

## PROYECTO DE ROTULO

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**Importador:** REHUE SA

**Dirección:** CALLE ENTRE RÍOS 331 , CIUDAD DE MENDOZA , CP 5500.  
PROVINCIA DE MENDOZA, ARGENTINA.

**NOMBRE GENERICO:** SISTEMA DE RAYOS X.

**MODELO:** EXSYS DEXI-D401S-FRM

EXSYS DEXI-A401S-FRM,

EXSYS DEXI-D402S-FRM,

EXSYS DEXI-A402S-FRM

EXSYS DEXI-D401P-FRM

EXSYS DEXI-A401P-FRM

EXSYS DEXI-D402P-FRM

EXSYS DEXI-A402P-FRM

EXSYS DEXI-D503T-FRM

EXSYS DEXI-A503T-FRM

EXSYS DEXI-D401S-FRA

EXSYS DEXI-D402S-FRA

EXSYS DEXI-D401P-FRA

EXSYS DEXI-D402P-FRA

EXSYS DEXI-D503T-FRA

**MARCA:** DRTECH

**LOTE:** XX XX XX

**FECHA DE FABRICACION:** XX/XX/XX

**VENCIMIENTO:** XX/XX/XX

**VER INSTRUCCIONES DE USO.**

**Director Técnico:** LIC .FEDERICO CASTRO RAMOS  
**MATRICULA N°:** 2992

**'VENTA EXCLUSIVA A PROFESIONALES E INSTITUCIONES DE SANITARIAS'**

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**Identificación del producto:**

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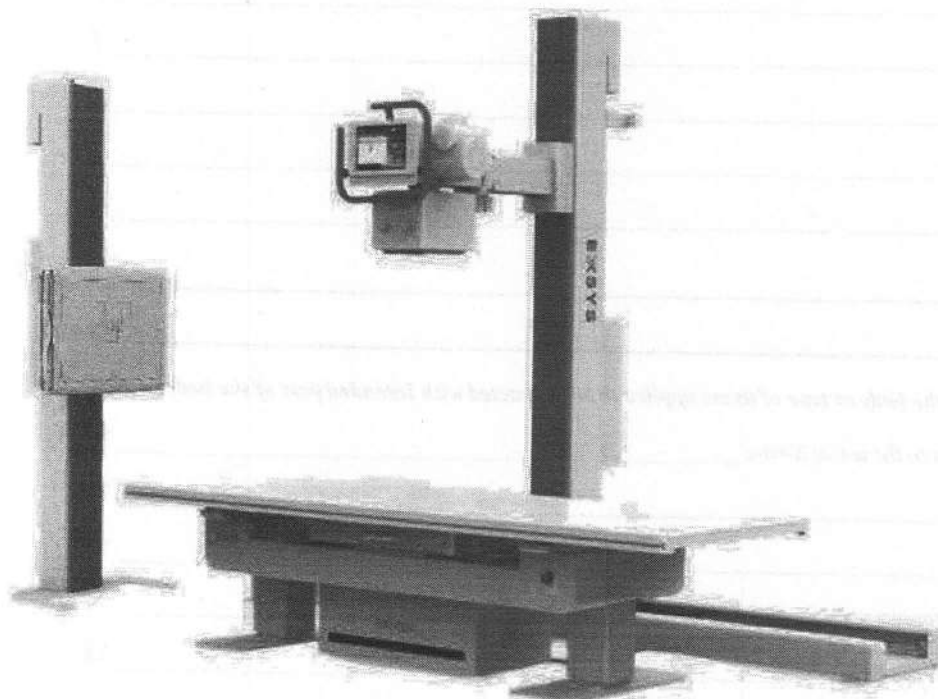
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## EXSYS DEXi [Manual, Standard Type]

[Installation, Operation and Service Manual]



**DRTECH**

Digital Radiography Technologies

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**EXSYS DEXi**

Installation, Operation and Service Manual

**DRTECH**

## Chapter 1

# Manual Introduction

**Diagnostic X-ray System**

**[EXSYS DEXi]**

  
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# 1 Manual Introduction

## 1.1 Introduction

This manual provides information necessary for installation of EXSYS DEXi, troubleshooting, using the product, and performing product maintenance.

This manual is copyrighted by DRTECH, and it is illegal to copy and use part or all of the contents of this manual without our consent.

