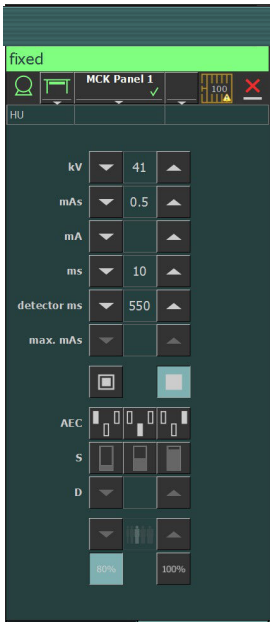
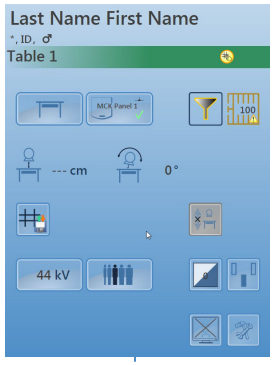
DR Software Console, DR Tube Head Display

User Manual





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Contents

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Introduction to this Manual

Topics:

Scope of this Manual

This manual contains the information for safe and effective use of the DR software console and the DR Tube Head Display.

The software is part of a General Radiography X-ray imaging system.

Warnings, Cautions, Instructions and Notes

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

Warning: Warnings are directions which, if they are not followed, can cause fatal or serious injuries to a user, engineer, patient or any other person or can lead to a mistreatment.

Caution: Cautions are directions which, if they are not followed, can cause damage to the equipment described in this manual or any other equipment or goods and can cause environmental pollution.

Instruction: This sign is typically used in combination with the warning sign when providing a specific instruction. If it is followed exactly, it should avoid the subject of the warning.

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 to sale by or on the order of a physician.*

Introduction to the DR Software Console

Topics:

Operation Controls

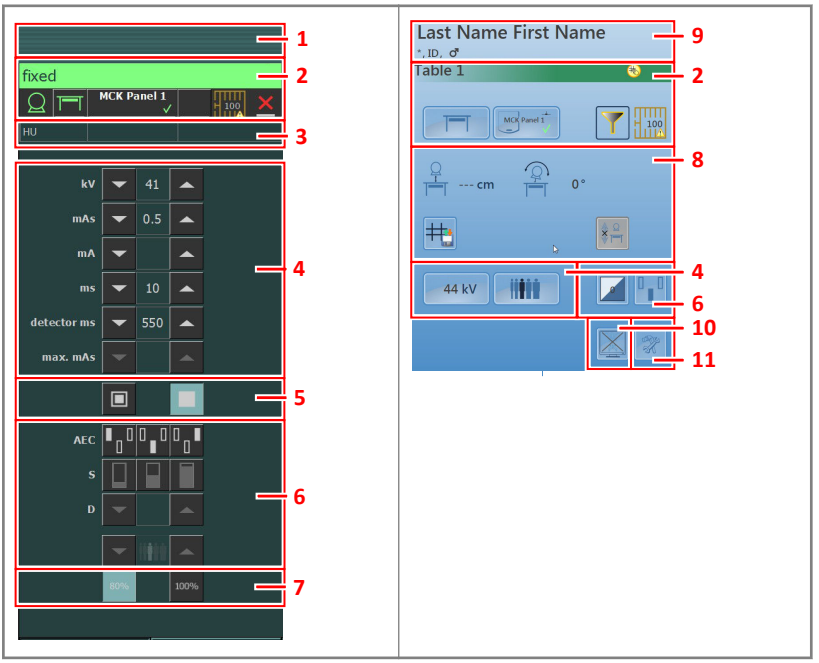


Figure 1: Operation controls

1. Title frame
2. Device status frame
3. Heat units and DAP value
4. Radiographic parameters
5. Focal spot indicator
6. AEC buttons
7. X-ray tube load
8. Positioning controls
9. Patient information
10. Toggle image preview button
11. Tools button

The graphical user interface consists of several panes and toolbars.

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 Links

Operation on page 20

Image Preview Window

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.

Tools Window

To switch to the tools window on the tube head display, push the Tools button.

The tools window contains a button that temporarily disables the tube head display to clean the screen during operation.

System Documentation

Refer to the user manual of the DR system for general safety instructions, system information and instructions for performing a basic workflow.

