

DENTAL X-RAY

PHOT-X IIs

505

INSTALLATION INSTRUCTIONS

·Floor Mount TypeFK1/FK2

·Mobile TypeFM

·Room Mount TypeRK

⚠ WARNING

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

⚠ CAUTION

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

The instructions contained in this book should be thoroughly read and understood by dealer service personnel 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.

 **Belmont®**

INDEX

	PAGE
SECTION 1 : TECHNICAL DATA	
[1] ELECTRICAL AND RADIATION DATA -----	2
[2] OVERALL VIEW AND MAJOR COMPONENTS -----	3
[3] PHYSICAL DIMENSIONS -----	5
[4] TUBE HEAD THERMAL CHARACTERISTICS -----	6
SECTION 2 : PRE-INSTALLATION INSTRUCTIONS	
[1] SUPPORT REQUIREMENTS -----	7
[2] ELECTRICAL REQUIREMENTS -----	7
SECTION 3 : INSTALLATION INSTRUCTIONS	
[1] INSTALLATION REQUIREMENTS -----	8
[2] INSTALLATION OF FK1/FK2 TYPE -----	8
[3] INSTALLATION OF FM TYPE -----	12
[4] INSTALLATION OF RK TYPE -----	14
[5] HEAD ASSEMBLY INSTALLATION -----	16
[6] MAIN CONTROLLER INSTALLATION -----	17
[7] SUB CONTROLLER INSTALLATION -----	19
[8] HAND EXPOSURE SWITCH (OPTION) -----	20
[9] EXTERNAL INTERLOCK (NOT SUPPLIED) -----	20
SECTION 4 : POST INSTALLATION INSPECTION	
[1] FK1/FK2 TYPE -----	21
[2] FM TYPE -----	22
[3] RK TYPE -----	22
[4] HEAD POSITIONING -----	23
SECTION 5 : CONTROL IDENTIFICATION AND OPERATION	
[1] MAJOR COMPONENTS AND CONTROL IDENTIFICATION -----	23
[2] FUNCTION OF CONTROLS -----	24
[3] OPERATING PROCEDURES -----	27
[4] ESTIMATED AIR KERMA -----	27
[5] HAND EXPOSURE SWITCH -----	26
[6] ERROR CODES -----	28
[7] MAINTENANCE -----	29
[8] DISPOSAL -----	29
SECTION 6 : POST INSTALLATION CONFIRMATION	
[1] CONFIRMATION OF POWER SUPPLY VOLTAGE -----	30
[2] CONFIRMATION OF TUBE POTENTIAL AND COMPENSATION VALUE -----	30
[3] MA ADJUSTMENT -----	30
[4] CONFIRMATION OF KV AND MA -----	31
[5] CONFIRMATION OF EXPOSURE WARNING LAMP & BUZZER -----	31
[6] CONFIRMATION OF LINE VOLTAGE REGULATION -----	31
SECTION 7 : INITIAL SETTING	
[1] SPEED SETTING FOR FILM AND DIGITAL IMAGING -----	32
[2] PRIORITY OF SELECTIONS -----	33
[3] ELECTRONIC CHIME ON/OFF -----	33
[4] ESTIMATED AIR KERMA DISPLAY SETTING -----	33
APPENDIX 1 : CIRCUIT DIAGRAM -----	34
APPENDIX 2 : MAINTENANCE CHECK LIST -----	35

SECTION 1 : TECHNICAL DATA

[1] ELECTRICAL AND RADIATION DATA

1. X-ray tube ----- Toshiba D-046 (Stationary Anode)
 - a. Nominal focal spot value ----- 0.4 (IEC60336)
 - b. Target Material ----- Tungsten
 - c. Target angle ----- 12.5°
 - d. Maximum anode heat content ----- 4.3kJ (6.1kHU)
2. Maximum x-ray tube assembly heat content ----- 293kJ (413kHU)
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	[Vac]	100	110	120	220	230	240
Minimum Line Voltage	[Vac]	90	99	108	198	207	216
Maximum Line Voltage	[Vac]	110	121	132	242	253	264
Rated Line Power	[kVA]	1.1	1.2	1.2	1.4	1.4	1.4
Rated Line Current at 70kV, 6mA	[Aac]	11.0	10.5	10.0	6.4	6.2	6.0
Maximum Line Current at 70kV, 6mA	[Aac]	12.1	11.6	11.0	7.0	6.8	6.6
Maximum Apparent Resistance	[Ω]	0.39	0.45	0.52	0.91	0.98	1.06
Range of Line Voltage Regulation	[%]	0 ~ 5	0 ~ 5	0 ~ 5	0 ~ 3	0 ~ 3	0 ~ 3
Over Current Release	[Aac]	≥ 15			≥ 10		
7. Power line frequency ----- 50 / 60Hz, Single Phase
8. Exposure time ----- 0.01 ~ 2.0 sec.
9. Inherent filtration ----- 1.7 mm Al Equivalent
10. Added filtration ----- 0.3 mm Al
11. Minimum filtration permanently in useful beam ----- 2.0 mm Al Equivalent at 70 kV
12. Nominal roentgen 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. ± 40%
b. Distal end of long cone -----	2.0 4.1	2.6 5.2 mGy/sec. ± 40%

(Data obtained by direct measurement in the useful beam)
13. Nominal electrical output of H.V. generator ----- 0.42 kW at 70 kV, 6 mA
14. Cone

	Source to skin distance	Field size
a. Regular cone -----	203 mm	58 mm dia., circular
b. Long cone (option) -----	305 mm	58 mm dia., circular
c. Rectangular colimator (option) -----	SSD of cone + 40mm	32 x 40 mm, rectangular
15. Maximum symmetrical radiation field ----- 60 mm dia. at distal end of cone
16. Leaking technique factor ----- 70 kV / 0.19 mA (697mAs at 1 hour)
17. Duty cycle ----- 1 : 30 (0.5 sec. exposure with 15 sec. interval)
18. Maximum deviation of tube potential, tube current and exposure time
 - a. Below 0.1 sec. setting ----- ±10 kV, ±2 mA, ±5 msec.
 - b. 0.1 sec. setting & up ----- ±5 kV, ±1 mA, ±10 msec.
19. Measurement base of technique factors
 - a. peak tube potential ----- Average of peak tube potentials during one exposure
 - b. tube current ----- Average of tube current during one exposure
 - c. exposure time ----- Time period during x-ray is emitted
20. Half value layer ----- 1.5 mm Al over
21. Source to the base of cone distance ----- 94 mm
22. Environmental condition for storage ----- -20 ~ 70°C, 10 ~ 100%, 500 ~ 1060hPa
23. Environmental condition for operation ----- 10 ~ 40°C, 30 ~ 70%, 700 ~ 1060hPa
24. Rotation angle of head ----- Horizontal 0 ~ 600°, Vertical 0 ~ 300°
25. Service Life ----- 10 Years

[2] OVERALL VIEW AND MAJOR COPMPNENTS

1. FOOR MOUNT TYPE (FK1/FK2)

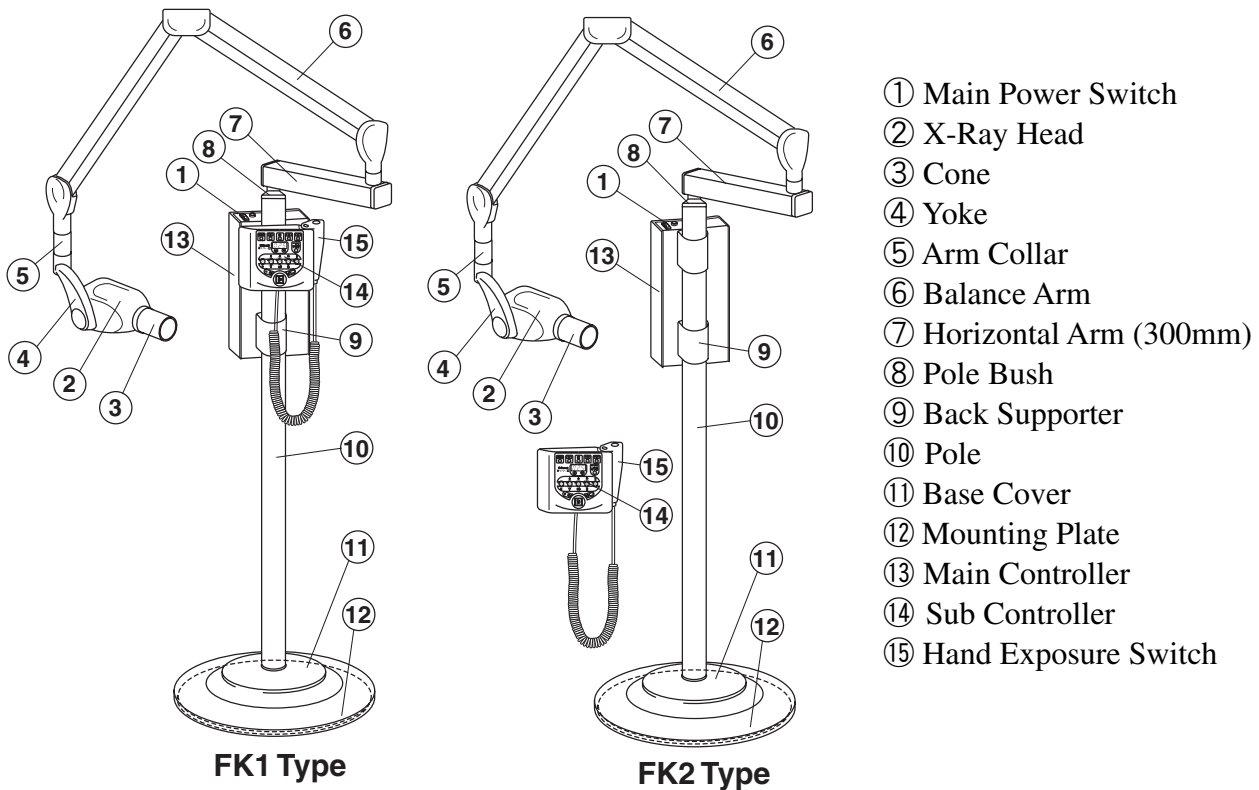


Fig.1-1 Overall view and Major Components for FK1/FK2

2. MOBILE TYPE (FM)

- ① Main Power Switch
- ② X-Ray Head
- ③ Cone
- ④ Yoke
- ⑤ Arm Collar
- ⑥ Balance Arm
- ⑦ Pole Bush
- ⑧ Pole
- ⑨ Pole Base
- ⑩ Leg Bar (long)
- ⑪ Leg Bar (Short)
- ⑫ Lock Caster
- ⑬ Standard Caster
- ⑭ Main Controller
- ⑮ Sub Controller
- ⑯ Hand Exposure Switch

