KODAK 2100 Intraoral X-ray System

User's Manual

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1 Safety and Regulatory Information

The information contained in this manual is based on the experience and knowledge relating to the subject matter gained by Carestream Health Inc. prior to publication. No patent license is granted by this information.

Carestream Health Inc. reserves the right to change this information without notice, and makes no warranty, express or implied, with respect to this information. Carestream Health Inc. shall not be liable for any loss or damage, including consequential or special damages, resulting from any use of this information, even if loss or damage is caused by Carestream Health Inc. negligence or other fault.

Conventions Used in This Manual

CAUTION:
Caution points out procedures that you must follow precisely to avoid damage to the system or any of its components, yourself or others, loss of data, or corruption of files in software applications.

Note

Notes provide additional information, such as expanded explanations, hints, or reminders.

Important

Important highlights critical policy information that affects how you use this manual and this product.

General Safety Guidelines

- This product is designed and manufactured to ensure maximum safety of operation. Operate and maintain it in strict compliance with the safety precautions and operating instructions contained in this manual.
- This product meets all the safety requirements applicable to medical equipment. However, anyone attempting to operate the system must be fully aware of potential safety hazards.
- There are no user serviceable parts in this system. The product must be installed, maintained, and serviced by qualified service personnel according to procedures and preventive maintenance schedules in the product service manual. If your product does not operate as expected, contact your Service Representative.
- Do not modify this product in whole or in part without prior written approval from Carestream Health Inc.
- The assembly, extensions, adjustments, modifications, and repairs must be performed by an authorized Service Representative. Your radiology system must be installed in premises that comply with applicable standards.
- Personnel operating and maintaining this system should receive training and be familiar with all aspects of operation and maintenance.

- To ensure safety, read all user manuals carefully before using the system and observe all Caution, Important, and Note callouts located throughout the manual.
- Keep this manual with the equipment.
- Reading this manual does *not* qualify you to operate, test, or calibrate this system.
- Unauthorized personnel are not allowed access to the system.
- If the product does not operate properly or fails to respond to the controls as described in this manual:
  - Follow the safety precautions as specified in this manual.
  - Stop using the equipment and do not make or authorize any changes to it.
  - Immediately contact your Service Representative, report the problem, and await further instructions.
- X-ray systems manufactured by Carestream Health Inc. comply with safety standards throughout the world for optimum protection against radiation risks.
- Be aware of the product specifications and of system accuracy and stability limitations. Consider these limitations before making any decision based on quantitative values. If you have any doubts, consult your Sales Representative.

CAUTION:
X-rays can be dangerous if used incorrectly. Take precautions even when following the instructions in this manual.

Use conventional commercially available equipment to protect yourself and your patients against scattered radiation risks.

- If you fail to comply with these instructions, Carestream Health Inc. will not be responsible for the safety reliability, and characteristics of the equipment.

Warnings and Safety Instructions

CAUTION:
Do not operate the equipment in the presence of explosive liquids, vapors, or gases. Do not plug in or turn on the system if hazardous substances are detected in the environment. If these substances are detected after the system has been turned on, do not attempt to turn off the unit or unplug it. Evacuate and ventilate the area before turning off the system.

DANGER: THIS IS AN ELECTRICAL UNIT. DO NOT EXPOSE IT TO WATER SPRAY. SUCH ACTION MAY CAUSE AN ELECTRICAL SHOCK OR A MALFUNCTION OF THE UNIT.

WARNING

The user is responsible for the operation and maintenance of this unit.

This unit must only be operated by legally qualified persons.

The cover of the unit must not be opened by the operator.

Inspection and maintenance operations should only be carried out by an approved technician.

WARNING

This unit must be installed in an x-ray room that complies with current installation standards. From this location, visual or audio communication must be maintained with the patient, together with access to the control interface during exposure.

WARNING

Do not operate the unit if there is the threat of an earthquake.

Following an earthquake, ensure that the unit is operating properly before using it again.

Failure to observe this precaution may expose patients to hazards.

WARNING

X-ray equipment can be hazardous to patients and the operator if the exposure safety factors and operating instructions are not observed.

WARNING

Do not place objects within the field of operation of the unit.

WARNING

We recommend that the patient and the operator wear protective lead-lined aprons, unless other Radiation Protection Protocols apply locally.

Ensure that any parts of the unit that may come into contact with the patient and the operator have been disinfected after each patient has been exposed to x-rays.

If the unit develops a fault, turn it off (O) and display a sign that states “Out of Service.”

WARNING

The operator must ask the patient to refrain from moving during the entire period of exposure.

In the European Union, this symbol indicates that when the last user wishes to discard this product, it must be sent to appropriate facilities for recovery and recycling.

Contact your local sales representative for additional information on the collection and recovery programs available for this product.

Labeling Summary

Safety Labels

CHASSIS GROUND STUD

ATTENTION: CONSULT ACCOMPANYING DOCUMENTS

CAUTION: IONIZING RADIATION

IEC Symbols Used

The system may have labels with one or more of the following symbols. These symbols indicate the IEC standards to which the system conforms.

Caution — consult accompanying documents

Protective earth

Power ON

Power OFF

Regulatory Information

The product conforms to the following safety standards: IEC/EN 60 601-1 Medical Electrical Equipment General Requirements for Safety, IEC/EN 60 601-2 Medical Electrical Equipment Electro-Magnetic Compatibility Requirements and Tests.

CE Conformity

This product conforms to the requirements of EU Council Directive 93/42/EEC. The Kodak intraoral x-ray system is a Class II b medical device, which bears the following mark of conformity: CE 0086 .

U.S. Regulations

CAUTION:
U.S federal law restricts this device to sale by or on the order of a dentist.

2 System Overview

Components

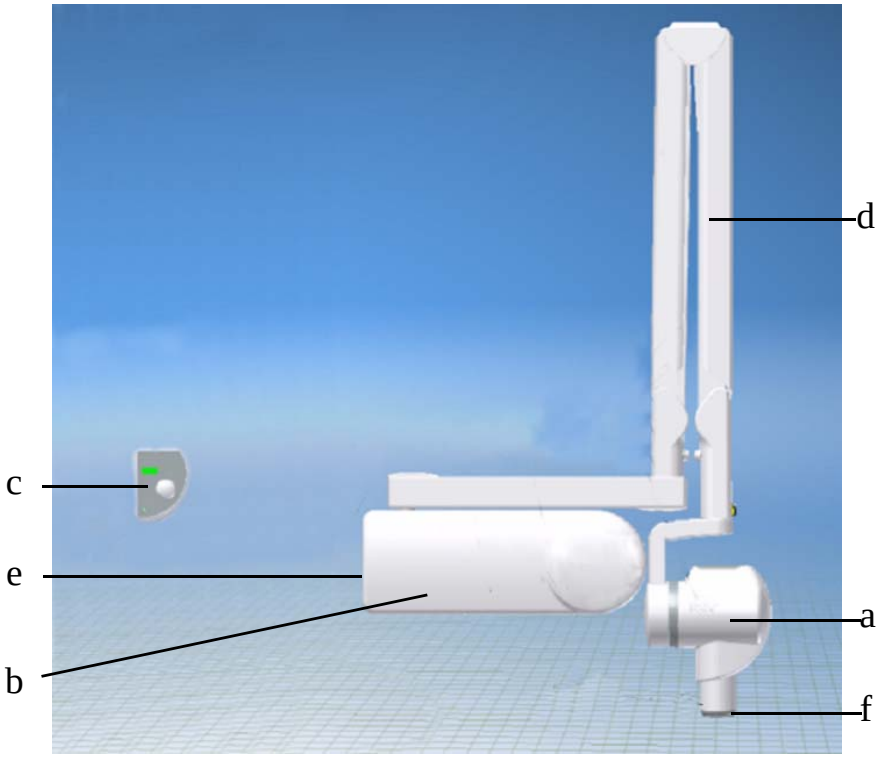


Figure 1. KODAK 2100 Intraoral X-ray System

a. High-frequency x-ray generator

- Transformer and associated electronics, and an oil-bathed x-ray tube
- Beam-limiting device
  - Radiation diameter – 6 cm (2 3/8 in.)
  - Distance from x-ray tube focal spot to skin – 20 cm (7 7/8 in.)
- Handle to facilitate positioning

