

X-ray High Voltage Generator

UD150B-40/L-40/V-40

D150BC-40/45 LC-40/45 VC-40/45

D150BC-41 LC-41 VC-41







GSC-2002L

Operation Manual

Read this manual thoroughly before you use the product.
Keep this manual for future reference.

About the Symbols Appearing in this Operation Manual

Throughout the text in this manual, warnings and other information essential when using this unit, such as cautionary or prohibited items, appear classified as per the following:

Mark	Description
 DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in serious injury or death.
 WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or possibly death.
 CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor to moderate injury or equipment damage.
 NOTE	Emphasizes additional information that is provided to ensure the proper use of this product.
	Provides useful information about operation of this system. Please read the description when required.
 Reference	Provides reference information.

Revision History

Revision	Date	Changes
AL	Aug. 30 2022	Compliant with Standards.
AM	Nov. 22 2022	Added the description of the phototimer receiver inside the FPD.
AN	2024-03-01	Compliant with Standards.
AP	2025-10-31	Changed "Software" . Changed "Warning and Caution Labels for Safety" . Changed 1.4 "Operator Profile" . Changed 1.5 "Safety Symbols for System" . Changed 2.2 "Operation Panel" . Changed 3.2 "Turning On the Power" . Changed 5.6 "Radiographic Operation" . Changed 7.3.4 "Sound" . Changed 7.3.5 "Illumination" . Changed 8.1 "Messages" . Changed 9.1 "Maintenance and Inspections" . Added 9.2.5 "SA-60" . Changed 11.7.2 "Power Supply Requirements" . Changed 11.10 "Labels" .

Preface

This operation manual must be carefully read prior to using the "X-ray High Voltage Generator UD150B-40/L-40/V-40, D150BC-40/45 LC-40/45 VC-40/45, D150BC-41 LC-41 VC-41, GSC-2002L" (hereafter referred to as "equipment") and thoroughly followed to ensure proper use.

Be sure to fully read and observe all safety-related warnings, cautions, and notes in this manual and in other supplied documents.

This manual should be kept available for future reference. If the user or usage location changes, ensure that this Operation Manual is always kept together with the equipment.

Periodically check to be sure that the operation manual and the warning labels are not missing or damaged. If they are, contact your Shimadzu service representative for replacement.

Original version is approved in English.

Notice

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Operating Precautions

"Operating Precautions when Using Electrical Medical Equipment (for Both Safety and the Prevention of Danger)"

1. Nobody without the following experience and knowledge should use the equipment.

- (1) Medical (radiographic) training (if particular qualifications are required in the country concerned, those qualifications must be held).
- (2) The capacity to read and understand the operation manual.

2. During installation:

- (1) Do NOT install this product near water supplies or equipment using water.
- (2) Do NOT install this product where extreme atmospheric pressures, temperatures or humidity, drafts, direct sunlight, dust, chlorine or sulfur gas are present.
- (3) During transportation and operation of this product, do not tilt this product or subject it to vibration or strong impacts.
- (4) Do NOT install this product where chemicals or gases are stored.
- (5) Be sure to use only the specified electrical power source with the appropriate frequency, voltage and current (or power consumption).
- (6) Be sure to check the condition of the battery's power source (power and polarity) before operating this product.
- (7) Properly ground this product.

3. Prior to operation:

- (1) Check the conditions of switch contacts, polarity, dial settings, and meters to confirm that this product is operating correctly.
- (2) Check that the product's ground is properly connected.
- (3) Check that all cords, cables, and other wiring are correctly connected.
- (4) Inspect all external electrical circuits which are directly connected to a patient.
- (5) Check the condition of the battery's power source.

4. During operation:

- (1) Do NOT exceed the time or the amount of product usage required for diagnosis or therapy.
- (2) Be sure to constantly monitor both the product and patient for early detection of potential problems.
- (3) When a problem is detected with this product or with the patient, stop operation of this product immediately, without harming the patient.
- (4) Do NOT let this product contact the patient unless necessary.

5. After operation:

- (1) Turn off all switches and return all dials to their original positions in the prescribed order. Then, turn the product's main power switch OFF.
- (2) Do NOT forcibly remove the power cable from the outlet.
- (3) When storing this product, be aware of the following:
 - (i) Do NOT install this product near water supplies or equipment using water.
 - (ii) Do NOT install this product where extreme atmospheric pressures, temperatures or humidity, drafts, direct sunlight, dust, chlorine or sulfur gas are present.
 - (iii) During transportation and operation of this product, avoid tilting, vibration and strong impacts.
 - (iv) Do NOT install this product where chemicals or gases are stored.
- (4) Clean all attachments, cables and contacts and store them in one location.
- (5) Keep this product clean to avoid problems during the next use.

6. Product malfunction:

If the product does not operate correctly, do not try to repair it. Place a sign on the unit to indicate that it is out of order and contact a certified repair technician.

7. Do NOT modify any part of this product.

8. Preventive maintenance:

- (1) Be sure to periodically check this product and its related equipment.
- (2) If this product has not been operated for an extended period of time, be sure to test it prior to actual operation to confirm that it works correctly and safety.

9. Related items:

For related safety information, be sure to follow all instructions given in this product's operation manual.

Precautions in Usage

When using this equipment, please observe the following precautions for safety of the operator and patient:



The responsibility for management of use and maintenance of medical equipment lies with the user.

This equipment is restricted to use by, or under supervision of, a diagnostic radiology technician or a person with a certificate indicating equal proficiency.

Repair and inspection of the inside of the equipment is dangerous. Be sure to contact your Shimadzu service representative for repair and inspection.



Never modify the equipment.

In general, modifications are strictly prohibited by the Regulatory requirements of the law of the country where the device is installed. Please contact your Shimadzu service representative if it is necessary to modify the equipment.



Perform periodic inspection.

Preventive maintenance is required to maintain long-term safety and performance of the equipment.

The "[9 Inspection and Maintenance](#)" chapter in this manual gives detailed descriptions of daily and periodic maintenance and inspection that a user should perform.

As for the maintenance and inspection that only specially trained experts can perform, utilize the maintenance agreement program offered by your Shimadzu service representative.

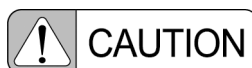


Repair and maintenance of the inside of the equipment can only be performed by your Shimadzu service representative.

Maintenance must be assigned to specially trained experts. Contact your Shimadzu service representative for repair and maintenance.




Connect this equipment only to Shimadzu certificated devices or devices that are proven to be safe and show no performance degradation in any combination including connecting system.



If the operator has no experience in operating the equipment, be sure that he or she receives instruction on how to operate it from your Shimadzu service representative or someone who has adequate experience in using the equipment.

In order to operate the equipment safely, an explanation of the operation needs to be given. When installing the equipment, your Shimadzu service representative explains the operating procedure using this operation manual.

Follow their directions and operate the equipment correctly.

 Reference [1.4 "Operator Profile"](#)

Be Sure to Read the Following to Prevent Explosion, Electric Shock, or Injury



Do NOT use any potentially flammable or explosive gas, such as disinfectant sprays, near the equipment.

Use of such gas may cause an explosion.



Check the condition of the patient before conducting a study.

If equipment usage is deemed to put the patient at risk due to the his or her condition, refrain from conducting the study or treatment.



Do NOT use the equipment in places where liquid may enter.

The equipment is not designed to be waterproof. Invasion of any liquid should cause electric shock, system failure or malfunction.



Do NOT spill any liquid, such as contrast medium, saline, or disinfectant, onto the equipment.

Should such liquid drip on equipment surfaces, wipe it off immediately. Any such liquid entering into system electronics may cause failure or malfunction. Should liquid drip on the equipment or enter the covers, immediately turn off the power and contact your Shimadzu service representative.



When there is any abnormality in operation, or unusual smell or smoke emission during operation, stop operation immediately and contact your Shimadzu service representative.

Continued use may damage the equipment and cause injury.



Do NOT open the covers of the equipment.

Otherwise, electric shock may result. When opening the covers for maintenance, contact your Shimadzu service representative.



Always be very careful when moving the equipment to avoid contact with the patient or operator and to ensure that the patient or operator does not become caught between the equipment and any neighboring devices.

Otherwise, it may cause injury.



Do NOT use in a location where metal fragments may enter the equipment.

This can result in electric shocks.



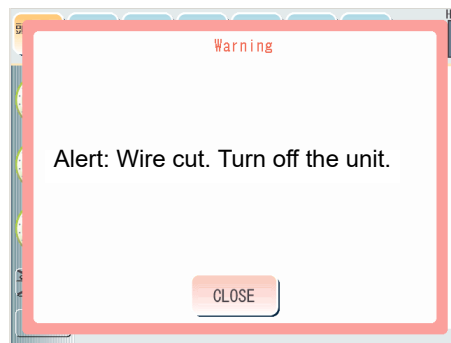
Do NOT perform any maintenance work of the equipment during study.

The patient may be injured.




If the message "Alert: Wire cut. Turn off the unit." is displayed on the operation touch panel, stop using the equipment and contact your Shimadzu service representative.

- If the wire of the ceiling tube support CH-200 breaks, radiography will not start even when the hand switch is pressed.
- Any continued use of the equipment while this message is displayed may result in serious injury to the patient or operator.



- A warning message is also displayed on the operation touch panel of the ceiling tube support CH-200.

 **Reference** Refer to the CEILING TUBE SUPPORT CH-200 OPERATION MANUAL.

Cautions on Environmental Conditions



Do NOT use the equipment in an oxygen-rich environment.

The use in an oxygen-rich environment may cause fatal or serious injuries or damage to the equipment due to easy ignition.



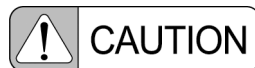
Be sure to use the equipment under the following environmental conditions:

The installation of a dedicated air-conditioner in the examination room is recommended if the building air-conditioner cannot meet the necessary environmental conditions.

Reference [11.7 "Environmental Conditions"](#)

Note also that there must be no sudden change in temperature or humidity.

This causes condensation, which can lead to equipment failure.



Please confirm input power specifications prescribed for each system configuration.

This equipment is different in input power rating from X-ray high voltage generators.

Reference [11 "Specifications"](#)

Do NOT connect the equipment to power strips, extension cords, or overloaded electrical circuits.

Cautions on Radiography



Restrict all persons other than the patient from accessing the equipment in accordance with local regulations.

To avoid unnecessary exposure, acceptable distances (maximum access values) to the equipment by any person other than the patient are defined for each region.



The equipment can be operated only by qualified personnel, such as radiology technicians or those with equivalent qualifications.



No person but the patient is allowed to stay in the examination room during X-ray irradiation.

If the equipment is not used correctly, the operator, the patient, and other persons may receive a greater dose of radiation than necessary.

* During radiography, the radiography indicator illuminates and the buzzer sounds an audible warning.



Perform X-ray irradiation carefully and according to the doctor's directions when using the equipment with expectant mothers, women who suspect they are pregnant, lactating women, or children.

Particular ways of using the equipment may increase the scatter dose absorbed into the patient, which may cause a radiation hazard.



Always check the X-ray exposure region using the collimator lamp.

Irradiating a patient with X-rays outside the required region risks exposure of the patient to unnecessary radiation.



During X-ray irradiation, ensure that the X-rays irradiate the necessary region only.

To avoid unnecessary exposure, narrow down the collimator and take protection measures, such as wearing a protective apron.



Do NOT place any unnecessary object in the location within the X-ray exposure region.

Doing so may result in unnecessary radiation exposure to the patient.



Be sure to carry out a warm-up (running-in operation of the X-ray tube unit) before taking an X-ray radiograph.

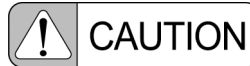
 Reference ["X-ray Tube Unit Warm-up" \(P.xiii\)](#)



Perform the warm-up if an arc occurs.

Suddenly using the X-ray tube unit near the nominal X-ray tube voltage (above 100 kV) after using the unit at a relatively low tube voltage (80 kV max.) for a prolonged period may result in arc. This arc occurs due to loss of the warm-up effect at high tube voltage after the X-ray tube unit is used at a relatively low tube voltage for a prolonged period.

 Reference ["X-ray Tube Unit Warm-up" \(P.xiii\)](#)



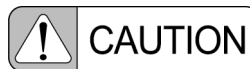
Do NOT perform unnecessary standby operations.

If standby status continues after the radiography preparation button is pressed, wire disconnection or withstand voltage failure may result owing to the evaporation of the X-ray tube filament.



Keep pressing the radiography preparation button or the first stage of the Hand Switch, and the radiography button or the second stage of the Hand Switch until the set exposure time is finished.

Releasing them will stop X-ray irradiation and the suitable radiography image will not be acquired.



In order to minimize the radiation dose on the patient, make the distance between the focus and the patient's body surface as long as possible (Minimum 45 cm).

The shorter the distance becomes, the greater the amount of scatter dose absorbed into the patient, which may cause a radiation hazard.



Pay extra attention when irradiating X-rays for a long time or repeatedly.

It may cause a radiation hazard.

X-ray Tube Unit Warm-up



Warm-up is effective to confirm that there is no failure in the X-ray tube unit as well as to prevent electric discharge. In the event of abnormal operation, turn off the unit's power and distribution board and contact your Shimadzu service representative.

Before performing warm-up, be sure to fully close the collimator leaf.

(1) Select large focus and perform radiographic operation following the order described below. Pause for 60 seconds between radiographic operations.

(i) 90 kV, 0.1 sec. Once

(ii) 100 kV, 0.1 sec. Once

(iii) 110 kV, 0.1 sec. Once

(iv) 120 kV, 0.1 sec. Once

* Select the tube current (mA) of about 1/2 of the maximum that can be selected for each kV value.

To use the unit for high-pressure radiography (130 kV or more), perform warm-up up to the tube voltage to be used.

(v) 130 kV, 0.1 sec. Once

(vi) 140 kV, 0.1 sec. Once

(vii) 145 kV, 0.1 sec. Once

(viii) 150 kV, 0.1 sec. Once

* Select the tube current (mA) of about 1/2 of the maximum that can be selected for each kV value.

(2) If an error occurs during warm-up, wait for one minute and reduce the tube voltage by 30 kV and perform radiographic operation.

(3) For an X-ray tube unit with two or more focuses, make sure that they can be changed during radiographic operation.

(4) If there are two or more X-ray tube units, perform warm-up for each unit.

(5) When fluoroscopic operation can be performed, perform the operation at 50 kV, increase the tube voltage at the rate of 10 kV/min. up to the nominal maximum voltage, and perform fluoroscopic operation at the nominal maximum voltage for five minutes.

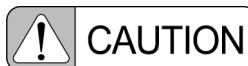
Cautions on Cleaning and Disinfection



Be sure to turn the equipment power OFF before cleaning and disinfecting the equipment.

Otherwise, a malfunction may occur in the equipment, or the equipment may operate in an unintended way.

Also, thoroughly ventilate the room before turning ON the power after disinfection work is complete.



Be sure to clean and disinfect the equipment periodically.

Cleaning and disinfection is very important to ensure that the equipment can be used hygienically and safely. Strictly follow the methods prescribed.



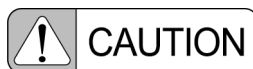
Be sure to clean the equipment frequently and after each patient use.

While doing so, do NOT directly apply or spray any disinfectant, cleaner, or water onto the equipment. Wipe down all contact surfaces using a cloth moistened with an appropriate disinfectant or cleaner. Make sure the cloth is NOT too wet. If it is, liquid may enter into system electronics, causing failure or malfunction.



Observe the following precautions when cleaning and disinfecting the touch panel:

- Do NOT rub or hit the panel surface because it tends to scar easily.
- Wipe gently with moistened soft cloth to remove the dust from the panel surface.



Use the following disinfectants and cleaner (intermediate level disinfectant):

- Chlorine disinfectants
 - Sodium dichloroisocyanurate solution (1 % maximum)
 - Sodium hypochlorite solution (1 % maximum)
- Alcohol disinfectants
 - Commercially available isopropyl alcohol solution (Up to 99 wt% can be used)
- Rubbing alcohol
 - (76.9 - 81.4 vol% Ethanol, Isopropyl alcohol as an additive)
- Glass cleaner (Only onto the touch panel)



Do NOT use the following disinfectants:

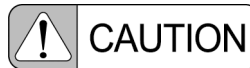
If any of the following disinfectants are applied, the equipment performance and safety cannot be guaranteed.

- Disinfectants that corrode metals, plastics, rubber, or paint
- Disinfectants unsuitable for metals, plastics, rubber, or paint
- Spray-gas type disinfectants
- Volatile disinfectants
- Disinfectants that may enter the equipment



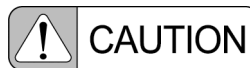
Use disinfectants at a minimum.

Repeated disinfection over a long time may lead to discoloring and cracking on the equipment surface, and deterioration of rubber and plastic. If any abnormality is found on the equipment after disinfection, stop using the equipment immediately. Contact your Shimadzu service representative for repair.



Do NOT use an organic solvent.

Organic solvents may change the surface color. If an organic solvent adheres to the surface, wipe it off immediately.



When disinfecting unpainted metals, do NOT use chlorine-based disinfectants.

Chlorine-based disinfectants may corrode the surface of the equipment. If chlorine-based disinfectants adhere to the surface, wipe them off immediately.



When disinfecting resin parts, do NOT use rubbing alcohol.

Rubbing alcohol may lead to deformation or crack of resin parts. Wipe it off immediately if it adheres to resin parts.

On completing the work, check the following points before switching the power ON again.

- There must be no water or disinfectant adhering to the equipment.
- The tools used in cleaning and disinfecting work must be tidied away.

 Reference 3 "Power ON/OFF"



When turning the power ON after cleaning, make sure the examination room is properly ventilated.

Turning the power ON while any flammable gas remains in the examination room could lead to fire, smoke, explosion or electrocution.

Cautions Relating to Cellular Telephones



Do NOT bring any cellular telephones or related devices into the examination room with their power ON.

Such devices can exceed the EMC standard limitations, and under some conditions this can impair the proper functioning of the equipment. In the worst case, this can cause serious injuries or clinical errors.

Cautions on Electromagnetic Compatibility (EMC)



This equipment needs special precautions regarding EMC.

Install and use the equipment according to the EMC information provided in this operation manual.

 **Reference** [11.9 "Environmental Conditions of EMC \(Electromagnetic Compatibility\)"](#)



Make sure that electromagnetic compatibility is obtained.

All peripheral devices must satisfy EMC standards regarding emission of electromagnetic energy and susceptibility to electromagnetic environment.


Devices that do not satisfy these standards may disturb the correct functioning of the equipment. In the worst case, this can cause serious injuries or clinical errors.

 **Reference** [11.9 "Environmental Conditions of EMC \(Electromagnetic Compatibility\)"](#)



Do NOT use this equipment adjacent to, or stacked with, other equipment.

If adjacent or stacked use is necessary, check to be sure that this equipment works properly in the environment.

 Reference [11.9 "Environmental Conditions of EMC \(Electromagnetic Compatibility\)"](#)



Do not use accessories, transducers and cables other than those specified or provided by Shimadzu.

The use of accessories, transducers and cables other than those specified or provided by Shimadzu could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and result in improper operation.



Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 inches) to any part of the UD150B-40/L-40/V-40, D150BC-40/D150LC-40/D150VC-40, D150BC-41/D150LC-41/D150VC-41, D150BC-45/LC-45/VC-45, GSC-2002L, including cables specified by the manufacturer.

Otherwise, degradation of the performance of this equipment could result.



Portable RF communications equipment (including peripherals such as antenna cables and external antennas) using TETRA (TERrestrial Trunked RAdio) should not be used no closer than 50 cm to any part of the UD150B-40/L-40/V-40, D150BC-40/D150LC-40/D150VC-40, D150BC-41/D150LC-41/D150VC-41, D150BC-45/LC-45/VC-45, GSC-2002L, including cables specified by the manufacturer.

Otherwise, degradation of the performance of this equipment could result.



Portable RF communications equipment (including peripherals such as antenna cables and external antennas) using Bluetooth, Wireless LAN (2.4 GHz), RFID, LTE (Band7) should not be used no closer than 45 cm to any part of the UD150B-40/L-40/V-40, D150BC-40/D150LC-40/D150VC-40, D150BC-41/D150LC-41/D150VC-41, D150BC-45/LC-45/VC-45, GSC-2002L, including cables specified by the manufacturer.

Otherwise, degradation of the performance of this equipment could result.



Portable RF communications equipment (including peripherals such as antenna cables and external antennas) using GSM 180, CDMA 1900, GSM 1900, DECT, LTE Band 1,3,4,25, UMTS should not be used no closer than 45 cm to any part of the UD150B-40/L-40/V-40, D150BC-40/D150LC-40/D150VC-40, D150BC-41/D150LC-41/D150VC-41, D150BC-45/LC-45/VC-45, GSC-2002L, including cables specified by the manufacturer.

Otherwise, degradation of the performance of this equipment could result.

Operating Precautions



Installation of the apparatus shall be made by your Shimadzu service representative or the dealer (referred to as the trader thereafter). If relocation is intended after installation, contact the trader.

Pay attention to the following items before use of the apparatus.

- Operation of switches, meters, etc. and state of connection of high-voltage cables and earth cord.
- Setting of adjusters to appropriate exposure conditions for fluoroscopic or radiographic operation.

Be careful of the following items during operation of the apparatus.

- Do NOT allow excess from the exposure time and amount required for diagnosis.
- In addition to the apparatus display circuit, always observe the whole apparatus and the patient for freedom from any problems.
- If any problem is found with the apparatus or the patient, take a proper action such as shut-down of the apparatus in state securing safety of the patient, etc.
- Do NOT allow the patient to touch the apparatus unnecessarily.

Observe the following items after end of operation of the apparatus.

- For sake of safety, leave open the hand switch to which the apparatus power cord is connected.
- Make sure of cleanliness of the apparatus, so that no problem is brought about with the next operation.

In the case of occurrence of a trouble, do not take any operation for yourself, but make a proper sign. For compensation or repair, take an appropriate treatment based on judgment of a qualified person, or contact your Shimadzu service representative.

Do NOT disconnect cords, cables and other connections, unless it is required.

Cautions When Irradiating Consecutive Pulse X-rays



Observe the following precautions when irradiating consecutive pulse X-rays.

- Conducting studies involving irradiating consecutive pulse X-rays onto the region where an implantable pacemaker or defibrillator is implanted may cause these devices to malfunction.
- Refer to the "Important General Cautions," "Interactions," or other relevant sections in the accompanying documentation of the implantable pacemaker or defibrillator and take the prescribed measures before irradiating the implanted region of these devices with consecutive pulse X-rays.

Fluoroscopy or radiography performed by irradiating consecutive pulse X-rays (such as serial radiography with a few second intervals, pulsed fluoroscopy, digital angiography, DSA, or cineradiography) can adversely affect the CMOS circuit in implantable pacemakers and defibrillators. Such affects may cause oversensing in these devices that can temporarily inhibit pacing pulse output and result in an inappropriate heart rate.

Warranty

The system is warranted to be free from defects in material and workmanship for one year from the date of delivery. If found to be defective, the system must be offered to your Shimadzu service representative for inspection and examination. Upon examination, your Shimadzu service representative, at its sole option, will repair or replace at no charge, the system or any part found to be defective. Components which wear are not warranted.

This warranty extends to original purchaser or the lessee of the new system only.

If the system is to be resold or delivered to a third party, such third party must be provided with a copy of this manual, the installation manual and the technical manual supplied with the system.

This warranty does not apply to the following:

1. Failure or damage due to any installation, relocation, or service not provided by your Shimadzu service representative or a SHIMADZU designated contractor.
2. Failure or damage caused by the product of other companies (except those purchased from SHIMADZU).
3. Failure or damage due to repairs using non-SHIMADZU certified service parts.
4. Failure or damage due to non-compliance with the notices and procedures set forth in this manual.
5. Failure or damage due to any operating environment deviating from the requirements set forth in this manual.
6. Failure or damage due to natural disasters such as power surge, rain, fire, earthquake, flood, and thunder.
7. Failure or damage due to being equipped with non-SHIMADZU approved vehicle, ship, aircraft, or others.
8. Failure or damage due to use in non-SHIMADZU certified countries.
9. Failure or damage in case of purchase from a store other than SHIMADZU or the service representative.
10. Failure or damage due to hit, drop, and shock.

Service after the expiration of the warranty is available at a reasonable cost and should be performed by your Shimadzu service representative.

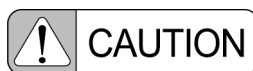
IN NO EVENT SHALL SHIMADZU AND ITS AFFILIATED ENTITIES BE LIABLE TO ANY PERSON OR ENTITY FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES (INCLUDING, WITHOUT LIMITATION, ANY DAMAGES RESULTING FROM LOSS OF USE, BUSINESS INTERRUPTION, LOSS OF PROFITS, LOSS OF SAVINGS, THE COST OF PROCUREMENT OF SUBSTITUTED GOODS, SERVICES OR TECHNOLOGIES OR FOR ANY MATTER ARISING OUT OF OR IN CONNECTION WITH THE USE OR INABILITY TO USE THE SYSTEM. In some jurisdictions, some of the foregoing warranty disclaimers or damage limitations may not apply.

Shimadzu will be indemnified for any claim, liability, or damage arising out of the misuse or non-compliance with this manual by the purchaser or lessee of the system.

Service Life

The equipment lifetime is 10 years (based on Shimadzu's criteria) assuming the specified maintenance checks are performed.

Disposal Precautions



When disposing of the equipment, contact your Shimadzu service representative.

An improper disposal of this equipment may pollute the environment by substances contained in parts.

Action for Environment (WEEE)

To all users of Shimadzu equipment in the European Union:

Equipment marked with this symbol indicates that it was sold on or after 13th August 2005, which means it should not be disposed of with general household waste. Note that our equipment is for industrial/professional use only.

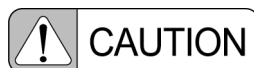


WEEE Mark

Contact your Shimadzu service representative when the equipment has reached the end of its life. They will advise you regarding the equipment take-back.

With your co-operation we are aiming to reduce contamination from waste electronic and electrical equipment and preserve natural resource through re-use and recycling. Do not hesitate to ask your Shimadzu service representative, if you require further information.

For California, USA Only



**This product contains a battery that contains perchlorate material.
Perchlorate Material - special handling may apply.
See www.dtsc.ca.gov/hazardouswaste/perchlorate**

Software

The information in this Operation Manual is based on the following software.

Version: Ver.UD150B/V/L40.V01

Revision: 2.8*

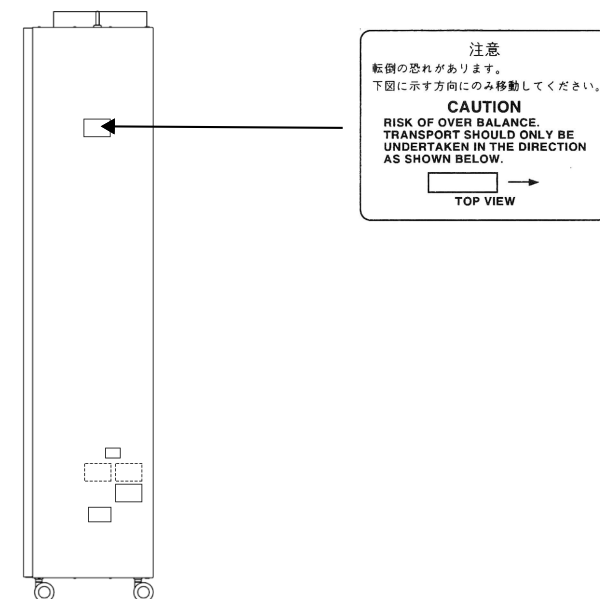
* : Even if the last digit of the revision is different from that above, the descriptions in the manual are valid.

Warning and Caution Labels for Safety

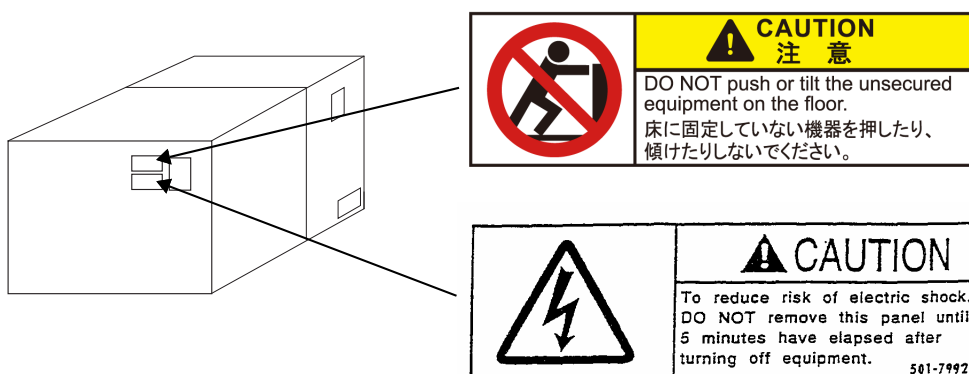
The warning and caution labels for safety, which describe handling precautions, are attached to the device. With adequate understanding of the contents on the labels and the warning/caution items in this manual, operate the device safely.

If the label for safety is peeled or unreadable by stain or scratch, replace it with a new one. For replacement, contact your Shimadzu service representative.

- Control cabinet



- Starter SA-60



Abbreviation

AEC	: Automatic Exposure Control
APR	: Anatomical Program
HU	: Heat Unit
IBS	: Image Brightness Stabilizer
I.I.	: Image Intensifier
kV	: kilovolt; unit of tube voltage
LED	: Light Emitting Diode
mA	: milliamperes; unit of tube current
mAs	: milliamperes second; unit of tube current time product
min	: minute; unit of fluoroscopy time
ms (msec)	: millisecond; unit of radiography time
sec	: second; unit of radiography time and fluoroscopy time
RIS	: Radiology Information System
CR	: Computed Radiography

Options

The "Options" described in this manual may be provided as standard, or may be unavailable, depending on the sales format.

System Activation

This equipment needs activation during installation.

The activation work needs authorization by Shimadzu.

*This is available for X-ray High Voltage Generator shipped after January, 2020.

Related Documents

M516-E009 High Speed Rotation Starter SA-60 Operation Manual

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1

Outline

This chapter describes the applications, features, principle, operator profile and safety symbols for system of the equipment.

1.1 Applications

■ Intended Use

The X-ray high voltage generator UD150B-40/L-40/V-40, D150BC-40/45 LC-40/45 VC-40/45, D150BC-41 LC-41 VC-41, GSC-2002L is used for radiography and fluoroscopy (optional) on patients combined with an X-ray tube unit, an X-ray collimator, and if necessary, an X-ray tube support, an X-ray radiography stand, an X-ray radiography table or an X-ray diagnostic table, and digital radiography system.

■ Indications for Use

This unit is used for radiographic and fluoroscopic examinations of whole body except mammography and interventional procedure when combined with an X-ray tube unit, an X-ray collimator, and if necessary, an X-ray tube support, an X-ray radiography stand, an X-ray radiography table or an X-ray diagnostic table, and digital radiography system.

This unit must only be operated by qualified personnel, such as radiography technicians or those with equivalent qualifications.

This unit is used for total patient population including pediatric examination.

The units support the following radiography:

● General radiography

- Bucky radiography
- Direct film radiography
- Auto-changer radiography

● Film tomography

● Fluoroscopic diagnosis (OPTION)

- Fluoroscopic diagnosis
- Direct spot filming
- I.I. indirect spot filming

● Optional radiography

- DR (requires additional option parts)
- Digital tomography (requires additional option parts)



- **Do NOT use the system for any other purpose than indicated above.**
- **Do NOT connect the system to any other equipment, either by electrical or mechanical means, or modify the system.**

1.2 Features



- Large LED display shows the X-ray conditions clearly.
- Hand switch lights up during radiography preparations and during radiography.
- X-ray radiography ready status, X-ray radiography underway, and fault notification by buzzer and operation panel illumination.
- A sequence of radiography conditions for an examination can be saved as a program to conduct radiography in the designated sequence.
- Easy-to-see color TFT touch panel.
- Jog shuttle and up and down buttons make it easy to set the X-ray conditions.
- Memory shot radiography conducts spot filming using a function to automatically set the technique factors based on fluoroscopy conditions. Up to 16 types of technique factors can be registered to the radiography program keys, in accordance with the radiography objective (double-contrast radiography, child radiography, etc.). (OPTION)
- Several preset fluoroscopy conditions (fluoroscopy mode) can be stored in the unit during installation adjustment. (OPTION)
- Radiography preparations can be completed in approximately half the normal time (Quick ready function).

1.3 Principle

■ Operation panel

The operation panel provides the function of setting the tube voltage and tube current that are applied to the X-ray tube unit, as well as the radiography time for performing fluoroscopy and radiography.

■ Control cabinet

The Control cabinet contains a power circuit used for such as opening/closing the main circuit and controls the generation of high voltage to be applied to the X-ray tube unit according to the signals of tube voltage, tube current and radiography time that are set on the operation panel.










Control circuits and interface circuits required for interlocking safety devices and external equipment are also provided within the Control cabinet.







1.4 Operator Profile

Item	Details
Age	Age that person can obtain the license of Radiological Technologist or a license equal to it.
Sex	No limitation
Nationality	No limitation
Education	Radiological Technologist or person who has a license equal to it. The capacity to read and understand the operation manual.
Knowledge	Radiological Technologist or person who has a license equal to it.
Language	Can read and understand English.
Experience	Necessary. Every operator needs to take training for operating the equipment before using the equipment.
Permissible impairments	Corrected visibility is over 0.7 in the decimal number. Impaired by 40 % resulting in 60 % of normal hearing at 500 Hz to 2 kHz.

1.5 Safety Symbols for System

Safety symbols displayed on the system are described below:

Symbol	Location	Meaning
	On name plate on covers	Alternating current
	Inside the equipment, where wiring earth conductor is connected	Earthing function
	Inside the equipment, where protective earth conductor in power cord is connected	Protective earth ground
	On warning and caution labels	Observe described items, or refer to operation manual.
	On name plate	Refer to operation manual
	On the power supply panel	Power on
	Off the power supply panel	Power off
	Inside X-ray tube cover	Risk of electric shock
	On X-ray tube cover	Ionizing radiation
	On name plate	Refer to operation manual

Symbol	Location	Meaning
	On name plate	Serial number
	On name plate	Year and month of manufacture
	On name plate	Manufacturer
	Next to name plate	Refer to operation manual.
	Breaker switch (SA-60)	Power ON
	Breaker switch (SA-60)	Power OFF

2

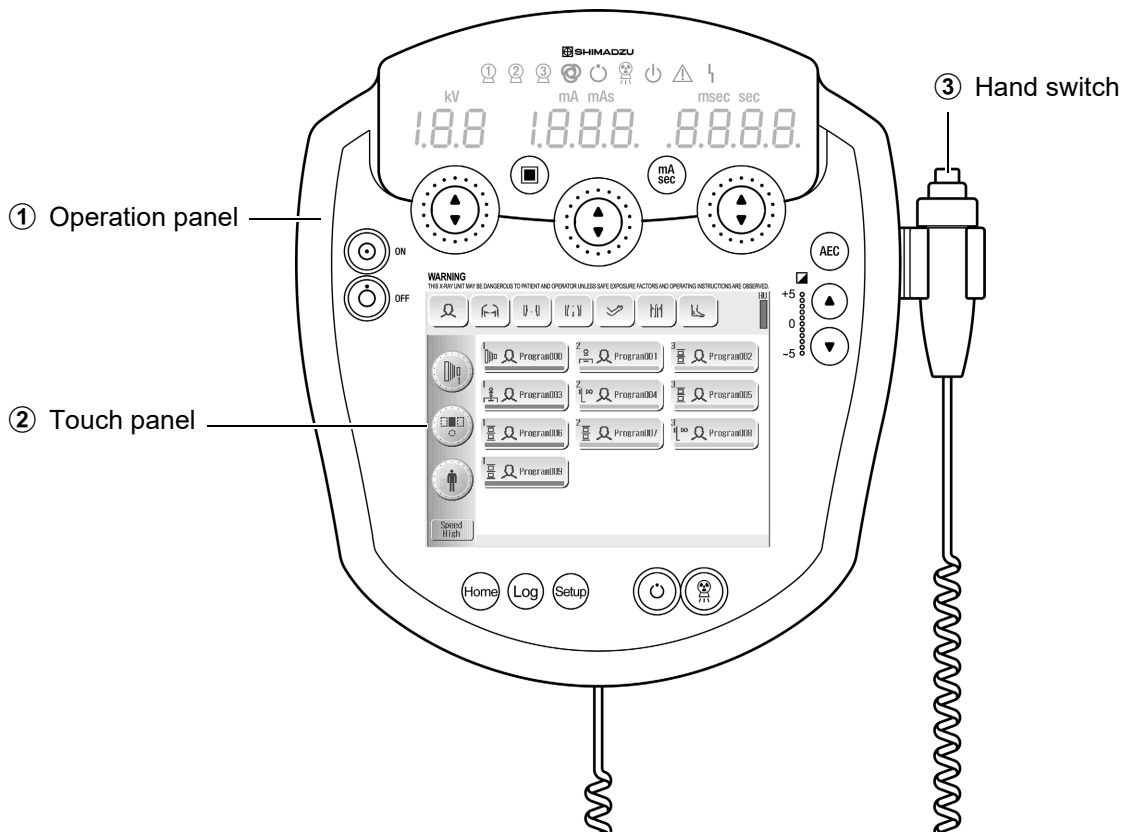
Configuration

This chapter describes the equipment configuration and the operation panel.