EXSYS DEXi is a product designed and manufactured in Korea.

Product functions or specifications are subject to change without notice.

## 1.2 Manual Contents

All illustrations in this manual are examples and may differ from the actual ones. This manual is not described with all options being included. Therefore, the options selected by the customer may not be included in the manual.

Product users should read the manual and be familiar with the contents, and after reading it, store it in an easy-to-find place to prevent loss.

## 1.3 Service

For technical support and purchase of accessories, contact the number below.

### Legal Manufacturer

Legal Manufacturer: DRTECH Corporation

Address: Suite No.1, 2 Floor / Suite No. 2, 3 Floor, 29, Dunchon-daero 541 beon-gil, Jungwon-gu, Seongnam-si, Gyeonggi-do, 13216, Republic of Korea

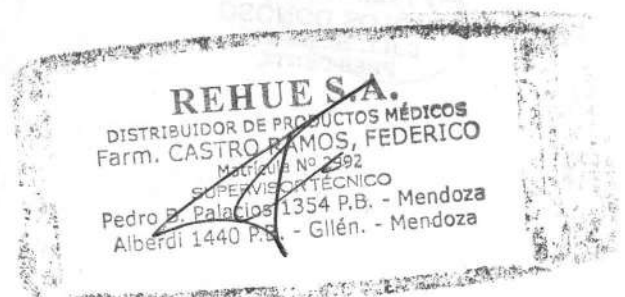
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**Manufacturer**

Manufacturer: ECORAY Co., Ltd

Address: 60-10, Nanosandan 5-ro, Nam-myeon, Jangseong-gun, Jeollanam-do, Republic of Korea

Homepage: <https://www.eco-ray.co.kr>

**1.4 Service period**

The free service period of the product is based on the factory shipment date, and is free of charge for 2 years, and the paid service is within 5 years from the end of the free service.

(However, free service of X-Ray tube, DAP, AEC Chamber is within one year, according to the standards of the parts manufacturer)

**1.5 Responsibility**

- DRTECH is responsible for product quality when installation, product maintenance, or repair is performed by an engineer authorized by DRTECH Corporation.
- DRTECH shall not be held liable for failure caused by user's neglect to maintain the product, wrong combination of the product, or the wrong product use.
- The product should be operated only by persons who have the required qualifications and training to use the product, and the product user is responsible for checking and managing it.
- Authorized Representative in the European
  - Title : DRTECH Europe GmbH
  - Address: Otto-Volger-Straße 3a, 65843 Sulzbach (Taunus), Germany
  - E-mail : [drlee@drtech.com](mailto:drlee@drtech.com)

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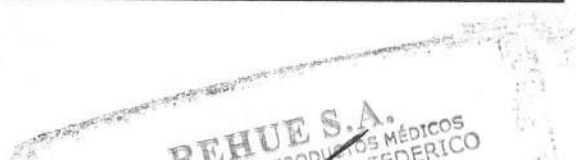


### 1.6 Revision History

The revision number identifies the update status of the manual, and the revision number and revision details are summarized in the table below.

| Revision No. | Application date | Changes                                        |
|--------------|------------------|------------------------------------------------|
| 00           | 2023-03-24       | First edition                                  |
| 01           | 2023-11-23       | Revision due to addition of components         |
| 02           | 2024-09-01       | Change of EU representative's physical address |
|              |                  |                                                |
|              |                  |                                                |
|              |                  |                                                |
|              |                  |                                                |
|              |                  |                                                |
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## Chapter 2