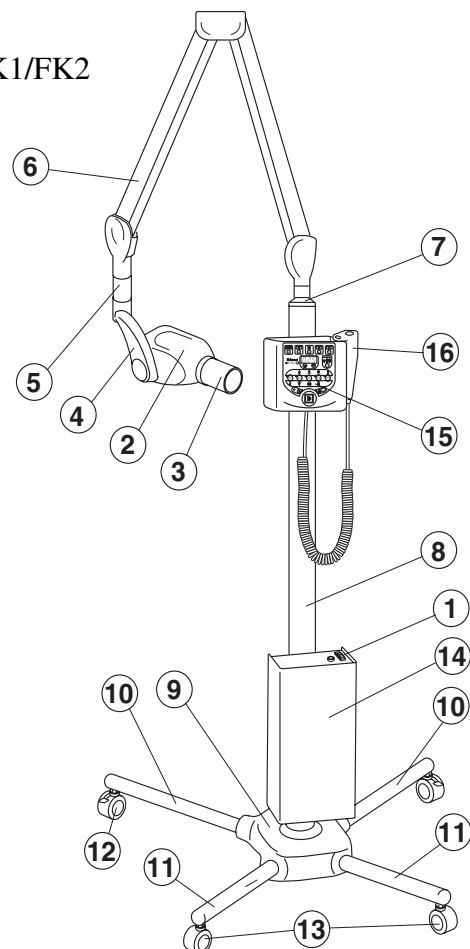


Fig.1-2 Overall view and Major Components for FM

3. ROOM MOUNT TYPE (RK)

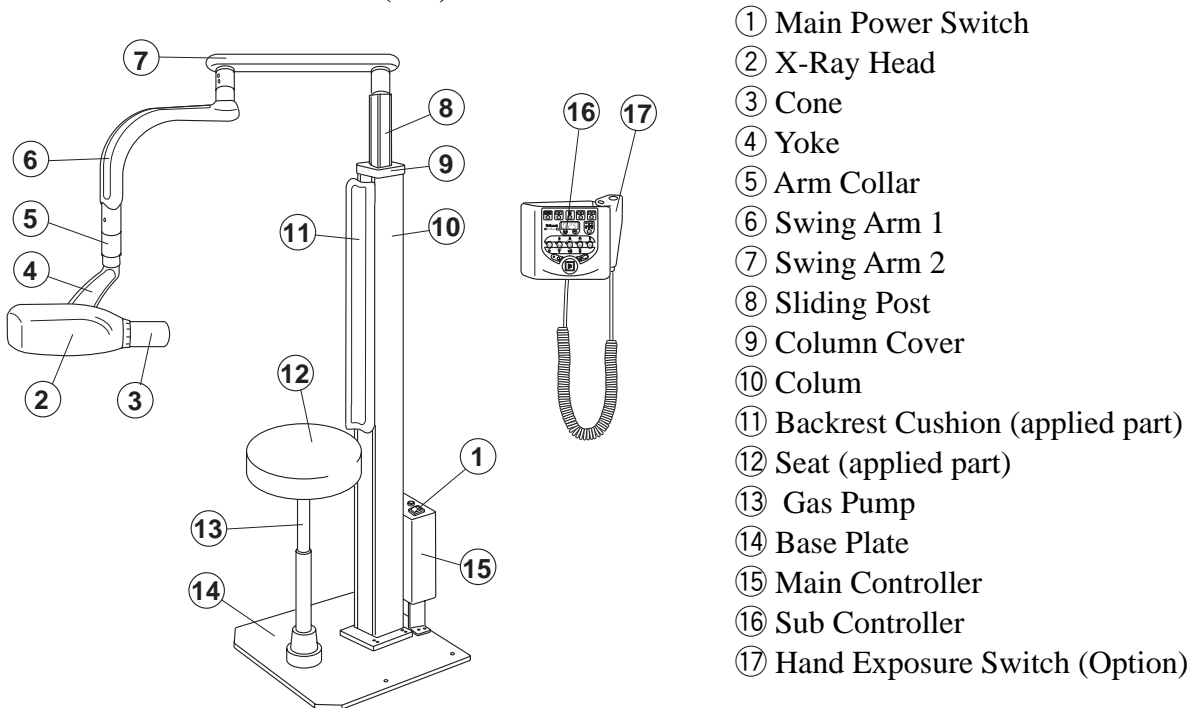


Fig.1-3 Overall view and Major Components for RK

4. SUB CONTROLLER

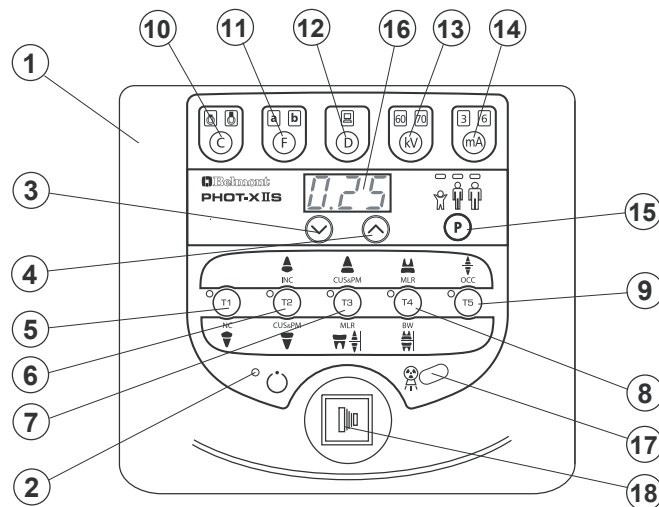


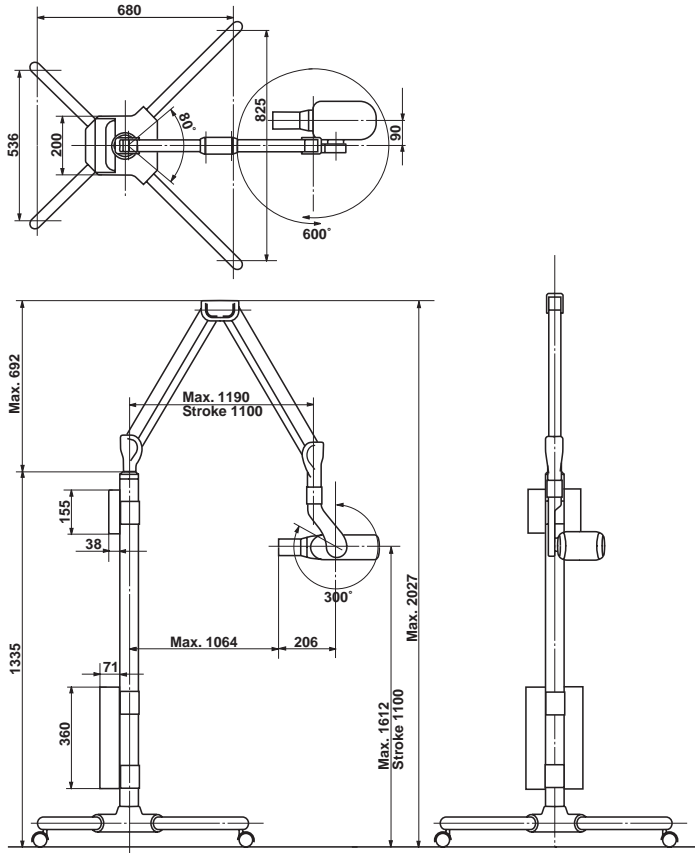
Fig.1-4 Main Power Switch & Sub Controller Switches

- ① Sub Controller Frant Panel
- ② Ready Light
- ③ Exposure Time Adjusting Switch (Down)
- ④ Exposure Time Adjusting Switch (Up)
- ⑤ Tooth Selection Switch (T1)
- ⑥ Tooth Selection Switch (T2)
- ⑦ Tooth Selection Switch (T3)
- ⑧ Tooth Selection Switch (T4)
- ⑨ Tooth Selection Switch (T5)
- ⑩ Cone Type Selection Switch
- ⑪ Film Speed Selection Switch
- ⑫ Digital Imaging Switch
- ⑬ kV Selection Switch
- ⑭ mA Selection Switch
- ⑮ Patient Size Selection Switch
- ⑯ Exposure Time Display Window
- ⑰ Exposure Warning Light
- ⑱ Exposure Switch

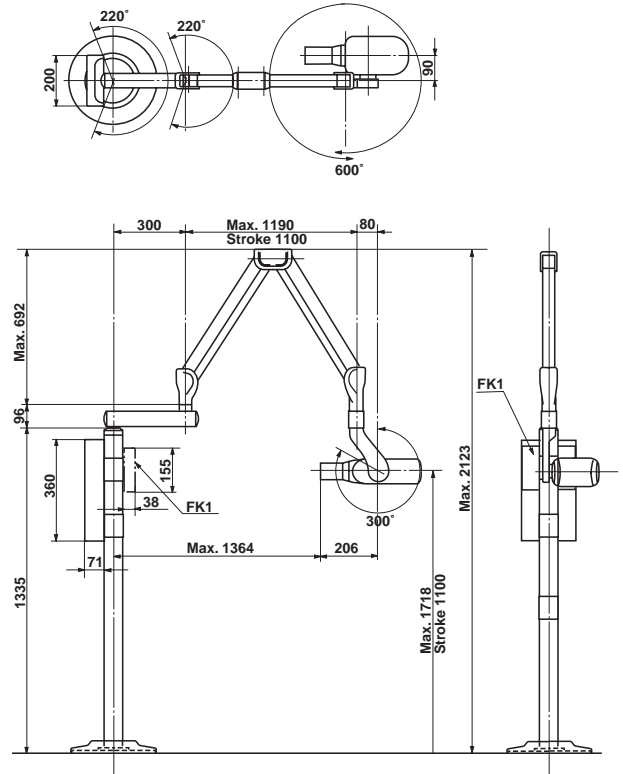
[3] PHYSICAL DIMENSIONS

[UNIT : mm]

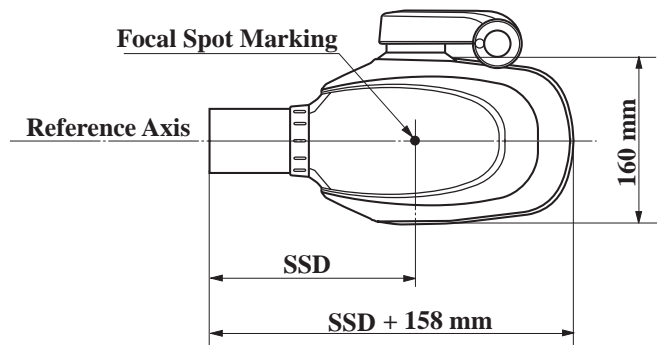
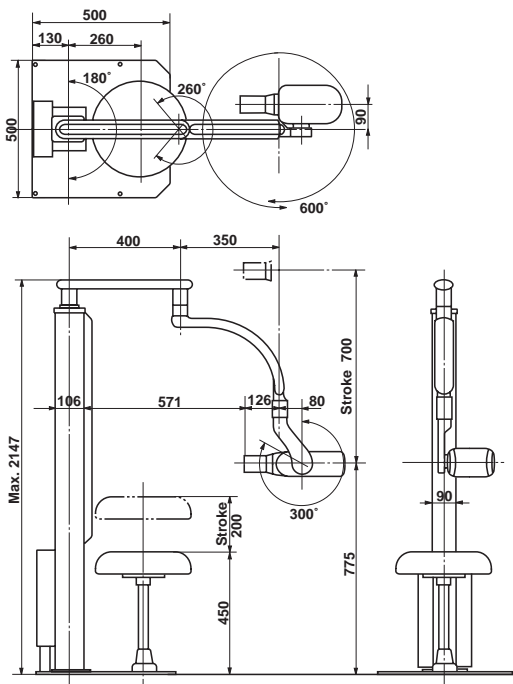
FM Type



FK1/FK2 Type



RK Type



SSD (Source to Skin Distance) :

- a. Regular cone-----203 mm
- b. Long cone-----305mm

Note : Installation of rectangular collimator increases SSD by 40 mm from above value.

Fig.1-5 Dimensions

[4] TUBE HEAD THERMAL CHARACTERISTICS

A. Interval between each exposure

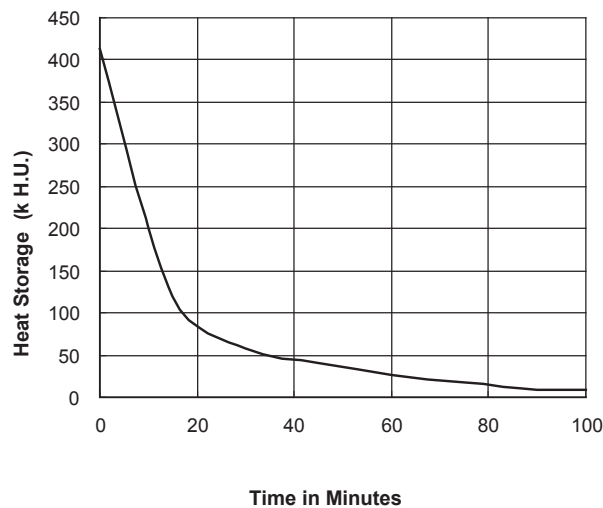
The temperature inside of the tube head rises when an exposure is made. The value of the heat generated is measured in Heat Units (HU), which is the product of tube potential, tube current and exposure time. Excessive heat will accumulate inside of the tube head if the x-ray is used without a proper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

B. Duty cycle

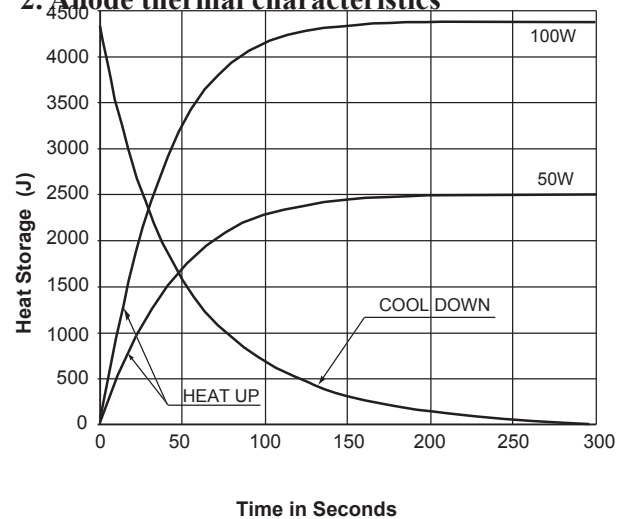
A cool down interval of 30 seconds or more must be allowed between each 1 second exposure. (a 15 second cool down must be allowed between each 0.5 second exposure.) This will avoid the accumulation of excess heat and prolong the tube head life.

C. Tube head cooling curve

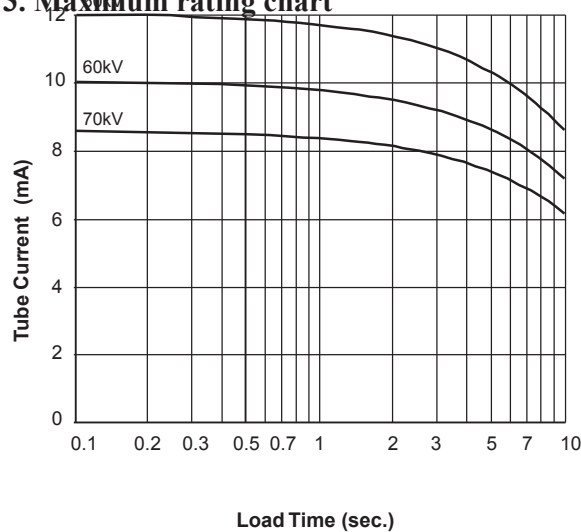
1. Tube Hosung cooling curve



2. Anode thermal characteristics



3. Maximum rating chart



SECTION 2 : PRE-INSTALLATION INSTRUCTION

[1] SUPPORT REQUIREMENTS

A. Arm and head

(1) Floor mounting type (FK1/FK2)

The floor and mounting hardware for floor mounting plate must be sufficient to withstand a **100 kg** withdrawal force.

B. Main Controller (Fig.2-1)

(1) Floor mountint type (FK1/FK2)

The main controller is installed on the pole.

(2) Mobile type (FM)

The main controller is installed on the pole.

(3) Room type (RK)

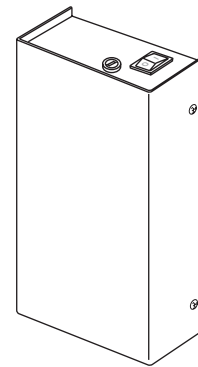
The main controller is installed on the base plate.

C. Sub Controller (Fig.2-1)

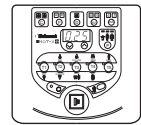
The sub controller for FK1, FM and RK type is installed on the post.

FK2 type sub controller is installed on the wall.

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



Main Controller



Sub Controller

Fig.2-1 Main Controller and Sub Controller

⚠ CAUTION

If the PHOT-X IIs 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 what 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

A. Power supply

PHOT-X IIs 505 system is operated on a power supply of rated line voltage $\pm 10\%$ with a three wire (hot, neutral, earth) circuit, separately connected to the central distribution panel with an over current protection device. Use a flexible cable approved by CEE (13) 52 or 53 consists of 0.75 mm² or 1 mm² conductors. Diameter of the sheath of cable should be 6 ~ 7.5 mm diameter. Line voltage regulation should be within the range of 0 ~ 5% (for 100V, 110V type) or 0 ~ 3% (for 220V, 230V, 240V type) at rated current.

B. Concealed wiring for RK,FK2 (Fig.2-2)

Concealed wiring is accomplished by bringing conduit and wires in a flush mounted junction box located behind the sub controller. Recommended height for the flush junction box is 1310 mm.

Wiring done in this manner should extend 300mm beyond the wall surface to allow sufficient wire for connections. Interconnecting wires between main controller and sub controller should be 4 conductor, 0.5 mm², 300V. Maximum wire run distance is 10 m.

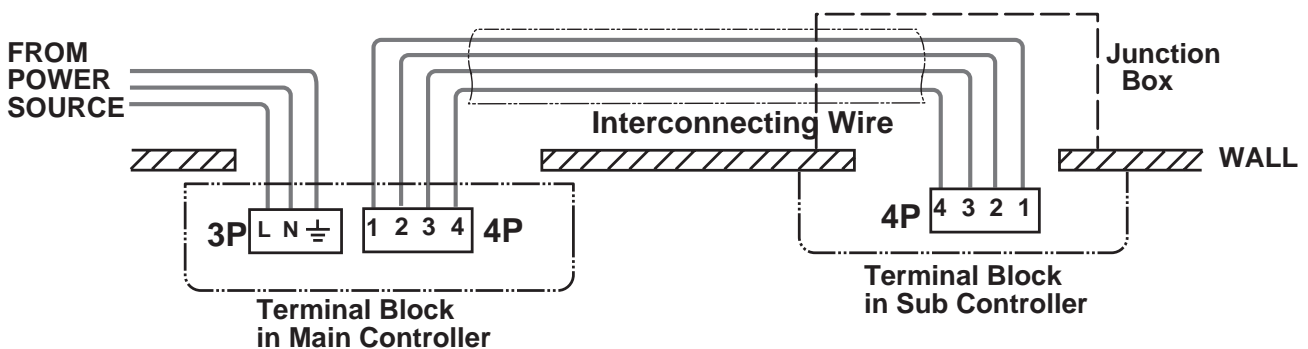


Fig.2-2 Concealed Wiring

Note : All connections, workmanship and materials used must comply with the local codes.