Labels

NX has an About box, showing information on version and release of NX and other software on the NX workstation. To consult the About box, click **About NX...** in the Tools section of the Main Menu.

Figure 2: Example of the NX About box

System messages

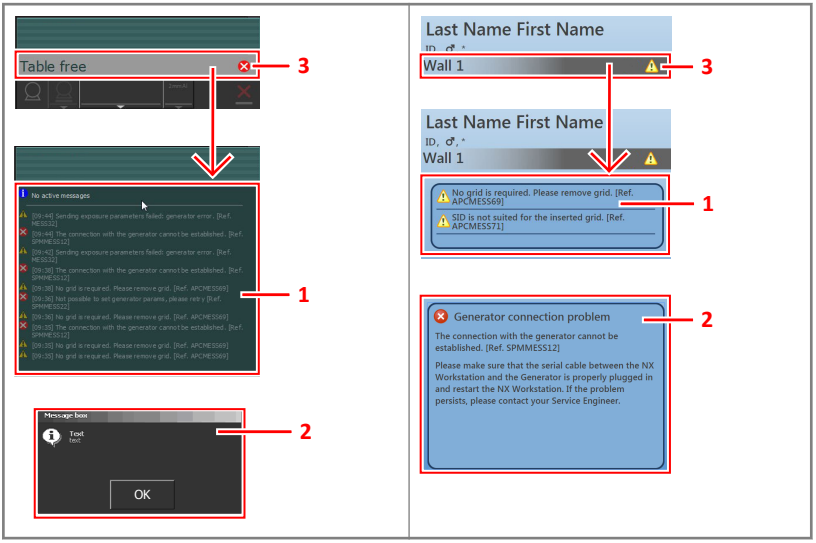
The system can display messages to the user on the screen. Messages are displayed on the Software Console and on the Tube head display.

- Device status frame

  A message icon is displayed in the device status frame. Click the right half of the device status frame to display the message frame. To hide the message frame, click anywhere in the display.

  The message frame on the Software Console displays active messages on top and a history list of messages below. The message frame on the Tube head display displays active messages only.
- Dialog box

  A dialog box is displayed in the middle of the screen. The dialog box can contain a title, a status description, an instruction for the user and a button.



1. Message frame
2. Dialog box
3. Device status frame

Figure 3: Messages

Related Links

Tube head display shows only Agfa logo on page 53

Message types

There are different types of messages. The icon in the device status frame shows the message type.

Type of message	Icon	User response
Information		Information messages help to understand the workflow status and do not affect safety or efficiency.
Warning		Warning messages indicate a difference between the actual status of the system and the status expected based on the configuration. Check the message frame for warnings and read the messages carefully. If there's a dialog box, click the button in the dialog box to continue operation.
Error		A dialog box is displayed. Read the message carefully. Click the button in the dialog box to continue operation.
Blocking error		A dialog box is displayed. Read the message carefully. It provides instructions to resolve the problem. Operation is blocked until the problem is resolved. The dialog box is closed automatically when the problem is resolved.

Messages that require no user response disappear automatically.

Warning or error messages may instruct to contact the Agfa service organization if the problem repeats, but by following the instructions in the message, the user can restore the operation of the system.

Getting started

Topics:

Starting the Software Console

The software console software is started automatically when the NX workstation is switched on.

Starting the Tube Head Display

The tube head display is started automatically when the DR modality is switched on and becomes operational when the NX workstation is switched on.

Stopping the Software Console

The software console is stopped automatically when the NX workstation is switched off.

Stopping the Tube Head Display

The tube head display is stopped automatically when the DR modality is switched off.

Operation

Topics:

