

# BELRAY

MODEL 096

*DENTAL X-RAY*

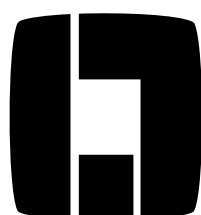
## OPERATOR'S INSTRUCTIONS (for USA & Canada)

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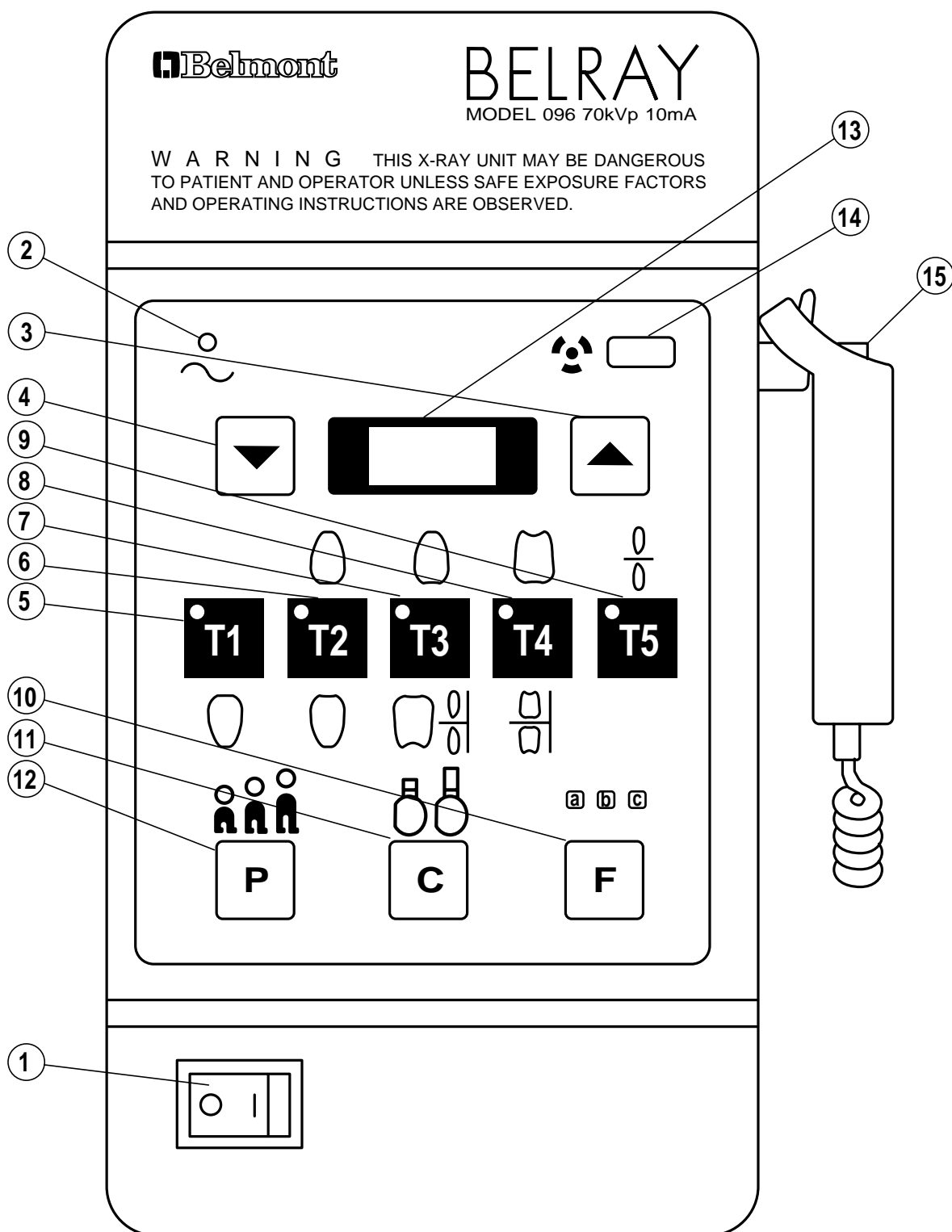
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**⚠ WARNING:**

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

 **Belmont**

# LAYOUT OF CONTROL BOX



## FUNCTION OF CONTROLS

### ① Main Power switch

Pushing right side of this switch energizes the x-ray unit.

(Ready lamp and pre-selected lamps for patient size, cone type and film speed illuminate.)

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

### ② Ready Lamp

This lamp lights when the line voltage is within operable range.

When this lamp is not on, exposure can not be made.

### ③,④ Exposure Time Adjusting Switches

By momentarily pushing (▲ or ▼) switch, exposure time displayed increases or decreases by one step. By keeping the switch depressed more than 2 sec., exposure time displayed increases or decreases continuously until the switch is released.

