

Convenience **Portable X-RAY**

DX3000



User's manual



MAXRAY

TABLE OF CONTENTS

1	DX-3000.....	5
1.1	INTRODUCTION	5
1.2	SYMBOLS USED IN THIS MANUAL	6
1.3	LABEL AND MARKING SYMBOLS.....	7
1.4	DEVICE LABELING.....	8
2	WARNINGS AND INSTRUCTIONS	9
2.1	SYMBOLS AND DETAILS.....	9
2.2	WARNINGS FOR USE.....	9
2.2.1	Warnings for product use.....	9
2.2.2	Warnings for battery use	10
2.2.3	Warning for product inspection.....	10
2.3	WARNINGS FOR STORAGE	10
3	CAUTION AND INSTRUCTIONS	12
3.1	SYMBOLS AND DETAILS.....	12
3.2	CAUTION AND INSTRUCTIONS.....	12
3.2.1	Caution for product storage	12
3.2.2	Caution for product use.....	12
3.3	CAUTION OF OTHER MATTERS.....	13
4	ITEMS TO CHECK	14
4.1	SYMBOL AND DETAIL	14
4.2	ITEMS TO CHECK	14

5 PRODUCT FEATURES..... 15

5.1	OUTLINE	15
5.2	PRODUCT FEATURES.....	15
5.2.1	Features	15
5.3	PRODUCT SPECIFICATIONS	16
5.3.1	Device main body	16
5.3.2	Battery Pack.....	16
5.3.3	Battery pack charging adapter.....	17
5.3.4	Battery charging cradle	17

6 PRODUCT COMPOSITION 18

6.1	OUTLINE	18
6.2	PRODUCT COMPOSITION.....	18
6.3	PRODUCT EXPLANATION	20
6.3.1	Main body name	20
6.3.2	UI screen composition and functions.....	21
6.3.3	Buttons and functions	24
6.3.4	Battery pack and charging devices	26

7 HOW TO USE 29

7.1	POWER ON/OFF	29
7.2	X-ray EXPOSURE POSITIONING.....	30
7.2.1	Patient's positioning.....	30
7.2.2	Film or intraoral sensor positioning.....	31
7.2.3	DX-3000 positioning.....	32
7.3	X-ray EXPOSURE	32
7.3.1	X-ray exposure sequence	32
7.3.2	Setting X-ray Exposure time	34

7.4	ENVIRONMENT SETUP	35
7.4.1	Environment setup screen.....	35
7.4.2	Environment setup list	36
7.5	FUNCTION SETUP	38
7.5.1	Function setup screen	38
7.5.2	Function setup list	38
7.6	WIRED REMOTE CONTROLLER	41
7.6.1	Wired remote controller usage.....	41
7.7	BATTERY	42
7.7.1	Mounting battery inside Main body.....	42
7.7.2	Battery level and charging	43

8 MAINTENANCE AND STORAGE 47

8.1	MAINTENANCE AND STORAGE	47
8.2	STORAGE	48
8.2.1	Check for Product storage	48
8.2.2	Charging adaptor and cradle storage	48
8.3	PRODUCT TRANSPORT, STORAGE CONDITIONS AND CONDITIONS OF USE	48
8.3.1	Transportation and storage conditions	48
8.3.2	Optimal conditions of use.....	49
8.4	ITEMS TO CHECK.....	49
8.4.1	Frequent inspection items.....	49
8.4.2	Periodic inspection items	49

9 INSPECTION ITEMS BEFORE REPAIR50

9.1	CHECK ITEMS BEFORE REQUESTING INSPECTION.....	50
9.2	TROUBLESHOOTING.....	52

10 PRODUCT SPECIFICATION AND QUALITY

ASSURANCE 53

10.1 PRODUCT SPECIFICATION 53

10.2 QUALITY ASSURANCE 54

11 DX-3000 TECHNICAL DOCUMENT..... 55

11.1 HIGH VOLTAGE GENERATOR..... 55

11.1.1 X-ray Tube : Toshiba D-081B 55

11.2 ELECTROMAGNETIC COMPATIBILITY 57

11.3 RADIATION PROTECTION..... 58

MANUAL VERSION 3.0
Revision date: May/2014

1 DX-3000

1.1 Introduction

Thank you for purchasing the portable X-ray system from Iridium Dental. The DX-3000 has been developed to not only take radiographs in an analog fashion using conventional film, but also to be used in Dental Digital Radiography (DDR) using a digital sensor. Please familiarize yourself with this manual and the X-ray unit prior to use.

Follow all product-use instructions while using the product.



PRODUCT USAGE

This product is a medical device, and it should only be used as a digital X-ray radiography device for X-ray radiography in the proper facility.



WARNING

This X-ray unit may be dangerous to the patient and operator unless safe exposure factors and operating protocol are observed.



TYPE B Applied Part





A "Type B Applied Part" provides the lowest degree of patient protection and is not suitable for direct cardiac application.












CAUTION

For proper usage and safety purposes, please ensure that only legally qualified personnel (Doctor, Medical Treatment Radiological Technologist, Medical Treatment X-ray Technologist) may use this product after it has been fully familiarized by the contents of this user manual.

1.2 Symbols used in this Manual



SYMBOL	NAME	DETAIL
	Radiation warning	The "Radiation Warning" sign explains details about possible radiation hazards and the potential for injury or death with improper use.
	Warning	The "Warning" sign explains details about improper use which may cause physical damage to the product.
	Caution	The "Caution" sign explains details about improper use which may cause bodily harm to the user.
	Check	The "Check" sign explains instructions that users must follow for product installation, operation, and maintenance.

1.3 Lables and markings: Symbols

SYMBOL	NAME	DESCRIPTION / FUNCTION
	Electrical protection	Insulated patient application (Type B).
	Radiation warning	This symbol indicates radiation hazards.
	Warning	This symbol indicates general hazards.
	Consult accompanying documents	This symbol advises the reader to consult the accompanying documents.
	Manufacturer information	This symbol is followed by the name and address of the device manufacturer.
	Manufacture date	This symbol is followed by the device manufacture date in the form YYYY-MM.
	Serial number	This symbol is followed by the device serial number.
	Representatives information	This symbol shows manufacturer's EU representative information.
	Separate collection for electrical and electronic equipment	Indicates the need for separate collection of electrical and electronic equipment in compliance with the Waste Electrical and Electronic Equipment (WEEE) Directive. This symbol indicates that electrical and electronic equipment wastes must not be disposed as unsorted municipal waste and must be collected separately. Please contact the manufacturer or an authorized disposal company to decommission your equipment according to local regulations





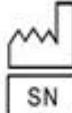
1.4 Device labeling

- Potable X-ray System
- DX3000
- Sources of electricity : DC 12~16.8V
- Power consumption : 285VA(MAX)
- Tube voltage : 65kV(Fixed)
- Tube current : 2.5mA(Fixed)
- Total Filtration :1.5mmAl (Inherent filtration 0.8mmAl)





0086

MADE IN KOREA

SN



Manufacturer
DEXCOWIN Co.,Ltd.
 #606, 2, Gasan digital 1-ro, Geumcheon-gu, Seoul, Korea.
 Tel : +82-2-2027-2880 / Fax : +82-2-2027-2884

EC	REP
----	-----

Paul Sweeney, Boston Dental Scientific Isabel Colbrand 10, Local 68, 28050Madrid, Spain
 Tel : 0034-91-358-8006 / Fax : 0034-91-358-8018

2 Warnings and instructions

2.1 Symbols and details



The "**Warning**" sign explains details about improper use which may cause physical damage to the product.

2.2 Warnings for use

2.2.1 Warnings for product use

- ◆ Ensure that the radiation exposure limit required for image diagnosis is not exceeded.
- ◆ If radiation exposure safety regulations and operation - related guidelines are not followed during use of this product, both patient and operator may be at risk.
- ◆ Only legally qualified personnel are permitted to operate this device.
- ◆ Use this device only for its designated purpose.
- ◆ If any abnormalities are found with the patient while using the device, stop using the device immediately and ensure patient safety.
- ◆ Do not make any modifications to the device.
- ◆ If you suspect any product malfunctions (such as oil leakage) while using the product, turn off the power immediately and contact the closest customer support center.
- ◆ Make sure a fire extinguisher is on-site in case of a fire emergency.

2.2.2 Warnings for battery use

- ◆ Use only the provided designated battery!
- ◆ Do not expose the battery to strong electrical currents, and keep it away from sharp objects.
- ◆ If the battery is kept under high temperature, it may explode.
- ◆ Do not let the battery become wet or be kept in damp conditions.
- ◆ Store batteries in a locked cabinet.
- ◆ Do not allow the battery terminals to come into contact with any metallic substance or surface.

