   One or more of the AEC fields are visualized with a question mark over them.

   The 3D depth sensing camera fails to get a consistent reading in this area.

Figure 55: Preview of collimation area and AEC fields

Warning: An uncovered AEC cell may not be detected if the patient is lying on a matrass.

Prerequisites for previewing collimation and AEC fields

Prerequisites for previewing the collimation area and the AEC fields:

- The SID is at least 100 cm.

  If the body part is too thick, the preview may fail. Increase the SID.
- Automatic collimation is active
- The X-ray tube is centered
- The bucky of the wall stand is in vertical position
- On the radiographic table, the X-ray tube must not be rotated.
- On the radiographic wall stand, the X-ray tube must be in 90° position
- The collimator must not be rotated
- The patient's body is not covered by a material that is highly reflective, highly absorbent (black) or transparant

If there is no preview, an icon is displayed. If the visualization fails, try moving the patient out of the field of view of the camera for an instant.

Figure 56: No preview because the X-ray tube is rotated

Figure 57: No preview, because the collimation area cannot be visualized

Figure 58: No preview, because one of the AEC fields cannot be visualized

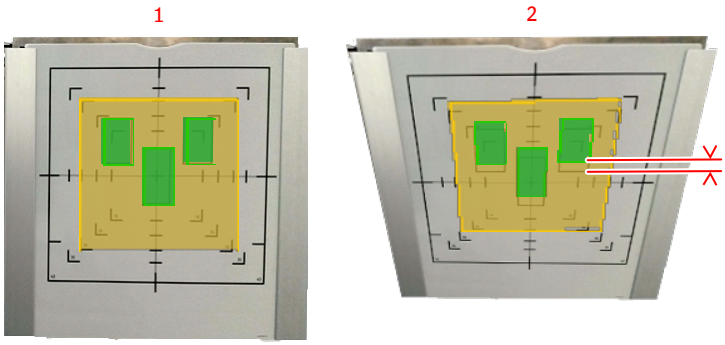
Figure 59: No preview because the camera is not calibrated for the current SID

The camera is calibrated by the service engineer. If the calibration icon is displayed, contact your local service organization to calibrate the camera.

Figure 60: No preview, because the camera is not calibrated

Non-perpendicular angles

If the X-ray tube is not perpendicular to the bucky of the wall stand, the AEC fields that are printed on the front panel of the bucky will not coincide with the AEC fields visualized on the camera image. The AEC fields visualized on the camera image represent more accurately the position of the actual AEC field inside the bucky.



1. X-ray tube is perpendicular to the bucky: preview of AEC fields coincides with print on front panel
2. X-ray tube is not perpendicular to the bucky: preview of AEC fields is shifted upward to indicate the actual position of the AEC field inside the bucky

Figure 61: X-ray tube not perpendicular to the bucky

The visualization of the collimation area and the AEC fields is virtually projected on the patient's body. The camera is positioned at an offset from the X-ray focal spot. This is the reason why the visualization may be warped.

X-ray image preview screen

After an exposure, the acquired image is displayed on the tube head display.

To return to the controls, push the display anywhere.

To disable image preview, toggle the **Image preview** button.

The default setting is configurable.

Cleaning the tube head unit

Figure 62: Button to clean the tube head unit during operation

Press and hold the cleaning button for 2 seconds to temporarily disable the tube head display and the touch sensitive handle

System messages screen

System messages are displayed at the bottom of the software console.

The color of the message indicates the importance:

Blue	Information
Yellow	Warning
Orange	Error

Messages that require feedback from the user contain a button that can be pressed.

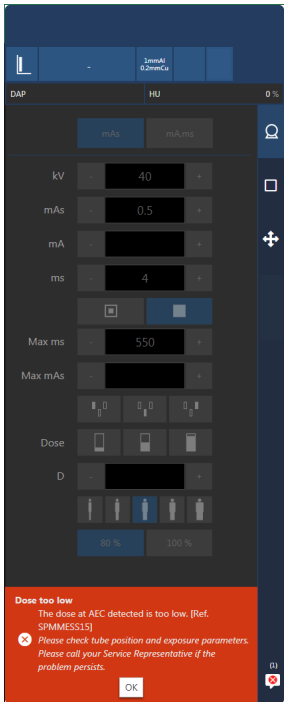


Figure 63: Error message requiring user feedback

More than one message can be active. The number of active messages and the type of messages is indicated on the navigation button.

Figure 64: Icon indicating that messages are waiting

The system messages screen lists all messages since the last startup of the software.

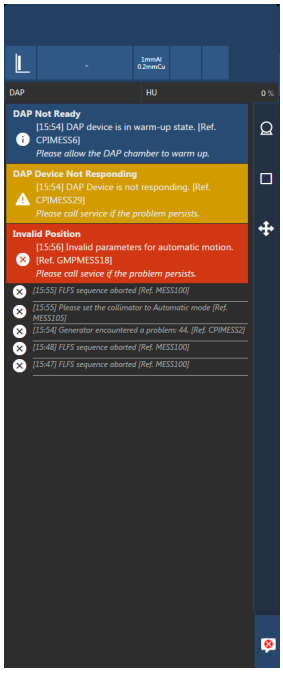


Figure 65: Messages history

Related information

X-ray generator messages and warning signals (Spellman) on page 248

Controls for positioning

Actual and target position parameters

The target position parameters correspond to the selected automatic position.

Table 13: Position parameters

	Source image distance (SID) No value is displayed for free exposures or if the X-ray tube is not pointing to the selected DR detector.
	X-ray tube tilting angle (alpha) Windmill movement
	X-ray tube rotation (beta) Carousel movement
 or 	Bucky position Horizontally position of the bucky at the radiographic table or vertical position of the bucky at the radiographic wall stand
	Tilting angle of the bucky at the radiographic wall stand

Related information

Main screen of the tube head display on page 112
Positioning screen on page 115

Tracking the radiographic table

The **position tracking** button on the main screen of the tube head display indicates if tracking can be performed.

Table 14: Tracking status

	Tracking can be performed but is not activated.
	Tracking cannot be performed. Make sure that the X-ray tube is pointing to the detector and that the distance between the tube head unit and the tabletop is higher than 50 cm and that the tube head unit is not in a collision zone.

Tracking synchronizes the movement of two components:

- Adjusting the table height drives the X-ray tube height. The SID is kept constant.
- Adjusting the position of the table bucky drives the X-ray tube longitudinal position.
- Adjusting the longitudinal position of the X-ray tube drives the position of the table bucky.
- Adjusting the alpha rotation of the tube head unit drives the position of the table bucky.

To enable tracking:

1. On the tube head display, press the **position tracking** button.

   Table 15: Tracking status

	Tracking is activated.

2. Adjust the table height, the position of the table bucky, the longitudinal position of the X-ray tube or the alpha rotation of the tube head unit.
   The corresponding component (X-ray tube or table bucky) is moving accordingly.

Note The movement of the X-ray tube stand has a small delay compared to the movement of the table. The movement of the X-ray tube is automatically stopped if the distance between the X-ray tube head and the table would become too small (SID lower than 45 cm).

The **lock** button controls the behaviour of the position tracking after the exposure is made.

Table 16: Locking the position tracking

	Position tracking is not active for the next exposure. It can be activated again by pressing the **position tracking** button.
	Position tracking is kept active for the next exposure.

Related information

Main screen of the tube head display on page 112

Tracking the radiographic wall stand

The **position tracking** button on the main screen of the tube head display indicates if tracking can be performed.

Table 17: Tracking status

	Tracking can be performed but is not activated.
	Tracking cannot be performed. Make sure that the distance between the tube head unit and the tabletop is higher than 15 cm and that the tube head unit is not in a collision zone.

Tracking synchronizes the movement of two components, without changing the SID:

On a configuration with radiographic wall stand with motorization:

- Adjusting the wall stand bucky height drives the X-ray tube height.
- Adjusting the height of the X-ray tube drives the height of the wall stand bucky.
- Adjusting the alpha rotation of the X-ray tube head drives the wall stand bucky height.

On a configuration with radiographic wall stand without motorization:

- Adjusting the wall stand bucky height drives the X-ray tube height.

To enable tracking:

1. On the tube head display, press the **position tracking** button.

   Warning: Do not use position tracking on the wall stand while the patient is lying on the table.

   Table 18: Tracking status

	Tracking is activated.

2. Adjust the wall stand bucky height, the height of the X-ray tube or the alpha rotation of the X-ray tube head.
   The corresponding component (X-ray tube or wall stand bucky) is moving accordingly.

Note The movement of the X-ray tube is automatically stopped if the distance between the X-ray tube head and the table top would become too small (less than 10 cm).

The **lock** button controls the behaviour of the position tracking after the exposure is made.

Table 19: Locking the position tracking

	Position tracking is not active for the next exposure. It can be activated again by pressing the **position tracking** button.
	Position tracking is kept active for the next exposure.

Related information

Collision indicator on page 175
Emergency stop button on page 38
Main screen of the tube head display on page 112

Automatic positioning

Warning: Collision with persons or objects within the movement area of the system. Do not activate automatic movement if persons or extraneous objects are in the allowed movement area of the system.

Each exposure has an automatic position configured in the workstation.

The default automatic positions are configured by the service engineer and cannot be changed by the user.

To use automatic positioning:

1. Select an exposure.
2. Press and hold the **automatic positioning** button.

   The system moves to the automatic position.

   The status of the automatic positioning is displayed on the header of the software console and of the tube head display.

   The movement of the ceiling suspension can be performed in two ways:

   - **Shortest path.** The tube head unit moves along the shortest possible path to the target position. The positioning time is reduced. However, more care must be taken to ensure that there are no extraneous objects are in the lower area of the room.
   - **Safest path.** The tube head unit first moves up, then horizontally and then down to the target position. The positioning time is longer. Most extraneous objects that may be present in the room are avoided.

   This setting is configurable by service.

   A short double beep indicates that position is reached.

To move to a different automatic position:

3. Display the position screen.

Figure 66: Positioning controls

4. Click the up or down arrow next to the illustration of selected position until the correct position is displayed.

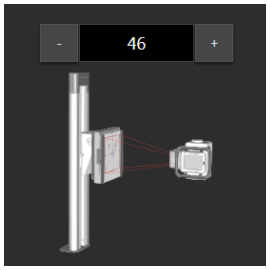


Figure 67: Software console

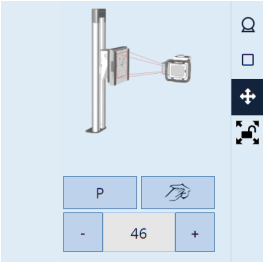


Figure 68: Tube head display

Table 20: Example symbols indicating the selected modality position

Symbol	Modality position
	Table
	Wall stand
	Free exposure
	Parking position
	Cleaning position
	No position selected

Up to 30 auto-positions per modality type (table, wall stand, free) can be configured.

Related information

Automatic positioning button on page 31
Main screen of the tube head display on page 112
Positioning screen on page 115
Positioning status on page 161

Automatically centering and alignment with DR detector in bucky

The automatic centering functionality is intended to center the X-ray tube head unit over the detector or cassette in the bucky on radiographic table or radiographic wall stand.

On the radiographic table automatic centering is limited to longitudinal and transversal movements.

On the radiographic wall stand automatic centering is limited to transversal and vertical movement relative to the radiographic wall stand, so SID or angulation of the tube head unit is not changed by this function.

Automatic centering is used to make sure the X-ray tube head and the bucky are aligned after applying manual movements.

The **automatic centering** button on the main screen of the tube head display indicates if automatic centering can be performed.

Table 21: Automatic centering status

	Automatic centering can be performed, but is not activated.
	Automatic centering cannot be performed. Make sure that the X-ray tube is pointing to the detector and that it is within a range of 50 cm from its center position.

To perform automatic centering:

1. Press the **automatic centering** button on the main screen of the tube head display.
2. Press and hold the **automatic positioning** button.

   The status of the automatic centering is displayed on the main screen of the tube head display:

   Table 22: Automatic centering status

	Automatic centering is active. Center position is not reached. The **automatic positioning** button can be pressed.
	Center position is reached.

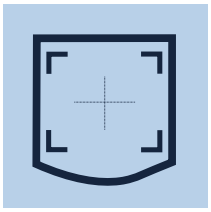
A short double beep indicates that position is reached.

To adjust the alignment on the radiographic wall stand:

3. Press the **alignment** button to switch between centering and asymmetric collimation alignment.

   On the radiographic wall stand, instead of vertically aligning the X-ray tube head unit to the center of the DR detector, it can be aligned to the top or the bottom of the DR detector. The alignment is taking into account the size of the collimation area.

Table 23: Centering and asymmetric collimation alignment

	Automatic centering will vertically align the X-ray tube head to the center of the DR detector
	Automatic centering will vertically align the collimation area to the top of the DR detector
	Automatic centering will vertically align the collimation area to the bottom of the DR detector

When changing the alignment, the position of the X-ray tube is adjusted immediately.

Related information

Automatic positioning button on page 31
Main screen of the tube head display on page 112

Moving the system to parking position

The parking position is defined during installation and cannot be changed by the user.

The parking position is intended as a position where the system can remain for longer time, e.g. over night, when it is switched off. Typically the tube head unit is moved towards a corner or over the radiographic table and the wall stand bucky is moved to vertical position so they are out of the way for other activities.

The parking position can be selected on tube head display only and applied without involvement of the NX workstation.

To move system to parking position:

1. Display the position screen.
   On the main screen of the tube head display, click the **Positioner** button.
2. Press parking button.

   The parking position settings are loaded.
3. Press and hold the **automatic positioning** button.

A short double beep indicates that position is reached.

Related information

Automatic positioning button on page 31
Positioning screen on page 115

Moving the system to cleaning position

The cleaning position is defined during installation and cannot be changed by the user.

The cleaning position is intended as a position the system allows best access to all components for cleaning purposes. Typically the tube head unit is moved in middle of the room so user can access them easily from all sides for cleaning. The radiographic table and the wall stand are typically moved to a mid position.

The cleaning position can be selected on tube head display only and applied without involvement of the NX workstation.

To move system to cleaning position:

1. Display the position screen.
   On the main screen of the tube head display, click the **Positioner** button.
2. Press cleaning button.

   The cleaning position settings are loaded.
3. Press and hold the **automatic positioning** button.

A short double beep indicates that position is reached.

Related information

Automatic positioning button on page 31
Cleaning on page 70
Positioning screen on page 115

Controls for X-ray exposure

Automated workflow for daily warming-up of X-ray tube

The software console provides an automated workflow for warming-up of the X-ray tube.

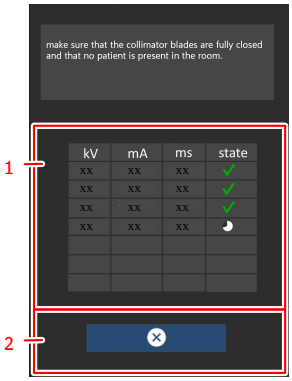
1. Close the collimator blades fully.
2. Make sure that no one will be exposed.
3. On the software console, go to the screen with modality controls.

Figure 69: Navigation button for modality controls

4. Click the button to start the automated workflow for warming-up of the X-ray tube.

Figure 70: Button to start the automated workflow for warming-up of the X-ray tube

A table is displayed with a list of exposures.



1. Table with list of exposures
2. Button to cancel the warming-up procedure

Figure 71: List of exposures for warming-up of the X-ray tube

5. Make sure that the collimator blades are fully closed and that no patient is present in the room.

   To avoid radiation on a DR detector, remove the detector, turn the tube away from the detector, or cover the detector with a lead apron.
6. Perform the exposures and wait for the timer icon to finish between exposures.

   The exposure parameters are set automatically.

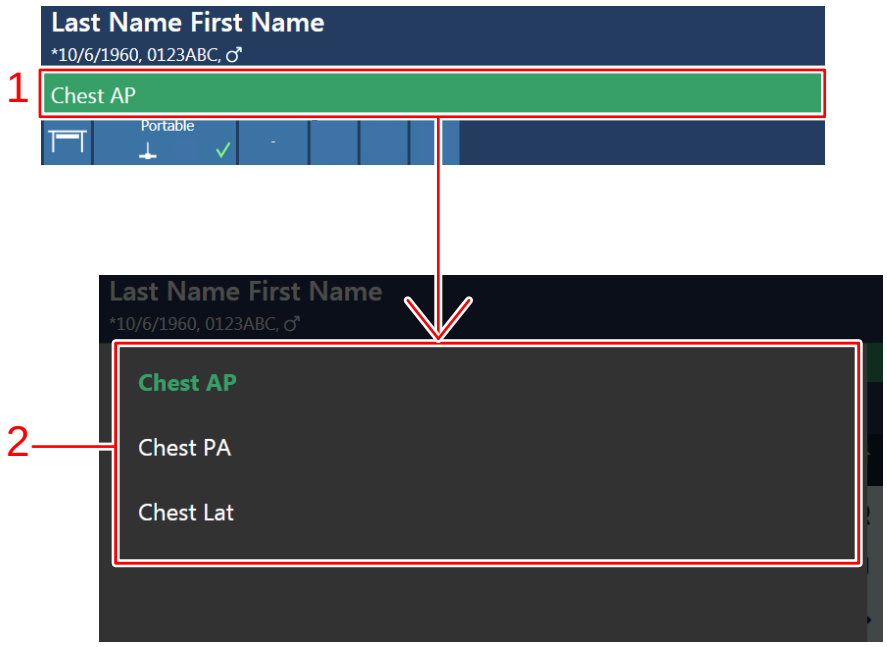
Related information

X-ray modality screen on page 114

Planned exposures

By clicking the status bar, an overview is displayed of the exposures that still have to be taken for the examination.

Select an exposure to load the default X-ray exposure parameters and to activate the selected DR Detector.



1. Status bar
2. Overview of exposures

Figure 72: Examination overview window

Related information

Header of the tube head display on page 111

Modality Position

The modality position is automatically selected, based on the selected exposure.

To modify the position on the modality where the exposure will be made, click the drop-down arrow and select the modality position from the list.

