SAFETY

This power supply unit generates high voltage and energy. Electric shock may lead to death or serious injury. Be sure to follow the instructions below and handle the unit with caution.

1. **BE SURE TO GROUND!!**

   Be sure to ground the power supply unit before use.

2. **DO NOT TOUCH ANY HIGH VOLTAGE TERMINALS!!**

   Do not operate the power supply unless who is familiar with the operation process, the hazards of high voltage, and the treatment for the electrical shock is present.

3. **UNDERSTAND THE HAZARDS OF HIGH VOLTAGE!!**

   In case you let somebody operate the power supply for you, must be sure that he/she fully understands the hazards of high voltage and the areas where never can be touched.

4. **CUT OFF THE POWER BEFORE TOUCH THE UNIT!!**

   Cut off the power, and check that the power is OFF, before you touch the power supply. Capacitors in the output circuit are still charged and dangerous even after the power has been cut off. Discharge all remaining high voltage by grounding them.

5. **DISCONNECT THE INPUT LINES(AC LINES) !!**

   In case you need to touch the inside of the power supply following instruction manual, cut off the power and disconnect the input lines(AC lines), and ground all the capacitors and high voltage section.
   Don’t remove the case or touch the inside of power supply unless so instructed in the instruction manual.

6. **OPERATE THE POWER SUPPLY WITH YOUR RIGHT HAND!!**

   In order to avoid the electric shock to your important organs, operate the power supply with your right hand and keep your left hand off from the power supply.
Various symbols are used in this instruction manual and on the product for ensuring safety. What will be caused by ignoring the instructions given with the symbols or by improper handling are classified as shown below. Read carefully and understand the descriptions before proceeding to the main body of this manual.

⚠️ **Warning:** failure to follow the instructions with this indication may lead to death or serious injury.

⚠️ **Caution:** failure to follow the instructions with this indication may lead to injury or damage in property.

### Meanings of the Symbols

- Indicates that which requires caution.
- Indicates that which forbidden.
- Indicates that which must be done.
- Indicates electric shock hazard.

#### Symbols

Some of the symbols used are shown on the right.

#### Warning

- Do not touch the output terminal or the leads or load connected to it while the unit is in operation or immediately after it is stopped. Otherwise it may cause electric shock or injury.

- Do not install the unit in a place subject to steam or water vapor. Otherwise it may cause poor insulation and lead to fire or electric shock.

- Do not install the unit in a place subject to dew condensation. Otherwise it may cause electric shock.

- Do not modify or damage the cables. Otherwise it may cause electric shock.

- Do not place any object on the unit. Dangerous situations may occur if the object drops or falls. Do not put any object in the unit. It may cause damage.

- Be sure to ground the unit to avoid a rare possibility of electric shock. Otherwise it may lead to fire, electric shock or injury.

- Do not disassemble, remodel or repair the unit. High voltage may be built up inside, which may cause electric shock. Disassembly, remodeling or repair hamper ensuring of safety and may lead to dangerous situations.

- Do not install the unit outdoors or in a place subject to leaking of water, flood or snow. Otherwise it may cause electric shock.
After reading this manual, be sure to store it in a place convenient for the users so that it can be referred to at anytime.

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**Caution**

- **Do not install the unit upside down or on a wrong side.**
  Insufficient heat release may cause deterioration of parts, which may generate smoke or set fire.

- **Do not use the unit in a place subject to high temperature or in an enclosed, limited area.**
  It not only hampers the unit from achieving its performance but also causes deterioration of parts leading to smoking or burning.

- **Do not cover the vent holes of the unit.**
  Vent holes are provided to prevent elevation of temperature inside.
  Covering them not only hampers the unit from achieving its performance but also causes deterioration of parts, which may generate smoke or set fire.

- **Do not install the unit and the remote controller in a place subject to direct cold air.**
  Condensation may lead to electrical leak/burning.

- **Do not wipe the unit with chemicals (such as thinner) or wet cloth.**
  It may allow water inside leading to electric shock, electrical leak or burning.

