DENTAL X-RAYModel 505 INSTALLATION INSTRUCTIONS (for USA)

Wall Mount Type.....WK

This x-ray equipment may be dangerous to patient and operator unless safe exposure factors, operating instructions and maintenance schedules are observed.

This manual provides information and instructions for the installation, assembly, calibration and certification procedures for **the BELMONT PHOT-XIIs Model 505** dental x-ray.

The instructions contained in this book should be thoroughly read and understood by dealer service personal before attempting to install the X-ray unit. After installation is completed, owners should file this manual and refer back to it to schedule periodic maintenance.

If this manual is lost or cannot be read by a damage, order the manual by the book number written on the last page.



INDEX

SECTION 1 : TECHINICAL DATA	
[1] ELECTRICAL AND RADIATION DATA	2
[2] PHYSICAL DIMENSIONS	3
[3] TUBE HEAD THERMAL CHARACTERISTICS	4
SECTION 2 : PRE-INSTALLATION INSTRUCTIONS	
[1] SUPPORT REQUIREMENTS	5
[2] ELECTRICAL REQUIREMENTS	5
[3] LOCATION OF COMPONENTS	6
SECTION 3 : INSTALLATION INSTRUCTIONS	
[1] INSTALLATION REQUIREMENTS	7
[2] UNPACKING	7
[3] MAIN CONTROLLER AND ARM INSTALLATION	8
[4] HEAD ASSEMBLY INSTALLATION	12
[5] SUB CONTROLLER INSTALLATION	14
[6] HAND EXPOSURE SWITCH (OPTION)	15
[7] EXTERNAL INTERLOCKS (NOT SUPPLIED)	15
SECTION 4 : POST INSTALLATION CONFIRMATION AND SETTING	
[1] ARM ASSEMBLY	16
[2] BALANCE ARM TENSION ADJUSTMENT	16
[3] HEAD POSITIONING	16
[4] CONFIRMATION OF POWER SUPPLY VOLTAGE	17
[5] INITIAL SETTING AND CONFIRMATION AFTER POWER ON	17
SECTION 5 : CONTROL IDENTIFICATION AND OPERATION	
[1] MAJOR COMPONENTS AND CONTROL IDENTIFICATION	20
[2] FUNCTION OF CONTROLS	21
[3] OPERATING PROCEDURES	25
[4] OPTIONAL HAND EXPOSURE SWITCH	25
[5] SETTING MODE	26
[6] ERROR CODE	28
[7] MAINTENANCE	29
[8] DISPOSAL	29
APPENDIX 1 : CIRCUIT DIAGRAM	30
APPENDIX 2 : MAINTENANCE CHECK LIST	31
APPENDIX 3 : PARTS IDENTIFICATION	-
[1] ARM AND HEAD ASSEMBLY	32
[2] CONTROLLER ASSEMBLY	33
APPENDIX 4 : CERTIFICATION	34

SECTION 1: TECHNICAL DATA

[1] ELECTRICAL AND RADIATION DATA

1. X-ray tube (Stationary Anode)	- D-046 or KL11-0.4-70 (See the label on head)
a. Nominal focal spot value	- 0.4 (IEC60366)
b. Target Material	- Tungsten
c. Target angle	- 12.5 deg (D-046), 12 deg (KL11-0.4-70)
d. Maximum anode heat content	- 4.3 kJ (6.1 kHU)
2. Maximum x-ray tube assembly heat content	- 293 kJ (413 kHU)
3. Rated peak tube potential	- 60 kV / 70 kV selectable
4. Rated tube current	- 3 mA / 6 mA selectable
5. Maximum rated peak tube potential	- 70 kV
6. Rated line voltage	- 120 VAC, 60 Hz, Single phase, 1.2 kVA
7. Line voltage range	- 108 VAC ~ 132 VAC
8. Range of line voltage regulation	$-0 \sim 5\%$ (Apparent resistance 0.52 ohm)
9. Rated line current	- 10 A at 70 kV, 6 mA
10. Maximum line current	- 11 A at 70 kV, 6 mA
11. Exposure time	$-0.01 \sim 2.0$ sec.
12. Inherent filtration	- 1.7 mm Al Equivalent
13 Added filtration	- 0.3 mm Al
14 Minimum filtration permanently in useful beam	- 2 0 mm Al Equivalent at 70 kV
15 Nominal radiation output	60 kV 70 kV
	3 mA 6 mA 3 mA 6 mA
a. Distal end of regular cone	- 4.6 9.1 5.9 11.8 mGy/sec. $\pm 40\%$
b. Distal end of long cone	- 2.0 4.1 2.6 5.2 mGy/sec. $\pm 40\%$
(Data obtained by direct measurement in the useful	ul beam)
16. Nominal electrical output of H.V. generator	- 0.42 kW at 70 kV, 6 mA
17. Cone	Source to skin distance Field size
a. Regular cone	- 8 inches (203 mm) 58 mm dia., circular
b. Long cone (option)	- 12 inches (305 mm) 58 mm dia circular
c. Rectangular collimator (option)	- SSD of cone + 40mm 32×40 mm, rectangular
10 Marine and the state of the field	60 mm dia at distal and of cono
18. Maximum symmetrical radiation field	\cdot ov mm uta, at uistat chu of conc
19. Leaking technique factor	$\sim 70 \text{ kV} / 0.19 \text{ mA} (697 \text{ mAs at 1 hour})$
 18. Maximum symmetrical radiation field 19. Leaking technique factor (0 19 mA is maximum rated continuous current for 	\sim 70 kV / 0.19 mA (697mAs at 1 hour) 6mA with a duty cycle 1.30)
 18. Maximum symmetrical radiation field 19. Leaking technique factor (0.19 mA is maximum rated continuous current for 20. Duty cycle 	$\sim 70 \text{ kV} / 0.19 \text{ mA} (697 \text{ mAs at 1 hour})$ 6mA with a duty cycle 1:30) $\sim 1 : 30 (0.5 \text{ sec. exposure with 15 sec. interval})$
 18. Maximum symmetrical radiation field 19. Leaking technique factor (0.19 mA is maximum rated continuous current for 20. Duty cycle 21. Maximum deviation of tube potential, tube current and 	 For this data at distal end of cone 70 kV / 0.19 mA (697mAs at 1 hour) 6mA with a duty cycle 1:30) 1 : 30 (0.5 sec. exposure with 15 sec. interval) and exposure time
 Maximum symmetrical radiation field Leaking technique factor	$\sim 70 \text{ kV} / 0.19 \text{ mA} (697 \text{mAs at 1 hour})$ $\sim 6\text{mA}$ with a duty cycle 1:30) $\sim 1 : 30 (0.5 \text{ sec. exposure with 15 sec. interval})$ and exposure time $\sim \pm 10 \text{ kV}, \pm 2 \text{ mA}, \pm 5 \text{ msec.}$
 Maximum symmetrical radiation field Leaking technique factor	$\sim 70 \text{ kV} / 0.19 \text{ mA} (697 \text{ mAs at 1 hour})$ 6mA with a duty cycle 1:30) $\sim 1 : 30 (0.5 \text{ sec. exposure with 15 sec. interval})$ and exposure time $\sim \pm 10 \text{ kV}, \pm 2 \text{ mA}, \pm 5 \text{ msec.}$ $\sim \pm 5 \text{ kV}, \pm 1 \text{ mA}, \pm 10 \text{ msec.}$
 Maximum symmetrical radiation field Leaking technique factor	$\sim 70 \text{ kV} / 0.19 \text{ mA} (697\text{mAs at 1 hour})$ 6mA with a duty cycle 1:30) $\sim 1 : 30 (0.5 \text{ sec. exposure with 15 sec. interval})$ and exposure time $\sim \pm 10 \text{ kV}, \pm 2 \text{ mA}, \pm 5 \text{ msec.}$ $\sim \pm 5 \text{ kV}, \pm 1 \text{ mA}, \pm 10 \text{ msec.}$
 Maximum symmetrical radiation field Leaking technique factor (0.19 mA is maximum rated continuous current for 20. Duty cycle 21. Maximum deviation of tube potential, tube current a a. Below 0.1 sec. setting b. 0.1 sec. setting & up 22. Measurement base of technique factors a. peak tube potential 	• 70 kV / 0.19 mA (697mAs at 1 hour) 6mA with a duty cycle 1:30) • 1 : 30 (0.5 sec. exposure with 15 sec. interval) and exposure time • ± 10 kV, ± 2 mA, ± 5 msec. • ± 5 kV, ± 1 mA, ± 10 msec. • Average of peak tube potentials during
 Maximum symmetrical radiation field	 of him dia. at distal end of cone 70 kV / 0.19 mA (697mAs at 1 hour) 6mA with a duty cycle 1:30) 1 : 30 (0.5 sec. exposure with 15 sec. interval) and exposure time ±10 kV, ±2 mA, ±5 msec. ±5 kV, ±1 mA, ±10 msec. Average of peak tube potentials during one exposure
 18. Maximum symmetrical radiation field 19. Leaking technique factor 19. Leaking technique factor	 of him dia. at distal end of cone 70 kV / 0.19 mA (697mAs at 1 hour) 6mA with a duty cycle 1:30) 1 : 30 (0.5 sec. exposure with 15 sec. interval) and exposure time ±10 kV, ±2 mA, ±5 msec. ±5 kV, ±1 mA, ±10 msec. Average of peak tube potentials during one exposure Average of tube current during one exposure
 Maximum symmetrical radiation field	 of him dia. at distal end of cone 70 kV / 0.19 mA (697mAs at 1 hour) 6mA with a duty cycle 1:30) 1 : 30 (0.5 sec. exposure with 15 sec. interval) and exposure time ±10 kV, ±2 mA, ±5 msec. ±5 kV, ±1 mA, ±10 msec. Average of peak tube potentials during one exposure Average of tube current during one exposure Time period during x-ray is emitted
 18. Maximum symmetrical radiation field	 of him dia. at distal end of cone 70 kV / 0.19 mA (697mAs at 1 hour) 6mA with a duty cycle 1:30) 1 : 30 (0.5 sec. exposure with 15 sec. interval) and exposure time ±10 kV, ±2 mA, ±5 msec. ±5 kV, ±1 mA, ±10 msec. Average of peak tube potentials during one exposure Average of tube current during one exposure Time period during x-ray is emitted 1.5 mm Al over
 Maximum symmetrical radiation field	 of him dia. at distal end of cone 70 kV / 0.19 mA (697mAs at 1 hour) 6mA with a duty cycle 1:30) 1 : 30 (0.5 sec. exposure with 15 sec. interval) and exposure time ±10 kV, ±2 mA, ±5 msec. ±5 kV, ±1 mA, ±10 msec. Average of peak tube potentials during one exposure Average of tube current during one exposure Time period during x-ray is emitted 1.5 mm Al over 94 mm
 Maximum symmetrical radiation field	 You him that at distal end of cone You kV / 0.19 mA (697mAs at 1 hour) 6mA with a duty cycle 1:30) Yum 1: 30 (0.5 sec. exposure with 15 sec. interval) and exposure time ±10 kV, ±2 mA, ±5 msec. ±5 kV, ±1 mA, ±10 msec. Average of peak tube potentials during one exposure Average of tube current during one exposure Time period during x-ray is emitted Yum 1.5 mm Al over 94 mm -20 ~ 70 °C, 10 ~ 100 %, 500 ~ 1060 hPa
 Maximum symmetrical radiation field	 You him that at distal end of cone You kV / 0.19 mA (697mAs at 1 hour) 6mA with a duty cycle 1:30) Yumma 1:30 (0.5 sec. exposure with 15 sec. interval) and exposure time ±10 kV, ±2 mA, ±5 msec. ±5 kV, ±1 mA, ±10 msec. Average of peak tube potentials during one exposure Average of tube current during one exposure Time period during x-ray is emitted 1.5 mm Al over 94 mm -20 ~ 70 °C, 10 ~ 100 %, 500 ~ 1060 hPa 10 ~ 40 °C, 30 ~ 70 %, 700 ~ 1060 hPa
 18. Maximum symmetrical radiation field	 You him that at distal end of cone You kV / 0.19 mA (697mAs at 1 hour) 6mA with a duty cycle 1:30) Yum 1: 30 (0.5 sec. exposure with 15 sec. interval) and exposure time ±10 kV, ±2 mA, ±5 msec. ±5 kV, ±1 mA, ±10 msec. Average of peak tube potentials during one exposure Average of tube current during one exposure Time period during x-ray is emitted 1.5 mm Al over 94 mm -20 ~ 70 °C, 10 ~ 100 %, 500 ~ 1060 hPa 10 ~ 40 °C, 30 ~ 70 %, 700 ~ 1060 hPa Estimated air kerma displayed [mGy]
 18. Maximum symmetrical radiation field	 You him that at distal end of cone You kV / 0.19 mA (697mAs at 1 hour) 6mA with a duty cycle 1:30) Yumma 1:30 (0.5 sec. exposure with 15 sec. interval) and exposure time ±10 kV, ±2 mA, ±5 msec. ±5 kV, ±1 mA, ±10 msec. Average of peak tube potentials during one exposure Average of tube current during one exposure Time period during x-ray is emitted Yumma 1:5 mm Al over 94 mm -20 ~ 70 °C, 10 ~ 100 %, 500 ~ 1060 hPa 10 ~ 40 °C, 30 ~ 70 %, 700 ~ 1060 hPa Estimated air kerma displayed [mGy] x 26.4 [cm²] (for regular and long cone)
 18. Maximum symmetrical radiation field	 of him dia. at distal end of cone 70 kV / 0.19 mA (697mAs at 1 hour) 6mA with a duty cycle 1:30) 1 : 30 (0.5 sec. exposure with 15 sec. interval) and exposure time ±10 kV, ±2 mA, ±5 msec. ±5 kV, ±1 mA, ±10 msec. Average of peak tube potentials during one exposure Average of tube current during one exposure Time period during x-ray is emitted 1.5 mm Al over 94 mm -20 ~ 70 °C, 10 ~ 100 %, 500 ~ 1060 hPa 10 ~ 40 °C, 30 ~ 70 %, 700 ~ 1060 hPa Estimated air kerma displayed [mGy] x 26.4 [cm²] (for regular and long cone) Estimated air kerma displayed [mGy]