### ⑤~⑨ Tooth Selection Switch (T1 ~ T5)

Pushing one of these switches sets the exposure time automatically in combination with following ⑩~⑫.

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 : Molars of Maxilla, Bitewing Molars

⑨ T5 : Occlusal

### ⑩ Film Speed Selection Switch

a) Film speed : Refer to page 1, Layout of control box.

Three kinds of film speeds are factory set (a,b,&c) and can be selected by the film speed selection switch, Item 10 on page 1.

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

b = Film speed No. F.04 (equivalent to ISO speed group "F/E", or Kodak InSight film)

c = Film speed No. F.02 (equivalent to ISO speed group "F")

b) Three film speeds can be selected. Pushing this switch momentarily indicates the film speed number being selected in exposure time display window (⑬).

Depressing the switch for more than 2 seconds alters the film type being selected.

**TABLE 1: FILM SPEED and EXPOSURE TIME (REGULAR CONE) (UNIT:SEC.)**

Patient Size	SMALL					MEDIUM					LARGE				
	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
<b>F.09</b>	0.10	0.17	0.20	0.27	0.38	0.16	0.27	0.33	0.44	0.62	0.19	0.33	0.41	0.54	0.76
<b>F.04</b>	0.04	0.07	0.08	0.10	0.16	0.06	0.11	0.13	0.17	0.25	0.08	0.14	0.16	0.20	0.31
<b>F.02</b>	0.03	0.05	0.06	0.07	0.11	0.05	0.08	0.09	0.12	0.18	0.06	0.10	0.11	0.15	0.22

**TABLE 2: FILM SPEED and EXPOSURE TIME (LONG CONE) (UNIT:SEC.)**

Patient Size	SMALL					MEDIUM					LARGE				
	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
<b>F.09</b>	0.20	0.36	0.44	0.58	0.81	0.33	0.58	0.71	0.93	1.32	0.41	0.71	0.87	1.15	1.62
<b>F.04</b>	0.08	0.15	0.17	0.22	0.33	0.14	0.24	0.27	0.36	0.54	0.17	0.29	0.33	0.44	0.66
<b>F.02</b>	0.06	0.10	0.12	0.16	0.24	0.10	0.17	0.19	0.25	0.38	0.12	0.20	0.24	0.31	0.47

**⑪ Cone Type Selection Switch**

The exposure time corresponding to the cone type being used (Standard Regular Cone or Optional Long Cone) can be selected by this switch.

**⑫ Patient Size Selection Switch**

Pushing this switch alters the selection of patient size (small → medium → large → small) and sets the exposure time accordingly.

**NOTE : Setting or adjusting the exposure time manually (with ▲ or ▼ switch) supersedes ⑤ ~ ⑫ functions.**

**⑬ Exposure Time Display Window**

Normally the exposure time selected is displayed.

Error Code is displayed when abnormal condition exists or malfunction occurs.

**⑭ Exposure Warning Light**

Illumination of this light indicates the unit is producing x-radiation.

**⑮ Exposure Switch**

Deadman Type exposure switch. When making an exposure, depress this switch and keep it depressed until the exposure warning light ⑭ and the audible warning terminate. Failure to keep this switch depressed will result in premature termination of the exposure and error code E.00 will be displayed.

## OPERATING PROCEDURES

1. Turn ON the main power switch①.
2. Confirm that ready lamp② is illuminated.  
**NOTE: The ready lamp will not illuminate unless the incoming line voltage is correct and within the x-ray's operable range.**
3. Select the appropriate tooth type (⑤ ~ ⑨), and confirm if the pre-selected conditions (film speed ⑩, cone type ⑪ and patient size ⑫) are suitable for exposure.

**NOTE: To manually set the exposure time, depress either manual exposure time adjust switch (③▲ or ④▼) until the desired exposure time is displayed in exposure time display window ⑬. While the unit is in manual mode, other selection switches (⑩ ~ ⑫) do not affect exposure time. (All the tooth selection lamps 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 ⑮. When the exposure switch is depressed, the exposure warning lamp ⑭ illuminates and the audible warning sounds. Do not release the exposure switch until the audible warning and the warning lamp terminate. Failure to keep the switch depressed will result in the exposure being terminated prematurely.
5. To continue to radiograph other teeth, just select appropriate tooth selection switch.

**IMPORTANT : To protect x-ray tubehead from heat accumulation, wait for 60 times of exposure time between exposures.  
[ex. 30 second wait interval for 0.5 sec. exposures]**

6. After use turn OFF the main power switch ① in order to prevent accidental exposures.

**NOTE : If the unit is left over 8 minutes without being operated and the main power switch is kept on, figure 1 runs through the exposure time display window. This does not mean that a malfunction of the unit has occurred, but saves energy. The unit returns to normal condition by pressing any one of the switches except the exposure switch.**

## ERROR CODES

When abnormal condition exists in the unit, or malfunction occurs, error code is displayed in exposure time display window.