### Introduction of Products

#### Diagnostic X-ray System

**[EXSYS DEXi]**

  
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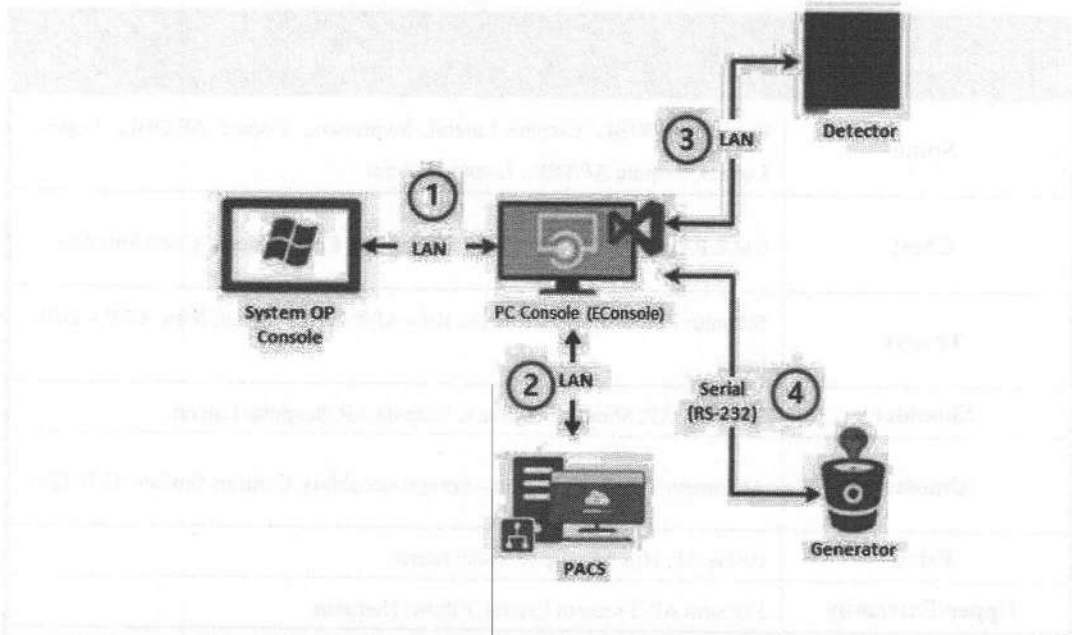
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## 2. Introduction

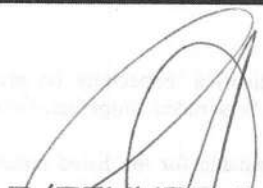
This equipment is general radiography x-ray system and it was controlled by high frequency type. This equipment is consisting of x-ray tube, tube stand, wall bucky stand, patient table, x-ray generator. Also, it has accessories with hand switch for X-ray exposure.

- Model name : EXSYS DEXi

### Description of all interfaces and communication protocols available on the device



| NO | Function                         | Function Description                           |
|----|----------------------------------|------------------------------------------------|
| 1  | System OP Console and PC Console | LAN Communication                              |
| 2  | PC Console and PACS              | DICOM communication with hospital PACS via LAN |
| 3  | PC Console and Wired Detector    | LAN Communication                              |
| 4  | PC Console and X-ray Generator   | Serial(RS-232) Communication                   |

  
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## 2.1 Intended Use

The EXSYS DEXi is a diagnostic X-ray system intended for use in generating radiographic images of human anatomy for general purpose. The system obtains necessary information of patient's anatomical structure by an image processing (workstation) after process of examination using radiation exposure with DR. This system is not intended for mammography applications.

## 2.2 Intended part of the body or type of tissue applied to or interacted with Intended part of the body:

| Anatomical region | Exam example                                                                                                  |
|-------------------|---------------------------------------------------------------------------------------------------------------|
| Spine             | C-spine AP/OBL, C-spine Lateral, Swimmers, T-spine AP/OBL, T-spine Lateral, L-spine AP/OBL, L-spine Lateral   |
| Chest             | Chest PA(High), Chest PA(Low), Chest AP, Chest Lateral, Chest Portable.                                       |
| Thorax            | Sternum RAO, Sternum Lateral, Ribs AP/PA/OBL upper, Ribs AP/PA/OBL lower                                      |
| Shoulder          | Shoulder AP, Shoulder Axillary, Scapula AP, Scapular Lateral.                                                 |
| Abdomen           | Abdomen – KUB, Abdomen – upright/decubitus, Contrast Studies (IVP, GB)                                        |
| Pelvis            | Pelvis AP, Hip AP, Hip X-Table lateral.                                                                       |
| Upper-Extremity   | Forearm AP, Forearm Lateral, Elbow, Humerus.                                                                  |
| Lower-Extremity   | Ankle AP-Mortise, Ankle Lateral, Tib-Fib AP, Tib-Fib Lateral, Knee AP-Lateral, Knee Tunnel, Femur AP-Lateral. |

## 2.3 Features

This equipment is used in x-ray room for general radiography purpose and it has features as follows.

High frequency inverter type x-ray generator, it could get stability x-ray output and low voltage ripple.  
Dual focal X-ray Tube with high level heating unit to get more good image and high value x-ray output.