Device Status Frame

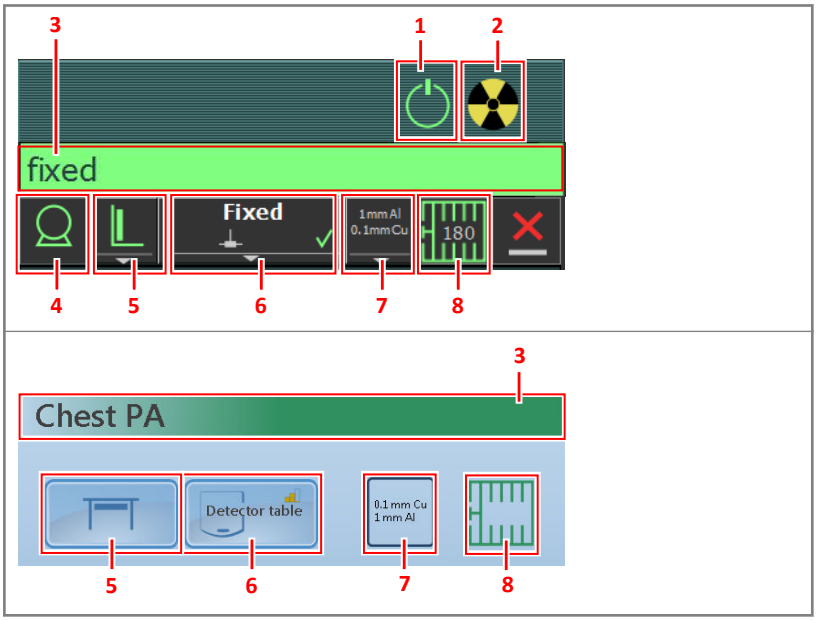


Figure 4: Device status frame

1. Preparation
2. X-Ray On
3. Ready for Exposure Status
4. X-Ray Tube
5. Modality Position
6. DR Detector Switch
7. Filter Status
8. Grid Status

Topics:

- *Preparation*
- *X-Ray On*
- *Ready For Exposure Status*
- *X-Ray Tube*
- *Modality Position*
- *DR Detector Switch*
- *Filter Status*

- *Grid Status*
- *Unknown status*

Preparation

Table 1: Preparation

Icon	Description
	The X-ray tube is prepared.
	The examination room door is open.

Press the handswitch 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.

X-Ray On

Figure 5: X-ray on

After pressing the handswitch completely, the X-ray exposure is made. The indicator on the console will light up.

Ready For Exposure Status

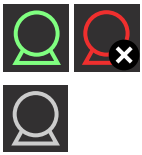
Table 2: Exposure ready

Color	Description
	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.
	Gray Exposure not ready. No examination defined.

X-Ray Tube

An icon indicates whether the X-ray system is ready for taking the exposure.

Table 3: Exposure ready

Icon	Description
	The color of the icon reflects the ready for exposure status.

If multiple tubes can be used, the number of the tube is displayed in the icon.

To select another tube, click the drop-down arrow and select the tube from the list.

Related Links

Ready For Exposure Status on page 25

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 4: 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.

Status icon on Tube Head Display

Table 5: Icon on buttons and status indicators on the tube head display to show the status of the highlighted component

Icon	Description
	Error
	Warning

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 also be used to switch to CR for making an exposure on a cassette.

Topics:

DR Detector Status

Battery status icon				
Meaning	Full	Medium	Low	Empty

Connection status icon (wifi/ wired)				
Meaning	Good	Low	Bad	Wired DR Detector

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

DR Detector Status on Tube Head Display

DR detector status icon				
Meaning	Ready	Initializing exposure	Error	One DR detector must be selected

Filter Status

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 or on the collimator.

- on the software console, click the filter status drop-down arrow and select the filter from the list.
- on the collimator, use the filter button

Table 6: Collimator with automatic filter

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

Table 7: Collimator with manual filter

(no icon)	No filter is required.
	A filter is required. Insert the filter manually.

Grid Status

Table 8: 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 grid type is displayed inside the icon.

Table 9: Grid status - not automatically detected

(no icon)	No grid is required.
	A grid is required.

Unknown status

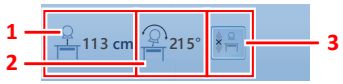
If a status is unknown, a question mark icon is displayed:

Figure 6: 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.

Positioning Controls



1. Source image distance (SID)
2. Tube angle
3. Tracking

Figure 7: Positioning controls

Topics:

- *Source image distance (SID)*
- *X-ray tube angle*
- *X-ray tube stand tracks table height*
- *X-ray tube stand tracks wall stand height*

Source image distance (SID)

The icon and reading of the SID depends on the position of the X-ray system.

Table 10: Source image distance (SID)

Icon	Value	X-ray system position
	reading of SID	using the bucky of the radiographic table
	reading of SID	using the bucky of the radiographic wall stand
(no icon)	(no value)	free exposure
 or 	--- cm	the X-ray tube is not pointing to the selected DR detector

Related Links

X-ray tube stand tracks table height on page 35
X-ray tube stand tracks wall stand height on page 36

X-ray tube angle

The icon and reading of the X-ray tube angle depends on the position of the X-ray system.