- **Do not install the unit in a place subject to corrosive gas or liquid (such as a place where chemicals are handled).**
  Deterioration of parts may cause generation of smoke or burning.
First-aid procedures to be implemented in case of electrical shock

(1) RESCUE

FREE VICTIM FROM CONTACT WITH LIVE CONDUCTOR QUICKLY.
AVOID CONTACT WITH EITHER LIVE CONDUCTOR OR VICTIM’S BODY.

Shut off high voltage at once and ground circuit. If high voltage cannot be turned off quickly, ground circuit.
An ax with a dry wooden handle may be used to cut high voltage line.
Use extreme caution to avoid resulting electric flash.
If circuit cannot be broken or grounded, use a dry board, dry clothing, or other nonconductor to free victim.

(2) SYMPTOMS

NEVER ACCEPT ORDINARY AND GENERAL TESTS FOR DEATH.

Symptoms of electric shock may include unconsciousness, failure to breathe, absence of
pulse, pallor, and stiffness, as well as severe burns.
WHENEVER VICTIM IS NOT BREATHING PROPERLY, GIVE ARTIFICIAL RESPIRATION.

(3) TREATMENT

START ARTIFICIAL RESPIRATION IMMEDIATELY.

Perform artificial respiration at scene of accident, unless victim’s or operator’s life is endangered. IN THIS CASE ONLY, remove victim to safe location nearby, if new location is more than few feet away, give artificial respiration while victim is being moved.
After starting artificial respiration, continue without loss of rhythm for at least FOUR HOURS, or until victim is breathing without help.
If you have to change operators while giving artificial respiration, do so without losing rhythm of respiration.

(4) AFTER VICTIM REVIVES

Be prepared to resume artificial respiration, as he may stop breathing again.
When victim is COMPLETELY CONSCIOUS, give him a stimulant (NOT AN ALCOHOLIC DRINK) such as teaspoonful of aromatic spirits of ammonia in a small glass of water, hot coffee, or hot tea.
Keep victim warm and lying down until he has been conscious for at least fifteen minutes.
Artificial respiration

1. POSITION VICTIM
   Place victim in face-upward position and kneel close to his ear.

2. CLEAR THROAT
   Turn head to one side quickly wipe out any fluid, mucus, or foreign body from mouth and throat with fingers.

3. OPEN AIR PASSAGE
   Tilt head back and extend neck to open air passage.

4. LIFT JAW FORWARD
   Ice thumb in victim’s mouth and grasp jaw firmly. Lift jaw forward to pull tongue out of air passage. Do not attempt to hold or depress tongue.

5. PINCH NOSTRILS CLOSED
   With other hand pinch nostrils closed to prevent air leak.

6. FORM TIGHT SEAL WITH LIPS
   Rescuer’s wide-open mouth completely surrounds and seals open mouth of victim.
   This is not a kissing or puckered position—mouth of rescuer must be wide-open.

7. BLOW
   Exhale firmly into victim’s mouth until chest is seen to lift.
   This can be seen by rescuer without difficulty.

8. REMOVE MOUTH AND INHALE
   During this time, rescuer can hear and feel escape for air from lungs.
   Readjust position if air does not flow freely in and out of victim’s lungs.
   Continue at a rate of 12 to 20 times per minute.
   Breathing should be normal in rate with only moderate increase in volume so that rescue breathing can be continued for long periods without fatigue. Do not breathe too forcibly or too large a volume if victim is an infant or small child.
1 Introduction

1-1 Introduction
Thank you very much for your purchase of our product, HIGH VOLTAGE POWER SUPPLY. We do our best to exercise quality control of our products. You will please handle this unit properly according to this operation manual so that you may display the full capacity of this unit, operate it for smoothly in high efficiency for many years to come and safely. We have done our best to prepare this operation but if you should recognize a doubtful or unknown point or an omission, we are very sorry but would you please contact our company immediately.

1-2 Unpacking the High Voltage Power Supply
When unpacked, you will please check the following accessories are enclosed together with the power supply body.

〈Accessories〉

• Instruction Manual
• Output cable
• Connector Screw terminal 2pin Screw terminal 3pin Screw terminal 4pin D-type connector 9pin (1pc.)
• Screw 2pc.