SECTION 3 : INSTALLATION INSTRUCTIONS

CAUTION

This section explains the installation instructions for PHOT-X IIs 505. After the installation is completed, PHOT-X IIs 505 requires the calibration and inspection. Refer to SECTION 5.

[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 300 V AC and 10 mA DC, and capable of indicating true RMS value within 1 sec.
- Standard calculator.

TEST 1 : POWER SUPPLY

Prior to starting the installation inspect the power supply and confirm that the power supply is within rated line voltage $\pm 10\%$ and that the supply is a 3 wire earthed circuit, separately connected to the central distribution panel with an overcurrent protection device.

[2] INSTALLATION OF FK1/FK2 TYPE

A. MOUNTING PLATE AND POLE INSTALLATION

1. Pass through the power supply cable in the centre hole of floor mounting plate. (FK1 Type)
Pass through the power supply cable and inter-connecting wires in the centre hole of floor mounting plate. (FK2 Type)
Fix the floor mounting plate to the floor. Make sure the mounting plate is firmly fixed and can withstand a 100kg withdrawal force. (Fig.3-1)

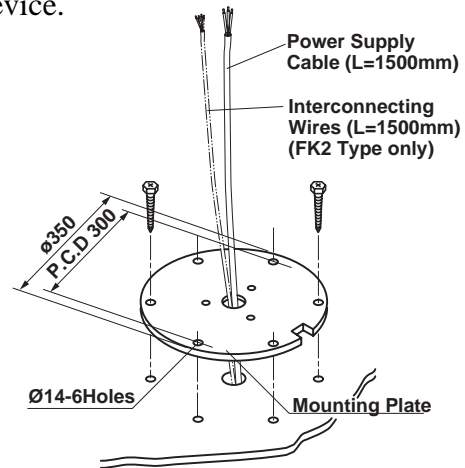


Fig.3-1 Fixing Floor Mounting Plate

2-1. FK1 Type

After setting the cover to the pole, pass through the power supply cable in the lower hole (for main controller) on the pole. Pass through the interconnecting wire from the upper hole to the lower hole on the pole. Connector side of wire should come out from the lower hole.

(Fig.3-2)

2-2. FK2 Type

After setting the cover to the pole, pass through the power supply cable and interconnecting wire in the lower hole (for main controller) on the pole. (Fig.3-2)

3. Attach the pole to the mounting plate by three mounting bolts. Make the pole vertical by adjusting three adjustment bolts and three mounting bolts. Then set the cover to the pole. (Fig.3-2)

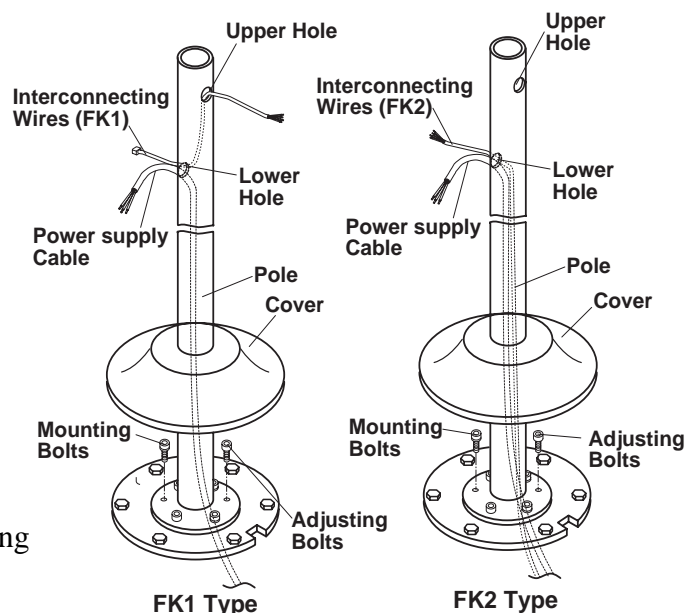


Fig.3-2 Fixing Pole & Cover

B. HORIZONTAL ARM INSTALLATION

1. Remove 2 set screws on the pole and remove the pole bushing. **(Fig.3-3)**
2. Insert the horizontal arm into the pole bushing then set stopper screw and brake plug, brake spring and brake screw on the pole bushing. **(Fig.3-3)**
3. After putting the back supporters to the pole, insert the pole bushing and horizontal arm into the pole with passing through the arm cable into the lower hole on the pole then fix the pole bush with 2 set screws. **(Fig.3-3)**

C. MAIN CONTROLLER FIXING PLATE INSTALLATION

1-1. FK1 Type

Pass through the interconnecting wire into the FK1 back supporter on the upper hole and fix the FK1 back support on the hole with 2 screws. Pass through the arm cable, power supply cable and interconnecting wire into the lower hole on the main controller fixing plate. Fix the main controller fixing plate to the back supporters and pole with 8 screws. **(Fig.3-4)**

1-2. FK2 Type

Pass through the arm cable, power supply cable and interconnecting wire into the lower hole on the main controller fixing plate. Fix the main controller fixing plate to the back supporters and pole with 6 screws. **(Fig.3-4)**

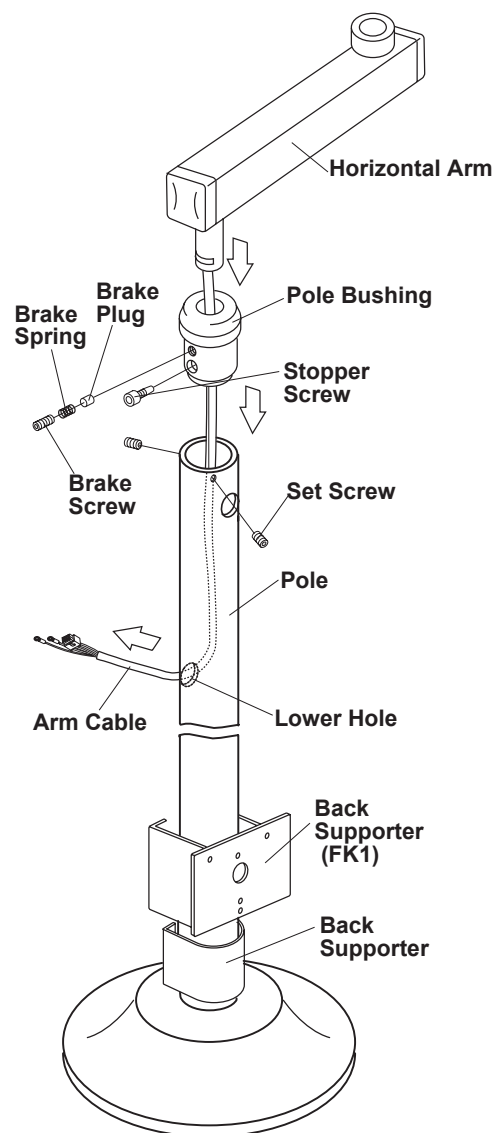


Fig.3-3 Horizontal Arm Installation

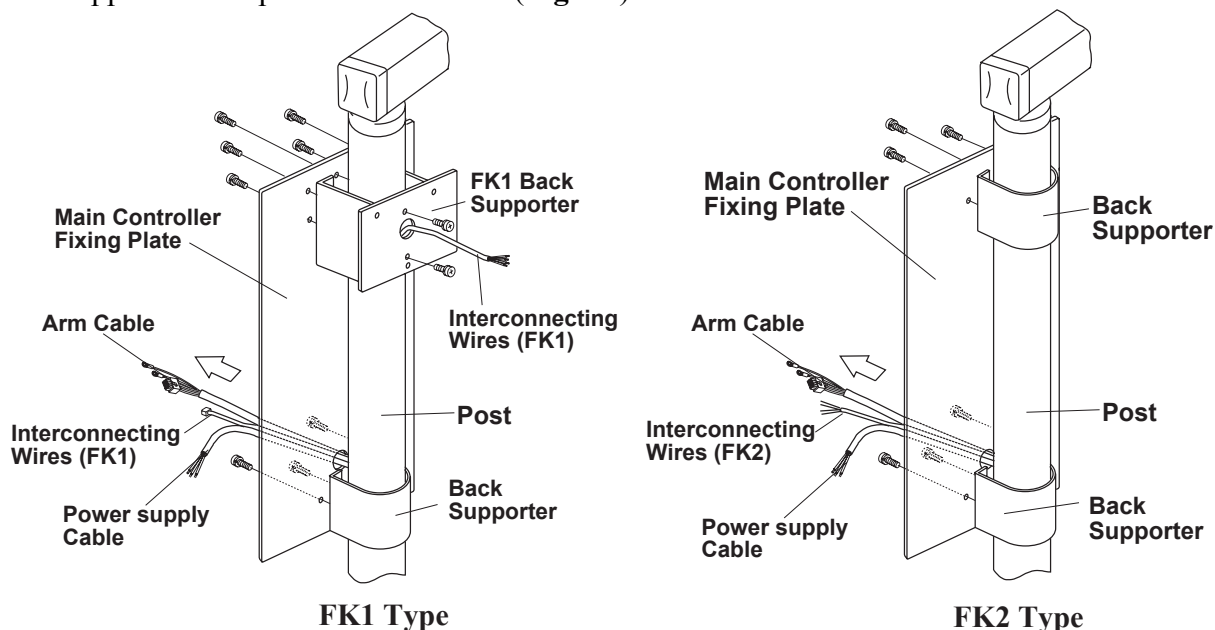


Fig.3-4 Main Controller Fixing Plate Installation

D. BALANCE ARM INSTALLATION

CAUTION

**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.3-5**)
3. 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.3-6**)
4. Secure the 3 wires (Grounded wires) with ring terminals together with the (M5 x 10mm) screw on the bottom cover. (**Fig.3-7A**)

Note : Three ring terminals should not protrude from a chassis plate. (**Fig.3-7A**)

5. Secure the wires from the balance arm to the bottom cover with the nylon cable clamp to prevent damage from twisting. (**Fig.3-7B**) Then connect the **2P** and **8P** connectors. (**Fig.3-7C**)

6. Re-attach the bottom cover to the horizontal arm with two screws. (**Fig.3-5**)

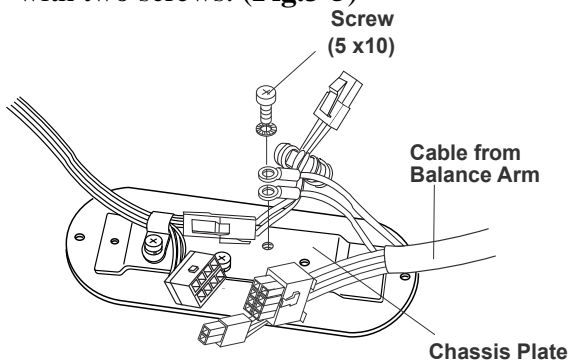


Fig.3-7A Attaching Grounded Wires on Bottom Cover

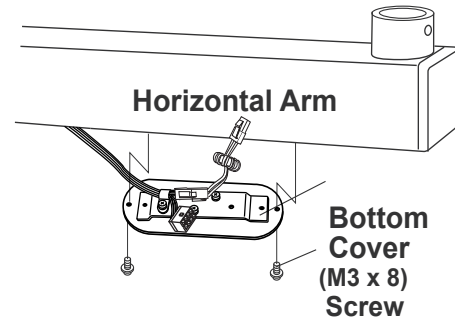


Fig.3-5 Horizontal Arm Bottom Cover

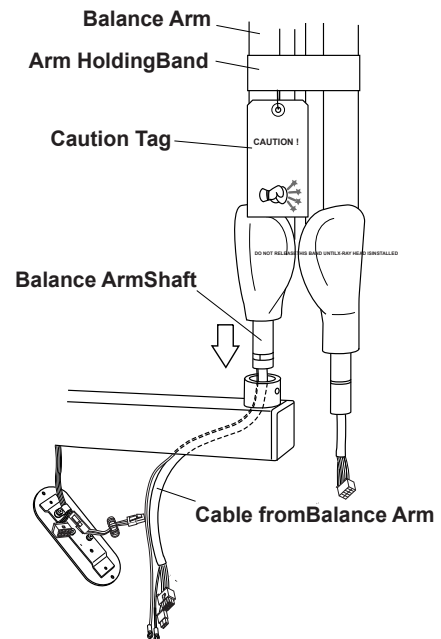


Fig.3-6 Balance Arm Installation

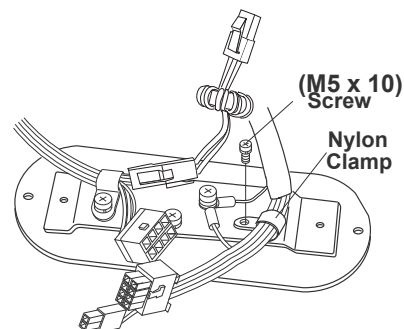


Fig.3-7B Attaching Balance Arm Cable on Bottom Cover

7. Insert the brake plug and brake screw (M6 x 6mm) into the horizontal arm collar. (**Fig.3-8**)

Do not fully tighten.

8. 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.3-8**)

⚠ CAUTION

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

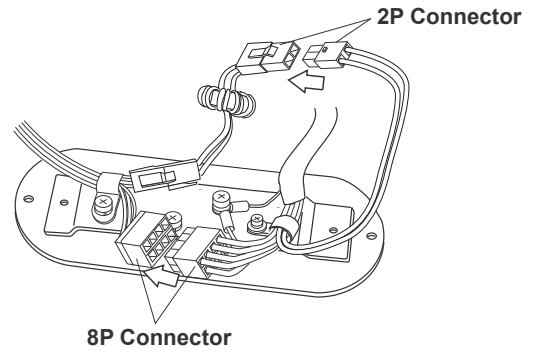


Fig.3-7C Connection of Connectors on Bottom Cover

E. HEAD INSTALLATION

Refer to **page 16**.

F. MAIN CONTROLLER INSTALLATION

Refer to **page 17**.

G. SUB CONTROLLER INSTALLATION

Refer to **page 19**.

H. ADJUSTMENT

1. Tighten the brake screw if arm drifts.
2. Perform the post installation inspection. (**page 21 ~ 23**).

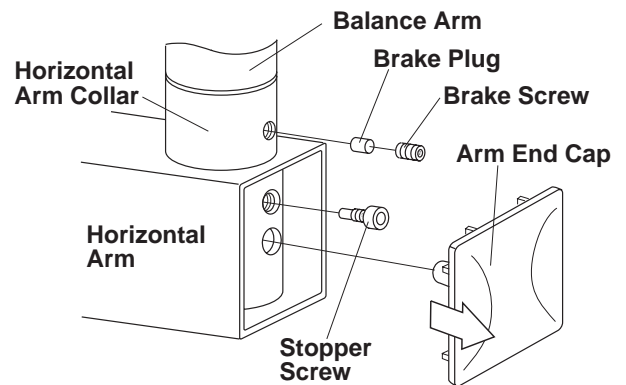


Fig.3-8 Attaching Balance Arm to Horizontal Arm

[3] INSTALLATION OF FM TYPE

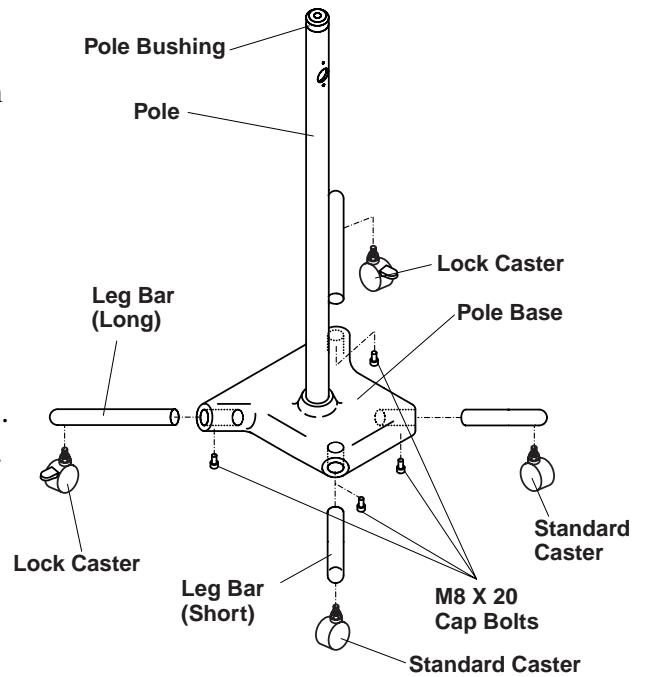
A. POLE ASSEMBLY INSTALLATION (Fig.3-9)

1. Attach four legs bars to the pole base and secure them by hex socket head bolts. (Align the hole on bottom of base with the threaded hole on the leg bar.).