b. Wall framework

- Contains the high-frequency generator's control electronics designed to support its mechanical stand

c. Control timer unit

- Selection of exposure times
- Self-test of the microprocessor each time the unit is activated
- Alarm during incorrect operation
- Digital icon that reduces the exposure time range if you are using a Kodak RVG sensor

d. Scissor arm

- Allow you to position the generator precisely and easily
- Wall-mounted with a choice of extensions

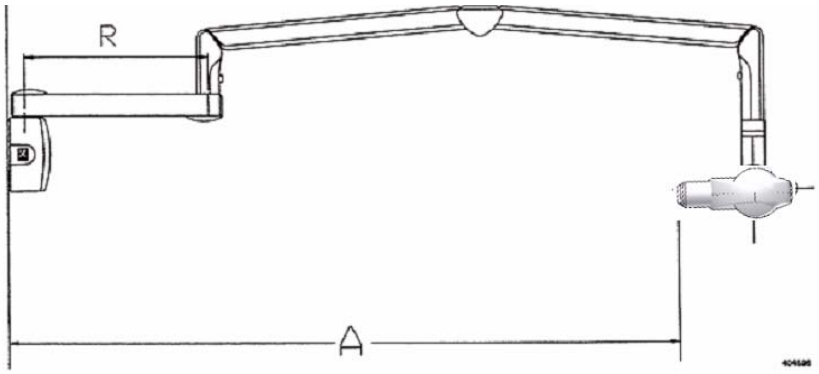


Figure 2. Side view of KODAK 2100 Intraoral X-ray System

Table 3. Types of Scissor Arms

Extension	R	Span A
CG 645	47.0 cm (18.5 in.)	170.0 cm (66 15/16 in.)
CG 646	64.8 cm (25.5 in.)	188.0 cm (74 in.)
CG 648	82.5 cm (32.5 in.)	205.0 cm (80 11/16 in.)

e. On/off switch

- Contains built-in light

f. Rectangular collimator (optional)

- Different sizes adapted to films and RVG sensors

Additional options

- Separate exposure switch (if the control panel is attached to the wall framework)
- Ceiling-mounted unit
- Floor-mounted unit
- Unit mounted on mobile stand

Ceiling-mounted Unit

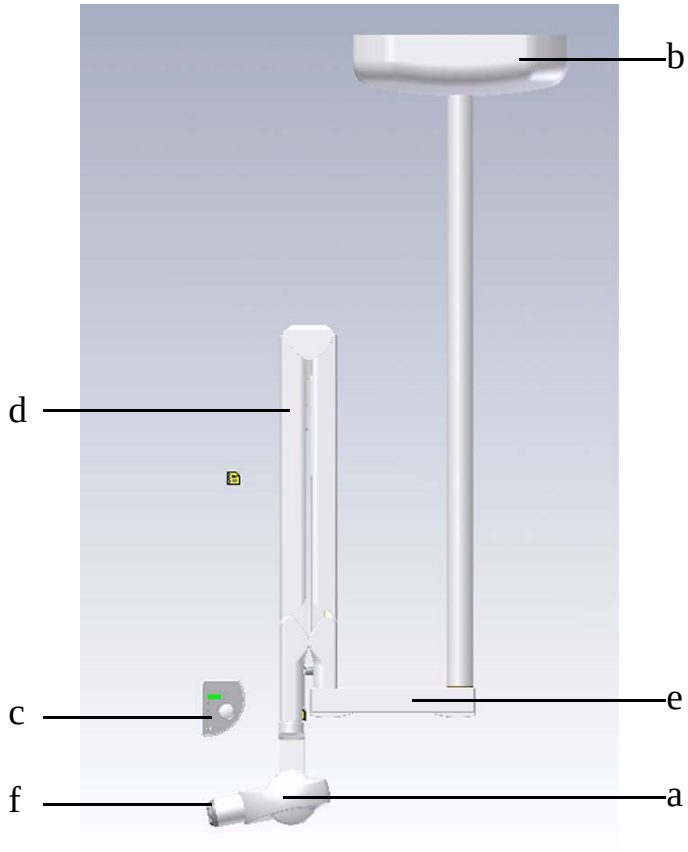


Figure 4. KODAK 2100 Intraoral X-ray System ceiling-mounted unit

a. High-frequency x-ray generator

b. Ceiling-mounted unit containing the high-frequency x-ray generator's control electronics

c. Separate timer/control unit for the x-ray generator

d. Scissor arm

e. On/off switch with built-in light

f. Rectangular collimator

Mounted on Mobile Stand (Optional)

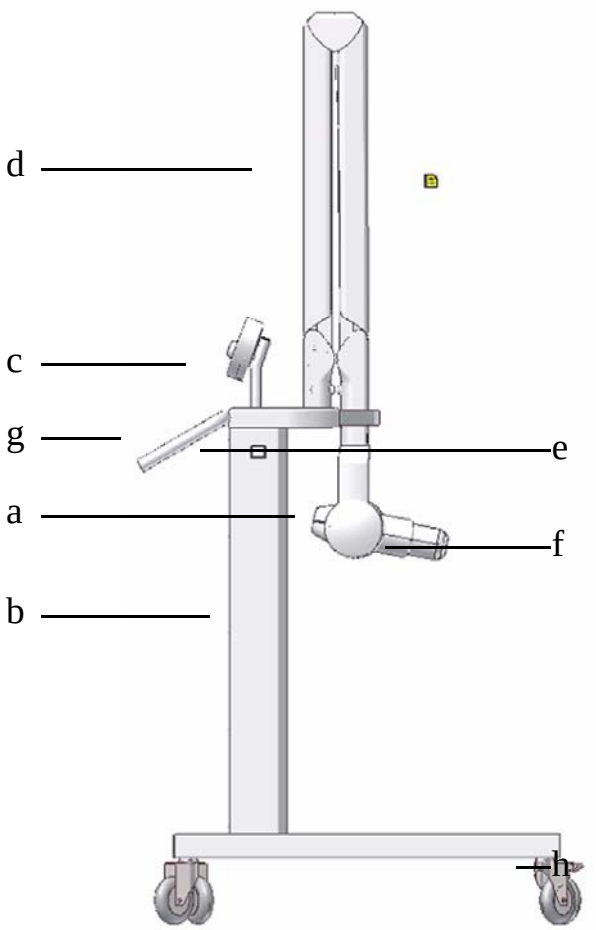


Figure 5. KODAK 2100 Intraoral X-ray System mounted on mobile stand

a. **High-frequency x-ray generator**
b. **Mobile stand containing the high-frequency x-ray generator's control electronics**
c. **Timer/control unit for the x-ray generator**
d. **Scissor arm**
e. **On/off switch with built-in light**
f. **Rectangular collimator**
g. **Handle**
h. **Foot brake**