[2] PHYSICAL DIMENSIONS



[3] TUBE HEAD THERMAL CHARACTERISTICS

A. Interval between each exposure

The temperature inside of the tube head rises when an exposure is made. The value of the heat generated is measured in Heat Units (HU), which is the product of tube potential, tube current and exposure time. Excessive heat will accumulate inside of the tube head if the x-ray is used without a proper cool down interval between each exposure. The excessive heat may damage the x-ray tube, high voltage generator or both.

B. Duty cycle

A cool down interval of 30 seconds or more must be allowed between each 1 second exposure. (a 15 second cool down must be allowed between each 0.5 second exposure.) This will avoid the accumulation of excess heat and prolong the tube head life.

C. Tube head cooling curve



1. Tube Hosung cooling curve

4500 50W (D-046) 4000 55W (KL11-0.4-70) 3500 **5** 3000 Heat Storage 100W (D-046) 2500 110W (KL11-0.4-70) 2000 1500 COOL DOWN 1000 500 HEAT UP 0 0 50 100 150 200 250 300 Time in Seconds

2. Anode thermal characteristics



3. Maximum rating chart

SECTION 2 : PRE-INSTALLATION INSTRUCTIONS

[1] SUPPORT REQUIREMENTS

Main Controller :

The main controller of Model 505 has wall plate disigned for mounting on 2 x 4 wood studs with 16 inches (406mm) centers. The wall and mounting hardware must be sufficient to withstand a **100 pound (45kg) shear load** and a **450 pound (205kg) withdrawal force** at each of the four (ø 9 x 75 mm) lag screws.

Sub Controller :

When mounting the sub controller, the wall and mounting hardware must be sufficient to withstand a **10 pound (4.5kg) shear load.**

If the PHOT-X IIs Model 505 is to be mounted in a manner other than what is specified in this manual or if the hardware to be used is other than waht is supplied, the support capability of the wall and the strength of the hardware must be checked and verified to be adequate.

[2] ELECTRICAL REQUIREMENTS

Power supply :

The Model 505 x-ray system will operate on a power supply of $120VAC \pm 10\%$ ($108 \sim 132VAC$) with a 3 wire GROUNDED circuit, separetely connected to the central distribution panel with an over current protection device rated for 15 ampares. Recommended wire size is 14 AWG; but if the wire run distance is to exceed 50 feet (15m), 12 AWG is required. For wire run distances in excess of 75 feet (23m) 10 AWG is required. Line voltage regulation must be within $0 \sim 5\%$ at 11 amps.

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

Interconnecting wiring between main controller and sub controller :

4 conductors, 20 AWG, 300V, 33 feet (10m) cable is included.

Concealed wiring :

Route conduit and wires through wall and into (2) flush mounted junction boxes located (1) behind the main controller and (1) behind the sub controller. Recommended heights above the finished floor for the flush junction boxes are : 44-7/8 inches (1140mm) for the main controller and 51-5/8 inches (1310mm) for the sub controller. Wiring done in this manner should extend 12 inches (300mm) beyound the wall surface to allow sufficient wire for connections.





Note : Follow local and national electrical code (NFPA 70) requirements during in stallation.



Fig.2-1 Main Controller



Fig.2-2 Sub Controller

[3] LOCATION OF COMPONENTS

A. Main Controller, Arm and Head Assemblies :

Using the information Provided in **Fig.2-4**, determine the correct location for the main controller.

The PHOT-XIIs Model 505 x-ray unit should be installed on the wall that prevents the horizontal arm rotate 360°.

NOTE : State and local requirements supersede guide lines indicated below.



Fig.2-4 Radius of Activity for X-ray Head

B. Sub controller

When determining the location for the sub controller, the following radiation requirements concerning the operator's positioning must be considered.

The operater must :

- 1. have full view of the patient.
- 2. have means for audio and visual communication with the patient.
- 3. have full view of kV, mA, timer selections and exposure warning light.
- 4. be at least 2 m away from the x-ray head and patient and out of the path of the x-ray beam or be positioned behind a protective device.

SECTION 3 : INSTALLATION INSTRUCTIONS

Within the installation and confirmation procedures are inspection/test steps which the installer must perform to insure that the installation meets the manufacturer's specifications. These steps require the installer to record the necessary information onto the "ASSEMBLER'S INSTALLATION REPORT " section of the limited warranty report from supplied, which **MUST** be returned to BELMONT along with the warranty card.

[1] INSTALLATION REQUIREMENTS

Tools :

Standard tool kit including 1.5 mm, 2 mm, 3 mm and 5 mm allen keys.

