Operation Manual

Digital Panoramic Radiograph

Bel-Cypher Pro

Notice to the operator and maintenance supervisor

＊Read this instruction manual before operation. After reading this manual, keep it in a safe place near the X-ray machine for the easy access.

Caution: Federal law restricts this device to sale by or on the order of a physician, dentist or other licensed practitioner

The classification is indicated as follows

According to the type of protection against electric shock. : Class Ⅰ

According to the degree of protection against electric shock. : Type B applied part

TAKARA BELMONT CORPORATION.

Thank you very much for purchasing our equipment Model Bel-Cypher Pro.
Please read this operation manual carefully before operation in order to use the X-Ray machine properly and safely.

INDICATION FOR USE: The Bel-Cypher Pro dental panoramic X-ray system is indicated for use as generator of radiographic images of the dento-maxilofacial region and is intended for dental examination and diagnosis of diseases of the tooth, jaw, and oral structures.

⚠ CAUTION

If you run software that force heavy load to PC, transfer & acquisition of image could be interrupted.

CONTENTS

01. Introduction

1. Read this manual carefully before using this equipment for the first time.

2. Be sure to observe warnings and prohibited items when operating the equipment.

3. Read the operation manual from beginning to end.
   Reading the operation manual from halfway through might lead to misunderstanding.

4. If you have any issues, read this manual again to confirm the portion in question.

5. The operation procedure of a Panoramic radiograph is the basis of X-ray radiography.
   Your can use this procedure for other radiography such as TMJ.

6. Explanation of the operation procedure of other radiograph are omitted, if the procedures are same as the one of Panoramic radiograph.
   Refer to operation procedure of panoramic radiograph, if you have any questions about operating procedures.

7. Discharge
   Be sure to observe the contents of this operation manual.
   Even if any trouble or an accident happens due to wrong use, we are not responsible for them.

8. Warranty Period
   Warranty period is two years after purchase of the equipment.
   We will repair failures or defects under this warranty. This warranty is void when a failure or defect is caused by conditions beyond the manufacturer's control, such as damage resulting from mishandling, neglect, misuse, improper maintenance, accident or alteration or repair by anyone other than Belmont or an authorized Belmont dealer. See your warranty card for more information.

9. Maintenance
   Be sure to properly maintain your equipment.
   The responsibility to maintain medical equipment lies with the user.

10. Period for repair and parts supply
    We will continue to supply parts for the equipment for up to 10 years after it has been discontinued.

11.  means " Attention, consult accompanying documents ".

12.  means " Protective earth(ground) ".

13.  means " OFF (Power: disconnection from the mains) ".

14. means " ON (Power: connection to the mains) ".

15.  means "Type B" Applied part

16.  means "Class 1 Laser product".

17.  means ionizing radiation.

18. No user serviceable items inside.

19. Conformability to indicated X-RAY requirement was determined in accordance with R10 sequences that follow ISO497.

20. The use of ACCESSORY equipment not complying with the equipment safety requirements of this equipment may lead to a reduced level of safety of the resulting system. Consideration relating to the choice shall include:

    Use of the accessory in the PATIENT VICINITY

    Evidence that the safety certification of the ACCESSORY has been performed in accordance to the appropriate IEC 60601-1 harmonized national standard.

    Computer and monitor shall comply with IEC60950-1 or IEC60601-1

21. Original manual was created in Japanese.

22. In addition to this operation manual, we supply an Installation manual

02

02. Warning

⚠ WARNING

Always conform to the safety work standards.
Repair work for internal parts of the equipment involves high risk. This should be strictly conducted by an authorized service personnel only.

NOTE

The warning messages in the Operation Manual are defined and classified as follows:

⚠ DANGER

Indicates an imminently hazardous situation, which, if not avoided, may result in death, serious injury and/or property damage such as total loss of equipment and fire when the instructions are not followed.

⚠ WARNING

Indicates a potentially hazardous situation, which, if not avoided, could result in death, serious injury and/or property damage such as total loss of equipment and fire when the instructions are not followed.

⚠ CAUTION

Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury, and/or partial damage to property and loss of computer data when the instructions are not followed.

NOTE

Indicates information helpful for use of the equipment.

⚠ WARNING

Precautions on use (and safety and hazard prevention) of medical electric/electronic equipment

1. DO NOT allow the person without expertise to use the equipment.

2. Pay attention to the following when installing the equipment.

(1) Install the equipment to avoid splashing water.
(2) Do not install the equipment to the place harmful to it due to atmospheric pressure, temperature, humidity, airflow, direct sunlight, dust, salinity and air including sulfur.
(3) Pay attention to the safety conditions such as inclination, vibration and impact (including those in transportation).
(4) Do not install the equipment to the place where chemicals are stored or gas generate.
(5) Pay attention to commercial frequency of power, its voltage and allowable current (or power consumption).
(6) Connect the equipment to the ground properly.

3. Check the following before using the equipment.

(1) Check contact of switches, polarity, dial settings and indicators. Check that the equipment operates normally.
(2) Check that the equipment is connected to the ground perfectly.
(3) Check that all cords are connected properly and perfectly.
(4) Pay attention to parallel use with other equipment as it may cause erroneous diagnosis or danger.
(5) Recheck the external circuit connected directly to a patient.
(6) Check the battery power.

4. Pay attention to the following when using the equipment.

(1) Avoid exceeding the time and the radiation dose rate necessary for diagnosis.
(2) Always monitor no abnormality in all equipments in use and the condition of a patient.
(3) When any abnormality is observed in the equipment or the patient, take appropriate action such as to stop the equipment in the condition safe for the patient.
(4) Do not allow a patient to touch the equipment.

5. Pay attention to the following after using the equipment.

(1) After returning operation switches and dials to their original position before use in accordance with predetermined procedure, turn off the power.
(2) Do not pull cords when removing them from the equipment.
(3) Be careful for the following items for storage.
  I) Store the equipment where water is not splashed on it.
  II) Do not store the equipment to the place harmful to it due to atmospheric pressure, temperature, humidity, airflow, direct sunlight, dust, salinity and air including sulfur.
  III) Pay attention to the safety condition such as inclination, vibration and impact (including those in transportation).
  IV) Do not store the equipment to the place where chemicals are stored or gas generates.
(4) After cleaning accessories, cords, and terminals, put them in order.
(5) Keep the equipment clean for the next use.

6. When the equipment fails, DO NOT attempt to repair it by yourself.
Indicate that the equipment is in failure and consign its repair to special engineer.

7. DO NOT modify the equipment.

8. Maintenance and inspection

(1) Be sure to perform regular inspection of equipment and its accessories.
(2) When resuming to use the equipment that was not used for a long time, be sure to check that the equipment operates normally and safely before use.

⚠ DANGER

This equipment is an electrical instrument.
Avoid contact with water, which may cause electric shock and damage to the equipment.

⚠ DANGER

This equipment is an electrical instrument incorporating high voltage circuits. Removing the equipment cover may result in electric shock.
DO NOT allow any person to open the cover other than the consigned engineer for maintenance.

⚠ WARNING

The user (hospital or clinic) of medical equipment shall be responsible for its maintenance and inspection.
DO NOT allow any person to use the equipment other than doctors and legally qualified personnel.
Repair and inspection of the internals of the equipment is dangerous.
Be sure to contact our sales representative.

⚠ WARNING

In general, modifications are strictly prohibited by the Regulatory requirements of the law of the country where the equipment is installed.

⚠ WARNING

This equipment should be installed in the X-ray room surrounded by walls that have over 1.0 mmPb lead equivalence.

⚠ WARNING

DO NOT use the equipment when an earthquake alarm is annunciated.
After the earthquake has subsided, be sure to check the safety of the equipment and use it after checking that no abnormality exists in the equipment.
Neglecting to take these actions may cause harm to patients.

⚠ WARNING

Unless the safe radiation conditions and safe use of the equipment are observed, this X-ray equipment may be dangerous to the operator and patient.

⚠ WARNING

DO NOT put things in the moving area of the equipment that could be an obstacle to the equipment.

⚠ WARNING

Be sure to make patient and assistant wear X-ray protective clothing.
("Assistant" represented in the above sentence means personnel allowed by a doctor for helping the patient.)

⚠ WARNING

After each irradiation and at the end of everyday work, disinfect the portion of the equipment that has come in contact with patients and operators.

⚠ WARNING

When moving the sliding unit horizontally, pay extra attention to the safety of the patient.

⚠ WARNING

After using this equipment, be sure to turn OFF the power for safety.

⚠ WARNING

When the equipment has trouble, turn off "Power Switch ".

⚠ WARNING

hen the X-ray is ON, DO NOT allow any person enter into an X-ray room other the patient and assistant authorized by the doctor.

⚠ WARNING

Provide means for audio and Visual communication between the OPERATOR and the PATIENT during an X-Ray exposure.

⚠ WARNING

Always monitor the patient, assistant and the equipment during X-ray irradiation.
When any abnormality occurs, release the Exposure switch immediately.

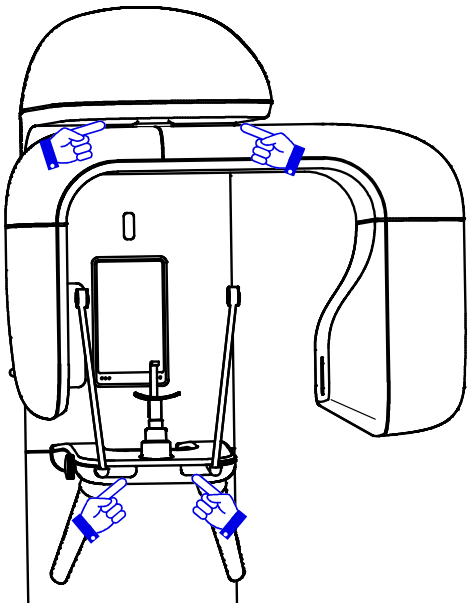
WARNING／AVERTISSEMENT

THIS X-RAY UNIT MAY BE DANGEROUS TO PATIENT
AND OPERATOR UNLESS SAFE EXPOSURE FACTORS
AND OPERATING INSTRUCTIONS ARE OBSERVED

Cet appareil á rayons X peut étre DANGEURUX POUR LE PATIENT
ET L'OPERATEUR SI LES FACTEURS D'EXPOSITION SECURITARES ET LES
INSTRUCTIONS D'OPERATION NE SONT PAS SUIVIES CORRECTEMENT.

⚠ WARNING

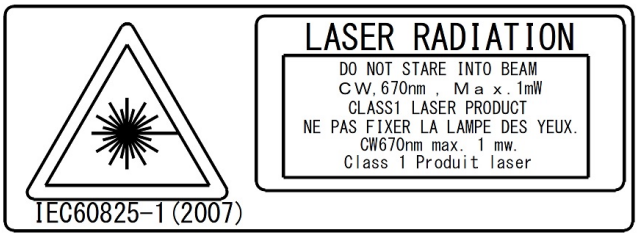
Do not bring your fingers close to positions indicated with “ ☞ mark”
By the inserting your finger, there is an injury risk.



⚠ WARNING

LASER, DOT NOT STARE INTO BEAM, CLASS 1 LASER PRODUCT

1. Laser Beam is applied. For safety, instruct patient not to look into the laser beam.
2. Before the beam is turned on, lower the Frankfurt Plane Beam to the bottom.
3. Do not set the beam pointing into patient's eyes.



⚠ CAUTION

When discarding this equipment, please contact your nearest sales office.

⚠ CAUTION

Do not turn the Arm Unit by hand. It may cause problems with the equipment.

⚠ CAUTION

Operator shall instruct the patient not to move while X-ray exposure is in progress.
Operator shall instruct the patient not to move until the movement of Arm Unit has completed - during RESET movement.

⚠ CAUTION

The equipment shall be connected to a power receptacle marked “Hospital Only” or “Hospital Grade”.

⚠ **WARNING**

Environmental Conditions of EMC (Electromagnetic Compatibility)

The equipment satisfies the EMC (Electromagnetic Compatibility) standard below
: IEC 60601-1-2:2007

Classification of EMI in Accordance with IEC 60601-1-2: 2007
Group 1, Class B

1. The medical electrical equipment needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in the Operation manual.

2. The portable and mobile RF communications equipment can affect medical electrical equipment.

3. The use of accessories, transducers and cables other than those specified, with the exception of transducers and cables sold by the manufacturer of the equipment as replacement parts for internal components, may result in increased emissions or decreased immunity of the equipment.

4. The cable that suits IEC60601-1-2:2007 of standards emission and the requirement of the immunity are recorded below.
   1) Power cable (3m)
   2) Exposure Switch cable (10m)
   3) LAN cable(type braided shield) for connection with personal computer (10m)

5. The equipment should not be used adjacent to or stacked with other equipment.

8.Basic performance
   1) Accuracy of LOADING FACTORS
   2) Reproducibility of the RADIATION output

⚠ **WARNING**

Guidance and manufacturer's declaration – electromagnetic emissions		
The model Bel-Cypher Pro is intended for use in the electromagnetic environment specified below. The customer or the user of the model Bel-Cypher Pro should assure that it is used in such an environment.		
Emission test	Compliance	Electromagnetic environment - guidance
RF emissions CISPR 11	Group 1	The model Bel-Cypher Pro uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The model Bel-Cypher Pro is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC61000-3-2	Not Applicable	
Voltage fluctuations/ Flicker emissions IEC61000-3-3	Not Applicable	

⚠ **WARNING**

Guidance and manufacturer's declaration – electromagnetic immunity			
The model Bel-Cypher Pro is intended for use in the electromagnetic environment specified below. The customer or the user of the model Bel-Cypher Pro should assure that it is used in such an environment.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic discharge (ESD) IEC61000-4-2	±6 kV contact ±8kV air	±6 kV contact ±8kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC61000-4-5	±1kV differential mode ±2kV common mode	±1kV differential mode ±2kV common mode	Mains power quality should be that of a typical commercial or hospital environment
Voltage dips, short interruptions and voltage variations on power supply input lines IEC61000-4-11	＜5% Ut (＞95% dip in Ut) for 0.5 cycle 40% Ut (60% dip in Ut) for 5 cycles 70% Ut (30% dip in Ut) for 25 cycles ＜5% Ut (＞95% dip in Ut) for 5 sec	＜5% Ut (＞95% dip in Ut) for 0.5 cycle 40% Ut (60% dip in Ut) for 5 cycles 70% Ut (30% dip in Ut) for 25 cycles ＜5% Ut (＞95% dip in Ut) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment
Power frequency (50/60Hz) magnetic field IEC61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment
NOTE Ut is the a.c. mains voltage prior to application of the test level.			

⚠ **WARNING**

Guidance and manufacturer's declaration – electromagnetic immunity			
The model Bel-Cypher Pro is intended for use in the electromagnetic environment specified below. The customer or the user of the Bel-Cypher Pro should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Conducted RF IEC61000-4-6 Radiated RF IEC61000-4-3	3 Vrms 150kHz to 80MHz 3 V/m 80MHz to 2.5 GHz	3 Vrms 3 V/m	Portable and mobile RF communications equipment should be used no closer to any part of the Bel-Cypher Pro, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance** $d = 1{,}2\sqrt{P}$ $d = 1{,}2\sqrt{P}$ 80 MHz to 800 MHz $d = 2{,}3\sqrt{P}$ 800 MHz to 2.5 GHz where P is the maximum output power rating of the transmitter in watts(W) according to the transmitter manufacturer and *d* is the recommended separation distance in metres(m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, [a]should be less than the compliance level in each frequency range.[b] Interference may occur in the vicinity of equipment marked with the following symbol: 
NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies. NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			
[a] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the Bel-Cypher Pro is used exceeds the applicable RF compliance level above, the Bel-Cypher Pro should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the Bel-Cypher Pro. [b] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.			

⚠ **WARNING**

Recommended separation distances between portable and mobile RF communications equipment and the Bel-Cypher Pro

The Bel-Cypher Pro is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the Bel-Cypher Pro can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Bel-Cypher Pro as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter W	**Separation distance according to frequency of transmitter m**		
	150 kHz to 80 MHz $d=1,2\sqrt{P}$	**80 MHz to 800 MHz** $d=1,2\sqrt{P}$	**800 MHz to 2.5 GHz** $d=2,3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.72
1	1.20	1.20	2.30
10	3.79	3.79	7.27
100	12.00	12.00	23.00

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts(W) according to the transmitter manufacturer.

NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

03

03. Explanation of Equipment

1. Outline

Bel-Cypher Pro can take radiographs of Panoramic and TMJ.

2. Indications for Use (Describe)

The Bel-Cypher Pro dental panoramic X-ray system is indicated for use as a generator of radiographic images of the dento-maxilofacial region and is intended for dental examination and diagnosis of diseases of the teeth, jaw, and oral structures.

3. Features

3. 1. High Frequency X-ray Generator

The X-ray generator uses a High Frequency Inverter to delivers high quality radiation. This enables improved image quality while reducing the radiation dose.

3. 2. X-ray Tube with minute focus spot size

Owing to the minute X-ray Tube focus spot size of 0.5mm, sharp and clear images are achieved.

3. 3. Versatile Combination of Exposure Factors

Tube voltage can be set from 60 kV to 80 kV in 1 kV step.
Tube current can be set at 2, 2.5, 3, 3.2, 4, 5, 6, 6.3, 7, and 8mA.
With wide range of exposure settings, Bel-Cypher Pro can obtain the ideal radiograph for every type of patient.

3. 4. Patient Positioning with 3 Beam Lines

Bright and easy-to-see three laser beams make positioning very easy and accurat e.

4. Configuration

Equipment consists of the assemblies outlined below.

1. Mechanical Assemblies, 2. X-ray Generator, 3. X-ray Controller

04. Specifications

General name	Digital Panoramic Radiograph
Model	Bel-Cypher Pro
Power Voltage	120V AC 60Hz 1ϕ 0.3Ω
Power Capacity	9A
High Tension Generator	High Tension Generator (100kHz)
X-ray Tube Voltage	60kV to 80kV (1kV step)
X-ray Tube Current	2 to 8mA (1mA step and R'10 series)
Exposure method	Manual
X-ray Tube	D-052SB (Toshiba)
X-ray Tube Focal Spot	0.5 mm
Total Filtration	2.5mmAl (minimum)
Radiographic Mode	Panorama (Adult, Child), Panoramic Bitewing (Adult, Child), TMJ
Exposure Time	Panorama: 10 sec. Panoramic Bitewing: 2.3 sec. (x 2) TMJ: 2.5 sec. (x 4)
Magnification Ratio	Panorama: 1.2 to 1.3, Panoramic Bitewing: 1.2 to 1.3 TMJ: 1.2
Image receiver	Digital Sensor
Beam for patient positioning	3 beams
Dimension	W:850mm x D:1,135mm x H:2,275mm
Weight	Approximately 231lb (105 kg)

Environmental conditions for Operation
Temperature : 41 to 95F (5 to 35℃)
Humidity : 30 to 85%
Pressure : 700 to 1060 hpa

Environmental conditions for Storage
Temperature : 14 to 140F (-10 to 60℃)
Humidity : 10 to 95%
Pressure : 700 to 1060 hpa

Environmental conditions for Transportation
Temperature : 14 to 140F (-10 to 60℃)
Humidity : 10 to 95%
Pressure : 700 to 1060 hpa

Recommended specifications of Personal Computer

Recommended PC specifications

CPU	Intel Core i7-6600U (2.6GHz) or later
Video Controller	NVIDIA GeForce 930M or more, or equivalent
Memory	16GB or more
OS	Windows 7 Professional 64-bit, English Version Windows 8 Professional 64-bit, English Version Windows 10 Professional 64-bit, English Version
Other	Ethernet ×1 (1000BASE-T)

Minimum PC specifications

CPU	Intel Core i5-6300U (2.4GHz) or later
Video Controller	Intel HD Graphics 520 or more, or equivalent
Memory	8GB or more
OS	Windows 7 Professional 64-bit, English Version Windows 8 Professional 64-bit, English Version Windows 10 Professional 64-bit, English Version
Other	Ethernet ×1 (1000BASE-T)

※ Use a LAN cable of Category 5e or better

Recommended specifications of the image display monitor

resolution	1920×1080
Grayscale Tones	256 tones
Display Colors	16.77 million：supported 8-bit

⚠ CAUTION

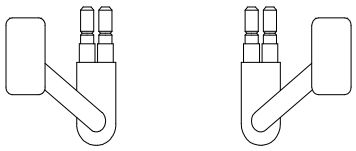
PC and monitor are required to meet the international IEC60950-1 or IEC60601-1 standard.

If you run software that heavily loads the PC, transfer & acquisition of images could be interrupted.
Please schedule Windows updates or virus scan updates to be performed outside clinic hours.