Floor-mounted Unit (Optional)

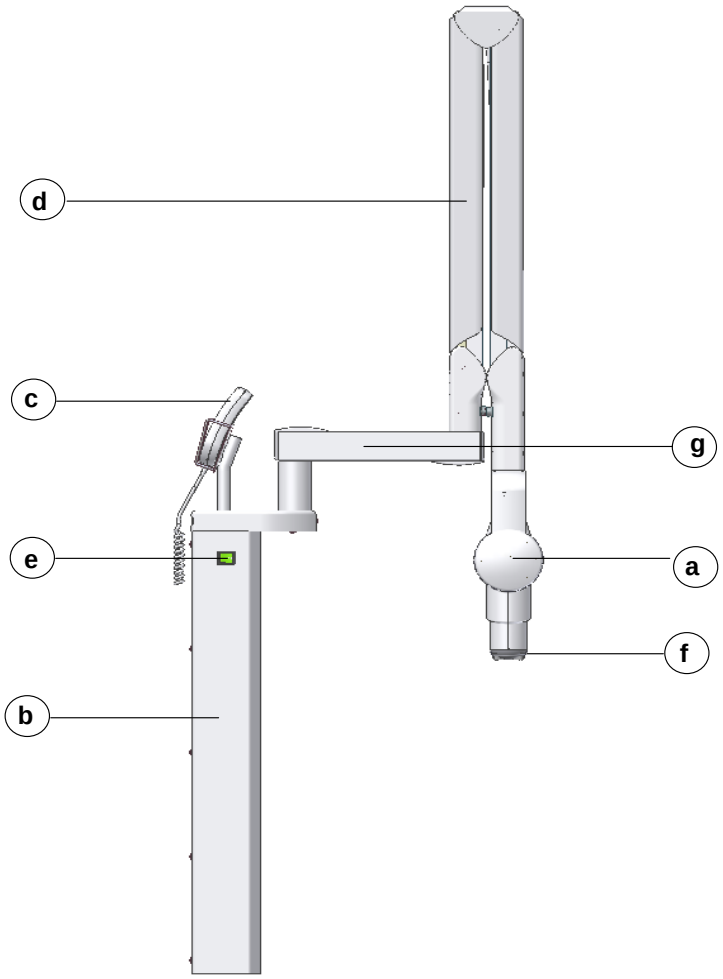


Figure 6. KODAK 2100 Intraoral X-ray System floor-mounted unit

a. **High-frequency x-ray generator**
b. **Floor column containing the high-frequency x-ray generator's control electronics**
c. **Timer/control unit for the x-ray generator**
d. **Scissor arm**
e. **On/off switch with built-in light**
f. **Rectangular collimator**
g. **Extension arm**

Control Timer Unit

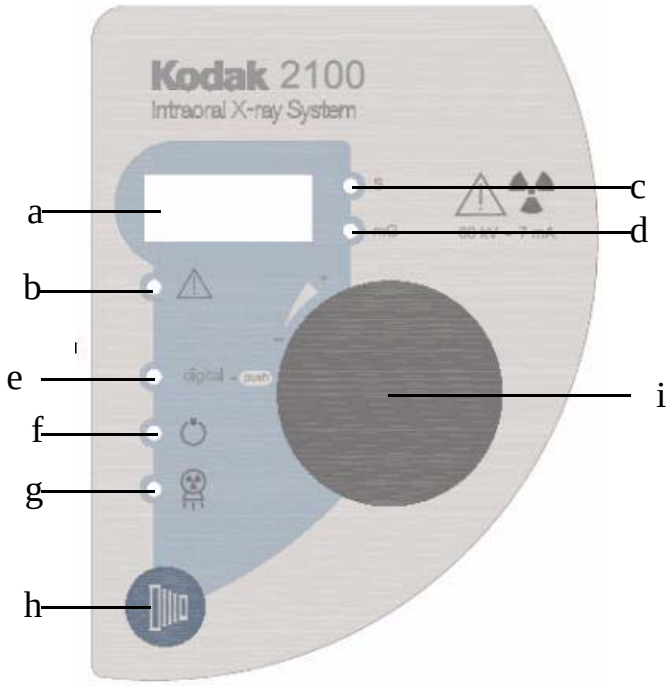


Figure 7. KODAK 2100 Intraoral X-ray System control timer unit

a. Display

b. "Warning, see accompanying documents" sign

c. Exposure time selection

d. Emitting dose calculation

e. Digital mode function

f. Ready mode

g. X-ray emission control light

h. X-ray exposure button

i. Selection knob

- Rotate the knob to select exposure time
- Press knob quickly to display the latest measure dose emitted
- Press and hold knob to switch from film to digital exposure time frame

3 Using the System

Every dental specialist would like to produce high-quality intraoral radiographs that reveal maximum detail with the minimum dose to the patient, show teeth and anatomic structures accurately with a minimum of distortion or magnification, and have optimal density and contrast to maximize their use for the detection of dental diseases.

To obtain high-quality intraoral radiography with maximum details, take extra care in all three steps of the radiography process: positioning the patient, the x-ray generator, and the imaging system; exposing the film or the sensor; and processing the film.

Positioning

Positioning the patient

Seat the patient with the sagittal plane vertical.

- For radiography of the upper maxillary, the Frankfort plane (nose-ear plane) must be horizontal
- For radiography of the lower maxillary, the occlusal plane must be horizontal

Figure 8. Patient positioning

Positioning the x-ray generator

The scissor arm allows you to accurately position the generator for any type of exposure. The beam-limiting device maintains a distance of at least 20 cm (8 in.) between the focal spot and the skin, which allows you to use either the paralleling technique or the bisecting technique.

Paralleling technique

The positioning tool used in the paralleling technique allows you to align the beam and the receptor. An adapted collimator reduces the dosage by limiting surface exposure.

Bisecting technique

When using the bisecting technique, do not use a rectangular collimator. This limits the risk of misaligning the x-ray beam and the image receptor.

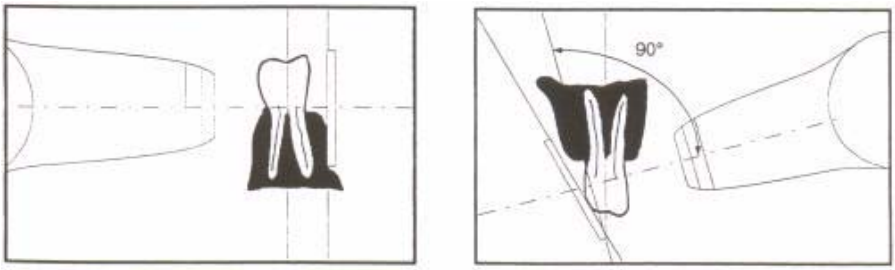


Figure 9. Paralleling technique (left) and Bisecting technique (right)

Positioning the imaging receptor

Using the KODAK 2100 Intraoral X-ray System, you may create an x-ray image on one of three different types of imaging receptors:

- Conventional silver halide films, such as KODAK INSIGHT or KODAK ULTRA-SPEED dental films
- Digital sensors, such as KODAK RVG sensor
- Phosphor plate

Properly placing the receptor is critical. Check your dental radiography text for information about proper placement of the imaging receptor.