Please refer to the table below.

Error code	Condition	Step to be taken	Possible solution
E.00	Exposure switch was released before the exposure terminates.	All the tooth selection switches blink. Depress one of the switches to return to operating mode.	Release exposure switch after exposure lamp turns off.
E.01	Exposure switch was depressed within 10 sec. of previous exposure.	Release exposure switch.	There is to be a waiting interval of 60 times of exp. time between successive exposures.
	Exposure switch was depressed within 3sec. after the main power switch has been turned on.		Exposure switch should be depressed after the ready lamp comes ON.
E.02	Line voltage was less than 90% of rated voltage.		E.03
E.03	Line voltage was more than 110% of rated voltage.		
E.04	Excess current during exposure.	Turn off the main power switch and wait for a while. Turn on the main power switch again.	If same error code is displayed, call service personnel.
E.05	Tube current of the last pulse was less than 7.5mA.		
E.06	Tube current of the last pulse was more than 12.5mA.		
E.07	Tube current during exposure was less than 5mA.		
E.08	Tube current during exposure was more than 15mA.		
E.09	Malfunction of the microcomputer.		
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.		

## MAINTENANCE

Model 096 BELRAY X-ray unit requires the following post installation confirmation and periodic maintenance checks to be performed by dealer service personnel, to ensure that the x-ray unit is functioning within the manufacturer's specifications and remains in compliance with the Standard.

It is the responsibility of the owner of the unit to see that these maintenance checks are done **once every 6 months** and that they are performed by a trained, certified service technician.

The specific instructions to perform these checks are located within the Model 096 installation manual.

- A. Line voltage confirmation
- B. Tube current confirmation
- C. Inspection of arm and head movements
- D. MECHANICAL SAFETY
  - 1. The wall plate should be checked to confirm its secure attachment to the wall.
  - 2. The arm mounting bracket should be checked to confirm its secure attachment to the wall mounting plate. The arm mounting bracket must be level horizontally and vertically.
  - 3. Check to insure the horizontal arm is not raising up and out of the arm mounting bracket. This should be observed routinely by treatment room personnel.

## TECHNICAL DATA

### ELECTRICAL AND RADIATION DATA

1. Focal point measurement ..... 0.8 mm x 0.8 mm
2. Rated peak tube potential ..... 70 kVp
3. Rated tube current ..... 10 mA
4. Maximum rated peak tube potential ..... 70 kVp
5. Rated line voltage ..... 120 V AC
6. Line voltage range ..... 108 V AC ~ 132 V AC
7. Range of line voltage regulation ..... 2 ~ 5 %
8. Rated line current ..... 10.8 A at 70 kVp, 10 mA
9. Maximum line current ..... 11.9 A at 70 kVp, 10 mA
10. Exposure time ..... 0.02 ~ 3 sec.  
(ON and OFF are zero crossed.)
11. Timer accuracy .....  $\pm 1$  pulse (1/60 sec.)
12. Inherent filtration ..... 1.3 mmAl Equivalent
13. Added filtration ..... 0.8 mmAl
14. Minimum filtration permanently in useful beam ..... 2.1 mmAl Equivalent at 70 kVp
15. Nominal roentgen output
  - a. Distal end of regular cone ..... 8.2 mGy/sec. + 30 %, - 40 %
  - b. Distal end of long cone ..... 3.7 mGy/sec. + 30 %, - 40 %(Data obtained by direct measurement in the useful beam)
16. Source to skin distance
  - a. Regular cone ..... 204 mm
  - b. Long cone ..... 305 mm
17. Leakage technique factor ..... 70 kVp / 0.16 mA  
0.16 mA is maximum rated continuous current  
for 10 mA with a duty cycle 1: 60
18. Duty cycle ..... 1: 60 (0.5 sec. exposure with 30 sec. interval)
19. Maximum deviation of tube potential and tube current  

	Pulse	Tube Potential	Tube Current
1st,2nd & 3rd		70 $^{+8}_{-11}$ kVp	10 $\pm 2$ mA
4th & Up		70 $^{+7}_{-10}$ kVp	10 $\pm 1$ mA
20. Measurement base of technique factors
  - a. peak tube potential ..... Peak tube potential of conducting half cycle
  - b. tube current ..... Average of tube current during one cycle of  
line frequency
  - c. exposure time ..... Impulses of power line frequency
21. Half value layer ..... 1.5 mmAl over
22. Source to the base of cone distance ..... 81 mm



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