1-3 Environmental requirements
• Install a high voltage power supply horizontally and use it.
• Never place an object on the high voltage power supply.
• Provide an ample space to the upper, right and left side of the high voltage power supply. Use it at the place where the ventilating condition is as good as possible.
• Avoid using the unit at such places where it is very dusty or there is much corrosive gas etc.
1–4 Points to be careful about in handling and care

WHEN TOUCHING LOAD AFTER TURNING OFF A HIGH TENSION

1. Make the setting of an output voltage to zero (0). Turn off the INTLK switch.
2. Turn the input voltage (24 VDC) OFF.
3. Earthling an output for longer than 10 seconds, check and confirm that the voltage is zero at another high tension voltmeter. It is especially dangerous that the load is capacitatively or a long cable is attached there to.
4. Make it a rule to touch load with right hand.

How to GROUND

- For safe operation, be sure to ground the ground terminal of power supply at one point on the ground.

If the Load frame is not grounded

![Diagram of load frame not grounded](image)

Wires should be:
- more than 5SQ
- less than about 2m
- not bared

If the Load frame is grounded

![Diagram of load frame grounded](image)

Wires should be:
- more than 5SQ
- less than about 2m
- not bared

- Be sure to complete grounding as shown above. Inadequate grounding may lead to electric shock of damage to the power supply unit, which is dangerous.
- If there is a possibility of development of a short-circuiting of load or discharging, make larger and shorter the grounding conductor.

IN ORDER TO INSURE SAFETY THE GROUND TERMINAL SHOULD BE EARTHED AT ALL TIME.
FOR SAFER OPERATION

1. Laying an insulation plate which can withstand the voltage to be used on the floor on which an operator stands, carry out the operation. If done so, it will be comparatively safe.

2. When operating a power supply and load, do so with right hand with left hand put in the pocket, taking care not to touch other objects.

3. After turning off the voltage (even if a long time has lapsed after turning off), if you touch load, be sure to earth the output longer than 10 seconds.

1–5 What to do before calling for service

- In case no output voltage is generated.

  1. Check whether or not a specified voltage has been inputted.
     - Input Voltage +24Vdc ±10%
     - Control voltage 0 – 10V at the time of controlling over external voltage.
     - Control voltage 0 – 10V at the time of controlling over external current.

- In case a discharging noise is generated near a high voltage output block:

  1. Check whether or not plug block of the high voltage connector (part shown with an arrow mark hereunder) is stained. If used with plug stained, a discharging phenomenon will develop sometimes inside connector sometimes. Wiping off stains with such liquids as alcohol, dry it fully and use it.
2 Exterior view diagram

PIN ASSIGNMENTS

J1  HV OUTPUT
  1  +10VDC REF
  2  N.C.

J2  1  +24VDC
    2  GND

J3  1  FILAMENT
    2  FILAMENT RETURN(GND)
    3  BIAS

J4  1  MONITOR RETURN(GND)
    2  kV MONITOR
    3  mA MONITOR
    4  INTLK

J5  1  +10VDC REF
    2  N.C.
    3  kV Prog Input
    4  RMT/LCL kV Prog Selector
    5  N.C.
    6  mA Prog Input
    7  RMT/LCL mA Prog Selector
    8  N.C.
    9  GND
WARNING
THIS EQUIPMENT GENERATES DANGEROUS VOLTAGE THAT MAY BE FATAL. PROPER GROUNDING OF ALL HIGH VOLTAGE EQUIPMENT IS ESSENTIAL.

CAUTION
ALWAYS OPERATE THE UNIT WITH THE COVER ON.

3-1 Overview
This product is a compact module power supply unit developed for small X-ray tubes. High voltage supply and filament supply are integrated and a tube current control function is provided.

3-2 Operation
1. Make sure that the specified connection (see 1-4 [Grounding]) is made with this unit before starting operation. For ensuring safety, be sure to ground the GROUND terminal of the unit.

2. Use the connector supplied to connect the power supply unit, filament, monitor and control system.
   For the control system, provide the J5 (D-sub 9-pin) connector as shown below.
   Output voltage control
   Local: connect between 3–4 (set with the kV ADJ trimmer).
   Remote: input the control voltage between 3–9 (GND).

   Output current control (tube current control)
   Local: connect between 6–7 (set with the mA ADJ trimmer).
   Remote: input the control voltage between 6–9 (GND).