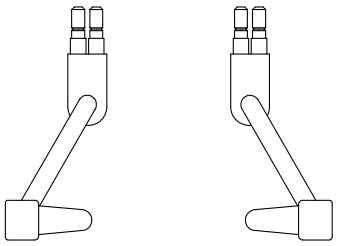
05

05. Standard Accessories

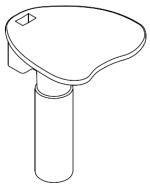
1. Temporal supports (Panorama)



2. Ear Rods (TMJ 4 sections)

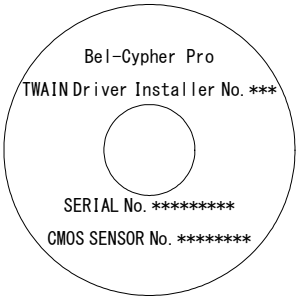


3. Chinrest (Panorama)

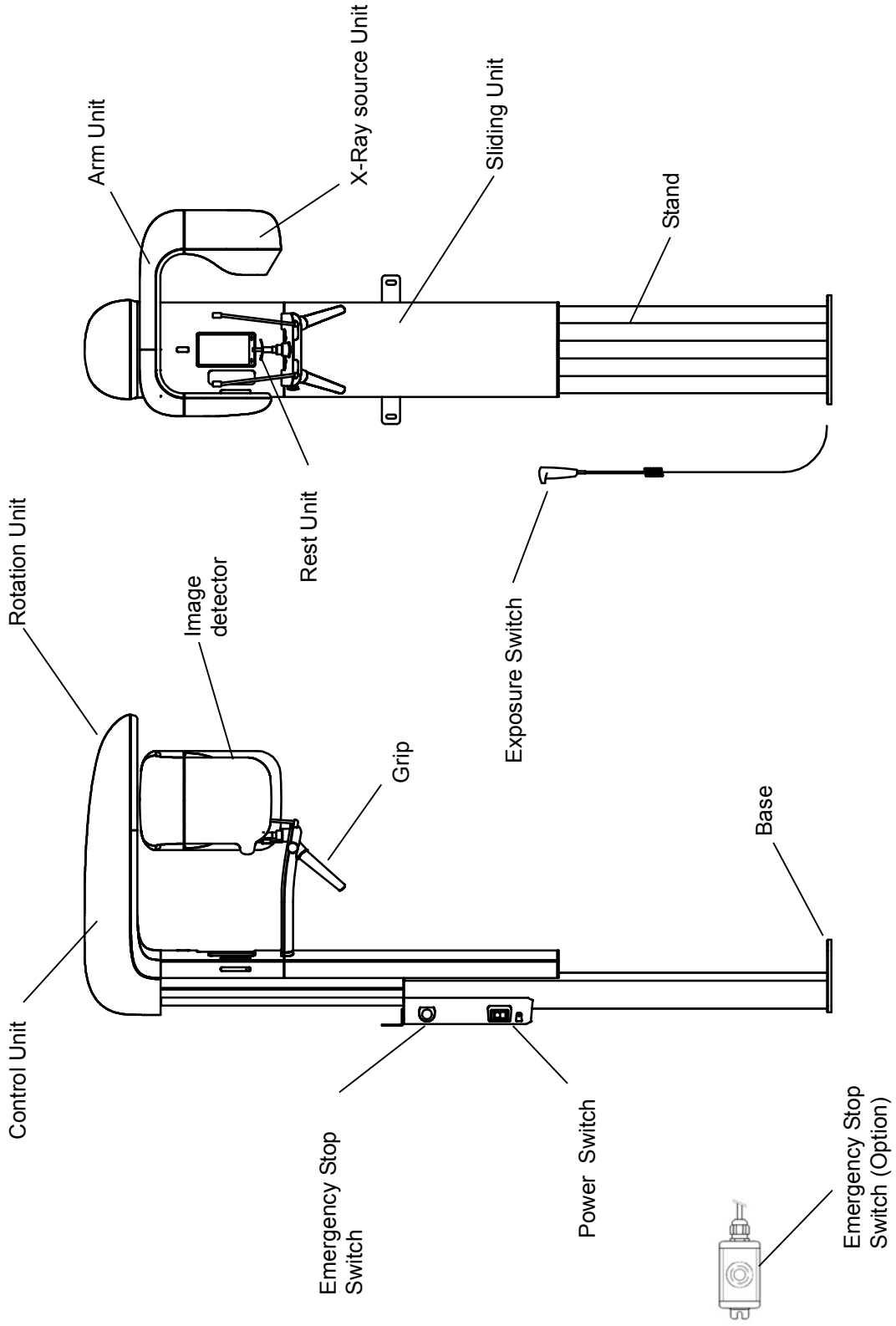


4. Bite Block (Panorama)

5. TWAIN Driver Installer



06. Names of the Major Components

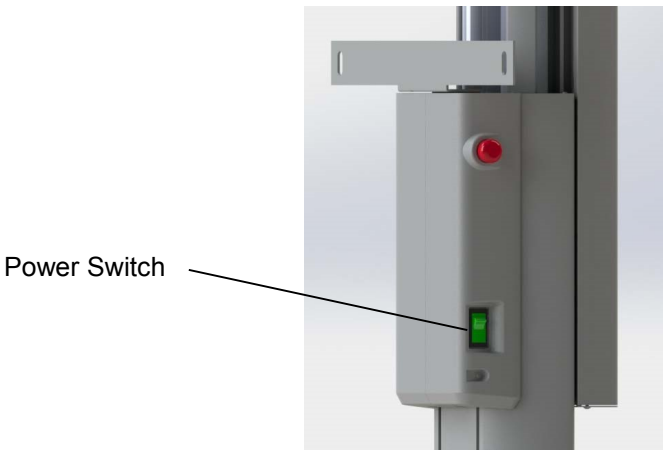


07. Explanation of each part

1. Power Switch

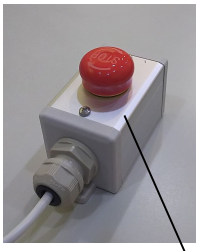
⚠ CAUTION
To protect this equipment, after turning the power on, wait 5 seconds before turning the power off. After turning the power off, wait 5 seconds before turning the power on.

Push " I " on the power switch to turn the power ON.
Push "O" on the power switch to turn the power OFF.



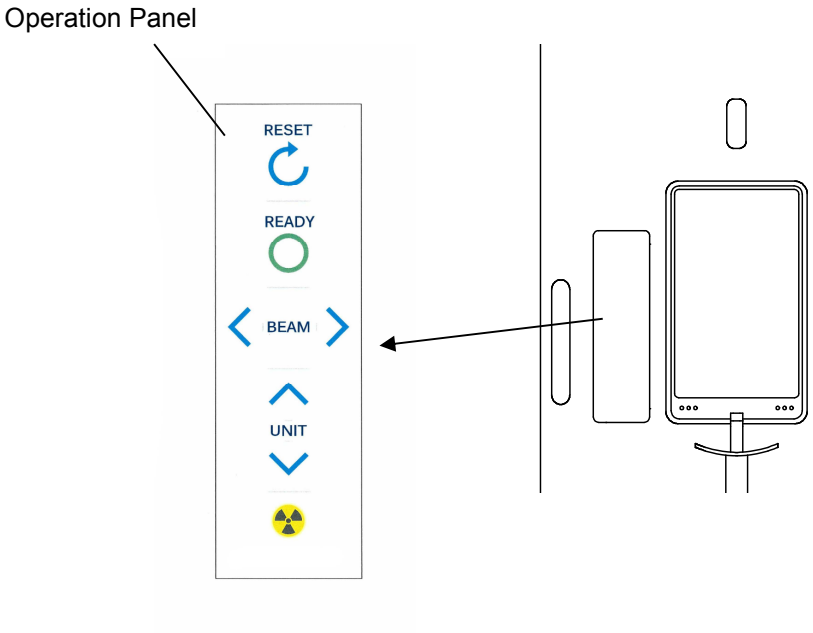
2. Emergency Stop Switch

Use this switch at an emergency.
It works by pressing the switch.
If you want to cancel, turn in the direction of the arrow.



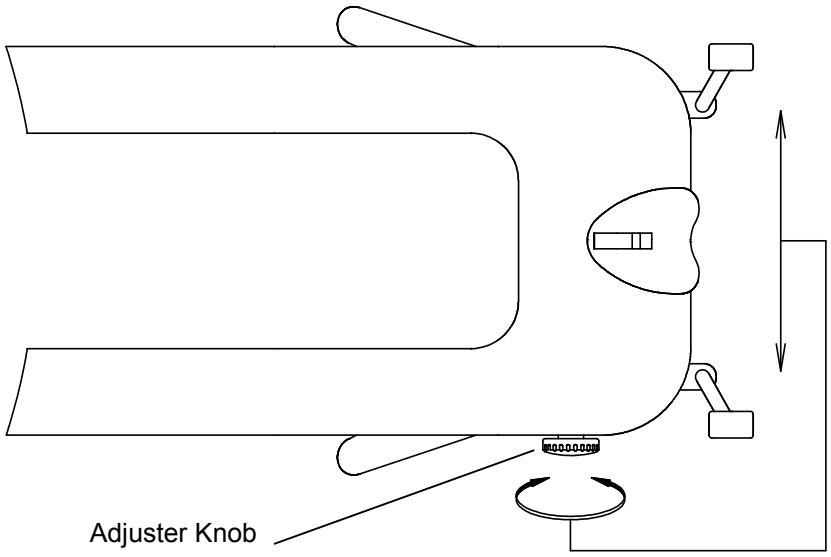
3. Operation Panel

See the 08.Operation Panel for more information.



4. Adjuster Knob

Temporal supports(for Panoramic) and Ear Rods(for TMJ) are used to hold the sides of the patient's head. The Adjuster knob is used to open or close Temporal supports or Ear Rods.



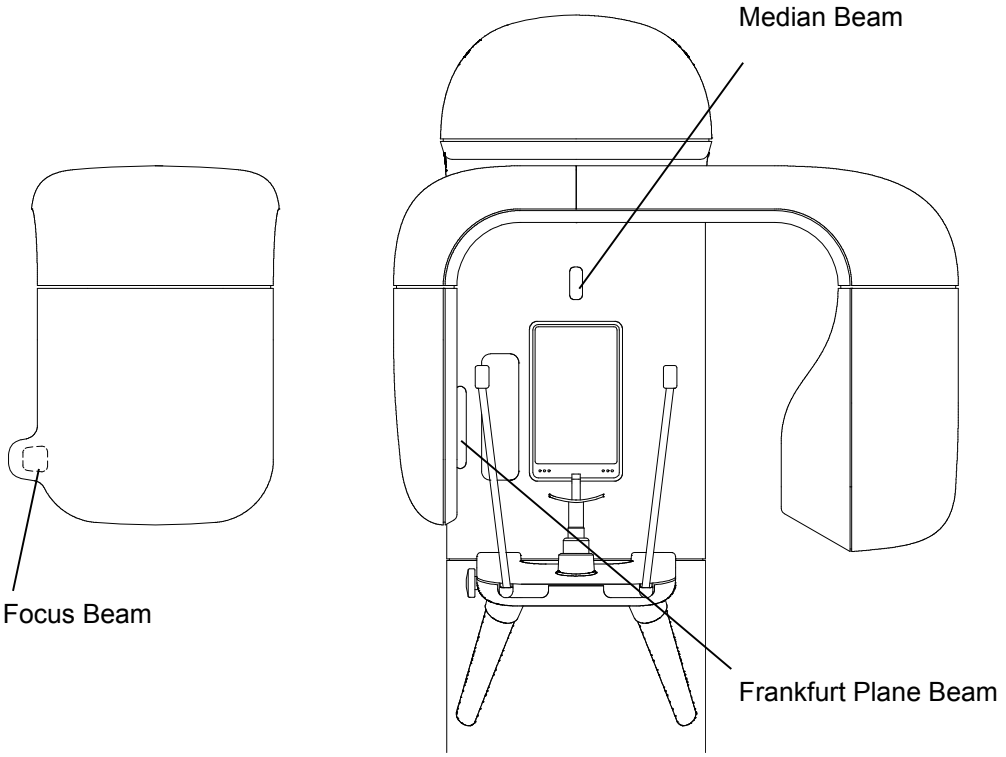
5. Names of Patient Positioning Laser Beams

Three Laser Beams are used for Patient Positioning

Median Beam: Adjust the center of the patient's face,

Frankfurt Plane Beam: Adjust the Frankfurt Horizontal Plane of a patient

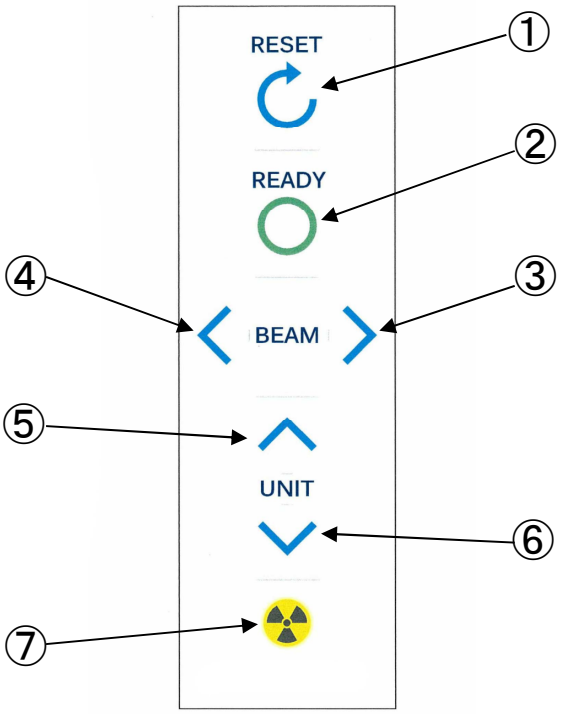
Focus Beam: Adjust the positions of the roots of upper and lower anterior teeth



⚠ CAUTION
1. Laser Beams are used to position the patient. 2. Warn the patient not to look directly into the laser beam. 3. Do not set the beam line so that it is aligns with the patient's eyes.

08. Operation Panel

1. Explanation of Operation Panel



No	Name	Function
1	Reset Switch	Set Arm Unit to start position Reset Error Reset Read On
2	Ready Switch	Start ready
3	Focus Beam Backward	Move Focus Beam Backward
4	Focus Beam Forward	Move Focus Beam Forward
5	Sliding Unit Up	Raises the sliding unit
6	Sliding Unit Down	Loweres the sliding unit
7	Exposure Mark	Mark is lit during exposure

09

09. Preparation before Exposure

1. Prepare accessories according to exposure mode

1. 1. **Panorama**

1) A pair of Temporal supports (Panorama)
2) A Chinrest (Panorama)
3) A Bite Block

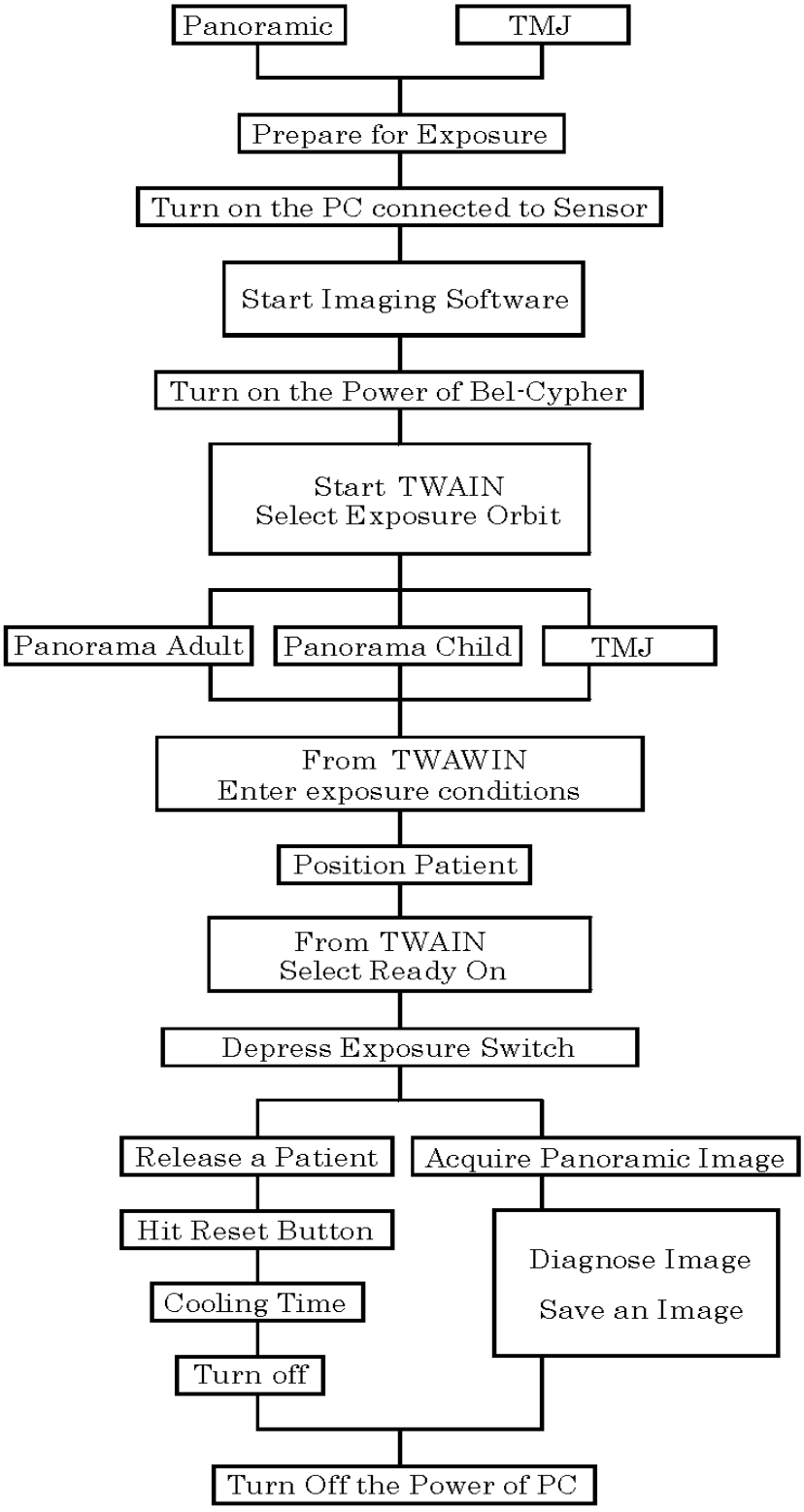
1. 2. **TMJ Lateral 4 sections**

A pair of Ear Rods (TMJ Lateral 4 sections)

2. Make patient wear X-ray protective clothing

10

10. Flow Chart of Exposure



1 1

11. Operation Procedure for Panorama & Panoramic Bitewing

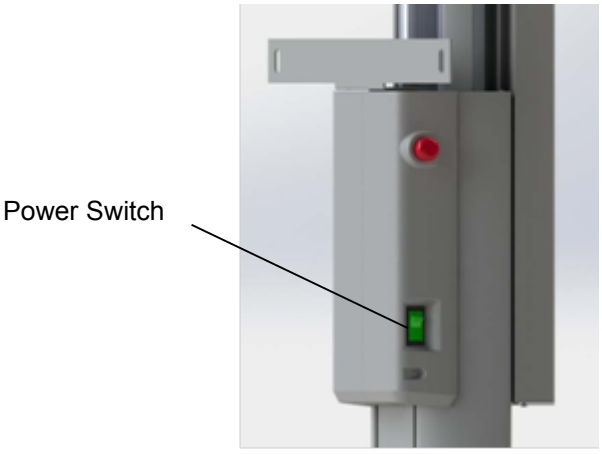
1. Learn Panoramic radiographic operation procedure this is basic X-ray radiography.
2. Explanation of operation procedure in other modes that the same operation as Panorama has been omitted. Refer to the operation procedure for Panorama accordingly.

1. Preparation for exposure

1. 1.
- ∗ X-ray protective clothing
- ∗ Temporal supports for Panorama
- ∗ Chinrest for Panorama
- ∗ Bite block

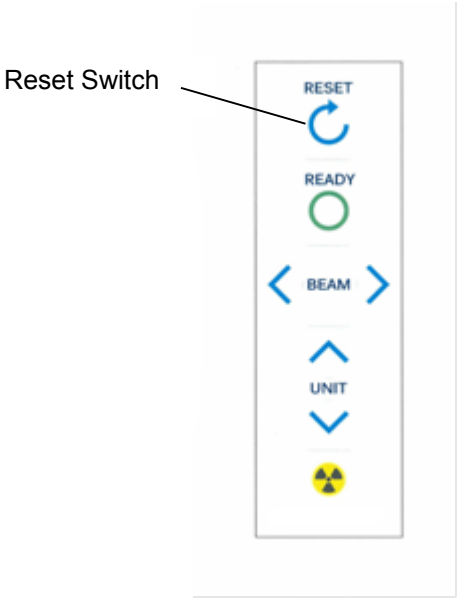
2. Turn on the Power of the Bel-Cypher Pro

2. 1. Push " I " on the power switch to turn the power ON.

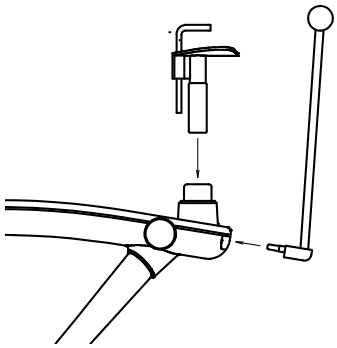


2. 2. If Arm Unit is not at its Reset Position, hit Reset Switch.

⚠ CAUTION
Before hitting the Reset Switch, remove the Chinrest and Temporal supports. By hitting the Reset Switch, the Arm starts to rotate. Stay away from Rotation area to avoid injury.



2. 3. Attach the Chinrest and Temporal supports.