Table 11: X-ray tube angle

Icon	Value	X-ray system position
	reading of tube angle	using the bucky of the radiographic table
	reading of tube angle	using the bucky of the radiographic wall stand
	reading of tube angle	free exposure

X-ray tube stand tracks table height

To keep constant SID while adjusting table height:

1. Set the required SID by adjusting the position of the X-ray tube stand.

   The distance between the X-ray tube head and the table top must not be less than 50 cm.
2. On the tube head display, press the position tracking button.

Figure 8: Table position tracking disabled and enabled

   The button is highlighted.
3. Adjust the table height.
   The X-ray tube stand is moving up or down 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).

Related Links

Emergency stop button on page 54

X-ray tube stand tracks wall stand height

To keep constant position of the tube head unit relative to wall stand bucky while adjusting wall stand height:

1. Set the required position of the X-ray tube stand.

   The distance between the X-ray tube head and the table top must not be less than 15 cm.

   Position the X-ray tube head and the table top such that they do not collide when the X-ray tube stand moves up or down.
2. On the tube head display, press the position tracking button.

   WARNING:
   Do not use position tracking while the patient is lying on the table.

Figure 9: Wall stand position tracking disabled and enabled

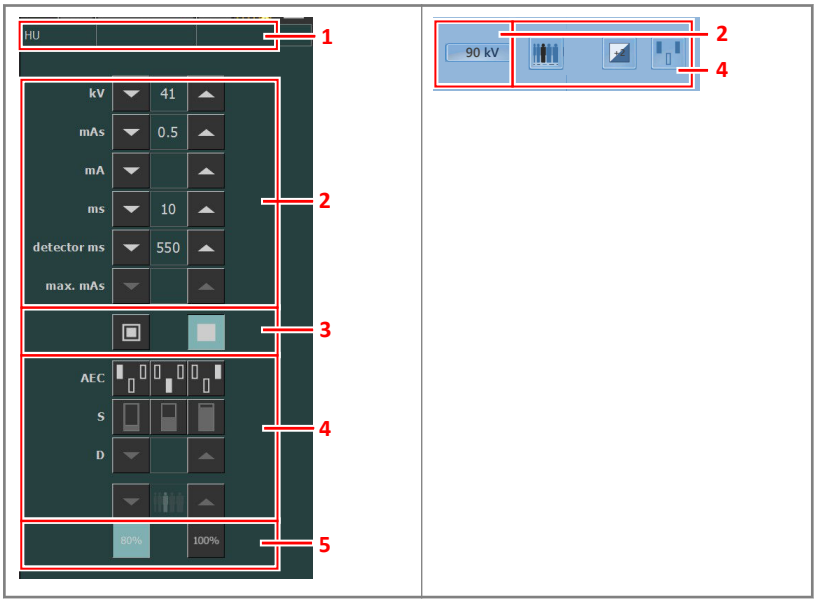
   The button is highlighted.
3. Adjust the wall stand height.
   The X-ray tube stand is moving up or down accordingly.

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).

Related Links

Emergency stop button on page 54

Generator Controls



1. Heat units and DAP value
2. Radiographic parameters
3. Focal spot indicator
4. AEC buttons
5. X-ray tube load

Figure 10: Operation controls

To change a value, use the UP and DOWN arrows. On the tube head display, touch the button to display the arrows. The values increase or decrease step by step each time the corresponding button is touched, and change faster when either of them is touched continuously. On the tube head display, touch elsewhere to hide the arrows.

Figure 11: UP and DOWN arrows on tube head display

Topics:

- *Radiographic Parameters*
- *Focal Spot Indicator*

- *X-Ray Tube Load*
- *Automatic Exposure Control (AEC)*
- *DAP Value*
- *Heat Units*

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**: shows the radiographic mA value (current) selected for 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.
- **Detector 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 Links

Radiographic Parameter Limits on page 52
One Point Mode (1P) on page 48
Two Point Mode (2P) on page 49
Three Point Mode (3P) on page 50

Focal Spot Indicator

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

Table 12: Focal Spot Indicator

	Small
	Large

You can change the focal spot by touching this indicator. It keeps kV and constant mAs, whenever it is possible. The mA value available is set according to maximum power, instantaneous power, space charge, etc.