Table 24: Modality Position

Icon	Description
	The image is planned for the radiographic table.
	The image is planned for the radiographic wall stand.
	The image is planned as a free exposure.
	A manual X-ray exposure can be made. No image will be acquired on the NX workstation.

The type and configuration of the X-ray system defines which modality positions are available.

The available workstations depend on the modality type and configuration.

Related information

Header of the tube head display on page 111
Header of the software console on page 110
X-ray modality screen on page 114

DR Detector Switch

The DR Detector Switch shows which DR Detector is active and shows its status. The DR Detector Switch can be used to activate another DR Detector. The DR Detector Switch can be switched to CR, depending on the configuration.

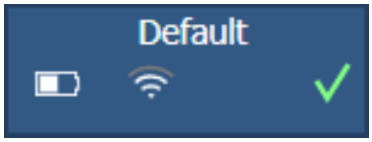


Figure 73: DR Detector Switch

Related information

DR detector status on page 146
Header of the tube head display on page 111
Header of the software console on page 110
X-ray modality screen on page 114

DR detector status

Table 25: Status of the battery

Battery status icon					
Meaning	Full	Medium	Low	Empty	Charging

Table 26: Status of the network connection

Connection status icon (wifi/wired)				
Meaning	Strong	Normal	Weak	Wired DR Detector

Table 27: Status of the DR detector

DR detector status icon		(blinking)			?
Meaning	Ready	Initializing exposure	Error	Sleep	One DR detector must be selected

One point, two point and three point working modes

You can select following radiographic working modes according to the parameters to be controlled and the degree of automation:

Table 28: Radiographic working modes

	One point mode, by selecting kV. The exposure is controlled by AEC.
	Two point mode, by selecting kV and mAs. AEC is disabled.
	Three point mode, by selecting kV, mA and exposure time independently. AEC is disabled.

To switch to one point mode, activate one or more AEC fields.

Depending on the radiographic working mode, some of the generator controls will be disabled.

Related information

Generator screen on page 113

One Point Mode (1P)

By selecting one of the AEC field buttons, the one point mode is activated.

The value of kV, mA, max ms, max mAs, the setting of focal spot, density, dose, patient size and the selected AEC fields can be adjusted.

The value for mAs and ms is not available.

For accurate AEC operation it may be needed to lower the mA value in order to obtain longer exposure times. The smallest exposure step is 1 ms.

Disabling all AEC fields will switch to two point mode.

After exposure all values reflect the settings actually used by the generator.

Two Point Mode (2P)

The value of kV, mAs, max ms, the setting of focal spot and X-ray tube load can be adjusted.

The value of mA and ms are adjusted automatically to keep the mAs value constant, within the boundaries of generator or X-ray tube limitations.

The setting of density, dose and patient size is not available.

By selecting one of the AEC field buttons, the one point mode is activated.

By adjusting the value of mA or ms, the three point mode is activated.

After exposure all values reflect the settings actually used by the generator.

Three Point Mode (3P)

The value of kV, mA and ms can be adjusted. The other values are adjusted automatically to keep the mAs value constant.

Radiographic Parameters

You can set up following radiographic parameters:

- **kV**: shows the radiographic kV value (X-ray tube voltage) selected for the exposure.
- **mAs** can show:
  - The radiographic mAs value selected for the exposure.
  - When an exposure is made, it shows the actual mAs at the end of the exposure.
- **mA**can show:
  - The radiographic mA value (electrical current) selected for the exposure.
  - When an exposure is made, it shows the the actual mA at the end of the exposure
- **ms** can show:
  - The time value (in milliseconds) selected for the exposure.
  - When an exposure is made, it shows the actual time at the end of the exposure.
- **Max ms** shows the integration time of the DR detector. When operating the DR detector, the calculated exposure time (ms) or manual overrides can never exceed the integration time (detector ms) of the DR detector.
- **Max mAs** shows the maximum allowed mAs value for exposures using AEC. The highest allowed setting for max mAs depends on the mA setting and the detector ms setting. Not available in Free Exposure mode using DR or Free Exposure mode using CR.

When using AEC, the exposure is terminated by the detector ms or max mAs settings, even if the target dose is not reached.

Related information

Generator screen on page 113

Focal Spot Indicator

A focal spot indicator shows the selected focal spot of the X-ray tube: “Small” or “Large”.

Table 29: Focal Spot Indicator

	Small
	Large

If you change the focal spot, the kV and mAs are kept constant. When changing from a large to smaller focal spot, exposure time may increase as the mAs is kept constant but the mA may be reduced automatically according to the performance of the tube.

Related information

Generator screen on page 113

Automatic Exposure Control (AEC)

Automatic Exposure Control (AEC) produces consistent detector dose regardless of the radiographic technique selected and of the patient size.

To activate AEC mode, push any of the three AEC field buttons.

Figure 74: AEC field buttons

To deactivate AEC mode, select the two point or three point radiographic working mode.

Figure 75: Buttons to select two point or three point radiographic working mode

Related information

Generator screen on page 113

AEC field selection

Each button indicates its related physical location of the selected field in the AEC exposure detector, and you may select or deselect it by touching it.

Any combination of fields can be selected and the color of the buttons changes (highlighted) when active. The exposure is ended if any of the selected fields measures the AEC cut-off dose.

Table 30: AEC field selection

	Left field
	Middle field
	Right field

Dose

Each of these buttons allows adjustment of the AEC cut-off dose (low dose, middle dose and high dose), depending on configuration at installation time and on the selected patient age group. Each time a button is selected (highlighted), the others are automatically deselected.

Table 31: Automatic filter

Dose	
	low dose

Dose	
	middle dose
	high dose

Density

These buttons are used to adjust the AEC cut-off dose (and patient entrance dose accordingly).

Density can be increased and decreased in a range of -4 to +4. Each step is a change of one exposure step. An exposure step is a change of approximately -20% or +25% in dose. When disabled, the density range number appears in black.

Table 32: Dose variation compared to reference dose

Density	**Dose**
-4	0.41
-3	0.51
-2	0.64
-1	0.80
0	1 (reference dose)
+1	1.25
+2	1.56
+3	1.95
+4	2.44

Patient Size

The size of the patient is classified in five categories: Extra Small, Small, Medium, Large and Extra Large.

Press one of the buttons to select the desired patient size.

In one point mode, the patient size affects the values of kV.

In two point mode, the patient size affects the values of mAs.

The default values for adjusting kV and mAs are listed in the following tables.

Table 33: kV variation over patient size

	Patient size	**kV**
	Extra Small	normal kV * 0.9
	Small	normal kV * 0.95
	Medium	normal kV
	Large	normal kV * 1.05
	Extra Large	normal kV * 1.1

Table 34: mAs variation over patient size

	Patient size	**mAs**
	Extra Small	normal mAs * 0.25
	Small	normal mAs * 0.5
	Medium	normal mAs
	Large	normal mAs * 2
	Extra Large	normal mAs * 4

Dose adaptation guidance

A system with a 3D depth camera can be configured to monitor the patient size automatically. The optimal dose adaptation setting for the patient is indicated by a blinking orange frame. To apply this setting, press the indicated patient size icon.

Figure 76: Patient size "extra small" is indicated as recommended dose adaptation setting

The indicated setting is a recommendation. The user has to confirm that the setting is correct. If the setting is not confirmed by the user, the medium patient size is applied.

If none of the icons is indicated by a blinking orange frame, dose adaptation guidance is not available and the user must assess the patient size and apply the correct setting.

Warning: Dose adaptation guidance overestimates the patient size if the patient is not positioned flat against the surface of the radiographic table or wall stand or if the patient is lying on a matrass. Dose adaptiation guidance may be inaccurate if the patient is moving.

Warning: Dose adaptation guidance is not accurate if based on a wrong bodypart. Make sure the correct thumbnail for the exposure is selected.

Warning: Dirt on the collimator camera may disturb the 3D depth sensor readings. Keep the camera clean to avoid incorrect readings.

In two point mode, the patient size can be configured to affect the values of both kV and mAs. The parameters that are affected by the patient size and the actual variation values can be defined specifically for each exam type.

Prerequisites for dose adaptation guidance:

- The SID is at least 100 cm.

  If the body part is too thick, the dose adaptation guidance may fail, indicated by warning signs next to the patient size icons

  Increase the SID.
- The X-ray tube is centered
- The bucky of the wall stand is in vertical position
- The X-ray tube must not be rotated
- The collimator must not be rotated
- The patient's body is not covered by a material that is highly reflective, highly absorbent (black) or transparant

Related information

Collimator camera on page 35

AEC dose failure

In AEC mode the exposure is interrupted automatically, when there is not enough dose detected within a certain time (e.g. when the AEC chamber is defect or covered with lead foil) or when there is too much dose detected within a certain time (e.g. when no patient is in front of the AEC).

Collimator Parameters

The collimation is automatically set, based on the selected exposure.

To use the same collimation setting on subsequent exposures, push the restore button to restore the collimation setting of the previous exposure.

The collimator parameters are available on the positioning screen of the software console and on the main screen of the tube head display.

Table 35: Collimator settings

Icon	Description
	Readout of the actual collimation setting.
	Restore the collimation setting of the previous exposure.

Related information

Main screen of the tube head display on page 112
Positioning screen on page 115

X-ray filter

On systems with automatic filtering, the filter is automatically set, based on the selected exposure.

The filter setting can be modified on the software console and the tube head display, or on the collimator.

Pressing the filter status opens the screen with modality settings.

Table 36: Collimator with automatic filter

(no icon)	No filter is used.
	A filter is used. Material and thickness of the filter are specified.

Related information

Header of the tube head display on page 111
Header of the software console on page 110
X-ray modality screen on page 114

Status readouts

Radiation status

Table 37: Radiation status

	The X-ray tube is prepared.
	After pressing the exposure button completely, the X-ray exposure is made. The indicator on the console will light up.
	The examination room door is open.

Press the exposure button halfway (“Prep” position) to prepare the X-ray tube for exposure. The indicator will light up when the X-ray tube is prepared and there are no interlock failures or system faults.

After pressing this push-button, the following functions are activated:

- Anode rotation.
- Filament current switches from stand-by to the selected mA.

Related information

Header of the tube head display on page 111
Header of the software console on page 110

Ready for exposure status

Table 38: Exposure ready

	Green Exposure ready. Indicates that the selected technique is properly set and there are no interlock failures or system faults.
	Red Exposure not ready. Check the message frame for more information. It is not possible to perform an exposure due to an error. The status will turn to green when problem is solved.
	Blue Exposure not ready. No examination defined.

Related information

Header of the tube head display on page 111
Header of the software console on page 110

Anti-scatter grid status

Table 39: Grid status - automatically detected

(no icon)	No grid is required.
	The correct grid type is inserted.
	The correct grid type is not inserted. A grid is inserted, but no grid is required. The SID does not correspond to the inserted grid.
	The grid is inserted wrongly.

The focal distance of the grid that is detected in the bucky, is displayed inside the icon.

Related information

Header of the tube head display on page 111
Header of the software console on page 110

Positioning status

Table 40: Positioning status

	Movement is active. The icon is displayed as long as user presses and holds the **automatic positioning** button.
	The target position is reached successfully.
	The target position is not reached due to failure or when the user releases the **automatic positioning** button early.

Related information

Header of the tube head display on page 111
Header of the software console on page 110

Collimator status

Table 41: Collimator status

(no icon)	Automatic collimation mode
	Semi-automatic collimation mode
	Manual collimation mode

Related information

Header of the tube head display on page 111

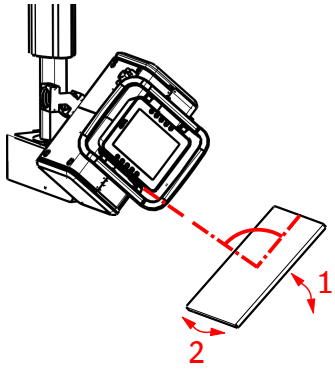
DR detector and X-ray tube head alignment

The tube head display can show a readout of the tilting angle of the DR detector and of the X-ray tube head.

	The relative angle between the DR detector and the horizontal surface.
	The relative angle between the X-ray tube and the vertical axis.

When both angles differ by less than one degree, they're displayed in green.

The exposure is perpendicular if both angles are displayed in green and the tilting axes of the DR detector and of the X-ray tube head are parallell. The alignment of the tilting axes must be visually verified by the user.



1. The relative angle between the DR detector and the horizontal surface.
2. The rotation of the DR detector around the vertical axis. This angle is not measured and must be visually verified by the user.

If the angle is very small (smaller than 3 degrees), it is hard to visually verify the alignment of the tilting axes. Use the light field of the collimator to verify the alignment of the X-ray tube head to the DR detector.

Depending on the orientation, the angle may be displayed as a negative number. The number sign is ignored for comparing the angles.

The availability of the alignment feature depends on the DR detector model and on the product license.

Caution: The alignment readout may not be available, e.g. if the position of the detector is not stable due to movement of the patient. A skilled operator can do the alignment visually.

Warning: There can be a delay on the readout of the tilting angle compared to the actual value. Confirm visually that the position of the X-ray tube head and the DR detector is stable.

Related information

Main screen of the tube head display on page 112

Unknown status

If a status is unknown, a question mark icon is displayed:

Figure 77: Unknown status

Depending on the component for which the unknown status is displayed, an action is required on the component or on the software to provide the system with the missing information.

E.g. to solve the unknown detector status, one DR detector must be selected.

X-ray tube load

Table 42: X-ray tube load

80%	As a way to increase the tube life cycle, the power percentage of the tube is reduced to a 80% by default.
100%	If a specific technique requires 100% of the X-ray tube power, touch the 100% button.

Depending on the status of the heat units, the system may limit the X-ray tube load, even when the X-ray tube load is set to 100%.

Related information

Generator screen on page 113

DAP Value

The DAP value shows the radiation value of the last exposure. The radiation measure is read as DAP value (Dose Area Product) in cGy*cm^2 (for example: DAP 12.22). This measurement unit is configurable.

A new exposure resets the DAP value.

Related information

Header of the software console on page 110
Generator screen on page 113

Heat Units

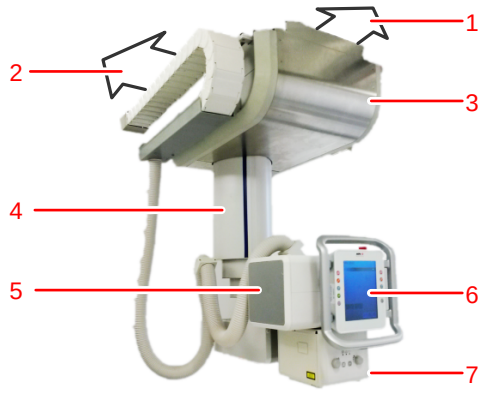
The status of the heat units is displayed below the X-ray icon.

During exposures, the heat units are calculated and totalled. The heat units display shows the percentage of the thermal capacity of the X-ray tube that is used. For example, a display of “HU 0” (0%) would indicate that all the heat units capacity of the X-ray tube remains. A display of "HU 100" (100%) would indicate that maximum heat capacity of the X-ray tube is reached and no exposures can be made until the tube has cooled down.

Related information

Header of the software console on page 110
Generator screen on page 113

Ceiling Suspension



1. Transversal rails
2. Longitudinal rails
3. Carriage
4. Telescope
5. X-Ray Tube Head Unit
6. Tube head display
7. Collimator

Figure 78: Ceiling Suspension

- Control Panel of the Tube Head Unit on page 169
- Positioning the X-Ray Tube on page 170
- Positioning the X-Ray Tube using the Remote Control on page 176
- Automatic Collimator on page 179
- Effect of SID on patient dose on page 184

Control Panel of the Tube Head Unit

The tube head unit has two variants, with and without touch sensitive handle.

1. Movement control buttons
2. Tube head display
3. Horizontal segments of the touch sentitive handle
4. Vertical segments of the touch sensitive handle

Figure 79: Control panel of the X-ray tube head unit with touch sensitive handle

1. Movement control buttons
2. Tube head display
3. Handle with release button for omni direction movement.

Figure 80: Control panel of the X-ray tube head unit without touch sensitive handle

Positioning the X-Ray Tube

The operation controls of the X-ray tube head unit are located at the control panel. The X-ray tube can be positioned by the operator manually.

Using the touch sensitive handle

The horizontal and vertical segments of the handle are touch sensitive. A segment can be touched with a flat hand on one side, to indicate the direction of the movement, or it can be gripped with the fingers around the handle.

To start motorized movement in a linear direction, touch with a flat hand one segment of the handle and follow the movement in the chosen direction. Remove the hand to stop the movement.

To move to any direction, grip the handle with one hand and move the X-ray tube head unit. Grip the handle with both hands to also change the angle of the X-ray tube (alpha).

To disable the touch sensitive handle during the exposure, e.g. if there is a risk that the handle is touched unintendedly by the patient, touch the button on the tube head display to disable the touch sensitive handle. The handle is enabled again after the exposure is made.

Figure 81: Disable touch sensitive handle during the ongoing exposure

Using the movement control buttons

To release the brake for the selected movement direction or rotation, press and hold the button and move the X-ray tube head unit. To improve the ease of performing the movement, the movement is supported by motors. The intensity of the motor support can be configured by the service engineer.

To stop the movement and activate the brake, release the button.

Precise positioning is done without motor support.

- While moving the X-ray tube head, keep the button pressed and apply a gentle force opposite to the movement direction. The motor support switches off to finalize the movement to the target position.
- When starting from rest, press the button for the selected movement direction twice within 1 second and hold it while moving the X-ray tube head unit. The brake is released, but the motor support is not switched on.

Precise positioning without motor support is only available on movement directions that keep the SID. The availability of this functionality depends on the configuration of the system.

Table 43: Movement controls

Button	Touch sensitive handle
X-ray tube rotation (beta) 	

Button	Touch sensitive handle
Transversal axis movement (back & front). 	With flat hand, push or pull the handle backward or forward 
Vertical axis movement (up & down) 	With flat hand, push one of the horizontal handle segments up or down 
Longitudinal axis movement (right & left) 	With flat hand, push one of the vertical handle segments right or left 

Button	Touch sensitive handle
Transversal, vertical and longitudinal movement. Release button in the handle of the tube head unit (this button is not available on the touch sensitive handle)	Grip the handle with one hand 
Transversal, vertical and longitudinal movement. X-ray tube angle (alpha) 	Grip the handle with both hands 

Warning: Risk of unintended movement of the tube head unit and risk of falling. Do not hold on to the touch sensitive handle when loosing balance!