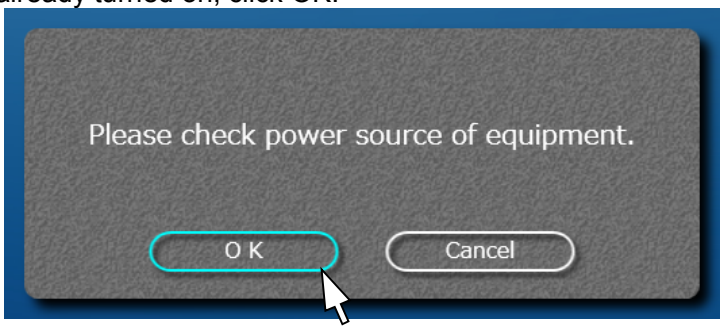


3. Exposure settings

Start-up of imaging software

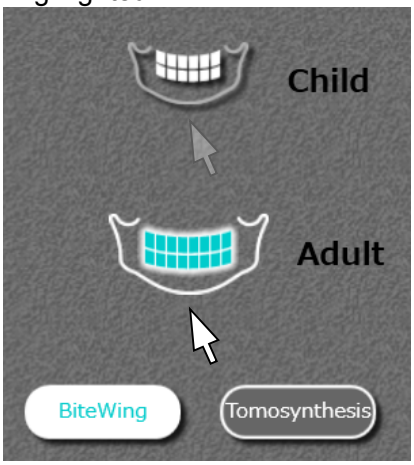
Start the imaging software from the management software.

Check Power
If the equipment has already turned on, click OK.

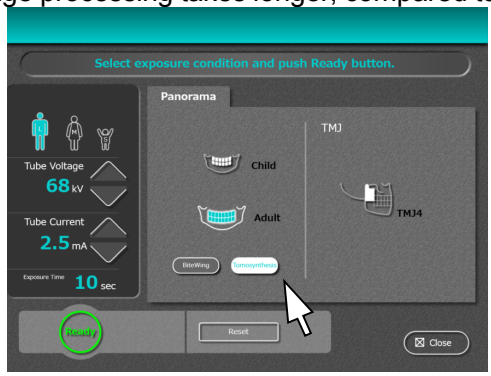


RESET
Click "Reset" to return the equipment arm to its original position.

Choose either Adult or Child.
Selected mode will be highlighted.



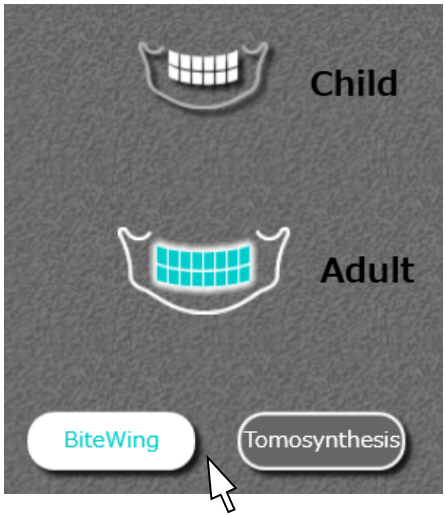
Set ON/OFF setting for Tomosynthesis.
When the [Tomosynthesis] button is highlighted, the Tomosynthesis function is ON. With the Tomosynthesis function ON, image processing takes longer, compared to when the function is OFF.



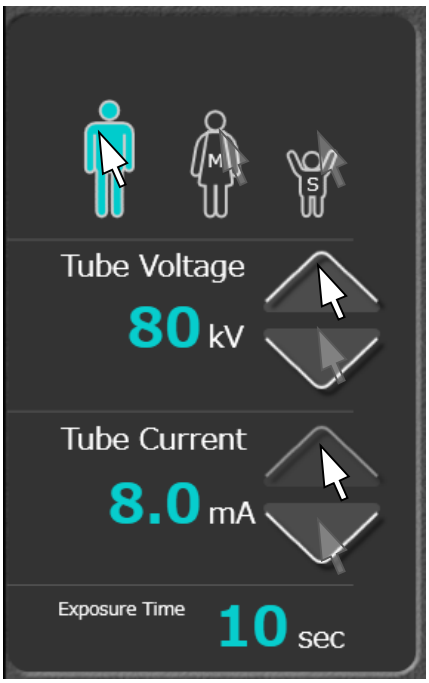
NOTE:

“Tomosynthesis” means the function which is used to acquire images of multiple tomographic layers in a single exposure.

If you want Panoramic Bitewing, choose “Bitewing”.
＊Tomosynthesis and Bitewing cannot be used together.



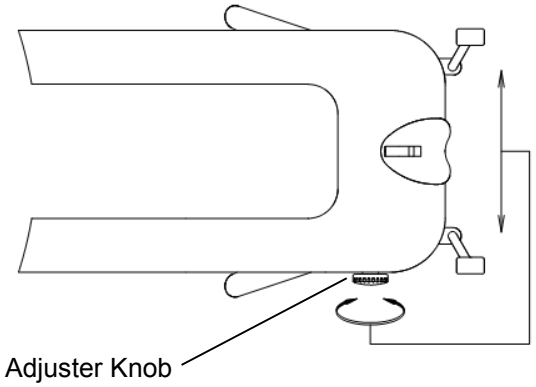
Voltage (kV) and current (mA) settings
Refer Sec 13 Table of Exposure Settings to choose appropriate setting values.
- Discretionary setting
  kV setting
    Click the ▲ (UP) or ▼ (DOWN) symbols on the right side of the kV display.
  mA setting
    Click the ▲ (UP) or ▼ (DOWN) symbols on the right side of the mA display.
  Or simply click patient size icon.
  You may need to adjust mA / kV for some patients.



4. Patient Positioning

Patient positioning is the key for a successful radiograph. Position the patient with care.

4. 1. By turning adjuster Knob, open the Temporal supports.

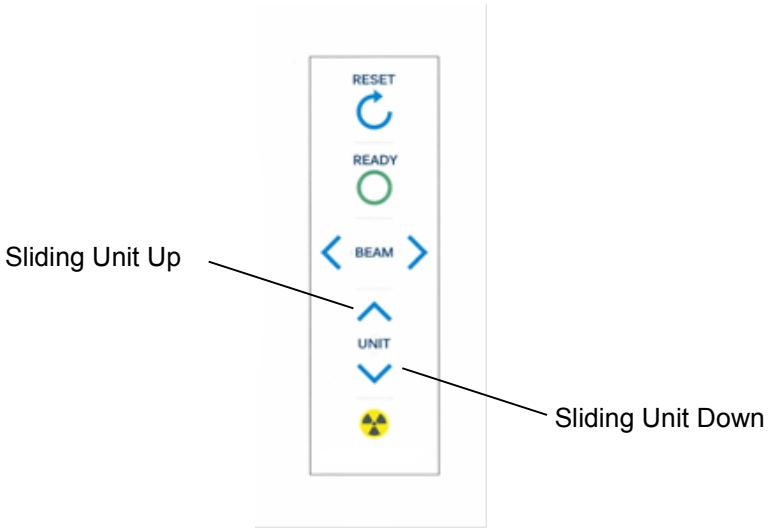


4. 2. Ensure the patient is wearing X-ray protective clothing.

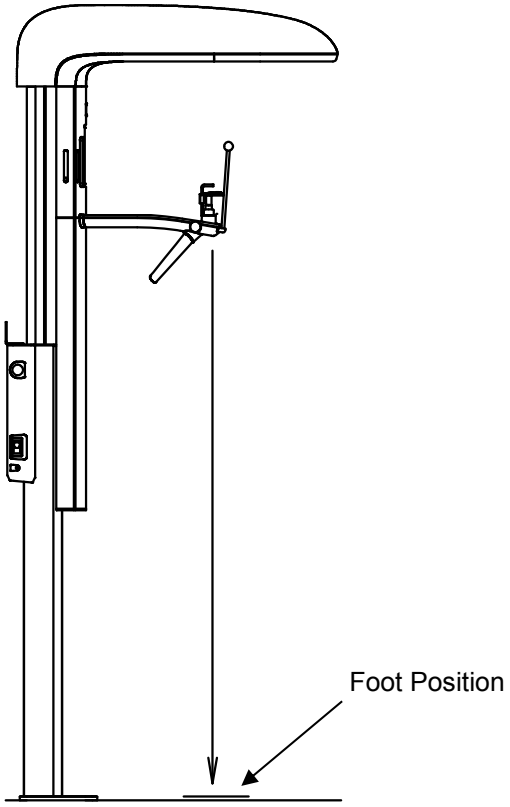
⚠ CAUTION
Ensure both the patient and assistant are wearing X-ray protective clothing.

4. 3. Bring the patient close to the Bel-Cypher Pro.

4. 4. Adjust the height of Chinrest by moving Sliding Unit Up/Down, so that the patient can stand upright and the patient's chin can rest on the Chinrest.



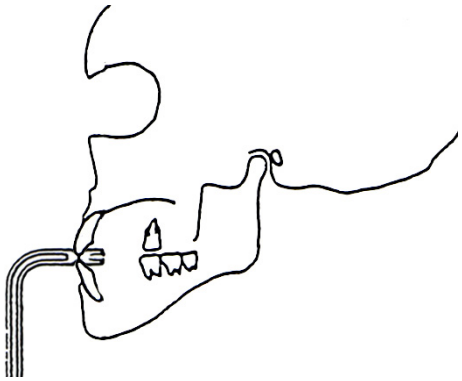
4. 5. Bring patient to stand at the foot position as shown below.



4. 6. Ask patient to hold the grips.

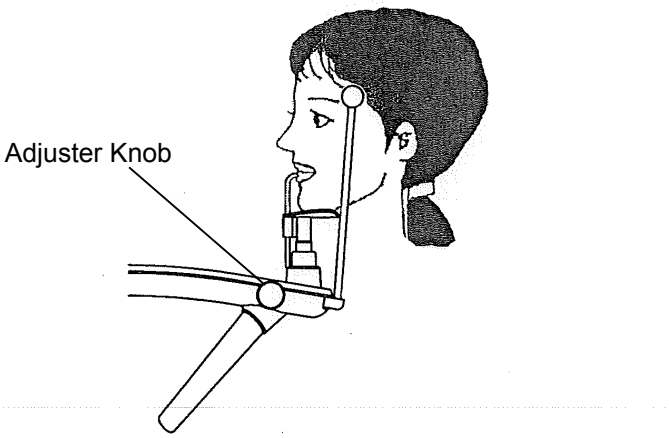
4. 7. Bring Chinrest (Panorama) until the Chinrest lightly touches the patient's lower jaw.

4. 8. Instruct patient to bite the groove of the Bite Block with upper and lower anterior teeth. Instruct patient to put chin on the Chinrest.



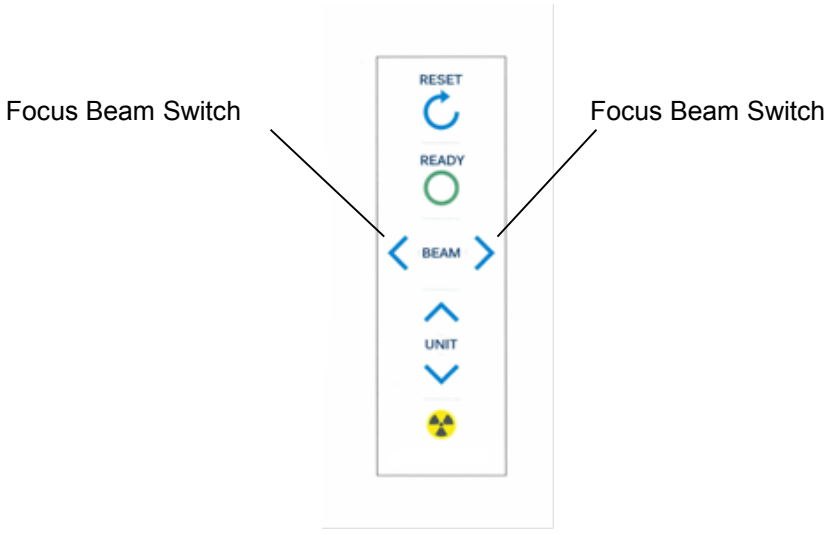
For an edentulous patient
Roll clean gauze on Bite Block, and instruct patient to bite onto it.

4. 9. Lightly close the Temporal supports to position patient's head.



4. 10. Turn Focus Beams ON

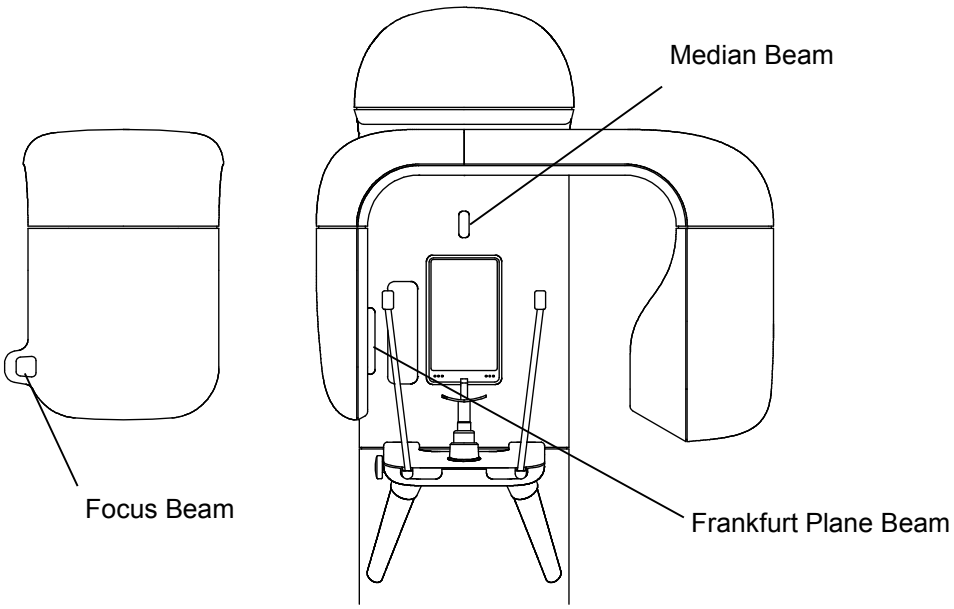
Depress either Focus beam switch to turn Patient Focus Beams on.



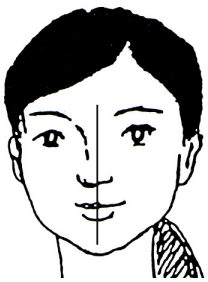
4. 11. Median Beam, Frankfurt Plane Beam & Focus Beam turn on at the same time.

⚠ CAUTION
1. Warn patient not to look directly into the beam of the laser. 2. Do not set the beam into the patient's eyes.

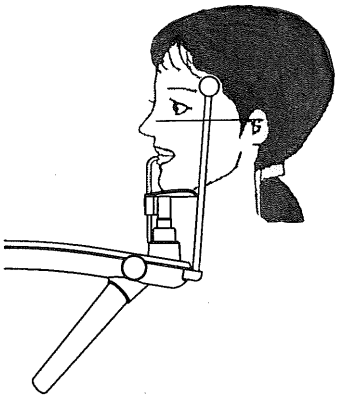
NOTE
Positioning beams have AUTO POWER OFF function. Laser beam will be automatically turned off a few minutes after the beam turned ON. In order to turn the laser on again, depress either Focus beam switch.



4. 12. Adjust the patient's head so that the Median Beam comes to the center of the patient's face.

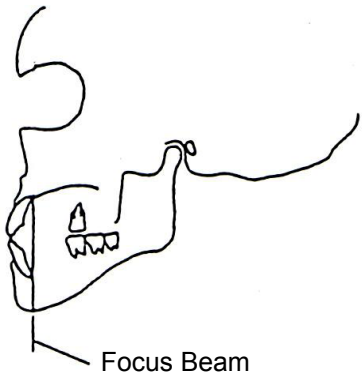


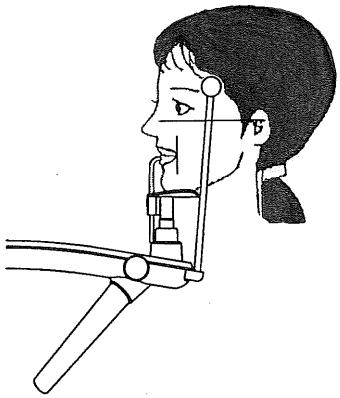
4. 13. Move Frankfurt Plane Beam to align Frankfurt Plane Beam with Frankfurt Plane of the patient's head.



4. 14. Carefully close Temporal supports to support the patient's head.

4. 15. Align Focus Beam with roots of upper and lower anterior teeth.



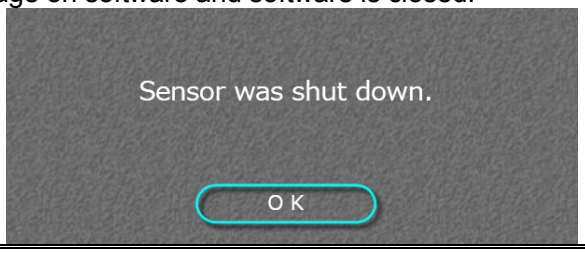


For an edentulous patient
Roll clean gauze on Bite Block, and instruct patient to bite it.

4. 16. When aligning the Focus Beam, look at patient from the side.

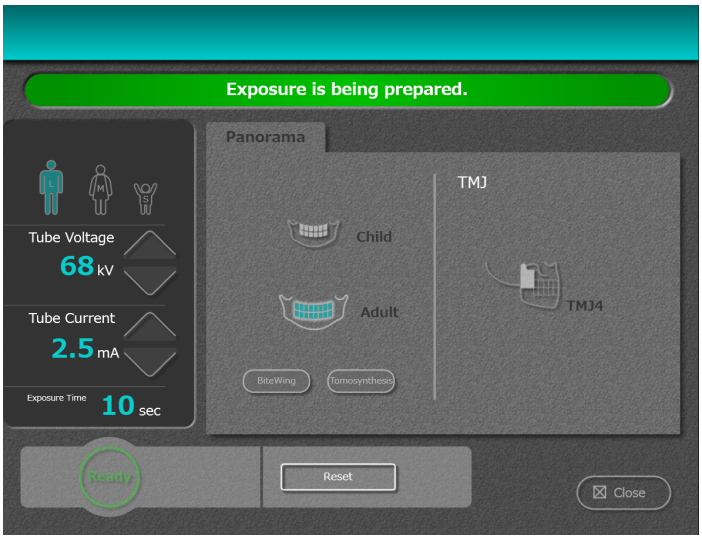
NOTE

If device is not operated by Operation Panel nor communicated by software for 6 min, sensor is shut down with displaying message on software and software is closed.

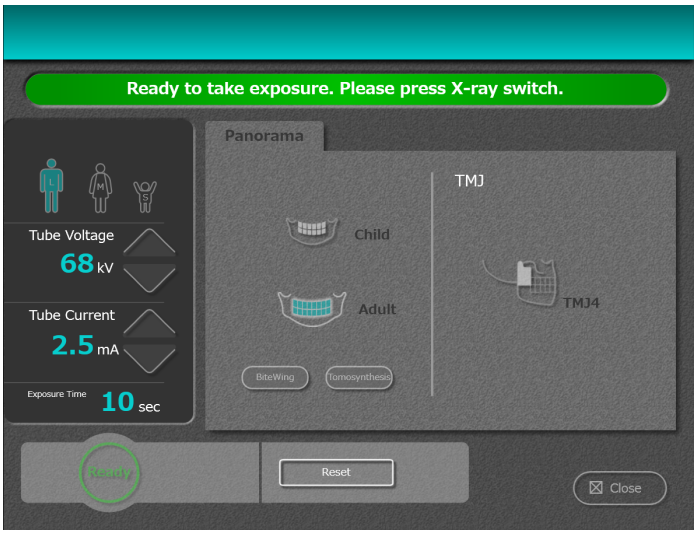


5. Ready On

1) Click "Ready" on the PC operation panel.
The color of the message of PC operation panel changes to green color and blinks.
The message "Sensor is being initialized" is displayed.



After finishing initialization of the sensor, the color of the message of the PC operation panel changes to green. The message “Start exposure” is displayed.



NOTE
1. After “Start Exposure” is displayed, if the Exposure switch is not depressed within 30 seconds, “Ready On” will be cancelled automatically.
2. Any key operation except Reset key cannot be operated during Ready On、to cancel Ready On, hit Reset key.
3. If Arm is not at “Reset position”, even if ready key is depressed, Read On won’t be displayed. hit Reset key to bring the Arm to the “Reset position”.

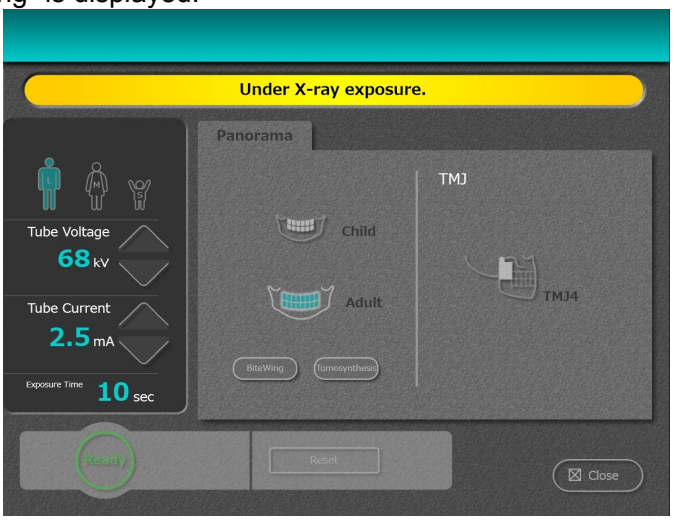
6. X-Ray Irradiation

⚠ WARNING
1. Other people except patient and operator should be outside the X-ray room. 2. The X-ray exposure switch should be depressed 7 feet away from Bel-Cypher Pro. Operator must stand behind the shielded partition. 3. Carefully observe patient while X-ray is irradiated, release the Exposure Switch immediately if any trouble occurs. 4. Instruct patient not to move while X-ray is in progress.

