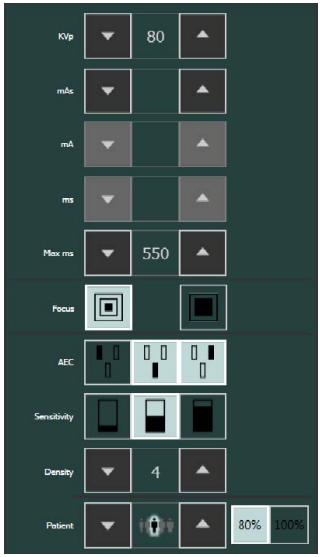
DX-D Software Console

User Manual



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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 DX-D software console.

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.

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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 DX-D Software Console

Topics:

Intended Use

The DX-D software console is used to control the X-ray exposure settings and position of the X-ray unit.

Operation Controls

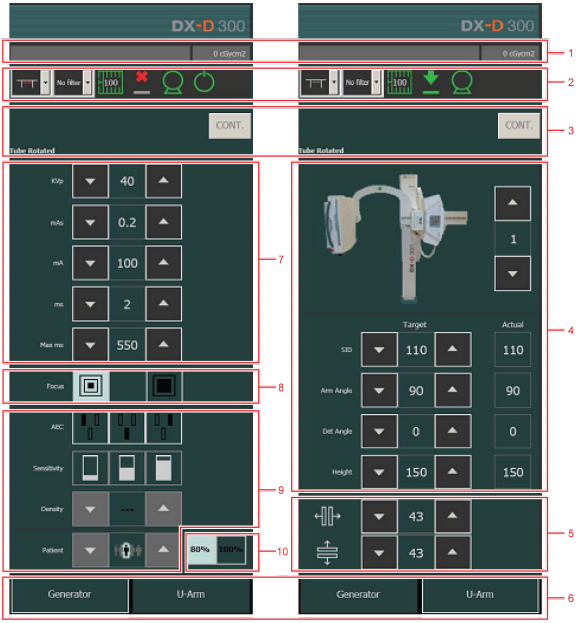

Figure 1: Operation controls

1. DAP display frame
2. Device status frame
3. Error status frame
4. Positioning parameters
5. Collimator parameters
6. Window navigation buttons
7. Radiographic parameters
8. Focal spot indicator
9. AEC buttons
10. X-ray tube load

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.*

Topics:

- *Device Status Frame*
- *Error Status Frame*
- *DAP Display Frame*
- *Generator Controls*

Device Status Frame

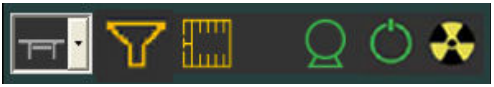

Figure 2: Device status frame

1. Drop-down list to select modality position and detector type.
2. Filter status
3. Grid status
4. Exposure ready
5. Preparation
6. X-ray on

Related Links

Device Status Frame on page 22

Error Status Frame

1. Button to confirm errors

The Error Status frame displays warnings, error numbers and error descriptions. If the error has been resolved, the “CONT.” button becomes active. Click the active button to reset the error condition.

A click on the text in the Error Status frame produces a pop-up message that includes the whole text.