Instruments :

• Digital multimeter with an accuracy of 1%, capable of measuring 150 V AC and 10 mA DC, and capable of indicating true RMS value within 1 sec.

· tandard calculator.

Power Supply :

Prior to starting the installation, inspect the power supply and confirm that it is $120VAC \pm 10\%$, and a 3 wire GROUNDED circuit, separately connected to the circuit breaker panel with an over current protection device rated for 15 A (Refer to Page 5, [2] ELECTRICAL REQUIREMENTS). **Record the voltage reading of power supply on "Assembler's Installation Report"**.

[2] UNPACKING

Unpack the entire contents of the shipping carton. Included within the shipping carton are :

Hardware	Quantity
Head with Regular Cone	1
Main Controller	1
Screw for chassis (M4 x 10 mm)	4
Screw for chassis (M4 x 20 mm)	1
Stopper Ring	1
Front cover seal	4
Wall Plate	1
Lag Screws for wall plate (Ø 9 x 75 mm)	4
Arm Mounting Bracket	1
Machine Bolt (M8 x 20 mm)	3
Washer (M8)	3
Sub Controller	1
Sub Controller Mounting wood screw (& 4.1 x 20 mm)	3
Head key	1
Arm collar	1
Balance Arm	1
Balance Arm Wrench	1
Horizontal Arm W/2 x End Caps	1
Brake Screw (M6 x 6 mm)	2
Brake Plug (Brass Plug & 5 x 4 mm)	2
Retaining Bolt (M6 x 35 mm)	2
Stopper Screw (M6 x 15 mm)	1
Brake Spring (o 5 x 11mm)	1
Hook for side cover	4
Screw for hook (M4 x 6mm)	8
Interconnecting wires (10m)	1
Sensor holder assembly	1

Documentation

Quantity

Installation manual 1	-
Operators manual 1	
Limited Warranty / Report Form 1	
Wall mounting Template 1	
FDA Form 2579 1	

Inspect contents of shipping carton for damage or missing components.

[3] MAIN CONTROLLER AND ARM INSTALLATION

The instructions given below are for mounting the main controller assembly on two 2 x 4 wood studs with 16 inch (406mm) centers. Should the PHOT-XIIs Modle 505 be mounted in a manner other than what is specified here, the wall and the strength of the hardware used must be checkedand verified as being adequate to withstand a 100 pound (45kg) shear load and a 450 pound (205kg) withdrawal force at each of the four (\emptyset 9 x 75mm) lag screws. When using concealed wiring, a flush mounted junction box with the necessary conduit and wiring must be pre-installed at 44-7/8 inches (1140mm) from the floor and between the two studs (refer to wall mounting template).

A. WALL PLATE OF MAIN CONTROLLER

Make sure the power supply is turned OFF at the circuit breaker panel.

- 1. Tape the wall mounting template to the wall, positioning it so that the holes for mounting plate lag screws are aligned with the vertical 2 x 4" studs.
 - **NOTE :** Confirm that the location of concealed wiring matches to the access hole of wall plate template.
- 2. Mark the hole locations for the mounting plate lag screws.
- 3. Use a 3/16" (5mm) dia. drill to make a pilot hole approximately 2" (50mm) deep for each mounting plate lag screws.



Installation

C. CHASSIS OF MAIN CONTROLLER

- 1.Remove the restriction plate over the terminal blocks by taking out two (M 4 x 8mm) screws. (Fig.3-3)
- 2.Route electrical interconnecting wires and power supply wires through the access holes on chassis and mount the chassis on the arm bracket with three of four (M4 x 8mm) screws. (A screw at lower right corner should be secured with a green wire from arm at setp D 6. on page 10.) Secure the bottom corner of chassis with two (M4 x 8mm) screws to the wall plate. (Fig.3-3)
- 3.Cut the wires to workable length and strip 3/8" of insulation for power supply wires and 3/16" for interconnecting wires for Sub Controller. Connect power supply wires to **3P** terminal block and interconnecting wires to 4P terminal block. (Fig.3-4)
- 4. Reattach the restriction plate. (Fig.3-3)



Fig.3-3 Attaching Chassis to Wall Plate



Fig.3-4 Wires Connection in Main Contoller







D. HORIZONTAL ARM

- 1.Place a thrust washer over the hole on top of the arm mounting bracket. (Fig.3-5) Insert the cable of horizontal arm into the hole, and mount to the arm mounting bracket, as shown in Fig.3-5.
- 2.Insert two retaining bolts into the upper threaded holes of the arm mounting bracket and tighten securely with a Allen wrench. (Fig.3-6)

IMPORTANT:

The retaining bolts must be installed to ensure that the horizontal arm can not lift out of the arm mounting bracket.

3.Insert brake plug, brake spring and brake screw $(M6 \times 6 \text{ mm})$ into the threaded hole of the hex fitting located on the arm mounting bracket. **DO NOT FULLY TIGHTEN.(Fig.3-6)**

4P

Block

4.Place a level on the horizontal arm and confirm that the arm is level throughout its left and right swing positions. (Fig.3-7)

NOTE : Final leveling of horizontal arm is described on Page 16.

- 5.Connect 2P and 8P connectors of horizontal arm cable to the respective connectors on power PC Board. (Fig.3-8)
- 6. Secure the green wire of arm cable by a lower right corner screw of four screws securing chassis to the arm bracket.





Fig.3-7 Level confirmation

E. FRONT COVER

Fig.3-8 Connecting 2P and 8P Connectors on Power PC Board

- **NOTE :** The front cover for the main controller should not be closed until all installation and the post-installation inspections and confirmation are completed.
- 1. Set the pins located on the bottom of the front cover into holes on the bottom of metal chassis, and then push the top side toward the wall to close. (Fig.3-9A)
- 2.Install two (M3 x 8mm) screws into the top of the cover and confirm that the cover is securely attached. (Fig.3-9B)



Fig.3-9A Attaching Front Cover-1

F. SIDE COVER

- 1. After the front cover of the main controller is installed, attach four hooks to the wall plate with (M4 x 6mm) screws supplied.
- 2. Slide in the side cover from right and left side of the wall plate as the hooks catch the side covers. (Fig.3-10)



Front Cover Fig.3-9B Attaching Front Cover-2



Fig.3-10 Side Cover Installation

G. BALANCE ARM ASSEMBLY

AWARNING

Do not release Arm holding band until the X-ray head has been installed.

Balance arm assembly is spring loaded and can cause equipment damage and injury if not handled in the proper manner.

- 1. During this procedure, do not remove Arm holding band.
- 2. Remove two (M3 x 8mm) screws from the underside of the horizontal arm to open the bottom cover. (Fig.3-11)
- Route the cable with 2P and 8P connectors from the balance arm shaft through the horizontal arm. Insert the balance arm into the horizontal arm. The cable should be fed through the bottom cover opening on the bottom of the horizontal arm. (Fig.3-12)
- 4. Secure 2 wires (Grounded wires) together with the (M5 x 10mm) screw on the bottom cover. (Fig.3-13A)
 - Note : Two ring terminals should not protrude from a chassis plate. (Fig.3-13A)



Fig.3-13A Attaching Grounded Wires on Bottom Cover







Fig.3-12 Balance Arm Installation

- 5. Secure the wires from the balance arm to the bottom cover with the nylon cable clamp to prevent damage from twisting. (Fig.3-13B) Then connect the 2P and 8P connectors. (Fig.3-13C)
- 6. Re-attach the bottom cover to the horizontal arm with two screws. (Fig.3-12)



Fig.3-13B Attaching Balance Arm Cable on Bottom Cover



8P Connector Fig.3-13C Connection of Connectors on Bottom Cover

7. Attach a sensor holder to a bottom cover of the horizontal arm with 2 countersunk screws (M4 x 5). (Fig.3-14A)

 Sensor holder can be mounted to left or right of horizontal arm. Set at convinient direction.
 Sensor holder is for holding a digital sensor. Do not use a sensor holder for other purpose.

- 8. Insert the brake plug and brake screw (M6 x 6mm) into the horizontal arm collar. (**Fig.3-14B**) Do not fully tighten.
- Remove the end cap from horizontal arm. Insert the stopper screw into upper threaded hole inside horizontal arm and tighten securely. Replace the end cap. (Fig.3-14B)

CAUTION

If stopper screw is not tightened securely, the Balance Arm can lift out of the horizontal arm.

[4] HEAD ASSEMBLY INSTALLATION

Do not release Arm holding band until the X-ray head has been installed. Balance arm assembly is spring loaded and can cause equipment damage and injury if not handled in the proper manner. Refer to the Caution Tag on the band.

- 1. Remove the arm collar screw (M4 x 8mm) from the arm collar. Slide the arm collar upward and temporarily hold it in position with adhesive tape. (**Fig.3-15**)
- Open the yoke inside cover of x-ray head by removing (M4 x15mm) cover screw. (Fig.3-16)



Fig.3-16 Removing Yoke Inside Cover

- 3. Making sure the stopper ring is placed on the yoke, insert the wiring from the balance arm assembly through the head shaft and into the yoke. (**Fig.3-17**)
- 4. Insert the shaft of the balance arm into the head yoke, and while holding the head in position, insert the head key securely into the retaining groove. (Fig.3-17)
- 5. Remove adhesive tape and slide the arm collar downward. Fix it in place with the arm collar screw.Remove the UP-mark from the arm collar. (Fig.3-17)
- 6. Loosen the (M5 x 10mm) screw and remove the nylon cable clamp from the yoke housing. Place cable clamp on the balance arm cable. Connect the 10P connectors, and then attach the balance arm cable to the yoke housing with the nylon cable clamp. (Fig.3-18)
- 7. Reattach the yoke inside cover with the screw (M4 x 15mm). Before closing the cover, note the CP values on the CP values label inside of the yoke. (**Fig.3-16**)
- 8. Remove arm holding band.