Warning: If a grinding noise is heard during movement of the X-ray tube head unit or radiographic wall stand, the steel cables inside the ceiling suspension or wall stand could be broken. Do not operate the unit any further and try to avoid hard vibration or knocks of any kind. Please contact service.

The curved corners of the handle are not touch sensitive and pushing the handle there will not make the X-ray tube head move.

The functions of the buttons take precedence over the functions of the touch sensitive handle.

Note If the behaviour of the touch sensitive handle is erratic, touch the button on the tube head display to disable the touch sensitive handle and fall back to the movement control buttons. Touching the handle in the right spot for each movement, may require some practicing.

Note If the touch sensitive handle is not responsive, try falling back to the movement control buttons. Contact your local service organization.

Note If movement in any direction blocks, do not apply force to overcome the blocking. Contact your local service organization.

Note To avoid shock and damage, move the tube head unit with normal speed and slow down when reaching the mechanical end stops.

Note Rotation may be limited by cables. Avoid strain on the cables during rotation.

- Stop positions on page 174
- Collision indicator on page 175

Stop positions

The system includes stop positions for manual movement of the X-ray tube head.

The preferred positions of the stops are defined during installation.

The stop positions are used to position the system manually for typical radiographic examinations, e.g. a SID of 180 cm for chest examinations.

Stop positions are different for radiographic table and radiographic wall stand. Which stop positions are active depends on the active modality position, selected on the Software Console.

To enter a stop position, move the X-ray tube head unit using the control buttons. The movement is stopped when a stop position is reached. Move at a regular speed to prevent the X-ray tube head unit to skip the stop position.

To leave a stop position, release and press again the according movement control button.

Collision indicator

Motorized movement is protected by a collision indicator. The collision indicator avoids collision of the X-ray tube head with the table or the wall stand.

The collision indicator will give a signal and stop motorized movement in following situations:

- The X-ray tube head moves closer than 45 cm to the tabletop or the wall stand front panel.
- The X-ray tube head moves closer than 10 cm to the side of the table or wall stand or any other fixed object in the room (e.g. a wall).

Motorized movement is also stopped in following situations:

- The target position is reached successfully.
- The movement is blocked.
- The automatic positioning button is released.
- The emergency stop button is activated.

Automatic positioning cannot be started if there is no safe path to reach the target position.

Manual movement is also protected by a collision indicator. The movement range is larger than for motorized movement.

The manual movement can be resumed by releasing the movement control button and pressing it again.

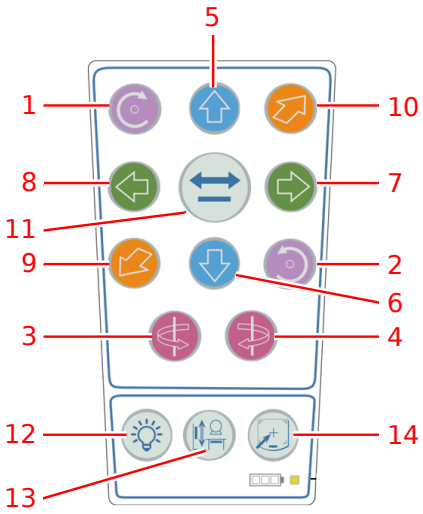
Related information

Tracking the radiographic wall stand on page 134

Positioning the X-Ray Tube using the Remote Control

To activate a movement, press and hold the button on the remote control.

To stop the movement and activate the brake, release the button.

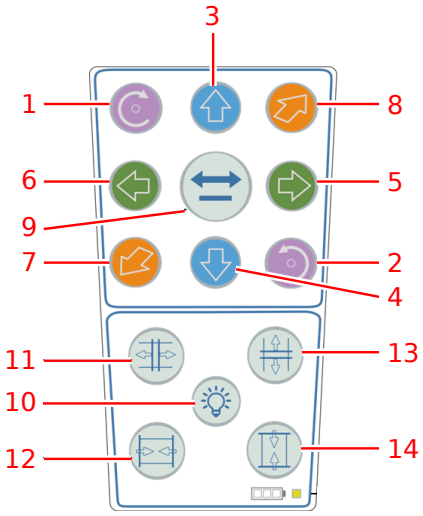


1. X-ray tube angle (alpha), right
2. X-ray tube angle (alpha), left
3. X-ray tube rotation (beta), right
4. X-ray tube rotation (beta), left
5. Vertical axis movement, up
6. Vertical axis movement, down
7. Longitudinal axis movement, right
8. Longitudinal axis movement, left
9. Transversal axis movement, front
10. Transversal axis movement, back
11. Automatic positioning button
12. Switch on the collimator light
13. Activate tracking

    Deactivate tracking
14. Activate automatic centering

    Deactivate automatic centering

Figure 82: Remote Control for positioning, tracking and automatic centering



1. X-ray tube angle (alpha), right
2. X-ray tube angle (alpha), left
3. Vertical axis movement, up
4. Vertical axis movement, down
5. Longitudinal axis movement, right
6. Longitudinal axis movement, left
7. Transversal axis movement, front
8. Transversal axis movement, back
9. Automatic positioning button
10. Switch on the collimator light
11. Increase the longitudinal collimation field
12. Decrease the longitudinal collimation field
13. Increase the transversal collimation field
14. Decrease the transversal collimation field

Figure 83: Remote Control for positioning and collimator control

Warning: Monitor the system movements initiated by the remote control always.

Warning: Do not use the remote control in case of an obvious defect.

Caution: When no movement of the system can be activated using the remote control and no error is shown, the X-ray generator may need to be restarted to restore communication between the remote control and the system.

Do not use the remote control after starting a digital tomosynthesis workflow or a full leg full spine workflow, until the complete sequence of exposure has ended.

A configuration can contain one of both remote controls or a combination of both remote controls.

When more than one button is pressed, the movement is stopped and a message is displayed. Operation can be resumed after all buttons have been released for 200 msec.

While more than one remote control can be linked to a system, only one remote control can be used at the same time.

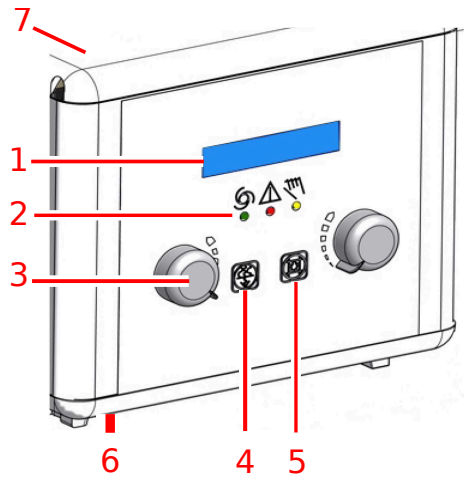
Note The speed of the movements controlled by the remote control is slower than movements controlled by the automatic positioning button.

Related information

Charging the battery of the remote control on page 24
No movement when using remote control on page 257

Automatic Collimator

The collimator can limit the collimated area to the size of the cassette or DR Detector inserted in the bucky.



1. Display
   - Size of the collimated area
   - Active filter
2. Operation mode indicators
   - Green: automatic mode
   - Red: error mode
   - Yellow: manual mode
3. Knobs to adjust the internal blades
4. Button to change the filter
5. Button to switch on or off the light field.

   After pressing the button, the lamp remains lit for a few seconds before automatically switching off. The time for the collimation light is configurable by service between 10 and 60 seconds.
6. Measurement tape to measure the distance between the focal spot of X-ray tube and the tabletop
7. Key to switch to manual mode

   The key is located on the backside of the collimator.

Figure 84: Ralco 225 ACS collimator controls

Another button to switch on the light field is available on both sides of the radiographic wall stand.

The collimator operates in full automatic mode normally. Other operation modes are manual collimation mode and semi-automatic collimation mode.

- Semi-automatic collimation mode on page 180
- Manual collimation mode on page 181
- Collimation area for free exposures on page 182
- Dose Area Product Meter (DAP) on page 183

Related information

Automatic collimator technical data on page 286
Bucky for large format DR only, with optional battery charger for XD/XF detectors on page 209
Bucky for all formats CR and DR, with optional battery charger for DR 14s detector on page 225

Semi-automatic collimation mode

The semi-automatic collimation mode is activated if any of following conditions applies:

- the tube head unit is rotated out of the center position
- the SID on the radiographic table is not within 90 cm to 130 cm
- the SID on the radiographic wall stand is not within 90 cm to 205 cm
- the tube head unit is not centered to bucky

In semi-automatic collimation mode the registration of the cassette or detector format in the bucky is stopped, but the collimation is still adapted when the SID is changed. The user can adjust the collimation manually.

Figure 85: Indication on the tube head display for semi-automatic collimation mode

Manual collimation mode

The manual collimation mode is activated when the user turns the key at the backside of the collimator. The yellow indicator at front of collimator is lit and an open key lock is displayed in the lower left corner of the collimator display.

Manual mode is used to set the collimation area larger than the size of the cassette or detector, e.g. for detector calibration. The collimation field size is not limited to cassette or detector size nor kept constant with changing SID.

Figure 86: Indication on the tube head display for manual collimation mode

Collimation area for free exposures

For free exposures, the collimated area is set automatically. Because the position of the cassette or detector is unknown, a preconfigured SID is assumed. The position of the X-ray tube relative to the cassette or detector must be manually adjusted to match the preconfigured SID.

Related information

Bucky for large format DR only, with optional battery charger for XD/XF detectors on page 209
Bucky for all formats CR and DR, with optional battery charger for DR 14s detector on page 225

Dose Area Product Meter (DAP)

An integrated DAP meter (Dose Area Product Meter) in the automatic collimator is availabe as an option.

The DAP meter reads the radiation as Dose Area Product in [cGy x cm^2].

The measured radiation value is transferred to the Software Console automatically and displayed after each exposure. No value is displayed if the measured radiation value is below the minimum readout value of the DAP meter.

The DAP meter cannot be removed from the collimator.

The DAP meter is calibrated during production to be used up to 2000 m altitude. Using the DAP meter on higher altitudes requires the application of a correction factor.

Effect of SID on patient dose

Changing the distance of the X-ray tube to the patient affects the dose applied to the patient.

For example doubling the distance reduces the dose by a factor of 4. The new dose can be calculated by a formula:

new mAs = known mAs × (new distance ^{2} / old distance ^{2})

Radiographic Table

The radiographic table allows X-ray examinations from head to foot of lying or sitting patients.

The table has a floating table top.

The table has blue LED in the table foot that is lit when the radiographic table is selected as active workstation.

1. Bucky
2. Tabletop movement pedals,
3. Blue LED indicator light for active workstation
4. Table covers
5. Emergency stop button
6. Tabletop

Figure 87: Radiographic table

- Positioning the Radiographic Table on page 186
- Collision protection on page 189
- Positioning the bucky on page 190
- Radiographic Table Accessories on page 191

Positioning the Radiographic Table

The radiographic table is adjustable in height from 55 cm to 90 cm.

An optional stop position at 70 cm can be configured during installation.

The movements of the radiographic table are controlled by foot pedals mounted at front side of the table. Additional foot pedals at the rear side are available as an option.

DANGER: Make sure that no persons or objects are within the movement area of the system where they can collide with moving parts of the system.

Warning: Maintain visual contact with the patient while moving the equipment close to the patient in order to detect hazardous situations (e.g. collisions) early and to avoid them.

- Positioning the floating tabletop on page 187
- Adjusting height on page 188

Related information

Collision protection on page 189
Collision indicator on page 175
Emergency stop button on page 38

Positioning the floating tabletop

To release the brake for moving the floating tabletop, double click and hold the foot pedal. The tabletop can be moved in longitudinal and transversal direction manually.

To stop movement and activate the brake, release the foot pedal.

Table 44: Movement controls

	Foot pedal to release the brake for the floating table top.

Note When the equipment is switched off, the tabletop can be moved freely. Pay extra attention when a patient needs to get off from the table.

Have the patient get on or off the table in the center of the table. If the table top is extended to the maximum length at the head or foot end, the patient must not sit on the end of the table top, since the weight load can lead to table deformations and damage to the product.

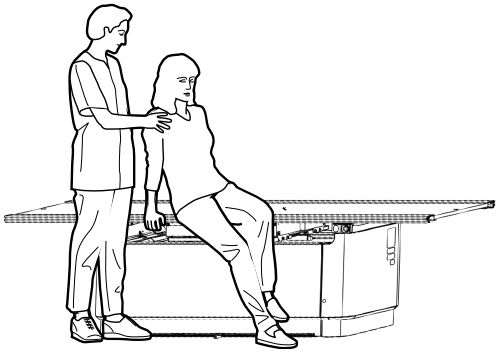


Figure 88: Getting on and off the radiographic table

In case of very heavy patients the table top has to be positioned in center before the patient getting on. The table top must remain in center also during examination.

The radiographic table is designed for a maximum patient weight of 400 kg.

Adjusting height

To adjust the height, double click and hold the foot pedal.

Table 45: Movement controls

	Foot pedal to lower table height (minimum 55 cm).
	Foot pedal to raise table height (maximum 90 cm).

When minimum or maximum position of the table is reached, the movement is stopped automatically.

If the standard exposure height stop position (optional) is enabled, the movement is stopped automatically when the standard exposure height (70 cm) is reached. To continue the movement, release the foot pedal and double click it again.

Markers on both sides of the table covers indicate the standard exposure height position.

Figure 89: Standard exposure height

Collision protection

The collision protection accessories are mounted on the frame of the radiographic table. They protect the tabletop from damage when colliding with objects below.

When the collision protection stops downward movement of the radiographic table, raise the table height and remove the object before lowering the table again.

Note The collision protection is influenced by the patient weight. Take special care when moving the radiographic table with a patient lying on.

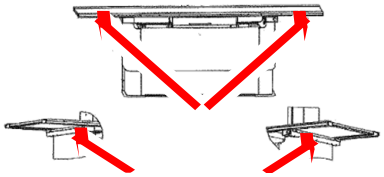


Figure 90: Location of the collision protection accessories

Positioning the bucky

1. Press and hold the bucky lock switch.
   The lock for the bucky movement is released.
2. Move the bucky in longitudinal direction.

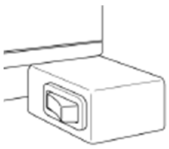


Figure 91: Bucky lock switch

3. Release the bucky lock switch.
   The position is locked.
4. To make sure the X-ray tube head and the bucky are aligned, use automatic centering or check the centering icon on the tube head display.

Related information

Automatically centering and alignment with DR detector in bucky on page 138

Radiographic Table Accessories

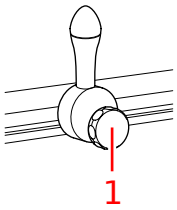
Warning: Using wrong accessories that cannot be properly attached to the system can lead to hazardous situations and injury. Use only original accessories provided by the manufacturer.

Mounting the patient hand grips

The pair of patient hand grips are used to stabilize the patient and give a feeling of security. Using the hand grips will avoid the patient grasping the table edges which could cause a risk to pinch fingers.

To mount a hand grip:

1. Slide the hand grip in the rails of the tabletop.
2. Tighten the hand screw to lock the hand grip in position.



1. Hand screw

Figure 92: Hand grip

Note The hand grips are not intended to support the weight of the patient.

Mounting the tabletop hand grips

The pair of tabletop hand grips are used by the operator for moving the floating tabletop. Using the hand grips will avoid the operator grasping the table edges which could cause a risk to pinch fingers.

To mount a hand grip:

1. Slide the hand grip in the rails of the tabletop.
2. Mount the stop blocks at the end of the rails to prevent the hand grip from sliding out of the rail.

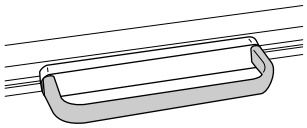


Figure 93: Hand grip

Foot pedals at the rear side

Additional foot pedals at the rear side are available as an option.

Mattress

The mattress fits the tabletop (220 cm x 80 cm) and is X-ray translucent.

Lateral cassette holder

The lateral cassette holder supports a cassette or detector in lateral position and is attached to the tabletop.

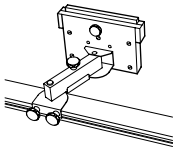


Figure 94: Lateral cassette holder

Lateral Exposures

1. Position the X-Ray tube head unit for lateral exposure over the table.

   If an automatic position is configured for lateral exposures, the X-Ray tube can be positioned using the automatic positioning.
2. Mount the lateral cassette holder on the side rail of the tabletop. Fix it using the two lower screws. Take care to lift the holders slightly up when moving it, to protect the tabletop from scratching.
3. Insert a cassette or a DR detector. Fix it using the upper screw.
4. Position the patient on the table between the X-ray tube and the lateral cassette holder. Adjust the lateral cassette holder to position the cassette as close as possible to the patient. Fix the position using the middle screw.

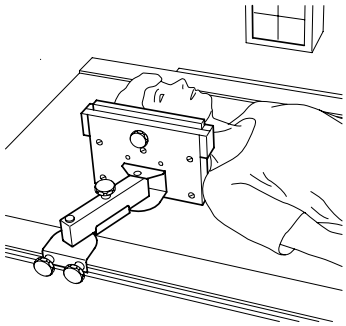


Figure 95: Lateral Exposures

Compression belt

The compression belt provides additional fixation for the patient on the table. It can be adjusted to patient thickness.