2.2.3 Caution for product inspection

- ◆ Do not touch the product, charger, or power plug with wet hands. Doing so may cause an electric shock.
- ◆ During the cleaning process of the product, do not use wet-wipe cloths or spraying products. Only clean the product once the battery has been removed.

2.3 Warnings for storage

- ◆ Moisture, salinity, dust, etc. can affect the performance of the device. Do not store the device in places with such conditions.
- ◆ Do not store the product in direct sunlight or places with frequent temperature changes for long periods of time. Under these conditions, the voltage generator's

cooling and insulating oil could shrink, swell, freeze, or overheat, causing critical damage to device functions.

- ◆ Do not store product with explosive gas or chemicals.
- ◆ Do not leave the battery pack connected to the charger during storage. When the battery is used or charged for too long, it may shorten battery lifespan or increase the danger of explosion.
- ◆ The device must be stored in the protection case. If kept elsewhere, it may cause critical damage to device functions.
- ◆ Do not place the device on a high shelf where it may become a falling hazard.
- ◆ Do not store the device in the trunk of a car or a cargo van where it may be move freely and become damaged. If it must be transported by vehicle, be sure that it is secured tightly.

3 Caution and instructions

3.1 Symbols and details



The "**Caution**" sign explains details about improper use which may cause bodily harm to the user.

3.2 Caution and instructions

3.2.1 Caution for product storage

- ◆ Moisture, salinity, dust, etc. can affect the performance of device. Do not store the device in places where such conditions may be present.
- ◆ Do not store the product in direct sunlight or places with frequent temperature changes for long periods of time.
- ◆ Do not store the product with explosive gas or chemicals.
- ◆ Do not leave the battery pack connected with the charger during storage.

3.2.2 Caution for product use

- ◆ Please maintain regular temperature and moisture levels for normal operation.
- ◆ During use or transportation of the device, please be careful to avoid severe shocks or vibration.
- ◆ Wear a protective lead apron or equivalent radiation protection gear during use.
- ◆ Keep the product clean for proper usage.
- ◆ Use care when disconnecting the battery pack cradle from the charger.

3.3 Caution for other matters

- ◆ In the event that the device breaks down, mark it as such and send it to a designated professional at the A/S center.
- ◆ Do not let patients touch the device. Do not leave it unsupervised.
- ◆ If the device is dropped, turn it off and remove the battery. Return the unit to the manufacturer for inspection.
- ◆ For discarding the product:



This symbol indicates the need for separate collection of electrical and electronic equipment in compliance with the Waste Electrical and Electronic Equipment (WEEE) Directive. This symbol indicates that electrical and electronic equipment wastes must not be disposed as unsorted municipal waste and must be collected separately. Please contact the manufacturer or an authorized disposal company to decommission your equipment according to local regulations.

4 Items to check

4.1 Symbol and Detail



The "**Check**" sign explains instructions that users must follow for product installation, operation, and maintenance.

4.2 Items to Check

- ◆ Check the condition of the device and battery pack before using. Confirm the that the device is operating properly.
- ◆ Check the part that makes direct contact with patients for any abnormalities.
- ◆ Use the device only in the designated sequence.
- ◆ Use the device in a stable environment with good ventilation.
- ◆ Check the remaining battery power display. If the remaining battery power is not sufficient, recharge the battery prior to use.
- ◆ Use the battery-pack charger exclusively for this product when charging.
- ◆ Do not let metallic products or other foreign substances touch the battery pack terminals. Keep it clean by using a dry cloth.
- ◆ Ensure that the device and all of its parts are regularly inspected.

5 Product Features

5.1 Outline

In Chapter 5, the features and specifications of this device are explained for safe usage.

5.2 Product Features

5.2.1 Features

- > Medical Device Name: Portable X-ray System
- > Model Name: DX-3000
- > Display: 2.5" LCD (Resolution: 128 x 64)
 - Adult and child mode
 - Film and digital mode
 - Remaining battery life
 - Exposure time setup by part of the teeth
- > Function for user
 - Film and digital mode selection
 - Maximum or Minimum exposure time setup
 - Exposure time unit setup
 - Single wired remote controller operation and exposure selection button
 - Automatic shutoff time-setup

- Continuation of LCD backlight time setup
- > Removable and rechargeable battery supply.

5.3 Product specifications

5.3.1 Device main body

- > Device Name: Portable X-ray System
- > Tube voltage: 65 kV (Fixed)
- > Tube current: 2.5 mA (Fixed)
- > X-ray tube focal spot size: 0.8 mm
- > Power consumption: 285 VA
- > Cooling method: OIL Cooling Method
- > Total filtration: Over 1.5 mmAl (inherent: 0.8 mmAl, fixed type added filter: 0.7 mmAl)
- > Target Angle: 20°
- > Time setting function: 0.02 – 2.5 sec. (Including film / digital mode)
- > Exposure time unit setting function: 0.01 – 0.1 sec.
- > Distance to target: Distance between target and Focal Spot > 20 cm (8 [inch])
- > Main body size: 166(L) x 240(W) x 82(H) mm (except length of cone)
- > Main body weight (exclusion battery): 2.2 kg

5.3.2 Battery Pack

- ◆ Model name: PF435060HP-4S

- ◆ Cell material: Lithium Polymer
- ◆ Charging conditions
 - Charging current: 1.0 [A]
 - Charging voltage: DC 16.8 [V]
 - Temperature range: 0 – 40 [°C]
- ◆ Usage conditions
 - Maximum output current: 26 [A]
 - Output voltage: DC 15 [V]
 - Temperature range: -20 – 60 [°C]

5.3.3 Battery pack charging adapter

- ◆ Model name: BPL910S16N01
- ◆ Input voltage: AC 100 – 240[V], 50/60 [Hz], 0.5 [A]
- ◆ Output voltage: DC 16.8[V]
- ◆ Output current: 1.0 [A]

5.3.4 Battery charging cradle

- ◆ Model name: D910
- ◆ Charging voltage: DC 16.8 [V]
- ◆ Charging current: 1.0 [A]
- ◆ Discharging voltage (at the time of battery connection): varies depending on discharging condition.
- ◆ Discharging current (at the time of battery connection): varies depending on discharging condition
- ◆ Size: 77.5(L) x 72.3(W) x 49.3(H) [mm]

6 Product composition

6.1 Outline

In Chapter 6, specific product parts are explained. Be familiar with the entire manual before using the device.

6.2 Product composition

The DX-3000 consists of the items below.

- ◆ Main body: 1 ea
- ◆ Battery pack: 2 ea
- ◆ Battery charging adapter: 1 ea
- ◆ Battery charging cradle: 1 ea
- ◆ Power cord: 1 ea
- ◆ Storage case: 1 ea
- ◆ User Manual CD (includes product warranty) : 1 ea
- ◆ Wired remote controller (sold separately): 1 ea
- ◆ Back Scattered shield (sold separately): 1 ea



CHECK

The images in this document may differ from the actual product depending on product function, federal and local regulations, and supply circumstances. Consider the following only for reference.



Main body



Battery



Battery charging adapter



Battery charging cradle



Power cord



Storage case



User Manual CD /
Product warranty



Wired remote controller
(sold separately)



Backscatter shield

Figure 6.1 Product Composition

6.3 Product Explanation

6.3.1 Main body parts

The parts of the main body are labeled as follows:

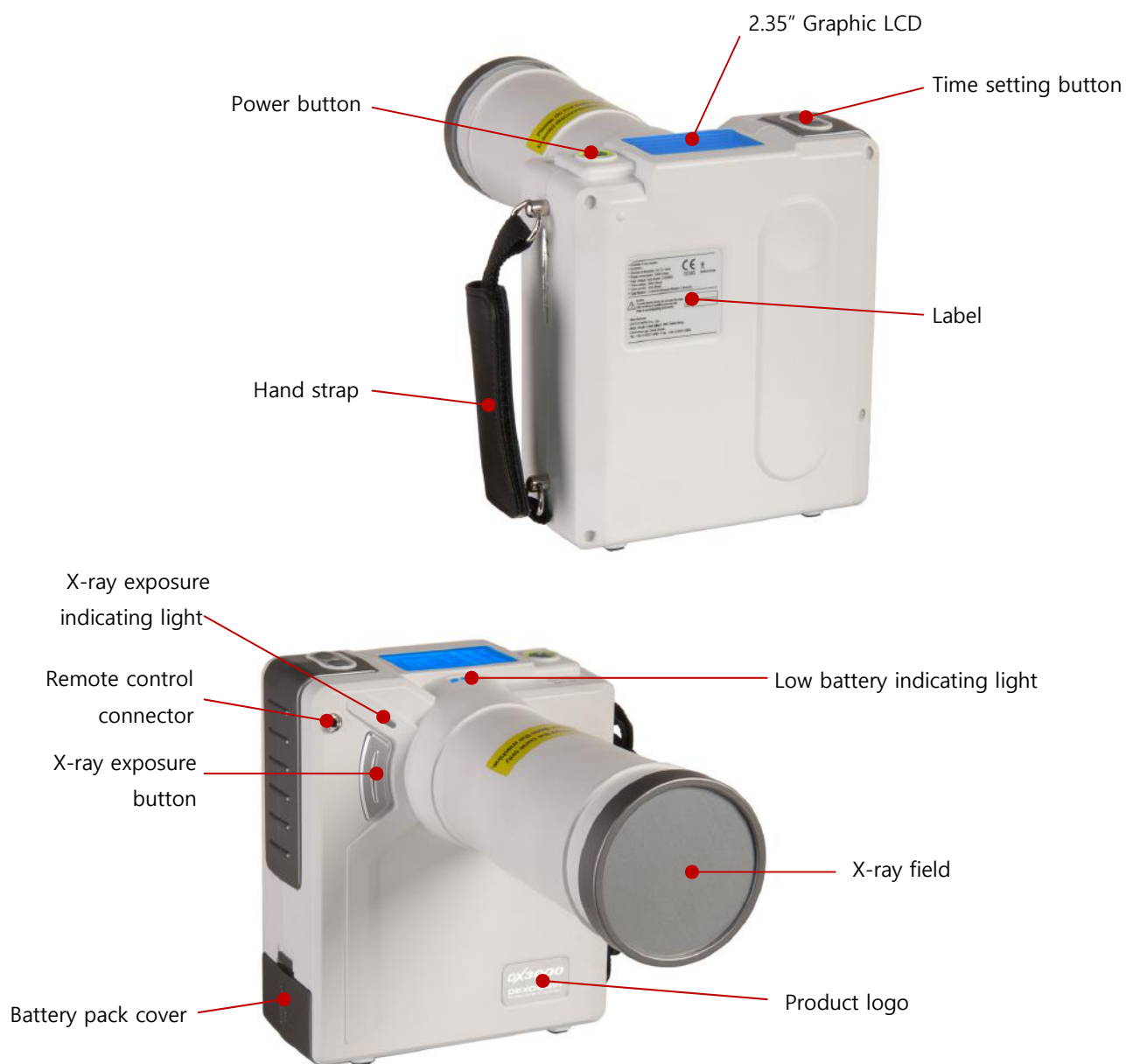


Figure 6.2 Main body parts

6.3.2 User interface (UI) screen composition and functions

① Main control screen

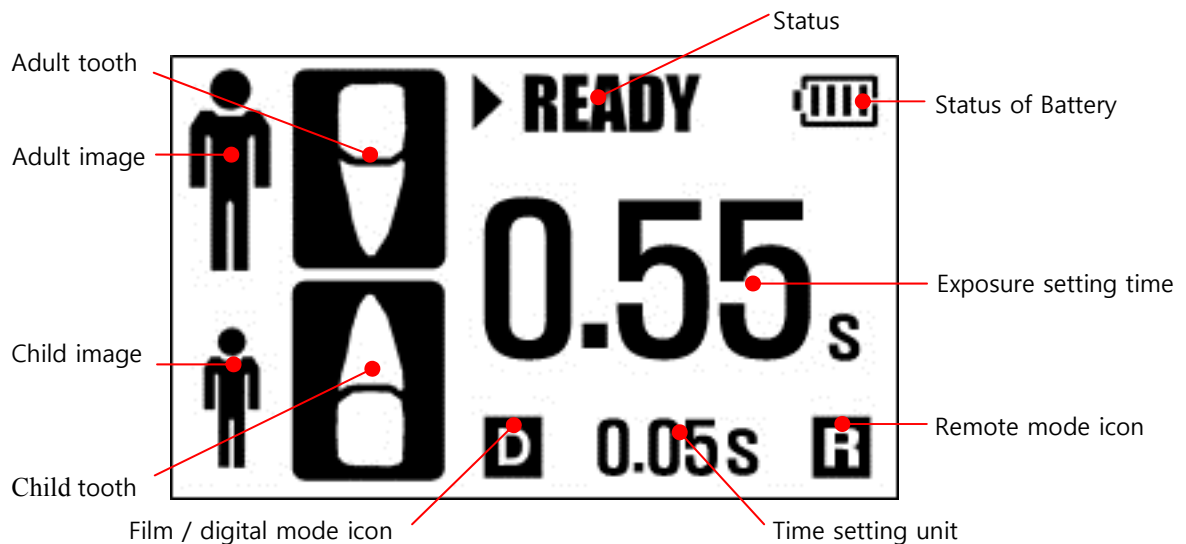


Figure 6.3 Main control screen

- Adult image and adult tooth: Indicates recommended adult tooth by time setting.
- Child image and child tooth: Indicates recommended child tooth by time setting.
- Status: Indication of the present operation of the device.
- Status of battery: Indicates the remaining battery life by 4 steps.
- Exposure setting time: Indicates X-ray irradiation time.
- Film / digital mode icon: Apply 'D' in environment setup menu when using digital sensor and apply 'F' when using film.
- Time setting unit: Time unit is adjustable from 0.01 seconds to 0.1 seconds and indicates the current setup.
- Remote mode icon: When selecting remote control, an "R" will appear.

② Environment Settings screen

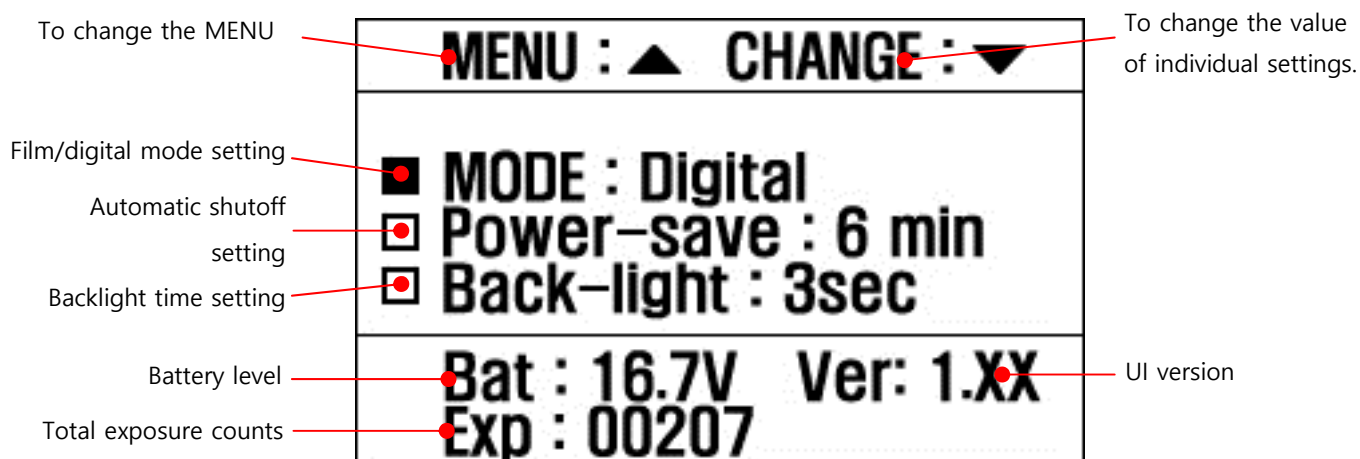


Figure 6.4 Environment settings screen

- **MENU change:** Indicates the menu options, which can be navigated by pressing the ▲ button on the upper part of main body.
- **Value setting change:** Indicates change of setup value, navigated by pressing ▼ button on upper part of main body.
- **Film / digital mode setting:** Changes present exposure mode to film or digital
- **Automatic shutoff setting:** Automatic shutoff time is adjustable from 1 minute to 10 minutes, by 1 minute intervals.
- **Backlight time setting:** The amount of time the backlight remains on after any button has been pressed is adjustable from 1 second to 10 seconds, by 1 second intervals.
- **Battery level:** Indicates the remaining battery strength.

- **Total exposure counts:** Indicates the number of x-ray exposures that have occurred.
- **UI version:** Indicates the current UI version number.