⚠ CAUTION

Two longer leg bars must be attached to the wider ends of the base.

2. Attach the lock casters to the each longer leg bar ends. Attach the standard casters to the shorter leg bar ends.



B. ARM ASSEMBLY INSTALLATION (Fig.3-10)

⚠ WARNING

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

1. Remove 2 mounting screws on the pole and remove the pole bushing.
2. Insert the pole bushing into the shaft of balance arm.
3. Insert brake plug, brake spring and brake screw (M6 x 6mm) into the upper threaded hole of pole bushing. **Do not fully tighten.**
4. Insert the stopper screws into lower threaded hole of pole bushing and tighten securely.
5. After putting 3 back supporters to the pole, insert the pole bushing and balance arm into the pole as the wires go through the lower hole of the pole.

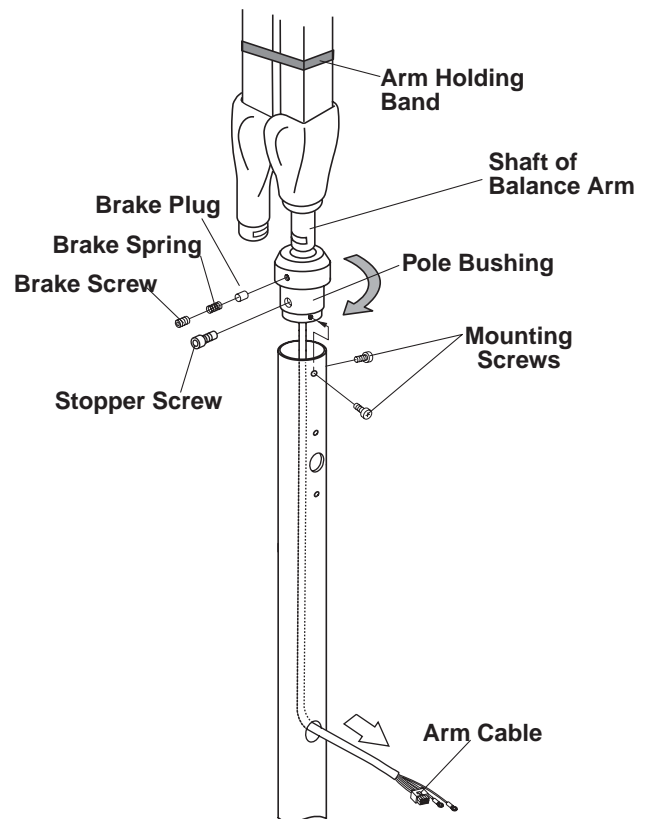


Fig.3-10 Arm Assembly Installation

C. MAIN CONTROLLER FIXING PLATE AND SUB CONTROLLER PLATE INSTALLATION (**Fig.3-11**)

1. Pass through the interconnecting wire from the upper hole to the lower hole on the pole.
Connector side of wire should come out from the lower hole.
2. Pass through the interconnecting wire and arm cable into the large hole on the main controller fixing plate. Set the main controller fixing plate over the lower hole on the pole at the short leg side. Fix the main controller fixing plate with 6 screws to 2 back supporters and the pole.
3. Screw a cable hook on the main controller fixing plate and fix it up right position with a nut from opposite side.
4. Pass through the interconnecting wire into the large hole on the sub controller fixing plate. Set the sub controller fixing plate over the upper hole of the pole at the short leg side. Fix the sub controller fixing plate with 4 screws to the back supporter and the pole.

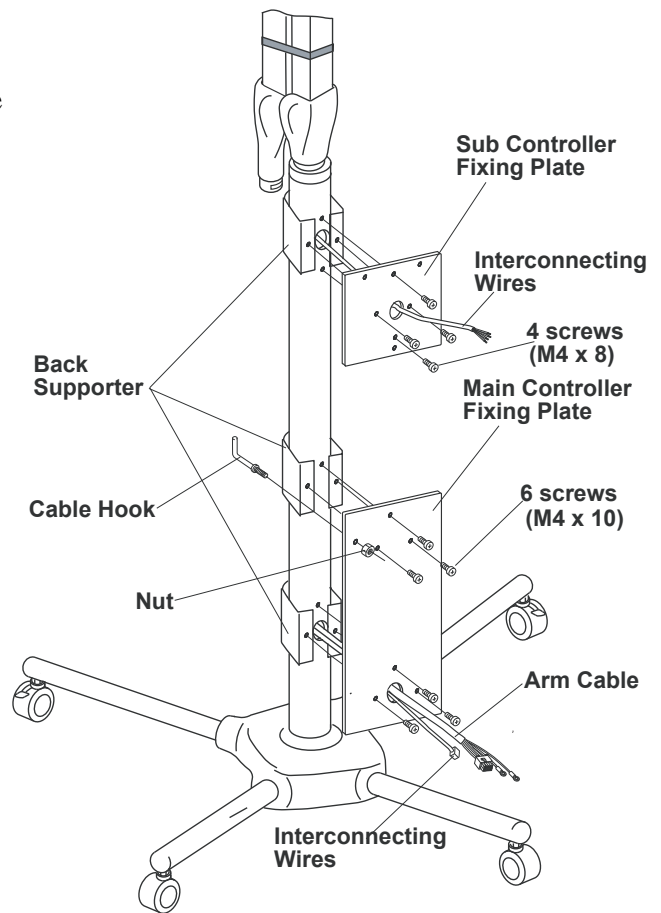


Fig.3-11 Controller Fixing Plates Installation

D. HEAD INSTALLATION

Refer to **page 16**.

E. MAIN CONTROLLER INSTALLATION

Refer to **page 17**.

F. SUB CONTROLLER INSTALLATION

Refer to **page 19**.

G. ADJUSTMENT

1. Tighten the brake screw if arm drifts.
2. Perform the post installation inspection.
(**page 21 ~ 23**).

H. BALANCE ARM SWING ANGLE ADJUSTMENT

After installation of the head, balance arm swing angle should be adjusted following 1 to 3.

1. Keeping the arm at the position (a) of **Fig.3-12**, rotate the pole bushing to the limit by the direction as the arrow in **Fig.3-10** indicates.
2. Fix the pole bushing by two mounting screws on the pole.
3. Confirm the swing angle of the arm is as **Fig.3-12**.

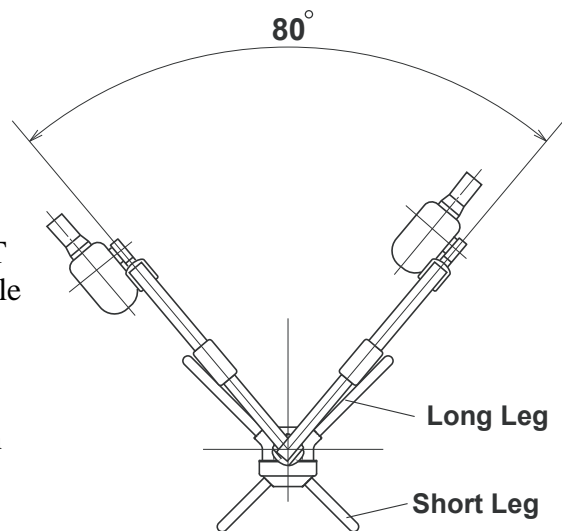


Fig.3-12 Arm Swing Angle Adjustment

[4] INSTALLATION OF RK TYPE

A. BASE AND COLUMN INSTALLATION

1. Fix the base plate on the floor with 5 lag screws (supplied) or with appropriate means. (Fig.3-13)

⚠ CAUTION

Make sure the base plate is fixed on the floor firmly.

2. Insert the sliding post with column cover into the column. The direction of sliding post is shown in Fig.3-14. (Fig.3-14)
3. Install the column on the baseplate with mounting bolts. Make it vertical with adjusting bolts. (Fig.3-15)

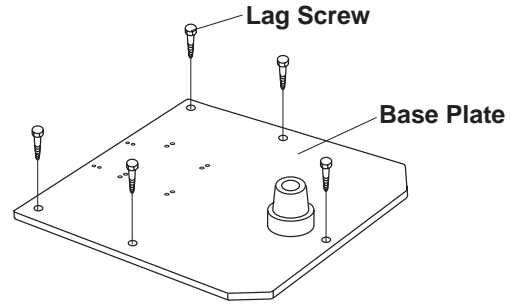


Fig.3-13 Fixing Base Plate to Floor

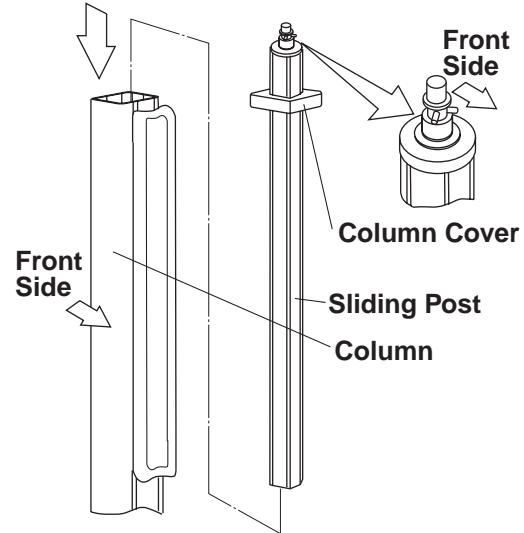


Fig.3-14 Setting Sliding Post

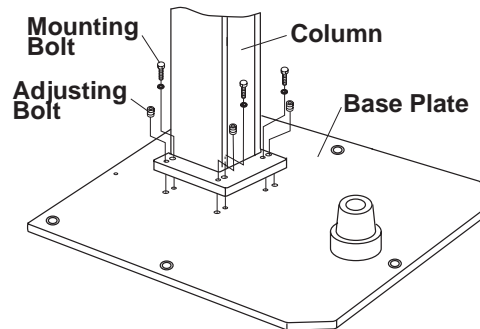


Fig.3-15 Fixing Column on Base Plate

⚠ CAUTION

When installing the swing arm assembly on the sliding post, keep holding the sliding post.

1. Pull down the sliding post into the column and hold it. Set the thrust washer on the top of sliding post. Keep holding the sliding post and insert the swing arm assembly on the top of sliding post. After setting the swing arm on the sliding post, slowly release the sliding post. (Fig.3-16)
2. Set and fix the cable guide on the rear side of column. (Fig.3-16)

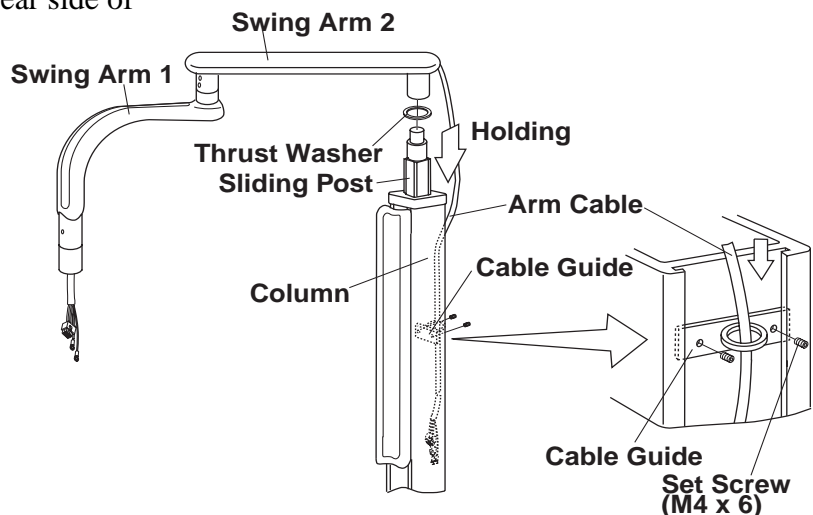


Fig.3-16 Swing Arm Installation

2. Set the stopper screw into lower threaded hole of swing arm 2. (**Fig.3-17**)
3. Set the brake plug then brake spring and brake screw into the upper hole of swing arm 2. (**Fig.3-17**)
Tighten the brake screw, IF ARM DRIFTS.
DO NOT FULLY TIGHTEN.
4. Fix the cable guide on the rear side of column with 2 screws. (**Fig.3-16**)

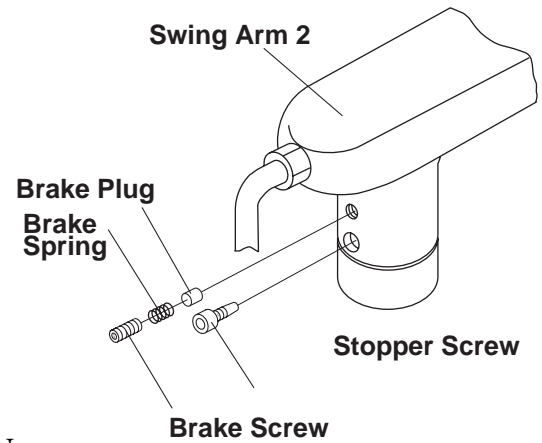


Fig.3-17 Setting Brake Screw and Stopper Screw on Swing Arm 2

C. STOOL AND BACKREST CUSHION INSTALLATION

1. Slide up the backrest cushion to the top of column.
2. Insert the gas pump into the gas pump bracket.
Mount the stool seat on the gas pump then press them. (**Fig.3-18**)

D. HEAD INSTALLATION

Refer to **page 16**.

E. MAIN CONTROLLER INSTALLATION

Refer to **page 17**.

After installation of the main controller, fix the main controller on the base plate. (**Fig.3-18**)

F. SUB CONTROLLER INSTALLATION

Refer to **page 19**.