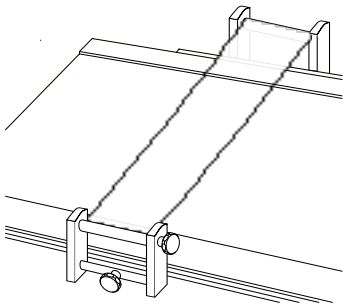


Figure 96: Compression belt

Radiographic Wall Stand

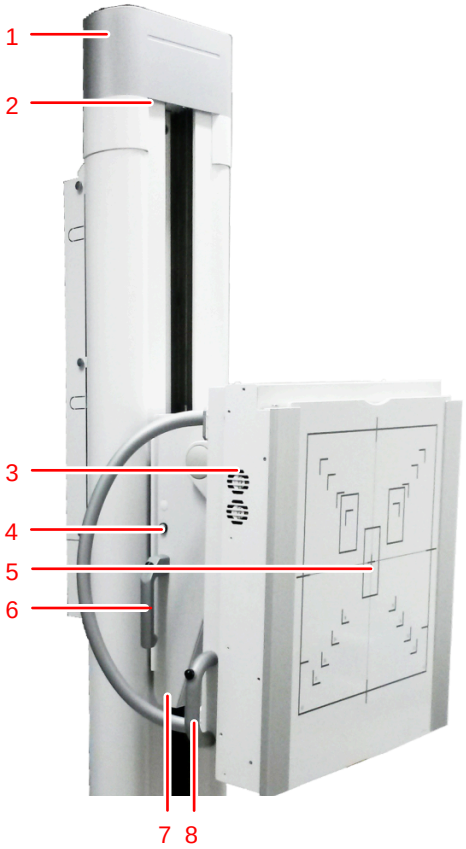
The radiographic wall stand allows vertical X-ray exposures of patients standing or sitting in front of the radiographic wall stand.

The bucky has two variants, depending on the orientation for loading a detector or cassette:

- Right hand side loading
- Left hand side loading

The wall stand bucky is height adjustable in a large range.

The wall stand has blue LED in the top that is lit when the radiographic wall stand is selected as active workstation.



1. Wall Stand column
2. Active workstation indicator
3. Bucky
4. Button to switch on the collimator light
5. Front panel
6. Vertical movement handle
7. Tilting extension
8. Tilting handle

Figure 97: Radiographic wall stand, vertical version and vertical tilting version

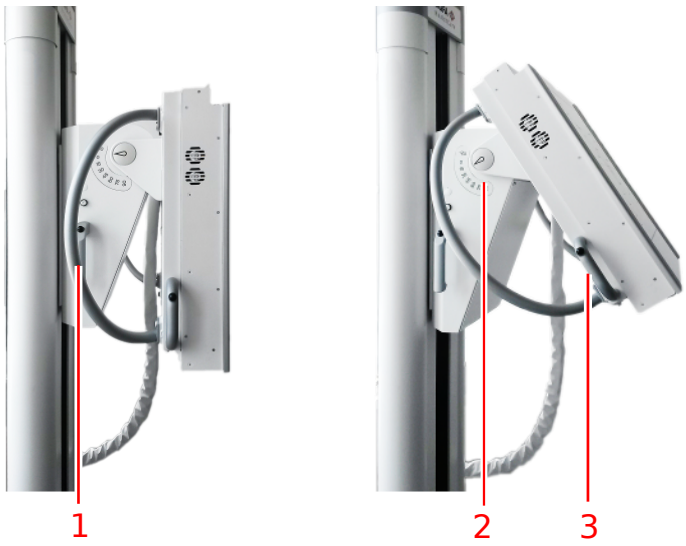
Caution: The format indications on the front of the bucky unit show the format and position of the cassette or detector. Take into account that the actual area for imaging is smaller

than indicated. The image of the exposed object is slightly magnified because there is a distance between the front of the bucky unit and the cassette or detector. The sensitive area of the cassette or detector may be slightly smaller than the indicated area. Check the technical data of the cassette or detector for exact values.

Automatic centering on the wall stand with the X-ray tube not perpendicular to the bucky, will cause the laser lines not to coincide with the center marks on the front panel of the bucky, because there is a distance between the front panel and the cassette or detector.

- Positioning the Radiographic Wall Stand on page 200
- Radiographic Wall Stand Accessories on page 202

Positioning the Radiographic Wall Stand



1. Vertical movement handle with brake switch
2. Tilting angle scale
3. Tilting handle

Figure 98: Positioning controls

DANGER: Make sure that no persons or objects are within the movement area of the system where they can collide with moving parts of the system.

Warning: Maintain visual contact with the patient while moving the equipment close to the patient in order to detect hazardous situations (e.g. collisions) early and to avoid them.

Warning: Be careful not to squeeze your finger or hand. Keep your hands at the handles while positioning the system.

Warning: If the tilting bucky is out of vertical position, do not use auto collimation. In this case switch the collimator to manual mode. When using automatic collimation on a tilting bucky, make sure that the bucky is in vertical position.

Vertical movement

To release the brake for vertical movement, press the switch that is integrated at the upper side of the handle located at the left and right side of the radiographic wall stand. The bucky can be moved up and down.

To stop movement and lock the bucky into position, release the switch.

Caution: The maximum load for the wall stand movement in vertical direction is 20 kg. The bucky unit may slip downwards when applying excessive load.

Note Do not move the bucky with excessive force to the end stop positions.

Tilting

To tilt the bucky, press and hold the button on the tilting handle and move the bucky. The scale for the angle is visible at the mounting point of the bucky.

To lock the bucky into position, release the button on the tilting handle.

Note The bucky can be tilted to horizontal position. Do not use the bucky as a seat.

Radiographic Wall Stand Accessories

Warning: Using wrong accessories that cannot be properly attached to the system can lead to hazardous situations and injury. Use only original accessories provided by the manufacturer.

Patient hand grips

The patient hand grips for wall stand are mounted fixed at the backside of the bucky. The patient uses these grips for stabilization and support of correct correct positioning, e.g. for chest exams.

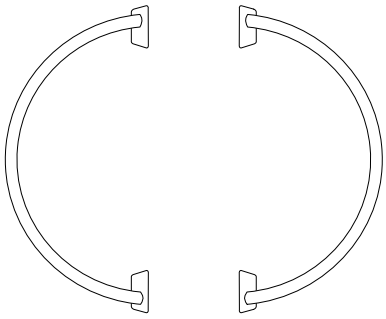


Figure 99: Patient hand grips

Mounting the lateral arm rest

Caution: The lateral arm rest can bear up to 20 kg. It is not intended to hold the whole weight of a patient.

Take care that the lateral arm rest does not collide with the ceiling when moving the bucky upward manually. For automatic movement, a sensor detects if the lateral arm rest is inserted and the movement is coordinated accordingly.

Do not insert the lateral arm rest oriented parallel to the bucky. The lateral arm rest may collide with the wall stand column.

To mount and position the lateral arm rest:

1. Insert the lateral arm rest on the left or on the right side of the bucky frame.
2. Grip the lower part of the lateral arm rest.
3. Pull the lateral arm rest forward
4. Adjust the angle.
5. Move the lateral arm rest back to fix the position.

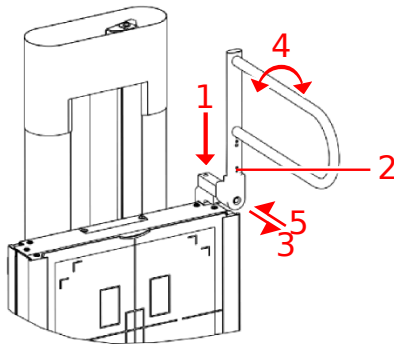


Figure 100: Lateral arm rest

Movement of the X-ray tube head is restricted in the neighbourhood of the lateral arm rest, to avoid collisions. To allow free movement of the tube head, the lateral arm rest must be unmounted from the wall stand. It is not sufficient to turn it 90 degrees out of the way.

Spacer

The spacer allows examination of sitting patients by offering additional space to position legs and feed under the bucky.

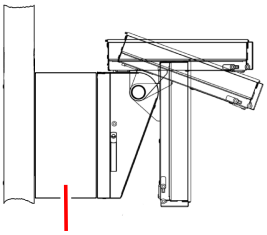


Figure 101: Spacer

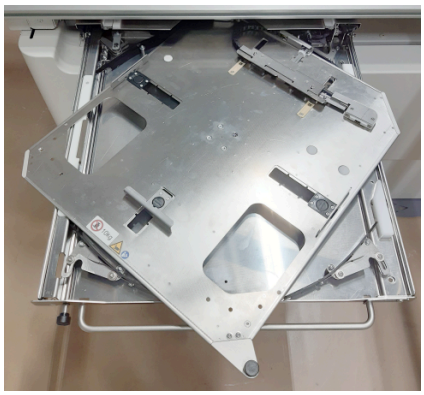
Wall stand fixation kit

For additional stability of the radiographic wall stand an additional fixation of the radiographic wall stand is provided. The kit is installed at backside of the radiographic wall stand under the head cover and then fixed to a wall. It has to be installed by service.

Bucky types

The type of bucky installed in the system defines which functionality is available.

Table 46: Bucky for large format DR only, with optional battery charger for XD/XF detectors

Radiographic table	5523/130 DR CASS. BUCKY FOR TABLE 5523/135 DR CASS. BUCKY FOR TABLE INCL DET CHARG (*)
Radiographic wall stand, left loading	5523/230 DR CASS. BUCKY WS LEFT L 5523/235 DR CASS. BUCKY WS LEFT L INCL DET CHARG (*)
Radiographic wall stand, right loading	5523/280 DR CASS. BUCKY WS RIGHT L 5523/285 DR CASS. BUCKY WS RIGHT L INCL DET CHARG (*)
Clamping mechnism for 35 cm x 43 cm and 43 cm x 43 cm DR detector formats Rotation mechanism DR detector detection with Automatic Cassette Size Sensing (ACSS) Removable grid with grid type and status detection AEC	

(*) Detector charging when DR detector is entered in the bucky tray, compatible with Agfa XD and XF detectors.

Table 47: Bucky for all formats CR and DR, with optional battery charger for DR 14s detector

Radiographic table	5523/120 5523/125
Radiographic wall stand, left loading	5523/220 5523/225
Radiographic wall stand, right loading	5523/270 5523/275

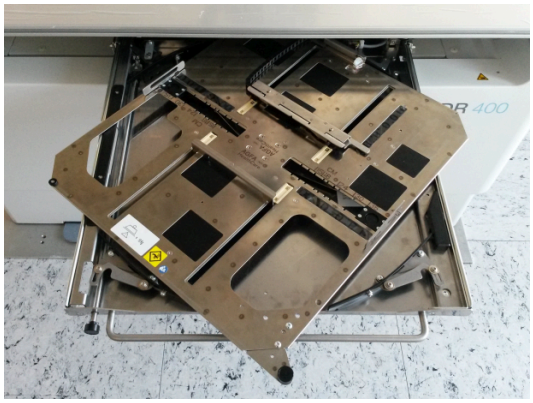
Clamping mechanism Rotation mechanism Cassette or detector detection CR double exposure protection Grid type and status detection AEC	
Automatic cassette size sensing (ACSS)	5523/120 5523/125 5523/220 5523/225 5523/270 5523/275
Integrated charger for DR 14s DR Detector	5523/125 5523/225 5523/275

Table 48: Bucky for fixed DR detector

Radiographic table	5523/300
Radiographic wall stand, left loading	5523/310
Radiographic wall stand, right loading	5523/320
Removable grid with grid type and status detection AEC	All types

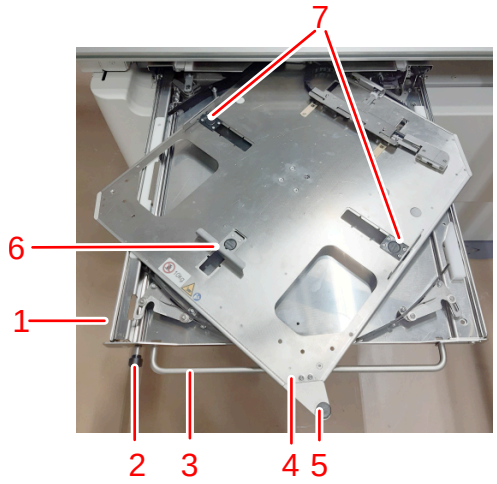
Bucky for large format DR only, with optional battery charger for XD/XF detectors

The bucky is installed in the radiographic table and in the radiographic wall stand.

The bucky clamps the detector during exposure and centers them relative to the Automatic Exposure Control (AEC) and the grid.

The bucky supports DR detectors in these formats: 43 cm x 35 cm (17 inch x 14 inch) and 43 cm x 43 cm (17 inch x 17 inch).

The bucky functionalities can be configured according the customer needs.



1. Bucky drawer
2. Button to release the lock
3. Bucky drawer handle
4. Carrier for the detector
5. Knob for rotating the detector
6. Clamps
7. Side clamps

Figure 102: Bucky

1. Tabletop
2. Removable grid
3. Automatic exposure control (AEC)
4. Carrier for detector
5. Bucky drawer with rotation mechanism

Figure 103: Bucky front view

- Bucky configuration on page 211
- Rotating the bucky on page 212
- Loading of the bucky in the Radiographic Table on page 213

- Loading of the bucky in the Radiographic Wall Stand on page 214
- Unloading of the bucky in the Radiographic Table on page 215
- Unloading of the bucky in the Radiographic Wall Stand on page 216
- Automatic Cassette Size Sensing on page 217
- Detector formats on page 218
- Compatible DR detector formats on page 219
- DR Detector formats and orientation on page 220
- Automatic Exposure Control (AEC) on page 224

Related information

Bucky for all formats CR and DR, with optional battery charger for DR 14s detector on page 225

Bucky configuration

Fixed DR Detector configuration

The bucky for the fixed DR detector has no clamping or rotation mechanism. The detector is permanently fixed in the bucky and can not be removed. The detector has a square format and requires no rotation.

Radiographic wall stand configuration

To allow chest exams with patient chin resting at the wall stand front panel, a 43 cm x 35 cm detector rotated in landscape orientation within the bucky, can be positioned centered or aligned with the upper edge of the bucky.

The bucky is available for left and right side loading of the wall stand.

Rotating the bucky

The detector in the bucky can be rotated without removing it from the clamping.

To change the orientation of the detector in the bucky:

1. Open the bucky drawer halfway by pulling the front handle.
2. Rotate the bucky carrier with the clamped detector using the rotation knob.
   - Rotate clockwise to change from portrait to landscape position
   - Rotate counterclockwise to change from landscape to portrait position

Figure 104: Example: rotate clockwise to change from portrait to landscape position

Make sure the rotation is complete before closing the bucky drawer.

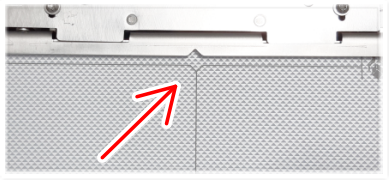
3. Close the bucky drawer using the front handle and pushing the button to release the lock.
   Make sure the bucky drawer is pushed up to the end to close completely.

Loading of the bucky in the Radiographic Table

To load the bucky with a DR detector:

1. Open the bucky drawer completely by pulling the front handle.
2. Push the detector towards the rear slider to open the clamping mechanism wide enough to contain the detector.
3. Let the detector slip into the clamping.

   Caution: Make sure your fingers are not between the clamping mechanism and the detector. The clamping mechanism may hurt your fingers, therefore take special care.
4. Align the detector center indication to the center mark on the clamp.



   Caution:

   When positioning the detector out of center:

   - The alignment to the X-ray tube must be controlled manually.
5. Close the bucky drawer using the front handle and pushing the button to release the lock. Make sure the bucky drawer is pushed up to the end to close completely.

Related information

Orientation of the XD and XF detector in the bucky on page 221

Loading of the bucky in the Radiographic Wall Stand

To load the bucky with a detector:

1. Open the bucky drawer completely by pulling the front handle.
2. Rotate the drawer to portrait orientation.
3. Adjust the side clamps to the detector format by pushing the lock button and moving the clamp.

4. Push the detector towards the lower slider to open the clamping mechanism wide enough to contain the detector.
5. Let the detector slip into the clamping.

Caution: Make sure your fingers are not between the clamping mechanism and the detector. The clamping mechanism may hurt your fingers, therefore take special care.

6. Rotate the detector if needed to get the correct position for next exposure.
7. Align the detector. The alignment can be centered or out of center.

Caution:

When positioning the detector out of center:

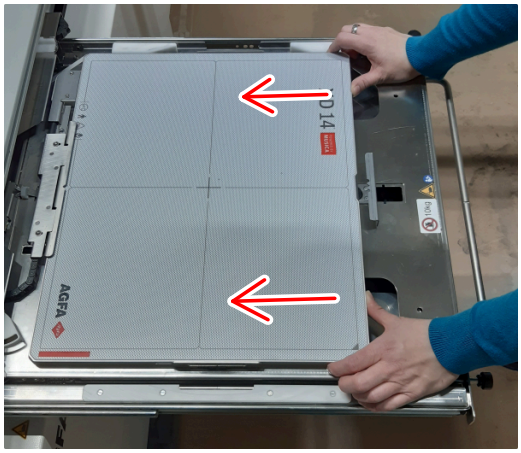
- The alignment to the X-ray tube must be controlled manually.
- The AEC cells might not be covered or not covered completely, causing wrong exposure dose. Make sure that AEC cells are covered.

8. Close the bucky drawer using the front handle and pushing the button to release the lock. Make sure the bucky drawer is pushed up to the end to close completely.

Unloading of the bucky in the Radiographic Table

To unload the bucky with a detector:

1. Open the bucky drawer completely by pulling the front handle.
2. Push firmly with both hands the detector towards the rear clamp to open the clamping mechanism.



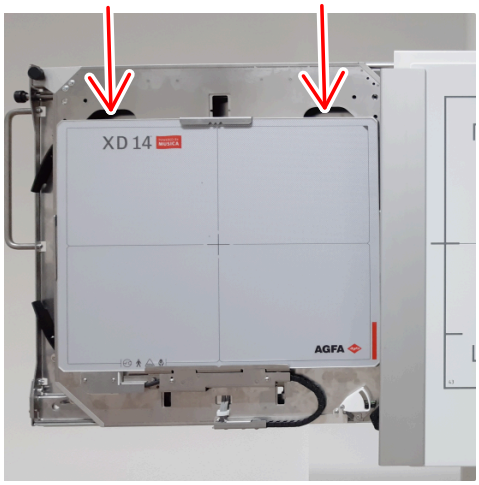
Caution: Make sure your fingers are not between the clamping mechanism and the detector. The clamping mechanism may hurt your fingers, therefore take special care.