2.1 Configuration

The equipment comprises the following parts.

GSC-2002L



D150BC-40/45 LC-40/45 VC-40/VC-45, D150BC-41 LC-41 VC-41

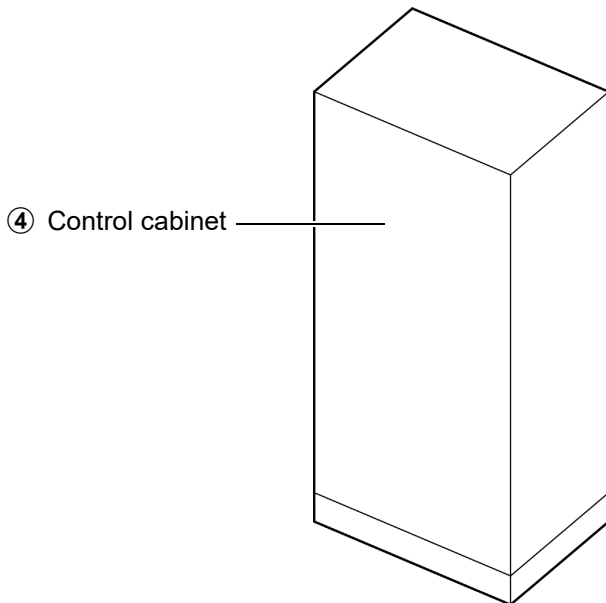


Figure 2.1 Equipment Configuration

① Operation panel

Offers the buttons and displays for X-ray radiography.

② Touch panel

Liquid crystal display operated by touching.

**NOTE**

- Only single operation should be performed using a touch panel after your confirmation of the display. If multiple operations are tried simultaneously, this system does not work properly.
- Operate the touch panel by pressing down gently with a fingertip or a hard, blunt object (such as a stylus pen or the back of a finger nail). Otherwise, unintended locations may respond.
- If a sharp object is used to touch the touch panel (such as a fingernail tip), it can cause a scratch or, if repeated, can break the panel.

③ Hand switch

Switch to conduct X-ray radiography.

The switch has 2-stage operation.

The first stage conducts preparation operations for X-ray radiography and the second stage conducts the X-ray radiography.

**NOTE**

Fasten the hand-switch cables with the cable clamps behind the operation panel.

④ Control cabinet

The cabinet that controls the high voltage, incorporating the high voltage generator.

**NOTE**

This part might be set up in the patient environment.

⑤ Connector cable set

Operation panel to Control cabinet	16 m
Control cabinet to power supply	10 m (16 m for USA)

⑥ Document set

"X-ray High Voltage Generator UD150B-40/L-40/V-40, D150BC-40/45 LC-40/45 VC-40/45, D150BC-41 LC-41 VC-41, GSC-2002L OPERATION MANUAL" (M501-E052)

2.2 Operation Panel

This section displays the operations of the buttons on the operation panel.

Buttons

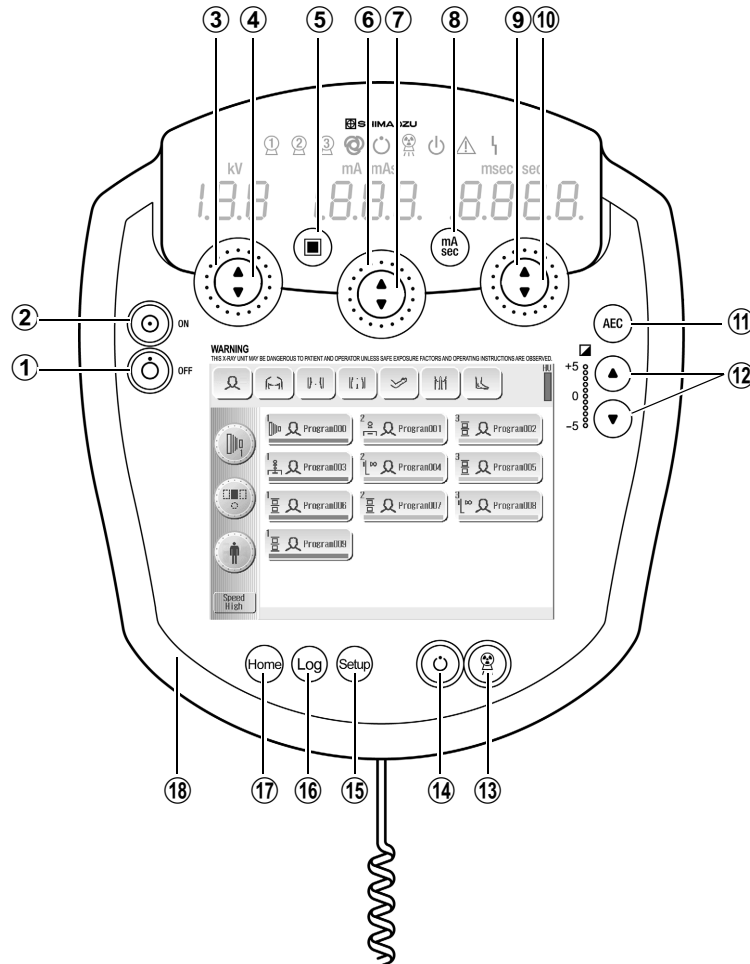


Figure 2.2 Operation Panel (Buttons)

① (Power OFF) Button

Turns off the equipment power.

② (Power ON) Button

Turns on the equipment power.

③ kV Shuttle

Sets the radiography tube voltage.

Turn clockwise to increase the displayed value. Turn counterclockwise to decrease the displayed value. Effective for making large changes to the value.

④ kV-up Button/ kV-down Button

Sets the radiography tube voltage.

Press ▲ to increase the displayed value. Press ▼ to decrease the displayed value. Effective for making small changes to the value.

⑤ (Focus Switch) Button

Switches the X-ray tube focus.

Toggles between large focus and small focus each time this button is pressed.

The switch lights when small focus is selected.

⑥ mA/mAs Shuttle

Sets the radiography tube current or the radiography tube current time product.

Turn clockwise to increase the displayed value. Turn counterclockwise to decrease the displayed value. Effective for making large changes to the value.

⑦ mA/mAs-up Button/ mA/mAs-down Button

Sets the radiography tube current or the radiography tube current time product.

Press ▲ to increase the displayed value. Press ▼ to decrease the displayed value.


Effective for making small changes to the value.

⑧ (mA/mAs Switch) Button

Switches the setting method for the radiography conditions.

Toggles between mA sec method and mAs method each time this button is pressed.

The switch lights when mA sec is selected.

 **Reference** Setting kV, mA or mAs sec in [4.3.2 "Editing Radiography Steps"](#)

⑨ sec Shuttle

Sets the radiography time.

Turn clockwise to increase the displayed value. Turn counterclockwise to decrease the displayed value.

Effective for making large changes to the value.

⑩ sec-up Button/sec-down Button

Sets the radiography time.

Press ▲ to increase the displayed value. Press ▼ to decrease the displayed value.

Effective for making changes one position at a time.

⑪ Button

Turns the AEC ON and OFF.



⑫ (Density-up) Button/ (Density-down) Button

Adjusts the density.

The density can be set in the range from +5 to -5. Increasing the density in the + direction produces darker images; increasing it in the - direction produces lighter images. The 0 position is the standard density.



13  **(X-ray Radiography) Button**

Starts X-ray radiography.

 (X-ray Radiography) button and  (Radiography Indicator) lights yellow during X-ray radiography.

14  **(Radiography Preparation) Button**

Starts preparations for X-ray radiography.

 (Radiography Preparation) button and  (Radiography Ready Indicator) lights green when X-ray radiography preparations are complete.

15  **Button**

Press this button to register a radiography program or to make equipment settings.

The setup screen is displayed on the touch panel.

16  **Button**

Displays the radiography history on the touch panel.

17  **Button**


Displays the home screen on the touch panel.

A home screen can be registered.

 **Reference** [2.5 "Home Screen"](#)

18 **Illumination**

The tube used, X-ray radiography preparation, X-ray radiography, and equipment errors are displayed by the set color and lighting mode.

 **Reference** [7.3.5 "Illumination"](#)

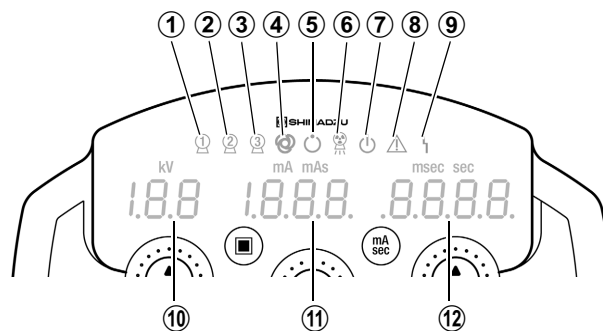
■ Displays

Figure 2.3 Operation Panel (Displays)

1  **(First X-ray Tube Indicator)**

Lights with the first X-ray tube is selected.

2  **(Second X-ray Tube Indicator)**

Lights with the second X-ray tube is selected.

③ (Third X-ray Tube Indicator)

Lights with the third X-ray tube is selected.

④ (Memory Shot Indicator)

Lights when the memory shot function is selected.

⑤ (Radiography Ready Indicator)

Lights green when X-ray radiography preparations are complete.

⑥ (Radiography Indicator)

Lights yellow during radiography.

⑦ (Stand-by Indicator)

Lights approximately two seconds after the power is turned on.

Radiography and fluoroscopy are possible only when this indicator is lit.

⑧ (Caution Indicator)

Lights when equipment is in a caution state.

Radiography is not possible while this indicator is lit.

⑨ (Fault Indicator)

Lights to indicate that a protective circuit operated or a notification issued by the equipment.

Radiography is not possible while this indicator is lit.

⑩ **kV Display**

Displays the radiography tube voltage.

⑪ **mA/mAs Display**

Displays the radiography tube current or the radiography tube current time product.

The measured value is displayed after radiography.

⑫ **sec Display**

Displays the radiography time.

The measured value is displayed after radiography.

2.3 Radiography Program Screen

This screen displays the radiography programs.

Press the Tab keys to switch between the radiography program pages on the screen.

Press a Radiography Program key to switch to the radiography step screen.

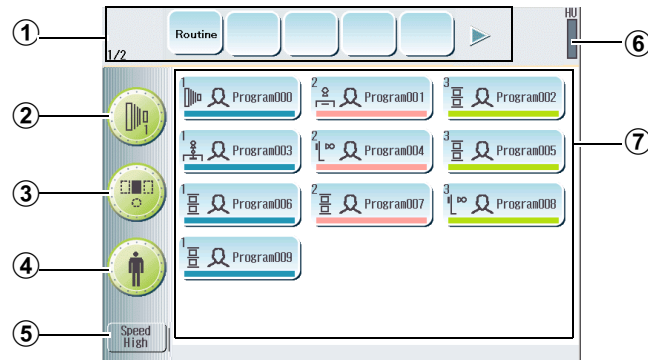


Figure 2.4 Radiography Program Screen

① Tab Keys

The radiography programs groups are displayed as an icon or text.

Press a key to switch between the radiography program pages on the screen.

The ◀ (left) and ▶ (right) keys are displayed if ten Tab keys have been configured.

Press the ◀ (left) key beside the Tab keys to display the first half of the Tabs.

Press the ▶ (right) key beside the Tab keys to display the second half of the Tabs.

② Technique Key

Displays the radiography technique.

Press this key to change the technique.

③ Photo Pickup Field Key

Displays the AEC photo pickup field.

Press this key to select the photo pickup field.

④ Body Thickness Correction Key

Displays the body thickness correction conditions.

Press this key to select the correction conditions.

⑤ Speed Key

Displays the speed (film sensitivity).

Press this key to change the speed.

⑥ Heat Unit Gauge

Displays the X-ray tube accumulated heat units.

⑦ Radiography Program Key

Displays the name of radiography programs that include multiple radiography steps.


Press this key to display the radiography steps.


2.4 Radiography Step Screen

This screen displays the radiography steps in the radiography program.

When a radiography step is selected, the radiography step conditions become the equipment radiography conditions.

Press a Tab key to revert to the radiography program screen.

 Depending on the installation settings, the background color of the radiography step screen can be changed to the color set using the Illumination key.

 Reference [7.3.5 "Illumination"](#)

■ Radiography Program

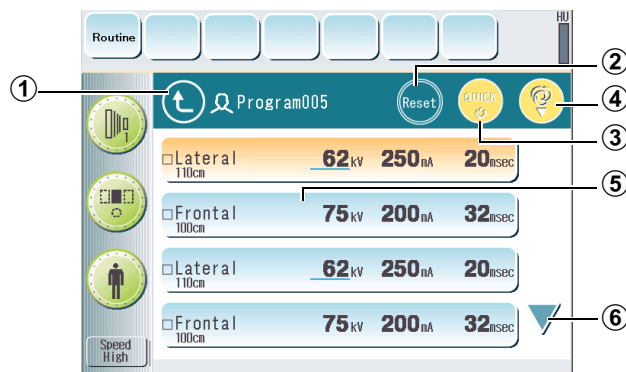


Figure 2.5 Radiography Step Screen

① Key

Reverts to the radiography program screen.

② Key

Reverts changed radiography conditions to the program conditions.

③ Quick ready Key

If this key is ON, the radiography preparations are completed in approximately half the normal time (as per the setting at the time of installation).

④ Automatic Stepping Key

If this key is ON, operation automatically proceeds to the next step when radiography is complete.

⑤ Radiography Step Key

The Radiography Step key displays the name and X-ray conditions registered for the radiography step.

When a button is selected to change the radiography conditions, the equipment radiography conditions change to the radiography step conditions.

⑥ ▲/▼ Keys

- ▼ : Displays the subsequent radiography steps.
- ▲ : Displays the previous radiography steps.

🔗 Reference When using the ceiling tube support CH-200 unit's auto positioning option, refer to 10.3 "Ceiling Tube Support CH-200 Auto Positioning"

■ Fluoroscopy (OPTION)

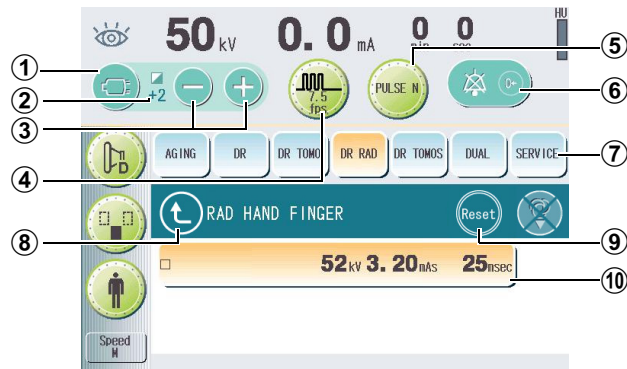


Figure 2.6 Radiography step screen

① IBS Key

Turns ON/OFF the IBS (Image Brightness Stabilizer). It lights up when the IBS is ON.

② IBS Correction Key

When IBS is ON, press the FkV setup keys to correct the image lighter or darker. Correction can be changed for 5 levels, from -2 (dark) to +2 (light). (Depending on installation settings).

③ FkV Setup Keys

Changes fluoroscopy tube voltage in 1kV increments.

④ Pulse Rate Selector Key

Press this key to switch pulsed fluoroscopy rates. It lights up during pulsed fluoroscopy. (Option)

⑤ Fluoroscopy Mode Key

Press this key to switch between different fluoroscopy modes.

⑥ Fluoroscopy Timer Key

Press this key to reset fluoroscopy buzzer or fluoroscopy accumulated time. It blinks when the preset fluoroscopy duration of audible warning is reached.

⑦ TAB Keys

These tabs serve to group radiography programs for examined regions. Press a Tab key to revert to the radiography program screen.

⑧ ⏪ Key

Reverts to the radiography program screen.


⑨ Key

Reverts changed radiography conditions to the program conditions.

⑩ Radiography Step Keys

When a radiography step is selected, the radiography step conditions become the equipment's radiography conditions.

2.5 Home Screen

The radiography program screen or radiography step screen can be registered as the home screen. Subsequently, this screen is displayed as the home screen when the  button is pressed.

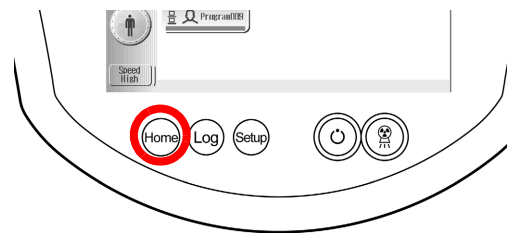
■ Registering the Home Screen

- 1 Display the radiography program screen or radiography step screen that you wish to register as the home screen.




- 2 Hold down the  button on the operation panel for at least two seconds.

The displayed screen is now registered as the home screen.



2.6 Setup Screen

Hold down the  button on the operation panel for at least one second to display the setup screen. Press the key corresponding to the radiography program to be set.

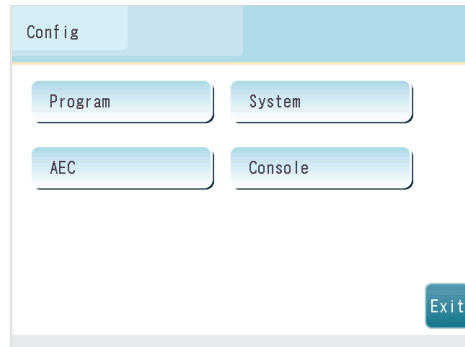





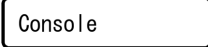



Figure 2.7 Setup Screen

- 
Displays the setup screen for radiography programs.
- 
Displays the setup screen to make the AEC radiography settings.
 **Reference** [7.1 "Setting Up AEC \(optional\)"](#)
- 
Displays the setup screen to make the system settings.
 **Reference** [7.2 "System Setup"](#)
- 
Displays the setup screen for the equipment environment, such as screen brightness and sound volume.
 **Reference** [7.3 "Setting Up the Equipment Environment"](#)

3


Power ON/OFF

This chapter describes how to turn the equipment power on and off.

3.1 Checking Safety

3.1.1 Starting Inspection

The daily inspections comprise the starting inspections and ending inspections. Daily inspections are necessary in order to keep using the system for a long time. Check that all inspections and corrective actions have been completed before using the system.

 **Reference** Use the "Starting Inspection Checklist" and "Ending Inspection Checklist" in [11.15 "Appendix"](#). We recommend that you retain filled out copies of the "Starting Inspection Checklist" and "Ending Inspection Checklist" for a fixed time.

3.1.2 Checking Safety



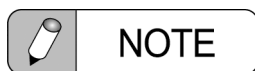
The power switch for the X-ray high voltage generator doubles as the power switch for other equipment, such as a Bucky table or R/F table. Check that the examination room is safe before turning on the power.

3.2 Turning On the Power





Contact your Shimadzu service representative if any of the following problems occur when the power is turned on:



- operation panel display shows an abnormality, such as flickering;
- operation panel makes an abnormal noise; or
- X-ray tube unit produces abnormal sounds or vibrations.



Wait at least 10 seconds before turning the power on again after shutting it off.

If the power is turned on again within 10 seconds, the system may not start correctly.

- 1 Turn ON the knife switch or the molded case circuit breaker connected to the power supply cables of the X-ray high voltage generator.
- 2 Check that the  (Power OFF) button on the operation panel is lit.
- 3 Press the  (Power ON) button.

The  (Stand-by indicator) lights approximately two seconds after the  button is pressed.

A message is displayed when the power is turned on if the internal battery is flat.

 Reference [8.1.4 "Messages at Power ON"](#)

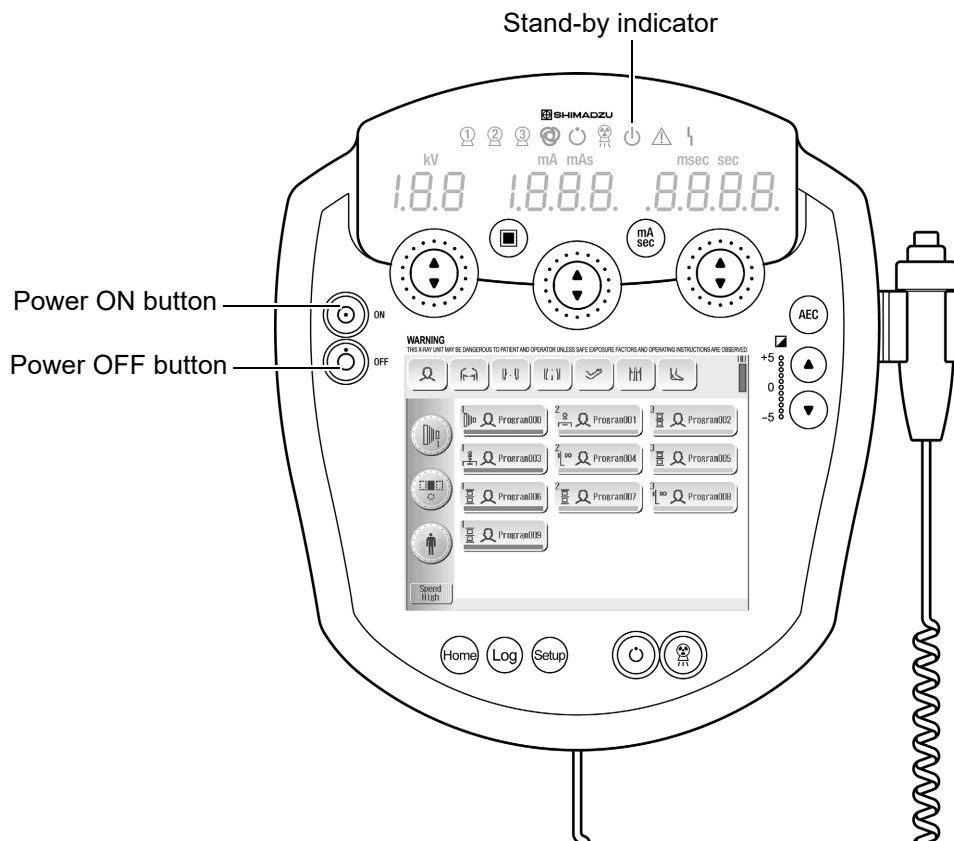



Figure 3.1 Operation Panel

3.3 Turning Off the Power

 **CAUTION**



- Except in case of emergency, do not turn off the power while the starter brake is applied to the X-ray tube or within approximately five seconds after X-ray radiography. This can reduce the life of the X-ray tube.
- Turn off the power when an emergency occurs and when no examinations are being conducted.
- As a safety precaution, open the knife switch or the breaker connected to the equipment power cable.

 **NOTE**

When using an X-ray tube that can maintain high-speed rotation, be sure to confirm that the Quick ready key is OFF before turning OFF the power.

 **Reference** [5.5 "Selecting Quick Ready"](#)

3 Power ON/OFF

- 1 Press the  (Power OFF) button on the operation panel.
The Power OFF button lights.
- 2 Turn the knife switch or molded case circuit breaker OFF to which the power supply cables of the X-ray high voltage generator are connected.
- 3 Check that the  lights off.

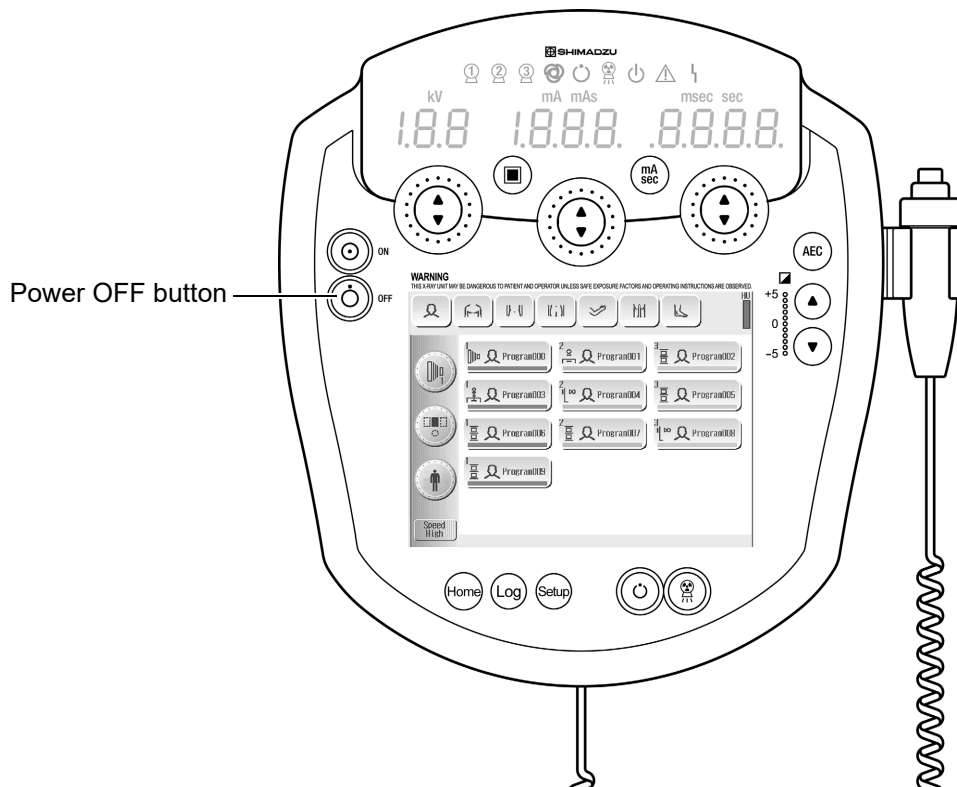


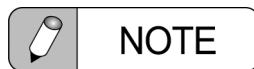
Figure 3.2 Operation Panel

4

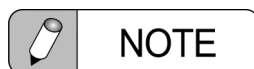
Registering and Changing Radiography Programs

This chapter describes how to register and change radiography programs.

4.1 Registered Contents of Radiography Programs



Several examples of radiography programs are factory-installed.
 Before using the equipment, set appropriate radiography programs according to the applications.



When setting radiography programs for pediatric patients, include the name such as "child" or "infant" in the programs or steps.

The contents registered in radiography programs are shown below.

Tab

- Registered name

Radiography program

- Name
- Body thickness
- Slice angle and slice speed data
 Only when a tomography unit can transfer slice angle and slice speed data.



Radiography Program Screen


Radiography steps

- Name
- Technique
- Focus
- kV, mA or mAs, sec
- AEC (optional)
 - AEC ON/OFF
 - Density
 - Photo pickup field
 - Speed
- Comment




Radiography Step Screen

4.1 Registered Contents of Radiography Programs

 The maximum number of steps and registered number of character in name or comment for on radiography steps can be selected on site installation.

Maximum number of registerable radiography steps	Number of character for name on radiography steps	Number of character for comment on radiography steps
400	14	14
600	14	8
600	12	10
800	10	6
800	8	8

 **Reference** When using the ceiling tube support CH-200 unit's auto positioning option, refer to [4.3.3 "Ending Radiography Program Registration"](#)


4 Registering and Changing Radiography Programs

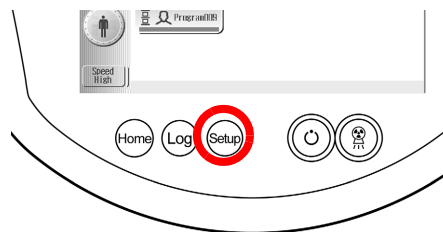
Registration of tabs, radiography programs, and radiography steps is conducted from the radiography program registration screen.

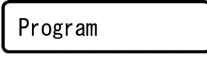
■ Displaying the Radiography Program Registration Screen

- 1 Hold down the  button on the operation panel for at least one second.

The setup screen is displayed.

 **Reference** The Password must be entered if one has been set. [7.5 "Entering Passwords"](#)



- 2 Press the  key.

The setup screen for radiography programs is displayed.

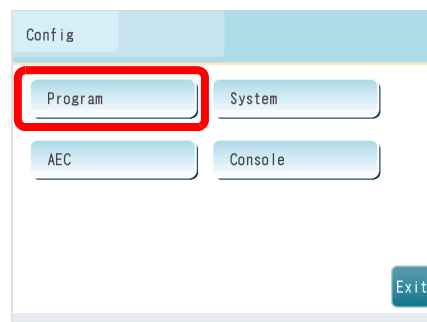


Figure4.1 Setup Screen for Radiography Programs

- 3 Conduct the registration operations from this screen.

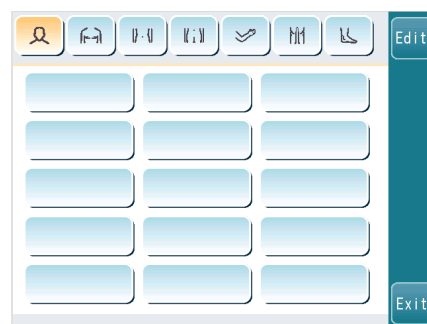

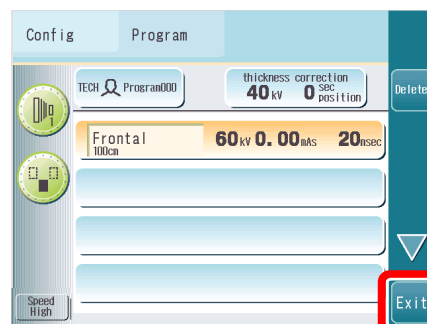


Figure4.2 Radiography Program Registration Screen

- 4 Press the  key when all registration operations are complete.



4.2 Editing the Tabs

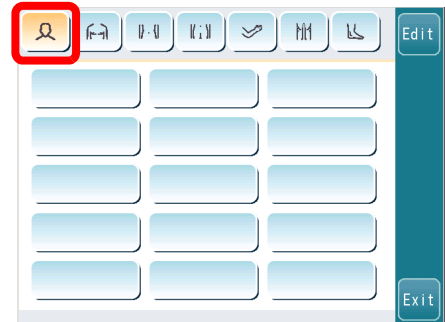
The tabs serve to group radiography programs for examined regions.

Press a Tab key on the radiography program screen to display the radiography program registered for that tab.

■ Editing the Tab Name

Select the tab name as an icon or as text (characters, numbers/symbols, or registered name).

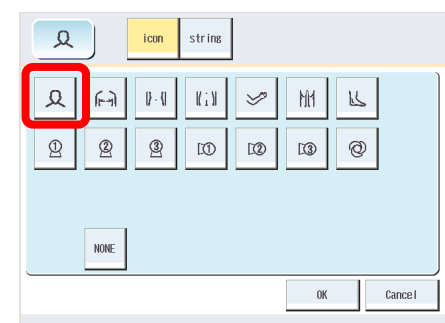
- 1 Press the Tab key on the radiography program registration screen.




- 2 Press the key.



- 3 To enter an icon, select the required icon.




4 Registering and Changing Radiography Programs



4 To enter text, press the  key.

① Select the appropriate tab for Characters, Numbers/Symbols, or Registered Names.

② <Entering Characters or Numbers/Symbols>
Press the appropriate keys.

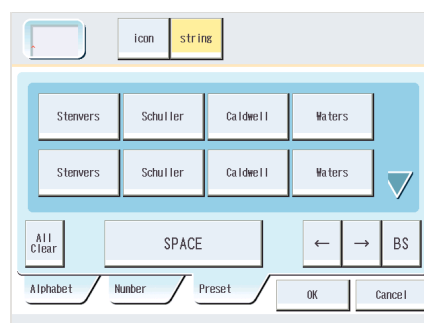
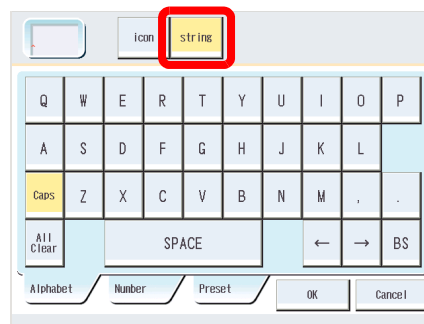
Up to 12 characters can be entered. After six characters, subsequent characters form a second line.

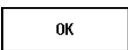
Press the  key to delete characters.

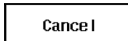
Press the  or  key to move the insertion point.

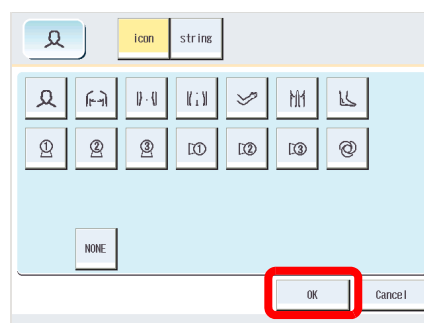
③ <Entering a Registered Name>

Press the key for the required registered name.



5 Press the  key.

Press the  key to proceed without registering the set name.



The display reverts to the radiography program registration screen.

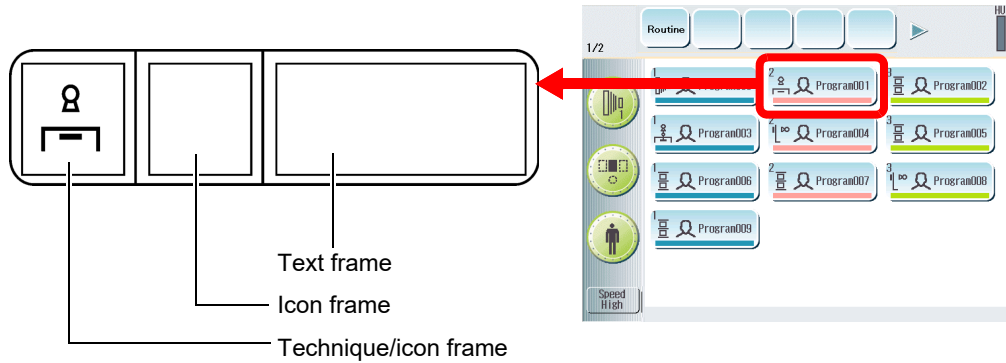


4.3 Editing Radiography Programs

4.3.1 Editing a Radiography Program

■ Editing the Radiography Program Name

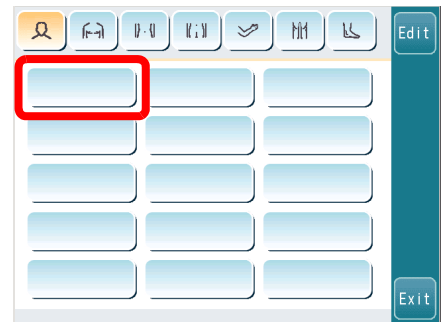
A radiography program name comprises three input frames.



Each input frame can contain the following contents:

- Technique/icon frame : Technique/icon
- Icon frame : Icon
- Text frame : Text (characters, numbers/symbols, or registered name)
Enter up to 20 characters (10 characters in the top line and 10 characters in the bottom line).

1 Press a Program key on the radiography program registration screen.



2 Press the **Edit** key to display the radiography program editing screen.



4 Registering and Changing Radiography Programs

- 3 Press the program name frame.
The icons are displayed to allow input of the technique icon or another icon.

Program name frame

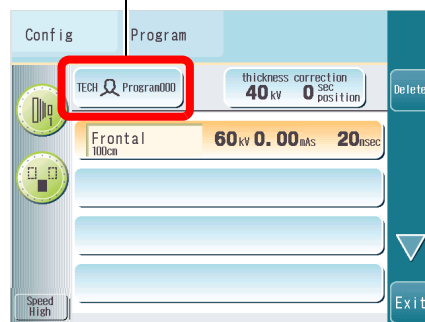


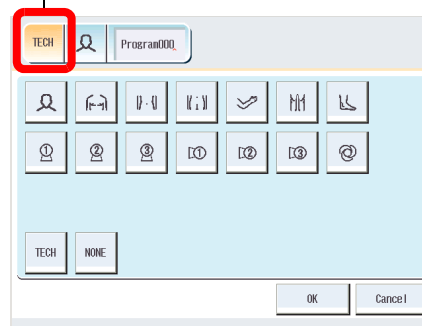
Figure4.3 Radiography Program Editing Screen

● Enter the name in the technique/icon frame.

- 4 Press the technique/icon frame.
- 5 Enter the technique icon or another icon.

- Technique icon:
Press the key. The radiography technique currently displayed in the Technique key appears in the frame.
- Icon:
Press the key for the required icon.
Press the key if no entry is required.

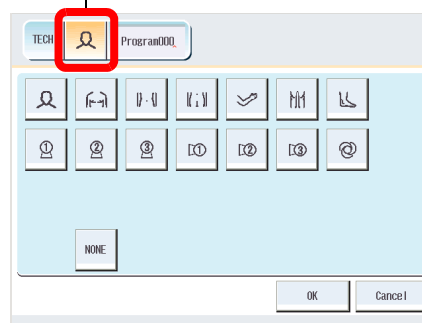
Technique/icon frame



● Enter the name in the icon frame.

- 6 Press the icon frame.
- 7 Enter the icon.
Press the key for the required icon.
Press the key if no entry is required.

Icon frame



● Enter the name in the text frame.

8 Press the text frame.

9 Enter the text.

① Select the appropriate tab for Characters, Numbers/Symbols, or Registered Names.

② <Entering Characters or Numbers/Symbols> Press the appropriate keys.