G. ADJUSTMENT

1. Tighten the brake screw if arm drifts.
2. Perform the post installation inspection.
(**page 21 ~ 23**)

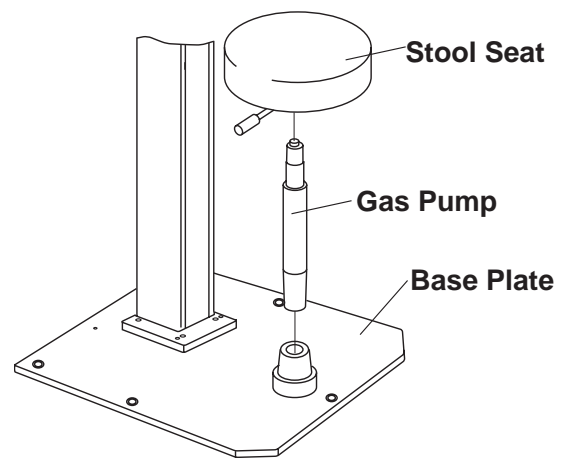


Fig.3-18 Setting Stool

[5] HEAD ASSEMBLY INSTALLATION

WARNING

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.3-19)
2. Open the yoke inside cover of x-ray head by removing (M4 x15mm) countersunk screw (Fig.3-20)

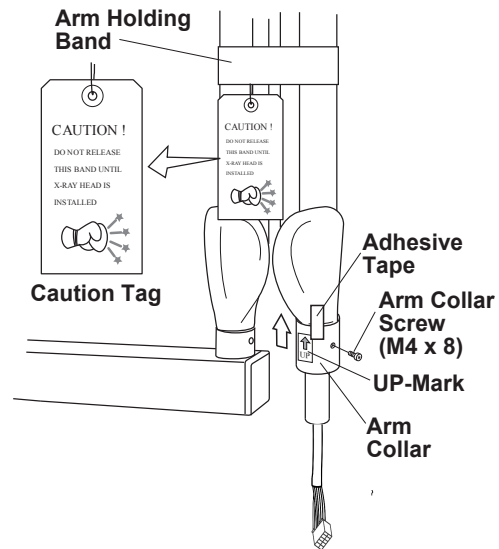


Fig.3-19 Setting Arm Collar on Balance Arm

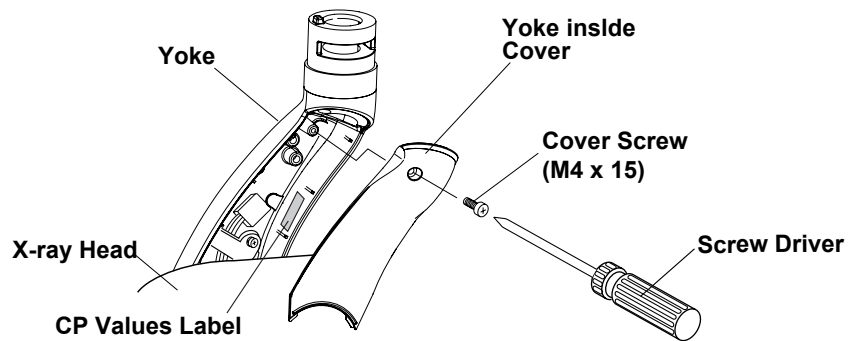


Fig.3-20 Removing Yoke Inside Cover

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.3-21)
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.3-21)
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.3-21)

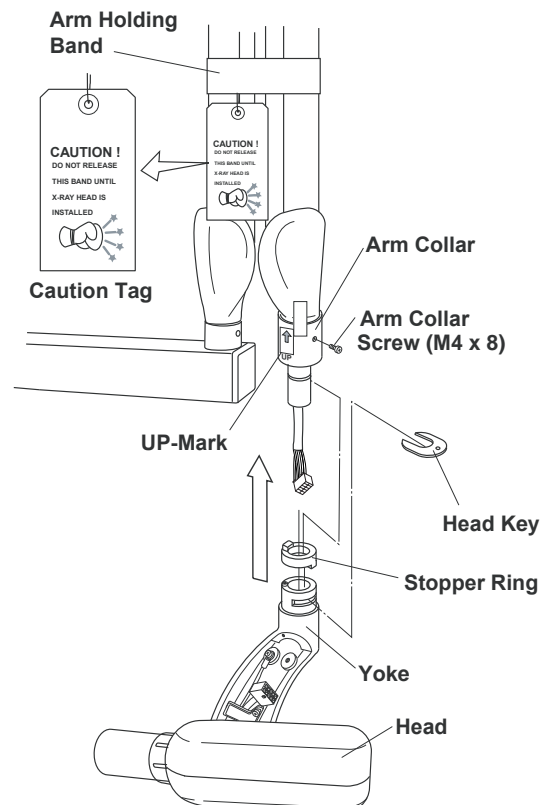


Fig.3-21 X-ray Head Installation

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.3-22**)

7. Remove the (M5 x 10mm) screw from the ground terminal inside of the yoke housing. Secure the green ground wires from balance arm and head to the ground terminal with the (M5 x 10mm) screw. (**Fig.3-22**)

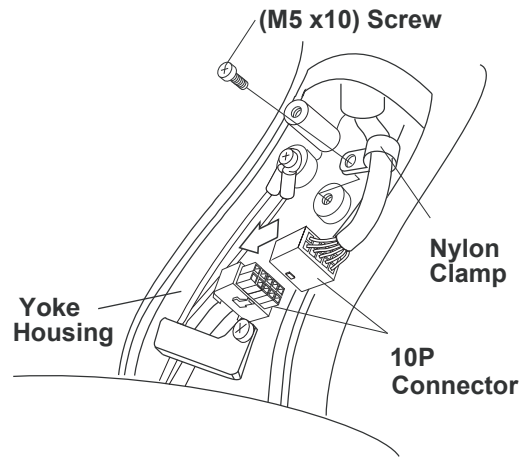


Fig.3-22 Connection 10P Connector in Yoke

8. Reattach the yoke inside cover with the screw (M3 x 8mm). Before closing the cover, note the CP values on the CP values label inside of the yoke. (**Fig.3-20**)

9. Remove arm holding band.

[6] MAIN CONTROLLER INSTALLATION

1. Remove 4 cover screws and open the front cover. (**Fig.3-23A, B**)

2-1. FK1/FK2 Type

After passing through the arm cable, interconnecting wires and power supply cable into the hole on the chassis of main controller, fix the main controller on the main controller fixing plate with 4 screws. (**Fig.3-23A**)

2-2. FM Type

After passing through the arm cable and interconnecting wires into the hole on the chassis of main controller, fix the main controller on the main controller fixing plate with 4 screws.

Power supply cable is pre-fixed on the main controller. (**Fig.3-23A**)

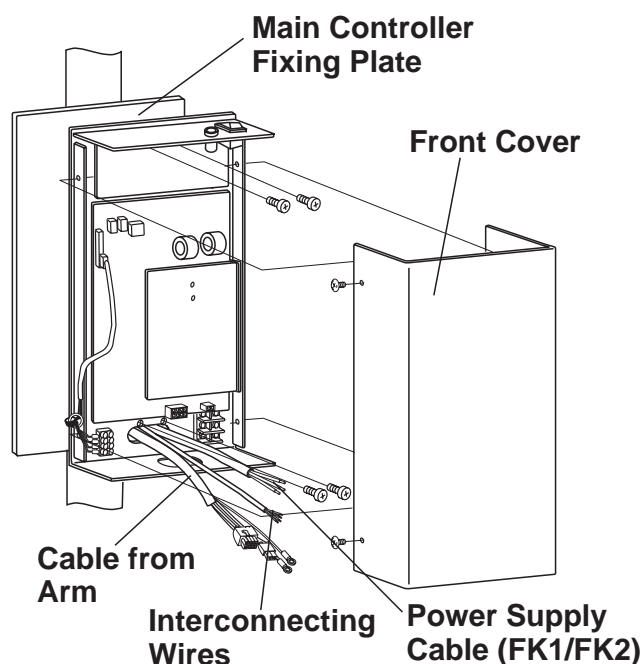


Fig.3-23A Fixing Main Controller (FK1/FK2, FM Type)

2-3. RK Type

- Attach the mounting plate to the main controller with 2 screws. The direction of the mounting plate should be as Fig 3-23B in order to attach two wire clamps to the bottom of the main controller.
- Take out the green ground wire through the bottom hole on the chassis of main controller and secure it to the base of column with M5 × 8 mm screw. **(Fig 3-23C)**
- Pass through the arm cable, interconnecting wires and power supply cable into the bottom hole on the chassis of main controller.
- Arm cable should be fixed by 2 clamps, one nylon clamp (insulated type) for holding the arm cable and one plating clamp (conducting type) for shielding wire to be grounded. **(Fig. 3-23B)**

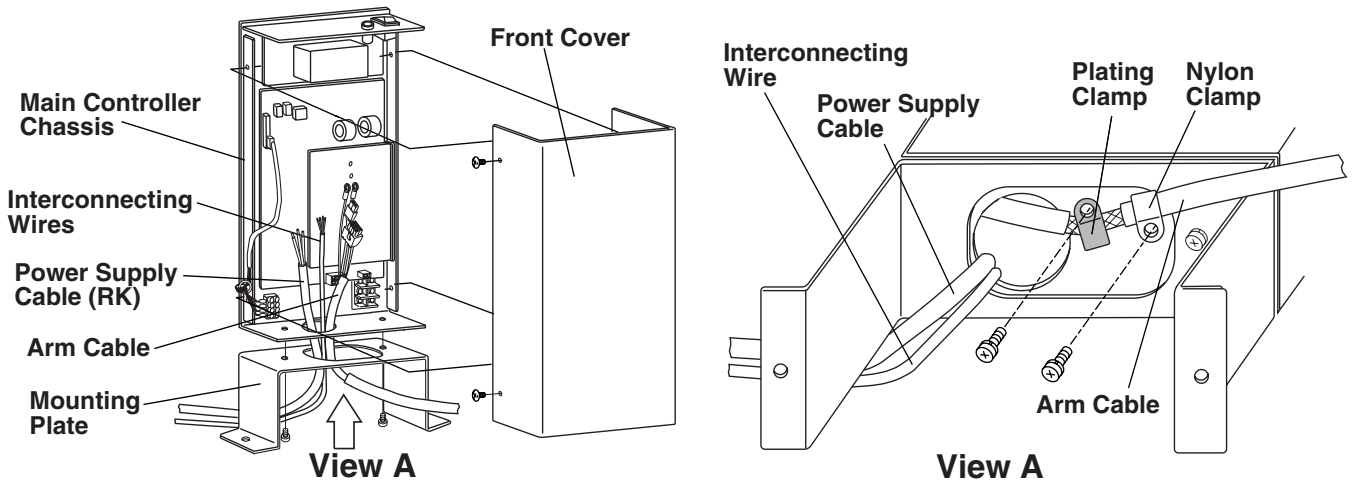


Fig.3-23B Fixing Main Controller (RK Type)

- Cut the wires of power supply cable to workable length and strip 10 mm of insulation. Connect the wires of power supply cable to 3P terminal block. **(Fig 3-24)**

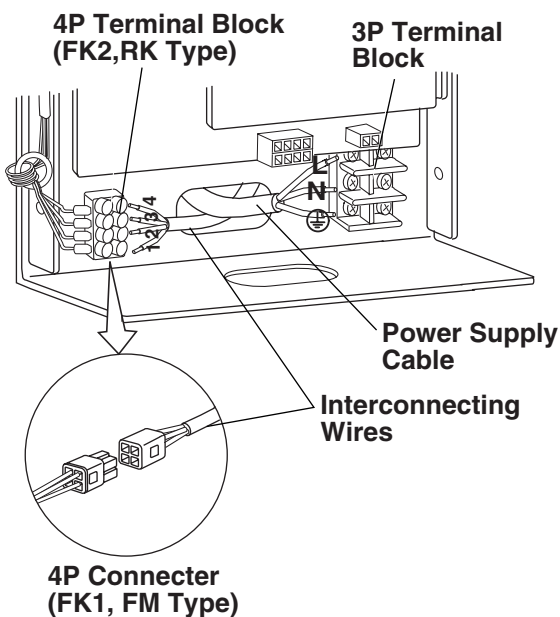


Fig.3-24 Power Supply Cable and Interconnecting Wires Connection

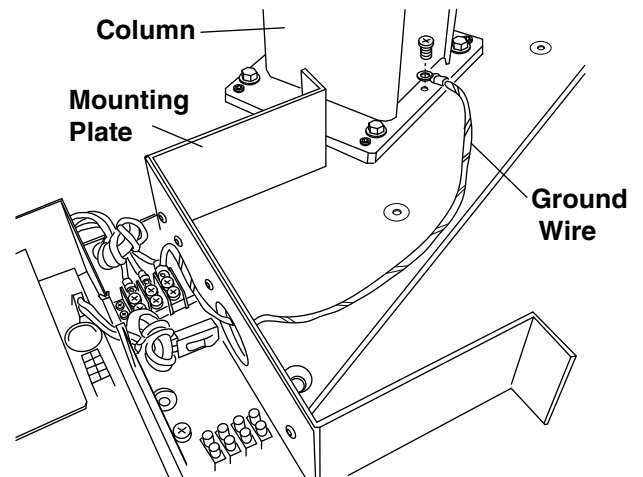


Fig.3-23C Ground Wire Connection (RK Type)

4-1. FK2, RK Type

Cut the interconnecting wires to workable length and strip 10mm insulation. Connect the wires to 4P terminal block. **(Fig.3-24)**

4-2. FK1, FM Type

Connect 4P connector of interconnecting wires to 4P connector in the main controller **(Fig.3-24)**

5. Connect 8P connector of the arm cable to the 8P connector on power PC board.
Connect 2P connector of the arm cable to the 2P connector coming from PC board.
(Fig.3-25)

6. Connect 2 wires with ring terminals from the arm cable to the chassis with a M5 screw.
(Fig.3-25)

Note : The front cover for the main controller should not be closed until all installation and the post-installation inspections and confirmation are completed.

For RK type : Mounting plate should be attached to the base plate with 2 screws after the front cover for main controller is closed.