Fig.3-17 X-ray Head Installation



Fig.3-18 Connection 10P Connector in Yoke

[5] SUB CONTROLLER INSTALLATION

The wall and the strength of the hardware used must be checked and verified as being adequate to withstand a 10 pound (4.5kg) shear load. A flush mounted junction box with the necessary conduit and wiring should be pre-installed at 51-5/8" (1310mm) from the floor.

- 1. Remove two (M3 x8mm) screws from the under side of the controller and open the front panel. (**Fig.3-19**)
- 2. Disconnect the 4P connector from the timer PC Board. (Fig.3-20)
- 3. Route the interconnecting wires from the main controller through access hole of chassis and mount on the wall with four (ø4.1 x 20mm) wood screws. (**Fig.3-20**)
- 4. Cut 4 interconnecting wires from main controller to a workable length. Strip 3/16" insulation off the wires and connect them to the 4P terminal block.Terminal number for each wire should be matched to the terminal number in the main controller. (Fig.3-21)





Miswiring causes permanent damage to both timer PC board and power PC board.

- 5. If wire length is too long, push it back into the access hole of the wall. This will prevent mechanical damage to the timer PC Board when replacing the front cover.
- 6. Reattach the 4P connector to the timer PC Board. (Fig.3-20)
- Set the pins located on the upper side of the front panel into holes on the top of chassis and attach the front cover to the chassis with two (M3 x 8mm) screws.
 (Fig.3-19 & Fig.3-22)



Screw (M3 x 8)





Fig.3-20 Attaching Sub Controller Chassis



Fig.3-21 Interconnecting Wires Connection in Sub Controller



Fig.3-22 Upper side of Sub Controller

[6] HAND EXPOSURE SWITCH (OPTION)

An optional hand exposure switch can be connected to the sub controller. Since this exposure switch has a coiled cord, operator can stand the most suitable position for operation.

The exposure switch on the front panel of sub controller and this hand exposure switch can be used. If local code prohibits use of both switches, disconnect the connector of either one of the switches.

1. Confirm the contents of optional hand exposure switch kit. (Fig.3-23)

Hand exposure switch ------ 1 Hook ------ 1 Screw for hook (ø3 x 8mm Tapping screw) ----- 1

- 2. Remove two (M3 x8mm) screws from the under side of the controller and open the front panel.
- 3. Connect the connector at the end of hand exposure switch coil cord to CN3 connector on the timer PC board. (Fig.3-24)
- 4. Insert the bushing of coil cord into the slot at the bottom of the chassis, reattach the front cover and secure two (M3 x 8mm) screws again. (Fig.3-24)
- 5. Place the hook on the top corner (right or left) of controller and attach it with the tapping screw (ø3 x 8mm). (**Fig.3-25**)

[7] EXTERNAL INTERLOCKS (NOT SUPPLIED)

If the external interlock for preventing from starting to emit x-radiation or to stop emitting x-radiation is used, the interlock switch should be inserted in #3 terminal of 4P terminal block either in the main controller or in the sub controller. If this interlock switch is opened, emittion will be stopped. It is recommended to indicate the state of this interlock switch. (Fig.3-26)





Hand Exposure Switch

Fig.3-23 Hand Exposure Switch Kit



Fig.3-24 Connecting Hand Exposure Switch



Wood Screw (ø3.1 x18)

Fig.3-25 Installation of Hook for Hand exposure Switch

SECTION 4 : POST INSTALLATION CONFIRMATION AND SETTING [1] ARM ASSEMBLY

1. Incorrect leveling of the wall plate and wall bracket can cause arm drift. First, check leveling with horizontal arm in position **#1**. (**Fig.4-1**) If not correct, bracket must be adjusted by placing shims behind the wall plate.

IMPORTANT :

If the end of the horizontal arm shown in position **#1** is pitched below level, then the tube head will drift away from the wall. If the end of the horizontal arm in position **#1** is pitched above level, then the arm will require only minimum adjustment of the brake screw. (**Fig.3-13**)

- 2. Check leveling in position **#2**. If not correct, adjust Horizontal Arm as follows : (**Fig.4-1**)
- a. Slightly loosen two top mounting bolts for arm mounting bracket.
- b. Shift the bracket left or right until the arms are accurately leveled.
- c. Move the horizontal arm to position **# 1**.
- d. Fully tighten two top mounting bolts.
- e. Fully tighten bottom mounting bolt.



Fig.4-1 Horizontal Arm Adjustment

Balance Arm Wrench

Loosen

Spring Adjuster

NOTE : Slight tendencies to drift can be corrected by tightening brake screw in horizontal arm. Do not tighten beyond what is required to prevent drift.

[2] BALANCE ARM TENSION ADJUSTMENT

- 1. Place the balance arm assembly into position.
- 2. If either balance arm drifts higher or lower from the set position, remove the spring adjuster cover and adjust the balance arm spring tension with the balance arm wrench supplied. (**Fig.4-2**)

[3] HEAD POSITIONING

- A. Place head into position.
- B. If head drifts from the set position, adjust the brake screws according to the following procedures. (**Fig.4-3**)
- 1. Loosen the yoke side cap screw (ø3 x 8mm tapping screw) and remove the yoke side cap.
- 2. Adjust the six brake screws using a screw driver.
- 3. After adjustment, reattach the yoke side cap and screw.

Fig.4-2 Balance Arm Tension Adjustment

TUC

Tighten

Cover

Balance Arm



Fig.4-3 Head Positioning

[4] CONFIRMATION OF POWER SUPPLY VOLTAGE

As specified in Electrical Requirements (page 5), power supply voltage must be within the operable range of $108 \sim 132$ VAC. Confirm the power supply voltage again before turning on the unit.

- 1. Open the front panel of main controller by loosening two screws on top of the controller.
- 2. Set the range of digital multimeter at 200 VAC, connect probes of multimeter to L and N of the 3P terminal block.

Do not touch the restriction plate (refer to Fig.3-3) with the probes of multimeter during measurement, or a short circuit occurs.

3. Confirm that the reading is $120V\pm10\%$ ($108 \sim 132$ VAC).

NOTE : The PHOT-XIIs Model 505 x-ray can not be operated unless the power supply voltage is within this range.

[5] INITIAL SETTING AND CONFIRMATION AFTER POWER ON

If power supply voltage is confirmed to be within the range, power can be ON. But before turning ON, please read SECTION 5 and understand the operation procedures.

When turning on the power switch at the first time after the factory shipment, a message asking for initial setup appears. If "YES" is selected, instructions for the following 2-1 to 2-7 will be displayed. If setup is finished according to the screen, this message will not appear again when the power switch is turned on later. If all setup is not finished or "NO" is selected, same massage will be displayed every time when the power switch is turned on until initial setup is completed.

5-1. CLOCK SETTING

For north america you can set the clock by selecting the area, if it is the first time to set after shipment. (When we ship the controller, clock is set at Japanese time. If you select the area, clock is changed according to the time difference between Japan and that selected area.)

For all earea including north america, you can set the clock by entering year, month, day, hour and minute manualy.

5-2. CONFIRMATION OF TUBE VOLTAGE COMPENSATION VALUE

Tube voltage is kept to be constant and same as the specified value by the feed-back control system. High voltage is converted into low voltage feed back signal by the voltage divider in the tube head. The precision of tube voltage depends on the accuracy of this voltage divider, although each divider has little deviation. To compensate this deviation, the compensation values for each tube head are defined and written on the label in the tube head yoke. Before making an exposure, check these values to be same as the values stored in the subcontroller.

- 1. Confirm the tube voltage compensation (CP) values for 60kV and for 70kV written on the label affixed inside of the head yoke.
- 2. Confirm the values on the LCD screen are same as the values on the label. If those are same, touch the store button. If different, adjust the values on LCD screen \bigotimes or \bigotimes button, and touch the store button.

5-3. CALIBRATION OF TUBE CURRENT (MA)

The PHOT-XIIs Model 505 x-ray incorporates self diagnose and adjusting system to check if the tube current are within specified ranges at the beginning of exposure.

- 1. Point the x-ray head away from all personnel.
- 2. Press the exposure switch according to the instructions on the LCD screen.

X-radiation is generated for 0.5 seconds.

- 3. By several exposures the adjustment value for tube current becomes optimum value.
- 4. If the adjustment is finished for 3mA and 6mA, OK will be appeared. Please touch OK button.

5-4. PRIORITY OF SELECTIONS AT POWER ON

Factory default settings are

kV selection: 60 kVmA selection: 6 mAImage receptor: Digital sensorPatient type: AdultCone type: Short cone (round)

If necessary, these settings can be changed. For example, in case of pedodontistry, patient type should be changed to Child. For the image receptor, as the sensitivity of each receptor is different, please set the sensitivity according to section 5 on page 22.

5-5. CONFIRMATION OF KV AND MA

- 1. Point the x-ray head away from all personnel.
- 2. Turn the main switch on and set the exposure time at 1 sec. and 60 kV, 3 mA.
- 3. Make an exposure and keep the exposure switch depressed continuosly after the exposure is over.