3. Lift the detector and remove it from the clamping. The openings in the carrier allow your fingers to grip the detector.
4. Load the bucky with another detector.
   - Alternatively, close the bucky drawer using the front handle and pushing the button to release the lock.

Unloading of the bucky in the Radiographic Wall Stand

To unload the bucky with a detector:

1. Open the bucky drawer completely by pulling the handle.
2. Rotate the carrier back to portrait position.
3. Push firmly with both hands the detector towards the lower clamp to open the clamping mechanism.



Caution: Make sure your fingers are not between the clamping mechanism and the detector. The clamping mechanism may hurt your fingers, therefore take special care.

4. Remove the detector from the clamping. The openings in the carrier allow your fingers to grip the detector.
5. Load the bucky with another detector.
   - Alternatively, close the bucky drawer using the front handle and pushing the button to release the lock.

Automatic Cassette Size Sensing

The ACSS functionality of the bucky detects the size and orientation of the DR detector and allows the collimator to limit the collimated area accordingly. The collimation setting received from the NX workstation or the collimation area set by the user is automatically adjusted.

The ACCS functionality is not available when the collimator is in manual mode.

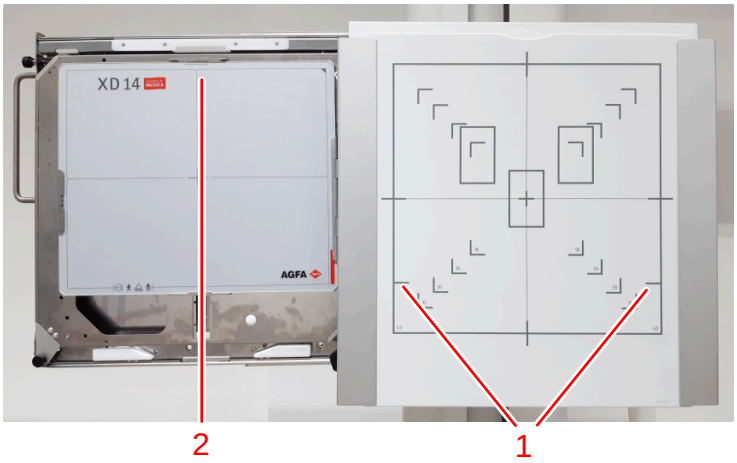
Related information

Automatic Collimator on page 179
Collimation area for free exposures on page 182

Detector formats

To adjust the side clamps to the format of the detector, indications are available in cm (and inch, depending on the bucky type). Corresponding indications are printed on the wall stand cover to align the collimation area.

The 43 cm x 35 cm (17 inch x 14 inch) detector can be positioned either centered or aligned to the top of the bucky in landscape position.



1. Indicators for large format detector position to the top of the bucky
2. Large format detector positioned to the top of the bucky

Figure 105: Wall stand bucky with large format detector positioned to the top of the bucky

Compatible DR detector formats

35 cm x 43 cm
43 cm x 43 cm

DR Detector formats and orientation

Refer to the user manual of the DR detector for instructions on the correct orientation of the detector when using it in the bucky.

The following sections contain instructions for specific situations where the instructions in the user manual of the detector do not apply.

- Orientation of the XD and XF detector in the bucky on page 221
- Using CR cassettes and DR detectors formats other than 35 cm x 43 cm and 43 cm x 43 cm only outside the bucky on page 223

Orientation of the XD and XF detector in the bucky

The orientations apply to XD 14, XD+14, XF+14, XD 17, XD+17 and XF+17 detectors.

If the bucky is equipped with an internal DR detector connector, the battery will be charged while the detector is in the bucky.

Orientation in the radiographic table

To use the detector in portrait orientation, insert the detector in portrait orientation.

To use the detector in landscape orientation:

1. Insert the detector in portrait orientation.
2. Rotate the detector in the bucky.

Figure 106: Landscape orientation in the radiographic table

Orientation in the radiographic wall stand left loading

- To use the detector in landscape orientation, insert the detector in landscape orientation.
- To use the detector in portrait orientation:

  1. Insert the detector in landscape orientation.
  2. Rotate the detector in the bucky.

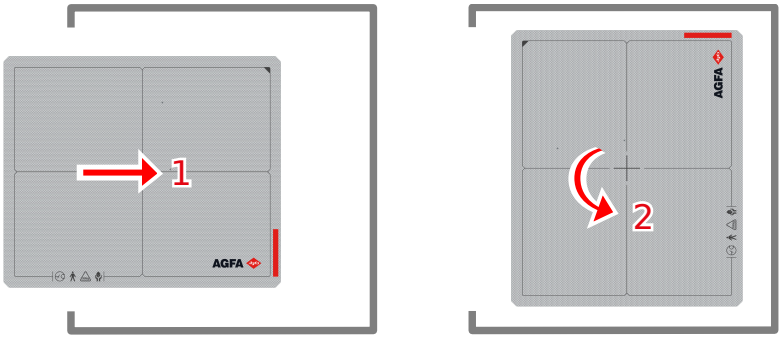


Figure 107: Portrait orientation in the radiographic wall stand left loading

Orientation in the radiographic wall stand right loading

- To use the detector landscape orientation, insert the detector in landscape orientation.
- To use the detector in portrait orientation:

  1. Insert the detector in landscape orientation.
  2. Rotate the detector in the bucky.

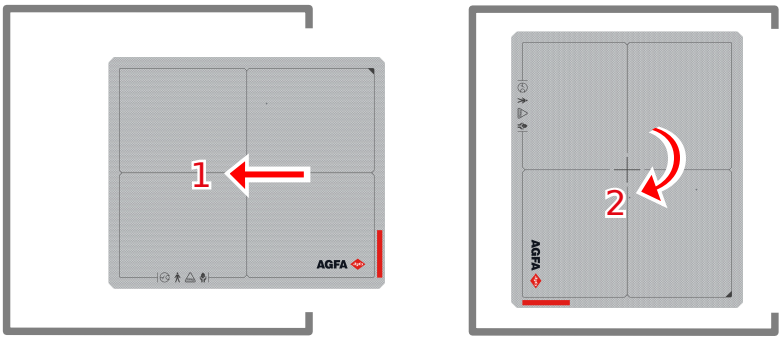


Figure 108: Portrait orientation in the radiographic wall stand right loading

Using CR cassettes and DR detectors formats other than 35 cm x 43 cm and 43 cm x 43 cm only outside the bucky

Use CR cassettes and DR detector formats other than 35 cm x 43 cm and 43 cm x 43 cm format (e.g. DX-D 45C, DX-D 45G, DR 10s, XD 10 and XF 10) only for free exposures. Do not put the detector inside the bucky of the radiographic table or the radiographic wall stand.

Automatic Exposure Control (AEC)

The use of an AEC ensures optimal and reproducible image quality independent of the radiation, the object exposed or other factors.

The AEC has three cells (ionization chambers).

The AEC is mounted in the bucky of the radiographic table and the radiographic wall stand between the grid and the detector. It is fixed and not intended to be removed from the bucky by the customer. If an exposure shall be done without AEC, the free exposure workflow has to be used, where the detector is placed outside the bucky, or the AEC has to be switched off in the Software Console.

The AEC is calibrated during production with default values. The AEC can be recalibrated during installation, defining three custom cut-off doses for the AEC cells, to suit user preferences or to balance out the three AEC cells.

The default orientation of the AEC cells on the table corresponds to a patient orientation with the head on the left side. The orientation is decided during installation of the system. A label is delivered with the system to indicate the patient orientation on the table.

The shortest irradiation time when using AEC is 2 ms.

Note The AEC cell is located in the bucky above the detector and may be slightly visible on the image. This applies most to flat field exposures and less to diagnostic images.

Related information

Automatic Exposure Control (AEC) Technical Data on page 285
Labeling of the Radiographic Table on page 60

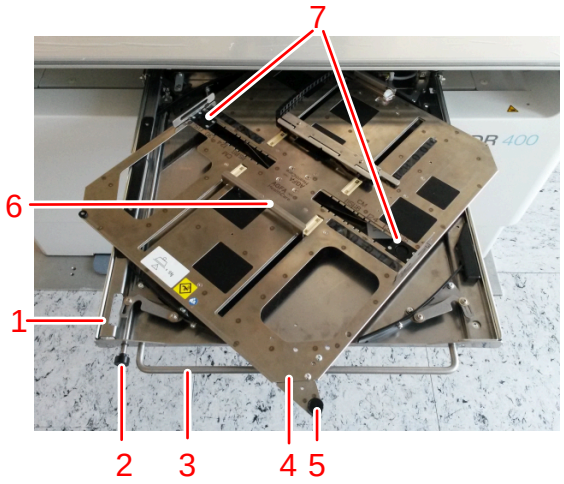
Bucky for all formats CR and DR, with optional battery charger for DR 14s detector

The bucky is installed in the radiographic table and in the radiographic wall stand.

The bucky clamps the cassette or detector during exposure and centers them relative to the Automatic Exposure Control (AEC) and the grid.

The bucky supports cassettes in standard formats as well as DR Detectors with cassette size format.

The bucky functionalities can be configured according the customer needs.



1. Bucky drawer
2. Button to release the brake
3. Bucky drawer handle
4. Carrier for the cassette or detector
5. Knob for rotating the cassette or detector
6. Clamps
7. Side clamps

Figure 109: Bucky

1. Tabletop
2. Removable grid
3. Automatic exposure control (AEC)
4. Carrier for cassette or detector
5. Bucky drawer with rotation mechanism

Figure 110: Bucky front view

- Bucky configuration on page 227
- Rotating the bucky on page 228
- Loading of the bucky in the Radiographic Table on page 229

- Loading of the bucky in the Radiographic Wall Stand on page 230
- Unloading of the bucky in the Radiographic Table on page 231
- Unloading of the bucky in the Radiographic Wall Stand on page 232
- Automatic Cassette Size Sensing on page 233
- Cassette and detector formats on page 234
- Standard cassette formats on page 235
- DR Detector formats and orientation on page 236
- Automatic Exposure Control (AEC) on page 240

Related information

Bucky for large format DR only, with optional battery charger for XD/XF detectors on page 209

Bucky configuration

Cassette only configuration

The workflow with cassettes requires removing the cassette from the bucky after each exposure. The cassette has to be scanned using a digitizer to get the final image.

The correct orientation of the cassette is applied by the way it is inserted in the bucky and there is no need to use the rotation mechanism.

In this configuration the rotation mechanism can be blocked during installation by the service engineer.

The bucky provides a protection for double exposure by checking if the bucky is re-armed after each exposure.

Fixed DR Detector configuration

The bucky for the fixed DR detector has no clamping or rotation mechanism. The detector is permanently fixed in the bucky and can not be removed. The detector has a square format and requires no rotation.

Radiographic wall stand configuration

The cassette or detector can be positioned centered or aligned with the upper edge of the bucky, to allow chest exams with patient chin resting at the wall stand front panel.

The bucky is available for left and right side loading of the wall stand.

Rotating the bucky

The cassette or detector in the bucky can be rotated without removing it from the clamping.

To change the orientation of the cassette or detector in the bucky:

1. Open the bucky drawer halfway by pulling the front handle.
2. Rotate the bucky carrier with the clamped cassette or detector using the rotation knob.
   - Rotate clockwise to change from portrait to landscape position
   - Rotate counterclockwise to change from landscape to portrait position

Figure 111: Example: rotate clockwise to change from portrait to landscape position

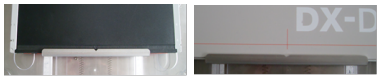
   Make sure the rotation is complete before closing the bucky drawer.
3. Close the bucky drawer using the front handle and pushing the button to release the brake. Make sure the bucky drawer is pushed up to the end to close completely.

Loading of the bucky in the Radiographic Table

To load the bucky with a cassette or detector:

1. Open the bucky drawer completely by pulling the front handle.
2. Push the cassette or detector towards the rear slider to open the clamping mechanism wide enough to contain the cassette or detector.
3. Let the cassette or detector slip into the clamping.

   Caution: Make sure your fingers are not between the clamping mechanism and the detector. The clamping mechanism may hurt your fingers, therefore take special care.
4. Align the cassette or detector center indication to the center mark on the clamp.



   Caution:

   When positioning the cassette or detector out of center:

   - The alignment to the X-ray tube must be controlled manually.
   - The AEC cells might not be covered or not covered completely, causing wrong exposure dose. Make sure that AEC cells are covered.
5. Close the bucky drawer using the front handle and pushing the button to release the brake. Make sure the bucky drawer is pushed up to the end to close completely.

Related information

Orientation of DR 14s in the bucky on page 237

Loading of the bucky in the Radiographic Wall Stand

To load the bucky with a cassette or detector:

1. Open the bucky drawer completely by pulling the front handle.
2. Rotate the drawer to portrait orientation.
3. Adjust the side clamps to the cassette or detector format by pushing the lock button and moving the clamp.

4. Push the cassette or detector towards the lower slider to open the clamping mechanism wide enough to contain the cassette or detector.
5. Let the cassette or detector slip into the clamping.

Caution: Make sure your fingers are not between the clamping mechanism and the detector. The clamping mechanism may hurt your fingers, therefore take special care.

6. Rotate the cassette or detector if needed to get the correct position for next exposure.
7. Align the cassette or detector. The alignment can be centered or out of center.

Caution:

When positioning the cassette or detector out of center:

- The alignment to the X-ray tube must be controlled manually.
- The AEC cells might not be covered or not covered completely, causing wrong exposure dose. Make sure that AEC cells are covered.

8. Close the bucky drawer using the front handle and pushing the button to release the brake. Make sure the bucky drawer is pushed up to the end to close completely.

Unloading of the bucky in the Radiographic Table

To unload the bucky with a cassette or detector:

1. Open the bucky drawer completely by pulling the front handle.
2. Push firmly with both hands the cassette or detector towards the rear clamp to open the clamping mechanism.

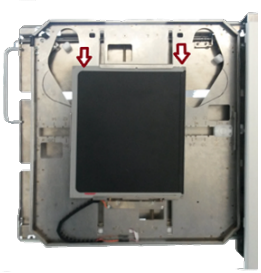
Caution: Make sure your fingers are not between the clamping mechanism and the detector. The clamping mechanism may hurt your fingers, therefore take special care.

3. Lift the cassette or detector and remove it from the clamping. The openings in the carrier allow your fingers to grip the detector or cassette.
4. Load the bucky with another cassette or detector.
   - Alternatively, close the bucky drawer using the front handle and pushing the button to release the brake.

Unloading of the bucky in the Radiographic Wall Stand

To unload the bucky with a cassette or detector:

1. Open the bucky drawer completely by pulling the handle.
2. Rotate the carrier back to portrait position.
3. Push firmly with both hands the cassette or detector towards the lower clamp to open the clamping mechanism.



Caution: Make sure your fingers are not between the clamping mechanism and the detector. The clamping mechanism may hurt your fingers, therefore take special care.

4. Remove the cassette or detector from the clamping. The openings in the carrier allow your fingers to grip the detector or cassette.
5. Load the bucky with another cassette or detector.
   - Alternatively, close the bucky drawer using the front handle and pushing the button to release the brake.

Automatic Cassette Size Sensing

The ACSS functionality of the bucky detects the size and orientation of the CR cassette or the DR detector and allows the collimator to limit the collimated area accordingly. The collimation setting received from the NX workstation or the collimation area set by the user is automatically adjusted.

The cassette or detector must be positioned in the center of the bucky. If the cassette or detector is not in the center of the bucky, the collimated area is automatically expanded to expose the whole surface of the cassette or detector. Because automatic collimation is always symmetrical, on one side the exposure will extend beyond the surface of the cassette or detector and the collimation must be corrected manually to apply an asymmetrical collimation area.

The collimator must not be rotated.

The ACSS functionality of the bucky is only available in combination with the automatic collimator. The ACCS functionality is not available when the collimator is in manual mode.

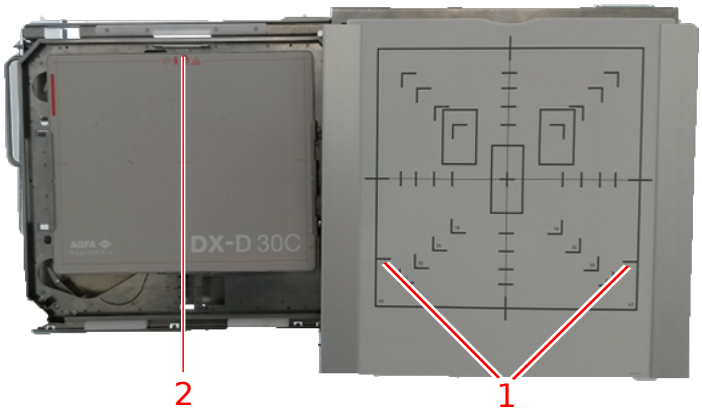
Related information

Automatic Collimator on page 179
Collimation area for free exposures on page 182

Cassette and detector formats

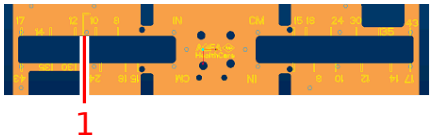
To adjust the side clamps to the format of the cassette or detector, indications are available in cm (and inch, depending on the bucky type). Corresponding indications are printed on the wall stand cover to align the collimation area.

The 43 cm x 35 cm (17 inch x 14 inch) cassette or detector can be positioned either centered or aligned to the top of the bucky in landscape position.



1. Indicators for large format cassette or detector position to the top of the bucky
2. Large format detector positioned to the top of the bucky

Figure 112: Wall stand bucky with large format detector positioned to the top of the bucky



1. Indicators for large format cassette or detector position to the top of the bucky

Figure 113: Indicators on bucky tray

Standard cassette formats

35 cm x 43 cm
35 cm x 35 cm
24 cm x 30 cm
18 cm x 24 cm
15 cm x 30 cm

DR Detector formats and orientation

Refer to the user manual of the DR detector for instructions on the correct orientation of the detector when using it in the bucky.

The following sections contain instructions for specific situations where the instructions in the user manual of the detector do not apply.