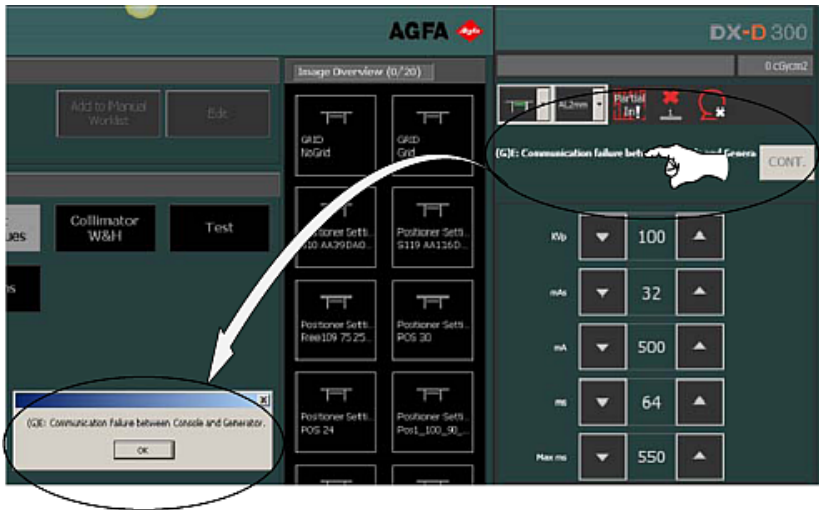

Figure 3: Error status frame and pop-up message

DAP Display Frame

The Dose Display shows the radiation value of the last exposure. The radiation measure is read as DAP value (Dose Area Product) in cGy*cm2 (for example: 12.22 cGycm2).

Selecting a new exposure resets the DAP value.

Figure 4: DAP display frame

Generator Controls

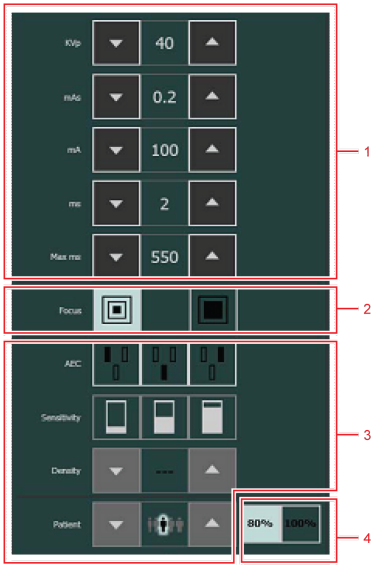

Figure 5: Generator controls

1. Radiographic parameters
2. Focal spot indicator
3. AEC buttons
4. X-ray tube load

Related Links

Generator Controls Window on page 32

System Documentation

Refer to the User Manual of the DX-D System for general safety instructions, system information and instructions for performing a basic workflow.

Messages

Error codes indicate the potential cause of a system failure. Error codes are shown on the software console. Correct the cause of the error and press the “CONT.” button until its indication disappears.

All these error codes will enable the operator to indirectly convey the possible source of error to service personnel. This may prevent the need for a service call or enable service personnel to anticipate corrective actions prior to arriving on site.

Figure 6: Example of error code

Getting started

Topics:

Starting the Software Console

The software console software is started automatically when the DX-D system is switched on. The software console may be hidden by the NX application.

To display the software console either:

- Click the SC button in NX, or
- Select a thumbnail in NX.

The software console is automatically displayed when the exposure button is pushed.

To manually start the software console:

In the Windows Start menu, select **Agfa** > **DR Calibration Tools** and click **Start Generator Software Console**.

Stopping the Software Console

The software console is stopped automatically when the DX-D system is switched off.

To manually stop the software console:

In the Start menu, select **Agfa** > **DR Calibration Tools** and click **Stop Generator Software Console**.

Operating the DX-D Software Console

Topics:

Device Status Frame

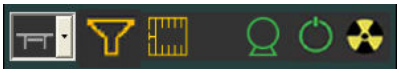

Figure 7: Device status frame

The following device statuses can be available:

- Modality Position Drop-down List
- Filter Status
- Grid Status
- Position Status
- Ready For Exposure
- Preparation
- X-Ray On
- Heat Units

Topics:

Modality Position Drop-down List

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 1: Modality Position

Icon	Description
	The image is planned for the radiographic table using the catapult bucky.
	The image is planned for the radiographic wall stand using the catapult bucky.
	The image is planned as a free exposure using CR.
	The image is planned for the radiographic table using the fixed DR detector.
	The image is planned for the radiographic wall stand using the fixed DR detector.
	The image is planned for the Portable DR detector inserted in the radiographic table bucky.
	The image is planned for the Portable DR detector inserted in the radiographic wall stand.