X-radiation is generated for 1 second.

- 4. Keeping the exposure switch depressed, press kV or mA selection switch. KV and MA measured values will be displayed on the LCD screen.
- 5. Confirm the values at steady portion are 60 ± 5 kV and 3 ± 1 mA.
- 6. Release the exposure switch and change the setting to 70 kV, 6 mA.
- 7. Make an exposure and keep the exposure switch depressed continuosly after the exposure is over.
- 8. Keeping the exposure switch depressed, press kV or mA selection switch. KV and MA measured value will be displayed on the LED screen.
- 9. Confirm the values at steady portion are 70 ± 5 kV and 6 ± 1 mA.

5-6. CONFIRMATION OF EXPOSURE WARNING LIGHT & BUZZER

A. EXPOSURE WARNING BUZZER

1. Make an exposure and confirm that the exposure warning sound is activated during the entire exposure.

B. EXPOSURE WARNING INDICATION

1. Make an exposure and confirm that the exposure warning indication appeares on LCD screen during the entire exposure.

5-7. CONFIRMATION OF LINE VOLTAGE REGULATION

- 1. Make sure that main power switch is "OFF".
- 2. Set the range of digital multimeter at 200 VAC, connect probes of multimeter to L and N of the 3P terminal block in the main controller.

Do not touch the restriction plate (refer to Fig.3-3) with the probes of multimeter during measurement, or a short circuit occurs.

- 3. Turn the main power switch on, and set the exposure time at 2.00 sec. with manual switch at 70kV, 6mA.
- 4. Record the no-load line voltage (VN) indicated by the multimeter before exposure.
- 5. Make an exposure and record the load voltage (VL) indicated by the multimeter during exposure.

WARNING X-Radiation is generated for 2 seconds.

- **NOTE :** Read the multimeter when the value is stabilized (about one second after exposure started).
- 6. Calculate line voltage regulation R(%) by the formula below

$$R = \frac{VN - VL}{VL} \times 100$$

NOTE : Line voltage regulation must not exceed the range of $0 \sim 5$ %. If it is greater than 5%, the size of the power supply wires must be increased. Refer to the power supply requirements outlined on page 5 to determine the correct wire size necessary. If line voltage regulation is within the range, apparent resistance of supply line can be considered to be less than 0.5 OHM.

SECTION 5 : CONTROL IDENTIFICATION AND OPERATION [1] MAJOR COMPONENTS AND CONTROL IDENTIFICATION



- (2) Ready Indication
- (3) Exposure Time Adjustment Switch (Down)
- (4) Exposure Time Adjustment Switch (Up)
- (5) Tooth Selection Switch (Maxilla)
- (6) Tooth Selection Switch (Mandible)
- (7) Tooth Selection Switch (Bitewing)
- (8) Tooth Selection Switch (Bitewing Molars)
- (9) Tooth Selection Switch (Occlusal)
- (10) Cone Type Selection Switch

- (13) kV Selection Switch
- (14) mA Selection Switch
- (15) Patient Size Selection Switch
- (16) Exposure Time Display Window
- (17) Exposure Warning Indication
- (18) Exposure Switch
- (19) Radiation Dose Indication
- (20) Setting Mode Switch



[2] FUNCTION OF CONTROLS

(1) Main Power Switch

Pushing the upper side of this switch to the ON position energizes the x-ray unit.

(2) Ready Indication

This indication becomes green when the exposure time is set and the line voltage is within operable range ($108 \sim 132$ Vac). When this indication is white, exposure cannot be made.

3(4) Exposure Time Adjusting Switches

By momentarily touching the \bigotimes (or \bigotimes) switch, the exposure time displayed increases (or decreases) by one increment. By keeping the switch touched more than 2 sec., the exposure time displayed increases (or decreases) continuously until the switch is released. PHOT-X IIs Model 505 has the following 37 exposure time settings:

0.00, 0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.10, 0.11, 0.13, 0.14, 0.16, 0.18, 0.20, 0.22, 0.25, 0.28, 0.32, 0.36, 0.40, 0.45, 0.50, 0.56, 0.63, 0.71, 0.80, 0.90, 1.00, 1.12, 1.25, 1.40, 1.60, 1.80, 2.00 (sec.)

(5)~(9) Tooth Selection Switches

Touching one of these switches sets the exposure time to the optimum value according to the tooth type and the following settings ($(10 \sim 15)$). Selected tooth is illuminated in orange.

- (5) Maxilla : Incisor, Cuspid & Premolar or Molar
- 6 Mandible : Incisor, Cuspid & Premolar or Molar
- (7) Bitewing : Incisor and Cuspid & Premolar
- (8) Bitewing : Molar
- (9) Occlusal : Maxilla and Mandible

10 Cone Type Selection Switch

This switch indicates the cone type being selected at the time. Momentarily touching this switch will open the cone type selection window. This window closes when one of cones is selected.



Cone type selection window

(1) Image Receptor Selection Switch

To get optimal images the exposure timer adjustment according to the sensitivity of image receptor is important. The PHOT-X IIs has 16 density settings for each three kinds of image receptors, i.e.



Image Receptor Selection windows

film, digital sensor and phosphor plate. For film, two different sensitivities can be selected as film-a and film-b and those can be switched easily.

(1) Film

Following two speed (=sensitivity) settings are pre-set at the factory.

a = Film speed No. F.09 (equivalent to ISO speed group "D", or Kodak Ultra-Speed film)

b = Film speed No. F.05 (equivalent to ISO speed group "F/E", or Kodak InSight film) Including these two speeds, the PHOT-X IIs Model 505 x-ray can provide 16 different film speeds (F.00 ~ F.15) and any two of them can be programmed as film-a and film-b.

Film speed number being selected at the time can be confirmed by touching switch (1).

If doctor uses a different film speed, or prefers darker (or lighter) radiographs, the new speed can be programmed as follows. Larger speed number makes films darker. If film speed number is increased by 1, exposure time becomes 25 % longer. The method to change the film speed setting is as follows.

- 1. Go to the setting mode by touching the switch (20).
- 2. Select "Image receptor sensitivity setting" at page 2/3 in "Setting mode".
- 3. If new film is used, select the "Preset setting", select "film-a" or "film-b" and select the manufacturer and model name of the film.
- If darker (or lighter) radiographs are preferred or film name is not listed in "Preset setting", select the "Manual setting" and by touching or or switch, increase or decrease film speed until the desired number is displayed. Touch the memory icon to store the setting.
- (2) Digital sensor and Phosphor Plate

If a digital imaging system is used, shorter exposure time is often required compared with film. PHOT-X IIs has 16 speeds for digital sensor and phosphor plate ($d.00 \sim d.15$).

Factory settings for digital sensor and phosphor plate are both d.10, but it is necessary to change according to the sensitivity of each model of digital sensor or phosphor plate. The density number selected can be checked by touching switch (11). The method to change the density setting for digital sensors or phosphor plate is same as film.







Preset setting mode



Manual setting mode

Speed					Child					Adult				La	rge Adı	ult	
Setting	kV	mA	T1	T2	Т3	T4	T5	T1	T2	T3	T4	T5	T1	T2	Т3	T4	T5
	60	3	0.20	0.25	0.28	0.32	0.50	0.32	0.40	0.50	0.56	0.80	0.40	0.50	0.63	0.71	1.00
E 00	60	6	0.10	0.11	0.14	0.16	0.25	0.16	0.20	0.25	0.28	0.40	0.20	0.25	0.28	0.36	0.50
г. 09		3	0.14	0.16	0.20	0.22	0.36	0.25	0.28	0.36	0.40	0.56	0.28	0.36	0.45	0.50	0.71
	70	6	0.07	0.08	0.10	0.11	0.18	0.11	0.14	0.18	0.20	0.28	0.14	0.18	0.22	0.25	0.36
	(0)	3	0.08	0.10	0.11	0.14	0.20	0.14	0.16	0.20	0.22	0.32	0.18	0.20	0.25	0.28	0.40
E 05	60	6	0.04	0.05	0.06	0.07	0.10	0.07	0.08	0.10	0.11	0.16	0.09	0.10	0.13	0.14	0.20
г. 05		3	0.06	0.07	0.08	0.10	0.14	0.10	0.11	0.14	0.16	0.25	0.13	0.14	0.18	0.20	0.28
	70	6	0.03	0.04	0.04	0.05	0.07	0.05	0.06	0.07	0.08	0.11	0.06	0.07	0.09	0.10	0.14
	60	3	0.13	0.14	0.18	0.20	0.28	0.20	0.25	0.28	0.36	0.50	0.25	0.32	0.36	0.40	0.63
d 10	60	6	0.06	0.07	0.09	0.10	0.14	0.10	0.13	0.14	0.16	0.25	0.13	0.16	0.18	0.22	0.32
d.10		3	0.09	0.11	0.13	0.14	0.22	0.14	0.18	0.22	0.25	0.36	0.18	0.22	0.25	0.32	0.45
	70	6	0.04	0.05	0.06	0.07	0.11	0.07	0.09	0.11	0.13	0.18	0.09	0.11	0.13	0.16	0.22

 TABLE 1. Speed Setting and Exposure Time (Short Cone)

[unit : sec.]

 TABLE 2. Speed Setting and Exposure Time (Long Cone)

[unit : sec.]