- Orientation of DR 14s in the bucky on page 237
- Using DX-D 45C, DX-D 45G, XD 10, XD*10 only outside the bucky on page 239

Orientation of DR 14s in the bucky

If the bucky is equipped with an internal DR Detector connector, the battery will be charged while the detector is in the bucky.

Orientation in the radiographic table

To use the detector in portrait orientation, insert the detector in portrait orientation.

To use the detector in landscape orientation:

1. Insert the detector in portrait orientation.
2. Rotate the detector in the bucky.

Figure 114: Landscape orientation in the radiographic table

Orientation in the radiographic wall stand left loading

- To use the detector in landscape orientation, insert the detector in landscape orientation.
- To use the detector in portrait orientation:

  1. Insert the detector in landscape orientation.
  2. Rotate the detector in the bucky.

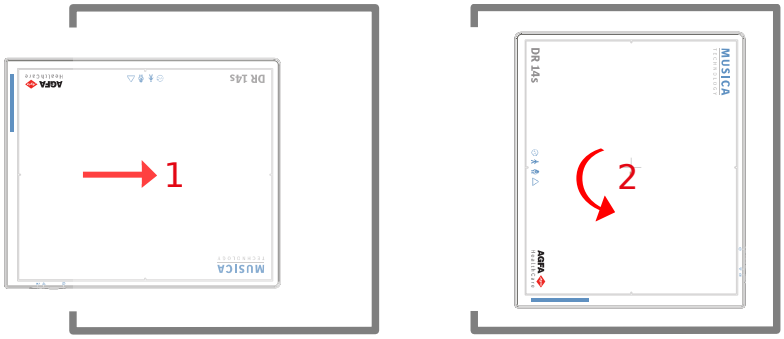


Figure 115: Portrait orientation in the radiographic wall stand left loading

Orientation in the radiographic wall stand right loading

- To use the detector landscape orientation, insert the detector in landscape orientation.
- To use the detector in portrait orientation:

  1. Insert the detector in landscape orientation.
  2. Rotate the detector in the bucky.

Figure 116: Portrait orientation in the radiographic wall stand right loading

Using DX-D 45C, DX-D 45G, XD 10, XD⁺10 only outside the bucky

Use the DX-D 45C, DX-D 45G, XD 10 and XD⁺10 detector only for free exposures. Do not put the detector inside the bucky of the radiographic table or the radiographic wall stand.

Automatic Exposure Control (AEC)

The use of an AEC ensures optimal and reproducible image quality independent of the radiation, the object exposed or other factors.

The AEC has three cells (ionization chambers).

The AEC is mounted in the bucky of the radiographic table and the radiographic wall stand between the grid and the detector or cassette. It is fixed and not intended to be removed from the bucky by the customer. If an exposure shall be done without AEC, the free exposure workflow has to be used, where the detector or cassette is placed outside the bucky, or the AEC has to be switched off in the Software Console.

The AEC is calibrated during production with default values. The AEC can be recalibrated during installation, defining three custom cut-off doses for the AEC cells, to suit user preferences or to balance out the three AEC cells.

The default orientation of the AEC cells on the table corresponds to a patient orientation with the head on the left side. The orientation is decided during installation of the system. A label is delivered with the system to indicate the patient orientation on the table.

The shortest irradiation time when using AEC is 2 ms.

Note The AEC cell is located in the bucky above the cassette or detector and may be slightly visible on the image. This applies most to flat field exposures and less to diagnostic images.

Related information

Automatic Exposure Control (AEC) Technical Data on page 285
Labeling of the Radiographic Table on page 60

Anti-scatter grids

Anti-scatter grids are used to reduce scattered radiation and improve image quality. Grids are available as an option.

For DR detectors focused grids are used. Focused grids require centering of the X-ray source to the detector and a specific distance range between X-ray source and detector. The color of the handle of the grid indicates which distance the grid is used for.

To change the grid in the radiographic table or the radiographic wall stand:

1. Pull out the grid using the handle.
2. Store the grid in a safe place to avoid damage.
3. Insert the grid with labels facing up in the appropriate slit of the bucky. Make sure the grid is pushed up to the end.

Warning: Handle anti-scatter grids with care and store them in a safe place when not in use. Dropping the grid can cause damage and create visible image artifacts or reduce image quality.

Caution: Using a focused anti-scatter grid with the X-ray source not centered or on a wrong distance may cause reduced image quality.

Caution: Injury of the patient or damage to the equipment can be caused by the anti-scatter grid if it is not properly inserted in the bucky.

- Anti-scatter grids on page 242
- Anti-scatter grid focal distance color indication on page 243
- Anti-scatter grid detection on page 243
- Storage box for DR detector and anti-scatter grids on page 244

Related information

Bucky Unit Technical Data on page 284

Anti-scatter grids

Anti-scatter grids are used to reduce scattered radiation and improve image quality. Grids are available as an option.

Refer to the Agfa website for specifications on the anti-scatter grids that have been found compatible with the system and the DR Detectors.

https://www.agfa.com/he/global/en/internet/library/overview.jsp?ID=54332498

Anti-scatter grid focal distance color indication

The handle of the grid is visible when the grid is inserted and its color indicates the focal distance of the grid.

Table 49: Grid focal distance color indication

Focal Distance	Color	
100 cm	red	
150 cm	green	
180 cm	blue	
Parallell grid	gray	

Anti-scatter grid detection

The grid detection functionality of the bucky detects the type of the grid and if the grid is correctly inserted in the bucky.

The grid status reflects if the inserted grid is suitable for the selected exposure and the current SID and is displayed on the tube head display and on the software console.

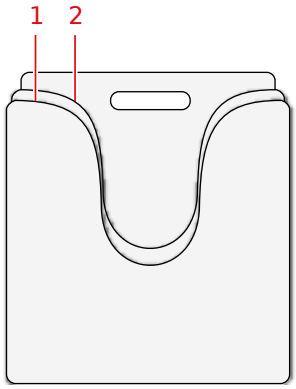
Related information

Anti-scatter grid status on page 160

Storage box for DR detector and anti-scatter grids

The storage box provides vertical storage space for a DR detector and up to three grids. It can be mounted to the wall or stand on a stable surface.

Caution: insert the DR detector and the anti-scatter grids in the storage box with care to avoid damage. Do not drop the items in the storage box.



1. Storage space for a DR detector
2. Storage space for up to three grids

Figure 117: Storage box

X-Ray Generator Mini Console

The X-ray generator mini console is limited in functionality to power on and power off the generator and to connect the DR Generator Sync with the exposure hand switch to trigger the exposure.

The X-ray exposure parameters are controlled on the **Software Console**.

Related information

System Documentation on page 273

Software Console and Tube Head Display on page 108

Starting and stopping the generator

The generator is switched on and off by the power buttons on the X-ray generator mini console.

⊙	Press the Power ON button on the X-ray generator mini console to switch on the generator.
⏻	Press the Power OFF button on the X-ray generator mini console to switch off the generator.

Following warning is printed on the X-ray generator mini console in English:

Warning: This x-ray unit may be dangerous to patient and operator unless safe exposure factors, operating instructions and maintenance schedules are observed.

This label is on the X-ray generator mini console. If the system has just been stopped, wait at least 10 seconds before starting it again, to allow all components to properly shut down.

Related information

X-ray generator mini console (Spellman) on page 32

X-ray tube start-up modes

The system can make exposures using two start-up modes, when pressing the exposure button in preparation stage:

- Low speed start-up that boosts the tube anode to ca. 3000 rpm.
- High speed start-up that boosts the tube anode to ca. 9000 rpm.

  No more than four high-speed start-ups are allowed per minute. An error is indicated if the number is exceeded.

High speed start-up is available during no more than 30 seconds. After that period the rotation speed will be reduced to low speed.

After the exposure and when the exposure button is released, the tube anode is braked automatically.

When the X-ray tube anode is rotating with high speed the generator must not be turned off. Please wait until the system is on low speed before switching the generator off. The bearings of the X-ray tube can be damaged if the generator is switched off before the anode is braked.

X-ray generator messages and warning signals (Spellman)

Acoustic signals

The generator indicates particular states with acoustic signals:

- Exposure is terminated: 500 ms tone
- Errors: rapid series of tones

Visual signals

The generator indicates particular states with visual signals:

- Preparation: flashing of prepare ready indicator (green LED)
- X-ray tube is prepared: prepare ready indicator is continuously lit (green LED)
- Exposure: radiation indicator is continuously lit (red LED)

Related information

System messages screen on page 128
X-ray generator mini console (Spellman) on page 32

Exposure parameters

Tube voltage

The tube voltage can be selected in steps of 1 kV in the range of 40 to 150 kV.

mAs product

Step	mAs	Step	mAs	Step	mAs	Step	mAs
0	0.5	10	5.0	20	50	30	500
1	0.63	11	6.3	21	63	31	600
2	0.8	12	8.0	22	80		
3	1.0	13	10	23	100		
4	1.2	14	13	24	125		
5	1.6	15	16	25	160		
6	2.0	16	20	26	200		
7	2.5	17	25	27	250		
8	3.2	18	32	28	320		
9	4.0	19	40	29	400		

Tube current [mA]

Step	mA	Step	mA
0	10	10	100
1	1 3	11	125
2	16	12	160
3	20	13	200
4	25	14	250
5	32	15	320
6	40	16	400
7	50	17	500
8	63	18	650 (1)
9	80	19	800 (2)

(1) only for generator with 50 kW power or higher

(2) only for generator with 65 kW power or higher

Exposure time [ms]

Step	ms	Step	ms	Step	ms	Step	ms
0	1	10	13	20	130	30	1250
1	2	11	16	21	160	31	1600
2	3	12	20	22	200	32	2000
3	4	13	25	23	250	33	2500
4	5	14	32	24	320	34	3200
5	6	15	40	25	400	35	4000
6	7	16	50	26	500	36	5000
7	8	17	63	27	630	37	6300
8	10	18	80	28	800		
9	11	19	100	29	1000		

Note Not all exposure parameters may be available, depending on the configuration of X-ray generator, X-ray tube and DR Detector.

Maximum tube current [mA] at 100 kVp and 0.1 s

	HFe 501 (50 kW)	HFe 601 (65 kW)	HFe 801 (80 kW)
E7252X	500 mA	650 mA	-
E7254FX	500 mA	650 mA	800 mA
E7869XX	-	650 mA	800 mA

All values are valid for 3-phase generator power line and large focal spot. Values for other exposure conditions can be determined using the technical data of the generator and the data sheets of the X-ray tubes.

In regular use these maximum exposure settings will not create doses that can cause deterministic effects. Effective patient doses for typical exposures are listed in Test Report for IEC 60601-1-3.

Note The accuracy for exposure parameter settings complies to EN IEC 60601-2-54 with absolute maximum of 10% for kV and an absolute maximum of 20% for mA.

- Radiographic Parameter Limits on page 250

Related information

System Documentation on page 273

Radiographic Parameter Limits

Switching between small focus and large focus may have a delay of a few seconds to enable the filament to warm up before switching.

The settings of kV and mAs or of mA and ms are defined by an algorithm. The highest mA setting is used for which the kV can be reached by the system and the exposure time is not lower than 1 ms or the mAs value is not lower than 0.5 mAs. When the kV setting is changed, the value of mA and

ms are adjusted automatically to keep the mAs value constant, within the boundaries of generator or X-ray tube limitations.

If the radiographic parameters limits are reached, a value of a radiographic parameter cannot be increased or decreased, or another value can be automatically adjusted:

- **Radiographic Parameters Limit**. A maximum or minimum radiographic parameter limit is reached. The value cannot be increased or decreased.
- **Generator Power Limit**. The generator power limit (kV x mA) is reached. The value of the selected parameter cannot be increased. When increasing the value of the other parameter, the value of the first parameter will automatically be decreased to keep the mAs value constant.
- **Space Charge**. The space charge limit in the selected X-ray tube is reached by changing the kV or mA values. An information message is displayed.
- **Instantaneous Power**. The instantaneous power limit of the X-ray tube (ratings limit or the X-ray tube is momentarily overheated) is reached by selecting some technique. An information message is displayed.

Exposure termination

In normal operation the exposure is terminated by the generator when:

- mAs product is reached
- Exposure time is reached
- AEC switches off

If the exposure switch is released the exposure is terminated instantaneously and an error is indicated.

In case of failure the exposure is instantaneously terminated when:

- AEC faulty
- Initial dose too high or too low with AEC (if function is activated)
- Maximum exposure time of 3.2 sec reached in 1-point technique with AEC
- mAs product of 600 mAs is reached
- Maximum permissible exposure time of 6.3 sec is reached (safety switch off)
- Door contact is opened

Problem solving

Restoring connection between generator and NX after generator failure

Details	An error on the generator occurred. NX lost connection to the generator. An error message that no connection with the generator can be established is displayed on the Software Console.
Cause	After a shutdown of the generator, the communication between the X-ray generator and the NX workstation is broken.
Brief Solution	To set up the communication between the X-ray generator and the NX workstation: **1.** Switch off the X-ray generator at X-ray generator console. **2.** After some seconds, switch the X-ray generator back on. **3.** Select an empty thumbnail in the Image Overview pane of the Examination window. **4.** The error message disappears. This may take some time. If an error is indicated on the X-ray generator by a signal, repeat step 1 to 3. During startup of the NX application and the Software Console, the communication to the generator is set up and the self-test of the generator is triggered.

NX does not connect to the generator due to ID tablet

Details	This occurs on a DR installation in combination with a digitizer using an ID Tablet. The NX application and the Software Console cannot connect to the generator. An error message that no connection with the generator can be established is displayed on the Software Console. Restarting the NX application does not help.
Cause	Conflicting communication sequence during startup of NX between the generator and the ID Tablet.
Brief Solution	**1.** Switch off the ID Tablet. **2.** Stop the NX workstation. **3.** Switch on the ID Tablet. **4.** Start the NX workstation.

No table movement

Details	The table is not moving up or down when pressing the foot pedals with double click. No error is shown.
Cause	One of the foot pedals was pressed longer than 90 seconds.
Brief Solution	**1.** Press the Power OFF button on the X-ray generator mini console to switch off the generator. **2.** Switch off the electrical room switch. **3.** Wait for 30 seconds. **4.** Switch on the electrical room switch. **5.** Press the Power ON button on the X-ray generator mini console to switch on the system.

No movement when using remote control

Details	No movement of the system can be activated using the remote control. No error is shown.
Cause	Communication between the remote control and the system.
Brief Solution	**1.** Press the Power OFF button on the X-ray generator mini console to switch off the generator. **2.** Switch off the electrical room switch. **3.** Wait for 30 seconds. **4.** Switch on the electrical room switch. **5.** Press the Power ON button on the X-ray generator mini console to switch on the system.

DR Detector is Exceeding the Maximum Working Temperature

Details	A message is displayed on NX indicating that the DR Detector is exceeding the maximum working temperature.
Cause	Due to ambient temperature conditions and the number of acquired images, the DR Detector's internal temperature may become too high.
Brief Solution	**1.** Power off the DR Detector. **2.** Leave the DR Detector unpowered for at least one hour. **3.** Stop the NX workstation. **4.** Power on the DR Detector. **5.** Start the NX workstation.

DR detector must be recalibrated

Details	A message is displayed indicating that the DR detector must be re-calibrated.
Cause	A DR detector must be recalibrated at regular interval.
Brief Solution	Follow the instructions in the user manual to calibrate the DR detector: • DR Detector Calibration Key User Manual, document 0134

Tube head display shows screen to check network connection

Details	The tube head display shows only the following screen.  
Cause	The tube head display does not detect a network connection.
Brief Solution	Check on the NX workstation if all network cables are plugged in.

Radiographic Parameter Limits

Switching between small focus and large focus may have a delay of a few seconds to enable the filament to warm up before switching.

The settings of kV and mAs or of mA and ms are defined by an algorithm. The highest mA setting is used for which the kV can be reached by the system and the exposure time is not lower than 1 ms or the mAs value is not lower than 0.5 mAs. When the kV setting is changed, the value of mA and ms are adjusted automatically to keep the mAs value constant, within the boundaries of generator or X-ray tube limitations.

If the radiographic parameters limits are reached, a value of a radiographic parameter cannot be increased or decreased, or another value can be automatically adjusted:

- **Radiographic Parameters Limit**. A maximum or minimum radiographic parameter limit is reached. The value cannot be increased or decreased.
- **Generator Power Limit**. The generator power limit (kV x mA) is reached. The value of the selected parameter cannot be increased. When increasing the value of the other parameter, the value of the first parameter will automatically be decreased to keep the mAs value constant.
- **Space Charge**. The space charge limit in the selected X-ray tube is reached by changing the kV or mA values. An information message is displayed.
- **Instantaneous Power**. The instantaneous power limit of the X-ray tube (ratings limit or the X-ray tube is momentarily overheated) is reached by selecting some technique. An information message is displayed.

Product Information

Compatibility

The system must only be used in combination with other equipment or components if these are expressly recognized by Agfa as compatible. A list of such equipment and components is available from Agfa service on request.

Changes or additions to the equipment must only be carried out by persons authorized to do so by Agfa. Such changes must comply with best engineering practice and all applicable laws and regulations that have the force of law within the jurisdiction of the hospital.

Connectivity

The NX workstation is connected to the X-ray system to exchange X-ray exposure parameters.

The NX workstation requires a 100 Mbit ethernet network to exchange information with a number of other devices.

The NX workstation communicates with other devices in the hospital network using one of the following protocols:

- DICOM
- IHE

The NX workstation can be connected to a RIS system (input scheduling), a PACS system (output image/data management) and to a hardcopy device (output image).

Note The data connections between the components of the system are separate from the hospital network and should not be disconnected or modified.

Compliance

The system is compliant with specific directives and standards.

General

- The product has been designed in accordance with Regulation (EU) 2017/745 on medical devices (MDR)
- ISO 13485
- ISO 14971

Safety

- IEC 60601-1
- AAMI ES 60601-1
- CSA C 22.2 No.60601-1

Essential performance

The product has no essential performance as defined in IEC 60601-1.

Electromagnetic Compatibility

- IEC 60601-1-2, EN 60601-1-2

For USA

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the installation manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. If required, contact your local service organization.