Up to 20 characters can be entered. After 10 characters, subsequent characters form a second line.

Press the **BS** key to delete characters.

Press the **←** or **→** key to move the insertion point.

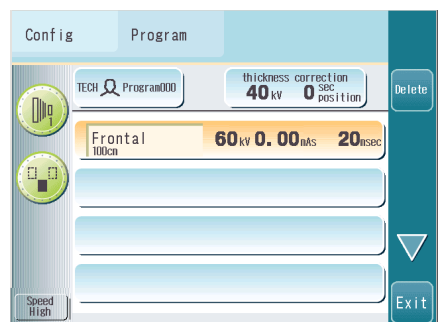
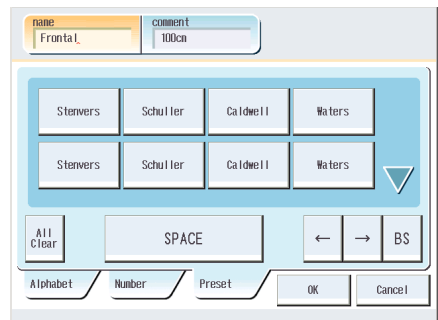
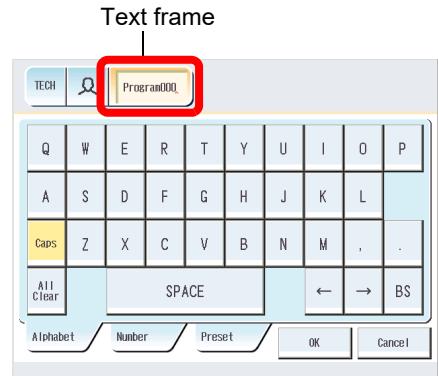
③ <Entering a Registered Name>

Press the key for the required registered name.

10 Press the **OK** key.

Press the **Cancel** key to proceed without registering the set name.

The radiography step registration screen is displayed.

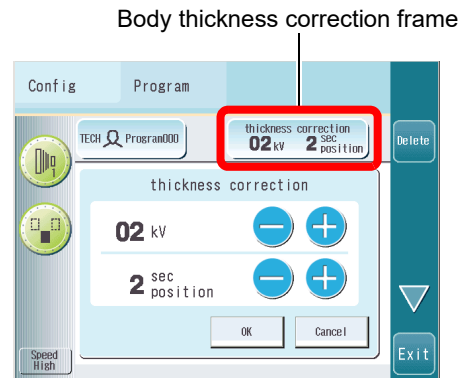


■ Setting the body thickness correction

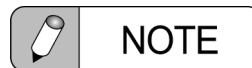
This procedure changes the radiography program conditions according to the patient's body thickness. Settings are made for kV and sec.

The kV value is set in units of kV; the sec value is set as a number of positions (one position is equivalent to an 12.5% change).

- 1 Press the body thickness correction frame to display the window shown.
- 2 Press the \oplus and \ominus keys to set the kV and sec values.



- 3 Press the key.
Press the key to proceed without saving the settings.



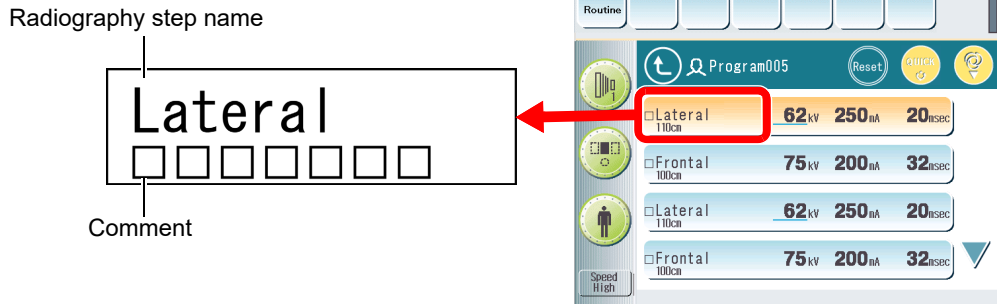
The body thickness correction settings are valid for all radiography steps in the radiography program.

4.3.2 Editing Radiography Steps

This procedure edits the radiography step name and the radiography conditions. Up to seven steps can be created for a single radiography program.

■ Editing the Radiography Step Name

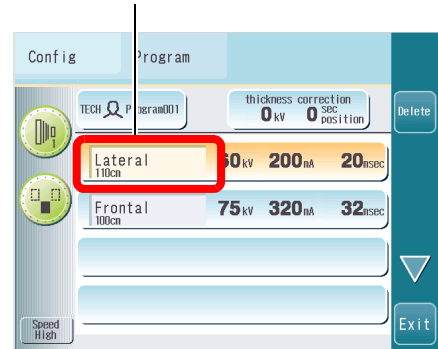
A name and comment can be added to a radiography step. As shown in the diagram, the comment is displayed below the radiography step name.



- 1 Press the radiography step name frame on the radiography program editing screen.

A name frame and comment frame are displayed to permit input.

Radiography step name frame



- 2 Enter the text.

- ① Select the appropriate tab for Characters, Numbers/Symbols, or Registered Names.

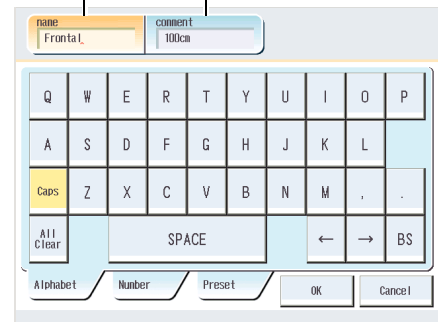
- ② <Entering Characters or Numbers/Symbols> Press the appropriate keys.

Reference For available number of character, [4.1 "Registered Contents of Radiography Programs"](#)

Press the key to delete characters.

Press the or key to move the insertion point.

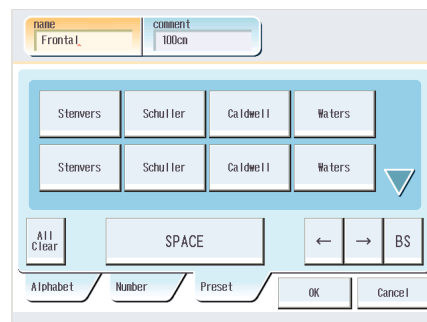
Name frame Comment frame



4 Registering and Changing Radiography Programs

③ <Entering a Registered Name>

Press the key for the required registered name.

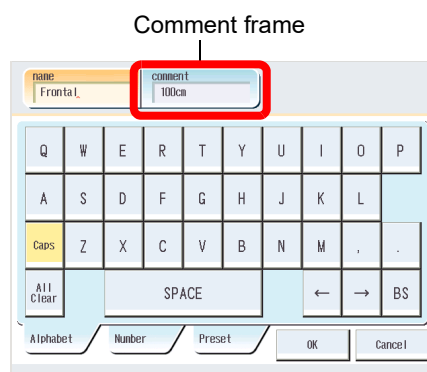


3 To enter a comment, press the comment frame.

The character input screen is displayed.

Enter the text as described for the step name frame.

Reference For available number of character,
[4.1 "Registered Contents of Radiography Programs"](#)



4 Press the key.

The entered text appears in the name and comment frames for the selected radiography step.









Press the key to proceed without saving the settings.

■ Selecting the Technique

1 Press the Technique key to display the radiography techniques.


2 Select the desired Technique.




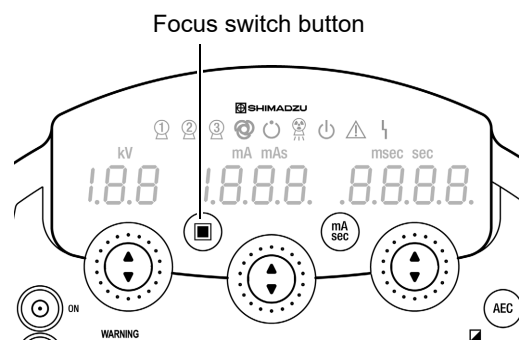
Icon	Description
Techniques where fluoroscopy is not performed.	
	Supine Bucky radiography
	Standing Bucky radiography
	Auto-changer radiography
	Tomography
	Radiography
Techniques where fluoroscopy is possible.	
	I.I. indirect spot filming
	DR
	Direct spot filming

- The number above the icon indicates the X-ray tube type.

■ Selecting the Focus

- 1 Press the  (Focus switch) button on the operation panel to switch the focus.


Small focus is selected when the  button is lit.



4 Registering and Changing Radiography Programs

■ Setting kV, mA or mAs, sec

Two types of setting method are available for the radiography conditions: mA sec and mAs.

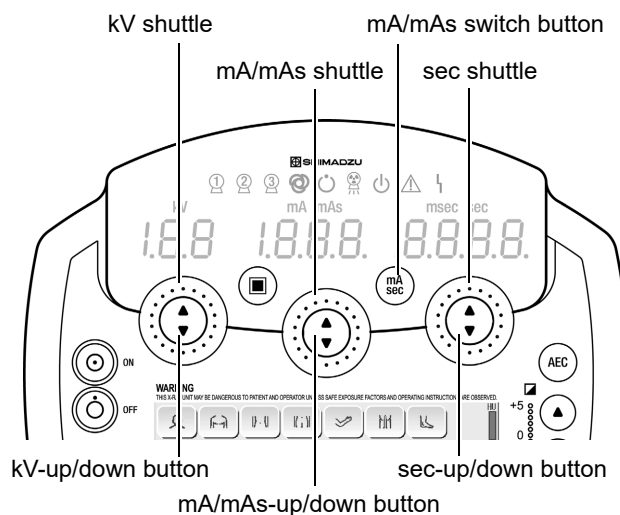
- 1 Press the  (mA/mAs switch) button to switch the setting method.

mA sec method
With this method, kV, mA, and sec are set.


mAs method
With this method, kV and mAs are set. The maximum tube current and minimum radiography time in the X-ray rated current range are calculated from the mAs value. The radiography time can also be manually corrected. If manual correction is made to the radiography time, the mA value is automatically corrected to match the set mAs value.

The  (mA/mAs switch) button lights when mA sec is selected.

- 2 Set the kV, mA or mAs, sec values.



Shuttle	right	Increases the value.
	left	Decreases the value.
Button	▲	Increases the value.
	▼	Decreases the value.

 **Reference** Read [11.1 "UD150B-40/D150BC-40/D150BC-45 Specifications"](#), [11.2 "D150BC-41 Specifications"](#), [11.3 "UD150L-40/D150LC-40/D150LC-45 Specifications"](#), [11.4 "D150LC-41 Specifications"](#), [11.5 "UD150V-40/D150VC-40/D150VC-45 Specifications"](#) and [11.6 "D150VC-41 Specifications"](#) for details about the set values.

■ **Setting Up AEC (optional)**

This procedure sets the environment for AEC radiography.

NOTE

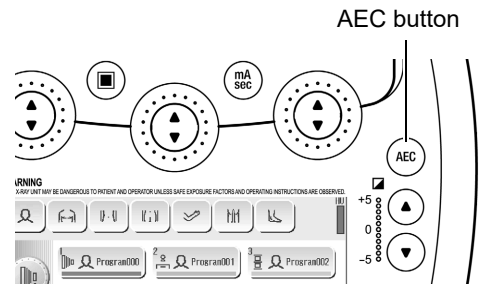
When combining the phototimer receiver inside the FPD, use the digital radiography system to set up the environment for AEC radiography.

● **AEC ON/OFF**

The AEC function must be turned on to make the AEC settings.

Press the .

The AEC button lights when the AEC function is on. To turn the AEC function off, press the AEC button so that the button is no longer illuminated.

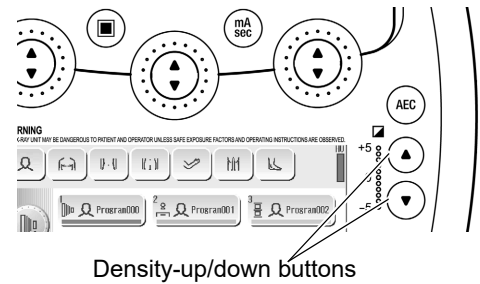


● **Set the density**

Press the (Density-up) or (Density-down) button to set the density.

- The 0 position is the standard density.
- Increasing the density by "+1" produces darker images by 15 %;
- Increasing the density by "-1" produces lighter images by 15 %.

Reference [7.1.1 "Photo Pickup Field"](#)



● **Set the photo pickup field**

- 1 Press the Photo Pickup Field key.

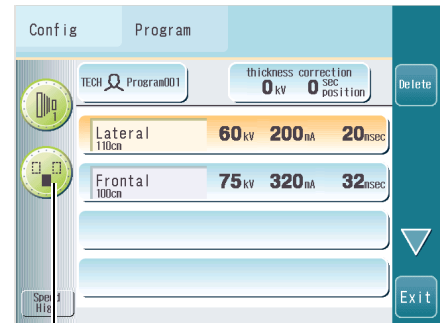
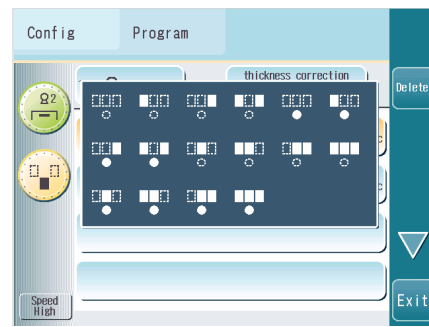


Photo Pickup Field key

2 Press the Photo Pickup Field key to set.

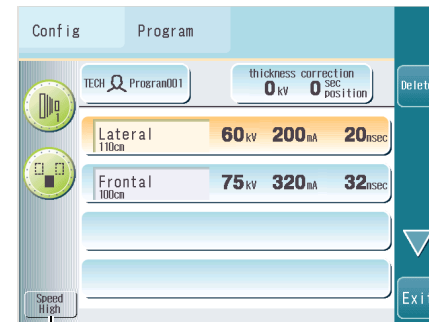


● Set the speed

Press the Speed key and select the AEC radiography speed (film sensitivity).

The speed setting changes each time the Speed key is pressed.

Reference [7.1.2 "Speed"](#)



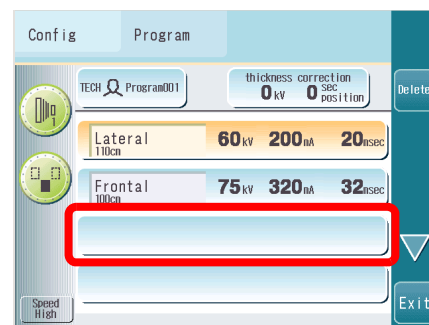
Speed key

■ Setting the Next Radiography Step

Press the next step.

The settings in the previous step are duplicated.

Proceed the operation in 4.3.2 Editing Radiography Steps again.



Reference When using the ceiling tube support CH-200 unit's auto positioning option, refer to [10.3 "Ceiling Tube Support CH-200 Auto Positioning"](#).

Reference When using the auto filtering function of X-ray collimator R-300, refer to [10.4 "Auto Filtering Function of X-Ray Collimator R-300"](#).

4.3.3 Ending Radiography Program Registration

Ending Radiography Program Registration

- 1 Press the **Exit** key
The following confirmation screen will appear.
- 2 When saving the settings and exiting:
Press the **Save** key.
When erasing the settings and exiting:
Press the **No Save** key.

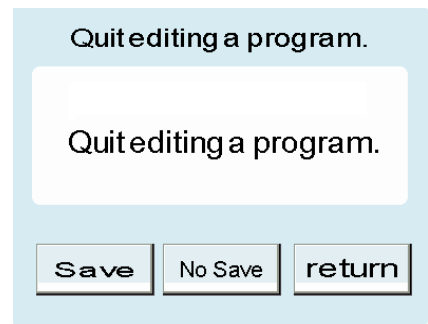


The radiography program will be registered, and the display will change to the radiography program registration screen.

If you do not wish to complete the radiography program's registration press the **return** key.

If the number of overall radiography steps exceeds registerable value, the data cannot be saved. When this occurs, the following memory error message will appear.

Reference For number of registerable radiography steps, [4.1 "Registered Contents of Radiography Programs"](#)

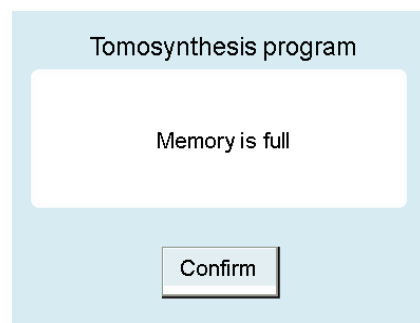
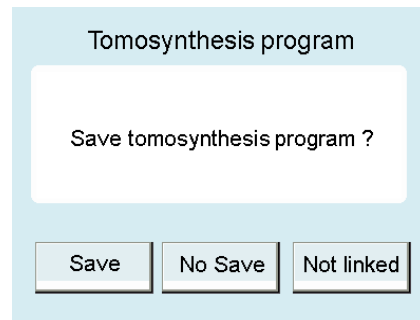


Concerning tomosynthesis program data registration

When the first radiography step will use a tomography technique to transfer slice angle and slice speed data to a tomography unit, the following tomosynthesis condition confirmation screen will appear, prior to the radiography program registration confirmation screen.

- To save the current tomosynthesis conditions, press the key.
- To not save the current tomosynthesis program conditions, press the key.
- If no link will be created to the tomosynthesis program key, press the key.

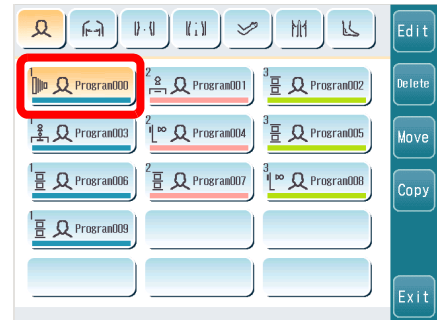
- The tomosynthesis data can be saved to the radiography program key. (Max. 16 items)
When the 17th item is registered, the following memory error message will appear.



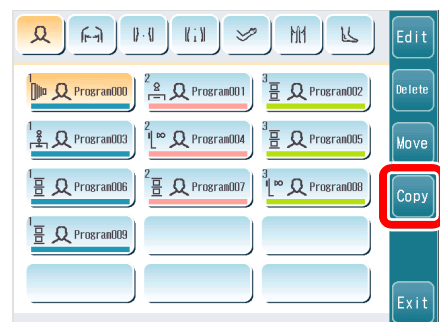
4.4 Copying a Radiography Program

This procedure copies a radiography program, including the radiography steps.

- 1 Press the program key on the radiography program registration screen for the radiography program to be copied.



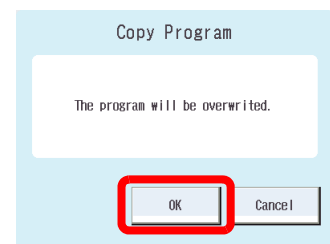
- 2 Press the key.
Press the key to cancel the operation without copying the radiography program.



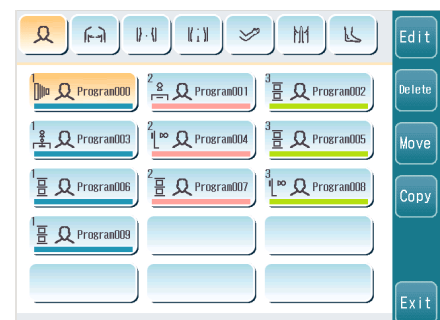
- 3 Press the program key to which the radiography program will be copied.
Press a Tab key to copy the program to a different tab. Press the key to confirm the copy destination.
Press the key to cancel the operation without copying the radiography program.



- 4 A prompt is displayed if a radiography program already exists at the copy destination. Press key to copy the radiography program.
Press the key to cancel the operation without copying the radiography program.



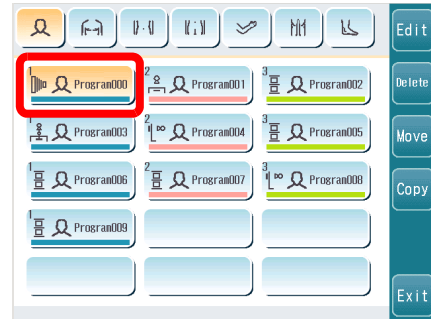
The radiography program is copied.



4.5 Moving a Radiography Program

This procedure moves a radiography program, including the radiography steps, to another program key.

1 Press the program key on the radiography program registration screen for the radiography program to be moved.



2 Press the key.

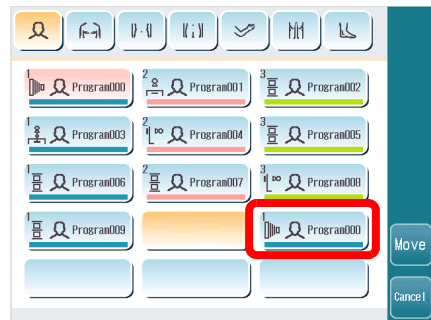
Press the key to cancel the operation without moving the radiography program.



3 Press the program key to which the radiography program will be moved.

Press a Tab key to move the program to a different tab. Press the key to confirm the move destination.

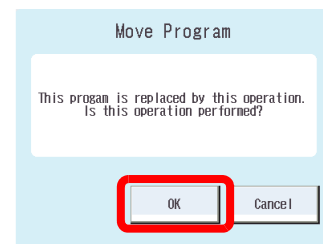
Press the key to cancel the operation without moving the radiography program.



4 A message prompts whether to replace the program if a radiography program already exists at the move destination. Press key to move the radiography program.

Press the key to cancel the operation without moving the radiography program.

The radiography program is moved.



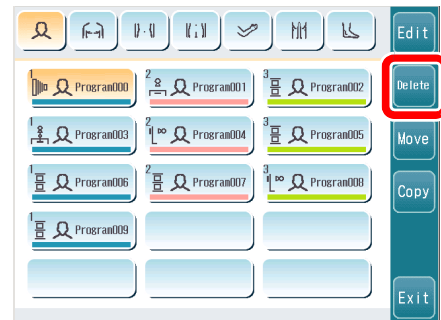
4.6 Deleting a Radiography Program

This procedure deletes a radiography program.

- 1 Press the program key on the radiography program registration screen for the radiography program to be deleted.



- 2 Press the key.
A prompt is displayed.



- 3 Press key to delete the radiography program.
Press key to cancel the delete operation.



The radiography program is deleted.

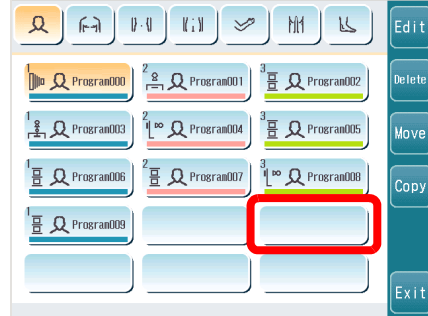



4


4.7 Registering Final Radiography Conditions in a Program

This procedure registers the final radiography conditions in a program, after the radiography program conditions were changed.

1 Press the program key on the radiography program registration screen corresponding to the program to be registered.

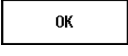


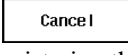
2 Press the  key.

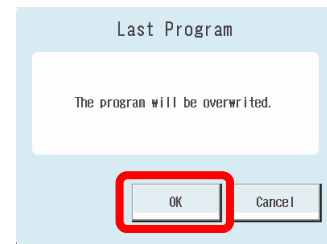
Press the  key to cancel the operation without registering the radiography program.



3 A prompt is displayed if a radiography program already exists at the registration destination.


Press  key to register the radiography program.

Press the  key to cancel the operation without registering the radiography program.



The radiography program is registered.



 **NOTE**

 is unavailable after the radiography program has been edited.

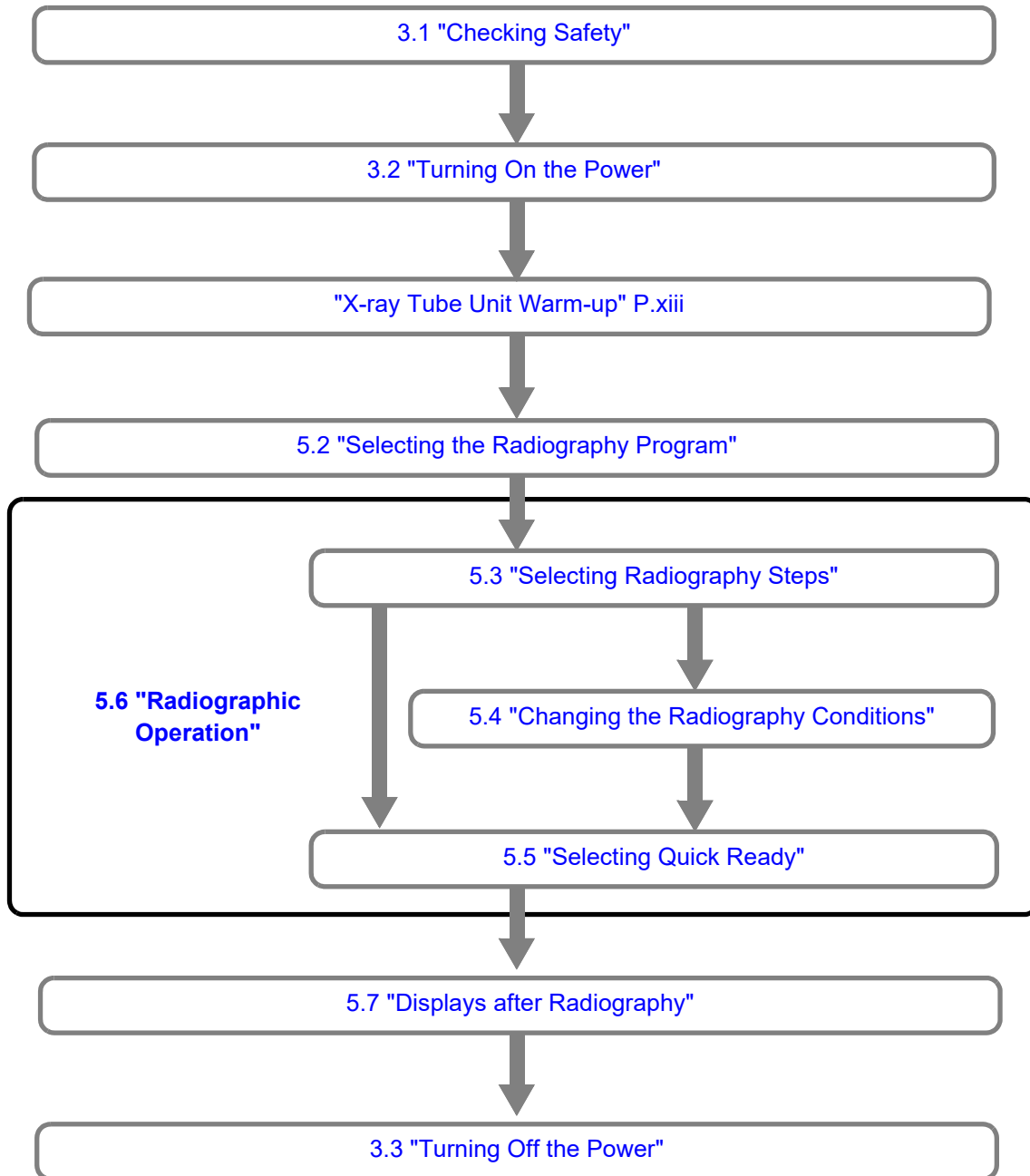
5

Radiographic Operation

This chapter describes how to conduct radiography and how to change the radiography condition settings.

5.1 Radiography Procedure

Use the following steps to perform radiography.

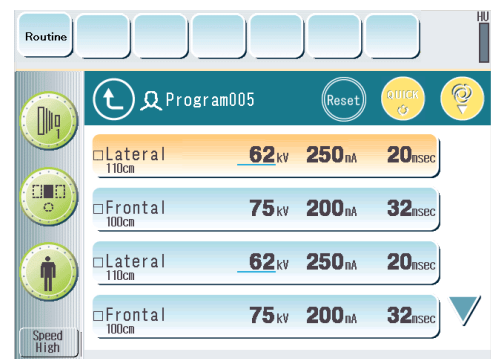
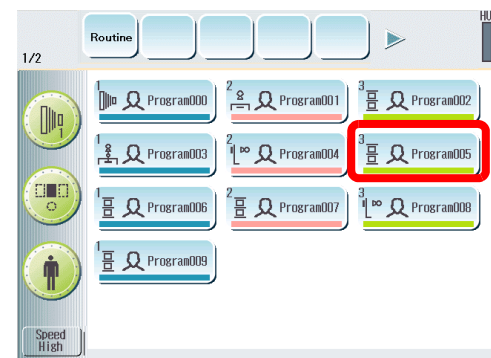


5.2 Selecting the Radiography Program

- 1 Press a Tab key.
(Not required if "NoTabs" setting is used.)




- 2 Press the program key for the radiography program.
The radiography steps are displayed.



5.3 Selecting Radiography Steps

Radiography steps can be selected by two methods.

5.3.1 Automatic Feed Sequentially from the Top Radiography Step

Ensure that the  (Auto-step) key is on.

If not, press the  (Auto-step) key to turn it on.

The next step is selected each time radiography is conducted.

5.3.2 Selection with the Radiography Step key

A Radiography Step key turns yellow when it is pressed.

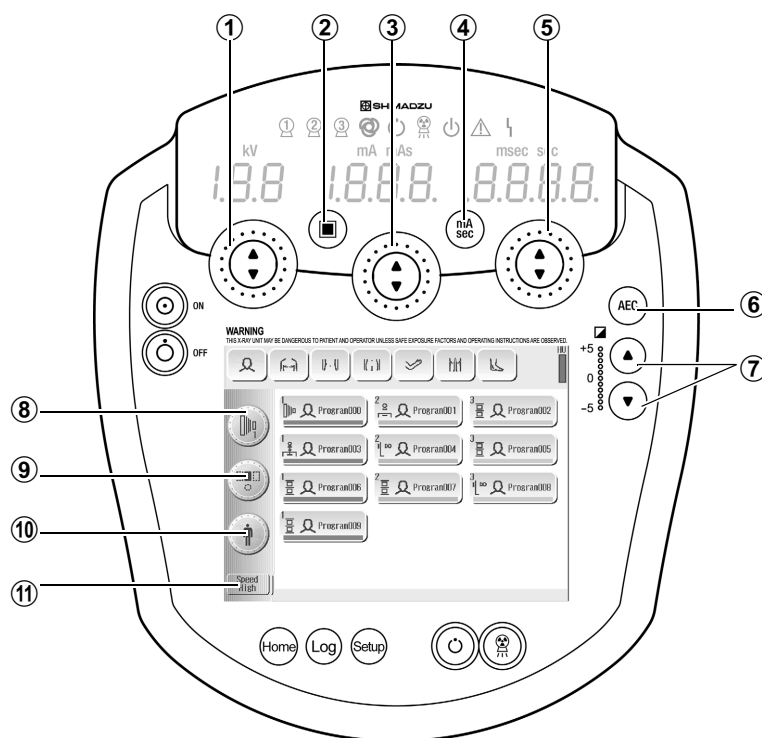
Press the ▼ or ▲ key to display radiography steps that are not visible.



5.4 Changing the Radiography Conditions


Press buttons or keys on the touch panel to change the radiography conditions.


- **Technique**..... ⑧
- **Focus**..... ②
- **kV**..... ①
- **Switch mA/mAs** ④
- **mA/mAs**..... ③
- **sec** ⑤
- **AEC (optional)**
 - AEC ON/OFF ⑥
 - Density ⑦
 - Photo pickup field..... ⑨
 - Speed ⑪




Reverts changed radiography conditions to their original settings.


Changed radiography conditions are displayed underlined.

 NOTE

X-ray conditions (①②③④⑤) cannot be changed when an Anatomical Program key that memory shot radiography is registered is selected. (when lights.)


 NOTE

When performing radiography using a tomography unit that can receive slice angle and slice speed data, the radiography time is automatically set and cannot be changed. Also, the radiography condition setting is fixed at mAs, and cannot be changed to mA sec.

 NOTE

The radiography condition is limited to 50 kW for serial radiography in the digital radiography.

Also, do not perform serial radiography under the radiography condition exceeding the high-speed serial load rating that is described in the X-ray tube operation manual.

 NOTE

When combining the phototimer receiver inside the FPD, use the digital radiography system to change the AEC settings. The touch panel only displays the AEC ON/OFF state.



• **Body Thickness Correction Key** ⑩

The radiography conditions can be corrected for the patient's body thickness.

- 1** Press the Body Thickness Correction key.

The body thickness correction window is displayed.



- 2** Select the body thickness correction conditions.

The Body Thickness Correction key displays the selected conditions.


 **Reference** [4.3 "Editing Radiography Programs"](#)

5.5 Selecting Quick Ready


If the Quick ready key is ON, the radiography preparations are completed in approximately half the normal time (or a quarter of the time when using an X-ray tube that can maintain high-speed rotation).

 The X-ray tube units that can maintain high-speed rotation are as follows.

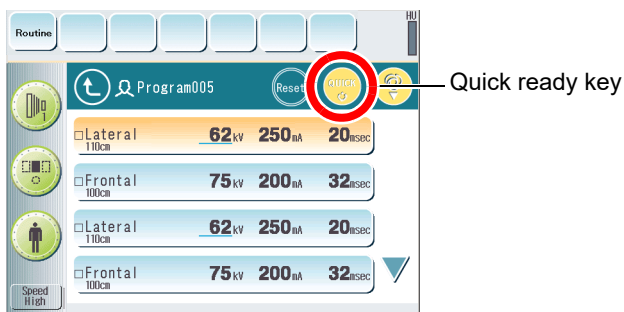
- 0.6/1.2P326D-150
- 0.6/1.2P366D-150

 **NOTE**

Selection of whether the Quick ready key is used/unused is as per the installation settings.

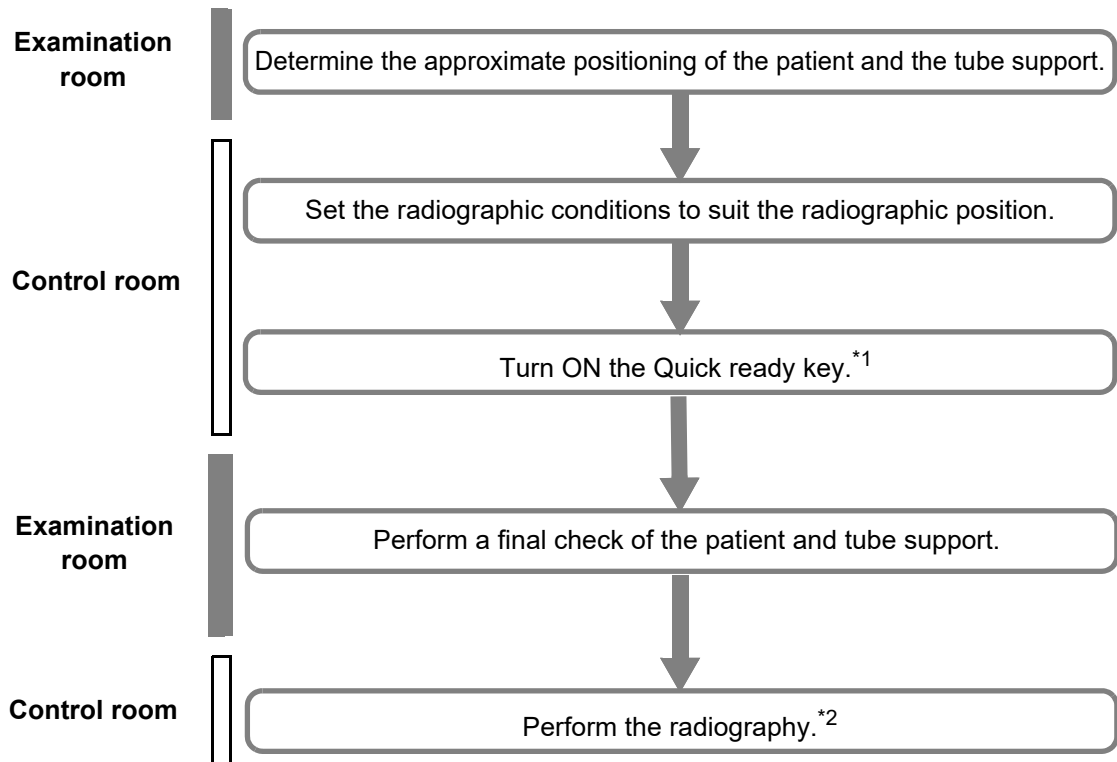
 **NOTE**

The X-ray tube may be damaged if the Quick ready function is used more than necessary.



5.5.1 Using Quick Ready

The following is an example of a radiographic procedure using the Quick ready key.



*1: When an X-ray tube unit that can maintain high-speed rotation is used, and the X-ray tube support CH-200 and the X-ray collimator R-300 are combined, the Quick ready key can be turned ON, interlocking with the lighting of the lamp on the R-300. If the lamp is turned ON when the Quick ready key is already ON, the duration of the Quick ready status will be extended.

 **Reference** [7.2.2 "Setting Quick ready"](#)

*2: When an X-ray tube unit that can maintain high-speed rotation is used, the Quick ready key will be turned ON. If a radiographic operation is made when the Quick ready key is already ON, the duration of the Quick ready status will be extended.