③ Function Setting Screen

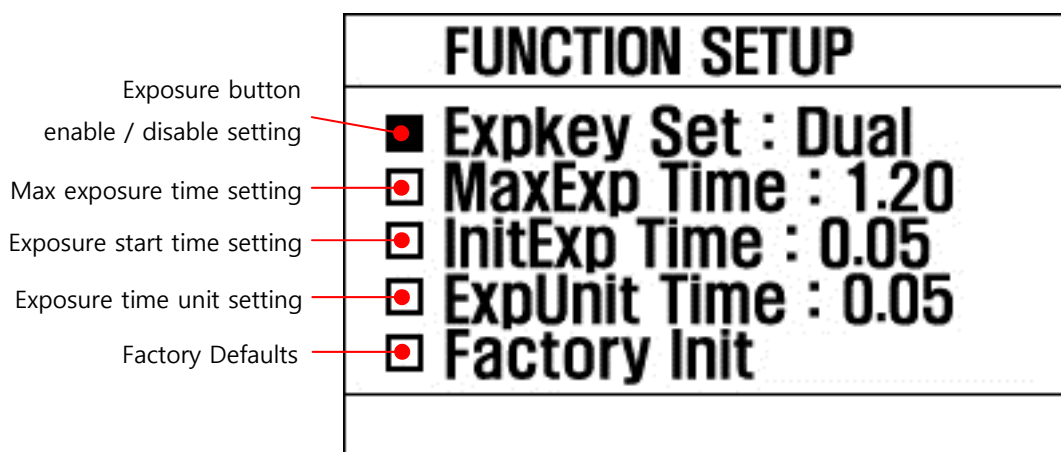


Figure 6.5 Function setting screen

- **Exposure button enable / disable setting:** 'Remote' appears when only the wired remote controller must be used to begin exposure, whereas 'Dual' appears when either exposure button can be used.
- **Max exposure time setting:** The maximum exposure time setup is available and adjustable from 1 second to 2.5 seconds, by 0.05 second intervals.
- **Exposure start time setting:** The minimum exposure time setup is available and adjustable from 0.02 seconds to 0.2 seconds, by 0.01 second intervals.
- **Exposure time unit setting:** Exposure time unit setup is available and adjustable from 0.01 seconds to 0.1 seconds, by 0.01 second intervals.
- **Factory defaults:** Returns all setup options to the initial factory settings.

6.3.3 Buttons and functions

① Top side buttons and functions



Figure 6.6 Top side buttons and functions

- **Power button:** Used to turn on/off the device and as combination button to enter the environment setup or function setup menus.
- **Time setting button:** Used as the exposure time-set button on the main control display and to switch between menus or change settings on the environment setup and function setup menus. The functions of the exposure time-set button on the different menu screens are displayed in Table 6-1.

Table 6-1. Functions of time setting buttons

Classification	Main control screen	Environment setting screen	Function setting screen
Button sequence to reach screen	Power button ON	While the device is ON: Power button + ▲button	While the device is ON: Power button + ▼button
▲ button function	Exposure time increase	Menu change	Setting change
▼ button function	Exposure time decrease	Setting change	Menu change

② Front side exposure button and function



Figure 6.7 Front side exposure button

- If 'Dual' is selected on the 'exposure button enable/disable' function setup display, pressing and holding the exposure button will cause the X-ray exposure.
- The X-ray exposure is accompanied by a tone while the button is engaged. The irradiation will stop when the button is released. (DMS method - Dead Man Switch)



CHECK

Because the product only generates X-rays while the button is pressed, releasing the button during the accompanying sound will suspend X-ray generation.

6.3.4 Battery pack and charging device parts

① Battery pack parts



Figure 6.8 Battery pack parts

- **Battery pack label:** Indicates the battery model name, manufacturer's address and serial numbers, as well as providing certain precautions.
- **Output terminal (+,-):** Provides power when the battery pack is inserted into the device.

② Charging cradle parts

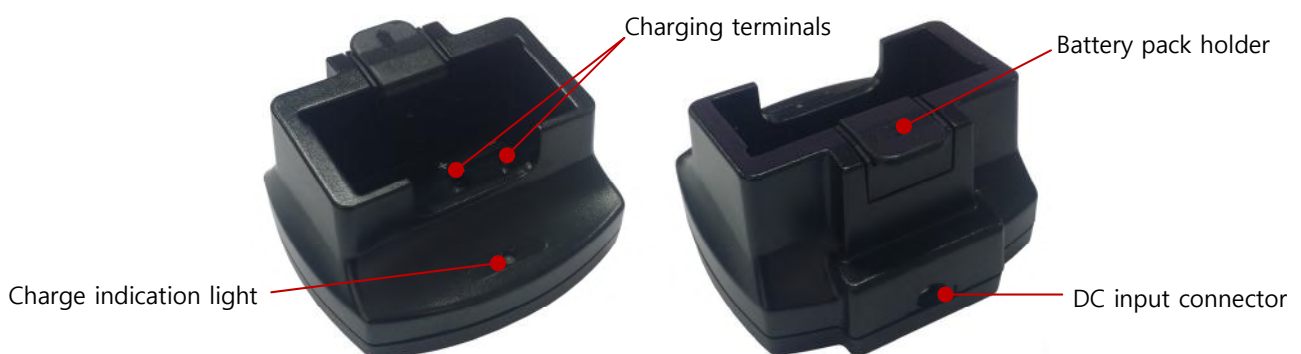


Figure 6.9 Charging cradle parts

- **Charge indication light:** Indicates the status of battery charge using three different colors (red - charging; green - fully charged; yellow - charging error)
- **Charging terminals:** Connect the output terminals of the battery pack to the charging terminals of the charging cradle to charge the battery.
- **Battery pack holder:** Holds the battery pack in place while its being charged.
- **DC input connector:** Receives charging power from charging adaptor
- **Charge source jack:** Provides DC output power from the adapter

② Charging adaptor parts



6.10 Charging adaptor parts

- **Output indicating light:** Indicates present output status.
- **AC input connector:** Connect with the AC input of the power cord.
- **Charging adapter label:** Indicates model name and input/output condition, certification, serial numbers.
- **AC power cord:** Connect to an external AC power source.

WARNING



The following rules must be followed whenever charging the battery pack:
 (1) Use only the provided charger and battery pack. (2) Keep the battery pack in the special storage case after it has been fully charged. (3) Avoid over-charging the battery pack once it has been fully charged. (4) Don't allow metal objects (coins, keys, clips etc.) to contact the battery terminal plate.

CAUTION



The charge indicating light turns green once charging is complete. Disconnect the battery pack and the power cord while the charger set is not in use.

CHECK



The battery pack is a consumable item, and its lifetime is gradually reduced as it is used. Once the battery lifetime is reduced to half of what it was upon purchase, replace it with a new battery pack.

CHECK



Used battery packs should not be thrown away. They should be recycled or placed in an exclusive case.

7 How to use

7.1 Power On/Off

- After opening the battery cover at the bottom of the main body, insert the battery pack, ensuring that it is inserted in the proper orientation.
- Hold down the power button on top of the main body for 1 second. A green light will appear along with a short beep, and the LCD window will display the manufacturer's logo (see Figure 7.1).



Figure 7.1 manufacturer's logo

- After the logo appears, the main control display (see Figure 7.2) will follow. The exposure-time setting is indicated in the center of the main display. Users can adjust the time setting by using the (▲▼) buttons on the top of the main body.
- Holding the power button for 1 second will power off the device.



Figure 7.2 main control display

CHECK



The DX-3000 has an automatic shutoff function in order to reduce battery consumption. The automatic shutoff time is set for three minutes after the device has not been used. The automatic shutoff time can be adjusted by the user in the settings menu from 1 minute to 10 minutes, in 1 minute intervals.

7.2 X-ray exposure positioning

7.2.1 Patient positioning

- Place the patient in a chair and have them maintain bilateral symmetry.
- Make sure the patient's head is in a fixed position.
- Exposing at 15~30° of patient's position is recommended but the degree and position can be adjusted according to user's convenience. However, the patient must not move during the exposure.

7.2.2 Film or intraoral receptor positioning

- X-rays generated by the DX-3000 can be detected by various receptors such as film, intra-oral sensors (digital), PSP and viewed screens.
- Place the film or sensor on the teeth and make sure it does not move.
- If film or PSP is to be used, make sure they are not bent or twisted to avoid image distortion.
- Typically, the receptor should be aligned with the center of the X-ray cone, perpendicular to the emitted X-rays (see Figure 7.3).