Speed					Child					Adult				La	rge Adı	ult	
Setting	kV	mA	T1	T2	Т3	T4	T5	T1	T2	Т3	T4	T5	T1	T2	Т3	T4	T5
		3	0.40	0.50	0.63	0.71	1.00	0.71	0.80	1.00	1.12	1.60	0.90	1.00	1.25	1.40	2.00
E 00	60	6	0.20	0.25	0.28	0.36	0.50	0.36	0.40	0.50	0.56	0.80	0.45	0.50	0.63	0.71	1.00
Г. 09	- 0	3	0.28	0.36	0.45	0.50	0.71	0.50	0.56	0.71	0.80	1.25	0.63	0.71	0.90	1.00	1.40
	70	6	0.14	0.18	0.22	0.25	0.36	0.25	0.28	0.36	0.40	0.56	0.32	0.36	0.45	0.50	0.71
		3	0.18	0.20	0.25	0.28	0.40	0.28	0.36	0.40	0.45	0.71	0.36	0.45	0.50	0.56	0.90
E 05	60	6	0.09	0.10	0.13	0.14	0.20	0.14	0.18	0.20	0.25	0.36	0.18	0.22	0.25	0.28	0.45
г. 05	-0	3	0.13	0.14	0.18	0.20	0.28	0.20	0.25	0.28	0.32	0.50	0.25	0.32	0.36	0.40	0.63
	70	6	0.06	0.07	0.09	0.10	0.14	0.10	0.13	0.14	0.16	0.25	0.13	0.16	0.18	0.22	0.32
		3	0.25	0.32	0.36	0.45	0.63	0.45	0.50	0.63	0.71	1.00	0.56	0.63	0.80	0.90	1.25
410	60	6	0.13	0.16	0.18	0.22	0.32	0.22	0.25	0.32	0.36	0.50	0.28	0.32	0.40	0.45	0.63
u.10	- 0	3	0.18	0.22	0.28	0.32	0.45	0.32	0.36	0.45	0.50	0.71	0.40	0.45	0.56	0.63	0.90
	70	6	0.09	0.11	0.13	0.16	0.22	0.16	0.18	0.22	0.25	0.36	0.20	0.22	0.28	0.32	0.45

13 kV Selection Switch

Momentarily touching this switch will open the kV selection window. This window closes when either 60 or 70 kV is selected.

(14) mA Selection Switch

Momentarily depressing this switch will open the mA selection window. This window closes when either 3 or 6 mA is selected.



These switches alter the selection of patient type/size to be radiographed (child, adult or large adult) and sets the exposure time

automatically. If the weight of child is less then 20kg, press \bigotimes switch once after setting to child. If the weight of child is over 50kg and less than 70kg, press \bigotimes switch twice after setting to child. If the weight of child is over 70kg, set to adult.

NOTE: Setting or adjusting the exposure time manually (with 🔗 or 🛇 switch) supersedes (5) ~ (15) functions.

(b) Exposure Time Display Window

This window displays the selected exposure time.

(17) Exposure Warning Indication

This indication appears while the unit is producing x-radiation.

18 Exposure Switch

This switch initiates radiographic exposure. When making an exposure, depress and hold this switch until the Exposure Warning Indication (17) and the audible warning shut off. Failure to keep this switch depressed will result in the premature termination of the exposure and an error code E.00 will be displayed.



KV Selection Window





19 Radiation Dose Indication

Estimated air kerma (radiation dose) at distal end of cone can be displayed below the exposure time display window. This value is calculated by kV, mA, exposure time and cone type selected at the moment. The value displayed below the ready indication is sum of estimated air kerma of each exposure after the power switch has been turned on.

The units of these values can be selected from mGy or mGycm². And also to display these values or not can be selected by the following procedures.

- 1. Go to the setting mode by touching switch 20.
- 2. Select "Estimated air kerma display setting" at 2/3 page of setting mode.
- 3. Select "Display ON" or "Display OFF".
- 4. If "Display ON" is selected, you can select "mGy" or "mGycm²" on next menu.

20 Setting Mode Switch

By touching this switch the normal operation mode will be changed to the setting mode or service mode. At the setting mode, following settings can be changed. Refer to section [5] for detail. Service mode is restricted to the qualified dealer service personnel and requires password.

Page 1/3: Parameter Selection at Power ON Loudness of Electronic chime Brightness of LCD Sensitivity of touch panel Language selection

- Page 2/3: Estimated air kerma display setting Image receptor sensitivity setting Standard density for each tooth Calibration of Tube Current Color of background
- Page 3/3: Standby display setting Nameplate setting Photo display setting Color of background

[3] OPERATING PROCEDURES

- 1. Turn ON the Main Power Switch ①.
- 2. Select the appropriate tooth type $(5 \sim 9)$, and confirm the pre-selected conditions (cone type, film or digital, kV, mA and patient size) are suitable for exposure.
 - NOTE : To manually set the exposure time, depress either of the Manual Exposure Time Adjusting Switches () ()) until the desired exposure time appears in the Exposure Time Display Window (6). While the unit is in manual mode, other selection switches () ~ (5) do not affect exposure time. (All of the tooth selection switches are white.) To return to the automatic exposure time selection mode, depress any one of Tooth Selection Switches () ~ (9).
- 3. Confirm that Ready Indication (2) is illuminated on green.

NOTE : The ready indication will not illuminate unless the incoming line voltage is correct and within the x-ray's operable range (108 ~ 132Vac).

- 4. Position the x-ray tube head to the patient using the standard positioning procedures.
- 5. Depress the Exposure Switch (18). When the Exposure Switch is depressed, the Exp. Warning Indication (17) appears and the audible warning sounds. Do not release the Exposure Switch until the Exposure Warning Indication and audible warning automatically shut off. Failure to keep the switch depressed will result in exposure being terminated prematurely.
- 6. To continue to radiograph other teeth, just select appropriate Tooth Selection Switches ($(5) \sim 9$).
 - **IMPORTANT** : To protect x-ray tube head from heat accumulation, wait for a time interval that is equal to 30 times the selected exposure time before making additional exposures. (Example : a 15 sec. wait is necessary between exposures that are 0.5 sec. in duration.)
- 7. Turn OFF the Main Power Switch (1) in order to prevent accidental exposures when the unit is not in use.
 - NOTE : If the unit is left without being operated and the Main Power Switch (1) is kept on, display will go into one of the following four standby display modes.
 - a. Energy saving mode
 - b. Fixed display of one photo
 - c. Slide-show of photos
 - d. Nameplate display

Transition time to the standby display mode can be set by 5 minutes steps and making switch enable and disable during standby mode is also selectable.

[4] OPTIONAL HAND EXPOSURE SWITCH

An optional hand exposure switch can be connected to the sub controller. Since this exposure switch has a coiled cord, operators can stand in the most suitable position for operation. As controller has separate connector for this exposure switch, both exposure switch (18) on the front panel of sub controller and this hand exposure switch can be used. If local code prohibits use of both, ask installer to disconnect the connector of either switch.

[5] SETTING MODE

By touching the setting mode switch at bottom left corner, the normal operation mode can be changed to the setting mode or service mode. There are 13 setting modes and each purposes of those settings are as follows.

1. Parameter Selection at Power ON

Factory default settings are

kV selection: 60 kVmA selection: 6 mAImage receptor: Digital sensorPatient type: AdultCone type: Short cone (round)

If necessary, these settings can be changed. For example, in case of pedodontistry, patient type should be changed to Child. For the image receptor, as the sensitivity of each receptor is different, please set the sensitivity as on page 22.

If the same settings before the power switch is turned off sould be set at power on, select "Same Selection befor Power OFF".

2. Loudness of Electronic Chime

Loudness of electronic chime can be selected from 9 levels including off setting. The loudness of the sound for exposure warning and error warning cannot be adjusted.

3. Brightness of LCD

Brightness for backlight of LCD display can be selected from 10 levels.

4. Sensitivity of Touch panel

Sensitivity of touch switch on the panel can be selected from 3 levels.

5. Language Selection

Language can be selected from English, French, Spanish or Japanese.

6. Estimated Air Kerma Display Setting

Whether to display the estimated air kerma (radiation output) or not to display can be selected. If displaying is selected, the unit of the values can be selected from mGy or mGycm².

7. Image receptor sensitivity setting

Manual setting or preset setting can be selected.

- Manual setting: Two film speeds can be selected from 16 speeds as film-a and film-b. One digital sensor sensitivity can be selected from 16 steps and one phosphor plate sensitivity can be selected form 16 steps. Refer to page 44 for detail.
- Preset setting: For each 4 types of image receptors, standard sensitivity can be set by selecting the manufacturer and model name of the image receptor.

8. Standard density for each tooth

The exposure time ratio between each tooth is preprogrammed. If doctor want to change this ratio, it can be done by this setting. Exposure time for each tooth can be increased (or decreased) by 4 steps individually. One step increase is corresponding to 25% increase of exposure time.

9. Calibration of Tube Current

Tube current can be adjusted to be the rated value by making several exposures at this mode. This calibration is necessary at the installation and at the annual maintenance checks.

10. Color of Background

The default color of the back panel at the normal operation mode is blue. This color can be changed to green or pink. And also there are two patterns for pink.

11. Standby display setting

If the unit is left without being operated and the main power switch is kept on, display will go into standby display mode. You can select one of following four kinds of standby display modes.