⚠ WARNING
1. The Exposure switch is a 'Deadman' type. X-ray irradiation and the movement of the Arm Unit will stop immediately when the Exposure Switch is released. **Keep the Exposure Switch depressed until the exposure is completely finished (indicated by a final beep then silence).** **If you release the Exposure Button before the completion of the exposure, you'll lose the image.** 2. If exposure switch is released while an X-ray operation is in progress, release the patient and depress Reset key to bring Arm Unit to the start position. Start from the beginning again.

6. 1. Keep the Exposure Switch pressed until the end of the Exposure.

6. 2. The Arm rotates, a buzzer sounds intermittently, and exposure begins.
During exposure, the message on the PC operating panel blinks in yellow, and "Under the X-ray exposing" is displayed.



6. 3. When irradiation is completed, arm rotation stops and buzzer stops sounding.

6. 4. ”Transferring Data” is displayed on the PC Screen.

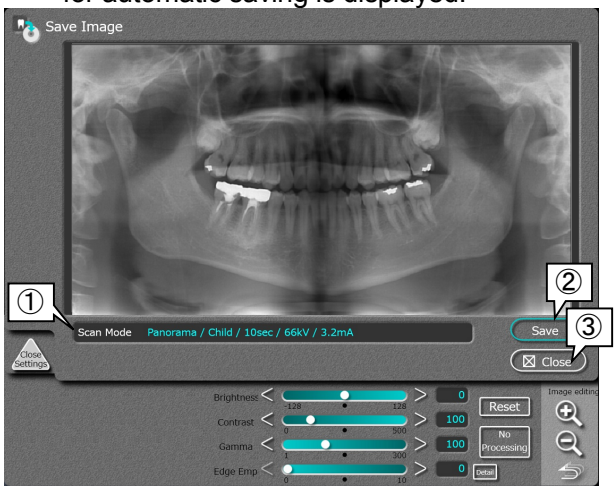
⚠ CAUTION
While data is transferring, do not turn off the power of Bel-Cypher Pro, or else data will be lost.

6. 5. After data is transferred, Panoramic Image is displayed on the screen.

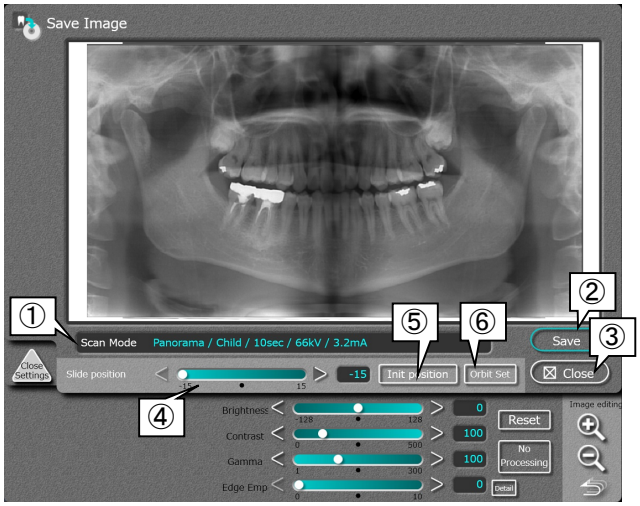
6. 6. Tomosynthesis

6.6.1

After the data transfer, the panoramic image is displayed for viewing.
When a tomosynthesis exposure is performed, the images of the optimum tomographic positions for automatic saving is displayed.

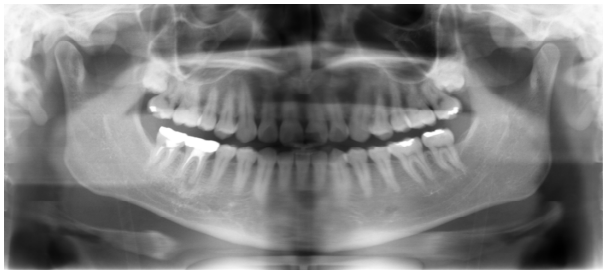


Panoramic display



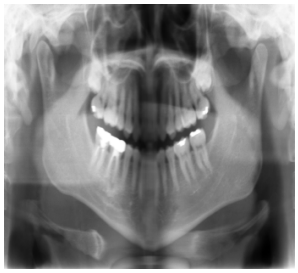
Tomosynthesis display

①	[Scan mode]	Displays the exposure conditions.
②	[Save]	Closes the window with the image saved.
③	[Close]	Closes the window without the image saved.
④	[Slice position]	By moving this slide bar the tomographic plane can be changed. Moving to the right produces forward movement of the tomographic plane, while moving to left produces backward movement.
⑤	[Init position]	Returns the value that was shown when the save screen is displayed.
⑥	[Orbit settings]	After the panoramic radiograph is taken, construct a panoramic image by setting the anterior section orbit and the molar section orbit. (refer to 6.6.2. Set tomosynthesis orbit)



When the slice position is set to +15:

When the slice position is set to 0:



When the slice position is set to -15:

∗Slide bar of tomosynthesis for changing range is different from radiography orbit (adults or children.)

6.6.2. Tomosynthesis orbit setting

After the panoramic radiograph is taken, you can create a panoramic image by setting the anterior section orbit and the molar section orbit. Use this function when the patient positioning is improper, or when the patient's dentition is too far displaced from the standard orbit.

Remarks

・This function is available only when you take a panoramic image by using the tomosynthesis mode.

・Position the patient correctly.

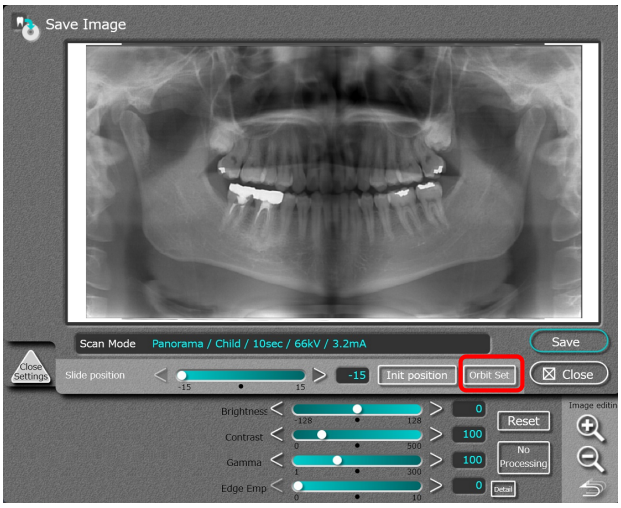
When the patient positioning is improper (beyond the limit of adjustment), you may not able to get the better image though you use this function.

・The lower limit value of the slice position may change when the image is created by using the orbit setting screen.

・Please confirm the image is acceptable before saving it.
Once the image is saved, you can't change the orbit again.

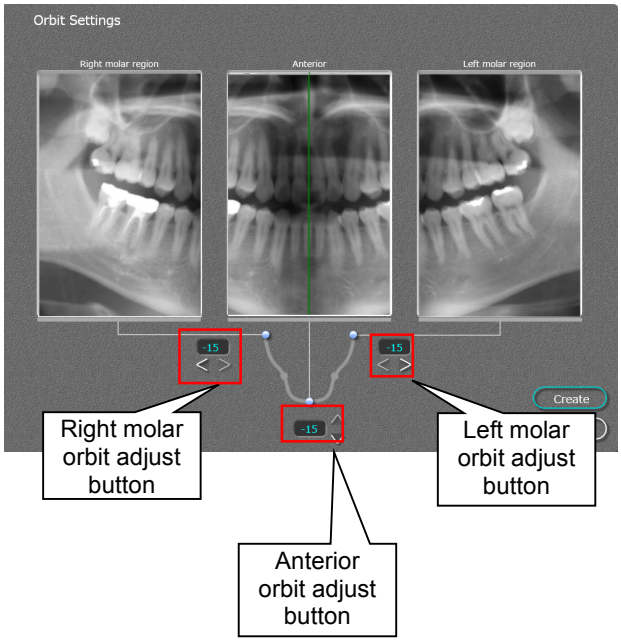
・The image in the orbit setting screen is shown without the edge emphasis.

6.6.3..Preparation of the orbit settings



1. To use the tomosynthesis orbit setting, click "Orbit set"

6.6.4.Set the orbits



1. By using the Right/Left molar orbit adjust button and anterior orbit adjust button, you can change the slicing orbit plane. Choose the orbit in which the anterior section is clearly shown. Then adjust the molar section so that the size of both left molar and right molar become the same. （Image changes in right/left directions）

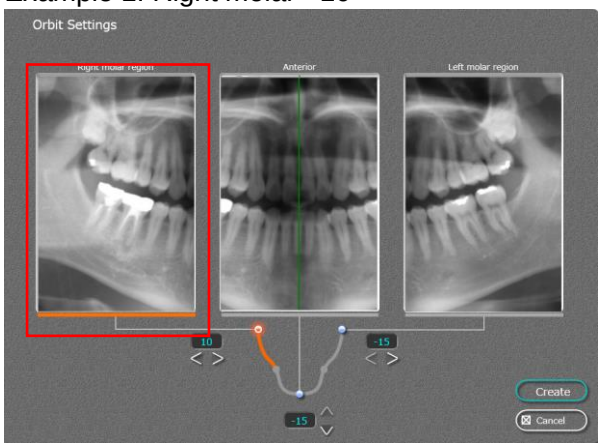
・Right Molar：
By clicking the left button, the molar orbit moves to cheek side (+) (Image expands to right/left directions）
By clicking the right button, the molar orbit moves to tongue side (-) (Image shrinks toward the center)

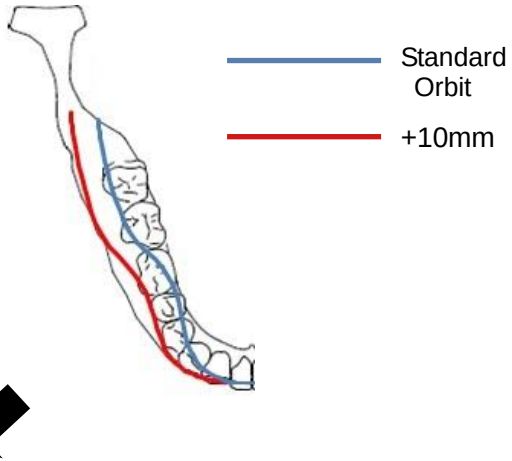
・Left Molar：
By clicking the left button, the molar orbit moves to tongue side (+) (Image expands to right/left directions）
By clicking the right button, the molar orbit moves to cheek side (-) (Image shrinks toward the center)

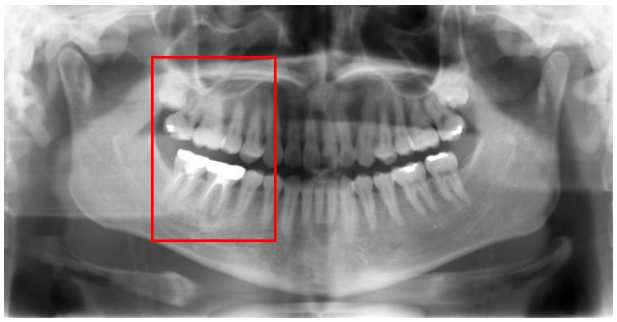
・Anterior：
By clicking up button, the anterior orbit moves to back side (-) (Image shrinks).
By clicking down button, the anterior orbit moves to front side(+) (Image expands)

* Molar section and anterior section covers same teeth, the orbit change will be reflected in 6th and 7th tooth areas (molar) and 1st through 3rd area(anterior)

Example 1: Right molar +10

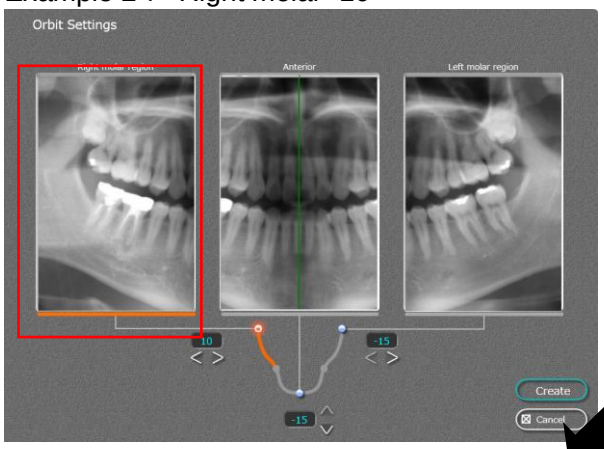


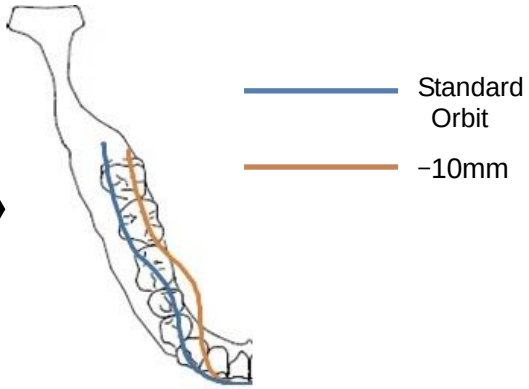




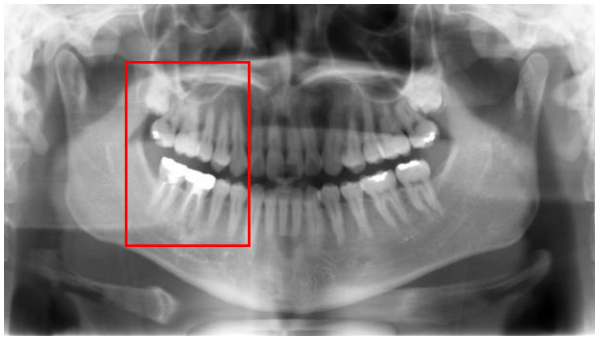
Orbit moves to cheek side for 10mm.

Example 2： Right molar -10

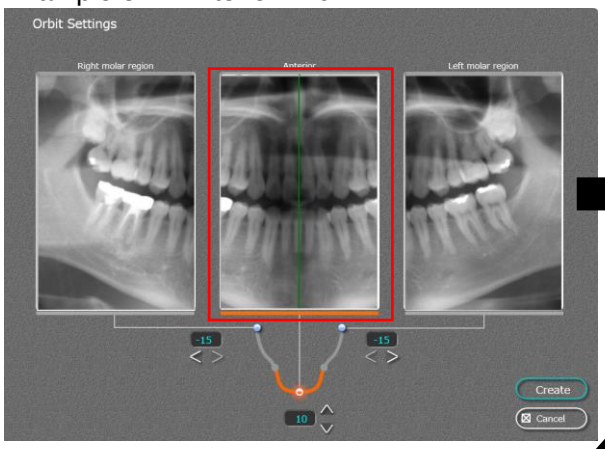


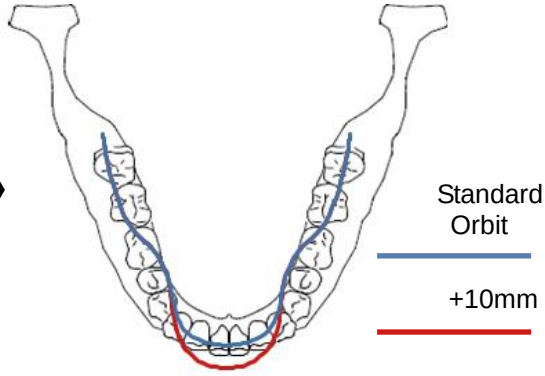


Orbit moves to tongue side for 10mm.

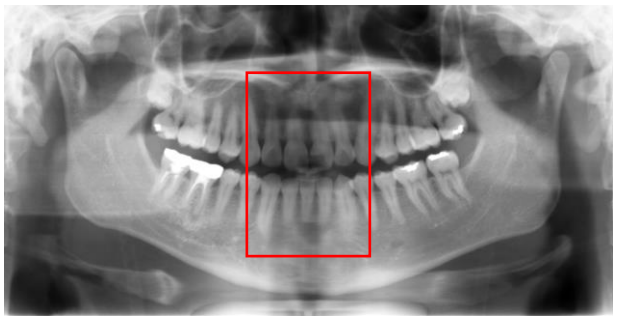


Example 3： Anterior +10

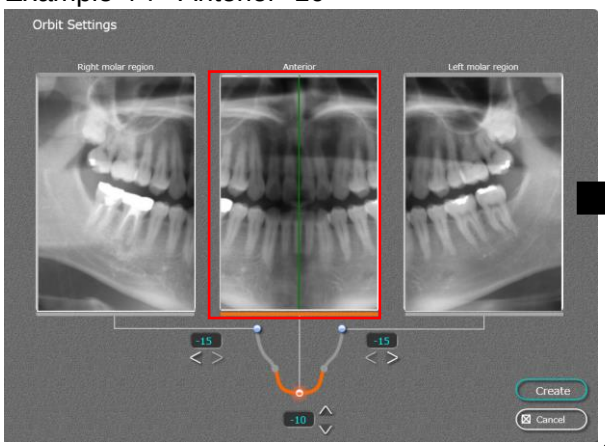


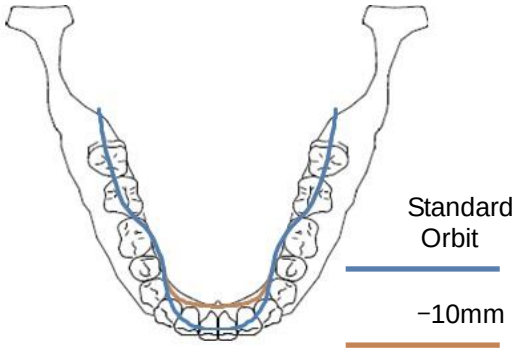


Orbit moves to front side for 10mm.

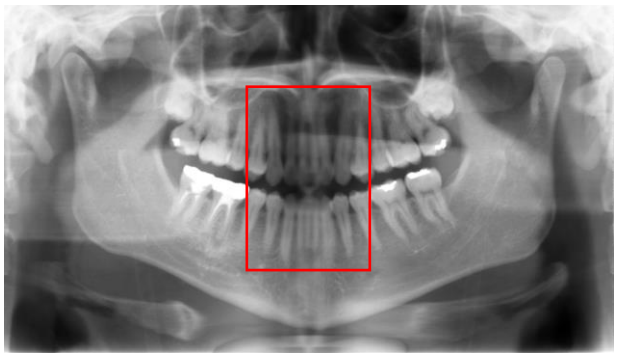


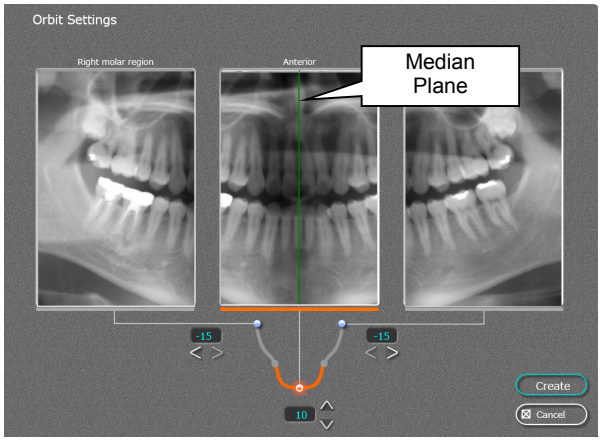
Example 4： Anterior -10





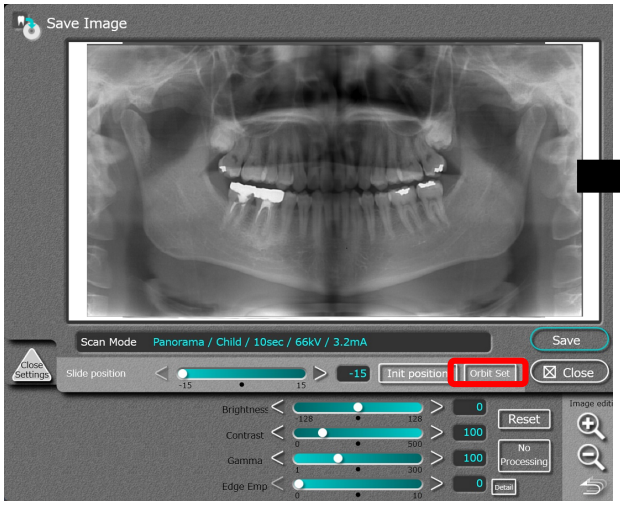
Orbit moves to back side for 10mm.



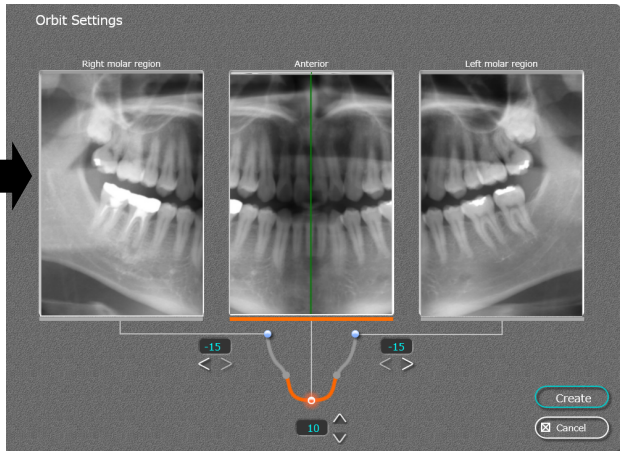


If the median plane is off, by dragging the median plane line, you can change the median plane.
*1： The median plane can be adjusted within ±10mm of median plane line.
*2： If the median plane is inclined by mis-positioning of the patient, this function can't adjust the angle of the median plane.