Improperly positioning the film or sensor results in errors on the radiograph, such as distorted teeth and roots, elongation, magnification, and/or overlapping contacts. The paralleling technique generally reduces the risk of such errors. However, if you improperly position the system, angulation errors can occur (angulation of the receptor to the tooth itself).

If the exit pattern of the beam is not aligned with the imaging receptor, then part of the radiograph will not be exposed to radiation and the final radiograph will have some clear (unexposed) areas. This defect is called “cone cuts”.

The imaging receptor is marked to indicate the tube side. If the orientation is not correct, the resulting radiograph is lighter and may show artifacts, such as foil pattern or sensor cable.

Exposure

Exposure parameters

Because each receptor (film, digital sensor, or phosphor plate) has its own sensitivity to x-ray radiation, the choice of receptor affects the exposure parameters. For instance, sensitivity class for conventional dental films is characterized with a letter D, E, or F where F is more sensitive than E, and E more sensitive than D. Consequently, the required dose for the correct exposure goes down with each increase in sensitivity.

Tables with recommended exposure times are found in Section 6. The exposure times are based on manufacturers’ recommendations. The table should be considered as a guideline; adjust to accommodate your conditions.

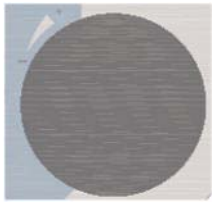
Adjust the exposure time range based on the type of receptor you use, film or digital. To change the mode, press and hold the selection knob at least 3 seconds. Then turn the selection knob to set the exposure time.

Procedure

1. Turn on the system.

   The on/off button and Ready indicator light up.

2. Select the exposure mode (digital or film) by pressing and holding the selection knob at least 3 seconds until the mode changes.[1]
   The digital mode has shortened exposure times to prevent overexposure of the digital sensor. When you select digital exposure, the digital indicator lights up.



3. Select the exposure time by turning the selection knob.
   Exposure tables are available in Section 6 of this manual. Additional tables are provided to hang close to your control timer unit.
   - For conventional use, the exposure time range goes from 0.05 to 1.25 sec.
   - For digital use, the exposure time range goes from 0.010 to 0.063 sec.

4. Acquire the image.
   a. Press the x-ray exposure button on the control timer unit.

      The x-ray emission indicator lights up and an audible signal is emitted.

   b. Keep pressing until the x-ray emission light goes out and the audible signal stops.

CAUTION:
If you stop pressing the control key before the exposure ends, a manipulator alarm is activated. It indicates that the x-ray emission was interrupted prematurely and that there is a risk of underexposure.

5. Read the emitted dose.

   Quickly press the selection knob. The “mGy” indicator lights up and the dose in mGy is displayed. Section 6 provides a table with emitted dosage based on exposure times.

Processing

When using conventional film, process the film according to manufacturer’s instructions. Develop the film under safelight conditions in an automatic processor or manually.

If you use an automatic processor, refer to the processor’s manual. Be sure to maintain the mechanically and keep the solutions replenished.

If you develop film manually, follow precisely the manufacturer’s recommendations for solution preparation, development time, and solution temperature. Any deviation from the manufacturer’s recommendations (such as a solution that is too concentrated or diluted, too hot or cold, or if film is processed for the wrong amount of time), will adversely affect the quality of the final radiograph.

1. This function may be disabled, depending on local regulations. See Section 4, User Mode.

Additional Features

- KODAK 2100 Intraoral X-ray System uses a high-frequency technology that has several advantages:
  - Shorter exposure times, reducing the risk of blur due to movement of the patient or film during exposure
  - Reduction in x-ray dose to patients because the KODAK 2100 System emits fewer soft rays absorbed by patients that do not contribute to the radiological picture
- A thermal safety system prevents the generator from overheating in case of intensive use. This system can prohibit any exposure as long as the generator did not cooled down: **I01** error message appears on the display unit and an audible signal is emitted until the cooling period is over.

CAUTION:
Do not turn off the system. If you turn off power, the microprocessor does not calculate the cooling time, and for safety reasons considers that the system has not gone into the cooling cycle.

- While the exposure is taken, the exposure time counts off on the control unit display.

  If the exposure is interrupted (such as by releasing the key), the audible and visible manipulator alarm is activated and the remaining exposure time is displayed. This information makes it easier to decide whether to develop the film or to start another exposure. (If the remaining time is short, you may develop the film.)

  To stop the manipulator alarm, press the selection knob.
- A self-test automatically activates when you turn on the unit.

  The self-test checks the display and alarm lights and all the systems.

  If the self-test detects a problem, an error code is displayed.

  When the test is completed, a short beep sounds and the display shows the firmware version and the total number of exposures (divided by 10) taken by this unit since it was installed.

4 User Mode

The User mode allows you to choose the length of the cone (which is necessary to calculate the correct emitted dose) and the type of imaging receptor (required by local regulatory agencies).

Entering User Mode

1. Turn on the system.
   The self-test is activated. At the end of the self-test, software information is displayed (for example, F718 1.00).
2. Quickly press the selection knob on the control timer to enter the menu. You have access to the menu when USER is displayed. The display intermittently shows the first parameter (P 01) and the setting (for example, ON).
3. To change from one parameter to another, turn the selection knob one step in any direction.

Changing Parameters

To change parameters:

1. Press and hold the selection knob at least 3 seconds until the display shows EDIT and you hear a sound.

   The parameter value starts blinking.
2. Turn the selection knob to change the parameter value.
   - To validate your choice, press and hold the selection knob at least 3 seconds until COPY is displayed and a noise sounds.
   - To keep the initial value, press the selection knob briefly. “Abor” appears on the display.

     The system returns to the parameters/programs mode.

Exiting User Mode

To exit the User mode:

- Press the selection knob briefly.

  “Quit” is displayed before the system return to operational mode.

N°	Parameters	Choice
P01	Digital receptor	ON / OFF
P02	Long cone	ON / OFF

5 Care and Maintenance

General Maintenance

To make sure that the system functions correctly, you must have it serviced annually by an authorized technician. In addition, every three months inspect the equipment and make sure of the following:

Generator

- The certification label is legible.
- There are no oil leaks.

Mechanical support

- The wall framework is securely attached to the wall.
- All the labels are legible.
- The scissor arm is stable in all positions.

Control unit and electrical installation

- The symbols are legible.
- The control unit cable and the power supply cable are in good condition.
- The ground is correctly installed.
- The radiology control key returns to its initial position after use.

Functioning

- The audible signal is audible and the x-ray emission light is visible when you make an exposure (for example, 0.1 sec.).

- The message “E01”, which means Operator Error, is displayed when you make an exposure (for example, 1.00 sec.) and release the control button before the exposure time has elapsed.

Timer self-test

- Turn on the system to activate the self-test.
  - The test starts with a simultaneous test of the display and alarm lights.
  - The unit proceeds to the systems test. At the end of this test, indicated by a short beep, the firmware version and the total number of exposures (divided by 10) made by the machine since installation is displayed.
  - If the test is not successful, an Error code is displayed on the display.