When a focal spot is selected, it sets the highest mA value available for the selected focal spot and the respective exposure time in order to keep constant mAs, whenever the mA value does not exceed the maximum tube power and the exposure time value does not exceed the maximum integration time of the DR detector or the maximum exposure time of the generator.

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%.

Automatic Exposure Control (AEC)

Automatic Exposure Control (AEC) produces consistent detector dose regardless of the radiographic technique selected and of the patient size. The AEC module comprises the controls for the selection of the exposure detector fields (ion chamber), S-value and density compensation.

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

To deactivate AEC mode, touch all the selected AEC field buttons until none of them is selected.

Related Links

One Point Mode (1P) on page 48

Topics:

- *Field Selection*
- *S-value*
- *Density*
- *Patient Size*
- *AEC dose failure*

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 13: Automatic filter

	Left field
	Middle field
	Right field

S-value

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). Each time a button is selected (highlighted), the others are automatically deselected.

Table 14: Automatic filter

S	
	low 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 15: Dose variation compared to reference dose

 (D)	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.

Touch the UP or DOWN arrows to select the desired patient size.

Table 16: 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

AEC dose failure

The AEC dose failure safety device terminates the X-ray exposure when no radiation is detected in the ion chamber or when the selected parameters (short backup time/mAs) are not appropriate for an exposure with AEC.

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).

A new exposure resets the DAP value.

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” would indicate that all the heat units capacity of the X-ray tube remains. A display of "HU 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.

Radiographic Working Modes

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

- One Point Mode (1P), by selecting kV. The exposure is controlled by AEC.
- Two Point Mode (2P), by selecting kV and mAs. AEC is disabled.
- Three Point Mode (3P), by selecting kV, mA and exposure time independently. AEC is disabled.

Topics:

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, S-value, 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.

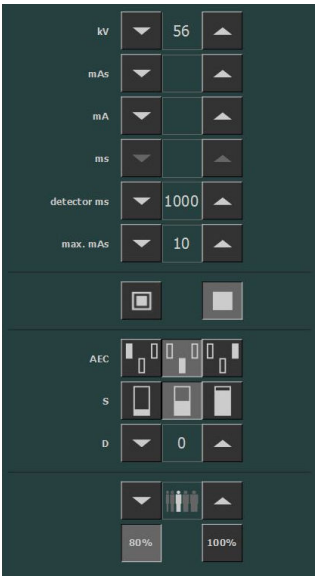


Figure 12: 1P working mode

Related Links

Automatic Exposure Control (AEC) on page 42

One Point Mode on Tube Head Display

Figure 13: 1P working mode

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, S-value 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.

Figure 14: 2P working mode

Related Links

Radiographic Parameters on page 39

Two Point Mode and Three Point Mode on Tube Head Display

Figure 15: 2P and 3P working mode

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.

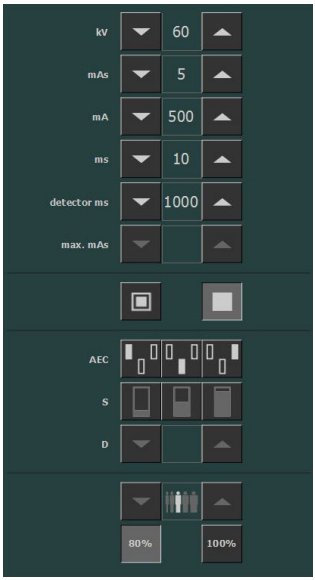


Figure 16: 3P working mode

Two Point Mode and Three Point Mode on Tube Head Display

Figure 17: 2P and 3P working mode

Problem solving

Topics:

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.

Tube head display shows only Agfa logo

Details	The tube head display shows only the Agfa logo. 
Cause	The tube head display has no connection to the NX workstation.
Brief Solution	Restart the NX workstation.

Emergency stop button

Figure 18: Emergency stop button

If a system malfunction causes an emergency situation involving the patient, operating personnel or any system component, activate the emergency stop on the radiographic table. All motor driven movements will be stopped.

To allow motorized movements again, turn the cap of the emergency switch in clockwise direction (default position).

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