- Robust structure and smooth movement structure.
- Low dose Collimator
- Overheating sensor and Protection circuit for X-ray tube.

## 2.4 Contraindications to the use of X-rays

The exposure of humans to ionizing radiation must always be medically justified. Especially on pregnant women, children and adolescents this procedure should be used with caution or be avoided altogether. However, the final decision lies with the attending physician or attending surgeon.

For the purpose of diagnosis on diseases using radiation, it is not recommendable for the listed patients as following on radiation diagnosis.

- \* Pregnant women
- \* Patients who get an implantable pace makers or implantable defibrillators transplant.
- \* Infants under 6 months.
- \* Patient with cardiovascular disease or orthosis.

## 2.5 Options

The present Operating Instructions describe a system with maximum configuration. The system configuration chosen by you may not contain all options and functions described here.

## 2.6 Side Effects

- Exposing high dose of radiation directly to patient's eyeballs might cause eye diseases.
- Exposing radiation to infant or pregnant woman without protection might cause genetic disorder.
- Exposing radiation to patient equipped with cardiac pacemaker due to cardiovascular disease might cause stop of the cardiac pacemaker.

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**2.7 X-ray protective equipment**

We recommend that you use the following X-ray protective equipment:

- X-ray protective apron
- X-ray protective eyewear
- Thyroid collar
- X-ray protective gloves

**2.8 Classification of Equipment**

This system is classified as follows, based on safety standards for electrical medical equipment.

- Type of protection against electric shock: Class I
- Degree of protection against electric shock (Patient connections): Type B applied part for table top of patient table and bucky stand
- Degree of protection against harmful ingress of water or particulate matter: Ordinary equipment (IPX0) except for wireless flat panel digital X-ray detector, type EVS 4343W, EVS 4343WG, EVS 4343WP, EVS 3643W, EVS 3643WG and EVS 3643WP (IP54)
- Degree of protection against harmful ingress of water or particulate matter:  
4 way patient table(DPT-4A, DPT-4B) foot switch : IPX4  
6 way patient table(DPT-6A, DPT-6B) foot switch : IPX6
- Methods of sterilization: The equipment is not intended to be sterilized by user
- Degree of safety application for use in an oxygen environment: Not applicable
- Mode of operation: Non-continuous operation (Resting time: Min. 5 min at max. mAs condition)

**2.9 Essential Performance**

|                                                                |
|----------------------------------------------------------------|
| ESSENTIAL PERFORMANCE requirements according to IEC 60601-2-54 |
| Accuracy of LOADING FACTORS                                    |
| Reproducibility of the RADIATION output                        |
| Imaging performance                                            |

  
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## 2.10 Intended patient population

| Item   | Details                 |
|--------|-------------------------|
| Age    | No special requirements |
| Gender | No special requirements |
| Weight | Max. 300 kg             |
| Height | No special requirements |
| Race   | No special requirements |
| Health | No special requirements |

## 2.11 Intended User Profile

The EXSYS DEXi is intended used by trained healthcare professional, especially radiologist, only.

| Item                    | Details                                                                                                                                                                                                          |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Education               | - A professional with specialist knowledge/ qualifications who has fully understood the product and the contents of this document. (Such as a doctor or radiological technologist)                               |
| Knowledge               | - Read and understand Western "Arabic numerals" written in Arial font<br>- Can distinguish human body<br>- Understands hygiene                                                                                   |
| Language Understanding  | - Understanding of manual that is written in English                                                                                                                                                             |
| Experience              | - Physician or certified operator                                                                                                                                                                                |
| Permissible impairments | - Mild reading vision impairment or corrected vision to log MAR 0.2<br>- Average degree of age-related short term memory impairment<br>- Impaired by 40 % resulting in 60 % of normal hearing at 500 Hz to 2 kHz |