Important

If the result of any of these checks is not satisfactory, discontinue using the equipment and contact an authorized technician.

Cleaning

Clean the outside of the system with a damp paper towel or soft cloth using an alcohol-based, non-corrosive cleaner.

Disinfecting

If necessary, wipe off surfaces with disinfectant.

⚠ CAUTION:

- **Do not allow liquids to drip into the system.**
- **Do not spray cleaner or disinfectant directly onto the machine.**
- **Protect the system from contamination using barriers available from dental distributors.**
- **Follow the manufacturer's safety recommendations when using the cleaner or disinfectant.**

Error messages

Table 10. Error messages

Error message	Cause	How to cancel
I01	Cooling cycle; this message can appear during a period of intensive use.	**Do not turn off the system**. The error message will disappear when the system returns to a satisfactory temperature.
⚠ CAUTION: **If you turn off power to the system, the microprocessor does not calculate the cooling time, and for safety reasons considers that the system has not gone into the cooling cycle.**		
E01 plus audible alarm	Release of the radiography control button before the end of the exposure. The display shows the remaining exposure time. (Based on this time, decide whether to develop the film or make another exposure.)	Press the selector knob to stop the alarm.
E02	The radiography control was activated while the unit was being powered on.	Turn off the system and restart. If the problem persists, call a qualified service technician and discontinue using the equipment.
E03–E04	Problems with the exposure time control.	Turn off the system and restart. If the problem persists, call a qualified service technician and discontinue using the equipment.
E10 to E18	kV voltage error.	Turn off the system and restart. If the problem persists, call a qualified service technician and discontinue using the equipment.

Table 10. Error messages

Error message	Cause	How to cancel
E20 to E24	Filament voltage error.	Turn off the system and restart. If the problem persists, call a qualified service technician and discontinue using the equipment.
E30	Problem with voltage to main power supply or to chemical capacitor.	Turn off the system and restart. If the problem persists, call a qualified service technician and discontinue using the equipment.
E40 to E46	System error (problems with the microprocessor on the power board).	Turn off the system and restart. If the problem persists, call a qualified service technician and discontinue using the equipment.
E50 to E54	Problems with the I2C bus (the connection between the control panel and the power board).	Turn off the system and restart. If the problem persists, call a qualified service technician and discontinue using the equipment.

Troubleshooting

Table 11. Troubleshooting

Problem	Cause	Solution
Nothing lights up	Unit is disconnected.	Connect the unit.
	Fuse F1 is burned out or defective.	Replace the fuse.
	Circuit breaker is off.	Turn on the circuit breaker.
Control unit does not light up	Control unit is disconnected.	Connect the control unit.
	Fuse F1 is burned out or defective.	Replace the fuse.
	Control unit is defective.	Call a qualified service technician.
No x-ray emission	Generator is cooling.	Wait for the **I01** message to disappear.
	Radiology control key is defective.	Call a qualified service technician.
X-ray emission works, but exposure is too light or completely white	Generator is positioned incorrectly.	Adjust the position of the generator.
	Exposure time is too short.	Increase the exposure time.
	Development time is too short.	Increase the development time. (Refer to the development instructions.)
	Developer is too cold.	Heat the developer.
	Developer is too old or diluted.	Replace with fresh developer.
	RVG mode is incorrectly selected.	Verify your exposure settings. (Refer to the exposure procedure.)
	Receptor is facing the wrong way.	Reposition the receptor.
	Unit was incorrectly installed.	Call a qualified service technician.
X-ray emission works, but exposure is too dark	Exposure time is too long.	Decrease the exposure time.
	Development time is too long.	Decrease the development time. (Refer to the development instructions.)
	Developer is too hot.	Cool the developer.
	Developer is too concentrated.	Adjust the concentration or replace the developer.
	RVG/film mode is incorrectly selected.	Verify your exposure settings. (Refer to the exposure procedure.)

6 Specifications

According to IEC Standard 601-2-7

Manufacturer

Trophy
A subsidiary of Carestream Health Inc.
4, rue F. Pelloutier - Croissy-Beaubourg
77435 Marne-la Vallée Cedex 2
France

Models

- Dental X-ray diagnosis devices, class 1, type B, intermittent use
- KODAK 2100-TR: equipped with tube TRX 708 from TROPHY
- KODAK 2100-C: equipped with tube OCX / 65-G from CEI

Electric power supply (during exposure)

- 230–240 V AC (± 10%), 50 Hz, 5 A, apparent resistance 0.5 Ω
- 100–110–130 V AC (± 10%), 50/60 Hz, 12 A, apparent resistance 0.2 Ω

Electric power supply (no exposure)

- 230–240 V AC (± 10%), 50 Hz, 100 mA
- 100–110–130 V AC (± 10%), 50/60 Hz, 100 mA

Rated high voltage and maximum corresponding current

- 60 kV / 7 mA

Current/voltage combinations for a maximum output power of:

- 420 W, 60 kV / 7 mA

Rated power for exposure time of 0.1 sec.

- 420 W

Rate of use

- At 60 kV, 7 mA and 0.1 sec. and at the maximum tank temperature: approximately one exposure every 8 sec.

Minimum value of the current/time product in the range of conformity

- 0.07 mAs at 7 mA

Fixed parameters

- 60 kV / 7 mA

Area of conformity to IEC standard 60601-2-7 (2002)

- Reproducibility of the emitted radiation: conform
- Linearity of the emitted radiation: conform
- Precision in radiography: conform

Measurement conditions

- kV: Indirect measurement using a kV peakmeter
- mAs: Direct measurement in the circuit using a mAs-meter
- Exposure time: Indirect measurement on the kV signal at 75% of the peak value

Storage and transportation conditions

- Temperature: -10°C to 60°C (14°F to 140°F)
- Relative humidity: 10% to 95%
- Atmospheric pressure: 700 to 1060 hPa

Dimensions and weight

• Control unit:	13 x 9 x 4 cm (5.1 x 3.5 x 1.6 in.)	0.15 kg (0.33 lb)
• Wall framework:	51.4 x 18.9 x 10.8 cm (20.2 x 7.4 x 4.3 in.)	4.3 kg (9.5 lb)
• X-ray emitting unit:	43.8 x 22.6 x 12 cm (17.2 x 8.9 x 4.7 in.)	4.3 kg (9.5 lb)
• Scissor arm:	87.3 x 13.3 x 6.3 cm (34.4 x 5.2 x 2.5 in.)	9 kg (19.8 lb)
• Mobile stand (optional):	90 x 60 x 110 cm (35.4 x 23.6 x 43.3 in.)	40 kg (88.2 lb.)
• Floor column (optional):	24 x 23 x 90 cm (9.4 x 9.1 x 35.4 in.)	20 kg (44.2 lb.)
• Ceiling column:	50 x 50 x 154 cm (19.7 x 19.7 x 60.6 in.)	12,8 kg (28.2 lb.)