3. Make sure that INTLK is turned OFF.
   (Note that High Voltage and Filament are output by next operation if INTLK is turned ON.)

4. Input 24 VDC as the input voltage. The PWR ON (green) and HV OFF (yellow) LEDs are illuminated.
5. Check the output voltage and output current (tube current) settings and set the voltage/current at will.

   For local setting, the following factory settings have been made.

   KV ADJ : 0 kV
   mA ADJ : 0 mA
   FIL LIM : see right table

   Factory setting of Filament Limit is 
   ☑ marked in the box.

<table>
<thead>
<tr>
<th>FIL LIM</th>
<th>1.24A</th>
<th>1.3A</th>
<th>1.37A</th>
<th>1.5A</th>
<th>1.7A</th>
<th>1.8A</th>
<th>2.3A</th>
<th>2.5A</th>
<th>3.2A</th>
<th>3.3A</th>
<th>3.5A</th>
</tr>
</thead>
</table>

   ![CAUTION](Set the anode voltage more than 5kV. If set to less than 5kV, there shall be no anode current due to filament protection function.)

6. Turn the interlock (INTLK) ON. The HV ON (red) LED is illuminated and High Voltage and Filament are output. High Voltage and Filament output are linearly ramped up in approximately 5 to 6 seconds.

7. Output voltage and output current (tube current) can be checked with the monitor.

8. To finish the operation of the power supply unit, turn the interlock (INTLK) and input voltage (24 VDC) OFF.
3–3 Connection and description of connectors

a. HIGH VOLTAGE FILAMENT

![X-ray tube CONNECTIONS diagram]

b. J2 : 24V INPUT CONNECTIONS

![J2 connections diagram]

<table>
<thead>
<tr>
<th>MODEL</th>
<th>INPUT CURRENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>HXR-〇〇〇-50-△△</td>
<td>4A max</td>
</tr>
<tr>
<td>HXR-〇〇〇-60-△△</td>
<td>4.8A max</td>
</tr>
<tr>
<td>HXR-〇〇〇-75-△△</td>
<td>6A max</td>
</tr>
<tr>
<td>HXR-〇〇〇-100-△△</td>
<td>8A max</td>
</tr>
</tbody>
</table>
c. J3 : FILAMENT CONNECTIONS

- J3
- BIAS
- FIL RTN
- FIL
- X-RAY TUBE FILAMENT
- FILAMENT P.S.
- 3.5A
- 5.5V

**CAUTION**
Please ensure that either the Specified resister or lamp is used.

3.5A
5.5V : Variable with BIAS ADJ trimmer (LB option)

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d. J4 : MONITORS: INTERLOCK CONNECTIONS

**CAUTION**
To prevent damage to the power supply, please do not connect the INTLK (J4 connector pins 4) directly to the ground.

- +24V
- RY
- 300Ω / 1~2W
- RESISTER or LAMP
- 12V LAMP (0.5W~0.7W)
- INTER LOCK
- 1kΩ
- 1kΩ
- 4
- 3
- mA MON
- 2
- kV MON
- 1
- MON RTN
- M +
- M -
e. J5 : I/O CONTROL CONNECTIONS (D-sub 9Pin)

① LOCAL CONTROL

- Pin 1: +10V REF OUTPUT (20mA MAX)
- Pin 2: N.C.
- Pin 3: SHORT (set with the kV ADJ trimmer)
- Pin 4: SHORT (set with the mA ADJ trimmer)
- Pin 5: N.C.
- Pin 6: N.C.
- Pin 7: N.C.
- Pin 8: N.C.
- Pin 9: N.C.
2 EXT. VOLTAGE CONTROL

![Diagram of EXT. VOLTAGE CONTROL](image)
3 Instructions for handling

③ EXT. POTENTIOMETER CONTROL

※1 VR = 5kΩ or 10kΩ recommended (MIN 1kΩ)
3–5 Option

**Bias Supply**

Output terminal J3–3
Via internal multi-turn potentiometer (BIAS ADJ) 0 to –300V, adjustable.
Load current is 0.25mA, load regulation is 1%
The unit will be preset to 0V prior to shipment.
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