5.5.2 Canceling Quick Ready

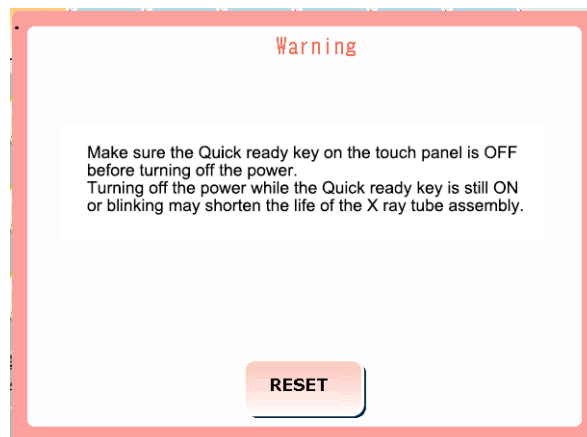
- The Quick ready function is automatically cancelled when the preset interval has elapsed. To cancel the function manually, press the Quick ready key to turn it OFF.
- If the X-ray tube is changed after Quick ready is turned ON, the function will turn OFF.

 **Reference** [7.2.2 "Setting Quick ready"](#)

- When an X-ray tube unit that can maintain high-speed rotation is used, the Quick ready function will turn OFF after the Quick ready key blinks about four seconds.



When using an X-ray tube unit that can maintain high-speed rotation, be sure to confirm that the Quick ready key is OFF before turning OFF the power. If the power is turned OFF while the Quick ready key is ON or blinking, the following pop-up window will be displayed at the next power-on.



5.6 Radiographic Operation


Radiographic operation can be conducted by three methods:

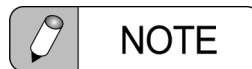
- with the hand switch
- with the operation panel button
- with the foot switch (option)




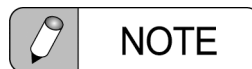
See 8.1.1 "Messages Related to the X-ray High Voltage Generator" if the  (fault indicator) is lit.



Do NOT perform unnecessary standby operations.
Failure to conduct radiographic operation in the Ready-up status ( lit) may result in wire disconnection or withstand voltage failure due to X-ray tube filament evaporation.








If radiographic operation does not occur when the [X-ray switch]  key is held down for five seconds, release the button and check if a message is displayed.




It is important to run-in (age) the X-ray tube before performing actual X-ray irradiation. Follow the warm-up procedure described in the section X-ray Tube Warm-up. Insufficient warm-up can result in arcing in the X-ray tube during X-ray irradiation.

 **Reference** "X-ray Tube Unit Warm-up" P.xiii

 NOTE



When using a technique for direct spot filming , I.I. indirect spot filming  or , DR, press the [X-ray switch]  on the R/F table console.

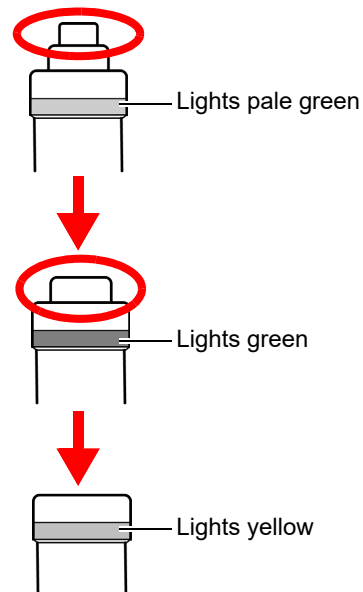
 Reference 6.6 "Spot Filming"

 NOTE

Make sure that the set exposure conditions are appropriate before performing radiography.
Performing radiography under inappropriate conditions may result in unnecessary exposure to the patient.


5.6.1 Radiography Using the Hand Switch

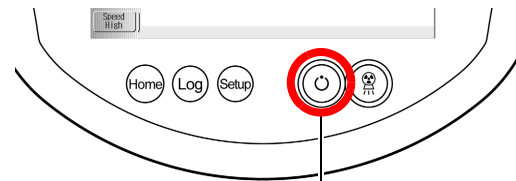
- 1 Press the hand switch to the first stage.
- 2 Confirm that the hand switch lights.
When radiography preparation is complete, the hand switch lights green and the  (radiography ready indicator) lights on the operation panel.
- 3 Press the hand switch to the second stage.
Radiography is conducted.
During radiography, the hand switch lights yellow and the  (radiography indicator) on the operation panel lights.
Hold down the hand switch until radiography is complete.







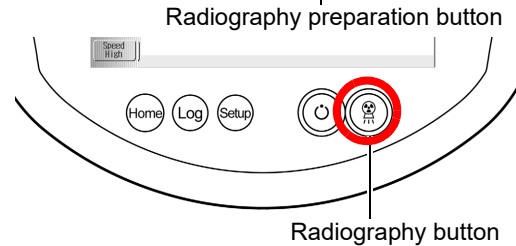
5.6.2 Radiography Using the Buttons on the Operation Panel



Radiography is also possible by pressing the buttons on the operation panel.


- 1 Hold down the  (Radiography preparation) button.



- 2 When the  button and  (Radiography ready indicator) lights green, press the  (Radiography) button on the operation panel while holding down the  button.



The  button and the  (radiography indicator) on the operation panel light yellow during radiography.

- 3 Hold down the  button until radiography is complete.

NOTE

If sounds and illumination are set as described in ["7.3 Setting Up the Equipment Environment"](#), the radiography ready status and radiography operation are notified by sounds and illumination.

NOTE

During AEC radiography, AEC normally completes radiography before the radiography time set by the sec value elapses.
If AEC does not operate, AEC back-up functions and radiography ends when the sec value elapses. If AEC backup is set in the sound and illumination settings described in ["7.3 Setting Up the Equipment Environment"](#), sound and illumination are used to indicate AEC back-up has been performed. In this case, a message is displayed and further radiography is not possible. To conduct radiography, first press to clear the message.

5.6.3 Radiography Using the Foot Switch (option)




Do NOT perform unnecessary standby operations.
If Ready-up status continues for a long time, wire disconnection or withstand voltage failure may result due to X-ray tube filament evaporation.


There are two types of foot switches (option). One is normal type and another is two-step type.

- Normal type:
Press down on the foot switch to two levels of step to perform radiography.
Pressing to the first step starts radiography preparation and pressing to the second step starts radiography, so that the normal type foot switch allows timing radiography.
- Two-step type:
Press down on the foot switch twice to perform radiography.
The first pressing starts radiography preparation and the second pressing starts radiography, so that the two-step type foot switch allows timing radiography.

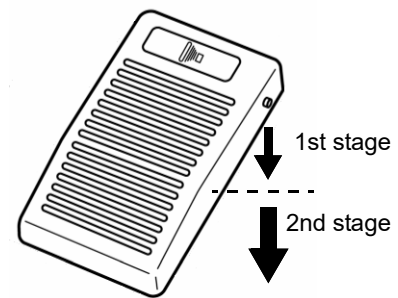
● Normal Type

- 1 Press down lightly on the foot switch to the first stage (radiography preparation).
- 2 Confirm that the  (Radiography ready indicator) on the operation panel lights green.
- 3 Press down on the foot switch to the second stage (radiography) .


Radiography starts.

During radiography, the  (radiography indicator) on the operation panel lights orange.

Hold down the foot switch until radiography is complete.




● Two-Step Type

- 1 Press down on the foot switch.
- 2 Confirm that the  (Radiography ready indicator) on the operation panel lights green.

When radiography preparation is completed, CH-200 issues a tune to notify Ready Up status.


- 3 Release the foot switch and press down on it again.

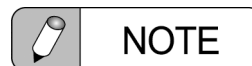
Radiography starts.

During radiography, the  (Radiography indicator) on the operation panel lights orange.

Hold down the foot switch until radiography is complete.

When radiography is completed, CH-200 issues a tune to notify completion of radiography.

-  When the equipment is combined with the CH-200, the CH-200 issues different tunes to notify Ready-up status and completion of radiography.

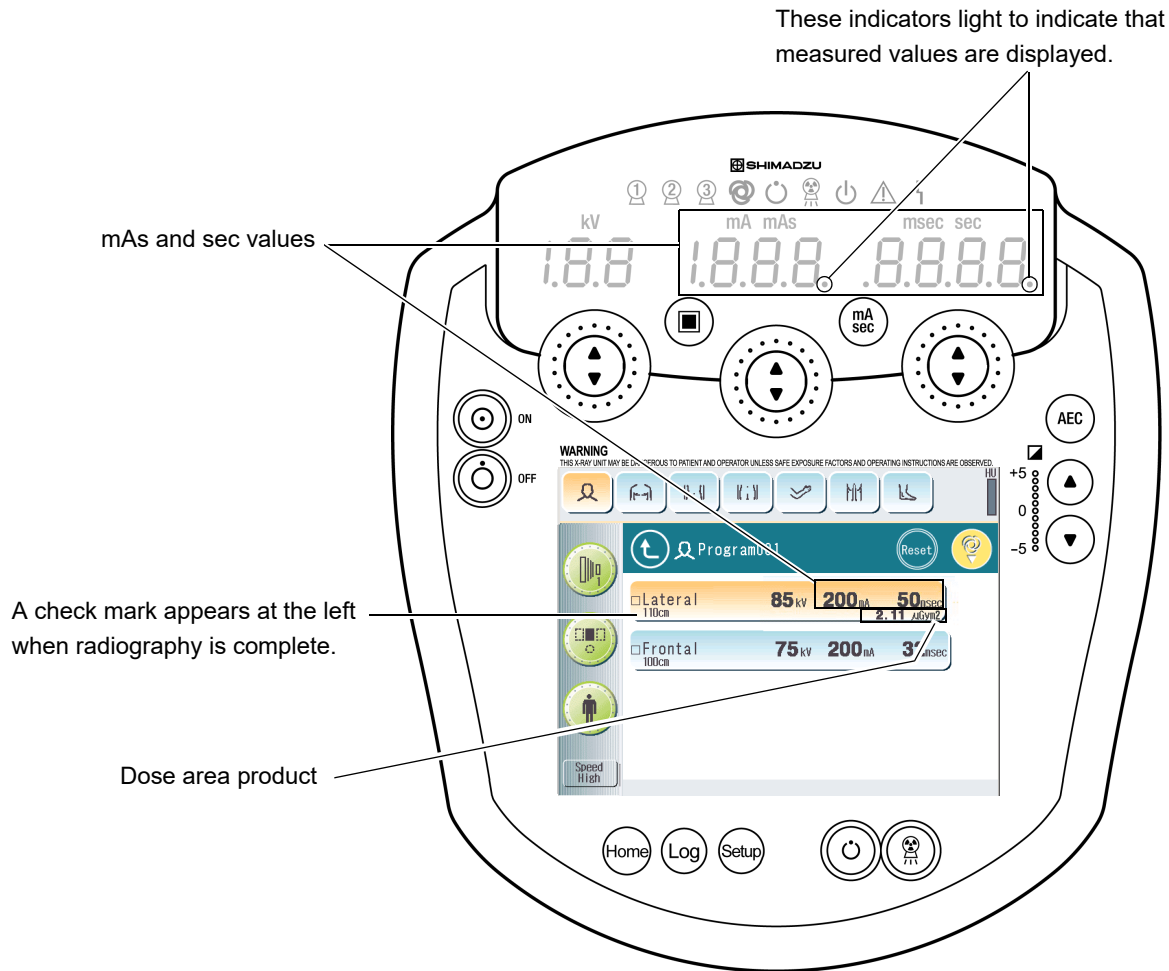


NOTE

Radiography may not start if the duration to keep the foot switch released, before pressing down on it again, is too short.

5.7 Displays after Radiography

After radiography, the operation panel and screen appear as shown below. The measured mAs and sec values are displayed after AEC radiography is complete.



Reference [10.5 "Displaying Dose Area Product"](#)

5.8 Displaying Radiography Log

The radiography conditions during radiography are recorded in the unit's radiography log.

- 1 Press the **Log** button on the operation panel.

The radiography history is displayed.



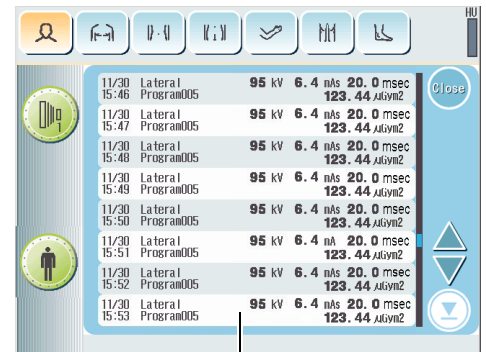
The radiography records are displayed sequentially from the top, with the latest radiography record at the bottom.

The radiography log can hold up to 512 records.

Press the **▲** and **▼** keys to scroll through the pages.

Press the **▼** key to return to the latest radiography record.

Press the **Close** key to exit the radiography log display.



Latest radiography record

5

NOTE

The dose calculation unit (option) displays the X-ray dose of patient skin surface instead of the area dose product.

5.9 Radiography using Conditions Selected from the Radiography Log

Radiography can be conducted using conditions displayed in the radiography log. The radiography conditions from the history can be changed before conducting radiography.

- 1 Press the **Log** button on the operation panel.



- 2 Select the required radiography record.
- 3 Make any required changes to the radiography conditions.

Reference [5.4 "Changing the Radiography Conditions"](#)



- 4 Perform radiography.

Reference [5.6 "Radiographic Operation"](#)

NOTE

If the radiography conditions are changed, the radiography time value is set to the settable value closest to the measured value.

NOTE

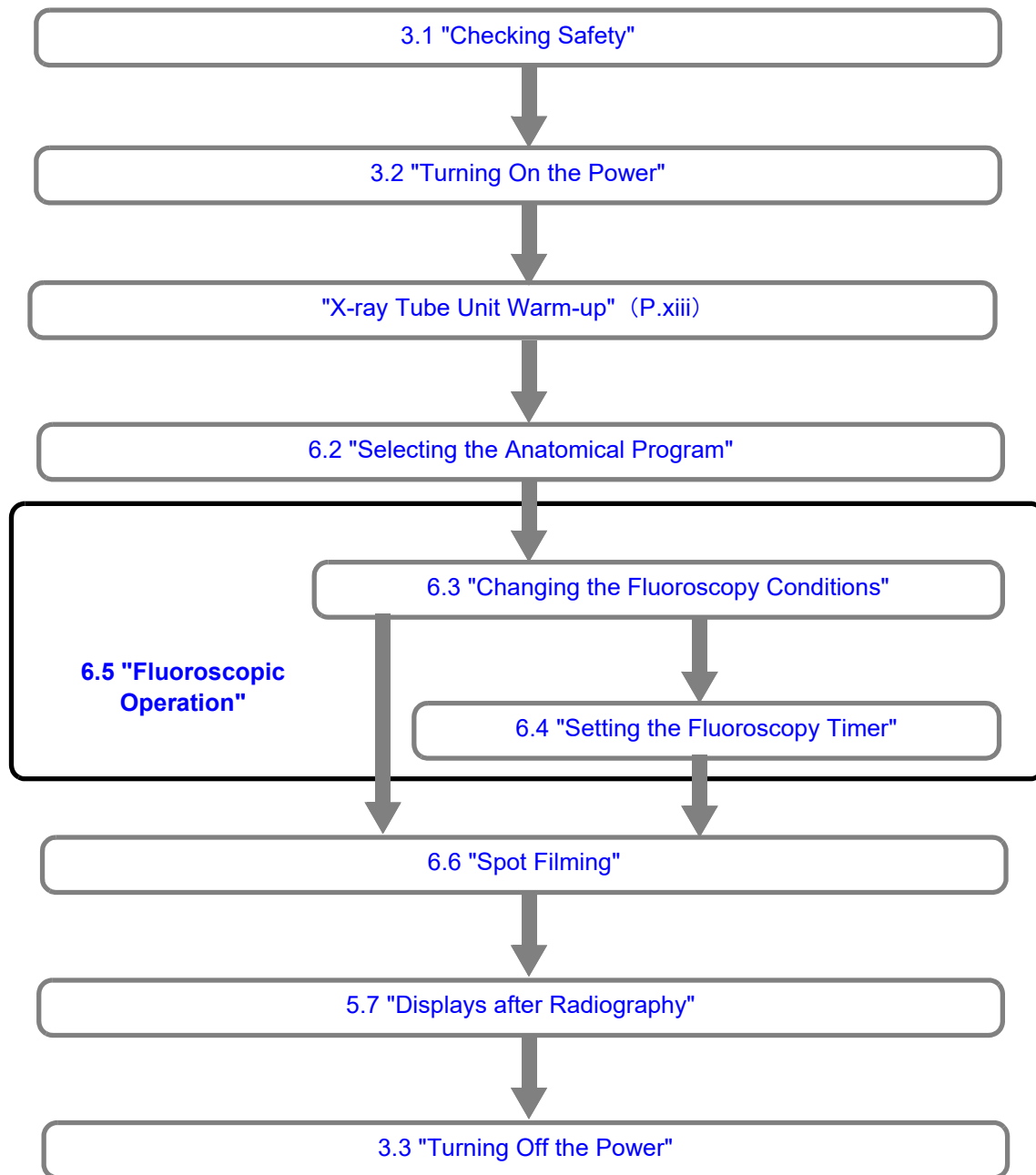
If radiography is performed with the radiography log screen displayed, even though Auto-step is turned ON, the radiography step does not move.

6

Fluoroscopic Operation (OPTION)

This chapter describes how to conduct fluoroscopy and spot filming.

6.1 Fluoroscopic Operation Procedure




6.2 Selecting the Anatomical Program

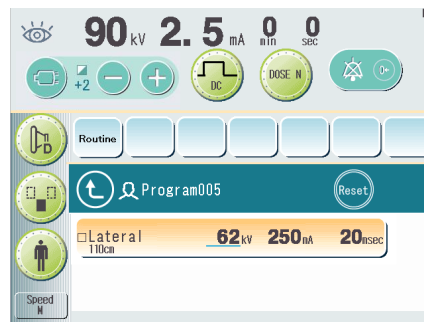
This section describes how to select a fluoroscopy program.

- 1 Press the [Anatomical Program] key to which a fluoroscopy-capable technique is registered.

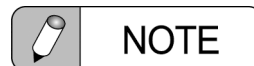
Sub-display shows fluoroscopy conditions.

Type	Technique
Techniques where fluoroscopy is possible.	

 **Reference** [5.2 "Selecting the Radiography Program"](#)



6



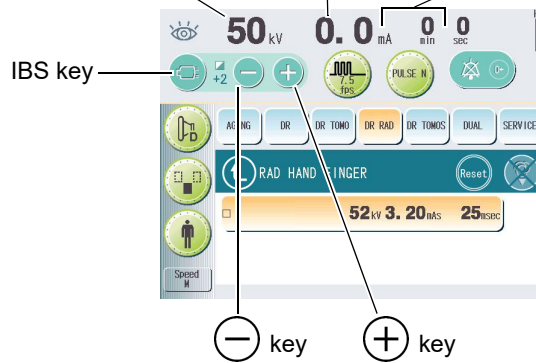
NOTE


For (optional) DR, refer to the DR unit's operation manual.


6.3 Changing the Fluoroscopy Conditions

Fluoroscopy conditions are shown in the touch panel display. Two methods are available: automatic setting of fluoroscopy conditions, and manual setting of only fluoroscopy tube voltage.


Fluoroscopy tube voltage Fluoroscopy tube current Fluoroscopy accumulated time



 **NOTE**

To conduct automatic voltage regulation for the fluoroscopy tube, press the [IBS]  key to turn on the indicator.


When IBS (Image Brightness Stabilizer) is turned ON, the tube voltage is adjusted automatically during fluoroscopy.

 **NOTE**


Depending on the installation setting (option), the fluoroscopy accumulated time is displayed by minute (0.0 min) instead of by second (0 sec).



■ **Setting fluoroscopy conditions automatically**

The fluoroscopy tube voltage can be changed manually.

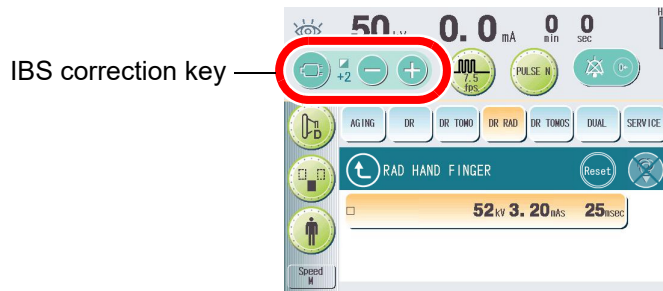
- 1 Press the [IBS]  key to make the key light up.

The setting range for the fluoroscopy tube voltage is 50-115 kV. (50-110 kV or 50-125 kV for some tubes.)

 **NOTE**




When the light of the [IBS]  key is off, manually set appropriate conditions or press the [IBS]  key so it lights up. Appropriate fluoroscopic images cannot be obtained without setting fluoroscopy conditions.

When IBS is ON, press the FkV setup keys to correct the image lighter or darker. Correction can be changed for 5 levels, from -2 (dark) to +2 (light). The correction value is displayed next to the IBS correction key. (Depending on installation settings)






■ **Setting the fluoroscopy tube voltage manually**

The fluoroscopy tube voltage can be changed manually.

- 1 If the [IBS]  key indicator is lit, press the [IBS] key to turn it off.
- 2 Press  or  to adjust the fluoroscopy tube voltage.

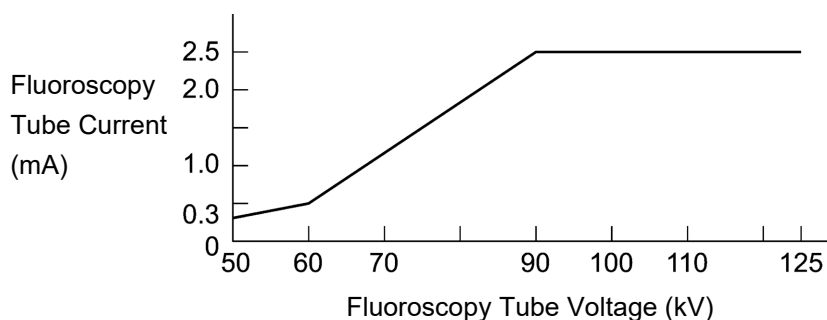
The setting range for the fluoroscopy tube voltage is normally 50-115 kV. (50-110 kV or 50-125 kV for some tubes.)

 **NOTE**

When the light of the [IBS]  key is off, manually set appropriate conditions or press the [IBS]  key so it lights up. Appropriate fluoroscopic images cannot be obtained without setting fluoroscopy conditions.

■ Fluoroscopy Tube Current

The fluoroscopy tube current is adjusted automatically according to the fluoroscopy tube voltage. The standard (DOSE N) fluoroscopy tube current values are shown below. Usually, small focus is automatically selected for fluoroscopy.



The above description is an example, and when installing it, it is possible to set it.

■ Selecting preset fluoroscopy conditions (fluoroscopy mode)

Several preset fluoroscopy conditions (fluoroscopy mode) can be stored in the unit during installation adjustment. They are useful for the following cases.

- To switch the relationship between fluoroscopy tube voltage and tube current for inspections of the abdomen and for orthopedic purposes
- To lower X-ray dosage to examine children

The following fluoroscopy conditions can be stored during installation adjustment.

- 1) Fluoroscopy tube current that is linked to the fluoroscopy tube voltage
- 2) Setting of the upper limit of the fluoroscopy tube voltage
- 3) Selection between pulsed fluoroscopy and continuous fluoroscopy
- 4) Limitation of the maximum rate during pulsed fluoroscopy

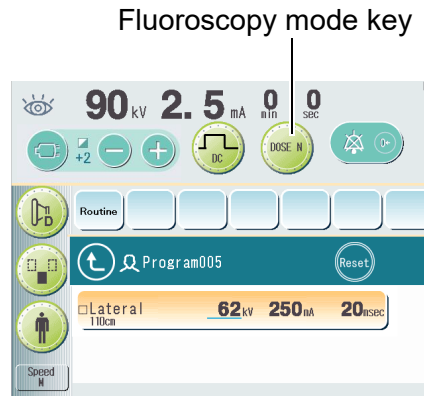


NOTE

A digital equipment with a memory function is necessary to perform pulsed fluoroscopy.

1 Press the [Fluoroscopy mode] **DOSE N** key.

Preset fluoroscopy conditions (fluoroscopy mode) displayed on the sub-display change in series.



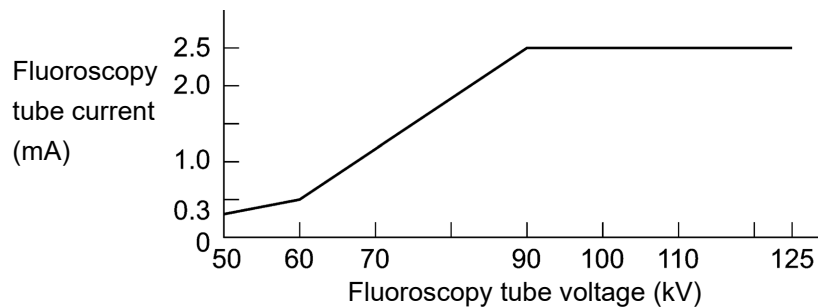
Preset fluoroscopy conditions (fluoroscopy mode) and preset conditions are shown below. "PULSE N" is optional.

Condition name	Condition	Remarks
DOSE N	Standard fluoroscopy (continuous fluoroscopy)	—
DOSE L	Fluoroscopy at low X-ray dosage (continuous fluoroscopy)	—
PULSE N	Pulsed fluoroscopy	Optional



■ Fluoroscopy tube voltage and tube current for DOSE L

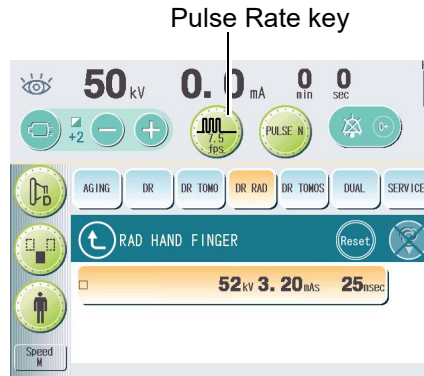
The relationship between the fluoroscopy tube voltage and tube current for DOSE L can be specified during installation of the unit. Usually, it is adjusted as shown below. (Usually, small focus is automatically selected.)



The above description is an example, and when installing it, it is possible to set it.

Changing the Pulse Rate (Optional)

If the selected fluoroscopy mode incorporates pulsed fluoroscopy, the pulse rate can be changed by pressing the [Pulse Rate] key.



NOTE

Pulsed fluoroscopy can be selected if the DR unit incorporates a pulsed fluoroscopy function.

- 1 Press the [Pulse Rate]  key and select the pulse rate.

The selected number appears on the sub-display.

The pulse rate value cycles regularly in the following sequence each time the [Pulse Rate] key is pressed:

30 fps → 15 fps → 7.5 fps → 3.75 fps → 30 fps,

- The fluoroscopy tube current during pulsed fluoroscopy is displayed as an average value over one second. The fluoroscopy tube current value changes according to the pulse rate, as above:

30 fps	---	2.4 mA	15 fps	---	1.2 mA
7.5 fps	---	0.6 mA	3.75 fps	---	0.3 mA

The above description is an example, and when installing it, it is possible to set it.

6.4 Setting the Fluoroscopy Timer

The accumulated time is calculated from the start of fluoroscopic operation and displayed on the sub-display. The fluoroscopy accumulated time ranges from 0 to 99 minutes 59 seconds. A duration of audible warning can be set to sound the buzzer when the set time is reached.

■ Setting the Duration of Audible Warning

- 1 Press the [Anatomical Program] key that fluoroscopy is registered.

 Reference 6.2 "Selecting the Anatomical Program"

- 2 Press the [Fluoroscopy Timer] key pushes for three seconds.


The duration of audible warning appears on the sub-display.

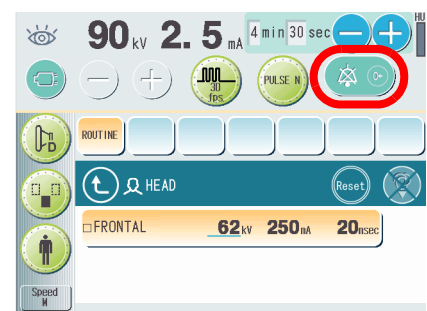
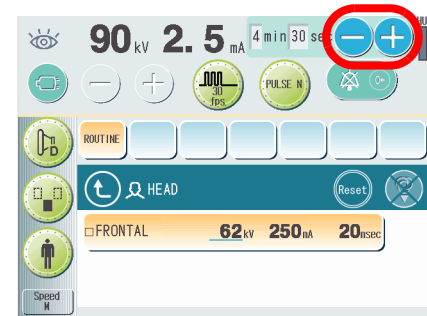
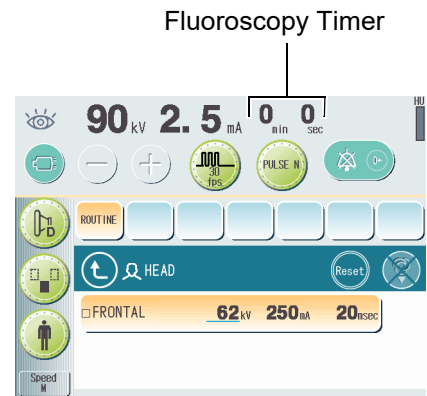
- 3 Press the  key and set the duration of audible warning.

- The following duration of audible warning can be set:

5 m → 4 m 30 s → 4 m → 3 m 30 s → 3 m →
2 m 30 s → 2 m → 1 m 30 s → 1 m → 30 s →
0 s.

- If the duration of audible warning is set to 0 s, the buzzer sounds continuously during fluoroscopy.

- 4 Press the [Fluoroscopy Timer]  key.




6

NOTE



Depending on the installation setting (option), the operations of this section is prohibited.


■ Stopping the buzzer (audible warning)

- 1 The buzzer sounds and the [Fluoroscopy Timer]  key blinks when the set time elapses after the start of fluoroscopic operation.





NOTE

- Sound quality and volume of the buzzer can be specified.
 Reference [7.3.4 "Sound"](#)
- Illumination color and its lighting change when the optional illumination is installed.
 Reference [7.3.5 "Illumination"](#)


- 2 Press the [Fluoroscopy Timer]  key.
The buzzer stops and the light on the key goes off.




NOTE

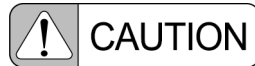
- After the audible warning is stopped, fluoroscopic operation can continue for a continuous fluoroscopy time of ten minutes.
 Reference [6.5 "Fluoroscopic Operation"](#)
- If the duration of audible warning is set to 0 s, the buzzer does not stop even when the [Fluoroscopy Timer]  key is pressed.
- The setting of the duration of audible warning is not reset even after stopping the buzzer.
- Depending on the installation setting (option), the buzzer stop automatically after sounding for two seconds.



■ Resetting the Fluoroscopy Accumulated Time

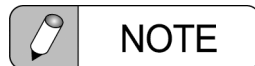
- 1 Hold down the [Fluoroscopy Timer]  key for at least three seconds when fluoroscopy is not performed.
Fluoroscopy accumulated time is reset.

6.5 Fluoroscopic Operation

- 1 Press the [Fluoroscopy]  key on the R/F table console.
The key lights.
- 2 Push the fluoroscopy foot switch (labeled [Fluoroscopy]) to start fluoroscopic operation.



Ordinarily, the [Fluoroscopy]  key lights off.
Pressing the [Fluoroscopy]  key only for fluoroscopy, confirm the key lights and then start fluoroscopic operation because the operator and other persons may receive a greater dose of radiation than is necessary.



Continuous Fluoroscopy Time

Fluoroscopic operation can be conducted continuously for a period of ten minutes. Fluoroscopic operation is interrupted after ten minutes. To restart fluoroscopic operation, release the foot switch and press it again.


6.6 Spot Filming


Spot filming (direct spot filming or I.I. indirect spot filming) can be conducted by two methods:

- Memory shot radiography
- Radiography using manual settings




Emergency Measures

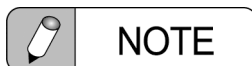
See 8.1.1 "Messages Related to the X-ray High Voltage Generator" if the  (fault indicator) appears on the display.

 Depending on the installation settings, AEC radiography density can only be changed automatically when the pressure tube is operating. (when using Socialvision system to perform spot filming)

6.6.1 Memory Shot Radiography

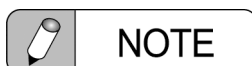
Memory shot radiography conducts spot filming using a function to automatically set the technique factors from the fluoroscopy conditions.

- 1 Press the [Anatomical Program] key registered Memory Shot radiography.
The key lights.
- 2 If the IBS indicator is OFF, press the [IBS]  key to turn it ON.



The appropriate technique factors may not be set if fluoroscopic operation is conducted without turning IBS ON.

- 3 Conduct fluoroscopic operation.

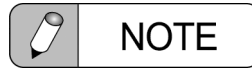



The appropriate technique factors may not be set if fluoroscopic operation is not conducted.

- 4 Press the [X-ray switch] on the R/F table console.

The actual mAs and sec values are displayed after AEC radiography (optional) is complete.

 Reference 5.7 "Displays after Radiography"



Spot filming cannot be conducted using the hand switch or the [X-ray switch]  key on the operation panel.

6.6.2 Radiography using Manual Settings

This procedure conducts spot filming with manual setting of the technique factors, without using the memory shot function.

- 1 Select the [Anatomical Program] key for which the manual settings are to be made.

- 2 Change the technique factors.

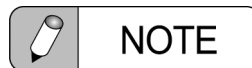
 Reference 5 "Radiographic Operation"


- 3 Conduct fluoroscopic operation.

- 4 Press the [X-ray switch] on the R/F table console.

The actual mAs and sec values are displayed after AEC radiography (optional) is complete.

 Reference 5.7 "Displays after Radiography"



Spot filming cannot be conducted using the hand switch or the [X-ray switch]  key on the operation panel.



AEC Backup Feature

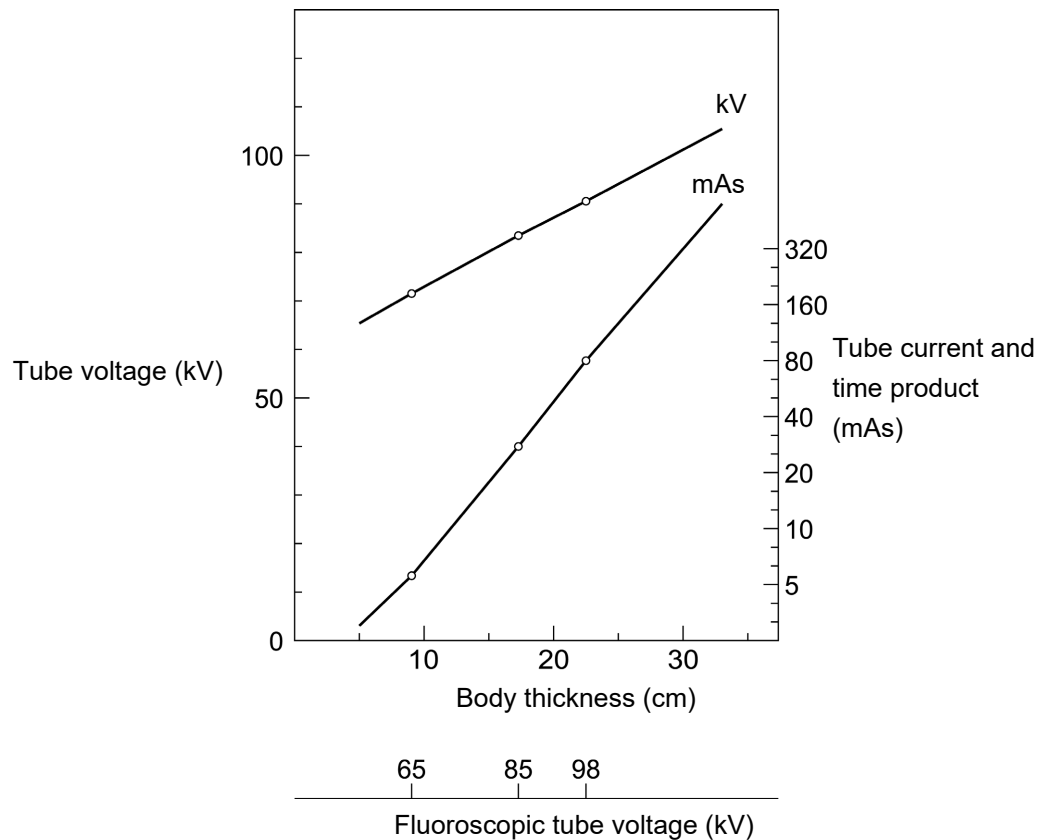
During AEC radiography, AEC normally completes radiography before the radiography time set by the sec value elapses.

If AEC does not operate, AEC back-up functions and radiography ends when the sec value elapses. If AEC backup is set in the sound and illumination settings described in [7.3 "Setting Up the Equipment Environment"](#), sound and illumination are used to indicate AEC back-up has been performed.

6.6.3 Registering and Changing Spot-filming Programs

■ Registering and Changing Memory Shot Programs

- Memory shot radiography is a type of spot filming that uses a function to automatically set the technique factors from the fluoroscopic conditions.
- Up to 16 direct spot filming and I.I. indirect spot filming techniques can be registered as memory shot programs.
- The following conditions are set as the standard memory shot conditions.