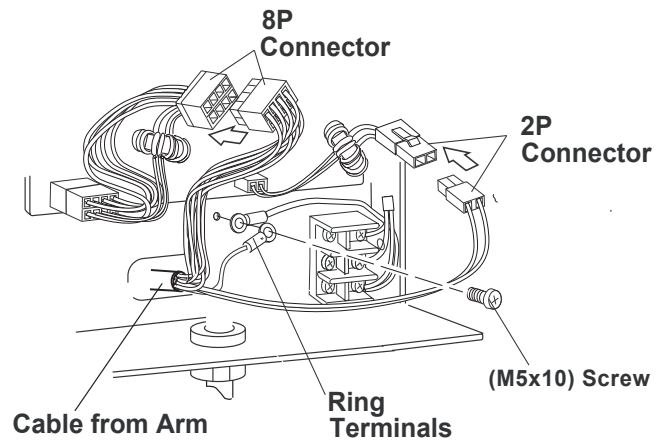


Fig.3-25 Connecting 2P and 8P Connectors on Power PC Board

[7] SUB CONTROLLER INSTALLATION

1. Remove two (M3 x8mm) screws under side of the controller and open the front panel. (Fig.3-26)
2. Disconnect the 4P connector from the timer PC Board.
(Fig.3-27)
3. Route the interconnecting wires from the main controller through access hole of chassis and mount on the wall with three (ø4.1 x 20mm) wood screws (FK2, RK type) or on the sub controller plate with three (M4 x 10) screws. (FK1,FM type).
(Fig.3-27)
4. Cut 4 interconnecting wires from main controller to a workable length. Strip 5mm 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.3-28)

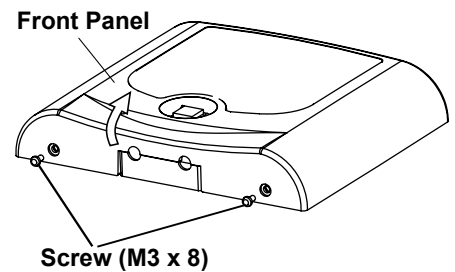


Fig.3-26 Opening Front Panel

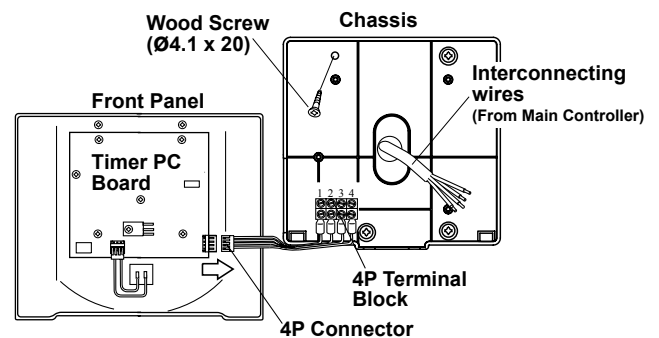


Fig.3-27 Attaching Sub Controller Chassis

⚠ CAUTION

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.3-27)

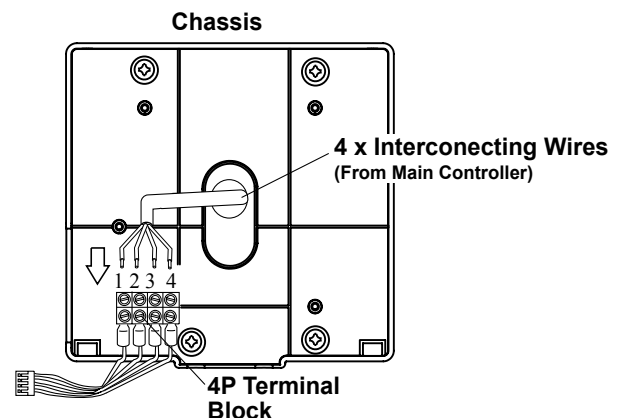


Fig.3-28 Interconnecting Wires Connection in Sub Controller

- 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.3-26 & Fig.3-29)

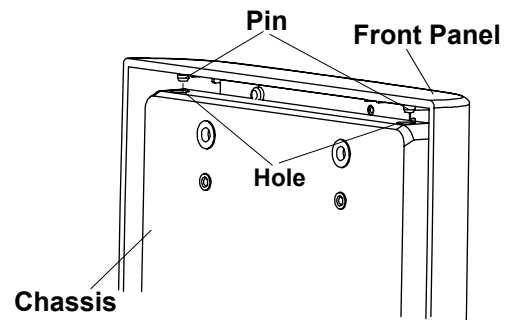


Fig.3-29 Upper Side of Sub Controller

[8] HAND EXPOSURE SWITCH

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.

- Confirm the contents of optional hand exposure switch kit. (Fig.3-30)

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

- Remove two (M3 x 8mm) screws from top of the sub controller and open front panel.
- Connect the connector at the end of hand exposure switch coil cord to CN3 connector on the timer PC board. (Fig.3-31)
- 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.3-31)
- Place the hook on the top corner (right or left) of controller and attach it with the tapping screw (ø3 x 8mm). (Fig.3-32)

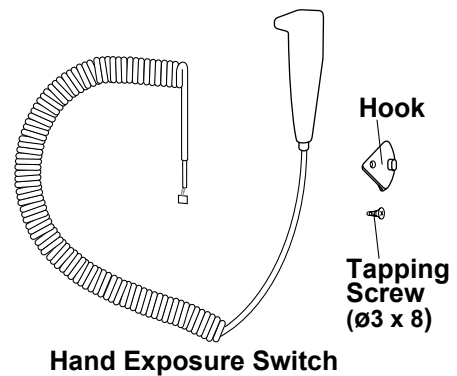


Fig.3-30 Hand Exposure Switch Kit

[9] 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, emission will be stopped.

It is recommended to indicate the state of this interlock switch. (Fig.3-33)

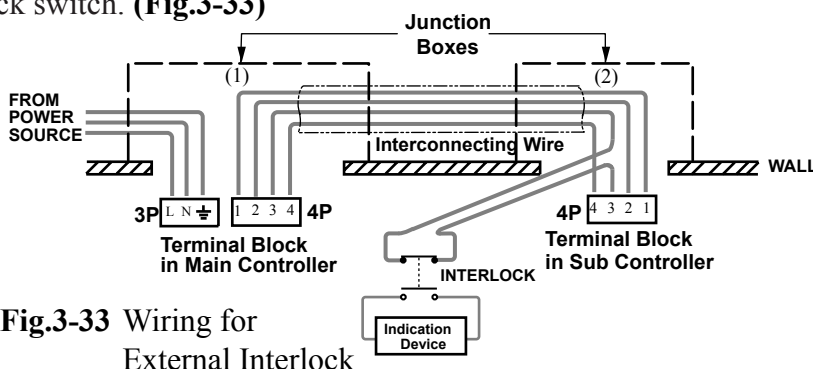


Fig.3-33 Wiring for External Interlock

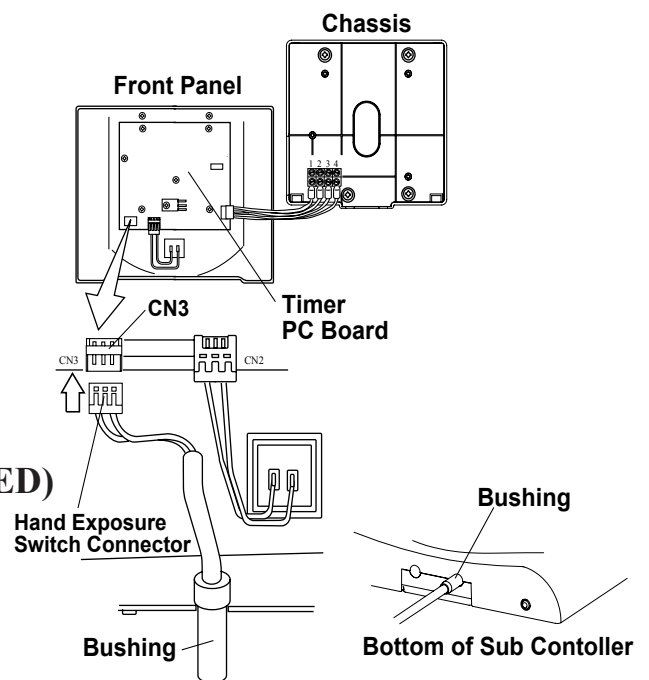


Fig.3-31 Connecting Hand Exposure Switch

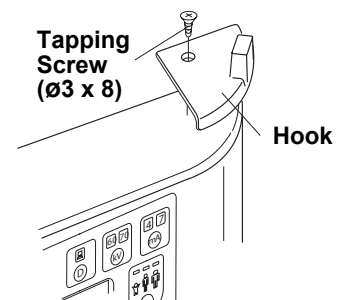


Fig.3-32 Attaching Hand Exposure Switch Hook

SECTION 4 : POST INSTALLATION INSPECTION

[1] FK1/FK2 TYPE

A. LEVEL ADJUSTMENT FOR FK1/FK2 TYPE

(Fig.4-1)

Level for FK1/FK2 type can be adjusted by 3 level adjusting bolts located bottom of the pole.

B. SWING FRICTION ADJUSTMENT FOR FK1/FK2 TYPE (Fig.4-2)

1. Horizontal Arm Swing Friction Adjustment

The horizontal arm swing friction can be adjusted by the brake screw located on the pole bush.

⚠ CAUTION

When adjusting arm swing friction, set the arm holding band on the balance arm for safety.

Remove 2 set screws and pull out the pole bush and adjust the brake screw.

2. Balance Arm Swing Friction Adjustment

The Balance arm swing friction can be adjusted by the brake screw located end of the horizontal arm.

C. BALANCE ARM TENSION ADJUSTMENT (Fig.4-3)

1. Place the balance arm into position.
2. If either balance arm drift higher or lower from the set position, remove the spring adjuster cover and adjust the balance arm spring tension with the balance arm wrench.

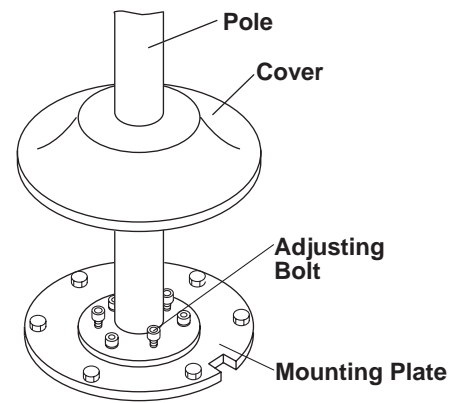


Fig.4-1 Level Adjustment for FK1/FK2

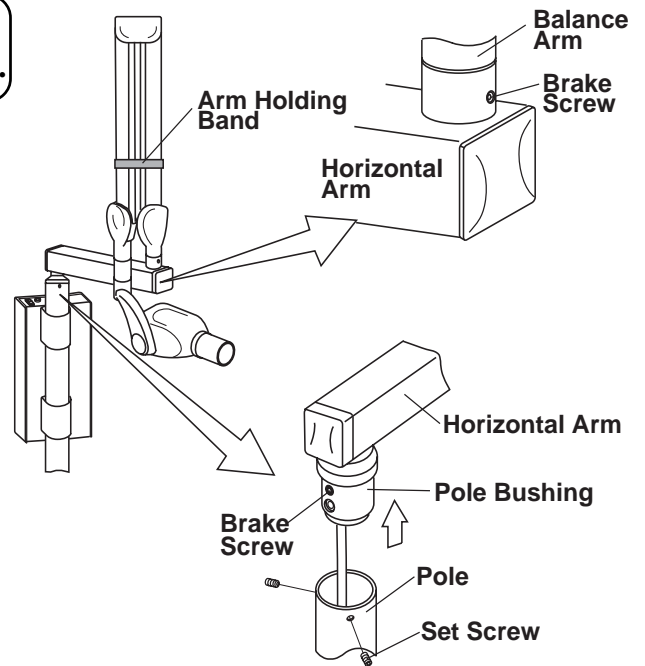


Fig.4-2 Swing Friction Adjustment for FK1/FK2

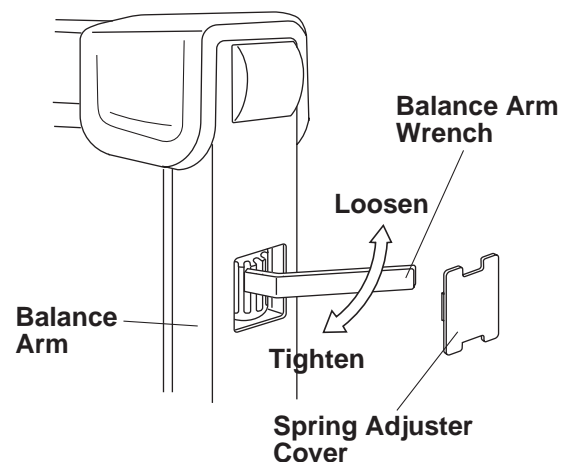


Fig.4-3 Balance Arm Tension Adjustment for FK1/FK2 and FM

[2] FM TYPE

A. LEVEL ADJUSTMENT FOR FM TYPE

(Fig.4-4)

Level for FM type can be adjusted by 4 x casters located bottom of the legs

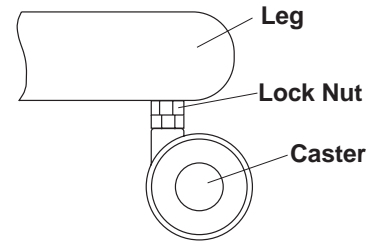


Fig.4-4 Level Adjustment for FM

B. BALNNE ARM SWING FRICTION ADJUSTMENT FOR FM TYPE (Fig.4-5)

⚠ CAUTION

When adjusting balance arm swing friction, set the arm holding band on the balance arm for safety.

Remove 2 mounting screws and pull out the pole bush with the balance arm assembly and adjust the brake screw.

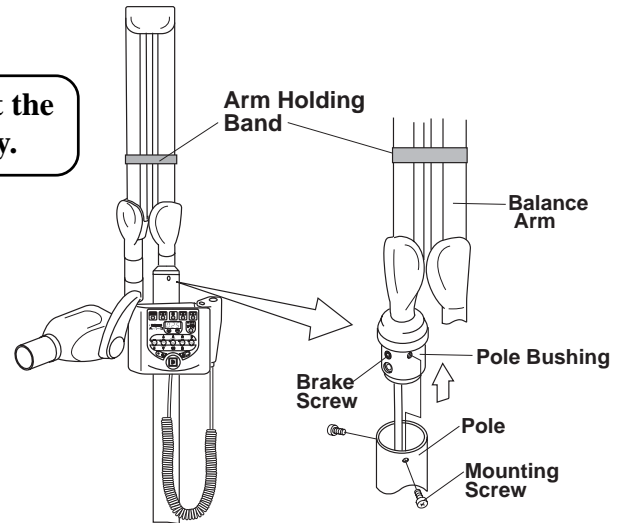


Fig.4-5 Balance Arm Swing Friction Adjustment for FM

C. BALANCE ARM TENSION ADJUSTMENT

(Fig.4-3)

1. Place the balance arm into position.
2. If either balance arm drift higher or lower from the set position, remove the spring adjuster cover and adjust the balance arm spring tension with the balance arm wrench.

[3] RK TYPE

A. LEVEL ADJUSTMENT FOR RK TYPE

(Fig.4-6)

Level for RK type can be adjusted by 4 level adjuster screws located bottom of the column.

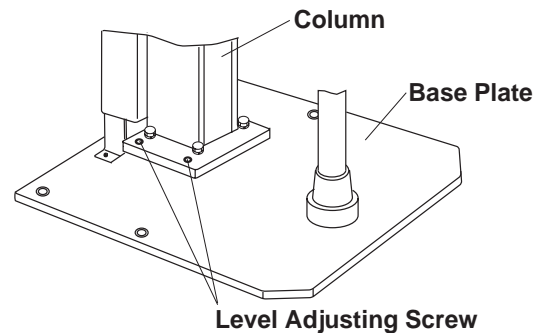


Fig.4-6 Level Adjustment for RK

B. SWING ARM FRICTION ADJUSTMENT FOR RK TYPE (Fig.4-7)

1. Swing Friction Adjustment for Swing Arm 1
The swing arm 1 friction can be adjusted by the brake screw A on the swing arm 2.
2. Swing Friction Adjustment for Swing Arm 2
The swing arm 2 friction can be adjusted by the brake screw B on the swing arm 2.