Scissor arm

- Equipped with gas jack specially designed for this application; proven to function correctly after more than 400,000 cycles

Electromagnetic compatibility

- KODAK 2100 Intraoral System complies with the European Directive 89/336/EEC and the IEC 60601.1.2 (2001) standard.
  Classification: Group 1, Class B

X-ray Generator

Table 12. Main characteristics of the x-ray generator

	***TROPHY* type TRX 708**	**CEI type OCX/65-G**
Rated high voltage	70 kV	70 kV
Rated anodic power	490 W	490 W
Maximum heat accumulated in the anode	8,700 J	10,000 J
Rated value of focal spot (IEC 60336/1993)	0.7 mm (0.027 in.)	0.7 mm (0.027 in.)
Target materials	Tungsten	Tungsten
Target slope	19°	19°
Filtration due to fixed materials	0.6 mm (0.023 in.) eq. Al	0.6 mm (0.023 in.) eq. Al

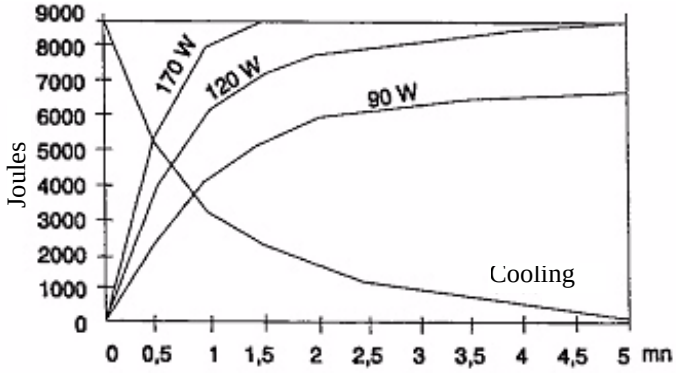


Figure 13. Heating and cooling curves for TROPHY TRX 708 tube

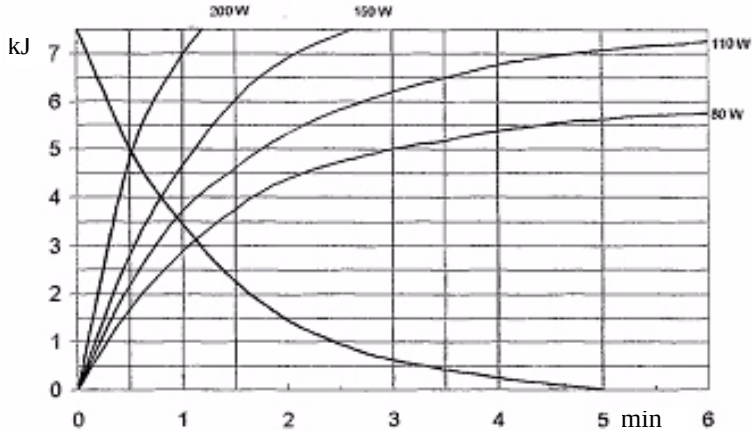


Figure 14. Heating and cooling curves for CEI OCX/65-G tube

Equipped X-ray Generator

Table 15. Equipped x-ray generator

IEC standard 60601-2-28 (1993)	Conform
Type of protection against electric shocks	Class I
Degree of protection against electric shocks	Type B
Rated value of inherent filtration	1.5 mm (0.059 in.) eq. Al
Rated value of additional filtration	1.0 mm (0.039 in.) eq. Al
Rated value of total filtration	2.5 mm (0.098 in.) eq. Al
Beam-limiting cone, focal spot/skin distance	20 cm (7 7/8 in.)
Maximum accumulated heat	32,500 J
Maximum continuous thermal dissipation	7 W
Amount of leaking radiation at maximum rate during one hour of use	< 0.25 mGy
Maximum field of symmetrical radiation	6 cm (2 3/8 in.) diameter
Position and tolerances of the focal point on the reference axis	0 mm +/-0.5 mm (0.020 in.)