For Canada

This class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

X-Ray Safety

- IEC 60601-1-3
- IEC 60601-2-54
- IEC 60601-2-28

For USA

The system conforms to DHHS radiation Standards of 21CFR subchapter J as of the date of manufacture.

X-Ray Accuracy

The system fulfills the X-ray radiation accuracy according EN IEC 60601-2-54 with a variation of max. 0.05 (5%).

Environmental Compliance

- European Council Directive 1907/2006 (REACH)
- European Council Directive 2011/65/EU (RoHS 2)
- European Council Directive 2012/19/EU (WEEE)

Biocompatibility

- EN ISO 10993-1

Usability

- IEC/EN 62366
- IEC/EN 60601-1-6

Earthquake resistance

Earthquake resistance is available on system configurations containing the earthquake kit. After an earthquake, the system remains operational with manual movements only.

- CBSC Title 24, Part 2 (OSHPD)

Equipment Classification

Per EN/IEC 60601-1, EN/IEC 60601-2-54, this device is classified as following:

Table 50: Equipment classification

Class I equipment	Equipment in which protection against electric shock does not rely on basic insulation only, but includes a fixed connection to mains power with protective earth conductor.
Type B applied part	A Type B applied part is one that provides a particular degree of protection against electric shock particularly regarding allowable leakage current and reliability of the protective earth protection.
Protection against ingress of solid foreign objects and water	IP10 This device is protected against solid objects with a size (diameter) of 50 mm or larger. This device is not protected against droplets of water.
Cleaning	See section on cleaning and disinfecting.
Disinfection	See section on cleaning and disinfecting.
Flammable anesthetics	This device is not suitable for use in the presence of a flammable anesthetic mixture with air, or in presence of a flammable anesthetic mixture with oxygen or nitrous oxide.
Operation	Continuous operation.

Related information

Cleaning and Disinfecting on page 69

Patient data security

The user must ensure that the patients' legal requirements are met and that the security of the patient data is guarded.

The user must define who can access patient data in which situations.

The user must have a strategy available on what to do with patient data in case of a disaster.

• Requirements on the operating environment on page 269

Requirements on the operating environment

These operating environment requirements for information security and privacy (ISP), set in compliance with point 17(4) and 18(8) of Annex I of the EU Medical Device Regulation 2017/745, must be implemented and used in connection with the use of the Agfa medical device by the Customer (User). These are minimum requirements and designed to protect against unauthorised access that could hamper the device from functioning as intended.

Although Agfa has defined these ISP Operating Environment Requirements for implementation by the Customer, Agfa makes no warranties, expressed or implied regarding those ISP Operating Environment Requirements.

Agfa disclaims all liability if a security incident would occur despite the implementation of these ISP Operating Environment Requirements by the Customer.

Agfa reserves the right to revise these ISP Operating Environment Requirements and to make changes to them at any time. Possible revisions of the ISP Operating Environment Requirements will only be available in an electronic form, on request, via our website, by using the user documentation request form https://www.agfa.com/he/global/en/internet/library.

The information presented herein is sensitive and is company confidential. Without written authority from Agfa, further distribution outside the company is not allowed.

- Perimeter firewalls shall be in place and appropriately configured in order to ensure that communications between medical devices and external resources are either denied or restricted to just the communications that are essential for the medical devices to properly function.
- Network Intrusion Detection/Prevention Systems (NIDS/NIPS) shall be in place at the perimeter and appropriately configured, in order to provide early warning of an attack attempt or successful compromise of a medical device as well as to attempt to prevent compromise of medical devices.
- A Network Time Protocol Server shall be configured in the medical devices in order to synchronize the time in the audit logs with the time on the NTP server.
- Medical devices shall be on an isolated network segment that restricts communication of the medical devices to the systems that are required for the device to function.
- Internal firewalls shall be put in place to improve upon network segmentation and to further restrict communications of medical devices to the systems (internal and external) that they need to interact with.
- Medical device configurations shall be backed up in a secure separate device.
- Security controls shall be put in place to ensure that physical access to medical devices is limited only to authorized individuals and that physical theft of the device is prohibited.
- An incident response plan detailing responsibilities and how to react and recover from incidents, shall be in place. Staff involved in the incident response plan shall be trained to respond appropriately and effectively.
- A formal user provisioning and de-provisioning process shall be implemented to enable the appropriate management of access rights to medical devices.
- Users shall be assigned unique accounts to medical devices.

- User access rights to medical devices shall be reviewed for appropriateness and corrected as needed, at regular intervals not exceeding once a year.

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.

For a patient/user/third party in the European Union and in countries with identical regulatory regimes (Regulation 2017/745/EU on Medical Devices); 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.

Contact 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

Environmental protection

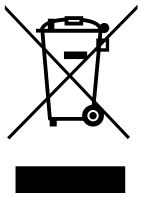


Figure 118: WEEE symbol

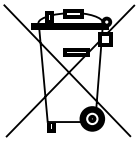


Figure 119: Battery symbol

WEEE end user notice

The directive on Waste Electrical and Electronic Equipment (WEEE) aims to prevent the generation of electric and electronic waste and to promote the reuse, recycling and other forms of recovery. It therefore requires the collection of WEEE, recovery and reuse or recycling.

Due to the implementation into national law, specific requirements can be different within the European Member States. The WEEE symbol on the products, and/or accompanying documents means that used electrical and electronic products should not be treated as, or mixed with general household waste. For more detailed information about take-back and recycling of this product please contact your local service organization and/or dealer. The recycling of materials will help to conserve natural resources.

Caution: By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product.

Battery notice

The battery symbol on the products, and/or accompanying documents means that the used batteries should not be treated as, or mixed with general household waste. The battery symbol on batteries or its packaging may be used in combination with a chemical symbol. In cases where a chemical symbol is available it indicates the presence of respective chemical substances. If your equipment or replaced spare parts contain batteries or accumulators please dispose of them separately according to local regulations.

For battery replacements please contact your local sales organization.

System Documentation

The DR 600 user documentation consists of

- DR 600 User Documentation DVD (digital media)
- MUSICA Acquisition Workstation (NX) User Documentation USB Flash Drive (digital media)
- User documentation for the supported DR Detectors

The DR 600 User Documentation DVD contains:

- DR 600 User Manual (this document)
- DR Detector Calibration Key User manual, document 0134
- DR Full Leg Full Spine User Manual, document 0179
- Exposure techniques for pediatric and adult use with DR 600, document 3263

These documents can be installed on the MUSICA Acquisition Workstation and be made available as part of the online help.

Other documentation available on the DR 600 User Documentation DVD:

- DAP Datasheet
- X-ray Tube Documentation
- Collimator Datasheet
- AEC Datasheet
- X-ray Generator User Manual
- Grid Instruction for Use
- Test Report for IEC60601-1-3
- Test Report for DIN6868-150

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.

Technical documentation is available in the product service documentation which is available from your local support organization.

The most recent version of this document is available on https://www.agfa.com/he/global/en/internet/library

- Installing the Online Help on page 273

Related information

Approved disinfectants on page 73
Anti-scatter grids on page 242

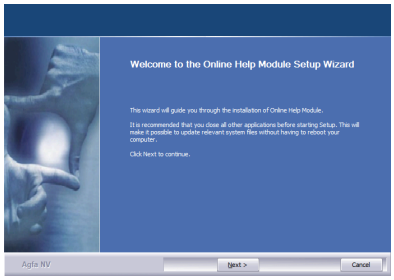
Installing the Online Help

The online help, published on this User Documentation CD, DVD or USB flash drive, can be installed on the NX workstation.

1. Open the CD, DVD or USB flash drive in **File Explorer**.

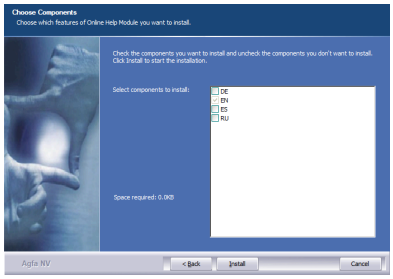
   Press simultaneously the **Windows** key and **E** to open **File Explorer**. Double-click the drive representing this documentation CD, DVD or USB.
2. Double-click the folder **Install Online Help on NX**.
3. Double-click the installer **Install Online Help.exe**.

   The installation wizard is started.



4. Click **Next**.

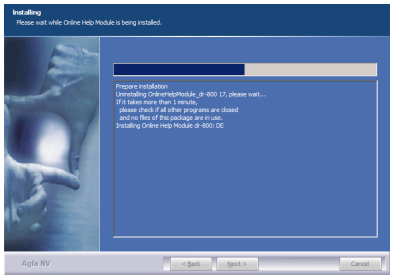
   The list of available languages is displayed.



5. Select the required languages and click **Install**.

   Only languages can be selected for which also the NX online help has been installed on the NX workstation.

6. The online help is copied to the NX workstation.



7. After the process is finished, click **Next** and complete the installation.

The online help is now always available on the NX workstation and can be accessed by pressing the **Help** button in the **Main Menu** of the NX application.

Training

The user must have received adequate training on the safe and effective use of the system before attempting to work with it. Training requirements may vary from country to country. The user must make sure that training is received in accordance with local laws or regulations that have the force of law. Your local Agfa or dealer representative can provide further information on training.

The user must note the following information in the system documentation:

- Intended Use.
- Intended User.
- Safety Directions.

Technical Data

DR 600 Technical Data

Manufacturer	Agfa NV Septestraat 27 2640 Mortsel, Belgium
Type	5530/100
Power line	See Generator Technical Data
Energy consumption (according to "COCIR Guidelines for users on saving energy")	
Scenario OFF	3.44 kWh
Scenario low power	4.14 kWh
Scenario Ready to scan	6.88 kWh
Permanent filtration	
E7254FX X-ray tube	2.8 mm Al @75kVp (+ 0.2 mm Al with DAP meter integrated in the collimator)
E7252X X-ray tube	2.9 mm Al @ 75kVp (+ 0.2 mm Al with DAP meter integrated in the collimator)
E7869XX X-ray tube	3.1 mm Al @ 75kVp (+ 0.2 mm Al with DAP meter integrated in the collimator)

Environmental conditions

Table 51: Environmental conditions for the X-ray system

Environmental Conditions (during storage and transport)	
Temperature (ambient)	between -15° and 50° Celsius
Humidity (non condensing)	between 15 and 90 % relative humidity
Atmospheric pressure	between 70 and 106 kPa
Environmental Conditions (during normal operation)	
Temperature (ambient)	between 10° and 35° Celsius
Humidity (non condensing)	between 30 and 75 % relative humidity
Atmospheric pressure	between 70 and 106 kPa
Maximum altitude	3000 m

For overall system environmental conditions, the environmental conditions of the DR Detector or image plate should be taken into account. Refer to the related User Manual for environmental conditions for the DR Detector or image plate. When using the DR Detector or image plate inside the

bucky, take into account that the temperature inside the bucky can be up to 5°C higher than the temperature in the X-ray room.

Generator Technical Data (Spellman)

Manufacturer	Spellman High Voltage Electronics GmbH Josef-Baumann-Strasse 23 D-44805 Bochum, Germany		
Supported Models	EDITOR HFe 501	EDITOR HFe 601	EDITOR HFe 801
Power rating for 400 VAC	113 A / 76 kVA	144 A / 96 kVA	180A / 120 kVA
Power rating for 480 VAC	97 A / 76 kVA	124 A / 96 kVA	154 A / 120 kVA
Max. Power	50 kW	65 kW	80 kW
Power Output (at 0.1s)	625mA: 80kVp 500mA: 100kVp 400mA: 125kVp 330mA: 150kVp	800mA: 80kVp 650mA: 100kVp 520mA: 125kVp 430mA: 150kVp	800mA: 80kVp 800mA: 100kVp 640mA: 125kVp 530mA: 150kVp
kV-Range	40-150 kV		
mAs-Range	0.5-600 mAs		
mAs-Range (tomosynthesis exposures)	0.1-16 mAs Maximum dose (air kerma) is reached at SID 100 cm, 150 kV, 16 mAs		
mA-Range	10-650 mA	10-800 mA	
ms-Range	1-6300 ms		
Power line 400 V Y-source	400V 3N~ PE (Y) 50/60 Hz		
Power line 400/480 V Delta-source	400/480V 3~PE (delta without N) 50/60Hz The power setting is selected during installation and printed on the type label.		
Dimensions	97 cm x 55 cm x 63 cm (HxWxD)		
Weight	129 kg		
Duty cycle	The Generator duty cycle is continuous, but limits should be set during installation depending on the capacity of the X-ray tube.		

Radiographic Table Technical Data

Manufacturer	Agfa NV Septestraat 27 2640 Mortsel, Belgium
Type	
TB-Elev-001	5521/500
Dimensions	
Radiographic table	140 cm x 77 cm x 55-90 cm (WxDxH)
Tabletop	220 cm x 81 cm x 4 cm (WxDxH)
Tabletop movement	Longitudinal, left side 60 cm Longitudinal, right side 50 cm Transversal, back and front 12 cm
Distance between tabletop and detector	< 60 mm
Tabletop attenuation equivalent mm Aluminum	≤ 0.7 According to DIN EN 60601-1-3 with 100kV and HVL 3.6 mm Al FDA 21 CFR § 1020.30 (n) with 100kV and HVL 3.6 mm Al
Weight of the radiographic table (including tabletop, bucky and accessories, without detector)	364 kg
Maximum load on the radiographic table	400 kg

Wall Stand Technical Data

Manufacturer	Agfa NV Septestraat 27 2640 Mortsel, Belgium
Type	
WS-Motorized-T-001	5522/600
Dimensions	
Height	2245 mm
Width	610 mm (only front panel) 715 mm (with tilting handles) 825 mm (with patient hand grips)
Depth	640 mm 990 mm (with spacer)
Height of detector center	33.5 to 185 cm
Angle of the detector	-20° to +90°
Minimum height of the bucky surface in tilted (horizontal) position	72 cm
Distance between front panel and detector	< 50 mm
Front panel attenuation equivalent mm Aluminum	≤ 0.7 According to DIN EN 60601-1-3 with 100kV and HVL 3.6 mm Al FDA 21 CFR § 1020.30 (n) with 100kV and HVL 3.6 mm Al
Weight	
Radiographic wall stand	196 kg
Radiographic wall stand with spacer	205 kg
Maximum load on the bucky (vertical)	32 kg
Maximum load on the brakes for the vertical movement	250 N

Ceiling Suspension Technical Data

Type		
Standard ceiling suspension	5530/110	5531/110
Ceiling suspension with reduced ceiling height	5530/130	5531/130
Dimensions		
Longitudinal rails	3.5 m to 6 m in increments of 0.5 m	
Transversal rails	2.5 m to 4 m in increments of 0.5 m	
Weight		
Carriage	240 kg	257 kg
Longitudinal rails	36.4 kg for rails of 3.5 m (for longer rails add 5.2 kg per 0.5 m)	77.7 kg for rails of 3.5 m (for longer rails add 11.1 kg per 0.5 m)
Transversal rails	25.2 kg for rails of 2.5 m (for longer rails add 5.0 kg per 0.5 m)	55.5 kg for rails of 2.5 m (for longer rails add 11.1 kg per 0.5 m)

X-Ray Tube Technical Data

Manufacturer	Canon Electron Tubes & Devices Co., Ltd. 1385 Shimoishigami Otawara-Shi, Tochigi-Ken 324-8550 Japan
E7252X	X-ray Tube 12º 150 kVp dual focal spots 0.6 and 1.2 mm 300 KHU LS 14/41 kW (50Hz) 16/45 kW (60Hz) HS 27/75 kW (180Hz) $7{,}24x10^6$ mAh@150kVp maximum load
E7254FX	X-ray Tube 12º 150 kVp dual focal spots 0.6 and 1.2 mm 400 KHU LS 22/55 kW (50Hz) 23/60 kW (60Hz) HS 40/102 kW (180Hz) $9{,}66x10^6$ mAh@150kVp maximum load
E7869XX	X-ray Tube 12º 150 kVp dual focal spots 0.6 and 1.2 mm 600 KHU LS 21/53 kW (50Hz) 23/58 kW (60Hz) HS 40/100 kW (180Hz) $14{,}49x10^6$ mAh@150kVp maximum load

Bucky Unit Technical Data

Manufacturer	Agfa NV Septestraat 27 2640 Mortsel, Belgium
Bucky for large format DR only, with optional battery charger for XD/XF detectors	
Supported sizes	35 cm x 43 cm in portrait and landscape orientation 43 cm x 43 cm
DR CASS. BUCKY FOR TABLE	5523/130
DR CASS BUCKY FOR TABLE INCL DET CHARG	5523/135
DR CASS. BUCKY WS LEFT L	5523/230
DR CASS BUCKY WS LEFT L INCL DET CHARG	5523/235
DR CASS. BUCKY WS RIGHT L	5523/280
DR CASS BUCKY WS RIGHT L INCL DET CHARG	5523/285
Bucky for all formats CR and DR, with optional battery charger for DR 14s detector	
Supported sizes	15 cm x 30 cm to 43 cm x 43 cm in portrait and landscape orientation
BT-Cassette-T-ACSS-001	5523/120
CASS BUCKY TABLE ACSS INCL DET CHARG	5523/125
BT-Cassette-WS-ACSS-L-001	5523/220
CASS BUCKY WS LL ACSS INCL DET CHARG	5523/225
BT-Cassette-WS-ACSS-R-001	5523/270
CASS BUCKY WS RL ACSS INCL DET CHARG	5523/275
Fixed DR detector configuration	
BT-Fixed-T-001	5523/300
BT-Fixed-WS-L-001	5523/310
BT-Fixed-WS-R-001	5523/320

Dimensions	
Dimensions in radiographic table	65.5 cm x 60.0 cm x 8.0 cm (WxLxH)
Dimensions in radiographic wall stand	62.5 cm x 61.5 cm x 12.5 cm (WxLxH)
Charging time of the DR Detector battery	maximum 9 hours