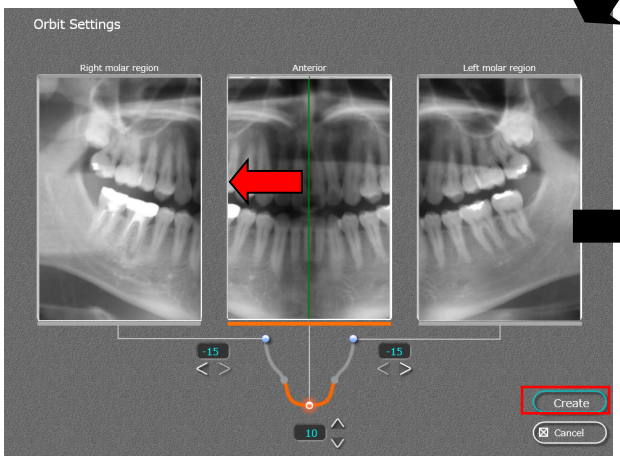
Example 5：Move the Median Plane Line
* Below example shows that median plane line is off to the left side.



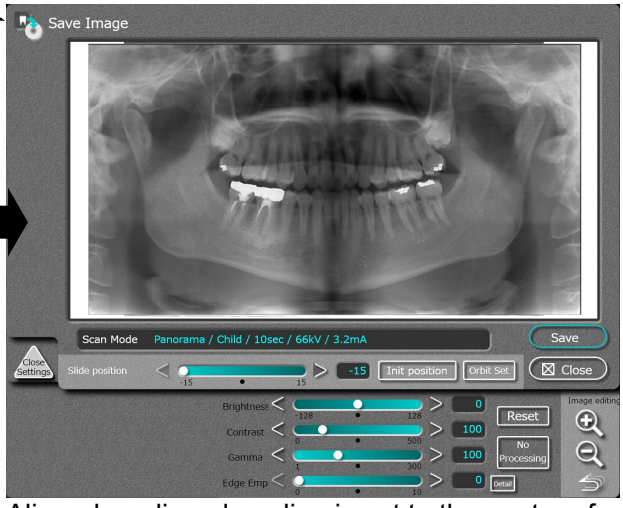
The median plane line is off to the left side
Click Orbit set



Orbit setting screen is shown



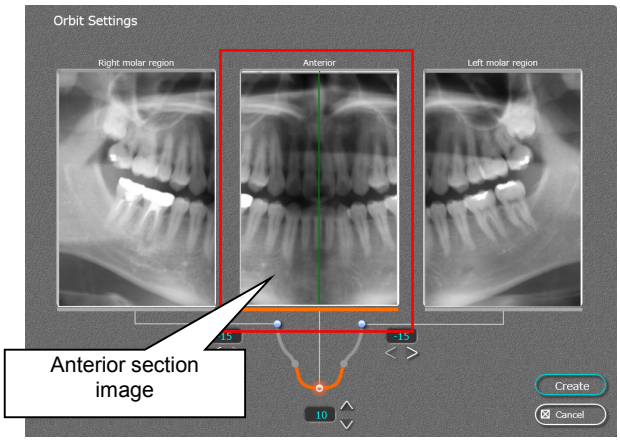
Move the median plane line (green) to the left side to align the median plane line to the center of image.
Click "Create" button.



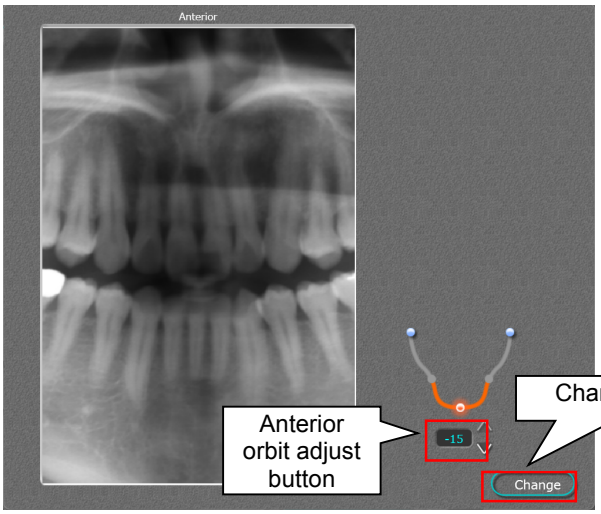
Aligned median plane line is set to the center of the image

6.6.6.Anterior image enlarge function

* Use this function to align the median plane line by looking at the enlarged image.



Double click anterior section image.



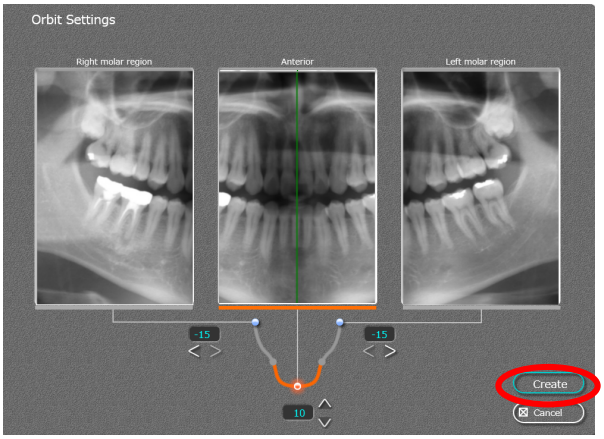
Enlarged image is shown here.

Use the anterior orbit adjust button to change the slicing orbit.

* Refer 6.6.4. .Set the orbits section.

Click “Change” button, to reflect adjusted slicing orbit.

Adjusted image is displayed.



Create Image (reflect changes to the image)

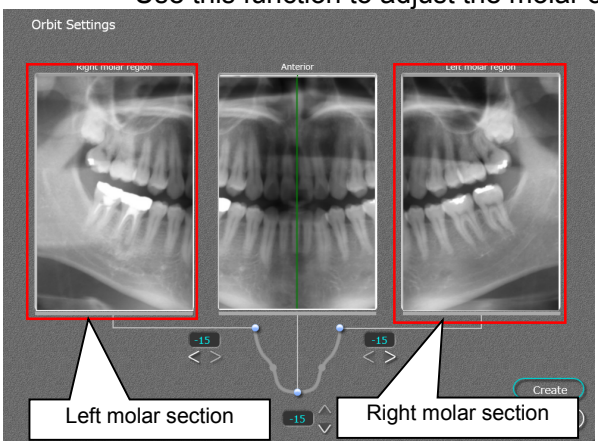
Click “Create” button.

The image that reflects the orbit adjustment and median line adjustment will be created.

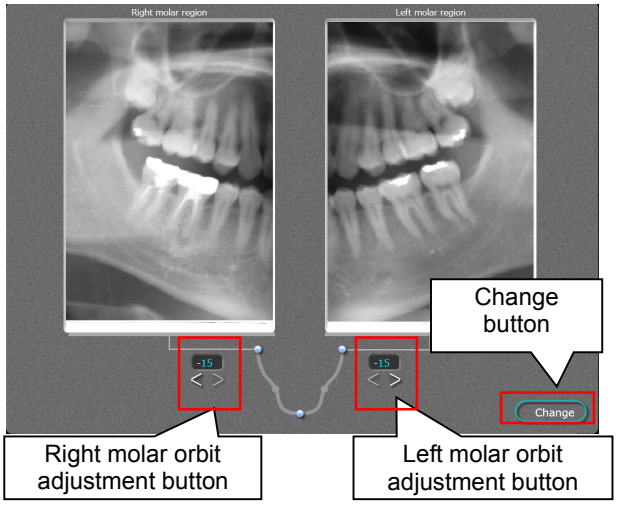
After the image is created, screen comes back to image save screen. Follow 6.6.9. procedure to save the image.

6.6.7. Molar image enlarge function

* Use this function to adjust the molar orbit line by looking at the enlarged image.



Double click either right or left molar section screen.



Enlarged image is shown.

Use molar orbit adjustment buttons to change the orbit plane.

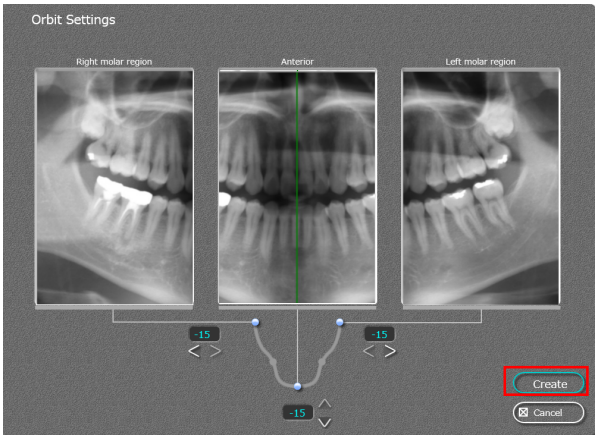
* Refer 6.6.4. .Set the orbits section.

Click “Change” button, to reflect adjusted slicing orbit.

Adjusted image is displayed.

6.6.8. Create Image

(reflect changes to the image)

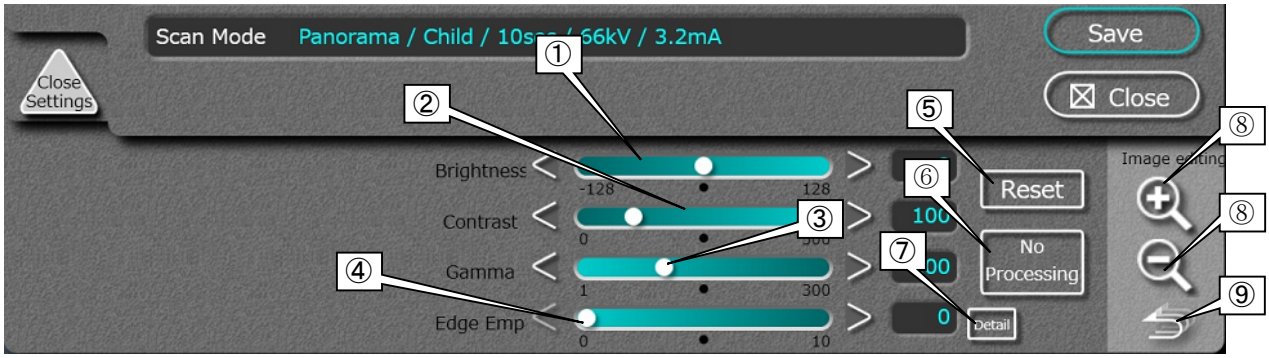


Click “Create” button.

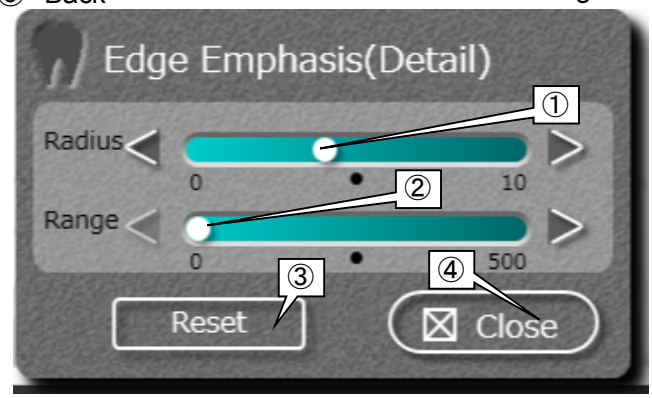
An image that reflects the orbit adjustment and median line adjustment will be created.

After the image is created, screen comes back to image save screen. Follow 6.6.9. procedure to save the image.

6.6.9. The image parameters can be edited in the image processing area.
The editable parameters are brightness, contrast, gamma, and edge emphasis.



①	[Brightness]	Moving the slide bar to the left darkens the image, and moving it to the right brightens the image.
②	[Contrast]	Moving the slide bar to the left increases image contrast, and moving it to the right decreases contrast.
③	[Gamma]	Moving the slide bar to the left lightens mid tones, and moving it to the right darkens them.
④	[Edge Emphasis]	Changes the emphasis of edges in the image (similar to image sharpening).
⑤	[Reset]	Returns the value changed to the initial value.
⑥	[No Processing]	Cancels the image processing by changing the value to the default value.
⑦	[Detail]	Sets the diameter and the range of edge emphasis.
⑧	Zoom in/out	Changes the zooming rate of the image. When the image is zoomed in, dragging the display position of the image can change the rate.
⑨	Back	Returns the zoom setting of the image to its initial value.



Edge Emphasis(Detail) display

①	[Radius]	Indicates the range to apply emphasis of outline. Small values emphasize the outline only, and large values emphasize the entire image.
②	[Range]	Indicates the brightness level of the border line of images. Large values emphasize the border line clearly.
③	[Reset]	Returns the diameter and the range changed to their initial values.
④	[Close]	Closes the edge emphasis (Detail) screen.

6. 7. Save the Image as needed.

7. Cooling Time

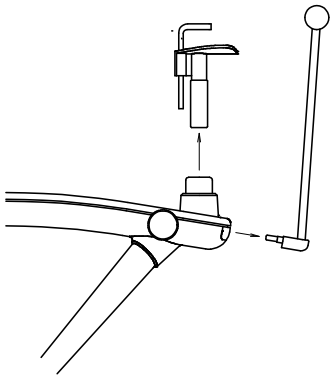
7. 1. When X-Ray Irradiation is complete, Bel-Cypher Pro automatically goes into its cooling phase. Remaining cooling time is displayed on the screen.

⚠ CAUTION
1. X-ray exposures cannot be made during COOLING TIME. 2. All key operations except the Reset key are inoperable during COOLING TIME. 3. Do not turn the power OFF until the end of COOLING TIME. 4. When a thermal error occurs, wait for 20 minutes before making another X-ray exposure.

8. Release of Patient

8. 1. Carefully open temporal supports then release the patient.

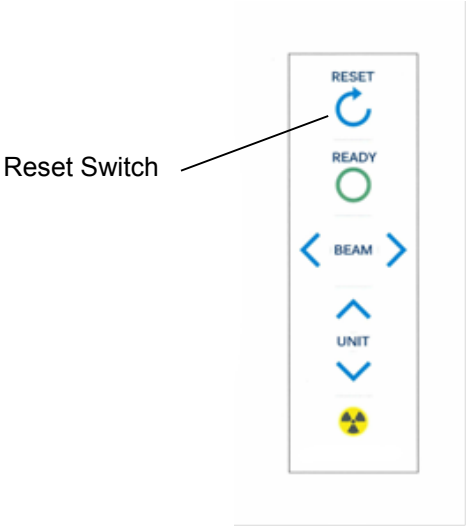
8. 2. Remove the Chinrest and Temporal supports.



9. Bring Arm Unit to the Reset Position

By depressing the Reset key on the sliding unit, Arm Unit moves to Reset Position.

⚠ CAUTION
Before hitting the Reset Switch, remove the Chinrest and Temporal supports. By hitting Reset Switch, Arm starts to rotate. Stay away from Rotation area to avoid injury.

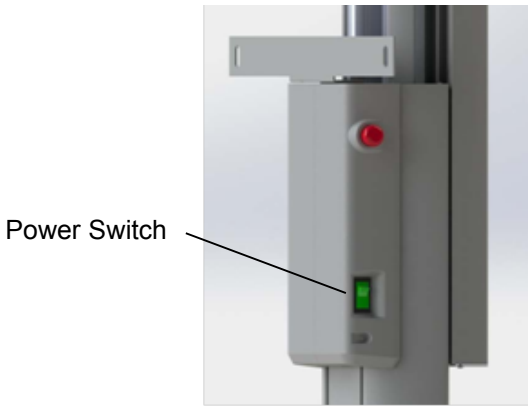


10. Turning Power OFF

10. 1. Confirm cooling time is finished.

10. 2. Confirm Panoramic Image is displayed on the PC Screen.

10. 3. Depress “O” key on POWER switch to turn the power off.



⚠ CAUTION
At the Power-off mode, if you start TWAIN Program, “Communication Error” occurs. If you don’t use Bel-Cypher Pro for more than 10 minutes, please turn off the power.

12. Operation Procedure for TMJ

1. Preparation for exposure

1. 1.

＊X-ray protective clothing

＊Ear Rods for TMJ

2. Turn the Power of Bel-Cypher Pro

2. 1. Push " I " on the power switch to turn the power ON.

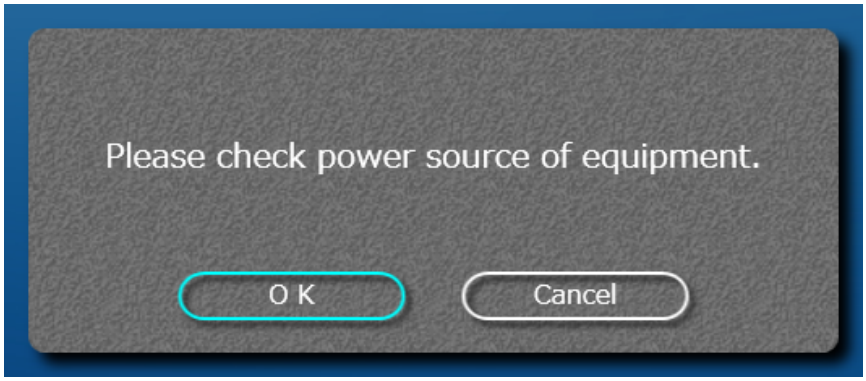
3. Exposure settings

Start-up of imaging software

Start the imaging software from the management software.

Check Power

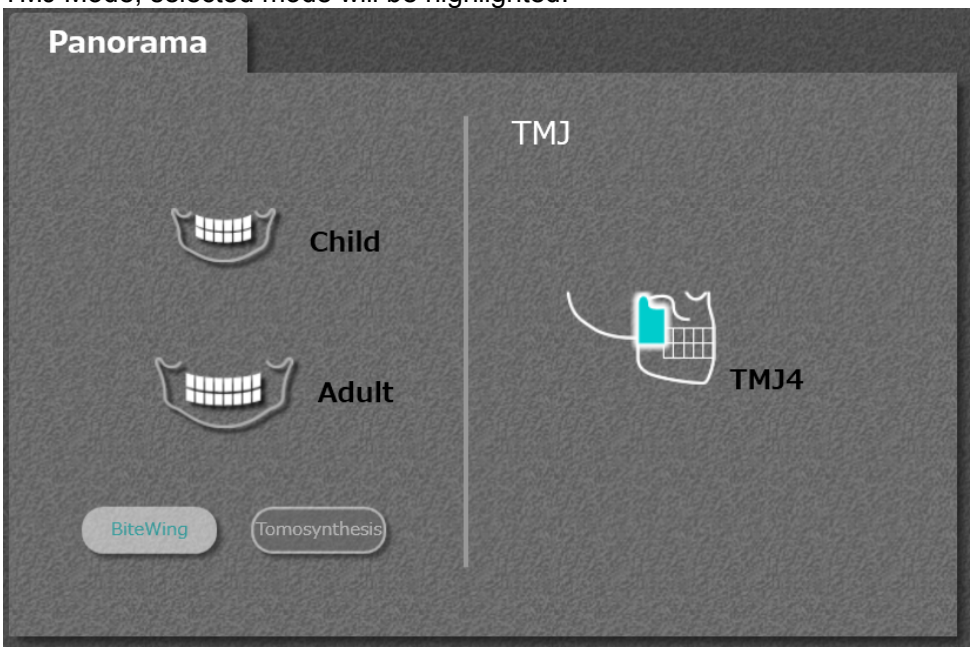
If the equipment has already turned on, click OK.



RESET

Click "Reset" to return the equipment arm to its original position.

Choose TMJ Mode, selected mode will be highlighted.



kV and mA settings

Refer Sec 13 Table of Exposure Settings to choose appropriate setting values.

- Discretionary setting

kV setting

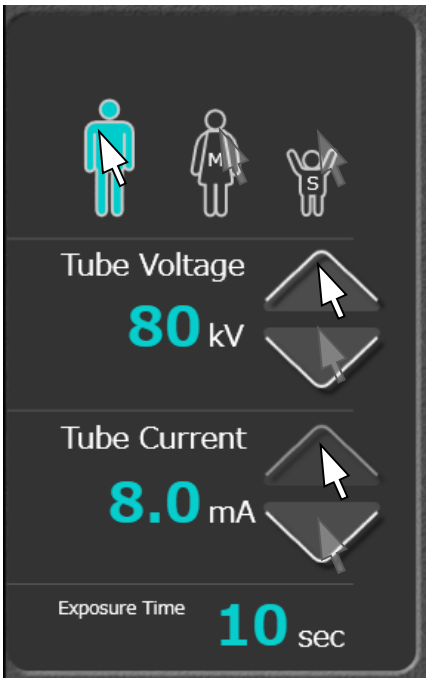
Click the ▲ (UP) or ▼ (DOWN) symbols on the right side of the kV display.

mA setting

Click the ▲ (UP) or ▼ (DOWN) symbols on the right side of the mA display.

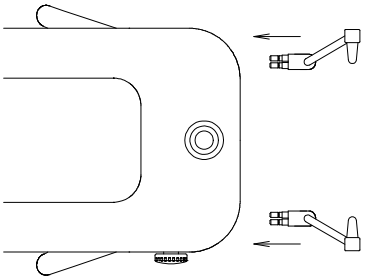
Or simply click patient size icon.

You may need to adjust mA / kV for some patients.

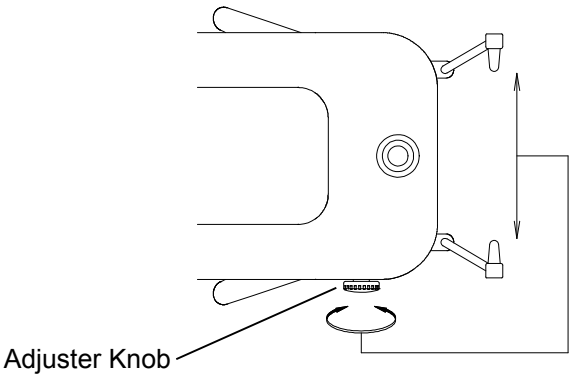


4. Patient Positioning

4. 1. Attach Ear Rods.