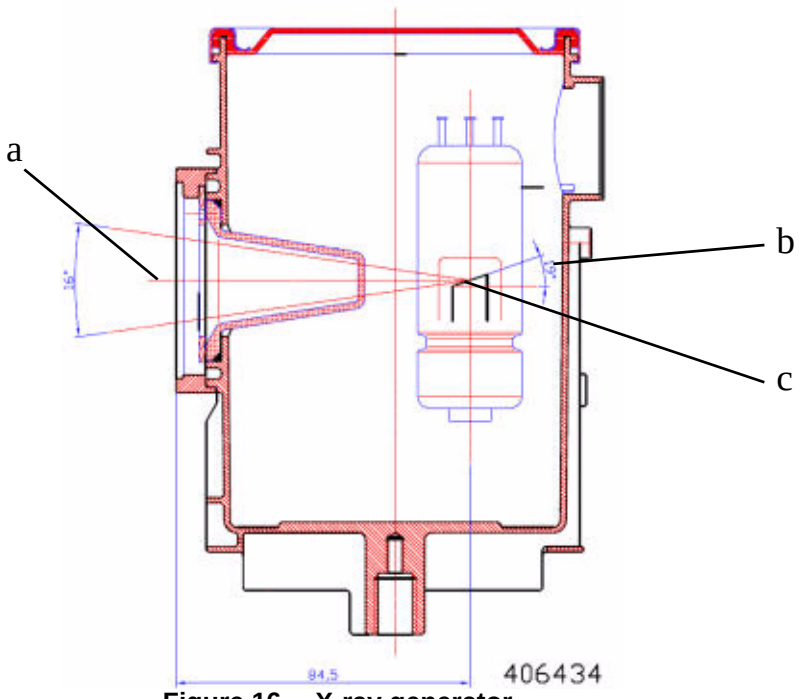


Figure 16. X-ray generator

a Reference axis

b Target angle

c Focal point

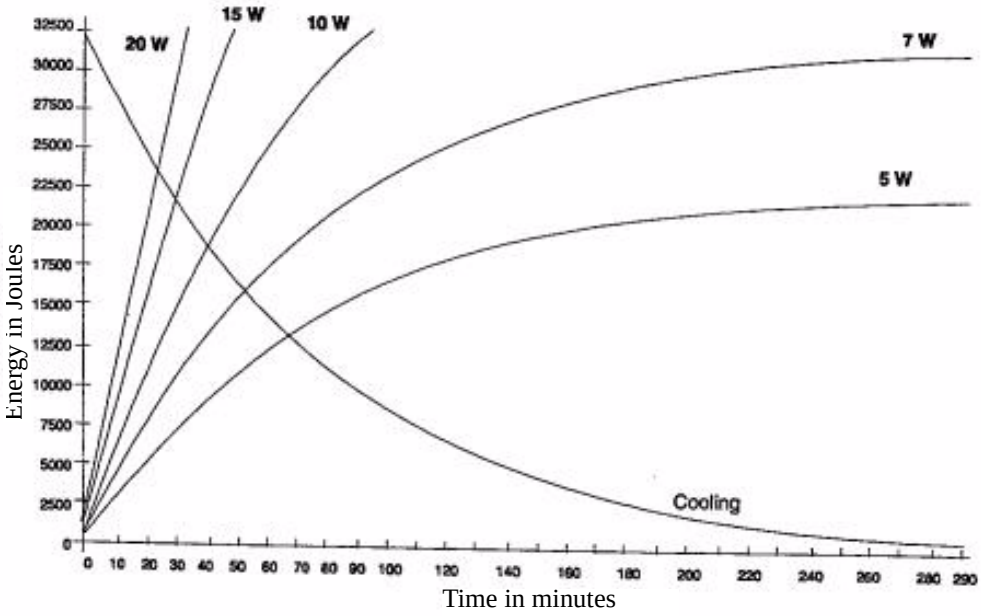


Figure 17. Heating and cooling curves of the KODAK 2100 system tube head

Position of Identification Labels

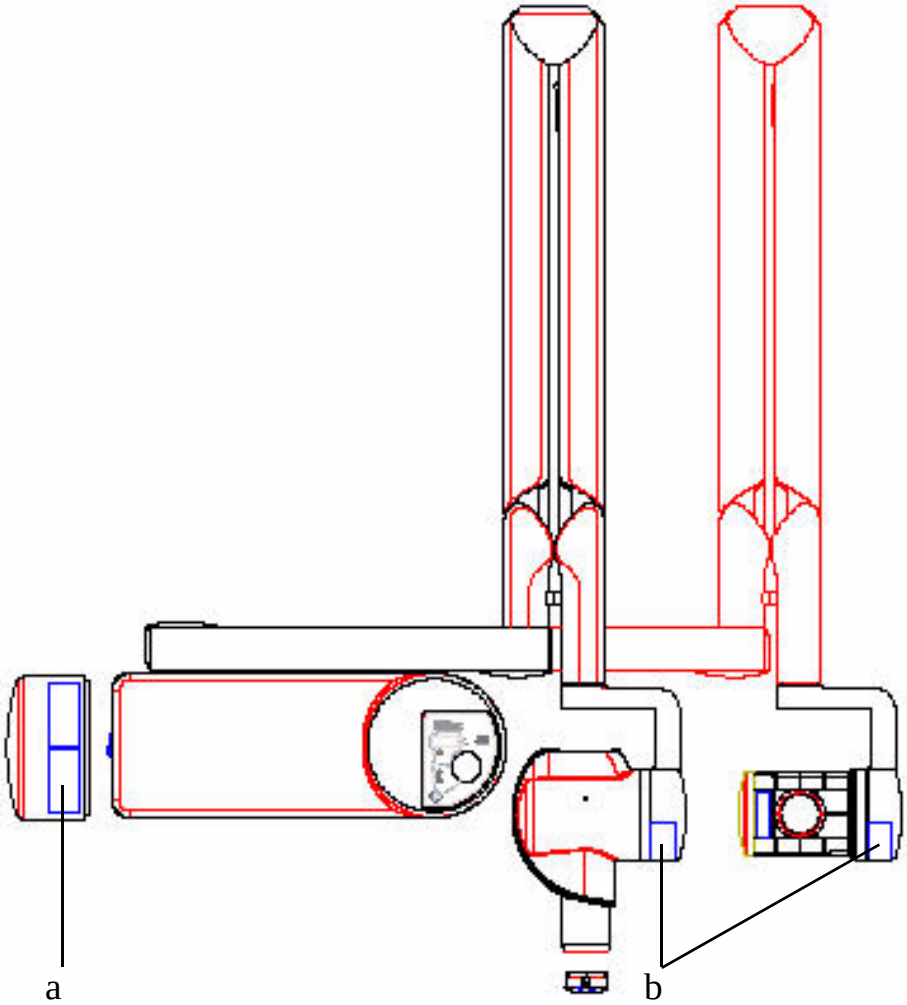


Figure 18. Position of identification labels

a Machine identification
b X-ray emitting unit identification

Tables of Exposure Times

Table 19. Exposure times in seconds for KODAK film

KODAK Ultra-Speed (D) film			KODAK Insight (F) film		
60kV - 7mA	**Cone 20 cm (8 in.)**		**60kV - 7mA**	**Cone 20 cm (8 in.)**	
Maxillary	**Child**	**Adult**	**Maxillary**	**Child**	**Adult**
Anterior	0.250	0.400	Anterior	0.100	0.160
Premolar	0.320	0.500	Premolar	0.125	0.200
Molar	0.400	0.630	Molar	0.160	0.250
Mandibular			**Mandibular**		
Anterior	0.200	0.320	Anterior	0.080	0.125
Premolar	0.250	0.400	Premolar	0.100	0.160
Molar	0.250	0.400	Molar	0.100	0.160
Bitewing			**Bitewing**		
Anterior	0.200	0.320	Anterior	0.080	0.125
Posterior	0.250	0.400	Posterior	0.100	0.160
Occlusal	0.500	0.630	**Occlusal**	0.200	0.250

Table 20. Exposure times in seconds for KODAK film

KODAK D-Speed (D) film			KODAK E-Speed (E) film		
60kV - 7mA	**Cone 20 cm (8 in.)**		**60kV - 7mA**	**Cone 20 cm (8 in.)**	
Maxillary	**Child**	**Adult**	**Maxillary**	**Child**	**Adult**
Anterior	0.250	0.400	Anterior	0.125	0.200
Premolar	0.320	0.500	Premolar	0.160	0.250
Molar	0.400	0.630	Molar	0.200	0.250
Mandibular			**Mandibular**		
Anterior	0.200	0.320	Anterior	0.100	0.160
Premolar	0.250	0.400	Premolar	0.100	0.160
Molar	0.250	0.400	Molar	0.125	0.200
Bitewing			**Bitewing**		
Anterior	0.200	0.320	Anterior	0.100	0.160
Posterior	0.250	0.400	Posterior	0.125	0.200
Occlusal	0.500	0.630	**Occlusal**	0.200	0.320

Table 21. Exposure times in seconds for KODAK CR plates

KODAK CR 7400 plates					
60kV - 7mA	**Cone 20 cm (8 in.)**		**60kV - 7mA**	**Cone 20 cm (8 in.)**	
Maxillary	**Child**	**Adult**	**Maxillary**	**Child**	**Adult**
Anterior	0.250	0.400	Anterior		
Premolar	0.320	0.500	Premolar		
Molar	0.400	0.630	Molar		
Mandibular			**Mandibular**		
Anterior	0.200	0.320	Anterior		
Premolar	0.250	0.400	Premolar		
Molar	0.250	0.400	Molar		
Bitewing			**Bitewing**		
Anterior	0.200	0.320	Anterior		
Posterior	0.250	0.400	Posterior		
Occlusal	0.500	0.630	**Occlusal**		

Table 22. Exposure times in seconds for KODAK RVG digital sensors

KODAK RVG 6000			KODAK RVG 5000		
60kV - 7mA	**Cone 20 cm (8 in.)**		**60kV - 7mA**	**Cone 20 cm (8 in.)**	
Maxillary	**Child**	**Adult**	**Maxillary**	**Child**	**Adult**
Anterior	0.080	0.125	Anterior	0.100	0.160
Premolar	0.100	0.160	Premolar	0.125	0.160
Molar	0.125	0.200	Molar	0.160	0.200
Mandibular			**Mandibular**		
Anterior	0.063	0.100	Anterior	0.080	0.125
Premolar	0.080	0.100	Premolar	0.080	0.125
Molar	0.080	0.125	Molar	0.100	0.160
Bitewing			**Bitewing**		
Anterior	0.063	0.100	Anterior	0.080	0.125
Posterior	0.080	0.125	Posterior	0.100	0.160
Occlusal	0.125	0.200	**Occlusal**	0.160	0.250