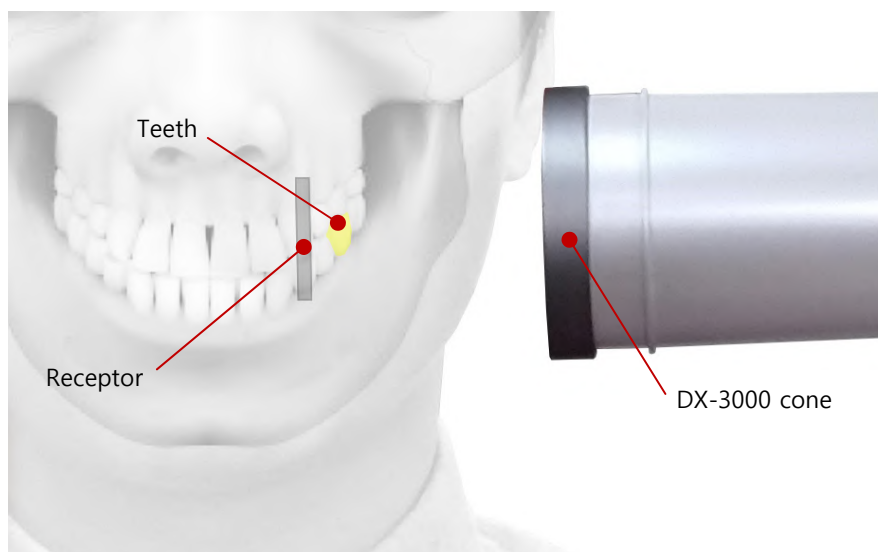


Figure 7.3 X-ray Panel display



CHECK

The position of the film or intra-oral sensor and the face of the DX-3000 must be parallel during exposure. If the angle deviates too much, the image can be twisted and the correct image may be lost.

7.2.3 DX-3000 positioning

- The distance between the end of the cone and the patient must be within at least 20cm (8 inch) from the X-ray focal spot.
- The target teeth must be positioned at the center of the cone in order to cover the whole tooth structure.
- Operate the exposure appropriate for the image receptor and the teeth being radiographed. Ensure the DX-3000's cone is perpendicular to the receptor and that the cone is pointed at the center of the teeth.

7.3 X-ray Exposure

7.3.1 X-ray exposure sequence

- The DX-3000's X-ray exposure sequence is as follows. Set up the user and patient in a location that is optimal for radiography prior to exposure.
 - ① Set up the exposure time according to the recommendation for the target teeth or to the user's preference.
 - ② Place the film or digital intra-oral sensor tightly inside the target teeth.
 - ③ Put the cone of the device up to the target teeth and perpendicular to the film or intra-oral sensor and press and hold the x-ray exposure button.
 - ④ Hold the exposure button until exposure has finished and then place the device in a safe place.
 - ⑤ Check images from the film or sensor after shooting.

- After pressing the exposure button, a tone warns that X-ray exposure has begun, and X-ray exposure continues with a corresponding tone. X-rays are only generated during the period of the consecutive tone and while the button is held.
- While X-rays are generated, the 'READY' signal on the upper LCD main control display will change to the 'EXPOSURE' signal, and the X-ray indicating light on the front part of the main body will turn yellow.
- Once the X-ray exposure has finished, the 'EXPOSURE' signal on the upper LCD main control display will disappear and the yellow X-ray indicating light will turn off.
- After the X-ray exposure has finished, a 'WAIT' signal appears on the upper LCD main control display and the device will prepare for the next X-ray exposure over the course of 10 seconds. X-ray exposure is not available during the wait period.



CHECK

The modified time set is only saved after an X-ray exposure has occurred. If, after changing the time set, no exposure is made, the time set reverts to the default value automatically after the device is turned off.



CAUTION

X-rays are only generated while the X-ray exposure button is being pressed. If the exposure button is released during the tone, exposure stops immediately.















CAUTION

Avoid any potential materials which may attenuate the X-ray beam between the X-ray cone and the target. This could cause image distortion or a decline in the image quality.

7.3.2 Setting X-ray Exposure time

- The DX-3000's X-ray exposure factors are fixed at 60 kV, 2.0 mA and is changeable only by exposure time.
- The DX-3000's X-ray exposure time is adjustable from 0.02 to 2.5 seconds.
- The exposure time is adjustable by 0.01 second intervals.
- Set up the exposure time by pressing the exposure time set button.
- Exposure time is decided by the teeth type, receptor type, and age of the patient. Table 7-1 shows the time settings by teeth.

Table 7-1. Time set table by teeth

Classification		Teeth types and exposure time							
Age	Adult	-	-						
	Child							-	-
Distance between cone and skin (20cm)	Sensor	0.05 ~ 0.10	0.10 ~ 0.15	0.15 ~ 0.20	0.20 ~ 0.25	0.25 ~ 0.30	0.30 ~ 0.35	0.35 ~ 0.40	0.40 ~
	film	0.15 ~ 0.25	0.25 ~ 0.35	0.45 ~ 0.55	0.60 ~ 0.70	0.70 ~ 0.80	0.80 ~ 0.90	0.90 ~ 1.00	1.00 ~ 1.10



CAUTION

Exposure time settings by teeth type can vary according to the sensor type and film, distance to patient, and the image preference. Please refer to the settings as recommendations only.

7.4 Environment setup

7.4.1 Environment setup screen

- After turning on the device, press the power button and the ▲ button at the same time to switch to the environment setting display (see Figure 7.4).

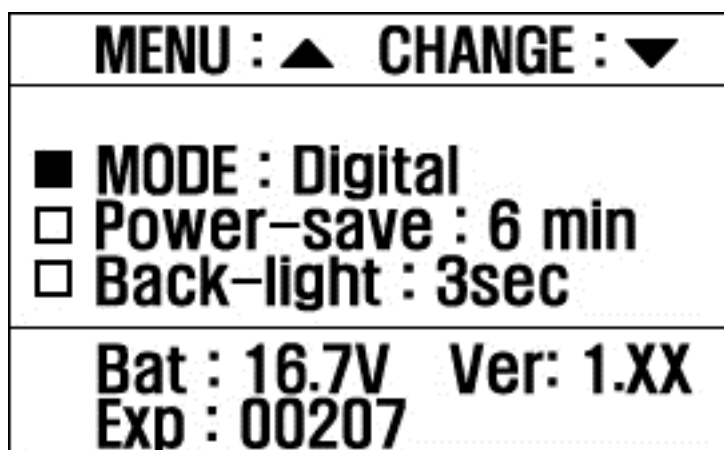


Figure 7.4 Environment setup display

- Press ▲ button to move through menu.
- Press ▼ button to change values.
- After changing the desired settings, turn off the device and turn it back on. The device will now operate under the changed settings.

7.4.2 Environment setup list

- **MODE**

- Once you choose Film or Digital mode, the relevant teeth images for each exposure sector are applied.
- Press the ▲ button to select 'MODE' and press the ▼ button to choose 'Film' or 'Digital'.
- After selecting either 'Film' or 'Digital' and saving the settings, 'F'(Film) or 'D'(Digital) will appear on the main control display (see Figure 7.5).

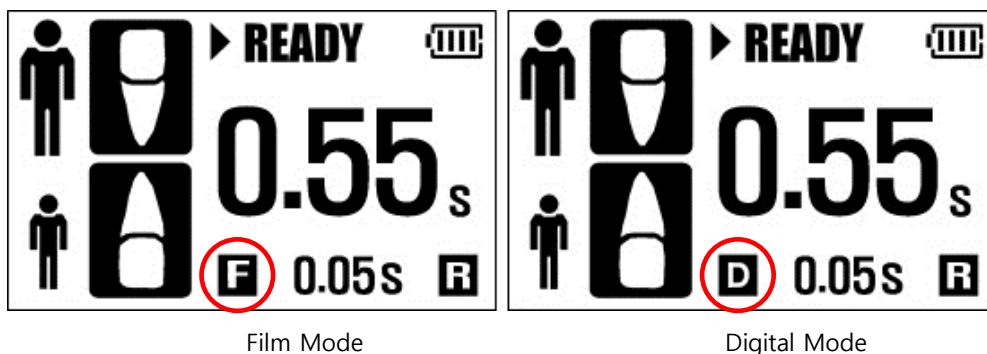


Figure 7.5 Mode Setting

- **Power-save**

- If the device has not been used for some time, the power will automatically shut off to avoid unnecessary power consumption.
- The default time setting is 5 minutes and it is adjustable from 1 minute to 10 minutes, by 1minute intervals.

- **Backlight**
 - The LCD display backlight time is adjustable.
 - The default time is set to 1 second and it is adjustable from 1 second to 10 seconds, by 1 second intervals.

- **Bat**
 - Battery life remaining is indicated on the display.
 - X-ray exposure is possible only when the battery level is from 14.0 V to 16.8 V.

- **Ver:** Indicates the current software version in use.

- **Exp:** Indicates the total number of X-ray exposures since counter reset.