Icon	Description
	The image is planned as a free exposure using the Portable DR detector.
	The image is planned as a free exposure.

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

Note: *The modality position of a U-Arm X-ray system is represented by the icon for a radiographic table.*

The modality position icon indicates the status of the DR detector.

Table 2: DR detector status

Icon	Status description
	Grey: the image is planned and the DR detector is in sleep mode.
	Green: the DR detector is ready to acquire the exposure on the selected acquisition system. Green flashing: the exposure has been performed and the acquisition is ongoing.
	Red: the DR detector is out of order. Red flashing: the selected acquisition system is starting up.

The available workstations depend on the modality type and configuration.

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 3: Collimator with automatic filter

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

Table 4: Collimator with manual filter

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

Grid Status

- The grid status is automatically detected.

Table 5: Grid status - automatically detected

	Empty: no grid is required.
	Green: the correct grid is inserted. The grid type is specified.
	Red: a grid is required. The correct grid is not inserted or inserted wrongly.

- The grid status is not automatically detected.

Table 6: Grid status - not automatically detected

	Empty: no grid is required.
	Orange: a grid is required.

Position Status

The position status is available on systems with automatic positioning.

Table 7: Position status

Icon	Description
	On target. The position of the X-ray system matches the target position.
	Not on target. The position of the X-ray system does not match the target position.
	Moving. The X-ray system is moving towards the target position.
	Suspect. The position of the X-ray system matches the target position, but the X-ray tube is more than three degrees out of the focus relative to the detector.

Related Links

Modality Position Drop-down List on page 23

Ready For Exposure

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

Table 8: Exposure ready

Icon	Description
	Exposure ready. Indicates that the selected technique is properly set and there are no interlock failures or system faults.
	Exposure not ready.

Preparation

Figure 8: Prep

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 9: X-ray on

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

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 “0%” would indicate that all the heat units capacity of the X-ray tube remains.

Generator Controls Window

The following generator controls are available:

- Radiographic Parameters
- Focal Spot Indicator
- X-Ray Tube Load
- Automatic Exposure Control (AEC)
- Radiographic Working Modes

Topics:

Radiographic Parameters

You can set up following radiographic parameters:

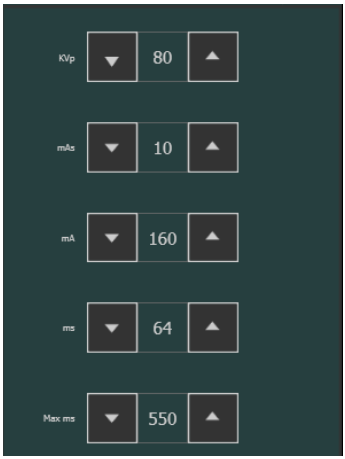

Figure 10: Radiographic parameters

To increase the radiographic parameters step by step, use the UP and DOWN arrows. The values increase or decrease step by step each time the corresponding button is touched.

- **kVp**: shows the radiographic kVp value (X-ray tube voltage) selected for the parameters.
- **mAs** can show:
  - The radiographic mAs value selected for the parameter.
  - The max mAs for an exposure using AEC. Based upon the max mAs and the mA setting, the generator must limit its maximum exposure time. X-rays outside these limits are NOT allowed. The highest allowed setting for max mAs depends on the mA.
  - 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 parameter. The focal spot selection is changed automatically if the mA value exceeds the applicable range.
- **ms** can show:
  - The time value (in milliseconds) selected for the parameter.
  - When an exposure is made, it shows the actual time at the end of the exposure.
- **Max ms** shows: the maximum exposure time allowed with DR detector operation (550 ms or 1000 ms). Based upon this, the generator must limit its maximum exposure time. X-rays outside the integration time slot of the DR detector are NOT allowed. This makes that with AEC, the exposure is

terminated even if the target dose is not reached. Not available in Free Exposure mode using DR or Free Exposure mode using CR.