Focus	Large
Speed	M
Density	±0


Figure 6.1 Conditions for Direct Spot Filming



What are the mAs and mA sec Methods?

Memory shot radiography can be conducted by two methods: the mAs method or the mA sec method.

Method	Description
mAs	Sets the tube voltage (kV) and tube current and time product (mAs) according to the patient's body thickness
mA sec	Fixes the exposure time (sec) and sets the tube voltage (kV) and tube current (mA) according to the patient's body thickness

- Select the appropriate body thickness and press the [mA/mAs switch]  button to switch between the mAs or mA sec methods. The mA sec method is recommended for patients with particularly low body thickness, while the mAs method is recommended for easier settings.
- Only one exposure step can be registered in a spot-filming program using the memory shot function.




Registering and Changing Memory Shot Anatomical Programs

1 Enter the program-editing mode.

 Reference [4.3 "Editing Radiography Programs"](#)

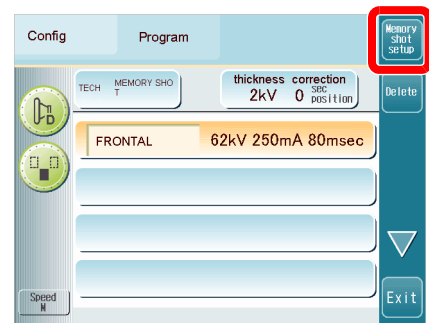
2 Press a [Technique] key to select the fluoroscopy technique.

Additional general techniques can be set as fluoros.

Icon	Description
	I.I. indirect spot filming
	Direct spot filming
	DR (OPTION)

3 Press the **Memory shot setup** key.

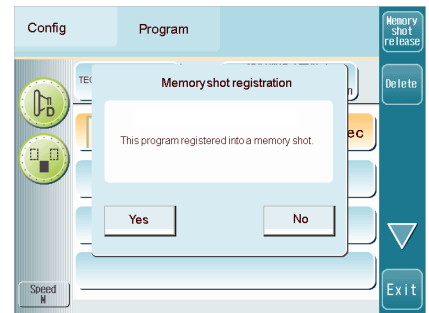
The following memory shot setup confirmation screen will appear.



4 Press **Yes**.

The memory shot technique factors screen will appear.

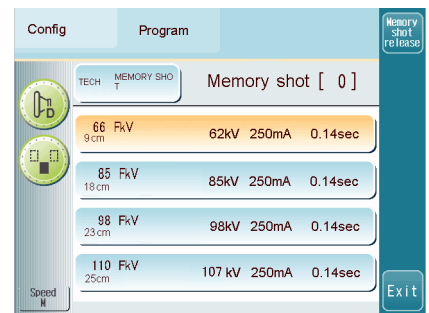
- If **No** is pressed, the Anatomical Program being used remains the same, and is not changed to memory shot. The fluoroscopy's Anatomical Program is edited.



5 Set the focus, AEC photo pickup field, density (photographic density), speed (intensifying screen sensitivity), and radiography method (mAs/mA sec methods) used for memory shot radiography.

At memory shot position lit is possible to change the focus and modify the AEC's photo pickup field, speed, and mA/mAs settings.

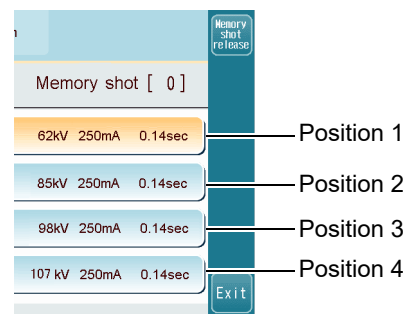
Reference 5.4 "Changing the Radiography Conditions"



6 Set the technique factor values for memory shot position 1 :kV, mA/mAs, and sec.

7 Set the technique factor values for memory shot positions 2,3,4:kV, mA/mAs, and sec.

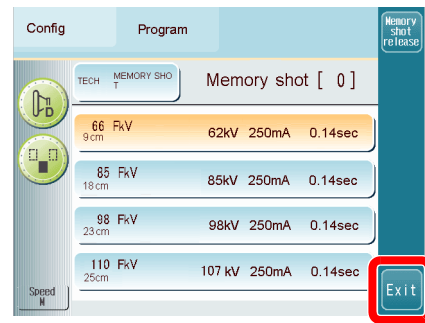
Depending on the installation conditions, setup of memory shot position 4 may not be required.



6 Fluoroscopic Operation (OPTION)

- 8 When finished modifying the memory shot radiography program, press the **Exit** key.

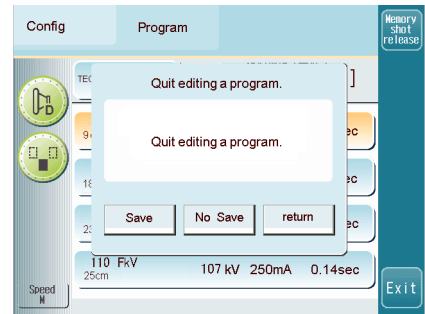
The memory shot radiography program's confirmation screen will appear.



- 9 Press the **Save** key.

The memory shot radiography program's confirmation screen will appear.

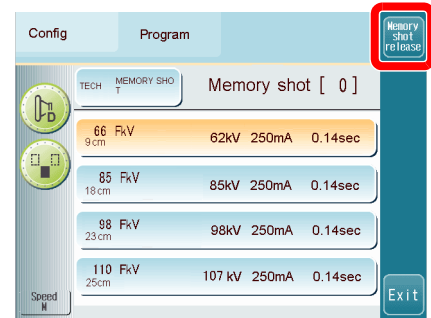
- Pressing **No Save** will discard the memory shot radiography program's modifications.
- Pressing **return** will return to the memory shot radiography program's edit screen.



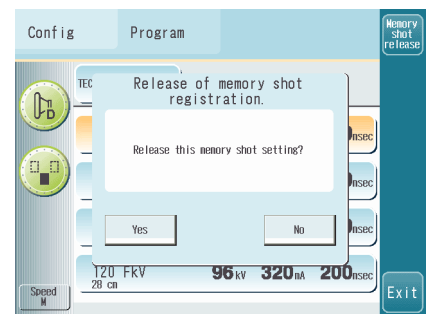
■ Deleting a memory shot radiography program

- 1 Select the desired memory shot radiography program.
 Reference [4.3.1 "Editing a Radiography Program"](#)

- 2 Press the key.
 The memory shot release confirmation screen appears.



- 3 Select key.
 The memory shot radiography program is deleted.
 - Selecting will return to the memory shot radiography program's edit screen.



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7

Setting Up AEC, System, and Equipment Environment

This chapter describes how to set up the equipment.

7.1 Setting Up AEC (optional)


This procedure sets up AEC radiography.

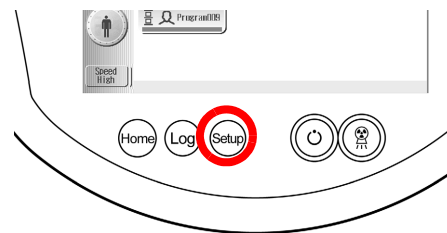



NOTE

When combining the phototimer receiver inside the FPD, use the digital radiography system to set the AEC settings.

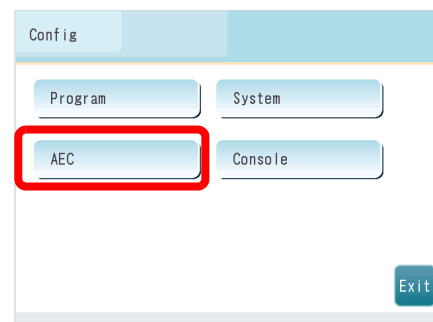
- 1 Hold down the  button on the operation panel for at least one second.

 **Reference** The password must be entered if one has been set. [7.5 "Entering Passwords"](#)

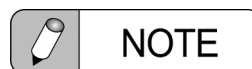
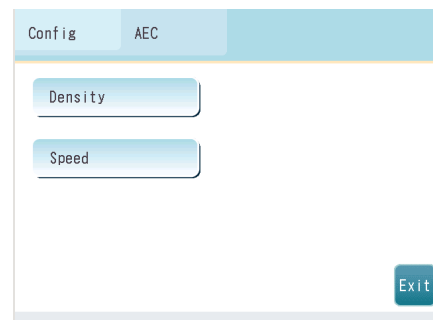


- 2 Press the  key on the setup screen.

The AEC setup screen is displayed.



- 3 Press the key for the item to set.



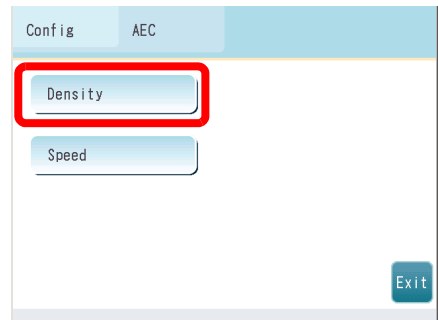
NOTE

After closing the setup screen, the home screen registered in 2.5 Home Screen is displayed.

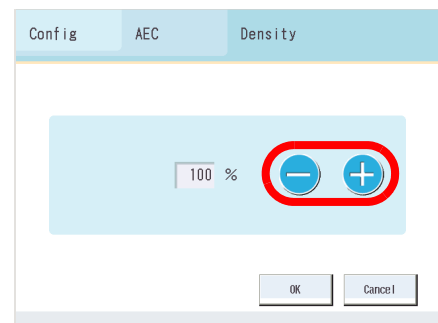
7.1.1 Photo Pickup Field

Sets percentage change in film density per step.

- 1 Press the key.



- 2 Press the \oplus and \ominus keys to set the density sensitivity.
(Standard setting: 115)



- 3 Press the key.

Press the key to proceed without saving the settings.

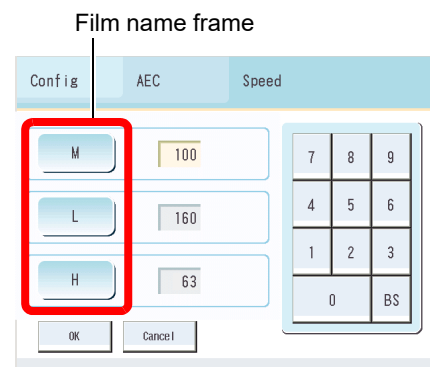
7.1.2 Speed

Sets the film name and radiography speed.

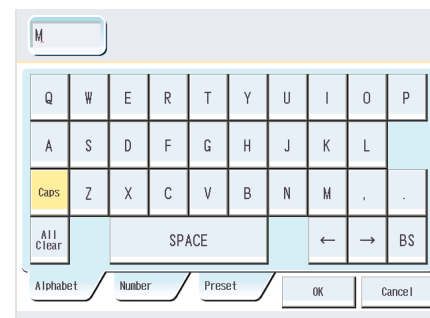
1 Press the key.



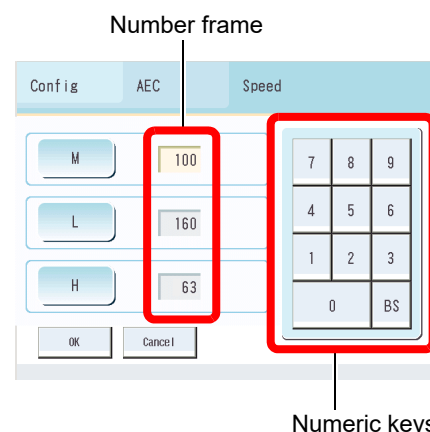
2 Press the film name frame.
The window is displayed to select the film name.



3 Press the key for the name of the film used.
The selected film name appears in the film name frame.



4 Press the number frame.





5 Enter the radiography speed with the numeric keys.
The value entered is displayed in the number frame.
Repeat the procedure from step 2 to make the settings for the other films.

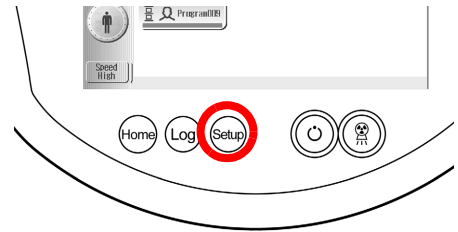
6 Press the key.

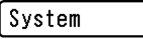
Press the key to proceed without saving the settings.

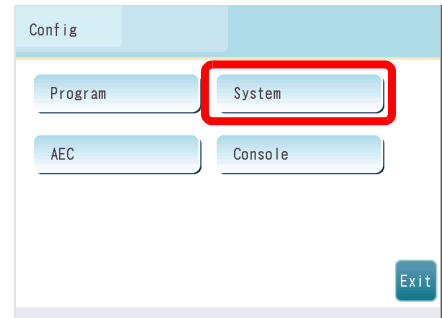
7.2 System Setup

This procedure makes the system settings.

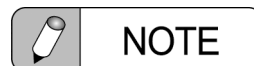
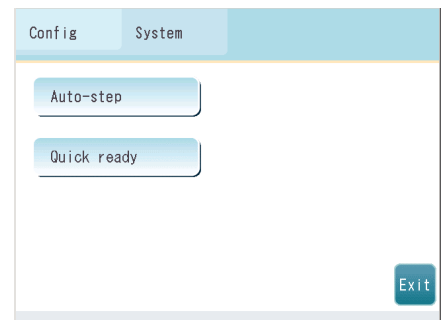
- 1 Press the  button.
 **Reference** The password must be entered if one has been set. [7.5 "Entering Passwords"](#)



- 2 Press the  key on the setup screen.




- 3 Press the key for the item to set.

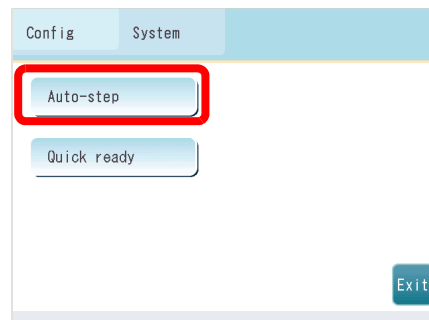


After closing the setup screen, the home screen registered in 2.5 Home Screen is displayed.

7.2.1 APR Automatic Stepping

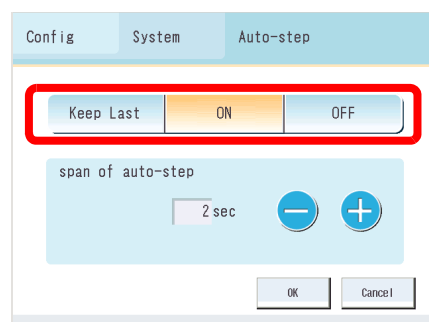
This procedure sets the initial status of the  (Auto-step) key when the radiography step screen is displayed and when the power is turned off and back on.



- 1 Press the key to display items.

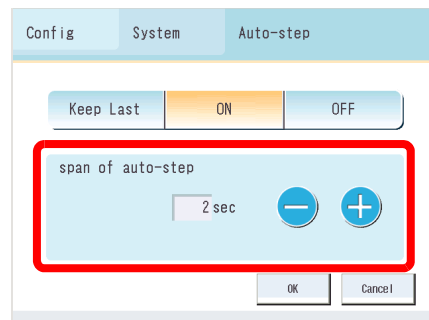


- 2 Press the key for the required initial status.

Key	Description
Keep Last	Same as previous time
ON	ON
OFF	OFF



- 3 Press the  and  keys to set the radiography step transfer time.



- 4 Press the key.

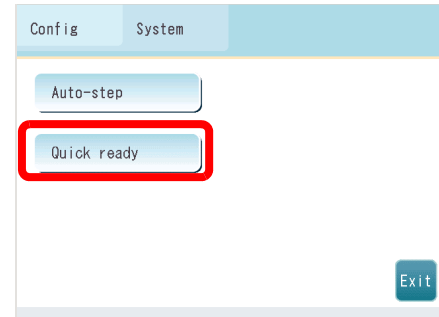
Press the key to proceed without saving the settings.

7.2.2 Setting Quick ready

Set the time to maintain the Quick ready function as follows.

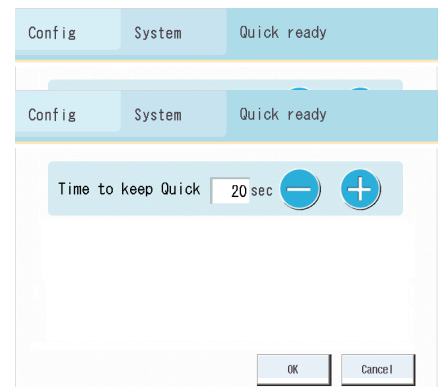
- 1 Press the **Quick ready** key.

The item will be displayed.

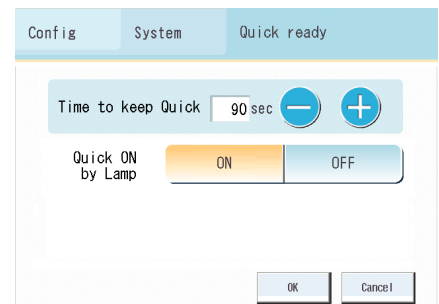


- 2 Press the **+** key or **-** key to set the Time to keep Quick.

- When not using an X-ray tube unit that can maintain high-speed rotation
The configurable times are 5 seconds, 10 seconds, 20 seconds, 30 seconds, 60 seconds, 90 seconds ... (30-second intervals) ... 270 seconds, and 300 seconds.



- When using an X-ray tube unit that can maintain high-speed rotation
The configurable times are 5 seconds, 10 seconds, 20 seconds, 30 seconds, 60 seconds, 90 seconds, and 120 seconds.





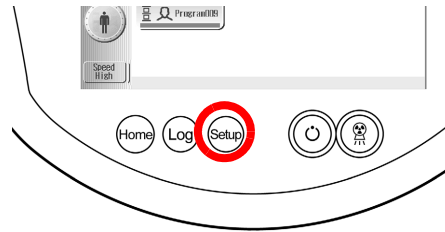
- 3 Press the **OK** key.

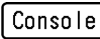
Press the **Cancel** key to cancel the settings changes.

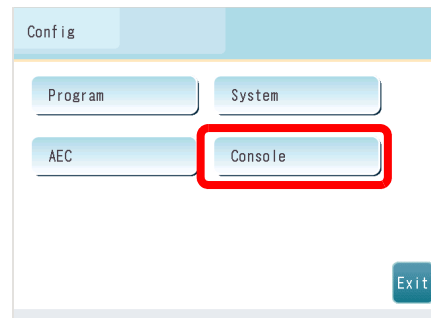
7.3 Setting Up the Equipment Environment

This procedure sets up the equipment environment.

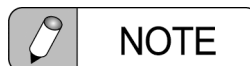
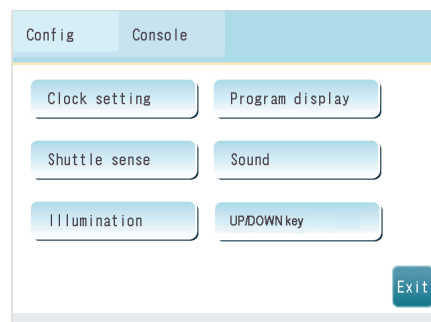
- 1 Press the  button.
 **Reference** The password must be entered if one has been set. [7.5 "Entering Passwords"](#)



- 2 Press the  key on the setup screen.



- 3 Press the key for the item to set.

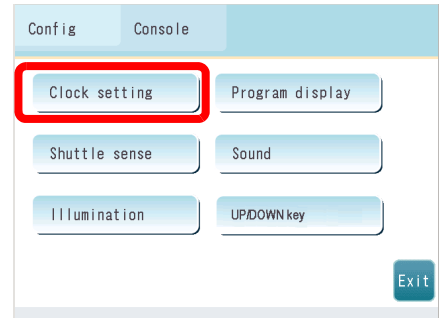


After closing the setup screen, the home screen registered in Home Screen is displayed.

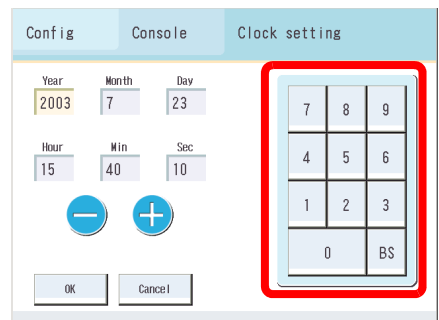
7.3.1 Setting the Clock

This procedure sets the date and time.

- 1 Press the **Clock setting** key.



- 2 Press the frame to set and enter the value from the numeric keypad.



- 3 Press the **OK** key.


Press the **Cancel** key to proceed without saving the settings.

7.3.2 Program Display

This procedure sets the radiography program screen display type and the number of radiography programs displayed.

Screen display type	3 rows	4 rows
with tabs(7)	15(Total 105)	20(Total 140)
with tabs(10)	15(Total 150)	20(Total 200)
no tabs	18	24

The With Tabs display shows the tab keys and radiography programs, whereas the No Tabs display shows the radiography programs only.

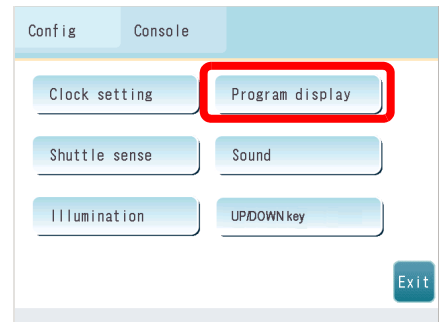


NOTE

When the DR unit is used, the settings "no tabs" and "4 rows" cannot be set.

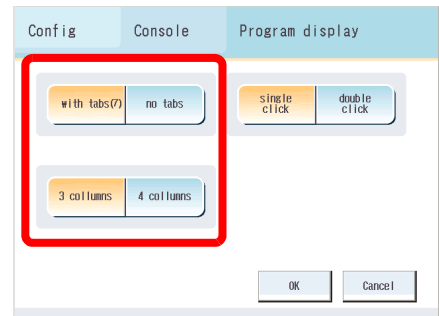


1 Press the **Program display** key.



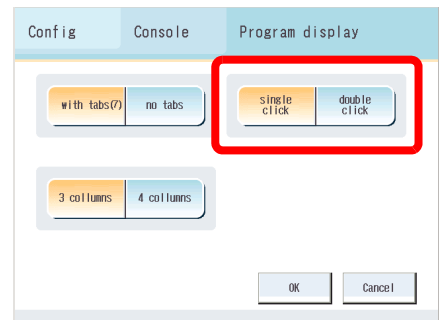
2 Select "with tabs" or "no tabs" display.

3 Select the number of rows of radiography programs to display.



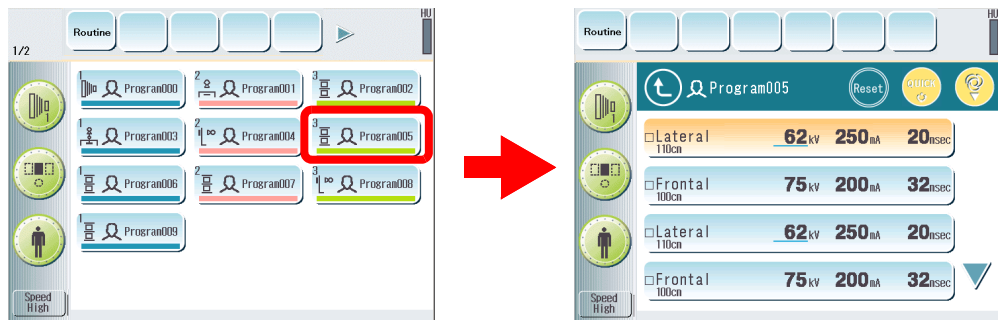
4 Select single-click or double-click.

The difference between the single-click and double-click operations is described below.



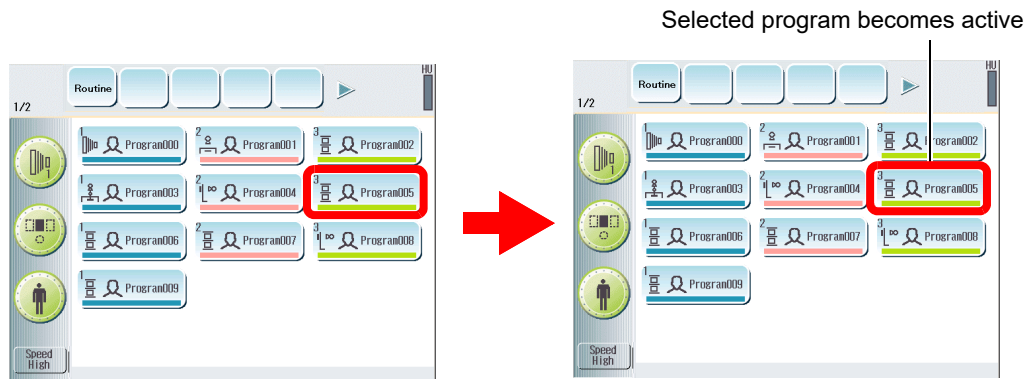
● **Single-click**

When a program is selected on the radiography program screen, the radiography step screen is displayed for the selected program.

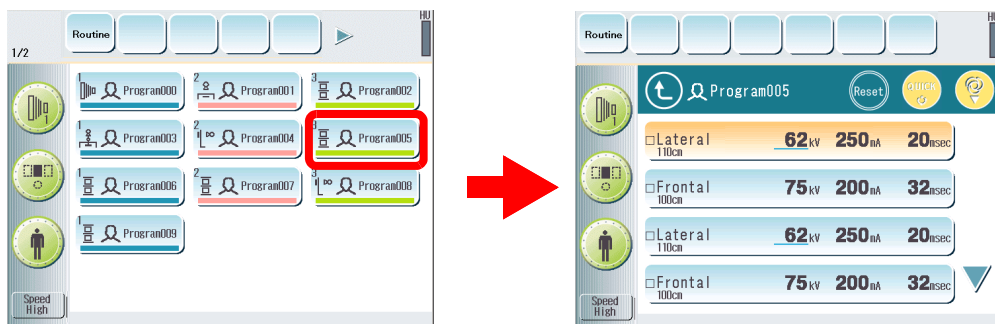


● Double-click

- ① When a program is selected on the radiography program screen, the radiographic conditions change to the radiographic conditions for the first step of the selected program. (The radiography program screen remains displayed.)

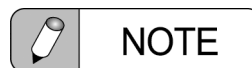


- ② When the program selected at step ① is selected again, the radiography step screen is displayed for the selected program.



- 5** Press the key.

Press the key to proceed without saving the settings.



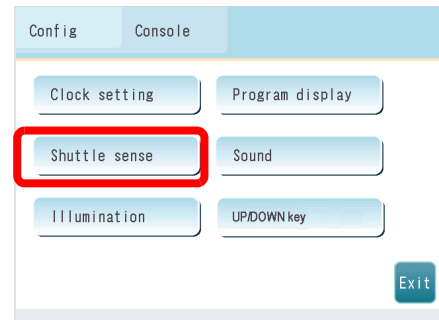
NOTE

The With Tabs display shows the tab keys and radiography programs, whereas the No Tabs display shows the radiography programs only.

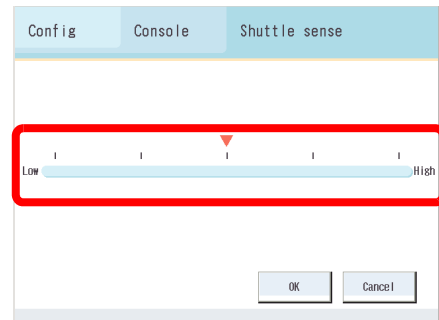
7.3.3 Dial Sensitivity

This procedure adjusts the sensitivity of the kV, mA/mAs, and sec jog shuttles.

- 1 Press the key.



- 2 Press the key to adjust the dial sensitivity.



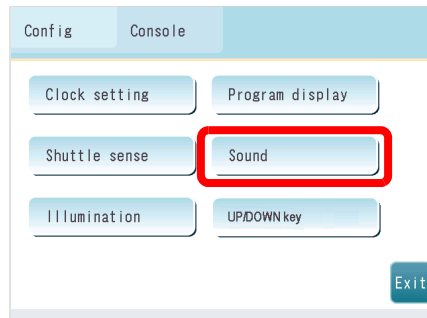
- 3 Press the key.

Press the key to proceed without saving the settings.

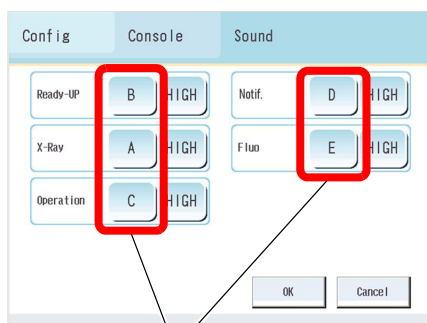
7.3.4 Sound

This procedure sets the volume and type of sounds during equipment operation.

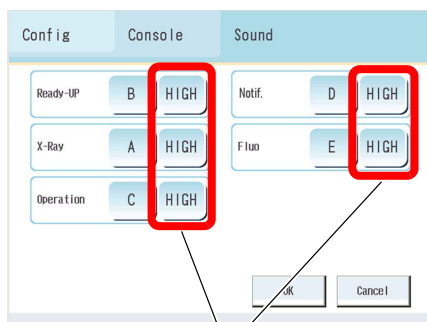
1 Press the key.



2 Press the sound type frame.
The setting keys are displayed.



3 Press the volume frame.
The setting keys are displayed.



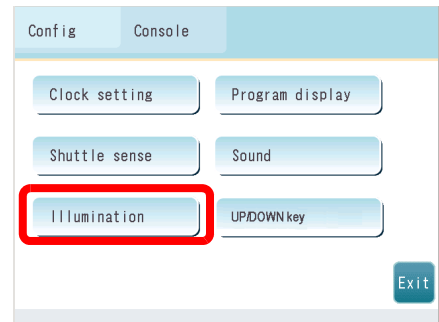
4 Press the key.

Press the key to proceed without saving the settings.

7.3.5 Illumination

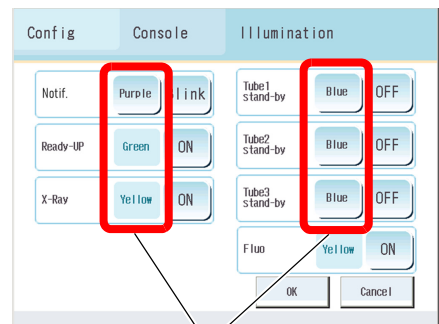
This procedure sets the illumination color and lighting mode during equipment operation.

1 Press the **Illumination** key.



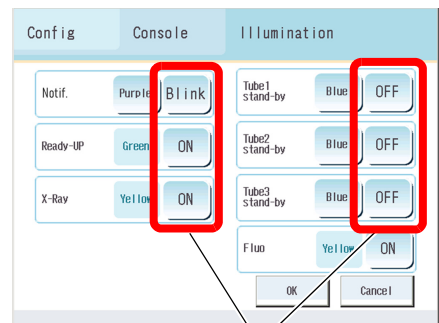
2 Press the color frame.
The setting items are displayed.

3 Press the key to select the required color.
The illumination lights in the selected color.



4 Press the lighting mode frame.
The illumination status setting changes each time a key is pressed. Illumination occurs according to the selected illumination status.

5 Press the **OK** key.
Press the **Cancel** key to proceed without saving the settings.



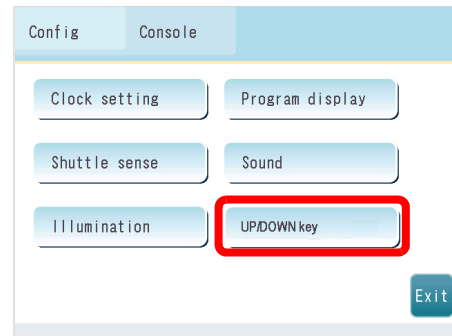
💡 Depending on the installation settings, "Tube 1 stand-by", "Tube 2 stand-by", and "Tube 3 stand-by" can be changed to "Stand Technique", "Table Technique", and "Other Technique".

💡 Depending on the installation settings, the background color of the radiography step screen can be changed to the color set using the Illumination key.

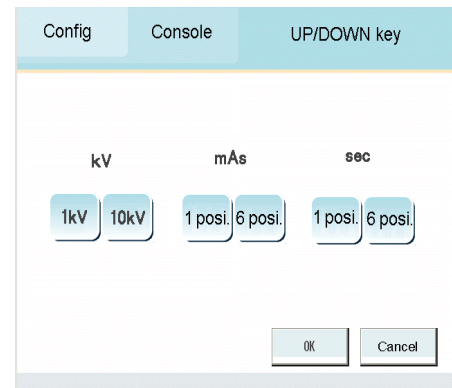
7.3.6 UP/DOWN Key Settings

These procedures set the UP/DOWN keys for kV, mA/mAs, and sec settings.

- 1** Press the key.



- 2** Enter the kV, mA/mAs, and sec settings.





kV	<input type="text" value="1kV"/>	Press the ▲/▼ keys to change the kV setting value 1 unit.
	<input type="text" value="10kV"/>	Press the ▲/▼ keys to change the kV setting value 10 units.
mAs	<input type="text" value="1posi."/>	Press the ▲/▼ keys to change the mAs setting value 1 position (12.5%)
	<input type="text" value="6posi."/>	Press the ▲/▼ keys to change the mAs setting value 6 positions (▼:1/2 time) (▲:2 times)
sec	<input type="text" value="1posi."/>	Press the ▲/▼ keys to change the sec setting value 1 position (12.5%)
	<input type="text" value="6posi."/>	Press the ▲/▼ keys to change the sec setting value 6 positions (▼:1/2 time) (▲:2 times)

- 3** Press the key.


Press the key to proceed without saving the settings.

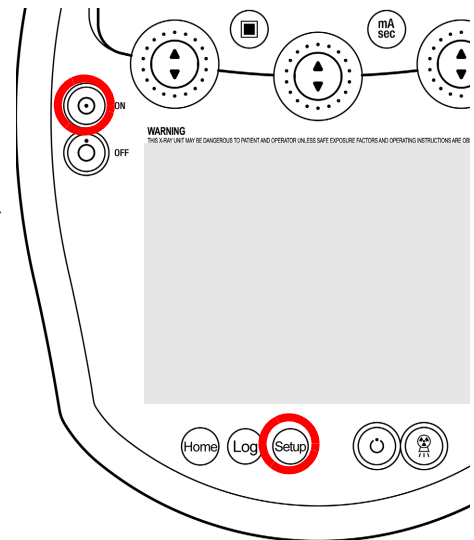
7.4 Touch Panel Settings

This procedure adjusts the touch panel display and touch sensor displacement.

- 1 Press the  (Power ON) button while holding down the  button on the operation panel.

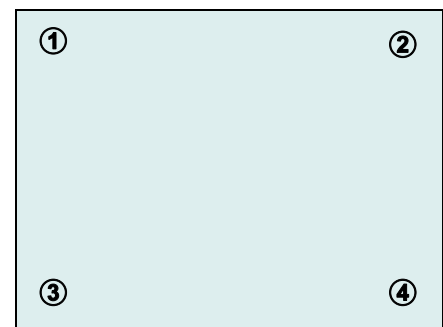
The touch panel adjustment screen is displayed.

- When it is ended not to do anything,  (Power off) button with holding down.



- 2 Press the numbers in order of ①, ②, ③, and ④ in the corners of the screen for 1 to 2 seconds with a hard, blunt object (such as a stylus pen or the back of a finger nail)

The touch panel display and touch sensor displacement are adjusted.



NOTE

- If a sharp object is used to touch the touch panel (such as a fingernail tip), it can cause a scratch or, if repeated, can break the panel.
- Do NOT perform this check using a soft object (such as the bottom of a finger). After adjustment is completed, check that the touch screen's touch sensors respond correctly. If the response is still not correct, perform alignment again.

7.5 Entering Passwords

The password entry screen is displayed only if Password Protection in the Setting Screen is set during installation of the equipment.

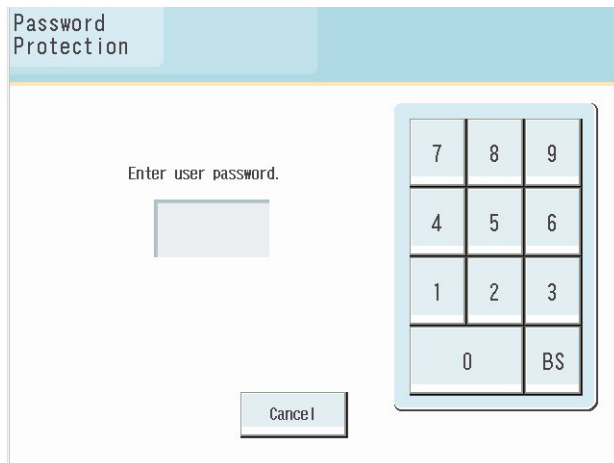
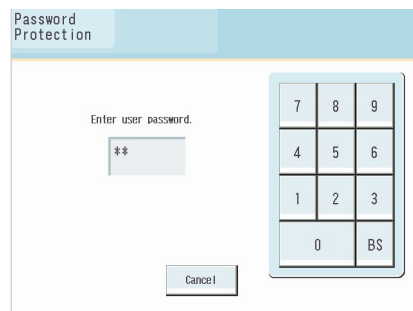


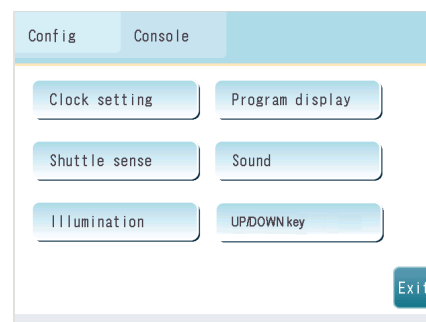
Figure 7.1 Password Entry Screen

- 1 Enter a 4-digit numeric password using the numerical keys.