7.5 Function setup

7.5.1 Function setup screen

- After turning on the device, press the power button and the ▼ button at the same time for a second to reach the function setup display (see Figure 7.6).

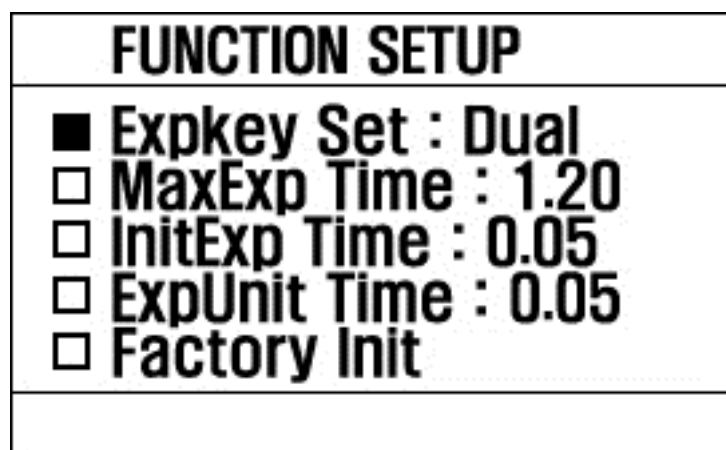


Figure 7.6 Function setup screen

- Press the ▼ button to move through the menu.
- Press the ▲ button to change values.
- After changing the desired settings, turn off device and turn it back on. The device will now operate under the changed settings.

7.5.2 Function setup list

- **Expkey Set**
 - Locks or unlocks the exposure button function. If locked (i.e. 'REMOTE'), X-ray exposure is available by wired remote control only.

- Press the ▼ button to select 'Expkey Set' and the ▲ button to choose 'Dual' (exposure button enabled) or 'Remote' (exposure button disabled/remote control use only).
- When selecting 'Remote', 'R' will appear on the main control display and will disappear when selecting 'Dual' (see Figure 7.7).

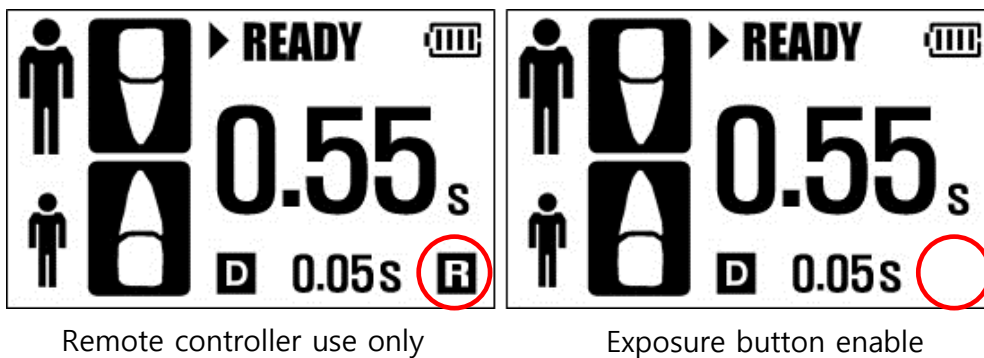


Figure 7.7 X-ray exposure button use check

- **MaxExp Time**
 - Changes the maximum exposure time. It is adjustable from 1 second to 2.5 seconds, by 0.05 second intervals.
 - Press the ▼ button to select 'MaxExp Time' and press the ▲ button to adjust the value (returns to 1s after 2.5s).
- **InitExp Time**
 - Changes the minimum exposure time. It is adjustable from 0.02 seconds to 0.1 seconds, by 0.01 second intervals.
 - Press the ▼ button to select 'InitExp Time' and press the ▲ button to adjust the value (returns to 0.02s after 0.1s).

- ExpUnit Time
 - Changes the time modification unit for exposure time. It is adjustable from 0.01 seconds to 0.1 seconds, by 0.01 second intervals.
 - Press the ▼ button to select 'ExpUnit Time' and press the ▲ button to adjust the value (returns to 0.01s after 0.1s).
 - The changed unit is indicated at the bottom center of the main control display (see Figure 7.8).



Figure 7.8 Time modification unit display

7.6 Wired remote controller

7.6.1 Wired remote control usage

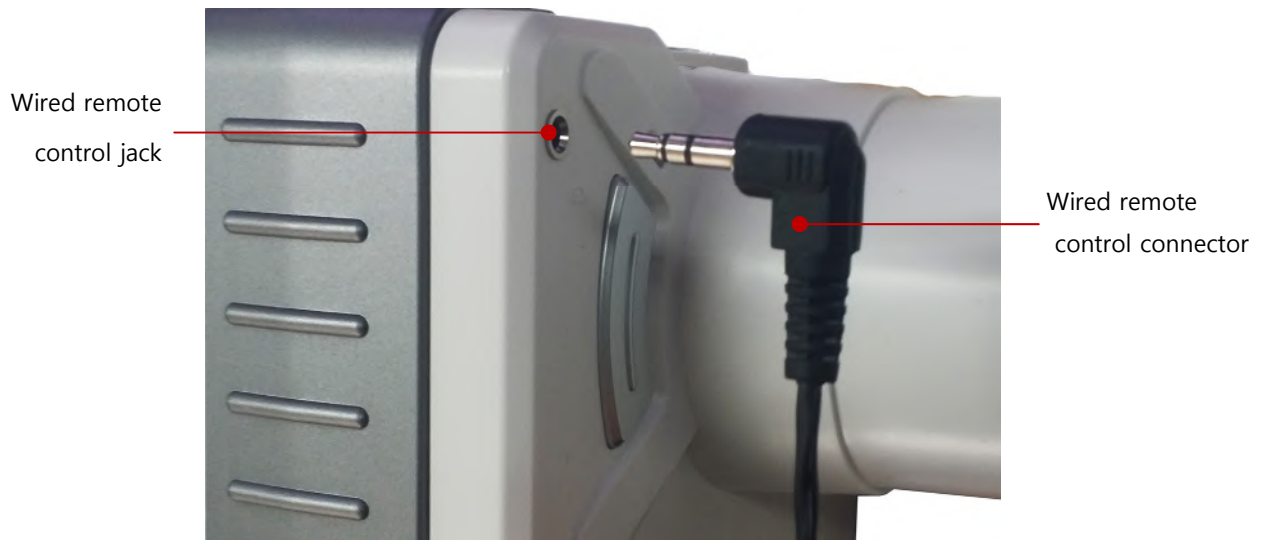


Figure 7.9 Wired remote control connection

- Connect the wired remote control connector to the wired remote control jack on the front face of the DX-3000. The remote control jack has to be connected completely inside the connector for proper operation.
- Operating the device using the wired remote control follows the same procedure as using the exposure button on the main body. The DX-3000 can be mounted on a stand for prolonged X-ray exposure.



CAUTION

Only used approved wired remote controls. An approved remote control is not included with the device, but can be purchased separately from distributors.

- If the button is pressed after the exposure range has been adjusted, X-ray exposure will occur.
- The wired remote control only performs X-ray exposure. Other settings and operations must be manipulated through the LCD screen on the device.

7.7 Battery

7.7.1 Mounting the battery inside the main body

- Check that the DX-3000 is powered OFF.
- The battery pack cover should be separated by sliding it backward after holding down the latch (circled in Figure 7.10).



Figure 7.10 Battery cover separation

- After the battery cover has been removed, the battery cam should be inserted into main body. The battery pack should be inserted in the direction of the

arrow from the side of the main body, with the battery label face-down (see Figure 7.11). The battery should fit into the slot's grooves smoothly.

- Close the battery cover. The cover will connect with the main body and make a clicking noise once it has properly been closed.
- Turn the power on to confirm that the device is operating normally.