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

Related Links

One Point Mode (1P) on page 41

Two Point Mode (2P) on page 42

Three Point Mode (3P) on page 43

Focal Spot Indicator

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

Figure 11: Focal spot indicator

You can change the focal spot by touching this indicator. It keeps kVp 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 (Max ms).

Note: *You can do the focal spot change whenever the present conditions of the X-ray tube allow it. The mA station set for the focal spot change is configured by the field engineer during the installation.*

X-Ray Tube Load

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

Depending on the status of the heat units, switching to 100% may not be possible.

Figure 12: Tube power

Automatic Exposure Control (AEC)

Automatic Exposure Control (AEC) produces consistent density with excellent contrast regardless of the radiographic technique selected. The AEC module comprises the controls for the selection of the exposure detector fields (ion chamber), sensitivity 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.

If the message “Wrong AEC Selection” is shown on the software console before the exposure, it means that the selected kVp value, AEC density and/or sensitivity set a technique that is out of the operative range with AEC and the next exposure will be inhibited. Change any parameter (kVp value, AEC density or sensitivity) in order to obtain a technique enabled for AEC.

Related Links

One Point Mode (1P) on page 41

Topics:

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.

Figure 13: Field selection

Sensitivity

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.

Figure 14: Sensitivity

Density

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

Figure 15: Density

Density can be increased and decreased in a range of -4 to +4. Each step gives a difference of 25% in dose (25% is the default setting). When disabled, the density range number appears in black.

Table 9: Density scale variation over reference dose (0)

	Density
-4	rd x 0.41
-3	rd x 0.51
-2	rd x 0.64
-1	rd x 0.80
0	Reference dose (rd)
+1	rd x 1.25
+2	rd x 1.56
+3	rd x 1.95
+4	rd x 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.

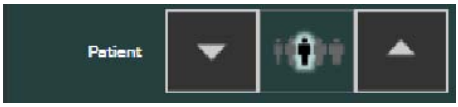

Figure 16: Patient size

AEC Backup Time

If the exposure is aborted by the AEC back-up timer, the “CONT.” button blinks and the message “Not Enough Dose” is shown on the software console. Next exposure is inhibited until the AEC function is reset by touching the “CONT.” button. When the generator is in “Prep” mode, the AEC function can not be reset.

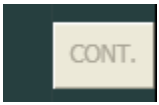

Figure 17: AEC Backup time

Rapid Termination

The rapid termination 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.

AEC rapid termination compares the AEC ramp with a 25% of the final value at 30% of the AEC backup time. It is activated after 30% of the AEC backup time and after 10 ms of exposure, both conditions have to be fulfilled. Whenever the AEC is active, it is recommended to select an exposure back-up time higher than 100 ms for improved operation of rapid termination.

The error code related to the rapid termination is E95.

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 kVp with AEC operations.
- Two Point Mode (2P), by selecting kVp and mAs.
- Three Point Mode (3P), by selecting kV, mA and exposure time independently.

Topics:

One Point Mode (1P)

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

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

The value of mAs is the max mAs. The default value for max mAs is the highest supported value.

The value for ms is not available.

Disabling all AEC fields will switch to two point mode.

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

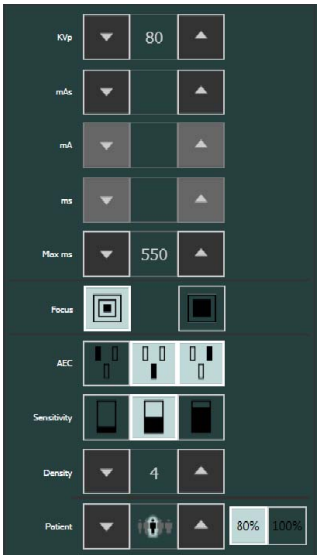

Figure 18: 1P working mode

Related Links

Automatic Exposure Control (AEC) on page 37
Radiographic Parameters on page 33

Two Point Mode (2P)

The value of kVp, 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 default value for mAs is 20 mAs.