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## 2.12 Symbols marked on EXSYS DEXi

| Symbol                                                                              | Description                                                                                                                                             |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | Read and understand all instructions and warning labels in the product documentation before using the equipment. Keep this manual for future reference. |
|    | General warning:<br>This symbol indicates hazard.                                                                                                       |
|    | High Voltage Caution:<br>This symbol means high voltage parts included.                                                                                 |
|    | Radiation Warning:<br>This symbols indicates radiation warning.                                                                                         |
|    | Warning: Optical radiation<br>This symbol indicates optical radiation warning.                                                                          |
|    | Protective earth:<br>This symbols means protective earth.                                                                                               |
|   | Serial Number:<br>This symbol means serial number of product.                                                                                           |
|  | EU-Representatives information: The manufacturer's EU representative information shows with this symbol.                                                |
|  | Country and date of manufacture                                                                                                                         |
|  | Manufacturer information:<br>The manufacturer's information shows with this symbol.                                                                     |
|  | The Waste Electrical and Electronic Equipment Regulations indicate separate collection for electrical and electronic equipment.                         |
|  | Type B Applied Part<br>: This symbol means Applied Part of product.                                                                                     |
|  | Alternating current<br>: To indicate on the rating plate that the equipment is suitable for alternating current only; to identify relevant terminals.   |
|  | Emergency Stop                                                                                                                                          |
|  | Medical device                                                                                                                                          |

EXSYS DEXi

DRTECH

Installation, Operation and Service Manual

|                                                                                           |                                                                                                               |
|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
|          | Unique device identifier                                                                                      |
| <b>Rx only</b>                                                                            | For U.S.<br>Caution : Federal law restricts this device to sale by or on the order of a licensed practitioner |
|          | Consult instructions for use                                                                                  |
| <br>0197 | CE mark<br>"0197" shows the notified body number for MD                                                       |

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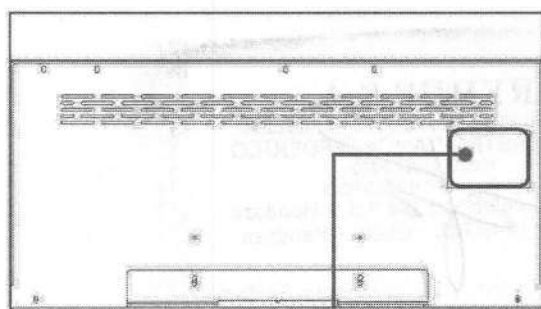
IF-2025-106384357-APN-INPM#ANMAT

### 2.13 Label

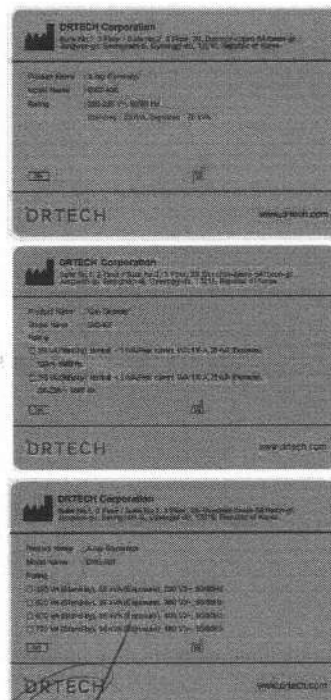
The label attached to the product displays the product name, product model, input power, manufacturing date, manufacturer name, manufacturer address, and product serial number, and the label is attached at the following location.

In order to check the labeling on the product, please use it in an environment with illumination of approximately 500 lux.

■ **Generator Part:** It is attached to the back of the X-ray Generator.



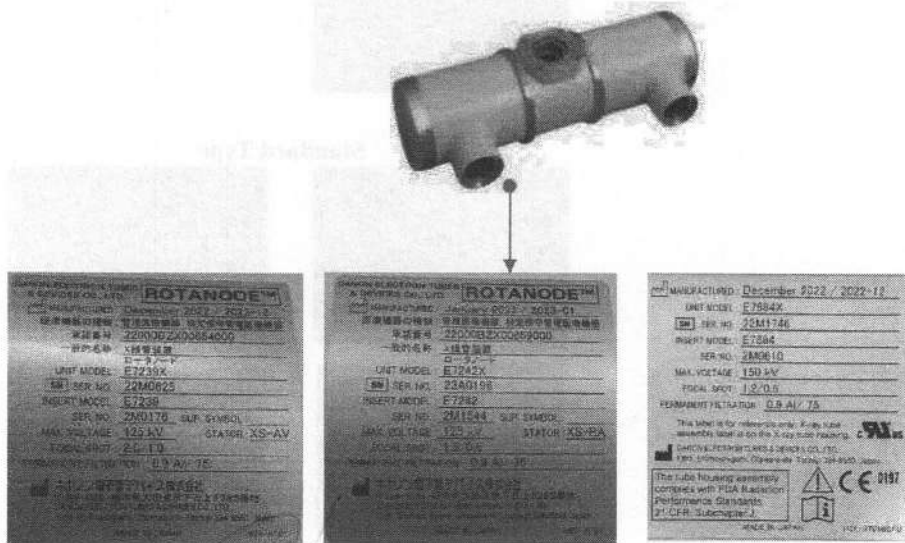
Generator Part Label



- **Collimator:** It is attached to the back of the Collimator.