Table 23. Exposure times in seconds for KODAK RVG digital sensors

KODAK RVG 6100 (sizes 1 & 2)			KODAK RVG 6100 (size 0)		
60kV - 7mA	**Cone 20 cm (8 in.)**		**60kV - 7mA**	**Cone 20 cm (8 in.)**	
Maxillary	**Child**	**Adult**	**Maxillary**	**Child**	**Adult**
Anterior	0.080	0.125	Anterior	0.050	0.080
Premolar	0.100	0.160	Premolar	0.063	0.100
Molar	0.125	0.200	Molar	0.080	0.125
Mandibular			**Mandibular**		
Anterior	0.063	0.100	Anterior	0.040	0.063
Premolar	0.080	0.100	Premolar	0.050	0.063
Molar	0.080	0.125	Molar	0.050	0.080
Bitewing			**Bitewing**		
Anterior	0.063	0.100	Anterior	0.040	0.063
Posterior	0.080	0.125	Posterior	0.050	0.080
Occlusal	0.125	0.200	**Occlusal**	0.080	0.125

Table 24. Exposure times in seconds for KODAK RVG digital sensors

KODAK RVG 5100					
60kV - 7mA	**Cone 20 cm (8 in.)**		**60kV - 7mA**	**Cone 20 cm (8 in.)**	
Maxillary	**Child**	**Adult**	**Maxillary**	**Child**	**Adult**
Anterior	0.100	0.160	Anterior		
Premolar	0.125	0.160	Premolar		
Molar	0.160	0.200	Molar		
Mandibular			**Mandibular**		
Anterior	0.080	0.125	Anterior		
Premolar	0.080	0.125	Premolar		
Molar	0.100	0.160	Molar		
Bitewing			**Bitewing**		
Anterior	0.080	0.125	Anterior		
Posterior	0.100	0.160	Posterior		
Occlusal	0.160	0.250	**Occlusal**		

Table 25. Exposure times in seconds for Trophy RVG digital sensors

Trophy RVG Access			Trophy RVG Ultimate		
60kV - 7mA	**Cone 20 cm (8 in.)**		**60kV - 7mA**	**Cone 20 cm (8 in.)**	
Maxillary	**Child**	**Adult**	**Maxillary**	**Child**	**Adult**
Anterior	0.100	0.160	Anterior	0.080	0.125
Premolar	0.125	0.200	Premolar	0.100	0.160
Molar	0.160	0.200	Molar	0.125	0.200
Mandibular			**Mandibular**		
Anterior	0.080	0.125	Anterior	0.063	0.100
Premolar	0.080	0.125	Premolar	0.080	0.100
Molar	0.100	0.160	Molar	0.080	0.125
Bitewing			**Bitewing**		
Anterior	0.080	0.125	Anterior	0.063	0.100
Posterior	0.100	0.160	Posterior	0.080	0.125
Occlusal	0.160	0.250	**Occlusal**	0.125	0.200

Table 26. Exposure times in seconds for Trophy RVG digital sensors

Trophy RVG Reference High Resolution			Trophy RVG Reference High Sensitivity		
60kV - 7mA	**Cone 20 cm (8 in.)**		**60kV - 7mA**	**Cone 20 cm (8 in.)**	
Maxillary	**Child**	**Adult**	**Maxillary**	**Child**	**Adult**
Anterior	0.080	0.125	Anterior	0.020	0.032
Premolar	0.100	0.160	Premolar	0.025	0.040
Molar	0.125	0.160	Molar	0.032	0.050
Mandibular			**Mandibular**		
Anterior	0.063	0.100	Anterior	0.016	0.025
Premolar	0.063	0.100	Premolar	0.020	0.032
Molar	0.080	0.125	Molar	0.020	0.032
Bitewing			**Bitewing**		
Anterior	0.063	0.100	Anterior	0.016	0.025
Posterior	0.080	0.125	Posterior	0.020	0.032
Occlusal	0.125	0.200	**Occlusal**	0.040	0.050

Table 27. Exposure times in seconds for Trophy RVG digital sensors

Trophy RVGui High Resolution			Trophy RVGui High Sensitivity		
60kV - 7mA	**Cone 20 cm (8 in.)**		**60kV - 7mA**	**Cone 20 cm (8 in.)**	
Maxillary	**Child**	**Adult**	**Maxillary**	**Child**	**Adult**
Anterior	0.080	0.125	Anterior	0.020	0.032
Premolar	0.100	0.160	Premolar	0.025	0.040
Molar	0.125	0.160	Molar	0.032	0.050
Mandibular			**Mandibular**		
Anterior	0.063	0.100	Anterior	0.016	0.025
Premolar	0.063	0.100	Premolar	0.020	0.032
Molar	0.080	0.125	Molar	0.020	0.032
Bitewing			**Bitewing**		
Anterior	0.063	0.100	Anterior	0.160	0.025
Posterior	0.080	0.125	Posterior	0.020	0.032
Occlusal	0.125	0.200	**Occlusal**	0.040	0.050

Table 28. Exposure times in seconds for Trophy RVG digital sensors

Trophy RVG THD					
60kV - 7mA	**Cone 20 cm (8 in.)**		**60kV - 7mA**	**Cone 20 cm (8 in.)**	
Maxillary	**Child**	**Adult**	**Maxillary**	**Child**	**Adult**
Anterior	0.040	0.063	Anterior		
Premolar	0.050	0.080	Premolar		
Molar	0.063	0.100	Molar		
Mandibular			**Mandibular**		
Anterior	0.032	0.050	Anterior		
Premolar	0.040	0.063	Premolar		
Molar	0.040	0.063	Molar		
Bitewing			**Bitewing**		
Anterior	0.032	0.050	Anterior		
Posterior	0.040	0.063	Posterior		
Occlusal	0.080	0.100	**Occlusal**		

Table 29. Exposure times in seconds for your local conditions (fill in this chart)

60kV - 7mA	**Cone 20 cm (8 in.)**		**60kV - 7mA**	**Cone 20 cm (8 in.)**	
Maxillary	**Child**	**Adult**	**Maxillary**	**Child**	**Adult**
Anterior			Anterior		
Premolar			Premolar		
Molar			Molar		
Mandibular			**Mandibular**		
Anterior			Anterior		
Premolar			Premolar		
Molar			Molar		
Bitewing			**Bitewing**		
Anterior			Anterior		
Posterior			Posterior		
Occlusal			**Occlusal**		

Emitted Doses

Table 30. Dose measured at extremity of cone area

20 cm (8 in.) cone	
t (s)	**D (mGy)**
0.010	0.06
0.013	0.08
0.016	0.10
0.020	0.12
0.025	0.15
0.032	0.19
0.040	0.24
0.050	0.30
0.063	0.38
0.080	0.49
0.100	0.61
0.125	0.76
0.160	0.97
0.200	1.22
0.250	1.52
0.320	1.95
0.400	2.44
0.500	3.05
0.630	3.84
0.800	4.87
1.000	6.09
1.250	7.61
1.600	9.74
2.000	12.18
2.500	15.23

Note

Dose accuracy: +/- 30% (mGray)
To obtain the dose in mGy.cm^2, multiply values by the exposed surface, which depends on the collimator that is used.

Table 31. Exposure surface versus type of collimator used

Collimator type	Format (mm)	Used with digital sensor	Used with film	Exposure surface (cm^2)
A	19 x 24	Size 0	-	4.6
B	23 x 35	Size 1	Size 0 22 x 35	8.3
C	31 x 39	Size 2	Size 1 24 x 40 Size 2 31 x 41	12.1
Standard cone	60 mm diameter	-	Size 3 27 x 54 Size 4 57 x 76	28.3

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