Automatic Exposure Control (AEC) Technical Data

Table 52: Varex AEC ionization chamber

Manufacturer	Varex Imaging Americas Corp. 3835 Carnation Street Franklin Park, IL 60131 U.S.A.
Supported Type	ICX1945B
Description	3-field ionization chamber with electronics
Maximum dose rate	1.250 uGy/s
Exposure time range	1 ms to 6 s
Attenuation equivalent mm Aluminum	0.35mm @ 100kV (no filtration)
Dimensions	45 cm x 45 cm x 0.8 cm (WxLxH)

Automatic collimator technical data

Manufacturer	Ralco Via dei Tigli 13/G 20853 Biassono (MB), Italy
Supported type	R 225 ACS
Maximum radiation leakage	150 kVp – 4 mA
Inherent filtration	2 mm Aluminum equivalent
Added filtration	0mm Al 2mm Al 1mm Al + 0.1mm Cu 1mm Al + 0.2mm Cu
Maximum field Size at SID of 100 cm	48 cm x 48 cm
Dimensions	28.5 cm x 24.4 cm x 20.2 cm (WxDxH)
Weight	11 kg

Dose Area Product Meter (IBA DAP) Technical Data

Manufacturer	IBA Dosimetry GmbH Bahnhofstrasse 5 DE-90592 Schwarzenbruck
Supported Type	120-131 HS/RS485
Dose area product range	(0.1...99999999.99) cGy x cm^2
DAP resolution	0.01 cGy x cm^2
Active area	14.0 cm x 14.0 cm
Dimensions	17.9 cm x 16.6 cm x 1.7 cm (WxDxH)
Weight	approx. 220 g
Equivalent filtration of the ionization chamber at 70 kV	0.31 mm Al

Correction factors for using the DAP meter on high altitude	
Environmental conditions	Correction factor
75 kPa (ca. 2500 m) 0° Celcius	1.26
75 kPa (ca. 2500 m) 20° Celcius	1.35
70 kPa (ca. 3000 m) 0° Celcius	1.35
70 kPa (ca. 3000 m) 20° Celcius	1.45

Dose Area Product Meter (VacuTec DAP) Technical Data

Manufacturer	VacuTec Messtechnik GmbH Dornblüthstrasse 13 D-01277 Dresden, Germany
Supported Type	VacuDAP 2004
Dose area product range	(1.0...9999999.9) cGy x cm^2
DAP resolution	0.1 cGy x cm^2
Active area	14.7 cm x 14.7 cm
Dimensions	18.2 cm x 17.7 cm x 1.8 cm (WxDxH)
Weight	270 g
Equivalent filtration of the ionization chamber at 70 kV	0.24 mm Al

Correction factors for using the DAP meter on high altitude	
Environmental conditions	Correction factor
75 kPa (ca. 2500 m) 0° Celcius	1.26
75 kPa (ca. 2500 m) 20° Celcius	1.31
70 kPa (ca. 3000 m) 0° Celcius	1.35
70 kPa (ca. 3000 m) 20° Celcius	1.40

Fixed DR Detector

Portable DR detector technical data (mounted fixed in the bucky)

Manufacturer	
Manufacturer DR detector	Vieworks Co., Ltd. (Gwanyang-dong), 41-3, Burim-ro 170beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, Korea
Distributor DR detector	Agfa NV Septestraat 27, B-2640 Mortsel - Belgium
Original manufacturer model name	
XD 17	FXRD-4343VAW
XD*17	FXRD-4343VAW PLUS
Electrical connection	
Power adapter with USB Type-C cable	DC 18 V, max. 2.78 A
Power consumption	max. 24 W
Network connection	
Wireless connection	IEEE 802.11n/ac (2.4 GHz/5 GHz)
Environmental conditions (during normal operation)	
Room temperature	between 0 °C and +40 °C
Humidity (non condensing)	between 5% and 90% RH (non-condensing)
Atmospheric pressure	between 700 hPa and 1060 hPa
Environmental conditions (during storage and transport)	
Temperature (ambient)	between -15 °C and +55 °C
Humidity (non condensing)	between 5% and 90% (non-condensing)
Atmospheric pressure	between 500 and 1060 hPa
Image acquisition	
Image acquisition time (minimum cycle time)	4 s
Conversion screen	CsI
Pixel size	140 µm
Active pixel matrix	3072 x 3072
Effective pixel matrix	3048 x 3048
Detector type	amorphous silicium
Active area size	430 mm x 430 mm

Effective area size	426.7.0 mm x 426.7 mm

Fixed DR detector technical data

Manufacturer	
Manufacturer DR detector	THALES AVS FRANCE SAS 460 Rue du Pommarin – BP122 38430 MOIRANS France
Supported models	
Pixium RAD 4343 C-E	CsI conversion screen
Electrical connection	
Operating voltage	+24V 3.5A DC
Warming-up time	
	5 minutes
Throughput	
Maximum number of image acquisitions	150 acquisitions per hour
Reliability	
Estimated product life (if regularly serviced and maintained according to Agfa instructions)	100 Gy

Pixel matrix	Pixium RAD 4343 G
Pixel size	148 µm (H,V)
Pixel matrix	2880(H) x 2880(V)
Active pixel matrix	2869(H) x 2874(V)
Fill factor	100 %
Detector type	Amorphous silicon
Active area size	426.6 mm (H) x 425.4 mm (V)

Fixed DR detector environmental conditions

Pixium RAD 4343 C

Environmental conditions (during normal operation)	
Temperature (ambient)	between 15° and 35° Celsius
Humidity Atmospheric pressure Maximum altitude	Refer to environmental conditions of the X-ray system

	minimum	**maximum**
Distance to calibration temperature	-6 °C	+6 °C
Distance to calibration pressure	-100 mbar	+100 mbar

Pixium RAD 4343 C-E

Environmental conditions (during normal operation)	
Temperature (ambient)	between 15° and 35° Celsius
Humidity Atmospheric pressure Maximum altitude	Refer to environmental conditions of the X-ray system

	minimum	**maximum**
Distance to calibration temperature	-10 °C	+10 °C
Distance to calibration pressure	-100 mbar	+100 mbar

Pixium RAD 4343 G, Pixium RAD 4343 G-E

Environmental conditions (during normal operation)	
Temperature (ambient)	between 15° and 40° Celsius
Humidity Atmospheric pressure Maximum altitude	Refer to environmental conditions of the X-ray system

	minimum	**maximum**
Distance to calibration temperature	-10 °C	+10 °C
Distance to calibration pressure	-100 mbar	+100 mbar

Portable DR detector technical data

Refer to the DR Detector User Manual.

NX workstation technical data

Electrical connection	
Operating voltage	90 – 263 VAC
Mains fuse protection	5.5 A
Mains frequency	47 – 63 Hz
Power consumption	
Maximum power consumption	320 W
Power consuption during standby (incl monitor)	32 W
Power consuption	45 W

DR Generator Sync Box technical data

Model name	DR Generator Sync Box
Type number	5400/516
Labeling	
Dimensions	
Depth	21.5 cm
Width	33.5 cm
Height	6.5 cm
Weight	3.2 kg
Electrical connection	100-240 V AC, 50/60 Hz
Estimated product life	7 years

Remarks for HF-emission and immunity

It is hereby certified that the device has interference suppression according to the EN 55011 Class A as well as the FCC Rules CFR 47 Part 15 Class A.

This device was tested for a normal hospital environment as described above.

The user of the device should ensure that it is used in such an environment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Warning: This device is intended for use by healthcare professionals only. This device may cause radio interference or may disrupt the operation of nearby equipment. It may be necessary to take mitigation measures, such as re-orienting or relocating the device or shielding the location.

Warning: The HF-emission and immunity can be influenced by connected data cables depending on length and the manner of installation.

This device is intended for operation in the electromagnetic environment given below. The user of the device should ensure that it is used in such an environment.

RF Emission Measurements	Agreement	Electromagnetic Environment Guidelines
High frequency RF emissions in accordance with CISPR 11	Group 1	The device uses high frequency energy exclusively for its internal functions. For this reason, its high frequency RF emission is very low and it is improbable that neighboring electronic equipment will be disrupted.
High frequency RF emissions in accordance with CISPR 11	Class A	The emissions characteristics of this equipment make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If it is used in a residential environment (for which CISPR 11 class B is normally required) this equipment might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the equipment.
Harmonic emission in accordance with IEC 61000-3-2	Class A	
Voltage fluctuations / flickering in accordance with IEC 61000-3-3	Fulfilled	

DR 600 is used in a professional healthcare facility / radiological environment. Environmental conditions are stated in the user manual.

This device was tested for a professional healthcare environment as described above. Nevertheless the HF-emission and immunity can be influenced by connected data cables depending on length and the manner of installation.

Resistance to Jamming Test	**Test level of professional medical equipment and basic EMC standards**	**Electromagnetic Environment Guidelines**
Discharge of static electricity in accordance with IEC 61000-4-2	± 8 kV contact discharge ± 2, 4, 8, 15 kV air discharge	Floors should consist of wood, concrete or ceramic tiles. The relative humidity must be at least 30%, if the floor is made of synthetic material.
Fast transient electrical disturbance variables / bursts in accordance with IEC 61000-4-4	± 2 kV mains ± 1 kV data lines	The quality of the voltage supplied should correspond to a typical commercial or clinical environment.
Impulse voltages (surges) in accordance with IEC 61000-4-5	± 1 kV line-line voltage ± 2 kV line-ground voltage	The quality of the voltage supplied should correspond to that of a typical commercial or clinical environment.
Voltage breakdown, short term interruptions and variations in the voltage supplied in accordance with IEC 61000-4-11	• 0% U_r for ½ period • 0% U_r for 1 period • 70% U_r (30% breakdown of U_r) for 25 periods at 0° • 0% U_r for 250 periods	The quality of the voltage supply should correspond to that of a typical commercial or clinical environment. If the user wants the device to work continuously, even when the energy supply is interrupted, it is recommended to use an energy supply free of interruptions or a battery.
Magnetic field at the supply frequency (50/60 Hz) in accordance with IEC 61000-4-8	30 A/m	Magnetic field at the network frequency should correspond to the typical values as they are in a commercial and clinical environment.
REMARK : U_r is the alternating current in the network before the application of the test level.		

This device is intended for operation in the electromagnetic environment given below. The user of the device should ensure that it is used in such an environment.

Tests of Resistance to Disruption	**Test level of professional medical equipment and basic EMC standards**	**Electromagnetic Environment** Recommended protective distance:
Conducted high frequency disturbance variables in accordance with IEC 61000-4-6	3 V 150 kHz to 80 MHz 6 V within ISM bands	
Radiated high frequency disturbance variables in accordance with IEC 61000-4-3	3 V/m 80 MHz to 2.7 GHz	

RF communication	Refer to the section "Immunity to RF wireless communication equipment"	
		Disruptions are possible near devices that carry the following symbol: 

The field strength of stationary transmitters, such as base stations of radio telephones, mobile broadcasts for rural areas, amateur stations, and AM and FM radio transmitters, cannot be precisely predetermined theoretically. An investigation of the location is recommended, to ascertain the electromagnetic environment as a result of stationary high frequency transmitters. If the field strength of the device exceeds the test level given above, the device must be observed with regard to its normal operation at each place of use. In case of unusual performance characteristics, it can be necessary to take additional measures, such as the re-orientation of the device, for example.

This device is intended for operation in an electromagnetic environment in which the radiated high frequency disturbance variables are monitored. The user of the device can help to prevent electromagnetic disruptions by maintaining the minimum distances between portable and mobile high frequency communication equipment (transmitters) and the device as recommended below, in accordance with the maximum output power of the communications equipment. See also the section with precautions on EMC.

Recommended Protective Distances between Portable and Mobile High Frequency Communication Equipment and the Device

Rated Power of the Transmitter W	Protective Distance in accordance with RF emission Frequency m		
	150 kHz to 80 MHz $d = 1.0 \sqrt{P}$	80 MHz to 800 MHz $d = 0.3 \sqrt{P}$	800 MHz to 2.7 GHz $d = 0.3 \sqrt{P}$
0.01	0.1	0.05	0.05
0.1	0.32	0.1	0.1
1	1.0	0.3	0.3
10	3.2	1.0	1.0

The distance can be determined through the equation for each respective column.

P is the rated power of the transmitter in watts (W) according to the manufacturer information on the transmitter, only for transmitters where the rated power is not mentioned in the above table.

REMARK : These Guidelines may not be relevant in all situations. The dispersion of electromagnetic waves is influenced by absorption and reflections from buildings, objects and people.

Immunity to RF wireless communication equipment

ISM Band (MHz)	**Service**	**Distance (m)**	**Immunity test level (V/m)**
300-390	TETRA 400	0.3	27
430-470	GMRS 460; FRS 460	0.3	28
704-787	LTE Band 13, 17	0.3	9
800-960	GSM 800/900; TETRA 800, IDEN 820; CO-MA 850; LTE Band 5	0.3	28
1700-1990	GSM 1800; COMA 1900; GSM 1900; DECT; LTE Band 1, 3, 4, 25; UMTS	0.3	28
2400-2570	Bluetooth; WLAN; 802.11 b/g/n; RFID 2450; LTE Band 7	0.3	28
5100-5800	WLAN 802.11 a/n	0.3	9

Precautions on EMC

Warning: Use of this equipment adjacent to or stacked with other equipment should be avoided because it could result in improper operation. If such use is necessary, this equipment and the other equipment should be observed to verify that they are operating normally.

Warning: Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 inches) to any part of the system, including cables specified by the manufacturer. Otherwise, degradation of the performance of this equipment could result.

Warning: The DR detectors might be interfered with by other equipment.

Cables, transducers and accessories

Cables, transducers and accessories which were tested and found to comply with the collateral standard IEC60601-1-2 (EMC):

Caution: Use of accessories, transducers and cables other than those specified or provided by the manufacturer of this equipment could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and result in improper operation.

Unless noted otherwise, available cable lengths are 16 m, 20 m and 24 m.

CR; **Gen/StC**	**type;** **maximum length (m)**	**remark**
Mini Console	10x AWG26; 30	20 m basic wiring + 10 m extension allowed
COM A	3 x AWG24 9p D-SUB BU/BU; 20	Basic wiring / Attention Cross Link
COM B	Standard RS-232 cable (9 Pin D-SUB); 20	Basic wiring
LAN Connectin to the system	CAT 5e SF/UTP or F/UTP; 20	Basic wiring
Positioning Control Box without ME functionality	4 x AWG20 20	Basic wiring
Light Push Button	2 x AWG20	Customized wiring
Exposer prep. / Exposer	2 x AWG18	Customized wiring
System "ON"	2 x AWG18	Customized wiring
Door Contact	2 x AWG18	Customized wiring

TP_T; **StC**	**type;** **maximum length (m)**	**remark**
Master ME/ES Signal	3 x AWG22; 20	Basic wiring
CAN Signal	Standard RS-232 cable (9 Pin D-SUB); 20	Basic wiring / Extension not allowed
Bucky D. exp. / Bucky select T	7 x AWG20; 20	Basic wiring

TP_T; **StC**	**type;** **maximum length (m)**	**remark**
Float-GND	1x AWG12; 20	Basic wiring
230V Power Supply	3x AWG18; 20	Basic wiring
PE Cable	1x AWG10; 20	Basic wiring
AEC	CAT 5e SF/UTP or F/UTP; 20	Basic wiring
Sync 1/2 Cable (Varian)	8 x AWG26; 16	Customized wiring / PIN 9 NC
Image Data Line Cable CR_PC_NIC - WS Bucky (direct wire)	CAT6; 40	Customized wiring / direct wire - Point to Point / Extension not allowed

TP_WS; **StC**	**type;** **maximum length (m)**	**remark**
ME/ES Signal	2 x AWG22; 20	Basic wiring for DR 600 WS
Positioning Control Box	4 x AWG20; 20	Basic wiring for DR400-600 WS 2 more Contorl Boxes can be added in the system
CAN Signal	Standard RS-232 cable (9 Pin D-SUB); 20	Basic wiring for DR 400-600 WS / Extension not allowed
X8 24V	2 x AWG16; 20	Basic wiring for DR 400-600 WS
Bucky D. exp.	6 x AWG20; 20	Basic wiring for DR 400-600 WS
230V Power Supply	3x AWG18; 20	Basic wiring for DR 400-600 WS

TP_WS; **StC**	**type;** **maximum length (m)**	**remark**
PE Cable	1x AWG10; 20	Basic wiring for DR 400-600 WS
AEC	CAT 5e SF/UTP or F/UTP; 20	Basic wiring for DR 400-600 WS
Sync 3/4 Cable (Varian)	8 x AWG26; 20	Customized wiring / PIN 9 NC
Image Data Line Cable CR_PC_NIC - WS Bucky (direct wire)	CAT6; 40	Customized wiring / direct wire - Point to Point / Extension not allowed

CS; **StC**	**type;** **maximum length (m)**	**remark**
ME/ES Signal	4 x AWG22; 20	Basic wiring
CAN Signal	3 x AWG22; 20	Basic wiring / Extension not allowed
Float-GND	1x AWG12; 20	Basic wiring
230V Power Supply	3x AWG18; 20	Basic wiring
PE Cable	1x AWG10; 20	Basic wiring
LPB	2 x AWG22; 20	Basic wiring
LAN for THU	CAT6 (Energy chain); 20	Basic wiring
HV 1 / 2	3 x AWG16; 20	Basic wiring
Control cable for X-ray tube	7 x AWG16; 20	Basic wiring

CS; **StC**	**type;** **maximum length (m)**	**remark**
DAP	4 or 7 x AWG26; 20	Basic wiring shielded

Extra monitor in examination room **Monitor; NX**	**type;** **maximum length (m)**	**remark**
230V Power supply	3x18AWG 20m	Basic wiring
USB 2.0 connection cable (active)	Tripp lite U026-20M 20m	Basic wiring
Displayport connection cable (active)	Lindy 41081 20m	Basic wiring
PE connection WS PE – monitor PE	8AWG 5m	Basic wiring

Maintenance on EMC relevant parts

Concerning the EMC safety of the DR 600 device, no relevant parts could be inspected by the operator. EMC relevant parts will be inspected from AFGA service engineer within the regular service interval until the end of lifetime. The needed verifications are described in the service manual.