Pass the key to return to the normal screen from the password entry screen.



- 2 If the entered password is correct, setup screen is displayed.



8

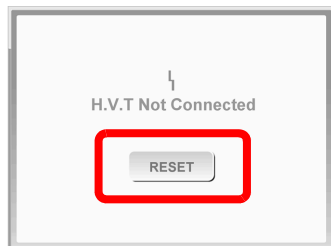
Troubleshooting

This chapter explains the messages displayed by the equipment and how to remedy them.

8.1 Messages

When the equipment sends a notification, it displays a message on the touch panel.

When a message is displayed, press the RESET key to close the message screen and then take the remedy for the message.



8.1.1 Messages Related to the X-ray High Voltage Generator

What to do if the ⚡ (fault indicator) on the operation panel appears and one of the following error messages is displayed. Radiographic operation is not possible while an error message appears on the sub-display.

Message	Problem	Remedy
Radio Over Current	Radiography tube current exceeded set value by +200 mA.	If this message appears repeatedly, contact your Shimadzu service representative.
Fluo Over Current	Fluoroscopy tube current exceeded approx. 9 mA.	
Line Voltage OVER	Supply voltage exceeded permitted range.	Contact your Shimadzu service representative.
Charge Volt ERR	Abnormal charging voltage of primary smoothing capacitor.	
Measured kV OVER	Measured tube voltage exceeded permitted range.	If this message appears repeatedly, contact your Shimadzu service representative.
Starter ERR	Abnormal starter.	
I.F. OVER	Abnormal filament heating current.	
Filament not ready		
Power Down	Abnormal control circuit supply voltage.	Contact your Shimadzu service representative.
H. V. T not connected	Abnormal connection to high-voltage transformer.	
Arcing Trouble	Repeated arcing occurred.	
Board status ERR	Abnormal control board.	
Starter is not working	Starter is not working when fluoroscopy.	

8.1.2 Messages Related to the Radiography Conditions

One of the following messages is displayed. Radiographic operation is not possible while a message appears on the sub-display.


Message	Problem	Remedy
mAs OVER	mAs value exceeded 800 mAs.	Change the set value.
mAs too small	mAs value was less than 0.5 mAs. Or, tube current was below minimum value for mAs setting method.	
Emission OVER	Emission characteristics out of range.	Increase radiography tube voltage or reduce radiography tube current.
Generator Load OVER	Equipment ratings exceeded.	Decrease radiography tube voltage or increase radiography tube current.
mAs/Time OVER	mAs value too large and radiography time exceeded 10 s. Or, radiography time exceeded permitted range.	Reduce the set value.
2 control range over	Setting out of range for mAs setting method.	

8.1.3 Messages Related to the X-ray Tube Heat Units

One of the following messages is displayed. Radiographic operation is not possible while a message appears on the sub-display.

Message	Problem	Remedy
HU OVER Predicted	Value predicted to go out of range if the heat units increase from the current heat unit value according to the set radiography conditions.	Change the radiography conditions or cease operation until heat unit value reduces.
HU Full Stored	Heat units reached the permitted limit.	Cease operation until heat unit value reduces.
Thermal Over	X-ray tube unit temperature exceeded the permitted limit.	

8.1.4 Messages at Power ON

Message	Problem	Remedy
Panel Battery WARNING	The data recording battery in the operation panel must be replaced soon.	Contact your Shimadzu service representative.
Cabinet Battery WARNING	The data recording battery in the Control cabinet must be replaced soon.	
Panel Battery EMPTY	The data recording battery in the operation panel is empty.	
Cabinet Battery EMPTY	The data recording battery in the Control cabinet is empty.	
X-ray switch ERR	The X-ray switch or the hand switch is kept being pushed.	
Fluo switch ERR	The fluoroscopy foot switch is kept being pushed.	
X-ray Foot Switch ERR	The foot switch (option) is kept being pushed.	
Installation incomplete! Please contact your service personnel. X-ray will be disabled after hours below. XXX* ¹ hours	The equipment installation is not completed. The exposure will be inhibited after the displayed time elapsed.	Turn the power off and then restart the equipment. If the code appears repeatedly, contact your Shimadzu service representative.
DAP meter error	Cannot communicate with the dosimeter.	
Make sure the Quick ready key on the touch panel is OFF before turning off the power. Turning off the power while the Quick ready key is still ON or blinking may shorten the life of the X-ray tube assembly.	The power was turned off while the X-ray tube unit was rotating at high speed.	Confirm that the X-ray tube unit is not rotating at high speed before turning the power off.  Reference 5.5.2 "Canceling Quick Ready"

*1: "XXX" shows the remaining time.

8.1.5 Messages Related to Communication and Radiography Conditions (optional)

This error can occur only if the optional communication unit is installed.

One of the following messages is displayed. Radiographic operation is not possible while a message appears on the sub-display.

Message	Problem	Remedy
Data transfer from the DR unit has been canceled. An exposure will be made with unintended X-ray conditions. Check the X-ray conditions displayed.	The information transferred from the DR unit was canceled.	Check whether X-ray conditions corresponds to the respected exposure region. If not, set correct the X-ray conditions.
Communication ERR		

8.1.6 Other Messages

One of the following messages is displayed. Radiographic operation is not possible while a message appears on the sub-display.

Message	Problem	Remedy
F Opt device ERR	Abnormal optical system during fluoroscopy.	Contact your Shimadzu service representative.
R Opt device ERR	Abnormal optical system during radiography.	
Door/Interlock	The examination room door is open.	Close the door.
AEC OVER	AEC failed and AEC backup was used during AEC radiography.	Extend the radiographic time.
Ready Up Time Over	Ready-up status continues for a long time even after the Ready-up operation is complete.	Cancel the Ready-up status.
Table is not ready.	The R/F table is not ready because I.I. is retracting, etc.	Confirm the settings of the R/F table.

8 Troubleshooting

Message	Problem	Remedy
CH Communication ERR (Ready Up)	Communication error with the CH-200 may have blocked the Ready-Up notice from the CH-200.	Contact your Shimadzu service representative.
CH Communication ERR (X-ray)	Communication error with the CH-200 may have blocked the radiography completion notice from the CH-200 after radiography.	

9

Inspection and Maintenance

This chapter explains the daily and periodic inspection items and describes the maintenance.

9.1 Maintenance and Inspections

By reliably maintaining the performance of the system, you can assure the safety of the operator and the patients, and efficiently provide images of exceptional diagnostic value.

Our thorough quality control and inspection procedures ensure that the system is shipped in the optimum condition. In order to maintain this optimum condition, you must implement maintenance and inspection in a deliberate way.



If any abnormality is found during the maintenance check, stop using the equipment and contact your Shimadzu service representative.

When a user performs the maintenance check for himself or herself, please keep in mind his or her own safety.


Shimadzu shall not be liable for any damage resulting from the checks other than those by Shimadzu or your Shimadzu service representative.

The maintenance and inspections for the system are classified as follows.

Type of maintenance/inspection		Implemented by	Inspection interval
Daily inspections	Starting inspection	Operator or equipment manager	At the start of work every day
	Ending inspection	Operator or equipment manager	At the end of work every day
Cleaning and disinfection		Operator or equipment manager	As required
Periodic inspections		Your Shimadzu service representative	Yearly

9.1.1 Daily Inspections

The daily inspections comprise the starting inspections and ending inspections. Daily inspections are necessary in order to keep using the system for a long time. Check that all inspections and corrective actions have been completed before using the system.

 **Reference** Use the "Starting Inspection Checklist" and "Ending Inspection Checklist" in [11.15 "Appendix"](#). We recommend that you retain filled out copies of the "Starting Inspection Checklist" and "Ending Inspection Checklist" for a fixed time.

9.1.2 Inspection for Warning and Caution Labels for Safety

Periodically (Yearly) inspect the labels attached to the equipment.

In case that the label is peeled off or unreadable by damage or dirt, contact your Shimadzu service representative for replacement of new one.

 **Reference** ["Warning and Caution Labels for Safety"](#).

9.1.3 Cleaning and Disinfecting



Be sure to turn the equipment power OFF before cleaning and disinfecting the equipment.

Otherwise, a malfunction may occur in the equipment, or the equipment may operate in an unintended way.

Also, thoroughly ventilate the room before turning ON the power after disinfection work is complete.



Be sure to clean and disinfect the equipment periodically.

Cleaning and disinfection is very important to ensure that the equipment can be used hygienically and safely. Strictly follow the methods prescribed.



Be sure to clean the equipment frequently and after each patient use.

While doing so, do NOT directly apply or spray any disinfectant, cleaner, or water onto the equipment. Wipe down all contact surfaces using a cloth moistened with an appropriate disinfectant or cleaner. Make sure the cloth is NOT too wet. If it is, liquid may enter into system electronics, causing failure or malfunction.



Observe the following precautions when cleaning and disinfecting the touch panel:

- Do NOT rub or hit the panel surface because it tends to scar easily.
- Wipe gently with moistened soft cloth to remove the dust from the panel surface.



Use the following disinfectants and cleaner (intermediate level disinfectant):

- Chlorine disinfectants
 - Sodium dichloroisocyanurate solution (1 % maximum)
 - Sodium hypochlorite solution (1 % maximum)
- Alcohol disinfectants
 - Commercially available isopropyl alcohol solution (Up to 99 wt% can be used)
- Rubbing alcohol
 - (76.9 - 81.4 vol% Ethanol, Isopropyl alcohol as an additive)
- Glass cleaner (Only onto the touch panel)



Do NOT use the following disinfectants:

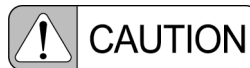
If any of the following disinfectants are applied, the equipment performance and safety cannot be guaranteed.

- Disinfectants that corrode metals, plastics, rubber, or paint
- Disinfectants unsuitable for metals, plastics, rubber, or paint
- Spray-gas type disinfectants
- Volatile disinfectants
- Disinfectants that may enter the equipment



Use disinfectants at a minimum.

Repeated disinfection over a long time may lead to discoloring and cracking on the equipment surface, and deterioration of rubber and plastic. If any abnormality is found on the equipment after disinfection, stop using the equipment immediately. Contact your Shimadzu service representative for repair.



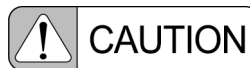
Do NOT use an organic solvent.

Organic solvents may change the surface color. If an organic solvent adheres to the surface, wipe it off immediately.



When disinfecting unpainted metals, do NOT use chlorine-based disinfectants.

Chlorine-based disinfectants may corrode the surface of the equipment. If chlorine-based disinfectants adhere to the surface, wipe them off immediately.



When disinfecting resin parts, do NOT use rubbing alcohol.

Rubbing alcohol may lead to deformation or crack of resin parts. Wipe it off immediately if it adheres to resin parts.

On completing the work, check the following points before switching the power ON again.

- There must be no water or disinfectant adhering to the equipment.
- The tools used in cleaning and disinfecting work must be tidied away.

 Reference 3 "Power ON/OFF"



When turning the power ON after cleaning, make sure the examination room is properly ventilated.

Turning the power ON while any flammable gas remains in the examination room could lead to fire, smoke, explosion or electrocution.

9.1.4 Periodic Inspections

Even without any problem in daily inspection, the following items should be inspected periodically.

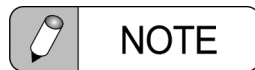


Be sure to perform periodic inspection (yearly).

Failure to do this may cause serious accidents or significantly shorten the lifetime of the equipment.

Periodic inspections mainly check the equipment performance and the internal mechanisms. The inspections require good knowledge of the internal mechanisms and can also be dangerous. Contact your Shimadzu service representative to request a periodic inspection. It is recommended to conduct periodic inspections yearly. A fee is charged for periodic inspections after expiry of the warranty periods.

The maintenance work involves dangerous tasks. Be sure to request your Shimadzu service representative to perform the periodic inspection..



If necessary, service engineers will contact the manufacturer of the equipment to get information about repairing.

No.	Inspection Item	Interval
1	X-ray output	Check tube voltage, current, and exposure time.
2	AEC	Check AEC radiography and film density with phantoms equivalent to the human body.
3	Displaying dose area	Check dose area product.

9.2 Maintenance Parts List

To maintain the performance of the system, the following parts need replacing at regular intervals. When replacing them, use the genuine parts and contact your Shimadzu service representative. Prepare some locking mechanism to keep a off status of Molded Case Circuit Breaker. When replacing the part, service engineer isolates from the supply mains.

9.2.1 Battery

The battery that backs up the equipment memory lasts approximately five years. After the battery life expires, the message "Battery WARNING" is displayed on the touch panel for approximately five seconds when the equipment is turned on. Contact your Shimadzu service representative when this message is seen.

In case the equipment is not used for 1 year or more contact your Shimadzu service representative and make them remove the battery.

Replacement cycle: 2 years

Part name
CR2450

9.2.2 Fuses

■ Control cabinet

Replacement cycle: 2 years

Model	Rated current	Rated voltage	Type
F-T2-0	1 A	250 V*	Slow Blow
		500 V*	
F-T2-2	1 A	250 V*	Slow Blow
		500 V*	
F-10LA	0.5 A	250 V	Slow Blow
F-100LB	0.5 A	250 V	Slow Blow
F-L0T	5 A	250 V	Slow Blow
F-L100T	5 A	250 V	Slow Blow
F-A0T	10 A	250 V	Slow Blow
F-A200T	10 A	250 V	Slow Blow

*: Replace to the same kind of fuse as used before replacing.

■ T1-40* (inside Control cabinet)

Replacement cycle: 2 years

Model	Rated current	Rated voltage	Type
F-L0	10 A	250 V	Slow Blow
F-L100	10 A	250 V	Slow Blow
F-L115	10 A	250 V	Slow Blow
F-L125	10 A	250 V	Slow Blow
F-A IN0	30 A	500 V	Slow Blow
F-A IN2	30 A	500 V	Slow Blow
F-A0	20 A	250 V	Slow Blow
F-A50	10 A	250 V	Slow Blow
F-A125	10 A	250 V	Slow Blow
F-A200	20 A	250 V	Slow Blow
F-A220	20 A	250 V	Slow Blow
F-135C	2 A	250 V	Slow Blow
F-18T	1 A	250 V	Slow Blow

■ T1-40X* (inside Control cabinet)

Replacement cycle: 2 years

Model	Rated current	Rated voltage	Type
F-A-200	20 A	500 V	Slow Blow
F-A125, F-A50	10 A	250 V	Slow Blow
F-A0	20 A	250 V	Slow Blow
F-AIN0, F-AIN2	30 A	250 V	Slow Blow
F-18T	1 A	250 V	Slow Blow
F-135C	2 A	250 V	Slow Blow
F-L0, F-L100, F-L115, F-L125	10 A	250 V	Slow Blow

*: Model of T1 is either T1-40 or T1-40X.

■ IGBT unit (inside Control cabinet)

Replacement cycle: 2 years

Model	Rated current	Rated voltage	Type
F1A	125 A	600 V	Fast Acting
F1B*	125 A	600 V	Fast Acting

*: only UD150B-40 and D150BC-40

■ XAT-2H* (inside Control cabinet: option)

Replacement cycle: 2 years

Model	Rated current	Rated voltage	Type
U	10 A	250 V	Slow Blow
V	10 A	250 V	Slow Blow
W	10 A	250 V	Slow Blow

*: XAT-2H is not mounted on the equipment shipped after February 2015.

9.2.3 Hand Switch

Replacement cycle: 2 years

Part name
Lighting hand switch, C2U-23

9.2.4 Contactor

Replacement cycle: 8 years

Location
MG-L
MG-RS
MG-C
MG-D
MG-F (option)

9.2.5 SA-60

■ Fuse

Replacement cycle: 2 years

Model	Required Qty
FLQ20	1
313.500	2
660GH-050	1

■ Battery

Replacement cycle: 2 years

Model	Required Qty
CR2450	1

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10

Options

This chapter describes the equipment option.

10.1 Communication Unit

Installing the optional communication unit permits the equipment to communicate with external instruments, such as RIS or CR.

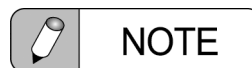
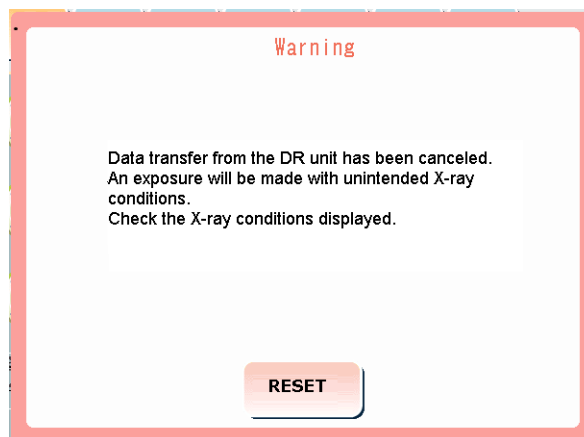
Technique factors can be received from external instruments and set for the equipment. In addition, technique factors can be sent to external instruments.

10.1.1 Sending and Receiving Technique Factors

■ Receiving technique factors

Technique factors received from external instruments can be set for the X-ray high-voltage generator. Set technique factors can be changed subsequently.


If data cannot be received such as when the transmitted data is inappropriate, the following pop-up window is displayed. Radiographic operation is not possible in this status. Press the **RESET** key on the pop-up window to reset the error.



Be sure to check the set technique factors after receiving data or when the above pop-up window is displayed.

Set technique factors that are correct with respect to the exposure region if inappropriate.

Radiographic operations using inappropriate technique factors may result in unnecessary exposure for the patient.

 When using the equipment with settings to directly receive technique factors instead of receiving an Anatomical Program, an Anatomical Program name irrelevant to the technique factors that are received and set will remain displayed. To prevent this, you are recommended to select in advance an Anatomical Program that is registered a name irrelevant to exposure regions, such as "ON LINE".

■ Transmitting technique factors

When radiographic operation is complete, the technique factors used are transmitted automatically. (The transmitted exposure time is the actual time taken for the X-ray irradiation.)

■ Stopping technique factor reception

Depending on the installation settings, the Stop Technique Factor Reception key can be used. When this key is set to OFF, external technique factors cannot be received. (Use of this key disables the ? Return key.)

Stop Technique Factor
Reception key



10.1.2 Technique Factor Transmission Specifications

■ Communication specifications

Connector: RS-232C

Pin allocation

1	FG
2	TX
3	RX
4	RTS
5	CTS
7	GND

D-SUB25P (female)

■ Basic communication protocol

Transmission mode: half duplex

Synchronization mode: asynchronous

Transmission code: 8-bit code prescribed in JIS-X-0201
(not including *, @, or ? codes)

Communications data format

Start bit	1 bit
Data	8 bit
Parity	1 bit (even)
Stop bit	1 bit

Transmission rate: 4800 bps

Communication control protocol:
conforms to JIS-X-5002

Response mode: ACK, NAK

Error check protocol: BCC (text block horizontal parity)
XOR from character after STX to ETX

Error correcting method: automatic re-transmission

■ Basic communication details

- 1) Receiving: technique factors (technique, kV, mA, sec, AEC settings) or Anatomical Program number (however, density setting range is -3 to +3)
- 2) Transmission: actual technique factors (technique, kV, mA, sec, AEC settings) (however, transmittable density setting range is -3 to +3)

10.2 Dose Calculation Unit





NOTE

This dose calculation unit is only for radiography.

The unit does not operate when fluoroscopy-capable techniques, such as



Direct spot filming,  I.I. Indirect spot filming, and  DR are selected. The unit cannot be used with an area dosimeter.

Dose calculation unit calculates and displays the following values:

- Distance from X-ray tube focal point to patient skin surface which is measured by the ultrasonic sound distance meter which is installed to the collimator.
- From X-ray conditions set to X-ray high-voltage system, calculate the X-ray dose of patient skin surface during acquisition.

Calculating Formula is shown below.

$$\text{Dose (mGy)} = C(\text{kV}) \times \text{mAs} \times 1 / (\text{focal point-distance of patient skin surface})^2$$

C(kV): Correction factor by tube voltage

mAs : Tube current time product

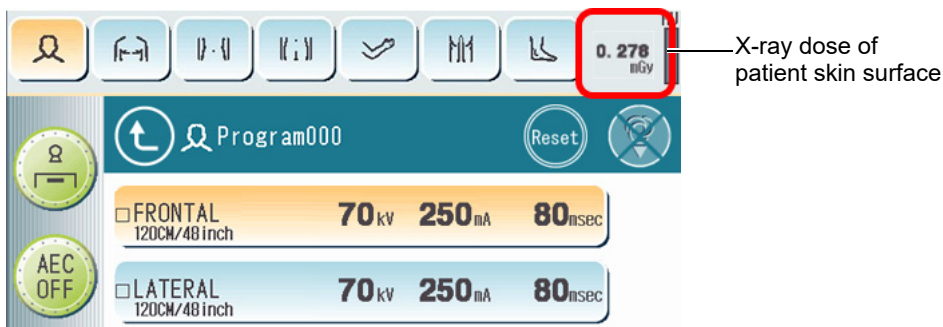
C(kV) is the system factor that depends on radiation quality and corrected upon installation.

■ Using Dose Calculation Unit

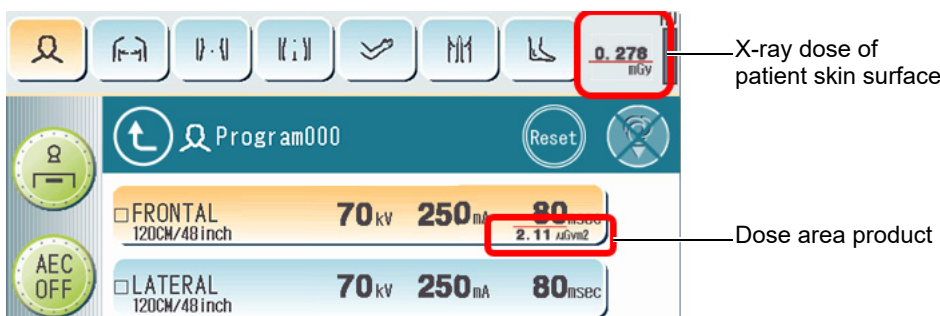
As usual X-ray radiography, set radiography conditions on X-ray high-voltage system, and guide a patient to the radiography table. Dose calculation unit calculates and displays the following values on the LCD screen of X-ray high-voltage system:

- Distance from X-ray tube focal point to patient skin surface.
- From X-ray conditions set to X-ray high-voltage system, calculate the X-ray dose of patient skin surface during acquisition.

■ **Displaying example of X-ray dose calculation value by dose calculation unit**



Before radiography



After radiography

12/30	Lateral	95 kV	6.4 mAs	20.0 msec	123.44 mGy
15:36	Program005				
12/30	Lateral	95 kV	6.4 mAs	20.0 msec	123.44 mGy
15:37	Program005				
12/30	Lateral	95 kV	6.4 mAs	20.0 msec	123.44 mGy
15:38	Program005				
12/30	Lateral	95 kV	6.4 mAs	20.0 msec	123.44 mGy
15:39	Program005				
12/30	Lateral	95 kV	6.4 mAs	20.0 msec	123.44 mGy
15:40	Program005				

Radiography History

● **Displaying of X-ray dose of patient skin surface**

① Before radiography:

Measure the distance between the X-ray tube focal point and patient with the ultrasonic sound distance meter which is installed to the collimator. And always calculate and display the X-ray dose of patient skin surface by configured X-ray conditions. Update the calculation result as needed.


② After radiography:

Display the calculation value by configured X-ray conditions after the acquisition. For AEC acquisition, display the calculation value using the measured time, after the acquisition.

When approximately 3 seconds elapse after the acquisition, the display returns to the status before acquisition.

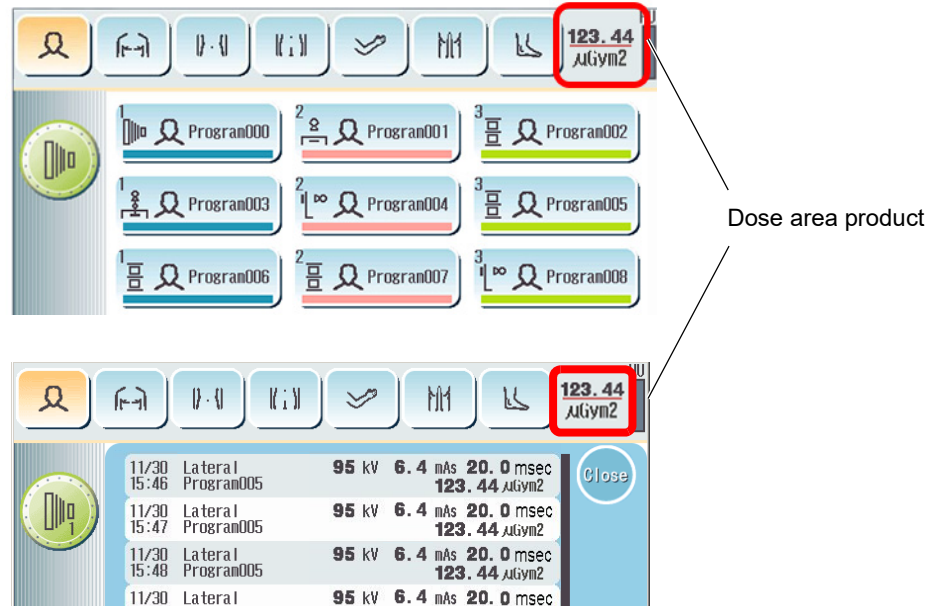
Radiography History displays the X-ray dose of patient skin surface.

📖 **Reference** [5.8 "Displaying Radiography Log"](#)

 NOTE

- When radiography is performed while the radiography program or radiography history screen is displayed, the dose area product is displayed in the section of the X-ray dose of patient skin surface.

When approximately 3 seconds elapse after the acquisition, the display returns to the status before acquisition. Confirm the X-ray dose of patient skin surface in radiography history.



- Use the calculation value that the dose calculation unit displays only as a guide. Because of measuring error of distance, collimator shutter, and back scattering of X-ray, approximately 20%^{*1} of measuring error may occur between an actual radiated dose value and calculation value. Accuracy of displayed calculation value cannot be guaranteed. Also, measuring error between actual radiated value and calculation value may exceed 20%^{*1}, depends on radiography region.
- The dose calculation unit is only for radiography.
- Radiation quality and X-ray dose will be changed as using additional filter, and measuring error between actual radiated value and calculation value may exceed 20%^{*1}.
- If patient put on clothes such as a T-shirt, distance may not measure properly.
- While measuring the distance, do not enter the measurement field (1m from the tube focal point and within a 20cm radius of a circle). If any one or any thing other than the patient is in the field, it will measure the distance to other people or things.
- If measurement fails, "Measuring" is displayed before radiography and "-----" is displayed in the section of the X-ray dose of patient skin surface and "-----" is displayed in the calculated dose display of radiography history after radiography.

*1 Error with measurement value of dosimeter used for calibration. Error may different depends on accuracy of dosimeter, when measuring with other dosimeter.

10.3 Ceiling Tube Support CH-200 Auto Positioning

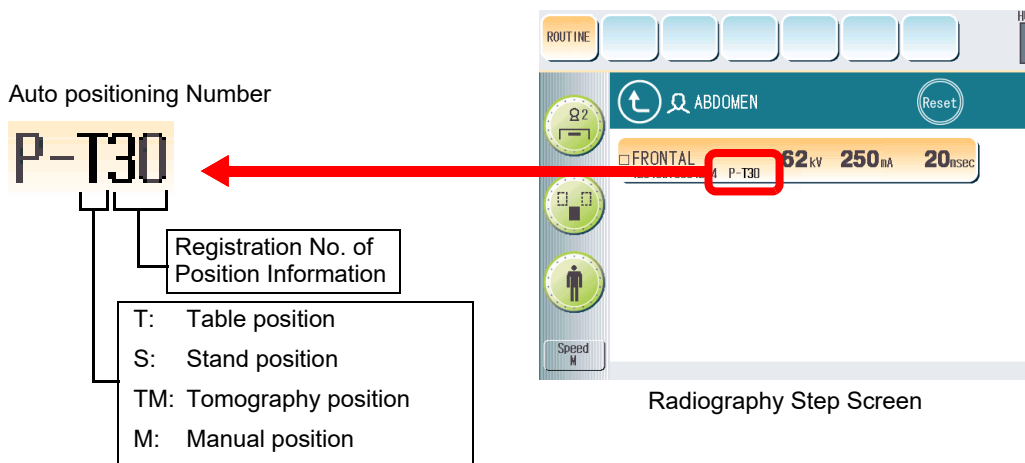
The Auto Positioning feature records the position information of the ceiling tube support CH-200 to a designated radiography program.

This information is registered or read out for each radiography step.

Reference For detailed information about the auto positioning feature, refer to M514-E070 Ceiling Tube Support CH-200 Operation Manual.

10.3.1 Display of Auto Positioning Number

Position information for the auto positioning feature is displayed on the Radiography Step screen.



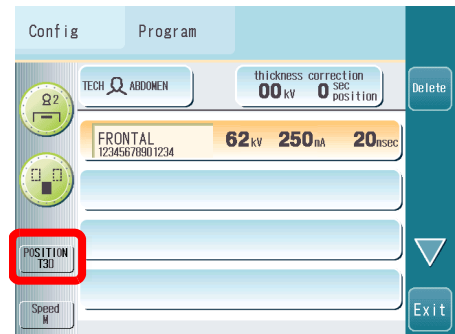
10.3.2 Registration Auto Positioning Number in the Radiography Program

■ Registration Auto Positioning Numbers (A/P numbers) in the Radiography Program

To register auto positioning numbers in the radiography program, set the auto positioning numbers registered separately on the CH-200 for each radiography step.

- 1 Press the **POSITION** key in the Radiography Program Editing screen.

The Auto Positioning Number table is displayed, and the registerable position information is displayed according to the designated technique.

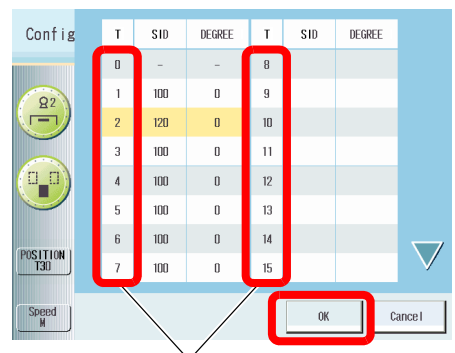


- 2 Press the A/P number to register.

The Color changes on the line of the A/P number. To change screens and display information after the 16th position, press the ▼ key.

- 3 Press the **OK** key.

Display returns to the Radiography Program Editing screen.



Registration No. of Position information (A/P number)

Reference To edit the radiography program, see 4.3 "Editing Radiography Programs"

10.4 Auto Filtering Function of X-Ray Collimator R-300

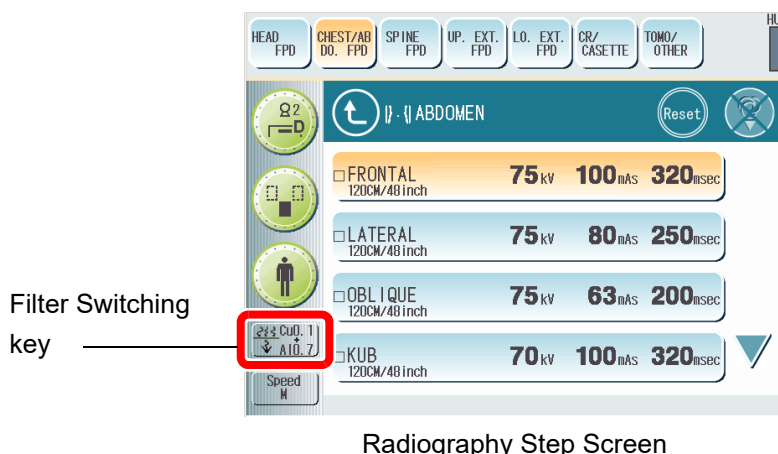
The auto filtering function is provided to relate BH filter information of the X-ray collimator R-300 with the radiography programs to store it.

Each radiography step can be registered, called, and also manually switched after the call.

Reference For detailed information about the auto filtering function, refer to "M526-E024 COLLIMATOR TYPE R-300 OPERATION MANUAL".

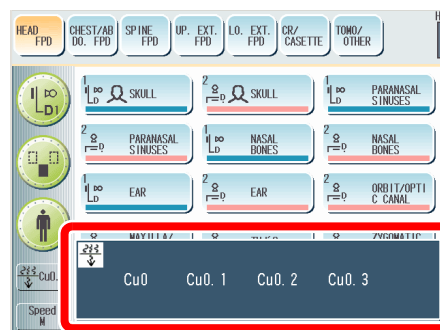
10.4.1 Displaying and Switching Filter Information


The filter information currently selected is displayed inside the Filter Switching key in the radiography step screen.



Switch the Filter

- 1 Press the Filter Switching key.
- 2 Press the key of the filter type to set.



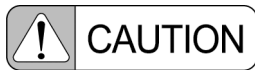
 The following are the X-ray condition (mAs) required to obtain X-ray images with equivalent density using each filter:

Filter	Item	60 kV	80 kV	100 kV	125 kV
Cu0.1	Required mAs ratio	1.4	1.2	1.1	1.1
	Dose ratio in relation to the case without filter when the mAs above is entered	0.6	0.7	0.7	0.7
Cu0.2	Required mAs ratio	2.0	1.5	1.4	1.2
	Dose ratio in relation to the case without filter when the mAs above is entered	0.5	0.5	0.6	0.6
Cu0.3	Required mAs ratio	2.8	1.7	1.5	1.3
	Dose ratio in relation to the case without filter when the mAs above is entered	0.5	0.5	0.5	0.6



NOTE

- The values above are only for reference purposes. The values may differ depending on the radiography systems.
- Image qualities may vary according to the filter used.
- For filter selection for each region, refer to "M526-E024 Collimator Type R-300 Operation Manual".



If the following error message is displayed on the screen, contact your Shimadzu service representative at once.



This error message is displayed when a problem occurs with the filter of the Collimator Type R-300. If there are no apparent problems with the image for diagnosis, it is possible to continue with radiography by pressing the [RESET] button on the screen; however, avoid keeping this condition for a long time. Press the [RESET] key to close the error message dialog box. The mark of [X] will remain displayed on the Filter Switching key.



For details on the error, refer to the "COLLIMATOR TYPE R-300 OPERATION MANUAL".

10.4.2 Registering Filter Information to Radiography Programs

■ Registering Filter Information to Radiography Programs

Set filter information for each radiography step on the radiography step editing screen.

- 1 Press the Filter Switching key on the radiography program editing screen to select a filter.



Filter Switching key

Reference To edit the radiography program, see [4.3 "Editing Radiography Programs"](#)

10.5 Displaying Dose Area Product

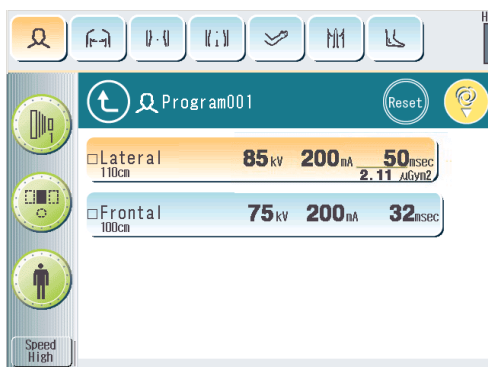
10.5.1 Displaying Dose Area Product

When in combination with an area dosimeter certificated by SHIMADZU, or R-300 or R-20J, the collimator by SHIMADZU, the dose area product can be displayed after exposure.

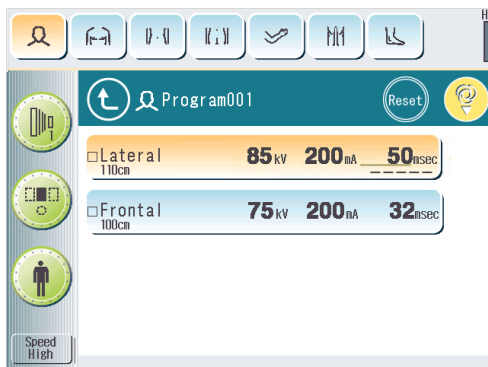
■ Displaying the dose area product

The dose area product is displayed after radiography.

 Reference [5.7 "Displays after Radiography"](#)

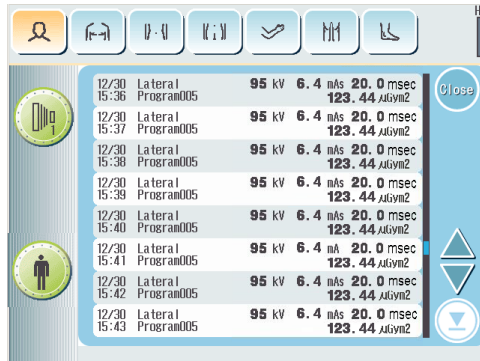


If data cannot be received from an area dosimeter, R-300 or R-20J, or when the collimator leaf is fully closed, the display will be as shown below:



The dose area product is also included in the radiography log screen.