- a. Energy saving mode: Backlight of LCD becomes minimum in this mode.
- b. Fixed display of one photo: One of ten photos pre-stored is displayed. You can overwrite your original photos on the pre-stored photos.
- c. Slide-show of photos: ten photos are displayed in turn continuously.
- d. Nameplate display: Any name within 20 characters with a photo is displayed.

Transition time from normal mode to the standby display mode can be set to $5 \sim 30$ minutes in 5 minutes step. Enabling or disabling of touch switch function during standby mode is also selectable.

12. Nameplate setting

Nameplate creation: Four kinds of nameplates can be created and stored. To check the nameplate already created, touch the mountain icon at right side. To modify or create new name, touch the name or "New Name Input" at left side. Maximum 20 characters can be used for the name of nameplate. After the name is fixed, you can use preinstalled photo or your original photo for that nameplate. If you want to use your own photo, USB flash drive containing your photo data should be connected to the right side connector of LCD controller. The file name of your photo should be the same as indicated on the screen and data format should be 16 bit BMP with 800 x 400 pixels.

Nameplate selection: One of the nameplates created should be selected for the standby display.

13. Photo display setting

Ten photos are pre-stored. One of ten photos is used for "fixed display of one photo" and ten photos are used for "Slide-show of photos" at standby display mode.

Stored photo can be checked by touching the mountain icon at right side. If you want to store your own photo, touch one of the bar named "FF00" to "FF09". Connect USB flash drive containing your photo data to the right side connector of LCD controller. The file name of your photo should be the same as indicated on the screen and data format should be 16 bit BMP with 800 x 480 pixels.

[6] ERROR CODES

If an abnormal condition exists in the unit, or a malfunction occurs, an error code, code condition and the possible solution are displayed on the LCD screen. Please refer to the Table below.

Error Code	Condition	Step to be Taken	Possible Solution
E.00	Exposure switch was released before exposure termination.	All the tooth selection lights blink. Depress one of the tooth switches.	Release the exposure switch after the exposure light turns off.
	Exposure switch was depressed within 10 sec. of previous exposure.		There should be a "wait" interval of 50 times the exposure time between successive exposures.
E.01	Exposure time was set and exposure switch was depressed within 3 sec. of the power switch being turned on	A 10 sec. delay is built in between each exposure.	Wait for a minimum 3 sec. after the main power switch is turned on before pressing the exposure switch.
		switch.	If line voltage is less than 90% of rated voltage
E.02	Line voltage was less than 90% of rated		correct it by using a step- up transformer (*)
E.03	Line voltage was more than 110% of rated voltage.		If line voltage is less than 110% of rated voltage, correct it by using a step- down transformer (*)
E.05	Tube current at last portion of exposure was less than 2 mA at 3 mA setting or less than 4.5 mA at 6 mA setting.		
E.06	Tube current at last portion of exposure was more than 4 mA at 3 mA setting or more than 7.5 mA at 6 mA setting.		Conduct the calibration
E.07	During the exposure, tube current becomes less than 1.5 mA at 3mA setting or less than 3 mA at 6 mA setting.	Turn off the main power	on page 26.
E.08	During the exposure, tube current becomes more than 4.5 mA at 3mA setting or more than 9 mA at 6 mA setting.	switch and wait for approximately 2 min. Turn on the main power	
E.09	Setting for pre-heating time is out of range.	switch again.	
E.10	Exposure switch or exposure circuit had been ON, when main power switch is turned on.		
E.11	Tube current is detected during pre-heating period.		Refer to the service
E.12	Tube current is detected when main power switch is turned on.		manual.
E.14	Tube potential at last portion of exposure was less than 50 kV at 60 kV setting or less than 60 kV at 70 kV setting.	+	

rror Code	Condition	Step to be Taken	Possible Solution
E.15	Tube Potential at last portion of exposure was more than 70 kV at 60 kV setting.		
E.16	During the exposure, tube potential becomes less than 40 kV at 60 kV setting or less than 50 kV at 70 kV setting.	switch and wait for approximately 2 min.	Refer to the service manual.
E.17	During the exposure, tube potential becomes more than 80 kV.	switch again.	
E.18	Excess current was detected in primary circuit of filament transformer.		
E.19	Excess current was detected in primary circuit of high voltage transformer.		
E.20	Exposure switch was depressed when tube head temperature was over 60 C.	Release the exposure switch.	Turn off the main power switch and wait until temperature goes down.
E.22	Failure of electrical communication between the power PCB and timer PCB.	Turn off the main power switch and wait for	Refer to the service manual.
E.23	Some switch had been on, when the main power switch is turned on. (Except the exposure switch.)	Turn on the main power switch again.	

(*) Should a step up or down transformer be required to follow local and national electrical code for electrical ratings (120VAC, 60Hz, Single Phase, 1.2kVA) and installation.

[7] MAINTENANCE

The PHOT-X IIs Model 505 x-ray unit requires post installation confirmation and periodic maintenance checks to be performed by dealer service personnel. These procedures ensure that the x-ray unit is functioning within the manufacture's specifications and remains in compliance with the Standard.

It is responsibility of the owner of the unit to see that these maintenance checks are correctly performed. The specific instructions to perform these checks are located within the PHOT-X IIs Model 505 Installation manual.

- a. Maintenance personnel : Qualified dealer service personnel who has the experience with Belmont's x-ray or has been trained by Belmont. But item 7 10 of the maintenace check list on page 31 should be verified routinely by treatment room personnel.
- b. Specification of the parameters to be monitored and monitoring frequency : Refer to the maintenance check list on page 31.
- c. Acceptance limit : Refer to the Maintenance check list on page 31.
- d. Required action when failed : Refer to the Maintenace check list on page 31.
- e. Tools to maintain quality control logs : Use the check list on page 31.
- f. Training material : Operator's instructions, Installation manual and Service manual

[8] DISPOSAL

1. Disposal of x-ray unit or components

The tube head of this x-ray unit contains the lead for x-ray shield and oil for insulation. When disposing the x-ray unit or components, appropriatly dispose complying with all current applicable regulations and local codes.

2. Disposal of used film and CCD cover Dispose the used film covers and CCD sensor covers appropriately, according to precedures indicatated by each manufacturer and all current applicabel regurations and local codes.

APPENDIX 1 : CIRCUIT DIAGRAM



Parameter	Acceptance limit	Frequency	Procedures when failed	OK/NG
1. Line voltage	Confirm the line voltage is within 120V±10%. Also confirm the voltage drop during exposure is within 5%.	Yearly	Connect to the power supply within 120V±10%. Check disconnection of wire or connection failure. Repair cable connection as needed.	
2. Tube current	Confirm the measured mA value indicated on the LED window is within the rated value ± 1 mA.	Yearly	Perform MA calibration. (Refer to page 26 of Installation manual.)	
3. Tube potential	Confirm the measured kV value indicated on the LED window is within the rated value $\pm 10\%$.	Yearly	Check the tube potential compensation (CP) values are same as the values on the label in the head yoke.	
4. Timer	Confirm the error of the measured value by noninvasive exposure time meter is within ±5% or 20mS at 0.01 and 2.0 seconds exposure. *The non invasive time meter should be calibrated to measure the radiation from dental x-ray.	Yearly	Exchange the power PC board to new one and check the result.	
5. Wall mounting plate	Confirm the wall plate is firmly fixed to the wall.	Yearly	If bolts are loose, find the reason why bolts became loose and take counter measure that prevents bolts from becoming loose.	
6. Arm mounting bracket	Make sure that the arm bracket is firmly attached to the wall plate.	Yearly	If bolts that fix the arm bracket to the wall plate are loose, find the reason why bolts beame loose and take counter measure that prevents bolts from becoming loose.	
7. Dosimetry	Save the image that was taken under appropriate conditions as a reference image. Compare a newly taken image with a reference image to assure the image quality.	Weekly	If the image quality is found poor comparing to a reference image, check the condition of image receptor (film, sensor or imaging plate), image developer (developing fluid, dental film developer, PC or scanner). If they are OK, then set appropriate film / sensor speed by referring to page 22 of installation manual.	
8. Horizontal arm	Confirm that horizontal arm is firmly inserted to the arm bracket. Make sure the retaining bolt is firmly inserted to the arm bracket.	Daily (before use)	If the retaining bolt is loose, find the reason why bolt became loose and take counter measure that prevents the retaining bolt from becoming loose.	
9. Head	Confirm the head can be smoothly positioned.	Daily (before use)	Adjust the brake screws by referring to page 16 of installation manual.	
10. Balance arm	Confirm the balance arm moves smoothly without making noise.	Daily (before use)	Adjust the tension of the balance arm by referring to page 16 of installation manual. If the balance arm makes noise, apply grease.	