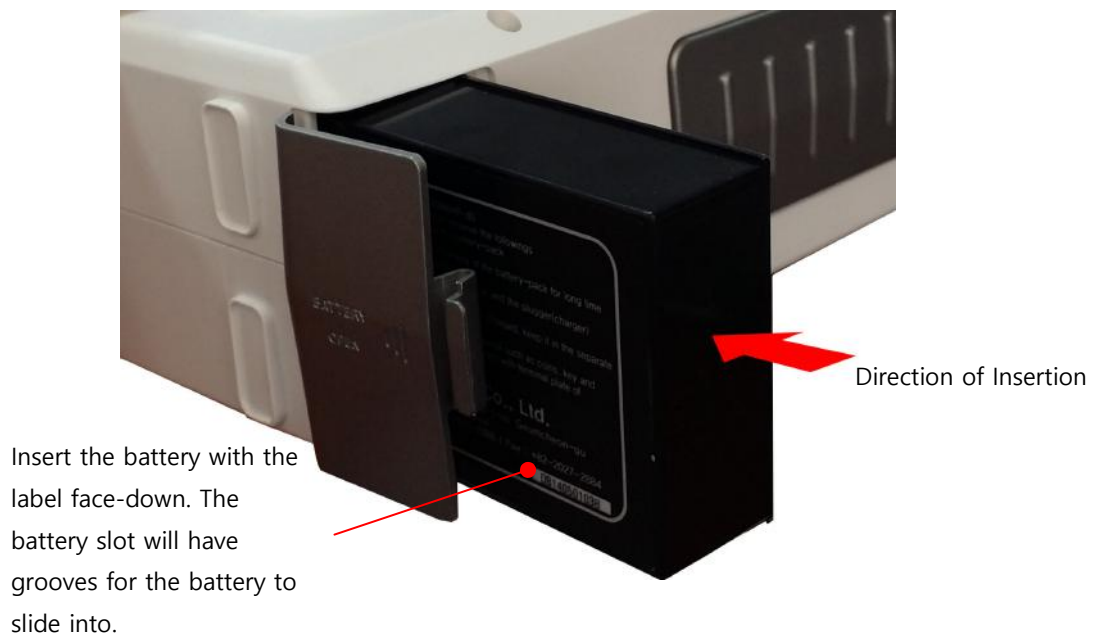


Figure 7.11 Main body battery pack insertion

7.7.2 Battery level and charging

- The DX-3000's battery has a high power output and, for safety purposes, is designed to charge separately from the main body.
- The user will be notified that it is time to charge the battery through either a buzzing sound, the LCD screen, the low battery-indicating light or the low power level upon powering up the device.

- When battery replacement is necessary, the battery level on the LCD display indicates 'LOW' and a 'LOW' battery image appears on the upper right part of the main control display. The battery replacement-indicating light on the upper part of main body will be yellow, as well.



CHECK

Recharge the battery pack once the LOW battery sign on the LCD screen is displayed. When changing the battery pack, take care not to drop it and ensure it is inserted correctly.

- The battery level display and remaining battery life shown on the right side of the main control screen is demonstrated in Figure 7.12. Replace the battery once the display indicates that 0~10% battery life remains.



7.12 Battery level display/remaining battery life

- If the device is used for too long after the 'LOW' battery signal began blinking, the warning message in Figure 7.13 will appear on the LCD display for a few seconds before the device powers off.



Figure 7.13 LCD screen after battery dies

- The battery charger consists of a charging adapter and a charging cradle (Figure 7.14).
- Connect the charger adapter DC plug to the charging jack on the back side of the charging cradle. Use a bundled AC power line to connect the charger adapter, and connect it to AC power. The AC power voltage range and frequency is 100 - 220V AC and 50 - 60 Hz, respectively. Confirm the device is rated for the AC power before connection.
- Place the battery in the charge cradle (Figure 7.15). Insert the battery until it fits smoothly into the groove of the charging cradle.
- When charging has begun, a red light will be displayed on the charger cradle. Once charging is complete, the red light will turn green.
- If the battery is not correctly connected to the charger or another problem occurs, the charge indicating light will be yellow.



Figure 7.14 Battery cradle and charger adapter



Figure 7.15 Connecting the battery into the cradle

8 Maintenance and storage

8.1 Maintenance

- Keep the device and battery pack in a safe place where only qualified personnel have access.
- The collimating cone that comes into direct contact with the patient should be cleaned by gently wiping with a clean cloth and rubbing alcohol.
- Do not use the device near an active heater, heating device, etc.
- Be sure to keep the DX-3000 and all parts in its storage cases while they aren't in use.
- Do not alter the device. If the SEAL attached to the product is broken, free A/S services will not be provided.
- To ensure safe operation, perform regular check ups of the device and its parts with a designated A/S center.
- Avoid use/storage in places with the following characteristics:
 - High moisture
 - Direct sunlight
 - Dusty/dirty
 - High humidity
 - No ventilation
 - High salinity
 - Chemical substances or explosive gases

8.2 Storage

8.2.1 Checks for Product storage

- Avoid places with high humidity or direct sunlight.
- Avoid place with lots of dirt and dust, as well as sloped surfaces.
- Do not store in extremely high or low temperatures.
- Remove the battery and store it and the device separately if they are not to be used for an extended period of time.

8.2.2 Charging adaptor and cradle storage

- Do not allow foreign substances near the charge cradle terminal. Wipe it gently with a cotton swab or soft cloth before use/storage.
- Don't allow the battery pack charger to contact metallic substances (coins, keys, clips, etc).
- Do not use any batteries other than those designed for use with the charger provided.

8.3 Product transportation, storage conditions, and conditions of use

8.3.1 Transportation and storage conditions

- Temperature: 0 ~ 40 °C
- Relative humidity: 30 ~ 75 %
- Atmospheric pressure: 700 ~ 1060 Hpa

8.3.2 Optimal conditions of use

1. Temperature: 10 ~ 30 °C
2. Relative humidity: 30 ~ 60 %
3. Atmospheric pressure: 900 ~ 1060 Hpa

8.4 Items to check

8.4.1 Frequent inspection items

- When turning powering on the product, confirm that the power-on sound is heard and that the normal initial screen is displayed.
- Exposure-time settings are changed by using the time setting buttons. Confirm that the time may be changed normally.
- During X-ray exposure, confirm that the tone is heard, and that the exposure indicating light turns to yellow.
- While charging the battery pack, check the charge indicating light on the cradle to confirm normal operation.

8.4.2 Periodic inspection items

- Confirm that the fully charged battery lifetime is sufficient. Purchase a new battery pack if the lifetime is half that of original lifetime.



CHECK

The battery pack is a consumable item, and the lifetime is gradually reduced as it is used. If the lifetime is shortened to less than half of what it was when it was first used, purchase a new batter pack.

9 Inspection items before repair request

9.1 Check items before requesting inspection

If an abnormality is found with the product, confirm the following items before requesting inspection.

	Symptom	Steps to take
Power defect	After powering on, tone is not heard and LCD screen does not display.	<ul style="list-style-type: none"> ● Confirm that the battery is inserted correctly or replace it with a charged battery. ● Separate the battery from the product to prevent discharge while not in use.
	After powering on, the tone is heard but the LCD screen does not display.	<ul style="list-style-type: none"> ● After checking the remaining battery life, replace it with a charged battery. If the screen is still not displayed, contact designated A/S center.
	While using (including X-ray exposure), the power turns off automatically.	<ul style="list-style-type: none"> ● Check the remaining battery life. ● Check the fully charged battery lifetime. If the lifetime is less than half that of the original lifetime, replace the battery with a new battery pack. ● The product has an automatic shutoff function to reduce battery consumption; check its setting.
Exposure defect	When X-rays are emitted, but exposure tone is not heard.	<ul style="list-style-type: none"> ● Check if 'Remote' mode is selected at Function Setup menu. Exposure button operates in 'Dual' mode only. ● Check that the LCD display shows main control screen status. X-rays are emitted with main control display only.

Symptom	Steps to take
<p>Low battery sign is displayed on the LCD screen</p>	<ul style="list-style-type: none"> ● Check remaining battery life, and replace it with a charged battery pack, if needed. ● Check the battery connection and be certain that the battery pack cover is closed.
<p>Battery won't charge</p>	<ul style="list-style-type: none"> ● Check the charge indicating light on the battery charger and cradle. The plug socket of adapter and connector must be completely connected to charge the battery. ● If the charge indicating light on the battery charging cradle is red while charging, the battery is still charging, and is done when the light is green. In case the indicating light is yellow (indicating an error), try to connect the battery and charger again. ● Confirm the battery charging cradle and battery pack are connected accurately.

Others

9.2 Troubleshooting

Problem	Cause	Solution
Nothing lights up	No battery pack.	Insert battery pack.
	Low battery.	Charge the battery.
No X-ray emission	Generator is preparing an exposure. Displays "WAIT".	Wait for X-ray exposure to be ready (about 10 seconds).
	"Remote" mode.	Connect the wired remote control or change "Expkey Set" to "Dual" on the function setting screen.
	Button defective.	Call a qualified service technician.
X-ray emission works, but exposure is too light or completely white	Receptor defective.	Change the receptor or compare with another receptor.
	Exposure is positioned incorrectly.	Adjust the position of the exposure.
	Exposure time is too short	Increase the exposure time
	Device defective.	Call a qualified service technician.
X-ray emission works, but exposure is too dark	Receptor defective.	Change the receptor or compare with another receptor.
	Exposure time is too long	Decrease the exposure time
	Device defective.	Call a qualified service technician.