4. 2. By turning Adjuster Knob, open Ear Rods

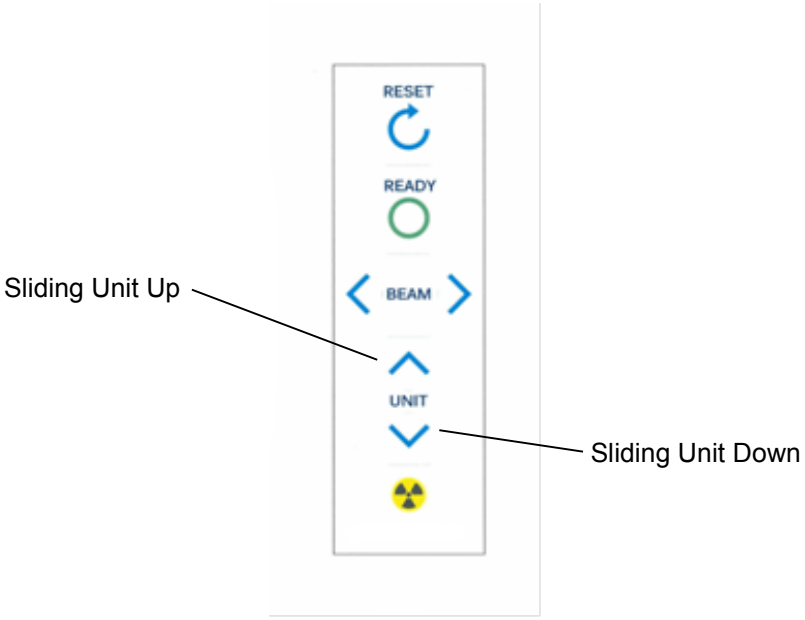


4. 3. Make patient wear X-ray protective clothing.

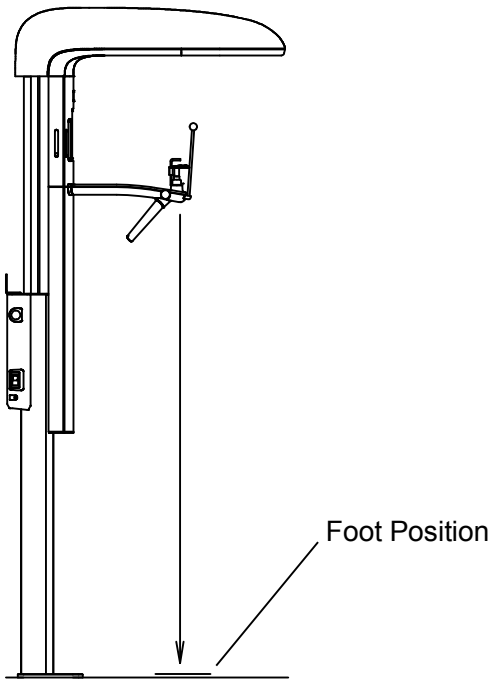
⚠ CAUTION
Ensure that the patient and assistant are wearing X-ray protective clothing.

4. 4. Bring the patient close to Bel-Cypher Pro.

4. 5. Adjust the height of Chinrest by moving Sliding Unit Up/Down, so that the patient can stand upright and align the ear rods to the patient's external auditory foramen.



4. 6. Bring patient to stand at the foot position as shown below.

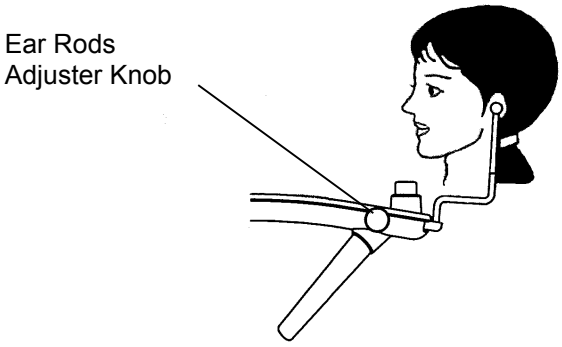


4. 7. Ask patient to hold the grips

4. 8. Adjust the height of Chinrest by moving Sliding Unit Up/Down, align ear rods to patient's external auditory foramen.

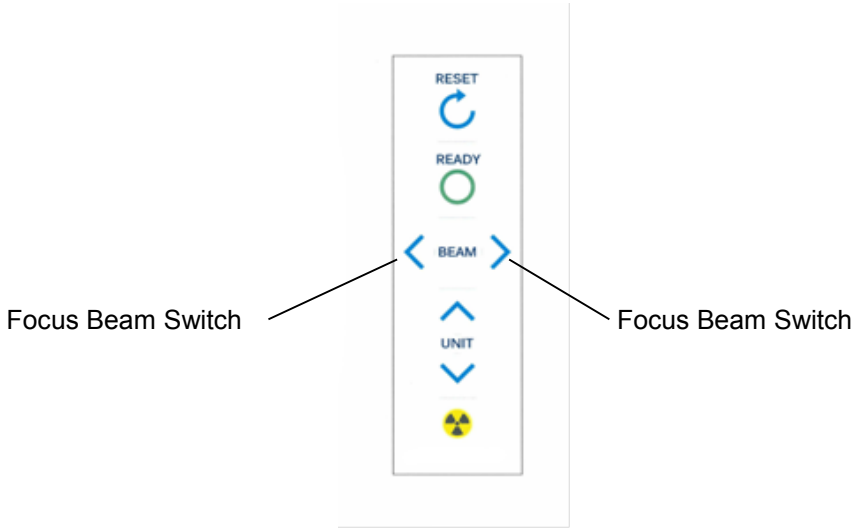
⚠ CAUTION
While moving Sliding Unit, be careful that the Sliding Unit does not hit the patient's head.

4. 9. Rotate the knob of the Rest Unit ASSY to insert Ear Rod into auricular holes of the patient and lightly fix the positions of the Ear Rods.



4. 10. Turn Focus Beams ON

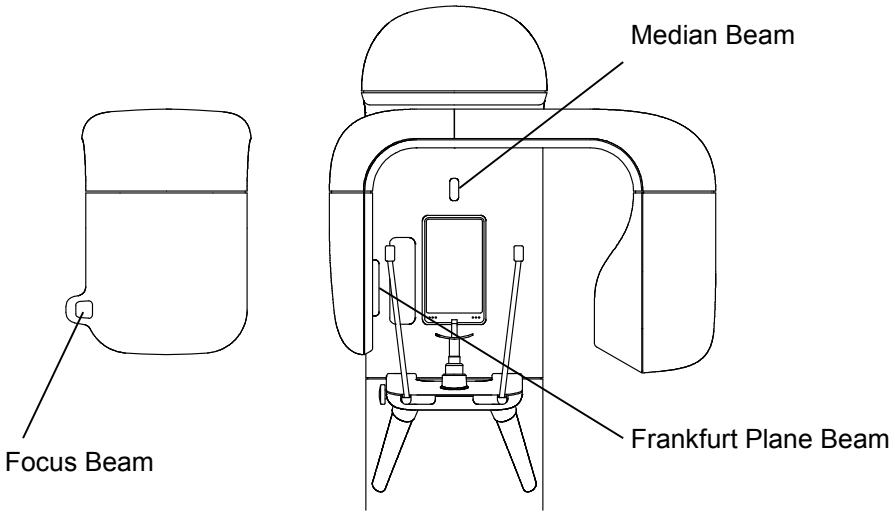
Depress any either Focus Beam switch to turn Patient Focus Beams on.



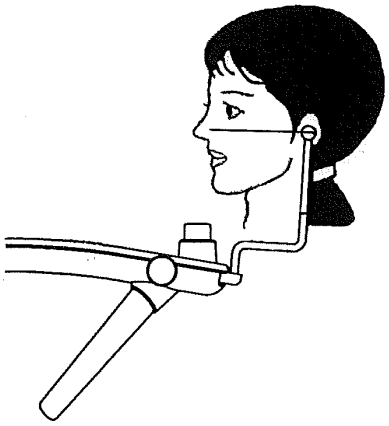
4. 11. Median Beam, Frankfurt Plane Beam & Focus Beam turn on at the same time.

⚠ CAUTION
1. Warn patient not to look directly into the beam of the laser. 2. Do not set the beam into the patient's eyes.

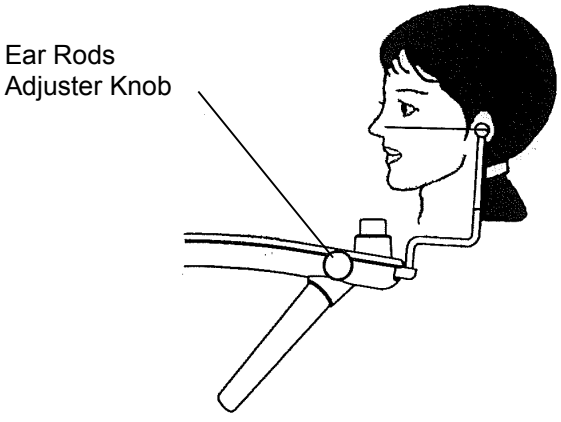
NOTE
Positioning beams have AUTO POWER OFF function. Laser beam will be automatically turned off a few minutes after the beam is turn ON. In order to turn the laser on again, depress either Focus Beam.



4. 12. Horizontally align to the patient's naso-auricularplane



4. 13. Rotate the knob of the Rest Unit ASSY to insert Ear Rod into auricular holes of the patient and lightly fix Ear Rod positions.



5. Ready On

Please refer to 5 Ready On of the Panoramic Procedures

6. X-Ray Irradiation

⚠ WARNING

1. Other people except patient and operator should be outside of X-ray room.
2. The X-ray exposure switch should be depressed 7 feet away from Bel-Cypher Pro. Operator must stand behind the shielded partition.
3. Carefully observe patient while X-ray is irradiated, release an Exposure switch immediately when any trouble happens.
4. Instruct patient not to move while X-ray is irradiated.

NOTE

1. The exposure switch is deadman type. X-ray irradiation and the movement of the Arm Unit will stop immediately when the exposure switch is released.
2. If exposure switch is released while an X-ray is in progress, release the patient and depress Reset switch to bring Arm Unit to the Reset position. Start from the beginning again.

6. 1. TMJ Lateral 4 sections consist of a series of two exposures. 1st exposure for the diagnosis of TMJ with mouth closed and 2nd exposure for TMJ with mouth open.

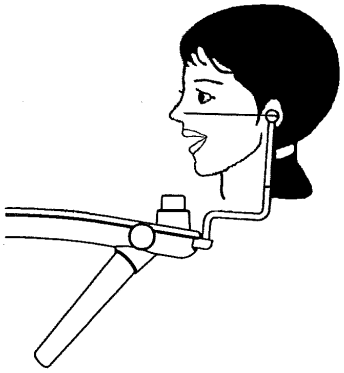
6. 2. Patient's mouth must be closed

6. 3. Depress the exposure switch and hold until the end of exposure

6. 4. The Arm Unit starts to rotate, X-RAY is indicated on indicator, and buzzer starts to sound intermittently.

6. 5. After the end of the first exposure, X-RAY indication display is turned OFF, the audible warning stops, the Arm Unit stops rotating, then returns to the Reset Position automatically

6. 6. Ask patient to open mouth by lowering mandible



6. 7. Depress “READY” key to get into READY ON condition

6. 8. Depress exposure switch and hold until the end of exposure

6. 9. The Arm Unit starts to rotate, X-RAY is indicated on indicator, and buzzer starts to sound intermittently.

6. 10. X-RAY keeps indicating and buzzer keeps sounding

6. 11. After 2nd exposure is finished, X-RAY light will be OFF, and buzzer will stop sounding and Arm Unit will stop rotating.

6. 12. ”Transferring Data” is displayed on the PC screen

⚠ **CAUTION**
While data is transferring, do not turn off the power of Bel-Cypher Pro, or else data will be lost.

6. 13. After data is transferred, TMJ Images are displayed on the screen

6. 14. Save Images as needed.

7. Cooling Time

7. 1. When X-Ray Irradiation is completed, Bel-Cypher Pro automatically goes into its cooling phase.
Remaining cooling time is displayed on the screen.

⚠ CAUTION
1. X-ray exposures cannot be made during COOLING TIME. 2. All key operations except the Reset key are inoperable during COOLING TIME. 3. Do not turn the power OFF until the end of COOLING TIME.

8. Releasing the Patient

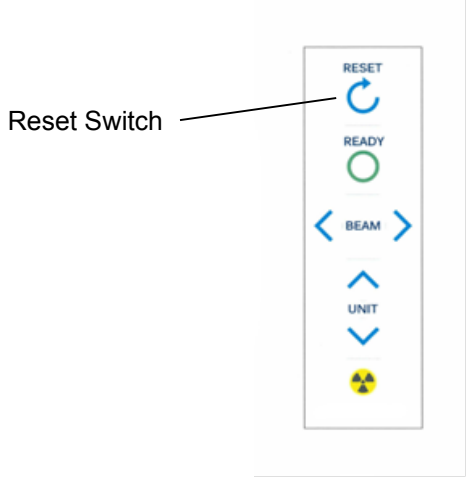
8. 1. Carefully open Ear Rods then release the patient.

8. 2. Remove the Chinrest and Temporal supports.

9. Bring Arm Unit to the Start Position

By depress Reset Switch on the Sliding Unit, Arm Unit moves to Reset Position.

⚠ CAUTION
Before hitting Reset Switch, remove Ear rods. Stay away from Rotation area to avoid injury while Arm Unit is rotating.



10. Turning Power OFF

10. 1. Confirm cooling time is finished.

10. 2. Confirm TMJ Images are displayed on the PC Screen.

10. 3. Depress “O” key on POWER switch to turn the power off.

⚠ CAUTION
To prevent the risk of accident, turn the power switch off when the unit is not in use

13. Table of Exposure Settings

1. Panorama & Panoramic Bitewing

Panoramic Child : CHILD ORBIT (PANORAMA:S)

Age	Sex	Tube Voltage (kV)	Tube Current (mA)	Sec
5～11years	—	60	5～8	10

Panoramic Adult : ADULT ORBIT (PANORAMA:N)

Age	Sex	Tube Voltage (kV)	Tube Current (mA)	Sec
12～15 years	—	60	5～8	10
Adult	Female（small）	60～70	5～8	10
	Male/Female	65～75	5～8	10
	Male（Large）	68～80	5～8	10

Factory default setting（Panoramic Adult）

	Tube Voltage (kV)	Tube Current (mA)
S（Small）	66	5
M（Medium）	68	5
L（Large）	70	5

2. TMJ

TMJ Lateral (4 sections)

Age	Sex	Tube Voltage (kV)	Tube Current (mA)	Sec
5～15 years	—	60	5～8	2.5×4
Adult	Female（Small）	60～70	5～8	2.5×4
	Male/Female	65～75	5～8	2.5×4
	Male（Large）	68～80	5～8	2.5×4

Factory default setting（TMJ 4 sections）

	Tube Voltage (kV)	Tube Current (mA)
S（Small）	70	5
M（Medium）	72	5
L（Large）	74	5

* Radiograph Condition depends on the age and bone density of the patient. Please select the appropriate Tube Voltage and Tube Current by evaluating patients.

14. Magnification of Image

Radiographic Mode		Magnification
PANORAMA	Child Orbit	1.2～1.3
PANORAMA	Adult Orbit	1.2～1.3
TMJ Lateral		1.2

15. Dose information

NOTE

Excessive dose is a health hazard, pay attention not to exceed the radiation dose necessary for diagnosis.
Dose Area Product values on following tables can be used as a reference, but the actual effective dose depends on the body type, the age of the patient, the position of the patient, etc.
Each AIR KERMA value and DAP value of following tables has 50% overall uncertainty.

The integrated value of AIR KERMA in front of the x-ray detector

Panorama 10sec / TMJ 2.5sec×4 Unit: mGy

KV＼mA	2	3	4	5	6	7	8
60	1.16	1.77	2.41	2.94	3.55	4.12	4.66
61	1.21	1.84	2.43	3.07	3.64	4.29	4.85
62	1.26	1.92	2.53	3.19	3.79	4.47	5.05
63	1.31	1.99	2.63	3.32	3.94	4.65	5.26
64	1.37	2.07	2.73	3.46	4.10	4.84	5.47
65	1.42	2.15	2.84	3.59	4.26	5.03	5.68
66	1.47	2.24	2.95	3.73	4.42	5.22	5.90
67	1.53	2.32	3.06	3.87	4.59	5.41	6.12
68	1.59	2.41	3.17	4.01	4.76	5.61	6.34
69	1.64	2.49	3.29	4.15	4.93	5.81	6.57
70	1.70	2.58	3.40	4.30	5.10	6.02	6.80
71	1.76	2.67	3.52	4.45	5.28	6.23	7.04
72	1.82	2.76	3.64	4.60	5.46	6.44	7.28
73	1.88	2.85	3.76	4.76	5.64	6.66	7.52
74	1.94	2.95	3.89	4.91	5.83	6.88	7.77
75	2.01	3.04	4.01	5.07	6.02	7.10	8.03
76	2.07	3.14	4.14	5.23	6.21	7.33	8.28
77	2.14	3.24	4.27	5.40	6.41	7.56	8.54
78	2.20	3.34	4.40	5.56	6.60	7.79	8.80
79	2.27	3.44	4.54	5.73	6.80	8.03	9.07
80	2.34	3.54	4.67	5.91	7.01	8.27	9.34

Dose Area Product (DAP)

Panorama 10sec / TMJ 2.5sec×4 Unit: mGycm^2

KV＼mA	2	3	4	5	6	7	8
60	9.58	14.53	19.83	24.22	29.26	33.91	38.36
61	9.99	15.15	19.98	25.25	29.96	35.35	39.95
62	10.40	15.78	20.80	26.29	31.20	36.81	41.61
63	10.82	16.42	21.65	27.36	32.47	38.31	43.29
64	11.25	17.07	22.51	28.45	33.76	39.83	45.01
65	11.69	17.73	23.38	29.56	35.07	41.38	46.77
66	12.14	18.41	24.28	30.68	36.41	42.96	48.55
67	12.59	19.10	25.18	31.83	37.78	44.56	50.37
68	13.05	19.80	26.11	33.00	39.16	46.20	52.22
69	13.52	20.51	27.05	34.19	40.57	47.86	54.10
70	14.00	21.24	28.01	35.40	42.01	49.56	56.01
71	14.49	21.98	28.98	36.63	43.47	51.28	57.96
72	14.98	22.73	29.97	37.88	44.95	53.03	59.93
73	15.49	23.49	30.97	39.15	46.46	54.81	61.94
74	16.00	24.26	31.99	40.44	47.99	56.61	63.99
75	16.52	25.05	33.03	41.75	49.55	58.45	66.06
76	17.04	25.85	34.08	43.08	51.13	60.31	68.17
77	17.58	26.66	35.15	44.43	52.73	62.21	70.31
78	18.12	27.48	36.24	45.81	54.36	64.13	72.48
79	18.67	28.32	37.34	47.20	56.01	66.08	74.68
80	19.23	29.17	38.46	48.61	57.69	68.06	76.92

NOTE

DAP value is calculated by multiplying Exposure Field to the AIR KERMA value.

16. Daily maintenance

Cleaning and Disinfection

In order to ensure proper hygiene and cleaning of the equipment, the following procedure must be followed.

1. Always disconnect the unit from the mains supply before cleaning or disinfection. No water or any other liquids should be allowed to enter the equipment, as this can cause short-circuits and corrosion.

2. The unit, including accessories and connecting cables, should be cleaned or disinfected only by using a damp cloth, followed by rubbing down with a dry cloth. Do not use solvents (toluene, benzine, etc.), corrosive cleaning agents or abrasive polishing materials. Spray disinfectants are not recommended, as the disinfectants may penetrate into the unit and cause short circuits or corrosion.

3. For parts specified in the table below, please clean or disinfect according to the instructions in the table.

Parts	How to maintenance
Bite Blocks (For Panorama)	Make enough disinfectant with alcohol for medical use, of which alcohol should be over 76% by volume. after every individual patient session
Temporal supports	
Ear Rods (TMJ Lateral 4 sections)	
Chinrest (Panorama)	
All other parts which patients touch.	
All other parts which operator touch.	Make enough disinfectant with alcohol for medical use, of which alcohol should be over 76% by volume, at end of daily operation.
Outside cover of the equipment	Wipe equipment with a dry cloth at the end of daily operation.

17. Trouble Shooting

1. POWER can not be turned ON

Check	Treatment
Is breaker turned on?	Turn breaker on.
Is power plug connected to outlet?	Connect power plug.

2. READY can not be turned on

Check	Treatment
Is positioning of Arm Unit at the Reset Position?	Depress RESET key.

3. Error message on PC display

Treat by following messages on display.

Display
Invertor error. Depress RESET button. Turn off the power and wait for 20 minutes for cooling.
X-Ray Tube temperature error. Depress RESET button. Turn off the power and wait for 20 minutes for cooling.
Y-axis motor error. Depress RESET button.
Rotation motor error. Depress RESET button.
X-ray SW error. Depressing exposure switch may be too fast after READY ON.