 **Reference** [5.8 "Displaying Radiography Log"](#)



Time	Mode	kV	mA	mAs	msec	DAP (μSv/m ²)
12/30 15:36	Lateral Program005	95	6.4	nAs	20.0	123.44
12/30 15:37	Lateral Program005	95	6.4	nAs	20.0	123.44
12/30 15:38	Lateral Program005	95	6.4	nAs	20.0	123.44
12/30 15:39	Lateral Program005	95	6.4	nAs	20.0	123.44
12/30 15:40	Lateral Program005	95	6.4	nAs	20.0	123.44
12/30 15:41	Lateral Program005	95	6.4	nA	20.0	123.44
12/30 15:42	Lateral Program005	95	6.4	nAs	20.0	123.44
12/30 15:43	Lateral Program005	95	6.4	nAs	20.0	123.44

NOTE

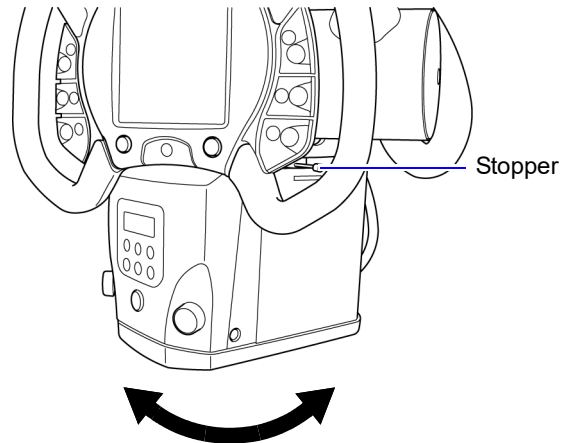
- When in combination with an area dosimeter, be sure to use an area dosimeter certificated by SHIMADZU. Also, an area dosimeter cannot be combined with equipment used for fluoroscopy.
- When the message "DAP meter error" appears on starting the system combined with an area dosimeter, the dose area product is not displayed.

 **Reference** [8.1.4 "Messages at Power ON"](#)

- The calculated dose area product values are just a guideline for reference purposes.
Approximately 35 % of measuring uncertainty may occur between an actual radiated dose value and calculation value. Accuracy of displayed calculation value is not guaranteed.
- Periodical calibration is required to keep the accuracy of the display for dose area product. Contact your Shimadzu service representative for details.
- When "-----" above appears again after exposure with the collimator leaf opened, contact your Shimadzu service representative.
- When using a small X-ray irradiation field or low-dose exposure conditions, the error between the actual dose and the calculated value may become large, or the indication of "-----" may appear.

 NOTE

If the collimator is rotated against the X-ray tube unit, the displayed dose area product may become larger than the actual value depending on the rotation angle, the collimator shutter position, and the maximum irradiation field size of the X-ray tube unit.



11

Specifications

This chapter describes the equipment specifications.

11.1 UD150B-40/D150BC-40/D150BC-45

Specifications

Table 11.1 UD150B-40/D150BC-40/D150BC-45 Specifications

Unit name		Specifications	
Radiography technique		Radiography, Bucky radiography, auto-changer radiography, tomography, direct spot filming, I.I. indirect spot filming, DR, direct serial radiography	
Number of connectable X-ray tubes		2 tubes (3 tubes optional)	
Setting range *1 *2 *3	Radiography	Tube voltage	40 to 150 kV
		Tube current	10 to 1000 mA
			Any 12 of the following positions permitted by the X-ray tube can be used for each focus: 1000, 900, 800, 710, 630, 560, 500, 450, 400, 360, 320, 280, 250, 220, 200, 180, 160, 140, 125, 110, 100, 90, 80, 71, 63, 56, 50, 45, 40, 36, 32, 28, 25, 22, 20, 18, 16, 14, 12, 11, 10 mA
		mAs	0.5 to 800 mAs
			Set from the following 65 positions. (500 mAs upper limit for AEC radiography.) 0.50, 0.56, 0.63, 0.71, 0.80, 0.90, 1.0, 1.1, 1.25, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10, 11, 12.5, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 71, 80, 90, 100, 110, 125, 140, 160, 180, 200, 220, 250, 280, 320, 360, 400, 450, 500, 560, 630, 710, 800 mAs
		Time	0.001 to 10 sec
	Set from the following 81 positions. (Cannot be set with an mAs value below 0.5 or above 800 mAs. 500 mAs upper limit for AEC radiography.) 1.0, 1.1, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10, 11, 12, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 71, 80, 90, 100, 110, 125, 140, 160, 180, 200, 220, 250, 280, 320, 360, 400, 450, 500, 560, 630, 710, 800, 900 ms, 1.0, 1.1, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10 sec		
	Fluoroscopy	Tube voltage	50 to 125 kV
		Tube current	0.3 to 20 mA
		Time	Total Time Display 99 min 99 sec, continuous fluoroscopy time 10 min.
Radiography programs		Advanced anatomical program method, offering up to 800 types of user-created radiography conditions.	
Display method		Liquid-crystal display of radiography conditions, etc.	
Setting method		touch panel	
Self-diagnostic functions		Displayed on touch panel	
Nominal supply voltage (50/60 Hz)	400 V system	380/400/415/440/480 VAC, 3-phase	
	200 V system	200/220/240 VAC, 3-phase	
	Factor depending on the waveform	1.00	

11.1 UD150B-40/D150BC-40/D150BC-45 Specifications

Unit name		Specifications
Power input		3-phase AC: 120 kVA
Rated output		80 kW (100 kV, 800 mA) Product of tube voltage and max. current that can flow in 0.1 s at 100 kV tube voltage
Short-time rating *2		150 kV 500 mA, 125 kV 630 mA, 100 kV 800 mA, 80 kV 1000 mA
Nominal max. tube voltage and max. tube current that can flow at nominal max. tube voltage *2		Short-time rating: 150 kV 500 mA Long-time rating: 125 kV 12 mA
Max. tube current and max. tube voltage to achieve max. tube current *2		Short-time rating: 80 kV 1000 mA Long-time rating: 75 kV 20 mA
Tube voltage and tube current combination for max. electrical output *2		Short-time rating: 80 kV 1000 mA, 100 kV 800 mA Long-time rating: 75 kV 20 mA, 125 kV 12 mA
Min. tube current time product		0.5 mAs
Nominal min. exposure time (AEC radiography) *4		3 ms
Long-time rating *2		75 kV 20 mA, 125 kV 12 mA
Dimensions	Operation panel	308 (W) × 345 (H) × 82 (D) mm
	Control cabinet	700 (W) × 1830 (H) × 400 (D) mm
Mass	Operation panel	2.5 kg
	Control cabinet	250 kg

*1 Setting range differs according to the X-ray tube type.

*2 Limited according to the X-ray tube type.

*3 The various conditions are as follows (conform to IEC-standards):

Tube voltage (within ± 8 %), Tube current (within ± 20 %)
mAs within ± (10 % + 0.2 mAs), Time within ± (10 % + 1 ms)

*4 9 ms if both of the following conditions apply.

- Setting time is over 1s.
- Phototimer receiver inside the FPD is used.

● Options

Phototimer (AEC) radiography option	Combination with the following receiver permits phototimer (AEC) radiography. The following types can be used: <ul style="list-style-type: none"> ① existing photomultiplier-type phototimer receiver (SPT-DY Series, etc.) ② Xe detector-type phototimer receiver (SPT-XD Series, etc.) ③ Phototimer receiver inside the FPD (CXDI-720C Wireless, etc.) Permitted combination: up to three receivers of type ① and ②. Type ③ cannot be used for Bucky radiography.
Communication Unit	Permits communication of radiographic conditions with other manufacturers' digital radiography units
Fluo Unit Option	Fluoroscopy is enabled

11.2 D150BC-41 Specifications

Table 11.2 D150BC-41 Specifications

Unit name		Specifications	
Radiography technique		Radiography, Bucky radiography, auto-changer radiography, tomography, direct spot filming, I.I.. indirect spot filming, DR, direct serial radiography	
Number of connectable X-ray tubes		1 tube	
Setting range *1 *2 *3	Radiography	Tube voltage	40 to 150 kV
		Tube current	10 to 1000 mA
			Any 12 of the following positions permitted by the X-ray tube can be used for each focus: 1000, 900, 800, 710, 630, 560, 500, 450, 400, 360, 320, 280, 250, 220, 200, 180, 160, 140, 125, 110, 100, 90, 80, 71, 63, 56, 50, 45, 40, 36, 32, 28, 25, 22, 20, 18, 16, 14, 12, 11, 10 mA
		mAs	0.5 to 800 mAs
			Set from the following 65 positions. (500 mAs upper limit for AEC radiography.) 0.50, 0.56, 0.63, 0.71, 0.80, 0.90, 1.0, 1.1, 1.25, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10, 11, 12.5, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 71, 80, 90, 100, 110, 125, 140, 160, 180, 200, 220, 250, 280, 320, 360, 400, 450, 500, 560, 630, 710, 800 mAs
		Time	0.001 to 10 sec
	Set from the following 81 positions. (Cannot be set with an mAs value below 0.5 or above 800 mAs. 500 mAs upper limit for AEC radiography.) 1.0, 1.1, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10, 11, 12, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 71, 80, 90, 100, 110, 125, 140, 160, 180, 200, 220, 250, 280, 320, 360, 400, 450, 500, 560, 630, 710, 800, 900 ms, 1.0, 1.1, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10 sec		
	Fluoroscopy	Tube voltage	50 to 125 kV
		Tube current	0.3 to 20 mA
		Time	Total Time Display 99 min 99 sec, continuous fluoroscopy time 10 min.
Radiography programs		Advanced anatomical program method, offering up to 800 types of user-created radiography conditions.	
Display method		Liquid-crystal display of radiography conditions, etc.	
Setting method		touch panel	
Self-diagnostic functions		Displayed on touch panel	
Nominal supply voltage (50/60 Hz)	400 V system	380/400/415/440/480 VAC, 3-phase	
	200 V system	200/220/240 VAC, 3-phase	
	Factor depending on the waveform	1.00	

Unit name		Specifications
Power input		3-phase AC: 120 kVA
Rated output		80 kW (100 kV, 800 mA) Product of tube voltage and max. current that can flow in 0.1 s at 100 kV tube voltage
Short-time rating *2		150 kV 500 mA, 125 kV 630 mA, 100 kV 800 mA, 80 kV 1000 mA
Nominal max. tube voltage and max. tube current that can flow at nominal max. tube voltage *2		Short-time rating: 150 kV 500 mA Long-time rating: 125 kV 12 mA
Max. tube current and max. tube voltage to achieve max. tube current *2		Short-time rating: 80 kV 1000 mA Long-time rating: 75 kV 20 mA
Tube voltage and tube current combination for max. electrical output *2		Short-time rating: 80 kV 1000 mA, 100 kV 800 mA Long-time rating: 75 kV 20 mA, 125 kV 12 mA
Min. tube current time product		0.5 mAs
Nominal min. exposure time (AEC radiography) *4		3 ms
Long-time rating *2		75 kV 20 mA, 125 kV 12 mA
Dimensions	Operation panel	308 (W) × 345 (H) × 82 (D) mm
	Control cabinet	700 (W) × 1830 (H) × 400 (D) mm
Mass	Operation panel	2.5 kg
	Control cabinet	250 kg

*1 Setting range differs according to the X-ray tube type.

*2 Limited according to the X-ray tube type.

*3 The various conditions are as follows (conform to IEC-standards):

Tube voltage (within ± 8 %), Tube current (within ± 20 %)
mAs within ± (10 % + 0.2 mAs), Time within ± (10 % + 1 ms)

*4 9 ms if both of the following conditions apply.

- Setting time is over 1s.
- Phototimer receiver inside the FPD is used.

● Options

Phototimer (AEC) radiography option	Combination with the following receiver permits phototimer (AEC) radiography. The following types can be used: ① existing photomultiplier-type phototimer receiver (SPT-DY Series, etc.) ② Xe detector-type phototimer receiver (SPT-XD Series, etc.) ③ Phototimer receiver inside the FPD (CXDI-720C Wireless, etc.) Permitted combination: up to three receivers of type ① and ② . Type ③ cannot be used for Bucky radiography.
Communication Unit	Permits communication of radiographic conditions with other manufacturers' digital radiography units
Fluo Unit Option	Fluoroscopy is enabled

11.3 UD150L-40/D150LC-40/D150LC-45

Specifications

Table 11.3 UD150L-40/D150LC-40/D150LC-45 Specifications

Unit name		Specifications	
Radiography technique		Radiography, Bucky radiography, auto-changer radiography, tomography, direct spot filming, I.I.. indirect spot filming, DR, direct serial radiography	
Number of connectable X-ray tubes		2 tubes (3 tubes optional)	
Setting range *1 *2 *3	Radiography	Tube voltage	40 to 150 kV
		Tube current	10 to 630 mA
			Any 12 of the following positions permitted by the X-ray tube can be used for each focus: 630, 560, 500, 450, 400, 360, 320, 280, 250, 220, 200, 180, 160, 140, 125, 110, 100, 90, 80, 71, 63, 56, 50, 45, 40, 36, 32, 28, 25, 22, 20, 18, 16, 14, 12, 11, 10 mA
		mAs	0.5 to 800 mAs
			Set from the following 65 positions. (500 mAs upper limit for AEC radiography.) 0.50, 0.56, 0.63, 0.71, 0.80, 0.90, 1.0, 1.1, 1.25, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10, 11, 12.5, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 71, 80, 90, 100, 110, 125, 140, 160, 180, 200, 220, 250, 280, 320, 360, 400, 450, 500, 560, 630, 710, 800 mAs
		Time	0.001 to 10 sec
	Set from the following 81 positions. (Cannot be set with an mAs value below 0.5 or above 800 mAs. 500 mAs upper limit for AEC radiography.) 1.0, 1.1, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10, 11, 12, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 71, 80, 90, 100, 110, 125, 140, 160, 180, 200, 220, 250, 280, 320, 360, 400, 450, 500, 560, 630, 710, 800, 900 ms, 1.0, 1.1, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10 sec		
	Fluoroscopy	Tube voltage	50 to 125 kV
		Tube current	0.3 to 9.0 mA
		Time	Total Time Display 99 min 99 sec, continuous fluoroscopy time 10 min.
Radiography programs		Advanced anatomical program method, offering up to 800 types of user-created radiography conditions.	
Display method		Liquid-crystal display of radiography conditions, etc.	
Setting method		touch panel	
Self-diagnostic functions		Displayed on touch panel	
Nominal supply voltage (50/60 Hz)		200/220/240/380/400/415/440/480 VAC, 3-phase	
		200/220/240 VAC, single-phase	
		Factor depending on the waveform : 1.00	
Power input		3-phase AC: 80 kVA Single-phase AC: 95 kVA	

11.3 UD150L-40/D150LC-40/D150LC-45 Specifications

Unit name		Specifications
Rated output		50 kW (100 kV, 500 mA) Product of tube voltage and max. current that can flow in 0.1 s at 100 kV tube voltage
Short-time rating *2		150 kV 320 mA, 125 kV 400 mA, 100 kV 500 mA, 80 kV 630 mA
Nominal max. tube voltage and max. tube current that can flow at nominal max. tube voltage*2		Short-time rating: 150 kV 320 mA Long-time rating: 125 kV 9 mA
Max. tube current and max. tube voltage to achieve max. tube current *2		Short-time rating: 80 kV 630 mA Long-time rating: 125 kV 9 mA
Tube voltage and tube current combination for max. electrical output*2		Short-time rating: 80 kV 630 mA, 100 kV 500 mA Long-time rating: 125 kV 9 mA
Min. tube current time product		0.5 mAs
Nominal min. exposure time (AEC radiography) *4		3 ms
Long-time rating *2		125 kV 9 mA
Dimensions	Operation panel	308 (W) × 345 (H) × 82 (D) mm
	Control cabinet	700 (W) × 1830 (H) × 400 (D) mm
Mass	Operation panel	2.5 kg
	Control cabinet	240 kg

*1 Setting range differs according to the X-ray tube type.

*2 Limited according to the X-ray tube type. The rating of 150 kV 320 mA may be limited to 10 ms depending on power circumstances.

*3 The various conditions are as follows (conform to IEC-standards):

Tube voltage (within ± 8 %), Tube current (within ± 20 %)
mAs within ± (10 % + 0.2 mAs), Time within ± (10 % + 1 ms)

*4 9 ms if both of the following conditions apply.

- Setting time is over 1s.
- Phototimer receiver inside the FPD is used.

● Options

Phototimer (AEC) radiography option	Combination with the following receiver permits phototimer (AEC) radiography. The following types can be used: ① existing photomultiplier-type phototimer receiver (SPT-DY Series, etc.) ② Xe detector-type phototimer receiver (SPT-XD Series, etc.) ③ Phototimer receiver inside the FPD (CXDI-720C Wireless, etc.) Permitted combination: up to three receivers of type ① and ② . Type ③ cannot be used for Bucky radiography.
Communication Unit	Permits communication of radiographic conditions with other manufacturers' digital radiography units
Fluo Unit Option	Fluoroscopy is enabled

11.4 D150LC-41 Specifications

Table 11.4 D150LC-41 Specifications

Unit name		Specifications	
Radiography technique		Radiography, Bucky radiography, auto-changer radiography, tomography, direct spot filming, I.I.. indirect spot filming, DR, direct serial radiography	
Number of connectable X-ray tubes		1 tube	
Setting range *1 *2 *3	Radiography	Tube voltage	40 to 150 kV
		Tube current	10 to 630 mA
			Any 12 of the following positions permitted by the X-ray tube can be used for each focus: 630, 560, 500, 450, 400, 360, 320, 280, 250, 220, 200, 180, 160, 140, 125, 110, 100, 90, 80, 71, 63, 56, 50, 45, 40, 36, 32, 28, 25, 22, 20, 18, 16, 14, 12, 11, 10 mA
		mAs	0.5 to 800 mAs
			Set from the following 65 positions. (500 mAs upper limit for AEC radiography.) 0.50, 0.56, 0.63, 0.71, 0.80, 0.90, 1.0, 1.1, 1.25, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10, 11, 12.5, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 71, 80, 90, 100, 110, 125, 140, 160, 180, 200, 220, 250, 280, 320, 360, 400, 450, 500, 560, 630, 710, 800 mAs
		Time	0.001 to 10 sec
	Set from the following 81 positions. (Cannot be set with an mAs value below 0.5 or above 800 mAs. 500 mAs upper limit for AEC radiography.) 1.0, 1.1, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10, 11, 12, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 71, 80, 90, 100, 110, 125, 140, 160, 180, 200, 220, 250, 280, 320, 360, 400, 450, 500, 560, 630, 710, 800, 900 ms, 1.0, 1.1, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10 sec		
	Fluoroscopy	Tube voltage	50 to 125 kV
		Tube current	0.3 to 9.0 mA
		Time	Total Time Display 99 min 99 sec, continuous fluoroscopy time 10 min.
Radiography programs		Advanced anatomical program method, offering up to 800 types of user-created radiography conditions.	
Display method		Liquid-crystal display of radiography conditions, etc.	
Setting method		touch panel	
Self-diagnostic functions		Displayed on touch panel	
Nominal supply voltage (50/60 Hz)		200/220/240/380/400/415/440/480 VAC, 3-phase	
		200/220/240 VAC, single-phase	
		Factor depending on the waveform : 1.00	
Power input		3-phase AC: 80 kVA Single-phase AC: 95 kVA	

Unit name		Specifications
Rated output		50 kW (100 kV, 500 mA) Product of tube voltage and max. current that can flow in 0.1 s at 100 kV tube voltage
Short-time rating *2		150 kV 320 mA, 125 kV 400 mA, 100 kV 500 mA, 80 kV 630 mA
Nominal max. tube voltage and max. tube current that can flow at nominal max. tube voltage*2		Short-time rating: 150 kV 320 mA Long-time rating: 125 kV 9 mA
Max. tube current and max. tube voltage to achieve max. tube current *2		Short-time rating: 80 kV 630 mA Long-time rating: 125 kV 9 mA
Tube voltage and tube current combination for max. electrical output*2		Short-time rating: 80 kV 630 mA, 100 kV 500 mA Long-time rating: 125 kV 9 mA
Min. tube current time product		0.5 mAs
Nominal min. exposure time (AEC radiography) *4		3 ms
Long-time rating *2		125 kV 9 mA
Dimensions	Operation panel	308 (W) × 345 (H) × 82 (D) mm
	Control cabinet	700 (W) × 1830 (H) × 400 (D) mm
Mass	Operation panel	2.5 kg
	Control cabinet	240 kg

*1 Setting range differs according to the X-ray tube type.

*2 Limited according to the X-ray tube type. The rating of 150 kV 320 mA may be limited to 10 ms depending on power circumstances.

*3 The various conditions are as follows (conform to IEC-standards):

Tube voltage (within $\pm 8\%$), Tube current (within $\pm 20\%$)
mAs within $\pm (10\% + 0.2 \text{ mAs})$, Time within $\pm (10\% + 1 \text{ ms})$

*4 9 ms if both of the following conditions apply.

- Setting time is over 1s.
- Phototimer receiver inside the FPD is used.

● Options

Phototimer (AEC) radiography option	Combination with the following receiver permits phototimer (AEC) radiography. The following types can be used: <ul style="list-style-type: none"> ① existing photomultiplier-type phototimer receiver (SPT-DY Series, etc.) ② Xe detector-type phototimer receiver (SPT-XD Series, etc.) ③ Phototimer receiver inside the FPD (CXDI-720C Wireless, etc.) Permitted combination: up to three receivers of type ① and ②. Type ③ cannot be used for Bucky radiography.
Communication Unit	Permits communication of radiographic conditions with other manufacturers' digital radiography units
Fluo Unit Option	Fluoroscopy is enabled

11.5 UD150V-40/D150VC-40/D150VC-45

Specifications

Table 11.5 UD150V-40/D150VC-40/D150VC-45 Specifications

Unit name		Specifications	
Radiography technique		Radiography, Bucky radiography, auto-changer radiography, tomography, direct spot filming, I.I.. indirect spot filming, DR, direct serial radiography	
Number of connectable X-ray tubes		2 tubes (3 tubes optional)	
Setting range *1 *2 *3	Radiography	Tube voltage	40 to 150 kV
		Tube current	10 to 800 mA
			Any 12 of the following positions permitted by the X-ray tube can be used for each focus: 800,710,650, 560, 500, 450, 400, 360, 320, 280, 250, 220, 200, 180, 160, 140, 125, 110, 100, 90, 80, 71, 63, 56, 50, 45, 40, 36, 32, 28, 25, 22, 20, 18, 16, 14, 12, 11, 10 mA
		mAs	0.5 to 800 mAs
			Set from the following 65 positions. (500 mAs upper limit for AEC radiography.) 0.50, 0.56, 0.63, 0.71, 0.80, 0.90, 1.0, 1.1, 1.25, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10, 11, 12.5, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 71, 80, 90, 100, 110, 125, 140, 160, 180, 200, 220, 250, 280, 320, 360, 400, 450, 500, 560, 630, 710, 800 mAs
		Time	0.001 to 10 sec
	Set from the following 81 positions. (Cannot be set with an mAs value below 0.5 or above 800 mAs. 500 mAs upper limit for AEC radiography.) 1.0, 1.1, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10, 11, 12, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 71, 80, 90, 100, 110, 125, 140, 160, 180, 200, 220, 250, 280, 320, 360, 400, 450, 500, 560, 630, 710, 800, 900 ms, 1.0, 1.1, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10 sec		
	Fluoroscopy	Tube voltage	50 to 125 kV
		Tube current	0.3 to 9.0 mA
		Time	Total Time Display 99 min 99 sec, continuous fluoroscopy time 10 min.
Radiography programs		Advanced anatomical program method, offering up to 800 types of user-created radiography conditions.	
Display method		Liquid-crystal display of radiography conditions, etc.	
Setting method		touch panel	
Self-diagnostic functions		Displayed on touch panel	
Nominal supply voltage (50/60 Hz)	400 V system	380/400/415/440/480 VAC, 3-phase	
	200 V system	200/220/240 VAC, 3-phase	
	Factor depending on the waveform	1.00	
Power input		3-phase AC: 120 kVA	

11.5 UD150V-40/D150VC-40/D150VC-45 Specifications

Unit name		Specifications
Rated output		65 kW (100 kV, 650 mA) Product of tube voltage and max. current that can flow in 0.1 s at 100 kV tube voltage
Short-time rating *2		150 kV 400 mA, 125 kV 500 mA, 100 kV 650 mA, 80 kV 800 mA
Nominal max. tube voltage and max. tube current that can flow at nominal max. tube voltage*2		Short-time rating: 150 kV 400 mA Long-time rating: 125 kV 9 mA
Max. tube current and max. tube voltage to achieve max. tube current *2		Short-time rating: 80 kV 800 mA Long-time rating: 125 kV 9 mA
Tube voltage and tube current combination for max. electrical output*2		Short-time rating: 100 kV 650 mA Long-time rating: 125 kV 9 mA
Min. tube current time product		0.5 mAs
Nominal min. exposure time (AEC radiography) *4		3 ms
Long-time rating *2		125 kV 9 mA
Dimensions	Operation panel	308 (W) × 345 (H) × 82 (D) mm
	Control cabinet	700 (W) × 1830 (H) × 400 (D) mm
Mass	Operation panel	2.5 kg
	Control cabinet	250 kg

*1 Setting range differs according to the X-ray tube type.

*2 Limited according to the X-ray tube type.

*3 The various conditions are as follows (conform to IEC-standards):

Tube voltage (within ± 8 %), Tube current (within ± 20 %)
mAs within ± (10 % + 0.2 mAs), Time within ± (10 % + 1 ms)

*4 9 ms if both of the following conditions apply.

- Setting time is over 1s.
- Phototimer receiver inside the FPD is used.

● Options

Phototimer (AEC) radiography option	Combination with the following receiver permits phototimer (AEC) radiography. The following types can be used: ① existing photomultiplier-type phototimer receiver (SPT-DY Series, etc.) ② Xe detector-type phototimer receiver (SPT-XD Series, etc.) ③ Phototimer receiver inside the FPD (CXDI-720C Wireless, etc.) Permitted combination: up to three receivers of type ① and ② . Type ③ cannot be used for Bucky radiography.
Communication Unit	Permits communication of radiographic conditions with other manufacturers' digital radiography units
Fluo Unit Option	Fluoroscopy is enabled

11.6 D150VC-41 Specifications

Table 11.6 D150VC-41 Specifications

Unit name		Specifications	
Radiography technique		Radiography, Bucky radiography, auto-changer radiography, tomography, direct spot filming, I.I.. indirect spot filming, DR, direct serial radiography	
Number of connectable X-ray tubes		1 tube	
Setting range *1 *2 *3	Radiography	Tube voltage	40 to 150 kV
		Tube current	10 to 800 mA
			Any 12 of the following positions permitted by the X-ray tube can be used for each focus: 800,710,650, 560, 500, 450, 400, 360, 320, 280, 250, 220, 200, 180, 160, 140, 125, 110, 100, 90, 80, 71, 63, 56, 50, 45, 40, 36, 32, 28, 25, 22, 20, 18, 16, 14, 12, 11, 10 mA
		mAs	0.5 to 800 mAs
			Set from the following 65 positions. (500 mAs upper limit for AEC radiography.) 0.50, 0.56, 0.63, 0.71, 0.80, 0.90, 1.0, 1.1, 1.25, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10, 11, 12.5, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 71, 80, 90, 100, 110, 125, 140, 160, 180, 200, 220, 250, 280, 320, 360, 400, 450, 500, 560, 630, 710, 800 mAs
		Time	0.001 to 10 sec
	Set from the following 81 positions. (Cannot be set with an mAs value below 0.5 or above 800 mAs. 500 mAs upper limit for AEC radiography.) 1.0, 1.1, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10, 11, 12, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 71, 80, 90, 100, 110, 125, 140, 160, 180, 200, 220, 250, 280, 320, 360, 400, 450, 500, 560, 630, 710, 800, 900 ms, 1.0, 1.1, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10 sec		
	Fluoroscopy	Tube voltage	50 to 125 kV
		Tube current	0.3 to 9.0 mA
		Time	Total Time Display 99 min 99 sec, continuous fluoroscopy time 10 min.
Radiography programs		Advanced anatomical program method, offering up to 800 types of user-created radiography conditions.	
Display method		Liquid-crystal display of radiography conditions, etc.	
Setting method		touch panel	
Self-diagnostic functions		Displayed on touch panel	
Nominal supply voltage (50/60 Hz)	400 V system	380/400/415/440/480 VAC, 3-phase	
	200 V system	200/220/240 VAC, 3-phase	
	Factor depending on the waveform	1.00	
Power input		3-phase AC: 120 kVA	

Unit name		Specifications
Rated output		65 kW (100 kV, 650 mA) Product of tube voltage and max. current that can flow in 0.1 s at 100 kV tube voltage
Short-time rating *2		150 kV 400 mA, 125 kV 500 mA, 100 kV 650 mA, 80 kV 800 mA
Nominal max. tube voltage and max. tube current that can flow at nominal max. tube voltage*2		Short-time rating: 150 kV 400 mA Long-time rating: 125 kV 9 mA
Max. tube current and max. tube voltage to achieve max. tube current *2		Short-time rating: 80 kV 800 mA Long-time rating: 125 kV 9 mA
Tube voltage and tube current combination for max. electrical output*2		Short-time rating: 100 kV 650 mA Long-time rating: 125 kV 9 mA
Min. tube current time product		0.5 mAs
Nominal min. exposure time (AEC radiography) *4		3 ms
Long-time rating *2		125 kV 9 mA
Dimensions	Operation panel	308 (W) × 345 (H) × 82 (D) mm
	Control cabinet	700 (W) × 1830 (H) × 400 (D) mm
Mass	Operation panel	2.5 kg
	Control cabinet	250 kg

*1 Setting range differs according to the X-ray tube type.

*2 Limited according to the X-ray tube type.

*3 The various conditions are as follows (conform to IEC-standards):

Tube voltage (within ± 8 %), Tube current (within ± 20 %)
mAs within ± (10 % + 0.2 mAs), Time within ± (10 % + 1 ms)

*4 9 ms if both of the following conditions apply.

- Setting time is over 1s.
- Phototimer receiver inside the FPD is used.

● Options

Phototimer (AEC) radiography option	Combination with the following receiver permits phototimer (AEC) radiography. The following types can be used: ① existing photomultiplier-type phototimer receiver (SPT-DY Series, etc.) ② Xe detector-type phototimer receiver (SPT-XD Series, etc.) ③ Phototimer receiver inside the FPD (CXDI-720C Wireless, etc.) Permitted combination: up to three receivers of type ① and ② . Type ③ cannot be used for Bucky radiography.
Communication Unit	Permits communication of radiographic conditions with other manufacturers' digital radiography units
Fluo Unit Option	Fluoroscopy is enabled

11.7 Environmental Conditions

To obtain proper performance, be sure to use the equipment under the specified environmental conditions.

11.7.1 Operation Environment

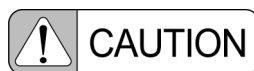
Use the equipment under the environmental conditions listed below:

The installation of a dedicated air-conditioner in the examination room and operation room is recommended if the building air-conditioning cannot meet the necessary environmental conditions.



Do NOT use the equipment in an oxygen rich environment.

In an oxygen rich environment, due to easy ignition, it may cause fatal or serious injuries or damage to the equipment.



Even under the prescribed conditions, avoid rapid changes of temperature or humidity.

Condensation may occur and cause failure. Also, rust or corrosion may occur inside the equipment.

- Atmosphere: No explosive or corrosive gases
- Ambient temperature: 10 °C to 40 °C
- Relative humidity: 30 % to 85 % (no condensation)
- Atmospheric pressure: 800 hPa to 1060 hPa
- Environment illuminance: 150 lx to 500 lx
- Ambient noise level: Under 70 dB

11.7.2 Power Supply Requirements



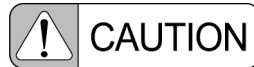
Be sure to use the power supply specified in the operation manual.

Using a power supply other than the one specified may cause equipment malfunction or serious accidents such as fire, smoke emission, or explosions.



Be sure to connect the equipment only to a (commercial) power outlet with a ground terminal.

If the outlet does not have a ground terminal, electric shock may occur.



If an earth leakage breaker is used with either power voltage, use an inverter-type earth leakage breaker to prevent malfunctions in the high-frequency circuits.

■ Power Input

	UD150B-40 D150BC-40/ BC-41/BC-45 UD150V-40 D150VC-40/ VC-41/VC-45	UD150L-40 D150LC-40/ LC-41/LC-45 (for 3-phase 400 V and 3-phase 200 V)	UD150L-40 D150LC-40/ LC-41/LC-45 (for single-phase 200 V)
Momentary	120 kVA	80 kVA	95 kVA
Standby	500 VA	500 VA	500 VA

■ 400 V, 3-phase System

- Frequency : 50/60 Hz
- Standard voltage and permitted voltage range and power-supply impedance under non-load conditions

Standard voltage	Permitted voltage range	Power-supply impedance	
		UD150B-40/V-40 D150BC-40/VC-40 D150BC-41/VC-41 D150BC-45/VC-45	UD150L-40 D150LC-40 D150LC-41 D150LC-45
380 V	±10%	0.10 Ω max.	0.16 Ω max.
400 V	±10%	0.11 Ω max.	0.17 Ω max.
415 V	±10%	0.12 Ω max.	0.19 Ω max.
440 V	±10%	0.13 Ω max.	0.21 Ω max.
480 V	±10%	0.16 Ω max.	0.25 Ω max.

- Relationship between cable length and cross-sectional area to match the transformer capacity

Transformer capacity:

75 kVA (3-phase): UD150B-40/V-40, D150BC-40/VC-40, D150BC-41/VC-41, D150BC-45/VC-45

50 kVA (3-phase): UD150L-40, D150LC-40, D150LC-41, D150LC-45

Length	Cross-sectional area	
	UD150B-40/V-40 D150BC-40/VC-40 D150BC-41/VC-41 D150BC-45/VC-45	UD150L-40 D150LC-40 D150LC-41 D150LC-45
10 m or less	5.5 mm ²	5.5 mm ²
20 m	8 mm ²	5.5 mm ²
30 m	14 mm ²	5.5 mm ²
40 m	22 mm ²	5.5 mm ²
50 m	22 mm ²	8 mm ²
60 m	22 mm ²	8 mm ²
70 m	38 mm ²	8 mm ²
80 m	38 mm ²	14 mm ²
90 m	38 mm ²	14 mm ²
100 m	38 mm ²	14 mm ²

- Safety Device

Type	Capacity		Rating	
	UD150B-40/ V-40 D150BC-40 VC-40 D150BC-41 VC-41 D150BC-45 VC-45	UD150L-40 D150LC-40 D150LC-41 D150LC-45	UD150B-40/ V-40 D150BC-40 VC-40 D150BC-41 VC-41 D150BC-45 VC-45	UD150L-40 D150LC-40 D150LC-41 D150LC-45
Circuit breaker	75 A min.	50 A min.	75 A	50 A

- Ground conditions: grounding resistance 10 Ω max.

■ 200 V, 3-phase System (requires Automatic Transformer option)

- Frequency: 50/60 Hz
- Standard voltage and permitted voltage range and power-supply impedance under non-load conditions

Standard voltage	Permitted voltage range	Power-supply impedance	
		UD150B-40/V-40 D150BC-40/VC-40 D150BC-41/VC-41 D150BC-45/VC-45	UD150L-40 D150LC-40 D150LC-41 D150LC-45
200 V	±10%	0.054 Ω max.	0.087 Ω max.
220 V	±10%	0.054 Ω max.	0.087 Ω max.
240 V	±10%	0.054 Ω max.	0.087 Ω max.

- Relationship between cable length and cross-sectional area to match the transformer capacity

Transformer capacity:

75 kVA (3-phase): UD150B-40/V-40, D150BC-40/VC-40, D150BC-41/VC-41, D150BC-45/VC-45

50 kVA (3-phase): UD150L-40, D150LC-40, D150LC-41, D150LC-45

Length	Cross-sectional area	
	UD150B-40/V-40 D150BC-40/VC-40 D150BC-41/VC-41 D150BC-45/VC-45	UD150L-40 D150LC-40 D150LC-41 D150LC-45
10 m or less	14 mm ²	8 mm ²
20 m	22 mm ²	14 mm ²
30 m	38 mm ²	14 mm ²
40 m	38 mm ²	22 mm ²
50 m	60 mm ²	38 mm ²
60 m	60 mm ²	38 mm ²
70 m	60 mm ²	38 mm ²
80 m	100 mm ²	60 mm ²
90 m	100 mm ²	60 mm ²
100 m	100 mm ²	60 mm ²

- Safety Device

Type	Capacity	Rating
Knife-switch with fuse or molded-case circuit	100 A min.	100 A
Knife-switch with fuse or Circuit breaker		

- Ground conditions: grounding resistance 100 Ω max.