10 Product Specification and Quality Assurance

10.1 Product Specification

Classification	Details
Product name	Portable X-ray System
Input power	Use the internal power supply (Battery)
B-type application	Cone
Waterproof rating	IPX0 (General Equipment)
Mode of operation	Continuous operation
Tube voltage	60 kV (Fixed)
Tube current	2.0 mA (Fixed)
Focal spot size	0.8 mm
Power consumption	285 VA (max.)
Input voltage	DC 15V
Battery Pack	Lithium-polymer 4 Cell 1050 mAh Large Capacity
Cooling method	Oil Cooled
Total Filtration	More than 1.5 mmAl (Inherent Filtration: 0.8 mmAl, Fixed added filter: 0.7 mmAl)
Target angle	20°
Time setting	0.02 ~ 2.5[sec] (minimum unit 0.01sec)
Distance to target	Distance between target and Focal Spot > 20 cm (8 inch) 60
X-ray field	mm Round
Size of main body	240(L) x 166(W) x 82(H) mm ³
Weight of body	2.2 kg (excluding battery)

10.2 Quality assurance

Product Quality Assurance Certificate

Medical device name	Portable X-ray System	Type name	DX-3000
Manufacturing number		Manufacture date	
Customer name		Contact information	
Customer Address			
Place of purchase		Warranty Period	1 year after purchase
E-mail		Purchase date	

1. This product is manufactured under a strict quality assurance standard and inspection process.
2. If breakdown occurs during the warranty period under normal usage, free repair services will be provided.
3. If breakdowns are due to incorrect usage or negligence, there will be charges for repair services even if this occurs within the warranty period.
4. If you have questions or product related inquiries, please contact Dexcowin Co., Ltd., customer service center.

For better management of quality and customer service, fill out all of the above, and fax or email our company.

Phone +82-02-2027-2880 Fax +82-02-2027-2884

Address: 606-ho, 2, Gasan digital 1-ro(Woorim Lions Vally 2), Geumcheon-gu, Seoul, Korea



11 DX-3000 Technical Document

11.1 High voltage generator

11.1.1 X-ray Tube : D-081B

1. Manufacturer: TOSHIBA(Japan)

2. Electrical Characteristics

- Operating Tube Voltage60 kV
- Focal Spot0.8 mm
- Input Power (at 1.0s)600 W

3. Mechanical Characteristics

- Dimensions

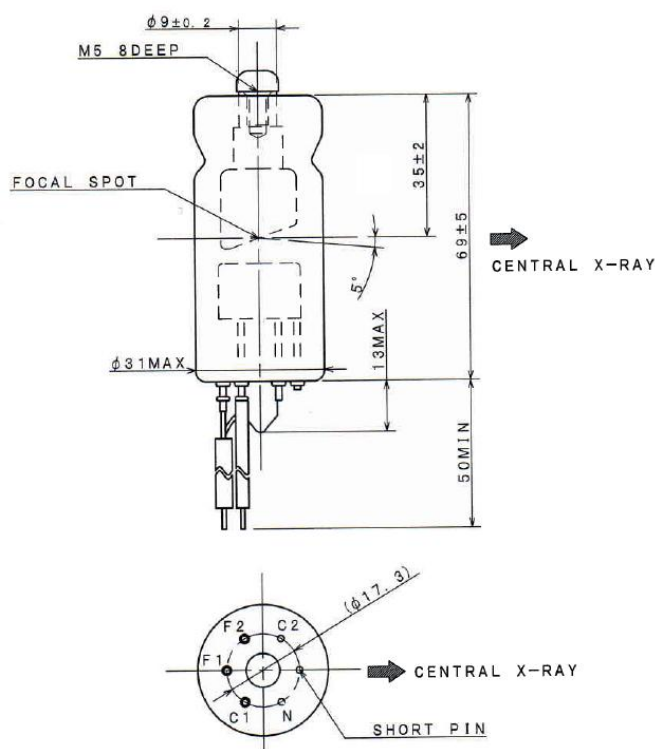


Figure 11.1 Dimension of the X-ray tube

- Target angle20 Degrees
- Target materialTungsten
- Inherent FiltrationAt least 0.8 mmAl equivalent at 50kV
- Anode Thermal Characteristics

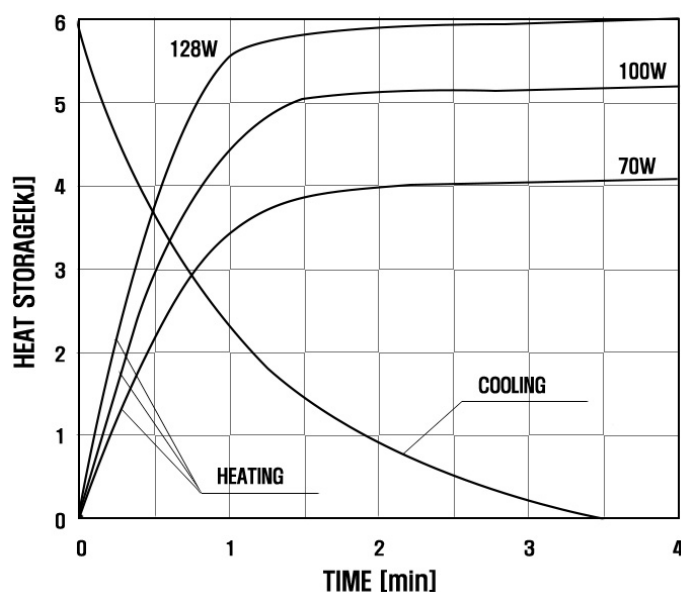


Figure 11.2 Anode Heating/Cooling curve

4. Absolute Maximum and Minimum Ratings

- Maximum Tube Voltage 65 kV
- Maximum Inverse Tube Voltage..... 75 kV
- Minimum Tube Voltage 50 kV
- Maximum Tube Current 19 mA
- Filament Voltage..... 2.9 ~ 4.0 V
- Maximum Filament Current 2.0 A
- Maximum Exposure Time 10 sec

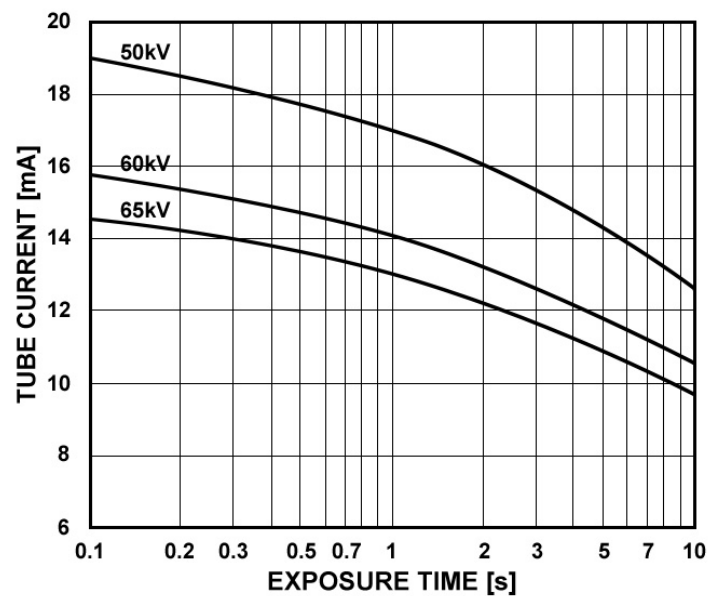


Figure 11.3 Maximum tube current curve by exposure time

11.2 Electromagnetic compatibility

The DX-3000 has been tested and found to comply with the limits for medical devices in IEC/EN 60601-1-2. These limits are designed to provide reasonable protection against harmful interference in a typical medical installation. This equipment generates, uses and can radiate radiofrequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference with other devices in the vicinity. However, there is no guarantee that interference will not occur in a particular installation. If the equipment does cause harmful interference with other devices, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures.

- Reorient or relocate the receiving device.
- Increase the separation distance between the equipment.
- Consult the manufacturer or field service technician for help.

11.3 Radiation Protection

The DX-3000 is compliant with the regulatory limits on radiation safety and protection as defined in IEC60601-1-3, IEC60601-2-28, and IEC60601-2-65.

- The device operator must protect him/herself with a lead apron or separating wall.
- The patient must be provided protective materials such as a lead apron and thyroid collar during exposure .
- The device must only be operated inside the X-ray protecting facility.
- The operator must monitor the status of the patient in case of an emergency.
- The operator should immediately stop operating the device if any problem occurs.
- Pregnant women and the parents of children must be made aware of their increased risks of X-ray exposure.