The setting of density, sensitivity 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.

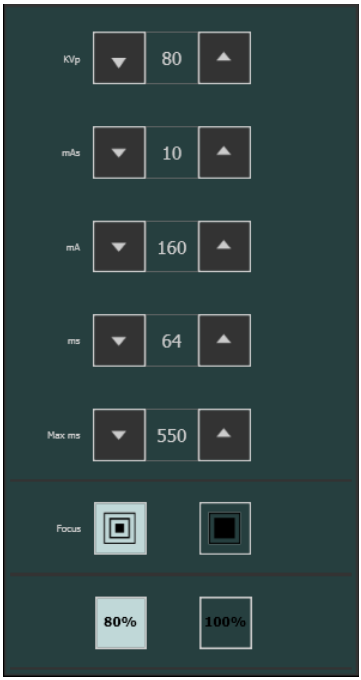

Figure 19: 2P working mode

Related Links

Radiographic Parameters on page 33

Three Point Mode (3P)

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

X-Ray Modality Controls Window

Topics:

Positioning Parameters

On systems with automatic positioning, the target position is automatically set, based on the selected exposure.

To modify the target position, you can:

- scroll through the preconfigured set of target positions by clicking the automatic position selection buttons. Each target position has a reference number. A reference image is displayed. The target positioning parameters are set.
- increase or decrease the positioning parameters step by step: use the UP and DOWN arrows. The values increase or decrease step by step each time the corresponding button is touched.

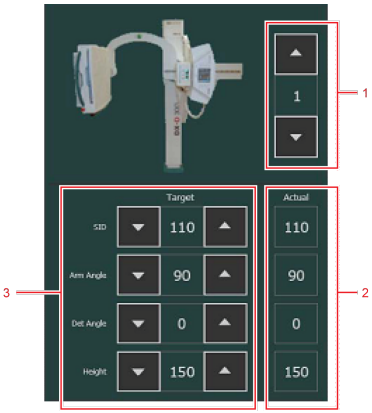

Figure 20: Positioning parameters

1. Automatic position selection buttons
2. Actual positioning parameters
3. Target positioning parameters

The selected modality position defines which positioning parameters are available.

Note: *Depending on the system configuration, the target positioning parameters may not be editable.*

To move the X-ray system to the target position, push and hold the MOVE button on the X-ray system or on the remote control. When the X-ray system reaches the target position, the values for the actual position parameters match the values for the target position parameters and the “On target” status is displayed in the device status frame.

Figure 21: “On target” position status

To make final adjustments to the position, use the position controls on the X-ray system.

The type of X-ray system defines which automatic positions and positioning parameters are available. Typical parameters are table height and bucky position for an RAD Table, bucky height for an RAD Wall Stand and height, arm angle and detector angle for a U-Arm X-ray system, as well as general parameters like Source Image Distance (SID).

Collimator Parameters

On systems with an automatic collimator, the collimation is automatically set, based on the selected exposure.

To modify the automatic collimation, increase or decrease the collimator parameters step by step, using the UP and DOWN arrows. The values increase or decrease step by step each time the corresponding button is touched.

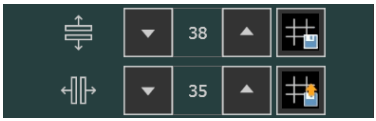

Figure 22: Collimator parameters

To use the same collimation setting on different exposures, push the store button on the first exposure and push the restore button on all later exposures that require the same collimation setting.