■ **200 V, Single-phase System (for UD150L-40, D150LC-40, D150LC-41, D150LC-45)**

- Frequency: 50/60 Hz
- Standard voltage and permitted voltage range and power-supply impedance under non-load conditions

Standard voltage	Permitted voltage range	Power-supply impedance
200 V	+10% -5%	0.051 Ω max.
220 V	±10%	0.051 Ω max.
240 V	±10%	0.051 Ω max.

- Relationship between cable length and cross-sectional area to match the transformer capacity

Transformer capacity: 50 kVA

Length	Cross-sectional area
10 m or less	14 mm ²
20 m	22 mm ²
30 m	38 mm ²
40 m	60 mm ²
50 m	60 mm ²
60 m	100 mm ²
70 m	100 mm ²
80 m	100 mm ²
90 m	100 mm ²
100 m	100 mm ²

- Safety Device

Type	Capacity	Rating
Knife-switch with fuse or molded-case circuit	100 A min.	100 A
Knife-switch with fuse or Circuit breaker		

- Ground conditions: grounding resistance 100 Ω max.

■ Electrical rating of Starter SA-60 and SA-61

Item	Specifications
Phase	Single phase AC
Frequency	50/60 Hz
Standard voltages	AC200 V, AC208 V, AC220 V, AC230 V, AC240 V (for power and control circuits)
Permitted voltage range	±10 % of Standard voltages
Supply capacity	5 kVA
Power Supply Impedance	Less than or equal to 0.5 Ω
Operating current rating of the circuit breaker	30 A

11.7.3 Transportation and Storage Environment

Keep the system under the following environmental conditions during transportation or storage:



Rust and corrosion may be generated due to dew inside this unit. The internal circuits may be damaged by frozen dew at a low temperature. Pay rigid attention when this unit is stored in a place with drastic difference in temperature and humidity such as warehouse.

Item	Specifications
Temperature	-10 °C to 60 °C
Humidity	10 % to 95 % (non condensing)
Air pressure	700 hPa to 1060 hPa

11.7.4 Power Consumption

The table below shows the heat generated by the equipment in each room.

Room	Equipment used	Heat generated	
		UD150B-40/V-40 D150BC-40/VC-40 D150BC-41/VC-41 D150BC-45/VC-45	UD150L-40 D150LC-40 D150LC-41 D150LC-45
Control room	Operation panel	Approx. 50 kcal/h	Approx. 50 kcal/h
Examination room	Control cabinet (including high-voltage generator)	Approx. 680 kcal/h	Approx. 600 kcal/h

- The heat generated in the examination room includes the heat generated by the X-ray tube: 220 kcal/h (UD150B-40/V-40, D150BC-40/VC-40, D150BC-41/VC-41, D150BC-45/VC-45)
or 170 kcal/h (UD150L-40, D150LC-40, D150LC-41, D150LC-45).
- 1 kW = 860 kcal/h
- High-frequency current
Use the following values to calculate the high-frequency current:
6-pulse equivalent capacity = 19.5 kVA
Circuit identification No.= 31
Quoted from "X-ray Devices" in the Harmonics Suppression Technical Guideline (JEAG9702).

11.8 Classification of Equipment

This equipment is classified as follows, based on safety standards for electrical medical equipment.

■ Protection Method Against Electric Shock

Class I equipment

■ Classification of Applied Parts

No Applied Parts

■ Operation Mode

Continuous operation

■ Degree of Protection Against Liquid Ingress

- Ordinary equipment
- IPX1* (Drip proof) for foot switch only
 - * : The IPX Waterproof Specification, specified by the International Electrotechnical Commission, indicates waterproof/drip-proof performance on instruments and equipment.

■ For Use in an Oxygen-rich Environment



Do NOT use the equipment in an oxygen-rich environment.

he use in an oxygen-rich environment may cause fatal or serious injuries or damage to the equipment due to easy ignition.

■ For Use in Flammable Atmosphere



Do NOT use the equipment or system in the presence of flammable anesthetics gas.

It may cause an explosion.

■ Classification of Installation Type

Permanently installed equipment

11.9 Environmental Conditions of EMC (Electromagnetic Compatibility)

The equipment satisfies the EMC (Electromagnetic Compatibility) standard below:

- IEC 60601-1-2:2014+A1:2020



The equipment is suitable for installing at a professional healthcare facility environment except below:

- Medical treatment areas with high-powered medical electrical equipment (High frequency surgical equipment, short-wave therapy equipment)
- Inside the radio frequency shielded room of an MRI.

■ Classification of EMI in Accordance with IEC 60601-1-2:2014+A1:2020

Group 1, Class A

The system uses radio-frequency energy only for its internal function and is not intended to deliver energy to the patient. But little leakage radio-frequency energy does harm to high-sensitive equipment.

The system main power line in the clinical site should be connected to the domestic power sources which are separated from the public main network.



For replacement parts of internal components, make sure to apply the cables supplied by Shimadzu.

The use of non-cable devices, accessories, or cables other than those sold by Shimadzu as replacement parts for the internal components may result in increased emissions or decreased immunity of the equipment.



NOTE

The emissions characteristics of the system make it suitable for use in industrial areas and hospitals (CISPR 11 class A).

If it is used in a residential environment (for which CISPR 11 class B is normally required) the system might not offer adequate protection to radio-frequency communication services.

The user might need to take mitigation measures, such as relocating or re-orienting the system.

■ Performance to Be EMC Immunity Tested (Essential performance)

Essential performances of the equipment are as follows:

- Settings of X-ray conditions
- X-ray exposure
- Maintain accuracy of X-ray tube load condition
- Reproduction of radiation output
- Automatic Exposure Control (AEC)

If an essential performance of this equipment is degraded or lost due to electromagnetic disturbances, the following may occur.

- X-ray radiography conditions cannot be changed.
- X-ray exposure cannot be performed.
- The X-ray tube loading condition exceed the accuracy specified in IEC 60601-2-54.
- The radiation output exceed the accuracy specified in IEC 60601-2-54.
- AEC operates with errors exceeding the accuracy specified in IEC 60601-2-54.

■ Cable List

No.	Cable Type	Cable Length	Shield	Manufacturer
1	CH-XGEN CABLE	20 m	S	Shimadzu
2	UD Hand holder Cable	32 m	S	Shimadzu
3	POWER SUPPLY CABLE,3-PHASE	16 m	S	Shimadzu
4	GROUNDING CABLE	16 m	U	Shimadzu
5	PANEL SIGNAL CABLE-40	32 m	S	Shimadzu
6	PANEL EARTH CABLE CE	32 m	U	Shimadzu
7	HAND SWITCH C2U-23	0.8 m	U	Shimadzu
8	HT CABLE (CL)	30 m	S	Shimadzu
9	POWER SUPPLY CABLE SA-60	20 m	U	Shimadzu
10	CABLE JS1	5 m	S	Shimadzu
11	SIGNAL CABLE FOR GENERATOR CE	5 m	S	Shimadzu
12	LOW-VOLTAGE-CODE,#20D	28 m	S	Shimadzu
13	CABLE,SPTX4	30 m	S	Shimadzu
14	DAP RELAY CABLE	30 m	S	Shimadzu
15	CABLE N	18 m	U	Shimadzu
16	EARTH CABLE	22 m	U	Shimadzu
17	LOW-VOLTAGE-CODE,#20D	22 m	U	Shimadzu
18	DOOR SWITCH CABLE	---	U	---
19	LAMP CABLE	---	U	---
20	FOOT SWITCH	10 m	U	Shimadzu

S: Shielded / U: Unshielded



NOTE

The cables listed above are specified parts, compliant with standards.
 These parts are not provided to the equipment.

Guidance and Manufacturer's Declaration - Electromagnetic Immunity

Immunity test	EN 60601/IEC 60601 test level	Compliance level
Electrostatic discharge (ESD) EN 61000-4-2/ IEC 61000-4-2	±8 kV Contact ±2 kV, ±4 kV, ±8 kV, ±15 kV Air	±8 kV Contact ±2 kV, ±4 kV, ±8 kV, ±15 kV Air
Electrical fast transient/burst EN 61000-4-4/ IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines
Surge EN 61000-4-5/ IEC 61000-4-5	±0.5 kV, ±1 kV line(s) to line(s) ±0.5 kV, ±1 kV, ±2 kV line(s) to earth	±0.5 kV, ±1 kV line(s) to line(s) ±0.5 kV, ±1 kV, ±2 kV line(s) to earth
Voltage dips, short interruptions and voltage variations on power supply input lines EN 61000-4-11/ IEC 61000-4-11	Dip: N/A Short interruption 0 % U_T^{*1} ; 250/300 cycles	Dip: N/A Short interruption 0 % U_T ; 250/300 cycles
Power frequency (50/60 Hz) magnetic field EN 61000-4-8/ IEC 61000-4-8	30 A/m	30 A/m
Conducted RF EN 61000-4-6/ IEC 61000-4-6	150 kHz to 80 MHz 3 Vrms (outside ISM bands ^{*2}) 6 Vrms (in ISM bands) (1 kHz, AM80 %)	150 kHz to 80 MHz 3 Vrms (outside ISM bands) 6 Vrms (in ISM bands) (1 kHz, AM80 %)
Radiated RF EN 61000-4-3/ IEC 61000-4-3	80 MHz to 2.7 GHz 3 V/m (1 kHz, AM80 %) Enclosure port immunity to RF wireless communications equipment Refer to the Table 11.1.	80 MHz to 2.7 GHz 3 V/m (1 kHz, AM80 %) Enclosure port immunity to RF wireless communications equipment Refer to the Table 11.1.
Proximity magnetic fields EN 61000-4-39/ IEC 61000-4-39	134.2 kHz 65 A/m (Pulse modulation 2.1 kHz, 50 % duty cycle square wave signal)	134.2 kHz 65 A/m (Pulse modulation 2.1 kHz, 50 % duty cycle square wave signal)
	13.56 MHz 7.5 A/m (Pulse modulation 50 kHz, 50 % duty cycle square wave signal)	13.56 MHz 7.5 A/m (Pulse modulation 50 kHz, 50 % duty cycle square wave signal)
<p>Note</p> <p>*1: U_T is the a.c. mains voltage prior to application of the test level.</p> <p>*2: The ISM bands between 150 kHz and 80 MHz are 6.765 to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz.</p>		

11.9 Environmental Conditions of EMC (Electromagnetic Compatibility)

Table 11.1 Test specifications for ENCLOSURE PORT IMMUNITY to
RF Wireless Communications Equipment

Test frequency [MHz]	Modulation	EN 60601-1/ IEC 60601-1 test level (V/m)	Compliance level (V/m)
385	Pulse modulation: 18 Hz ^{*1}	27	19
450	FM ±5 kHz deviation: 1 kHz sine ^{*2}	28	28
710	Pulse modulation: 217 Hz ^{*1}	9	9
745			
780			
810	Pulse modulation: 18 Hz ^{*1}	28	28
870			
930			
1462	Pulse modulation: 217 Hz ^{*1}	10	10
1720	Pulse modulation: 217 Hz ^{*1}	28	19
1845			
1970			
2450	Pulse modulation: 217 Hz ^{*1}	28	19
5240	Pulse modulation: 217 Hz ^{*1}	9	9
5500			
5785			

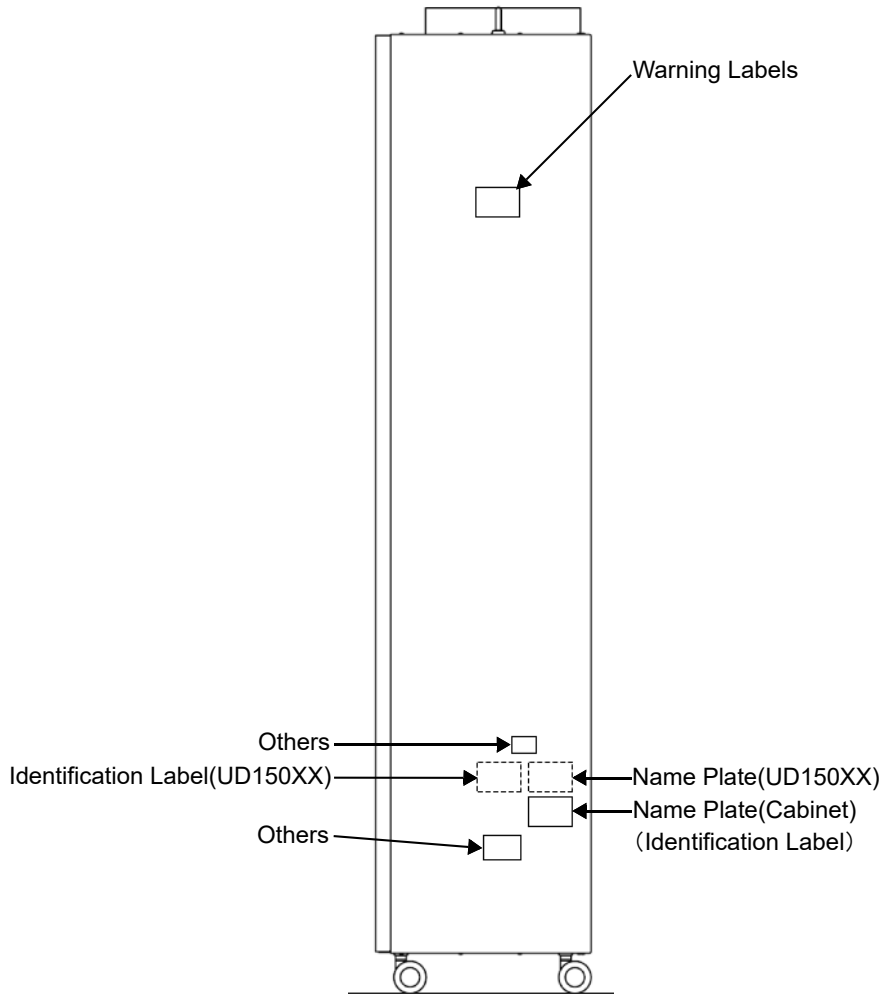
*1: The carrier shall be modulated using a 50 % duty cycle square wave signal.

*2: As an alternative to FM modulation, the carrier may be pulse modulated using a 50 % duty cycle square wave signal at 18 Hz. While it does not represent actual modulation, it would be worst case.

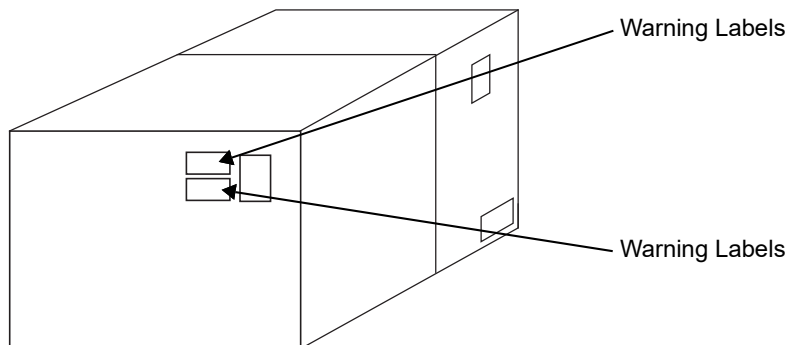
11.10 Labels

■ Location where the labels are attached on:

Control cabinet




Starter SA-60



■ Identification Label (UD150B-40/L-40/V-40)


UD150B-40

MODEL	UD150 B-40	NO.	
SUPPLY MAINS		INPUT POWER	
3	~ 200/400V	50/60Hz	120 kVA
	~	V 50/60Hz	kVA
MANUFACTURED			KYOTO


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SHIMADZU CORPORATION
 1, Nishinokyo-Kuwarabacho, Nakagyo-ku, Kyoto 604-8511, Japan


UD150L-40

MODEL	UD150 L-40	NO.	
SUPPLY MAINS		INPUT POWER	
3	~ 200/400V	50/60Hz	80 kVA
	~ 200	V 50/60Hz	95 kVA
MANUFACTURED			KYOTO


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SHIMADZU CORPORATION
 1, Nishinokyo-Kuwarabacho, Nakagyo-ku, Kyoto 604-8511, Japan

UD150V-40

MODEL	UD150 V-40	NO.	
SUPPLY MAINS		INPUT POWER	
3	~ 200/400V	50/60Hz	120 kVA
	~	V 50/60Hz	kVA
MANUFACTURED			KYOTO



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Name Plates

Name Plate (UD150B-40/L-40/V-40)
Included Recognition number (by the Ministry of Health and Welfare)


UD150B-40
(For IEC 60601-1:2005)

一般的名称 MODEL	据置型診断用X線発生装置 X-RAY HIGH VOLTAGE GENERATOR UD150B-40
販売名 医療機器の別 PN / SN	診断用X線高電圧装置 UD150B-40 管理医療機器 特管
V. Hz, VA RATED	3 ~ 200/220/240/380/400/415/440/480, 50/60, 120k 125kV, 12mA CONTINUOUS 75kV, 20mA 150kV, 500mA INSTANT
PROTECTION	CLASS I
MANUFACTURED	() (製造年月) MADE IN JAPAN
製造販売認証番号	22000BZX00454000号


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UD150B-40
(For IEC 60601-1:1988+A1:1991+A2:1995)

MODEL	X-RAY HIGH VOLTAGE GENERATOR UD150B-40
PN / SN	/ SN
V. Hz, VA RATED	3 ~ 200/220/240/380/400/415/440/480, 50/60, 120k 125kV, 12mA CONTINUOUS 75kV, 20mA 150kV, 500mA INSTANT
PROTECTION	CLASS I
MANUFACTURED	() MADE IN JAPAN


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UD150L-40
(For IEC 60601-1:2005)

一般的名称 MODEL	据置型診断用X線発生装置 X-RAY HIGH VOLTAGE GENERATOR UD150L-40
販売名 医療機器の別 PN / SN	診断用X線高電圧装置 UD150L-40 管理医療機器 特管
V. Hz, VA RATED	3 ~ 200/220/240/380/400/415/440/480, 50/60, 80k ~ 200/220/240, 50/60, 95k 125kV, 9mA CONTINUOUS 150kV, 320mA INSTANT
PROTECTION	CLASS I
MANUFACTURED	() (製造年月) MADE IN JAPAN
製造販売認証番号	22000BZX00456000号


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UD150L-40
(For IEC 60601-1:1988+A1:1991+A2:1995)

MODEL	X-RAY HIGH VOLTAGE GENERATOR UD150L-40
PN / SN	/ SN
V. Hz, VA RATED	3 ~ 200/220/240/380/400/415/440/480, 50/60, 80k ~ 200/220/240, 50/60, 95k 125kV, 9mA CONTINUOUS 150kV, 320mA INSTANT
PROTECTION	CLASS I
MANUFACTURED	() MADE IN JAPAN


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UD150V-40
(For IEC 60601-1:2005)

一般的名称 MODEL	据置型診断用X線発生装置 X-RAY HIGH VOLTAGE GENERATOR UD150V-40
販売名 医療機器の別 PN / SN	診断用X線高電圧装置 UD150V-40 管理医療機器 特管
V. Hz, VA RATED	3 ~ 200/220/240/380/400/415/440/480, 50/60, 120k 125kV, 9mA CONTINUOUS 150kV, 400mA INSTANT 80kV, 800mA
PROTECTION	CLASS I
MANUFACTURED	() (製造年月) MADE IN JAPAN
製造販売認証番号	22000BZX00458000号


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UD150V-40
(For IEC 60601-1:1988+A1:1991+A2:1995)

MODEL	X-RAY HIGH VOLTAGE GENERATOR UD150V-40
PN / SN	/ SN
V. Hz, VA RATED	3 ~ 200/220/240/380/400/415/440/480, 50/60, 120k 125kV, 9mA CONTINUOUS 150kV, 400mA INSTANT 80kV, 800mA
PROTECTION	CLASS I
MANUFACTURED	() MADE IN JAPAN



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■ Name Plate (Cabinet) (Identification Label)


D150BC-40

MODEL	D150BC-40		
PN / ID	562-23375-** / -----		
V. HZ. VA	3 ~ 200/220/240/380/400/415/440/480. 50/60. 120k		
RATED	125 kV.	12mA	CONTINUOUS
	75 kV.	20mA	
	150 kV.	500mA	INSTANT
	80 kV.	1000mA	
PROTECTION	CLASS I		
MANUFACTURED	-----		Made In Japan
565-10266-**			
 株式会社 島津製作所 604-8511 京都市中京区西ノ京原町1 SHIMADZU CORPORATION 1, Nishinokyo-Kuwabaracho, Nakagyo-ku, Kyoto 604-8511, Japan			


D150LC-40

MODEL	D150LC-40		
PN / ID	562-23375-** / -----		
V. HZ. VA	3 ~ 200/220/240/380/400/415/440/480. 50/60. 80k ~ 200/220/240. 50/60. 95k		
RATED	125 kV.	9mA	CONTINUOUS
	150 kV.	320mA	INSTANT
	80 kV.	630mA	
PROTECTION	CLASS I		
MANUFACTURED	-----		Made In Japan
565-10268-**			
 株式会社 島津製作所 604-8511 京都市中京区西ノ京原町1 SHIMADZU CORPORATION 1, Nishinokyo-Kuwabaracho, Nakagyo-ku, Kyoto 604-8511, Japan			

D150VC-40

MODEL	D150VC-40		
PN / ID	562-23375-** / -----		
V. HZ. VA	3 ~ 200/220/240/380/400/415/440/480. 50/60. 120k		
RATED	125 kV.	9mA	CONTINUOUS
	150 kV.	400mA	INSTANT
	80 kV.	800mA	
PROTECTION	CLASS I		
MANUFACTURED	-----		Made In Japan
565-10267-**			
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D150BC-41

MODEL	D150BC-41		
PN / ID	562-23375-** / -----		
V. HZ. VA	3 ~ 200/220/240/380/400/415/440/480. 50/60. 120k		
RATED	125 kV.	12mA	CONTINUOUS
	75 kV.	20mA	
	150 kV.	500mA	INSTANT
	80 kV.	1000mA	
PROTECTION	CLASS I		
MANUFACTURED	-----		Made In Japan
565-16245-**			
 株式会社 島津製作所 604-8511 京都市中京区西ノ京原町1 SHIMADZU CORPORATION 1, Nishinokyo-Kuwabaracho, Nakagyo-ku, Kyoto 604-8511, Japan			

D150LC-41

MODEL	D150LC-41		
PN / ID	562-23375-**-** / -----		
V, Hz, VA	3 ~ 200/220/240/380/400/415/440/480, 50/60, 80k ~ 200/220/240, 50/60, 95k		
RATED	125 kV, 9mA	CONTINUOUS	
	150 kV, 320mA	INSTANT	
	80 kV, 630mA		
PROTECTION	CLASS I		
MANUFACTURED		-----	Made in Japan
565-16247-**-**			
株式会社 島津製作所 604-8511 京都市中京区西ノ京桑原町1 SHIMADZU CORPORATION 1, Nishinokyo-Kuwabaracho, Nakagyo-ku, Kyoto 604-8511, Japan			

D150VC-41

MODEL	D150VC-41		
PN / ID	562-23375-**-** / -----		
V, Hz, VA	3 ~ 200/220/240/380/400/415/440/480, 50/60, 120k		
RATED	125 kV, 9mA	CONTINUOUS	
	150 kV, 400mA	INSTANT	
	80 kV, 800mA		
PROTECTION	CLASS I		
MANUFACTURED		-----	Made in Japan
565-16246-**-**			
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D150BC-45


MODEL	D150BC-45		
PN / SN	/ -----		
V, Hz, VA	3 ~ 200/220/240/380/400/415/440/480, 50/60, 120k		
RATED	125 kV, 12mA	CONTINUOUS	
	75 kV, 20mA		
	150 kV, 500mA	INSTANT	
	80 kV, 1000mA		
PROTECTION	CLASS I		
MANUFACTURED		-----	Made in Japan
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D150LC-45

MODEL	D150LC-45		
PN / SN	/ -----		
V, Hz, VA	3 ~ 200/220/240/380/400/415/440/480, 50/60, 80k ~ 200/220/240, 50/60, 95k		
RATED	125 kV, 9mA	CONTINUOUS	
	150 kV, 320mA	INSTANT	
	80 kV, 630mA		
PROTECTION	CLASS I		
MANUFACTURED		-----	Made in Japan
株式会社 島津製作所 604-8511 京都市中京区西ノ京桑原町1 SHIMADZU CORPORATION 1, Nishinokyo-Kuwabaracho, Nakagyo-ku, Kyoto 604-8511, Japan			

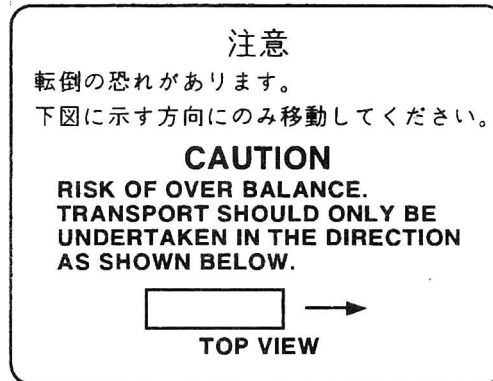
D150VC-45

MODEL	D150VC-45		
PN / SN	/ -----		
V, Hz, VA	3 ~ 200/220/240/380/400/415/440/480, 50/60, 120k		
RATED	125 kV, 9mA	CONTINUOUS	
	150 kV, 400mA	INSTANT	
	80 kV, 800mA		
PROTECTION	CLASS I		
MANUFACTURED		-----	Made in Japan
株式会社 島津製作所 604-8511 京都市中京区西ノ京桑原町1 SHIMADZU CORPORATION 1, Nishinokyo-Kuwabaracho, Nakagyo-ku, Kyoto 604-8511, Japan			

 **Reference** For the symbols shown on the labels, see 1.5 "Safety Symbols for System".

Warning Labels

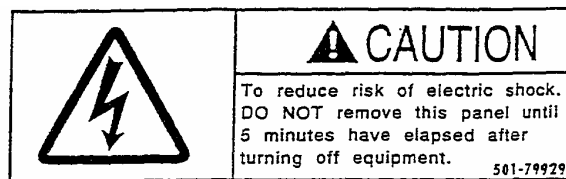
- Caution Label (transport direction)



- Caution Label

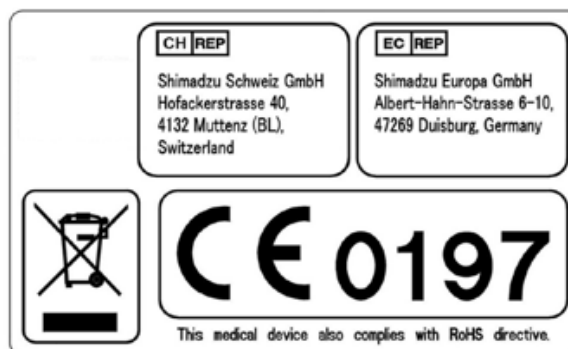


- Caution Label

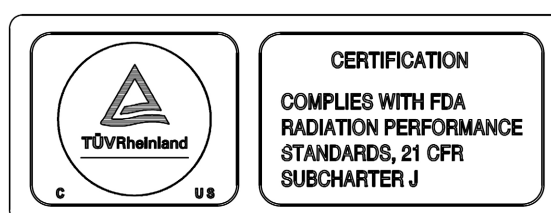


Others

- Label, CE (For CE)



- Label, cTUVus mark (For USA)



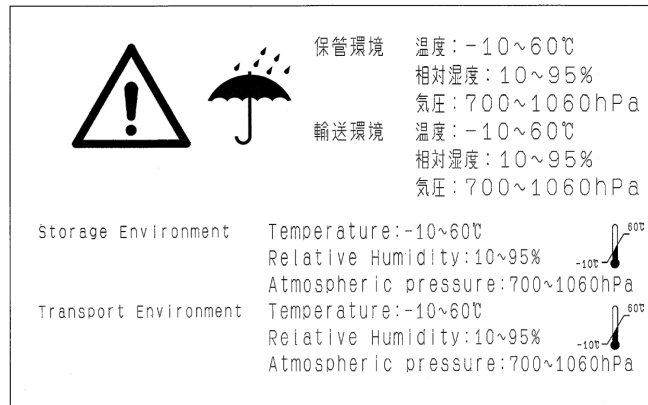
11 Specifications


- Label, Refer to operation manual



■ Package for transport

The following shows the label on the package for transportation, describing about storage environment and transport environment.



Symbol	Location	Meaning
	Package	Keep away from rain in during transport.

11.11 Statement of Compliance [For Europe]

11.11.1 Regulatory Information

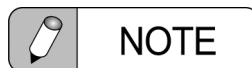
For Europe:

This product complies with the requirement of the Medical Device Directive 93/42/EEC and RoHS Directive 2011/65/EU.

Product Name: X-RAY HIGH VOLTAGE GENERATOR UD150B-40
X-RAY HIGH VOLTAGE GENERATOR UD150L-40
X-RAY HIGH VOLTAGE GENERATOR UD150V-40

Manufacturer: SHIMADZU CORPORATION Medical System Division
1, Nishinokyo-Kuwabaracho, Nakagyou-ku,
KYOTO, 604-8511, Japan

Authorized Representative Shimadzu Europa GmbH
/ Importer: Albert-Hahn-Strasse 6-10,
47269 Duisburg, Germany



When any serious incident occurred in relation to the system, report that to your Shimadzu service representative and to the competent authority of the Member State in you are established.

“Serious incident” means any incident that directly or indirectly led, might have led or might lead to any of the following:

- (a) The death of a patient, user or other person
- (b) The temporary or permanent serious deterioration of a patient's, user's or other person's state of health
- (c) A serious public health threat

11.11.2 Company's Quality System

The company's quality management system complies with the requirements of Annex II, excluding Section 4 of the MDD 93/42/EEC, which is certified by TÜV Rheinland LGA Products GmbH (Notified under No.0197)

11.11.3 International Standards

This equipment conforms the following international standards.

- IEC 60601-1:2005+A1:2012+A2:2020 / EN 60601-1:2006+A1:2013+A12:2014+A2:2021
- IEC 60601-1-2:2014+A1:2020 / EN 60601-1-2:2015+A1:2021
- IEC 60601-1-3:2008+A1:2013+A2:2021 / EN 60601-1-3:2008+A2:2021
- IEC 60601-1-6:2010+A1:2013+A2:2020 / EN 60601-1-6:2010+A1:2015+A2:2021
- IEC 60601-2-54:2022 / EN IEC 60601-2-54:2024
- ISO 10993-1:2018 Corrected version / EN ISO 10993-1:2020
- ISO 14971:2019 / EN ISO 14971:2019+A11:2021
- IEC 62304:2006+A1:2015 / EN 62304:2006+A1:2015
- IEC 62366-1:2015+A1:2020 / EN 62366-1:2015+A1:2020
- ISO 15223-1:2021 / EN ISO 15223-1:2021
- EN 1041:2008+A1:2013

11.11.4 Protection Against Radiation

Refer to the standard about the acceptance and performance testing.

(ex:DIN6868-150:2013-06)

11.12 Statement of Compliance with Standards

- X-RAY EQUIPMENT for RADIOGRAPHY and RADIOSCOPY ...
X-ray High Voltage Generator UD150B-40/L-40/V-40, D150BC-40/D150LC-40/
D150VC-40, D150BC-41/D150LC-41/D150VC-41, D150BC-45/LC-45/VC-45, GSC-
2002L
IEC 60601-2-54:2022
- X-RAY EQUIPMENT for RADIOGRAPHY and RADIOSCOPY ...
X-ray High Voltage Generator UD150B-40/L-40/V-40, D150BC-40/D150LC-40/
D150VC-40, D150BC-41/D150LC-41/D150VC-41, D150BC-45/LC-45/VC-45, GSC-
2002L
EN IEC 60601-2-54:2024

11.13 Manufacturer Information

Manufacturer : SHIMADZU CORPORATION
Medical Systems Division

Address : 1, NISHINOKYO-KUWABARACHO,
NAKAGYO-KU, KYOTO, 604-8511, JAPAN

11.14 Information on Radiation

11.14.1 Radiation Protection

To minimize X-ray exposure on patients and medical staff, the operator must observe the local laws and regulations specified in each region, as well as the following precautions. It is also highly recommended to study and know about the recommendations of the International Commission on Radiological Protection (ICRP).

■ Principle

- Limit X-ray irradiation to the minimum.

■ For Radiation Protection of Patients

- If there is any possibility that the regions easily affected by radiation (eye balls, gonad, etc.) are irradiated by X-ray, be sure to protect those regions.
- Adjust X-ray irradiation field appropriately to avoid X-ray irradiation to the area other than the region of interest.
- Keep the focus-skin distance as long as possible.

■ For Radiation Protection of Medical Staff

- If for some reason another person has to be in the examination room, that person must take adequate measures to protect themselves against radiation (protective apron, screen, etc.).

11.14.2 Deterministic Effect

Deterministic effects may occur when radiation dose on certain organs or body tissues exceeds the threshold. The areas of interest of diagnostic radiology are the skin and the crystalline lens. The threshold at which a deterministic effect occurs on these body tissues is 1 Gy to 3 Gy.

The operator must control exposure dose properly in consideration of the above, when using the equipment.

11.15 Appendix

Date implemented: _____

Implemented by: _____

11.15.1 Starting Inspection Checklist

Always carry out the inspection described below before using the system.

- 1 Check the following points visually before switching the power ON. Use the corrective actions to correct any problems.

Check points	Corrective action
<input type="checkbox"/> Are there unnecessary items near the equipment?	Clear them away.
<input type="checkbox"/> Before turning power ON, is the examination room safe?	Check this.
<input type="checkbox"/> Are cables trapped, twisted, or rubbing against anything?	Correct this.
<input type="checkbox"/> Are any cable connectors wet?	Dry them with a cloth.
<input type="checkbox"/> Is there any damage to cable insulation?	Contact your Shimadzu service representative.
<input type="checkbox"/> Are unusual dents, cracks or condensation visible on the surface of the equipment?	



- 2 Check visually that connections have been made correctly before switching the power ON. Correct any nonconformity.

Check points	Corrective action
<input type="checkbox"/> Is the cable connected correctly?	Connect it.

- 3 Turn the power ON. Check the following points visually and aurally. Correct any nonconformity.

Check points	Corrective action
<input type="checkbox"/> Does the display flicker?	Contact your Shimadzu service representative.
<input type="checkbox"/> Are there any unusual smells?	Turn the equipment's breaker OFF, and contact your Shimadzu service representative.
<input type="checkbox"/> Are all operation-related noises normal?	
<input type="checkbox"/> Are there any abnormal sounds or vibrations from X-ray Tube?	

4 Check the following items before using the unit.

Check points	Corrective action
<input type="checkbox"/> Has X-ray tube warm-up been performed?  Reference "X-ray Tube Unit Warm-up" (P.xiii)	Conduct warm-up.
<input type="checkbox"/> Are all options operating normally? For example, make sure that the photographic density is appropriate when using the AEC (phototimer).	Contact your Shimadzu service representative.
<input type="checkbox"/> Is the IBS  (image brightness stabilizer) normally? (OPTION) <ul style="list-style-type: none"> • Select the IBS mode. • Full open the collimator. • Execute the fluoroscopy. • Check that the FkV becomes lowest value (near the 50 kV). • Close the collimator during fluoroscopy. • Then check that the FkV becomes increasing the maximum limit kV. 	Contact your Shimadzu service representative.
<input type="checkbox"/> Is the displayed dose area product appropriate? <ol style="list-style-type: none"> 1) Set the radiography condition as 70 kV, 200 mA, and 10 msec. Do not use any added filter. Set AEC to OFF. 2) Adjust the collimator so that the X-ray irradiation field assumes a 14×14 inch size at an SID of 100 cm, and perform radiography. 3) Check the dose area product displayed. Check whether the difference of it and the value in the column below falls within ±30%. <p>"Dose Area product Column"</p> <p>Follow the procedure above as early as possible after installation and adjustment, and write down the dose area product displayed, with the unit.</p> <div style="border: 1px solid black; width: 100%; height: 20px; display: flex; justify-content: flex-end; align-items: center; padding-right: 5px;"> μGym² </div>	Contact your Shimadzu service representative.

Date implemented: _____
 Implemented by: _____

11.15.2 Ending Inspection Checklist

Always check the following points before finishing use of the system.

1 Check the following points visually before switching the power OFF. Use the corrective actions to correct any problems.

Check points	Corrective action
<input type="checkbox"/> Does the display flicker?	Contact your Shimadzu service representative.
<input type="checkbox"/> Are there any unusual smells?	Turn the equipment's breaker OFF, and contact your Shimadzu service representative.
<input type="checkbox"/> Are all operation-related noises normal?	
<input type="checkbox"/> Are there any abnormal sounds or vibrations from X-ray Tube?	

2 Switch the power OFF. Check the following points visually. Correct any nonconformity.

Check points	Corrective action
<input type="checkbox"/> Have unnecessary items in the vicinity of the system been cleared away?	Clear them away.
<input type="checkbox"/> Are any cables trapped, twisted, or rubbing against anything?	Correct this.
<input type="checkbox"/> Are any cable connectors wet?	Dry them with a cloth.
<input type="checkbox"/> Is there any damage to cable insulation?	Contact your Shimadzu service representative.
<input type="checkbox"/> Are unusual dents, cracks or condensation visible on the surface of the equipment?	

3 As often as necessary, clean and disinfect the system.

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