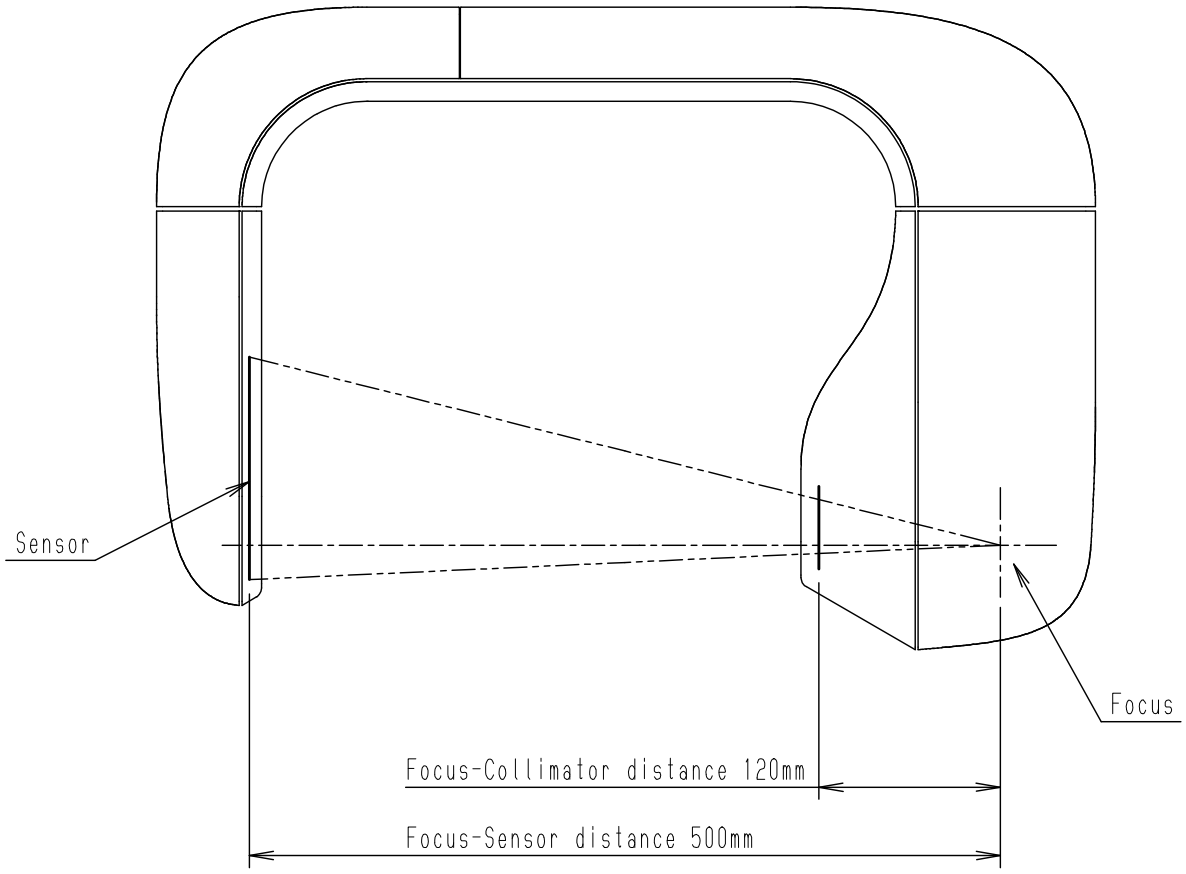
If you can not solve problem by the above, turn off the power and turn on again.

* When the trouble cannot be resolved, turn the power of the equipment OFF, and unplug the power cable from electric outlet, and contact your dealer or our office.

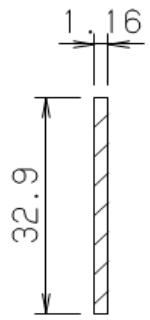
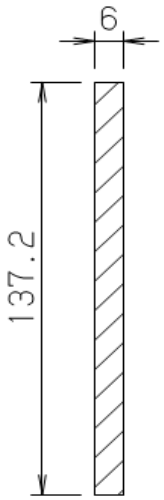
⚠ CAUTION
If you run software that force heavy load to PC, transfer & acquisition of image could be interrupted.

18. X-Ray Tube Focus, Sensor Location, Collimator & Exposure Field

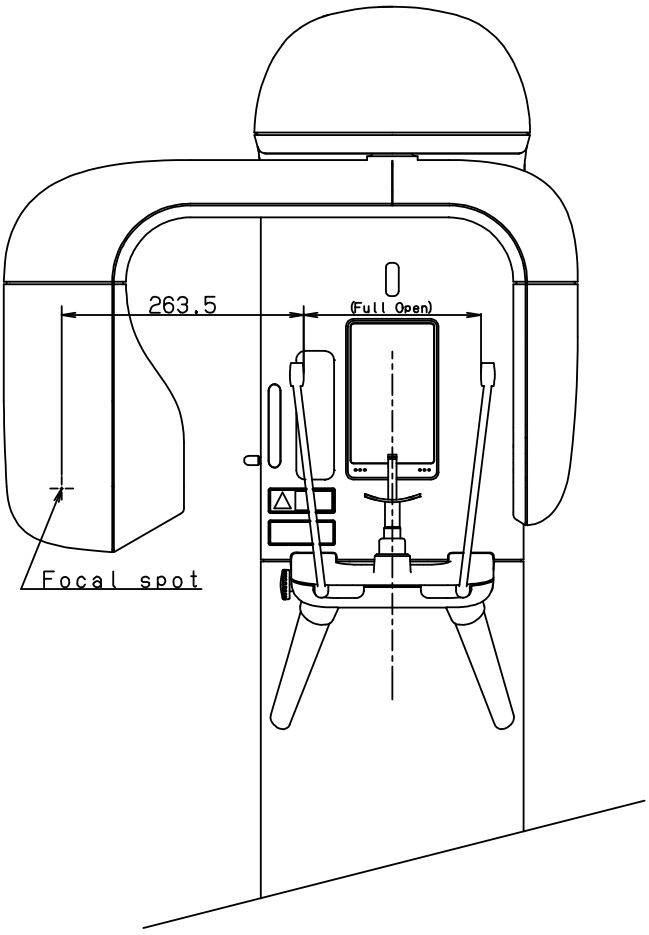
X-Ray Tube Focus and Sensor Location



Collimator and Exposure Field

Shape of Collimator	Exposure Field
	

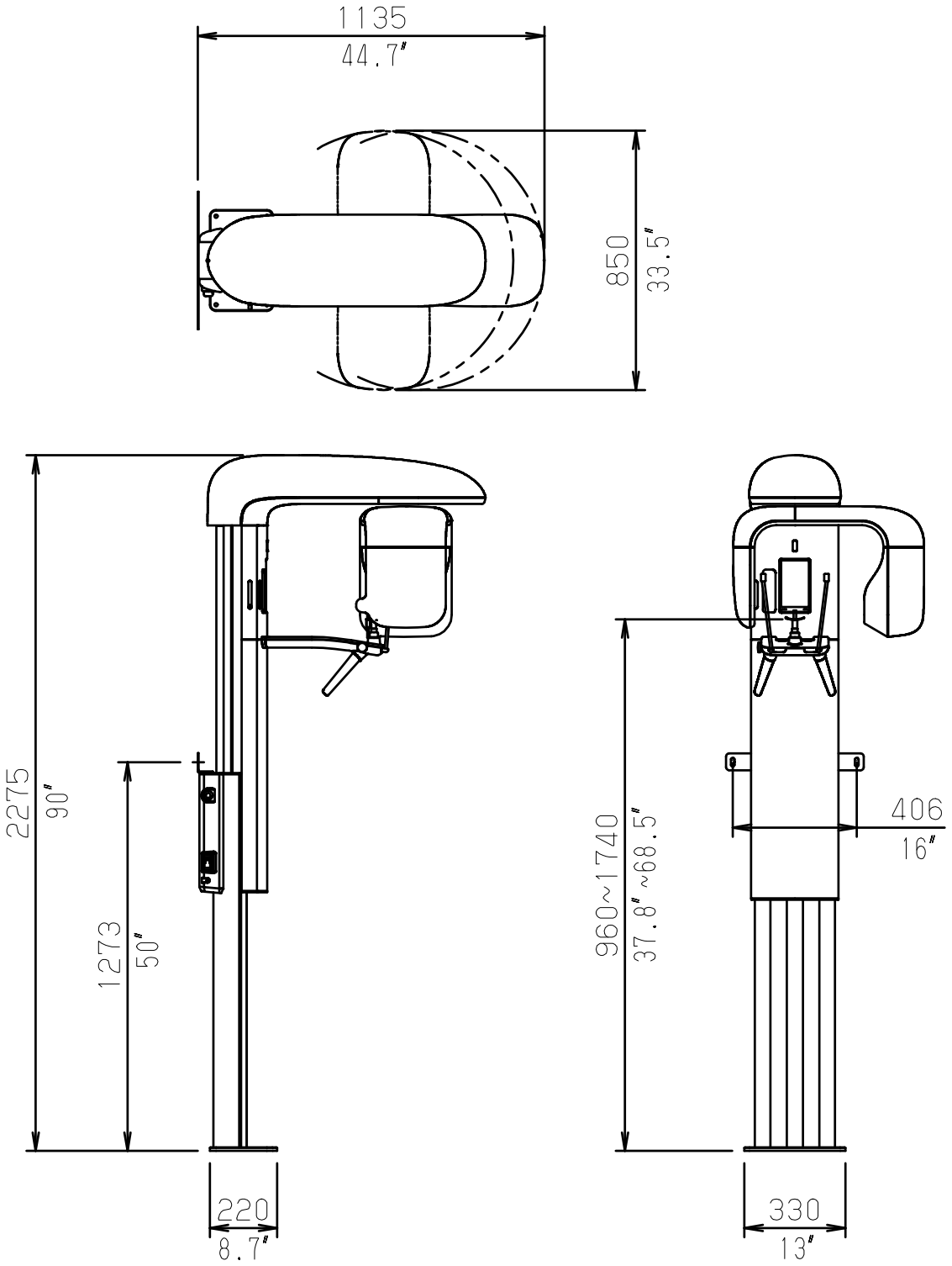
Focal spot to skin distance



NOTE
The focal spot to skin distance depends on the size of the patient's head. On the use of this equipment, the patient position is specified, so appropriate positioning of the patient is most important.

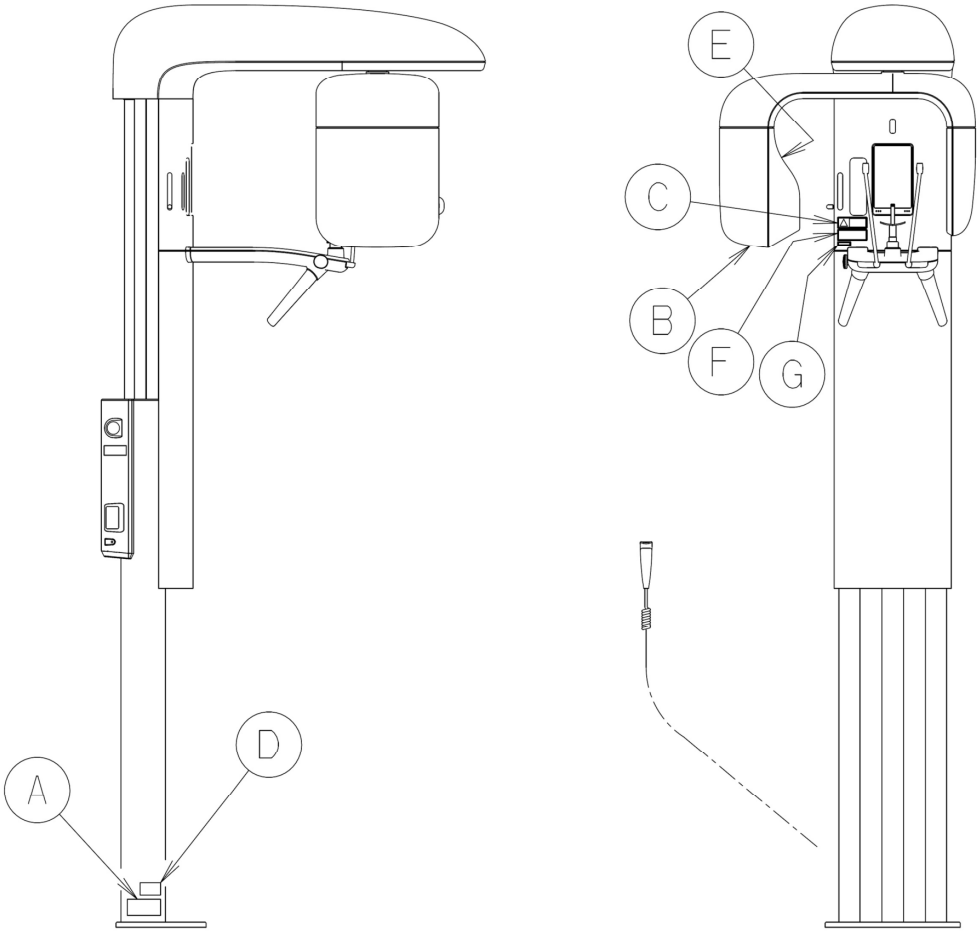
19. Physical Dimensions

Dimensions of equipment



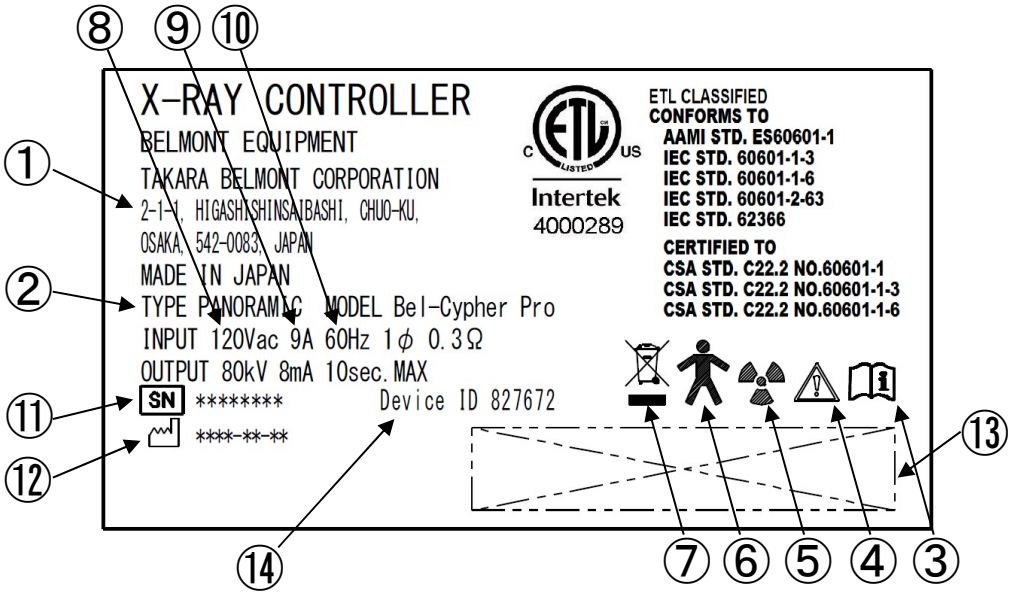
20. Labels

Description of labels



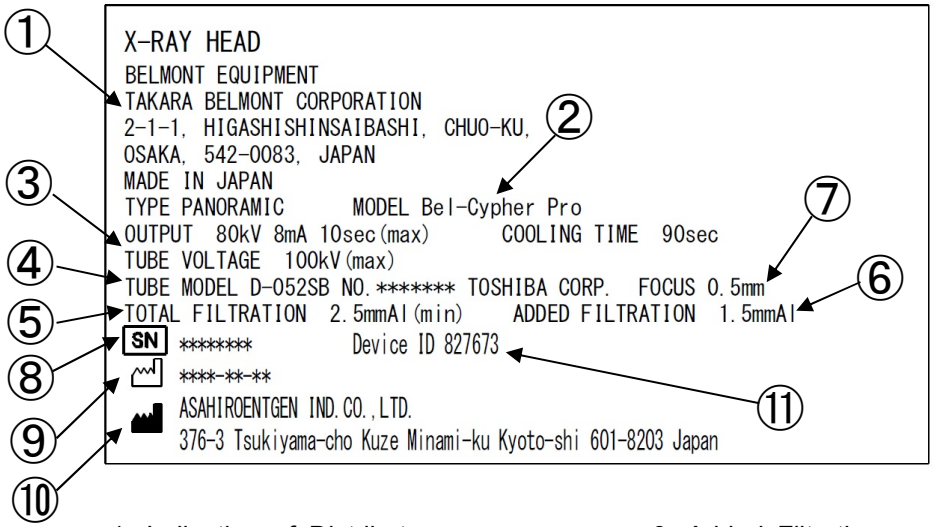
A	X-RAY CONTROLLER LABEL
B	X-RAY HEAD LABEL
C	Warning Label (Laser)
D	Certification Label of CFR 21
E	Tubes Label
F	Warning Label (UL)
G	Rx Only Label

A. X-RAY CONTROLLER LABEL



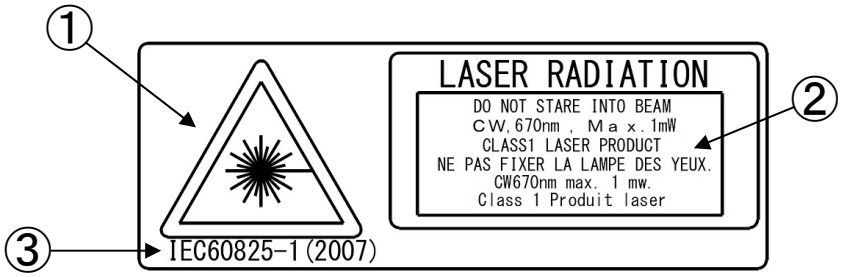
1: Indication of Distributor
2: Model Name
USA : Bel-Cypher Pro
CANADA : Bel-Cypher Pro –C X199
3: “Operation manual” mark
4: “CAUTION label” mark
5: “Ionizing Radiation” mark
6: TYPE B Applied Part
7: WEEE mark
8: Source Voltage
9: Power consumption
10: Supply frequency
11: Serial number
12: Date manufactured
13: UDI Barcode (USA ONLY)
14: Device ID (CANADA ONLY)

B. X-RAY HEAD LABEL



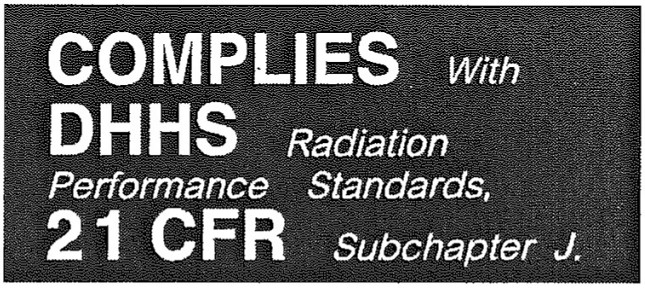
1: Indication of Distributor
2: Model Name
USA : Bel-Cypher Pro
CANADA : Bel-Cypher Pro –H X199
3: Maximum X-ray TUBE VOLTAGE
4: X-RAY TUBE Type
5: Total Filtration
6: Added Filtration
7: Focus Size
8: Serial Number
9: Manufacturing Date
10: Manufacturer
11: Device ID (CANADA ONLY)

C. Warning Label (Laser)

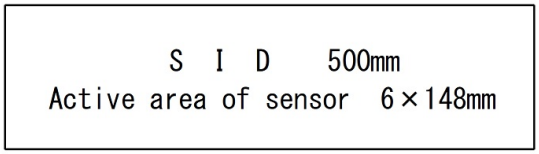


1: Hazard Symbol
2: Explanatory Document
3: IEC standard

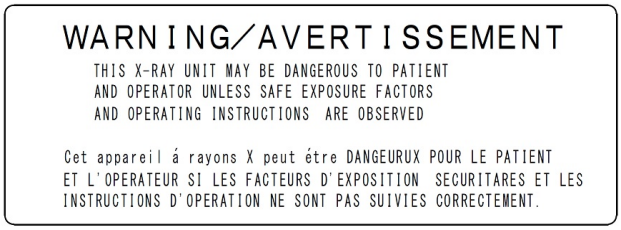
D. Certification Label of CFR 21



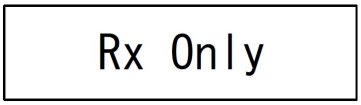
E. Tubes Label



F. Warning Label (UL)



G. Rx Only Label



21. Technical Data

1. International standards

IEC 60601-1:2005
IEC 60601-1-2:2007
IEC 60601-1-3:2008
IEC 60601-2-63:2012
IEC 60601-2-28:2010

2. Equipment classification

1. According to the type of protection against electric shock
   a) Equipment energized from external electrical power source.
   Class I equipment
2. According to the degree of protection against electric shock
   Type B applied part
   Protection against Ingress of water
   Ordinary**4.**
   Equipment not suitable for use in the presence of a FLAMMABLE ANAESTHETIC MIXTURE WITH AIR OR WITH OXYGEN OR NITROUS OXIDE
3. According to the mode of operation:
   Continuous Operation

3. Environment condition

Temperature: 5-35°C
Humidity: 30-85%
Atmospheric pressure: 700-1060 hPa

4. Storage condition

Temperature: -10-60°C
Humidity: 10-95%
Atmospheric pressure: 700-1060 hPa

5. X-ray generator data

1. Maximum electric output
   Maximum tube voltage: 80 kV
   Maximum tube current: 8 mA
2. Nominal maximum electric power output
   80 kV, 8 mA
   640 W
3. Maximum product of current and time
   80 mAs (8 mA,10 sec)
4. Minimum product of current and time
   20 mAs (2 mA, 2.5 sec x 4 exposures)
5. Nominal anode input capacity

1750 W

6. Maximum anode heat capacity
   35 kJ (50 kHU)
7. Target material
   Tungsten (W)
8. Target angle (anode inclination)
   5°
9. Focal spot
   0.5 (mm)
10. X-ray inherent filtration
    Minimum 0.8 mm Al
11. Nominal X-ray tube voltage
    50-100 kV
12. X-ray tube filament rating
    3.5-4.9 V 3.5 A
13. Generator weight
    Approx. 14.7 kg
14. Generator type
    Class I
15. Standard assembling angle of X-ray generator
    Horizontal/Perpendicular
16. Target angle of assembling X-ray generator
    5°
17. Accuracy of X-ray tube (focal spot) assembled into X-ray generator
    ±0.5 mm
18. Focal spot when assembled into X-ray generator
    0.5 mm
19. Duty cycle
    Cooling time: 90 sec
20. Reproducibility of the radiation output
    Coefficient of variation of the AIR KERMA is not greater than 0.05.
21. Accuracy of loading factors
    The error of the value of the x-ray tube voltage is not greater than 10%.
    The error of the value of the x-ray tube current is not greater than 20%.
    The error of the value of the x-ray tube irradiation time is not greater than 5%+50ms.
    The error of the value of x-ray tube current time product is not greater than ±(10%+0.2mAs).