APPENDIX 2 : MAINTENANCE CHECK LIST

APPENDIX 3 : PARTS IDENTIFICATION [1] ARM AND HEAD ASSEMBLY



ID.No.	Parts No.	Description	QTY
1	1P03TGA0	X-Ray Head Assembly	1
2	1A0FU4A0	Yoke	1
3	1A0FU6A0	Yoke Inside Cover	1
4		Yoke Inside Cover Screw (M4 x 15)	1
5	1P03JRA0	Head Housing Cover Set	1set
6	ECQR60A0	Yoke Side Cap	1
7		Yoke Side Cap Screw (Ø 3 x 8)	1
8	ECPJ65A0	Lock Ring	1
9	1P04W8A0	Short Cone	1
10	1P04W6A0	Long Cone Collimator (Option)	(1)
11	1P04W7A0	Long Cone Assembley (Option)	(1)
12	1S01WEA0	Rectangular Collimator (Option)	(1)
13	ECQR62A0	Head Key	1
14	ECQR24A0	Stopper Ring	1
15		Arm Collar Screw (M4 x 8)	1
16	ECQR31A0	Arm Collar	1
17	1P03JSA0	Wire Harness in Balance Arm	1
18	1A0FU7A0	Left Cover for Joint No.3	1
19	1A0FU8A0	Right Cover for Joint No.3	1
20	ECPE16E0	Joint No.3	1
21	ECQR33A0	Cushion Absorber	1
22	1A0FUCA0	Crevice Cover	4
23	1A0FUDA0	Spring Adjuster Cover	2
24	1A0FULA0	Arm Cover No.2	1
25	ECPE30B0	Balance Arm No.2	1
26	1A0FUBA0	Cover for Joint No.2	2
27	ECPJ58B0	Joint No.2	1
28	1A0FUKA0	Arm Cover No.1	1
29	ECPE31B0	Balance Arm No.1	1
30	1A0FU9A0	Left Cover for Joint No.1	1
31	1A0FUAA0	Right Cover for Joint No.1	1
32	ECPE15B0	Joint No.1	1
33	1P0528A0	Balance Arm Asembly	1
34	ECLJ82A0	Balance Arm Wrench	1

[2] CONTROLLER ASSEMBLY



		00	
ID.No.	Parts No.	Description	QTY
1	1A0FUJA0	Wall Plate	1
2	ECPE34B0	Arm Mounting Bracket	1
3	1A0389B0	Chassis	1
4	1A0ERXC0	Power PC Board	1
5	1S02BVA0	Sensor Holder Assembly	1
6	1A0387A0	Restriction Plate	1
7	1A0FTZA0	Front Panel	1
8		Screw for Front Panel	4
9	1E01J8A0	Main Power Switch	1
10	1A0FTYA0	Front Cover	1
11	1A0FUEA0	Side Cover	1
12	1A0KGWA0	Horizontal Arm Frame (800mm)	1
13	ECQR61A0	Arm End Cap	2
14	1A0KH5A0	Arm Bottom Cover	1
	1P04E3A0	Wire Harness in Horizontal Arm (800mm)	
	1P04E4A0	Wire Harness in Horizontal Arm (1000mm)	
15	1P04E0A0	Wire Harness in Horizontal Arm (300mm)	1
	1P04E1A0	Wire Harness in Horizontal Arm (500mm)	
	1P04E2A0	Wire Harness in Horizontal Arm (650mm)	
16		Lag Screw (ø9 x 75)	4
17		Machine Bolt (M8 x 20)	3
18	ECPR44B0	Retaining Bolt	2
19	ECLS06B0	Brake Plug	2
20		Brake Screw	1
21	ECLS11B0	Brake Spring	1

ID.No.	Parts No.	Description	QTY
22	ECLS09B0	Stopper Screw	1
23		Screw for Chassis (M4 x 8)	4
		· ·	
25		Screw for Chassis (M4 x 8)	2
26		Screw for Cover (M3 x 8)	2
27	1A0LYNC0	Chassis for Sub Controller	1
28	1A0M2CA0	Front Panel for Sub Controller	1
29	ECQR58A0	Protector for Timer PC Board	1
30	1A0N9PA0	Timer PC Board	1
31	ECPJ47A0	Hook for Hand Exposure Switch (Option)	1
32	EHLL53A0	Hand Exposure Switch Assembly (Option)	1
33		Wood Screw ø3.1 x 18 (Option)	1
34		Front Cover screw for Sub Controller	2
35		Wood Screw (ø4.1 x 20)	4
	1P04E8A0	Horizontal Arm Assembly (800mm)	
	1P04E9A0	Horizontal Arm Assembly (1000mm)	
37	1P04E5A0	Horizontal Arm Assembly (300mm)	1
	1P04E6A0	Horizontal Arm Assembly (500mm)	
	1P07E7A0	Horizontal Arm Assembly (650mm)	
38	1P04SUA0	Main Controller Assembly	1
39	1P0525A0	Sub Controller Assembly	1
40	1A0FUFA0	Hook for Side Cover	4
41		Screw for Hook	8
42	1G06N8A0	Exposure Switch PC Board	1

APPENDIX 4 : CERTIFICATION

FORM FDA 2579 FROM THE DEPARTMENT OF HEALTH AND HUMAN SERVICES MUST BE COMPLETED AND MAILED TO THE RESPECTIVE AGENCIES FOR THIS INSTALLATION TO BE CONSIDERED COMPLETE. ALSO COMPLETE THE WARRANTY CARD AND THE ASSEMBLERS INSTALLATION REPORT AND RETURN TO BELMONT EQUIPMENT CORP.

REFER TO THE SAMPLE FORM :

FOR FDA USE ONLY	MENT OF HEALTH AND HUMAN SERVICES PUBLIC HEALTH SERVICE FOOD AND DRUG ADMINISTRATION				ES Fro Ex Se	From Approved: OMB No. 0910-0213 Expiration Date: December 31, 1992 See reverse for OMB statement.				
		FASS CX-F	EMBLY RAY SYSTEM			D	XX	xxxxx 🖣		
1. EQUIPMENT LOCATION 2. ASSEMBLER INFORMATION										
a. NAME OF HOUSPITAL, DOCTOR OR OFFICF WHERE INSTALLED				a. COMPANY NAME						
b. STREET ADDRESS				b. STREET ADDRESS			V			
с. СІТҮ V		d. STATE		c. CITY		V	V		d. STATE	
e. ZIP CORD	TELEPHONE NUMBER			e. ZIP CORD			f. TELE	f. TELEPHONE NUMBER		
3. GENERAL INFORMATION										
a. THIS REPORT IS FOR ASSEMBLY OF CERTIFIED COMPONETS WHICH ARE(Check appropriate box(es)) NEW ASSEMBLY - FULLY CHRTIFIED SYSTEM REASSEMBLY - FULLY CHRTIFIED SYSTEM REASSEMBLY - FULLY CHRTIFIED SYSTEM AN ADDITION TO AN EXISTING SYSTEM AN ADDITION TO AN EXISTING SYSTEM										
b. INTENDED USE(S)(Check applicble box(es)) GENERAL PURPOSE RADIOGRAPHY GENERAL PURPOSE FLUOROSCOPY TOMOGRAPHY (Other than CT) ANGIOGRAPY		PODIATRY CT HEAD SCANN UROLOGY CT WHOLE BODY MAMMOGRAPHY HEAD - NECK (M CHEST CHEST CHEST CHIROPRACTIC			SCANNE E BODY ECK (Med INTRAO CEPHAL	SCANNER dical) RAL _OMETRIC				
c. THE X-RAY SYSTEM IS (Check one) STATIONARY	d. THE MASTER CONTROL IS IN ROOM Location of Control Box			e	e. DATE OF ASSEMBLY					
 COMPONENT INFORMATION (If additional space is needed for this section use another form, replacing the preprinted number with form Number and complete items 1,4, and 5 only) 										
a. THE MASTER CONTROL IS A NEW INSTALLATION EXEMPTING CONTROL MANUFAN		CTURER Imont, USA Inc.			b. CONTROL SERIAL NUMBER					
	UMBER 505-CS				c. SYSTEM MODEL NAME (CT Systems Only)					
Complete the following infomation for the certified components listed below which you installed. For beam limited device, tables and CT gantries the manufacturer and Model number in the indicated spaces. For other certified components, enter in the appropriat block how many of each you installed in this system.										
f. SELECTED		OTHER CERTIFIED COMPONENTS f (Enter number of each installed in appropriat					ONENTS			
MANUFACTURER MODEL NUMBER		DATE								
	FACTURER MODEL NUMBER		MANUFA			X-RAY CONTR	(CONTROL VOLTAGE GENERATOR		CRADLE FILM CHANGER	
MANUFACTURER	MODEL NUMBER	DATE MANUF		CTURED VER		VERTICAL CA	SSETTE HOL	DER	IMAGE INTENSIFIER	
™ MANUFACTURER	MODEL NUMBER	DATE MANUFA				TUBE HOUSIN (Medical) DENTAL TUBE	G ASSEMBL'	([[SPOT FILM DEVICE	
MANUFACTURER	MODEL NUMBER	DATE	DATE MANUFACTURED							
5. ASSEMBLER CERTIFICATION		· ·		(
I affirm that all certified components assembled or installed by me for which this report is being made, were adjusted and test manufacturer(s), were of the type required by the diagnostic x-ray performance standard (21 CFR Part 1020), were not modified t accordance with provisions of 21 CFR Part 1020. I also affirm that all instruction manuals and other infomation required by 21 purchaser and within 15 days from the date of assembly, each copy of this report will be distributed as indicated at the bottom of each copy.										
a. PRINTED NAME		SIGNATURE			c. DATE			c. DATE	V	
d. COMMENTS	Г									

FORM FDA 2579(7/92) PREVIOUS EDITION IS OBSOLETE



BELMONT EQUIPMENT, Division of Takara Belmont, USA, Inc.

101 Belmont Drive Somerset, New Jersey 08873 U.S.A. TEL.:(732) 469-5000 / (800) 223-1192 www.belmontequip.com

Fax.:(732)526-6322 / (800) 280-7504

Book No. 1A0N9QA0 Printed in Japan 2017-11