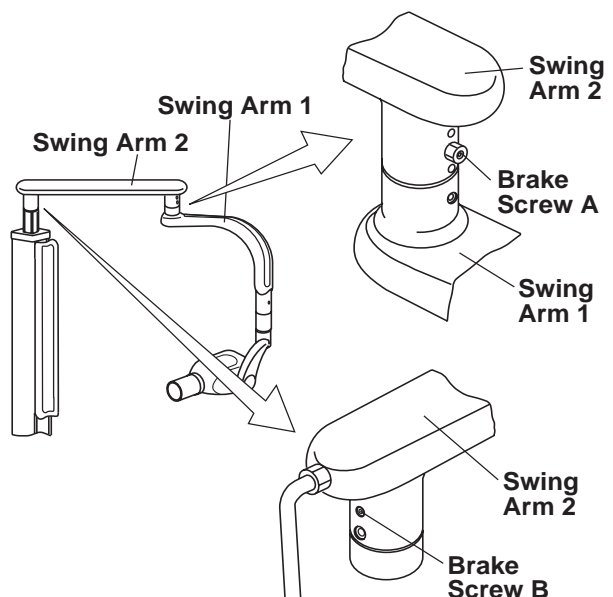


Fig.4-7 Swing Arm Friction Adjustment for RK

[4] 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.4-8)

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.

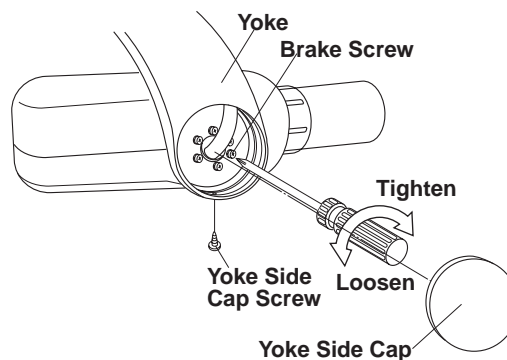


Fig.4-8 Head Positioning

SECTION 5 : CONTROL IDENTIFICATION AND OPERATION

[1] MAJOR COMPONENTS AND CONTROL IDENTIFICATION

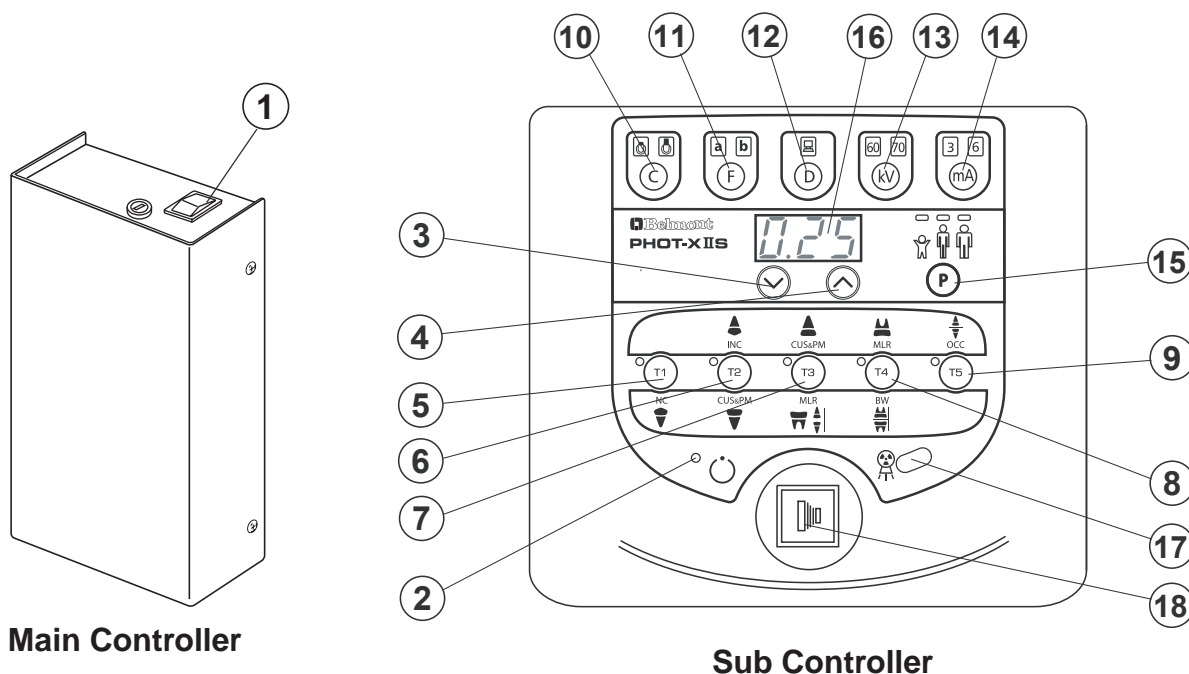


Fig.5-1 Major Components and Control Identification

- | | |
|---|---------------------------------|
| ① Main Power Switch | ⑩ Cone Type Selection Switch |
| ② Ready Light | ⑪ Film Speed Selection Switch |
| ③ Exposure Time Adjusting Switch (Down) | ⑫ Digital Imaging Switch |
| ④ Exposure Time Adjusting Switch (Up) | ⑬ kV Selection Switch |
| ⑤ Tooth Selection Switch (T1) | ⑭ mA Selection Switch |
| ⑥ Tooth Selection Switch (T2) | ⑮ Patient Size Selection Switch |
| ⑦ Tooth Selection Switch (T3) | ⑯ Exposure Time Display Window |
| ⑧ Tooth Selection Switch (T4) | ⑰ Exposure Warning Light |
| ⑨ Tooth Selection Switch (T5) | ⑱ Exposure 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. (Ready light and pre-select lights for cone type, film or digital, kV, mA, and patient size illuminate.)

It is recommended to keep this switch OFF when the unit is not in use, in order to prevent an accidental exposure.

IMPORTANT : To prevent the risk of an accidental exposure, push the lower side of this switch to the OFF position, when the unit is not in use.

② Ready Light

This light illuminates when the line voltage is within operable range ($\pm 10\%$ of rated voltage). When this light is not on, exposure can not be made.

③④ Exposure Time Adjusting Switches

By momentarily pushing the \wedge (or \vee) switch, the exposure time displayed increases (or decreases) by one increment. By keeping the switch depressed more 2 sec., the exposure time displayed increases (or decreases) continuously until the switch is released.

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 (T1 ~ T5)

Pushing one of these switches sets the exposure time automatically for the following ⑩ ~ ⑮ .

⑤ T1 : Incisor of Mandible

⑥ T2 : Incisor of Maxilla, Cuspid & Premolar of Mandible

⑦ T3 : Cuspid & Premolar of Maxilla, Molars of Mandible, Bitewing

⑧ T4 : Molar of Maxilla, Bitewing Molars

⑨ T5 : Occlusal

If the T1 switch⑤ is depressed more than 3 sec. unit goes into " Lock Mode". In lock mode, the only functional switch is the power switch. To exit from the lock mode, depress the T1 switch more than 3 sec. again.

⑩ Cone Type Selection Switch

Depressing this switch for more than 2 sec. selects the cone type : 8" standard cone or 12" optional long cone. (If the optional rectangular cone is to be used, select the 8" standard cone setting.)

⑪ Film Speed Selection Switch

a. PHOT-X IIs has 16 film speed settings. (F.00 ~ F.15)

Two speed settings are pre-set at the factory (a & b) and can be selected with switch⑪.

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, PHOT-X IIs 505 x-ray can provide 16 different film speeds (F.00 ~ F.15) and any two of them can be programmed for easy selection. If doctor uses a different film speed, or prefers darker (or lighter) radiographs, the new speed can be programmed as follows. Higher speed settings make films darker. If film speed is increased by 1, exposure time becomes 25 % longer.

1. Keep the kV selection switch and mA selection switch depressed simultaneously for more than 3 seconds. Release the switches if the ready light starts to flash.

2. Push F switch momentarily until the "a" light above the F switch illuminates. The exposure time display window shows the present film speed for "a" setting. (The factory default setting, F.09 should be displayed.) By depressing ⤴ or ⤵ switch, increase or decrease film speed number until desired number for "a" setting is displayed.
 3. To change the "b" setting from the factory default, F.05, push F switch momentarily until the "b" light illuminates. By depressing ⤴ or ⤵ switch, increase or decrease film speed until the desired number for "b" setting is displayed.
 4. Press T1 switch to store these settings, then turn the main power switch off.
- b. Pushing **Film Speed Selection Switch** ⑪ momentarily displays the selected film speed setting in the **Exposure Time Display Window** ⑩
Depressing this switch for more than 2 sec. changes the film type being selected.
- c. If the **Digital Imaging Switch** ⑫ is depressed, both of the film speed indicating lights (a & b) are turned off.

⑫ Digital Imaging Switch

If a digital imaging system is used, shorter exposure time is often required. PHOT-X IIs has 16 speeds for digital imaging (d.00 ~ d.15). Pushing this switch momentarily displays the speed being selected in the **Exposure Time Display Window** ⑩. With the factory speed setting d.10, the exposure time becomes half of F.10 setting.

As the sensitivity is different according to each manufacturer of digital imaging sensors, this setting should be adjusted. To get a darker image, increase the speed setting and to get a lighter image, decrease the speed setting. If the speed setting is increased by 1, exposure time becomes 12 % longer.

1. Keep kV selection switch and mA selection switch depressed simultaneously for more than 3 seconds.
2. Push D switch momentarily until the light above the D switch illuminates and the exposure time display window shows the present speed setting. (The factory default setting d.10 should be displayed.)
3. By depressing ⤴ or ⤵ switch, increase or decrease speed until the desired number is displayed.
4. Press **T1 switch** to store these settings, then turn the main power switch off.

⑬ kV Selection Switch

Momentarily depressing this switch will change the tube potential to 60 or 70 kV. If either the Film Speed Switch ⑪ or Digital Imaging Switch ⑫ is depressed, 60kV is automatically selected.

⑭ mA Selection Switch

Momentarily depressing this switch will change the tube current setting (3 or 6 mA). If the Digital Imaging Switch ⑫ is depressed, 3 mA is automatically selected and if the Film Speed Switch ⑪ is depressed, 6 mA is automatically selected.

TABLE 1. Speed Setting and Exposure Time (Regular Cone) [unit : sec.]

Speed Setting	kV	mA	Child					Adult					Large Adult				
			T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
F.09	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
		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
	70	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
		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
F.05	60	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
		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
	70	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
		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
d.10	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
		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
	70	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
		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 2. Speed Setting and Exposure Time (Long Cone) [unit : sec.]

Speed Setting	kV	mA	Child					Adult					Large Adult				
			T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
F.09	60	3	0.56	0.63	0.80	0.90	1.25	0.90	1.12	1.25	1.40	*	1.12	1.40	1.60	1.80	*
		6	0.28	0.32	0.40	0.45	0.63	0.45	0.56	0.63	0.71	1.12	0.56	0.63	0.80	0.90	1.40
	70	3	0.40	0.45	0.56	0.63	0.90	0.63	0.80	0.90	1.00	1.60	0.80	1.00	1.12	1.25	2.00
		6	0.20	0.28	0.36	0.40	0.45	0.32	0.40	0.45	0.50	0.80	0.40	0.50	0.56	0.63	1.00
F.05	60	3	0.22	0.28	0.32	0.36	0.56	0.36	0.45	0.56	0.63	0.90	0.45	0.56	0.63	0.80	1.12
		6	0.11	0.13	0.16	0.18	0.28	0.18	0.22	0.28	0.32	0.45	0.22	0.28	0.32	0.40	0.56
	70	3	0.16	0.20	0.22	0.25	0.40	0.25	0.32	0.40	0.45	0.80	0.40	0.50	0.56	0.71	1.00
		6	0.08	0.10	0.11	0.13	0.20	0.13	0.16	0.20	0.22	0.32	0.16	0.20	0.25	0.28	0.40
d.10	60	3	0.32	0.40	0.50	0.56	0.80	0.56	0.63	0.80	0.90	1.40	0.71	0.80	1.00	1.12	1.60
		6	0.16	0.20	0.25	0.28	0.40	0.28	0.32	0.40	0.45	0.63	0.36	0.40	0.50	0.56	0.80
	70	3	0.25	0.28	0.36	0.40	0.56	0.40	0.50	0.56	0.63	1.00	0.50	0.56	0.71	0.80	1.25
		6	0.11	0.14	0.18	0.20	0.28	0.20	0.25	0.28	0.32	0.50	0.25	0.28	0.36	0.40	0.63

⑮ Patient Size Selection Switch

This switch alters the selection of patient type/size to be radiographed (child→adult→obese→child) and sets the exposure time automatically. If the weight of child is less than 20kg, press Ⓢ switch once after setting to child. If the weight of child is over 30kg and less than 50kg, press Ⓢ switch once after setting to child. If the weight of child is over 50kg and less than 70kg, press Ⓢ 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.

⑯ Exposure Time Display Window

This window displays the selected exposure time. Estimated air kerma (radiation output) at distal end of cone can be displayed in this window by manual operation or automatically after the exposure. If an abnormal condition exists or a malfunction occurs, an Error Code is also displayed in this window. (See Section :[8] **ERROR CODES**)

⑰ Exposure Warning Light

Illumination of this light indicates 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 Light** 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 in **Exposure Time Display Window** ⑯.

[3] OPERATING PROCEDURES

1. Turn ON the Main Power Switch ①.
2. Confirm that Ready Light ② is illuminated.

NOTE : The ready light will not illuminate unless the incoming line voltage is correct and within the x-ray's operable range (rated voltage $\pm 10\%$).

3. Select the appropriate tooth type (⑤ ~ 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 (⤴ or ⤵) until the desired exposure time appears in the Exposure Time Display Window ⑯. While the unit is in manual mode, other selection switches (⑤ ~ ⑮) do not affect exposure time. (All of the tooth selection lights are off.) To return to the automatic exposure time selection mode, depress any one of Tooth Selection Switches (⑤ ~ ⑨).

4. Depress the Exposure Switch ⑱. When the Exposure Switch is depressed, the Exp. Warning Light ⑰ illuminates and the audible warning sounds. Do not release the Exposure Switch until the Exposure Warning Light and audible warning automatically shut off. Failure to keep the switch depressed will result in exposure being terminated prematurely.
5. To continue to radiograph other teeth, just select appropriate Tooth Selection Switches (⑤ ~ ⑨).

IMPORTANT : To protect x-ray tubehead 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.)

6. Turn OFF the Main Power Switch ① in order to prevent accidental exposures when the unit is not in use.

NOTE : If the unit left over 8 min. without being operated and the Main Power Switch ① is kept on, figure "1" runs through the Exposure Time Display Window ⑯. This does not mean that malfunction of the unit has occurred ; this is an energy saving feature. The unit returns to ready condition by pressing any one of the switches, except the Exposure Switch ⑱.

[4] ESTIMATED AIR KERMA

Estimated air kerma (radiation output) at distal of cone can be displayed in the exposure time window by depressing the patient switch for more than 1 second. Unit for this value is mGy and this value is calculated by the loading factors (kV, mA and Exposure time) selected at that time. Patient type display lamps and displayed value in the window are flashing in this mode and if either of the manual exposure time adjusting switch is depressed during this mode, accumulated air kerma will be displayed. Accumulated value will be reset when the power switch is turned off or leave the x-ray unit more than 8 minutes without depressing any switch. To return to normal mode, press the patient switch for more than 1 second again.