6. Aluminum (Filter material)

Part name: filter
Aluminum equivalent amount: 1.5 mm Al

7. Power supply impedance

0.3 Ω

8. Duty Cycle of Actuator for lifting equipment

10%, Max 2 Min ON / 18 Min OFF

TOSHIBA
Leading Innovation

Technical Data TD

TOSHIBA X-RAY TUBE
D-052 / D-052S / D-052SB

Stationary Anode X-ray Tube

- Especially designed for dental tomography unit.
- Low target angle adaptive for dental tomography.
- Provided with an insulation cylinder and lead cylinder. (D-052S, D-052SB)
- These tubes have a focus 0.5, and are available for maximum tube voltage 100 kV.
- Installed in the same enclosure with the high voltage transformer.

General Data

Electrical:

Circuit:
- High Voltage Generator ..... Two-Peak High-Voltage Generator
  Constant Potential High-Voltage Generator
- Grounding ..... Center-Grounded

Nominal X-ray Tube Voltage ..... 100 kV
Nominal Focal Spot Value 0.5
Nominal Anode Input Power (at 1.0s) ..... See rating charts
- Two-Peak High-Voltage Generator ..... 840 W
- Constant Potential High-Voltage Generator ..... 1750 W

Exposure Duty Cycle ..... 1:60 or more
(Exposure time: interval time)

Mechanical:

Dimensions:
- Overall Length ..... See dimensional outline
- Maximum Diameter ..... See dimensional outline

Target:
- Anode Angle ..... 5 degrees
- Material ..... Tungsten

Inherent Filtration ..... At least 0.8 mm Al at 50 kV
X-ray Coverage ..... 75 × 380 mm at SID 550 mm

No. TE-D-052/S/SB,A 2011-02-01

Weight:
- D-052 ..... Approx. 450 g
- D-052S ..... Approx. 550 g
- D-052SB ..... Approx. 780 g

Cooling Method ..... Oil immersed (60 °C Max.) and convection oil cooling.

Tube Holding:
- D-052 ..... Holding the glass envelope of the anode end and cathode end or the screw of the anode shank
- D-052S ..... Holding the insulation cylinder
- D-052SB ..... Holding the insulation cylinder or the lead cylinder

Absolute Maximum and Minimum Ratings
(At any time, these values must not be exceeded.)

Maximum X-ray Tube Voltage ..... 100 kV
- Anode to Ground ..... 50 kV
- Cathode to Ground ..... 50 kV

Minimum X-ray Tube Voltage .....50 kV

Maximum X-ray Tube Current .....See rating charts
- Two-Peak High-Voltage Generator ..... 24 mA
- Constant Potential High-Voltage Generator ..... 22 mA

Maximum Filament Current ..... 3.5 A

Filament Frequency Limits ..... DC or AC (Sine Wave) 0 ~ 20 kHz

Filament Voltage:
- At Maximum Filament Current (3.5 A) ..... 3.5 ~ 4.9 V

Thermal Characteristics:
- Anode Heat Content ..... 35 kJ
- Maximum Anode Heat Dissipation ..... 250 W

Maximum Exposure Time ..... 20 s

Environmental Limits

Operating Limits (in dielectric oil):
- Oil Temperature ..... 10 ~ 60 ℃
- Oil Pressure ..... 70 ~ 140 kPa

Shipping and Storage Limits:
- Temperature ..... -40 ~ 70 ℃
- Humidity ..... 10 ~ 90 % (No condensation)
- Atmospheric Pressure .....50 ~ 106 kPa

Cautions

Read this page carefully before using the tube.

Since X-ray tube will emit X-rays when it is energized with high voltage, special knowledge is required to handle it. The items below show general cautions for the tube handling.

1. The tube shall be handled or operated only by qualified personnel.
   Only a specialist with knowledge of X-ray tube should assemble, maintain and remove the tube.

2. The tube envelope is made of glass. In transporting and handling, sufficient care should be taken not to give strong impact or vibration to the tube.

3. Radiation protection of the tube unit assembled with this tube must be sufficiently taken. And the leakage technique factor of the tube unit must not exceed maximum anode cooling rate of this tube.

4. Regulations and standards require the minimum source-skin distance (SSD) and the minimum filtration of the useful beam.
   Use the tube after fulfilling them.

5. The tube might be broken due to only one overload operation.
   Provide proper overload protection circuit.
   Operate the tube by selecting a proper input condition according to the conditions for operation and tube characteristics charts.

6. The X-ray shield of this tube is made of lead (Pb).
   Powdered or vaporized lead is harmful to the human body. The lead shield should not be machined, polished, burned or wiped with any chemicals.
   Dispose the scrapped products according to the requirement of local regulation.
   If you have any questions, please contact to our local sales representatives for further information.

7. Information of containing plastic
   Following table shows information of X-ray tube containing plastic (more than 25g).

Model	Applied parts	Abbreviated term	Material name
D-052S D-052SB	Insulation cylinder	EP(GF)	Epoxy resin (glass fiber included)

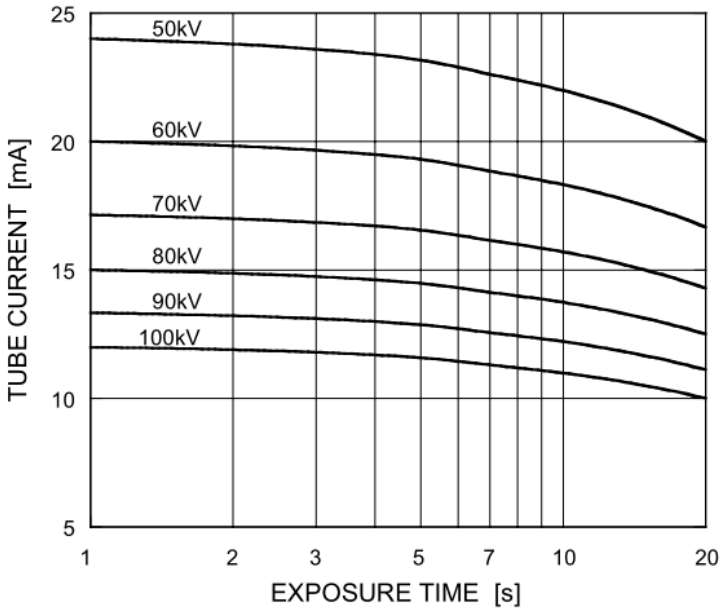
8. If any abnormalities are found in using this tube, immediately switch off the power supply and contact TETD.

9. The charts of this specification are indicating standard values.
   For usage not described here or for any unclear items, contact TETD.

Maximum Rating Charts
(Absolute maximum rating charts)

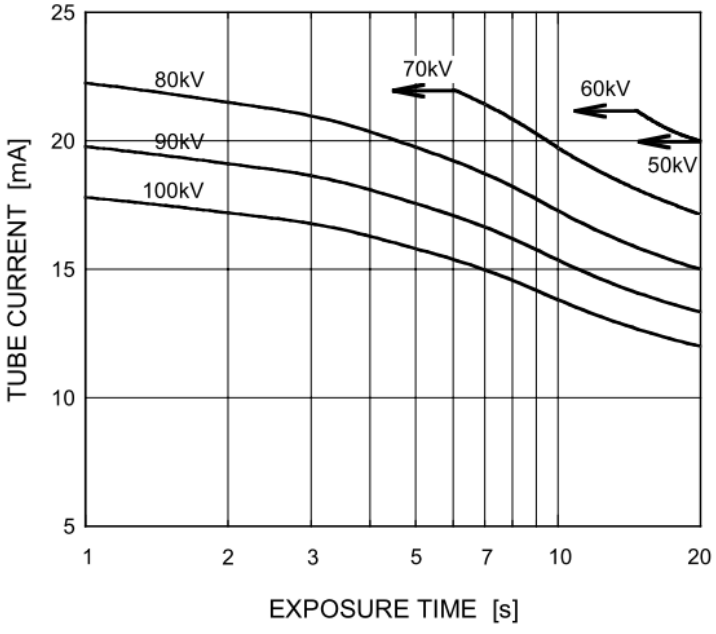
Two-Peak High-Voltage Generator

Nominal Focal Spot Value: 0.5



Constant Potential High-Voltage Generator

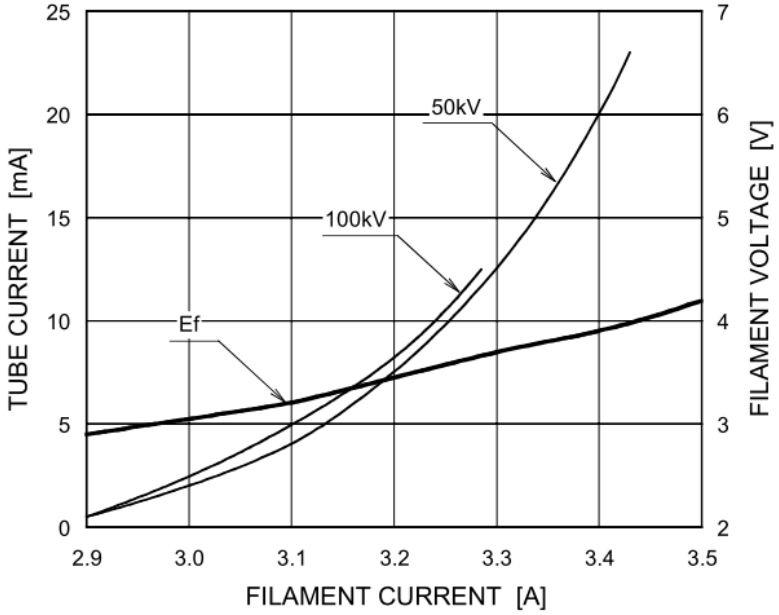
Nominal Focal Spot Value: 0.5



Emission & Filament Characteristics

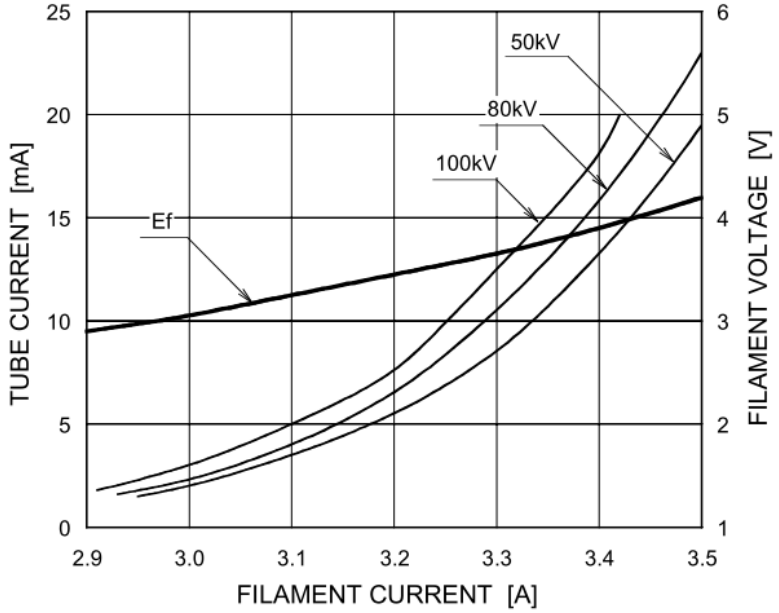
Two-Peak High-Voltage Generator

Nominal Focal Spot Value: 0.5

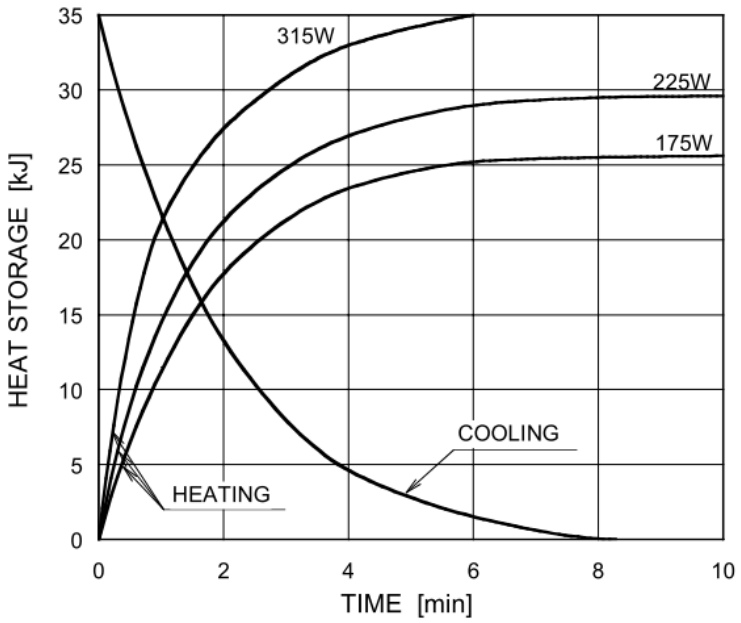


Constant Potential High-Voltage Generator

Nominal Focal Spot Value: 0.5

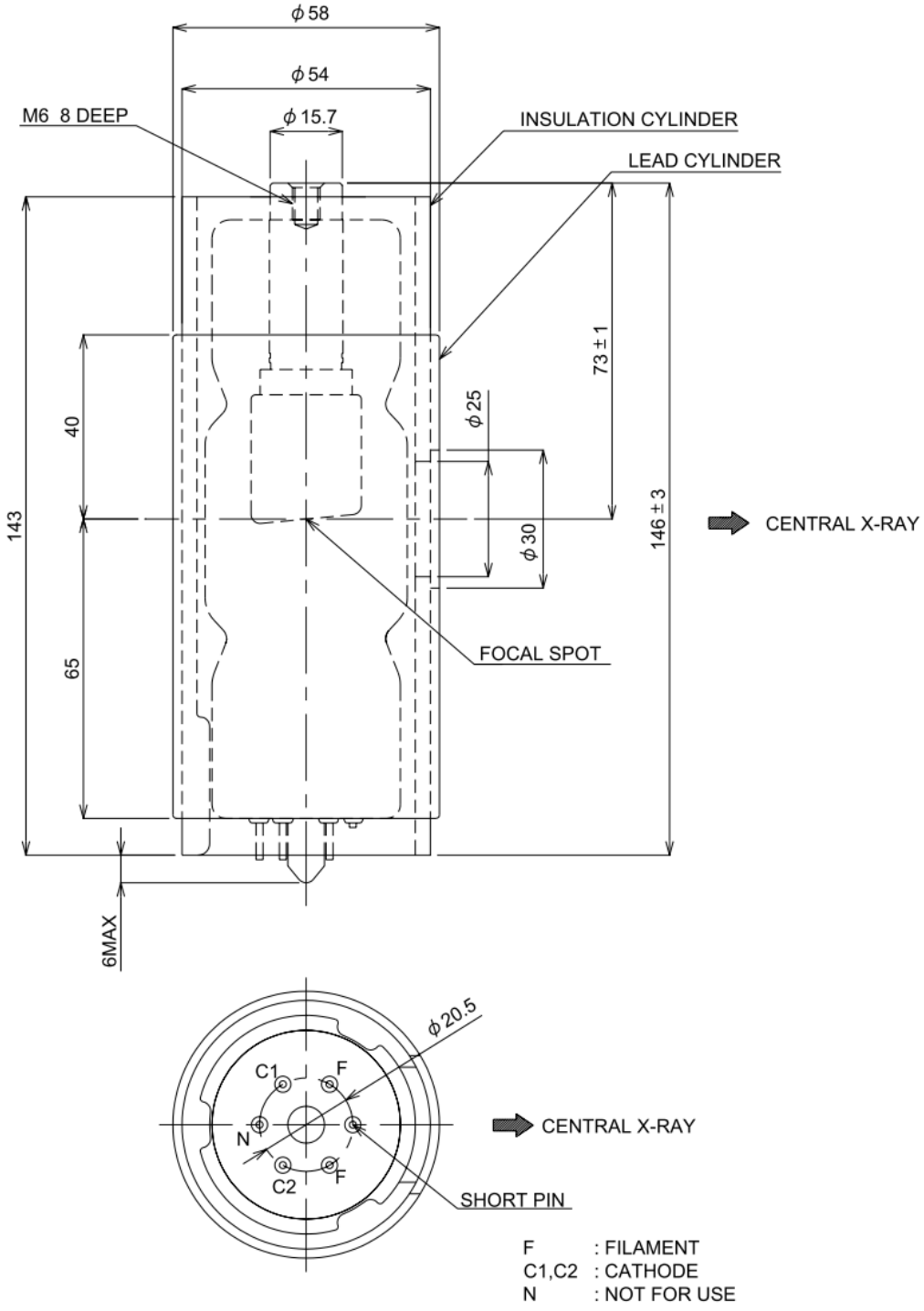


Anode Heating / Cooling Curve



Dimensional Outline of D-052SB

Unit: mm



Note: Cathode terminals ″C″ are connected mutually inside the tube.

22. Maintenance

⚠ WARNING

High voltage is applied to inside of the equipment. Do not open the cover by yourself.
Before requesting a repair, turn the power of the equipment OFF, and unplug from the power outlet.
After you unplug the equipment, wait for 10 minutes before starting any service work.

Special knowledge and special measuring tools are required to check this equipment.
To ensure that the X-ray unit functions within the manufacturer's specifications and remains in compliance with Standards, daily checking (by visual inspection) and periodic maintenance by the dealer service personnel are recommended.

Maintenance by service personnel 1-2 times/year

Check Item	Purpose	Action	Method
Electricity Condition	Check voltage range	Check whether incoming voltage is within the equipment's requirement or not.	●
External Appearance	External Appearance	A) Deformation, scratches.	◎
		B) Warning Labels	◎
	Inside of the equipment	Check for stains and dust	●
Installation place	Temperature & Humidity	Check compatibility of the environmental conditions to operate the equipment	●
	Level of floor	Check the influence on the equipment	●
	The Installation condition of the equipment	Check vibration and movement stability of the equipment	●
	Check obstacles	Make sure that there are no obstacles within the movement range of the equipment	◎
	Rust	Check the condition of rust. Evaluate the influence on safety.	◎
Safety Test for Electric Shock	Insulation Resistance	Check the resistance between a power line and the earth	●
	Leakage current from the outer cover	Check the current which is leaked from the outer cover of the equipment to the earth	●
	Earthing resistance	Check the resistance value between an exposed metal and the earth	●
	Resistance of the Earth wire	Resistance between the earth terminal and the earthing point	●
Movement Accuracy of the equipment	Power Circuit voltage	Check the voltage of the power circuit	●
	Check Radiographic Circuit	Check the wave shape and the setting values of the radiographic circuit	●
	Check Control Circuit	Check the movements of operating sequences	●
	Accuracy of the Positioning Mechanism	Check the deterioration of the positioning mechanism	●
	Check the Movement of the Protection Circuit	Check the setting values of the protection circuit. Check the movement of the protection circuit.	●
	Check display circuit	Check the functions of display circuit	●

Check Item	Purpose	Action	Method
Display during an exposure	Check irradiation of X-ray and “X-RAY ON” display are in sync	Check this while X-ray is irradiated.	◎
X-ray Generator	X-ray tube	Check the leakage of insulation oil	◎
	Low voltage cables	Check wear, damage, tension, and twist	◎
	Cone	Check looseness, transformation, and damage	◎
	Filter	Check transformation and damage	◎
	Slit Plate (Collimator)	Check off-alignment of exposure field. Confirm the exposure width	●
Radiographic mechanism	Movement of the Arm Unit ASSY	Check slip, abnormal sound, and stopping accuracy	◎
	Patient Positioning Mechanism	Play, looseness, operational performance, and safeness	◎
	Positioning beams	Check the brightness and the positioning accuracy	◎
Sliding mechanism	Upward / downward movements	Check smoothness of movement	◎
	Drop prevention mechanism	Check safety mechanism works properly	●
X-ray output	X-ray Tube Voltage	Check X-ray Tube voltage	●
	X-ray Tube Current	Check X-ray Tube current	●
	Exposure Time	Check exposure time	●

Checking Methods

◎ : Check by eyes during a daily operation

● : Check by a service personnel.

⚠ **CAUTION**
If oil adheres to the skin, please wash with plenty of water and soap.

23. Contact Information

Belmont Equipment
A Division of TAKARA BELMONT USA, Inc.
101 Belmont Drive
Somerset, NJ 08873
Toll Free (800) 223-1192
Toll Free Fax (800) 280-7504
www.belmontequip.com

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24. Revision data of this manual

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