Problem solving

Topics:

Radiographic Parameter Limits

If the value of a radiographic parameter cannot be increased or decreased, one of these limits may be applied:

- **Radiographic Parameters Limit**. A maximum or minimum radiographic parameter limit is reached. An information message is displayed.
- **Generator Power Limit**. The generator power limit (kVp x mA) is reached. An information message is displayed. If the generator power limit is reached by increasing the mA up to a maximum possible value, you could increase the kVp up to its maximum value. The mA value will then automatically decrease as long as the mAs value is kept constant.
- **Space Charge**. The space charge limit in the selected X-ray tube is reached by changing the kVp or mA values. An information message is displayed.
- **Maximum Energy (60kJ)**. Only in AEC mode, the maximum energy (60kJ) is exceeded. 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.

The following table indicates the different information messages that may appear on the console when increasing or decreasing one of the exposure parameters.

Table 10: Radiographic parameter limits

Information message	Description
Min kVp	Minimum kVp (generator limit)
Max kVp	Maximum kVp (generator limit)
Max kVp Tube	Maximum kVp (limited by the X-ray tube load curves or limited during the generator configuration)
Min mA	Minimum mA (generator limit configured for each focal spot)
Max mA	Maximum mA (generator limit configured for each focal spot)
Min mAs	Minimum mAs (generator limit)

Information message	Description
Max mAs	Maximum mAs = 500 mAs (regulatory limit for AEC)
Min ms	Minimum exposure time (generator limit)
Max ms	Maximum exposure time (generator limit)
Min ms & Min mA	Minimum exposure time and minimum mA (generator limit)
Max ms & Max mA	Maximum exposure time and maximum mA (generator limit)
Max Power	Maximum power (generator limit)
Space Charge	Filament emission limit for a combination of kVp and mA in the selected focal spot.
Max Energy (60kJ)	The maximum energy cannot exceed 60 kJ (kVp x mAs = 60 kJ) (regulatory limit for AEC).
Instant Power	Instantaneous power limit of the X-ray tube depending on the anode temperature, the selected exposure time and the selected focal spot.

Self-diagnosis Indicators

Self-diagnosis indicators identify a malfunction in the system alerting the operator that an error is inhibiting exposure. During normal operation of the system, these indicators are directly shown on the lower area of the console or as an error code close to the “CONT.” button.

Table 11: Self-diagnostic indicators

Indicator	Description
DOOR OPEN	Indicates that the X-ray room door is open when the X-ray equipment is in use.
GENERATOR OVER-LOAD	Indicates that the exposure was interrupted because arcing or malfunctioning occurred during exposure on the HV circuitry (X-ray tube, HV transformer and/or HV cables) or a failure of IGBT module (overheated or defective IGBTs) was detected. It can also appear when making a lengthy or high powered exposure with the X-ray tube cool (when the X-ray tube has not been sufficiently warmed-up).
TUBE OVERLOAD	Indicates that either the technique selected is beyond the X-ray tube ratings or present conditions of the X-ray tube inhibit the exposure (anode overheated). Parameters for next exposure may be temporarily limited by the generator (change the exposure values or wait for the X-ray tube to cool).
ROTOR ERROR	Indicates that the X-ray tube anode is not rotating while “Prep” is active. Exposures are inhibited.
OVERHEAT	Indicates that the X-ray tube thermostat/ pressurestat is open due to overheating of the X-ray tube housing (housing is too hot, wait for the housing to cool) or that there is a thermostat/ pressurestat malfunction (housing is cool). Heat units may rise to any value.

Indicator	Description
TECHNIQUE ERROR	 Caution**:** If “TECHNIQUE ERROR” is displayed during exposure it means the exposure has been interrupted by the “Security Timer” because of a system failure. You should call field service. This error can also be shown if a failure on the automatic collimator has been detected (blades are full open or in movement during exposure, etc.). In this case the indicator lights up continuously.
PANEL OFF	Indicates that the detector panel has been automatically powered off due to: • a power off in the X-ray generator control. • an overheat (above 47 °C) in the detector panel. Exposure with the DR detector is inhibited except for the free exposure mode.
(G)E63	Excessive current in auxiliary winding during acceleration to 10000 RPM. Retry the exposure.