[5] 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.

[6] ERROR CODES

If an abnormal condition exists in the unit, or a malfunction occurs, an error code is displayed in the Exposure Time Display Window ⑯. 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.
E.01	Exposure switch was depressed within 10 sec. of previous exposure.	A 10 sec. delay is built in between each exposure. Release the exposure switch.	There should be a " wait" interval of 50 times the exposure time between successive exposures.
	Exposure time was set and exposure switch was depressed within 3 sec. of the power switch being turned on.		Wait a minimum 3 sec. after the main power switch is turned on before pressing the exposure switch.
E.02	Line voltage was less than 90% of rated voltage.		If line voltage is less than 90% of rated voltage, 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.	Turn off the main power switch and wait for approximately 2 min. Turn on the main power switch again.	Conduct the confirmation of tube current described in section 6.
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.		
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.		
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.		
E.09	Setting for pre-heating time is out of range.		Refer to the service manual.
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.		
E.12	Tube current is detected when main power switch is turned on.		
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.		

Error 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.	Turn off the main power switch and wait for approximately 2 min. Turn on the main power switch again.	Refer to the service manual.
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.		
E.17	During the exposure, tube potential becomes more than 80 kV.		
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 approximately 2 min. Turn on the main power switch again.	Refer to the service manual.
E.23	Some switch had been on, when the main power switch is turned on. (Except the exposure switch.)		

(*) Should a step up or down transformer be required to follow local and national electrical code for electrical ratings and installation.

[7] MAINTENANCE

PHOT-X IIs 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 505 Installation manual.

- 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 29 should be verified routinely by treatment room personnel.
- Specification of the parameters to be monitored and monitoring frequency : Refer to the maintenance check list on page 29.
- Acceptance limit : Refer to the Maintenance check list on page 29.
- Required action when failed : Refer to the Maintenance check list on page 29.
- Tools to maintain quality control logs : Use the check list on page 29.
- 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, appropriately 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.

SECTION 6 : POST INSTALLATION CONFIRMATION

[1] CONFIRMATION OF POWER SUPPLY VOLTAGE

As specified in Electrical Requirements (page 5), power supply voltage must be within the operable range. (Rated voltage $\pm 10\%$). 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 300 VAC, connect probes of multimeter to L and N of the 3P terminal block.

WARNING





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 rated line voltage $\pm 10\%$.

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

[2] CONFIRMATION OF TUBE POTENTIAL COMPENSATION VALUE

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

1. Confirm the tube potential compensation (CP) values for 60kV and for 70kV written on the label attached inside of the head yoke.
2. Turn on the main power switch. Keep depressing P(patient), C(cone) and kV selection switches together until “CP. ○” is displayed in exposure time window. This value is for 60kV and should be the same value on the label. If displayed value is different, press Exposure Time Adjusting Switches ( or ) and make the CP value to be same as the label and press patient switch to store it
3. Press kV switch, then CP value for 70kV will be displayed. This value should be same as the value for 70kV written on the label. If it is different, adjust displayed value by the Exposure Time Adjusting Switches ( or ) and press patient switch to store it.

[3] MA (TUBE CURRENT) ADJUSTMENT

PHOT-X IIs 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. Keep depressing tooth selection switches T1, T4 & T5 together until “h.○○” is appeared on the exposure time display window
2. Wait until the display changes to be “0.50”.
3. Make exposure by depressing the exposure switch.

WARNING

X-radiation is generated for 0.5 second.

4. Repeat step 2. and 3. until “Fin” is displayed. This self diagnose and adjustment is automatically done for 3mA and 6mA.

[4] CONFIRMATION OF KV and MA

1. Turn the main switch on and set the exposure time at 1 sec. and 60 kV, 3 mA.
2. Make an exposure and keep the exposure switch depressed continuously after the exposure is over.
3. Keeping the exposure switch depressed, press kV selection switch twice. KV measured value will be displayed on the LED window. This value should be 60 ± 5 kV.
4. Keeping the exposure switch depressed, press mA selection switch twice. MA measured value will be displayed on the LED window. This value should be 3 ± 1 mA.
5. Release the exposure switch and change the setting to 70 kV, 6 mA.
6. Make an exposure and keep the exposure switch depressed continuously after the exposure is over.
7. Keeping the exposure switch depressed, press kV selection switch twice. KV measured value will be displayed on the LED window. This value should be 70 ± 5 kV.
8. Keeping the exposure switch depressed, press mA selection switch twice. MA measured value will be displayed on the LED window. This value should be 6 ± 1 mA.

[5] CONFIRMATION OF EXPOSURE WARNING LIGHT & BUZZER

A. EXPOSURE WARNING BUZZER

1. Make an exposure and confirm that the exposure warning buzzer located within the sub controller is activated during the entire exposure.

B. EXPOSURE WARNING LIGHT

Exposure warning light is located on the front panel of the sub controller,

1. Make an exposure and confirm that the warning light illuminates during the exposure.

[6] CONFIRMATION OF LINE VOLTAGE REGULATION

1. Make sure that main power switch is "OFF".
2. Set the range of digital multimeter at 300 VAC, connect probes of multimeter to L and N of the 3P terminal block in the main controller.



WARNING

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(%) in the formula below :

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

NOTE : Line voltage regulation must not exceed the range of 0 ~ 5 % for 100, 110, 120V and 0 ~ 3 % for 220, 230, 240Vac. If it is greater than this range, 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 in the range of value specified on page 2.

SECTION 7 : INITIAL SETTING

[1] SPEED SETTING FOR FILM AND DIGITAL IMAGING

A. FILM SPEED

Prior to shipment of the x-ray from the factory, the following two film speeds are programmed to be selected by the Film Speed Selection Switch.

a = Film speed F.09 (equivalent to ISO speed group "D", or Kodak Ultra-speed Film)

b = Film speed F.05 (equivalent to ISO speed group "F/E", or Kodak InSight Film)

In addition to these two speeds, PHOT-X IIs 505 x-ray can provide 16 different film speeds (F.00 ~ F.15) and any two of them can be programmed for easy selection. If the doctor uses a different film speed, or prefers darker (or lighter) radiographs, the new speed can be programmed as follows. Higher speed settings make films darker. If film speed is increased by 1, exposure time becomes 25 % longer.

1. Keep the kV selection switch and mA selection switch depressed simultaneously for more than 3 seconds. Release the switches if the ready light starts to flash.
2. Push F switch momentarily until the "a" light above the F switch illuminates. The exposure time display window shows the present film speed for "a" setting. (The factory default setting, F.09 should be displayed.) By depressing ⤴ or ⤵ switch, increase or decrease film speed number until desired number for "a" setting is displayed.
3. To change the "b" setting from the factory default, F.05, push F switch momentarily until the "b" light illuminates. By depressing ⤴ or ⤵ switch, increase or decrease film speed until the desired number for "b" setting is displayed.
4. Press **T1 switch** to store these settings, then turn the main power switch off.

B. SPEED FOR DIGITAL IMAGING

PHOT-X IIs 505 x-ray has 16 speeds for digital imaging (d.00 ~ d.15). The factory setting is d.10 and with this setting the exposure time becomes half of F.10 setting.

As the sensitivity is different according to each manufacturer of digital imaging sensors, this setting should be adjusted. To get a darker image, increase the speed setting and to get a lighter image, decrease the speed setting. If the speed setting is increased by 1, exposure time becomes 12 % longer.

1. Keep kV selection switch and mA selection switch depressed simultaneously for more than 3 seconds. Release the switches if the ready light starts to flash.
2. Push D switch momentarily until the light above the D switch illuminates and the exposure time display window shows the present speed setting. (The factory default setting d.10 should be displayed.)
3. By depressing ⤴ or ⤵ switch, increase or decrease speed until the desired number is displayed.
4. Press **T1 switch** to store these settings, then turn the main power switch off.

[2] PRIORITY OF SELECTIONS

Factory default setting :

Cone	: Regular cone
Film Speed	: "a"
Digital Imaging	: off
kV selection	: 60 kV
mA selection	: 6 mA
Patient Type	: Adult

If necessary, these settings can be changed. For example, if digital imaging is used for pedodontistry, digital imaging and "child" (patient type) should be selected.

1. Keep kV selection switch and mA selection switch depressed simultaneously for more than 3 seconds. Release the switches if the ready light starts to flash.
2. Press D switch momentarily. (Light above D switch illuminates and speed setting for digital imaging is displayed on exposure time display window.)
3. Select the patient type "child" by depressing P switch momentarily.
4. Press **T1 switch** until buzzer beeps twice to store these settings, then turn the main power switch off.
5. Cone type, kV and mA selection can be changed by same procedures.

NOTE : For digital imaging, 60 kV and 3 mA is recommended to get good contrast and precise exposure time control.

[3] ELECTRONIC CHIME ON/OFF

An electronic chime sounds when switches are depressed. If preferred, this sound can be deactivated as follows :

1. Keep T1 and T2 switches depressed together for more than 3 seconds.
Release the switches if the ready light starts to flash.
2. "bu. 2" will be displayed in exposure time display window.
3. By depressing either ☹ or ☺ switch, display changes to "bu.0".
4. Press **P switch** (Patient type Switch) until the buzzer beeps twice to store this setting and turn off the main power switch.

NOTE : Exposure Warning Buzzer and alarm sound of error code can not be eliminated.

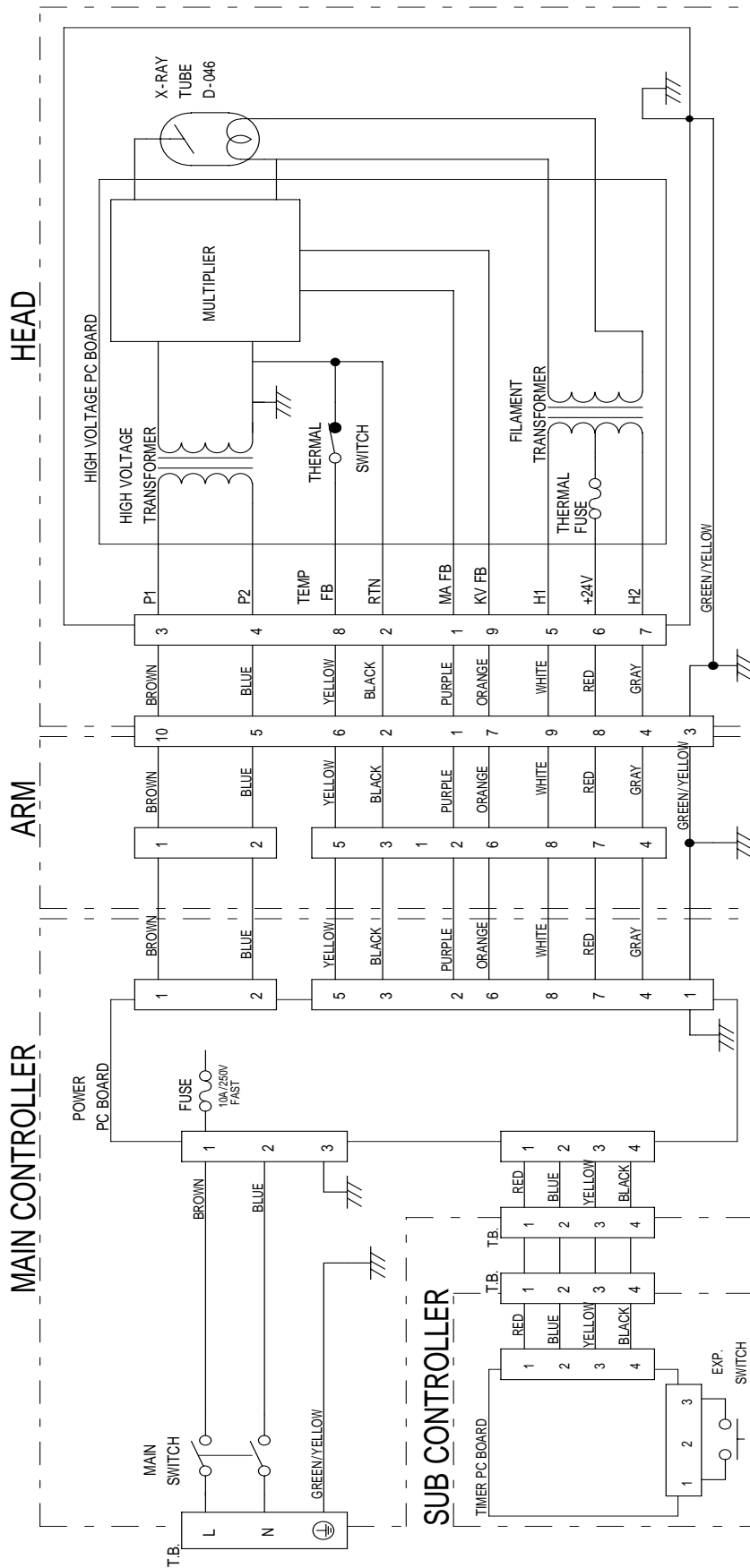
[4] ESTIMATED AIR KERMA DISPLAY SETTING

With factory setting the estimated air kerma can be displayed only when the patient type selection switch is depressed more than 1 second. If automatic display after each exposure is preferred, change the display setting as follows.

1. Keep T2 and T5 switches depressed together for more than 3 seconds.
Release the switches if the ready light starts to flash.
2. "rd.1" will be displayed in exposure time display window.
3. By depressing either ☹ or ☺ switch, change display to "rd.2".
4. Press P switch (Patient type Switch) until the buzzer beeps twice to store this setting and turn off the main power switch.

NOTE : If "rd.0" is stored, estimated air kerma can be displayed automatically and can not be checked manually either.

APPENDIX 1 : CIRCUIT DIAGRAM



APPENDIX 2 : MAINTENANCE CHECK LIST

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 adjustment. (Refer to Installation manual.)	
3. Tube potential	Confirm the measured kV value indicated on the LED window is within the rated value ±10%.	Yearly	Check the tube potential compensation (CP) values are same as the values on the label in the head yoke.	
4. Mounting plate for floor (FK1/FK2)	Confirm the plate is firmly fixed to the floor (FK1/FK2).	Yearly	If bolts are loose, find the reason why bolts became loose, take counter measure that prevents bolts become loose.	
5. 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 installation manual.	
6. Horizontal arm (FK1/FK2)	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, take counter measure that prevent the retaining bolt become loose.	
7. Head	Confirm the head can be smoothly positioned.	Daily (before use)	Adjust the brake screws by referring to installation manual.	
8. Vertical movement of balance arm	Confirm the balance arm moves smoothly without making noise.	Daily (before use)	Adjust the tension of the balance arm by referring to installation manual. If the balance arm makes noise, apply grease.	
9. Swing angle of balance arm (FM)	Confirm the balance arm swings between two long legs.	Daily (before use)	Check the stopper screws and mounting screws of pole bushing.	
10. Caster (FM)	Confirm all casters move smoothly and lock function works fine by two lock casters.	Daily (before use)	Clean up the casters or replace them.	
11. Sliding post and swing arms. (RK)	Confirm the post slides smoothly and the joints of the swing arms are connected firmly.	Daily (before use)	Check the rollers of sliding post and the stopper screws and brake screws at the joints.	

NOTE

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