- **TUBE:** It is attached to the lower part of the tube. (example: E7239X)  
(\*The appearance of E7239X, E7242X, and E7884X is identical.)

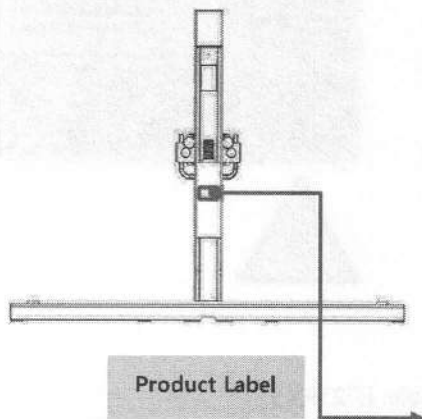


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■ **Total Part(Product Label):** It is attached to the back of the Tube stand control box.

● **EXSYS DEXi:** It is attached to the control box of the tube stand.



### Manual Type

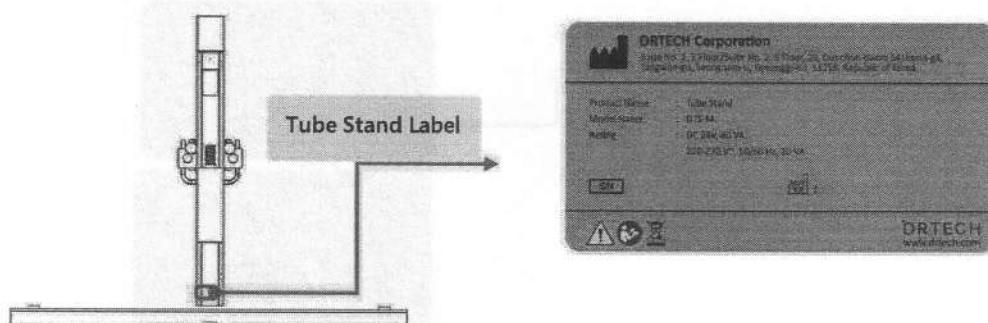


### Standard Type



### ■ Machinery Part

- **Tube stand:** It is attached to the lower part of the back of the tube stand.



- **Bucky stand:** It is attached to the lower part of the back of the bucky stand



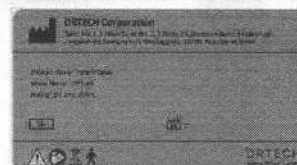
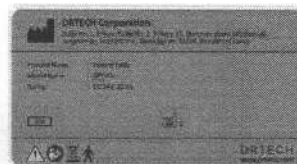
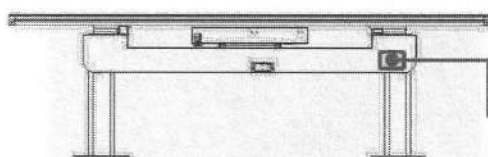
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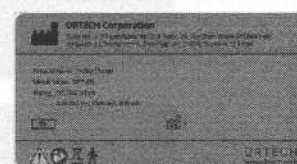
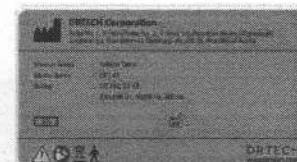
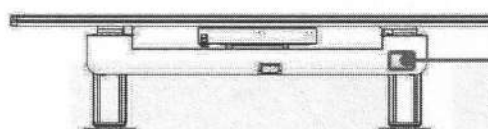


- **Table:** It is attached to the upper part of the back of the table.

### - 4 way table



### - 6 way table



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**2.14 Items supplied separately**

External devices can be applied separately to this system, and items provided separately are as follows.

- AEC Chamber
- DAP
- Wireless Detector Charger
- Detector

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## Chapter 2

### Safety

#### Diagnostic X-ray System

**[EXSYS DEXi]**

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## 3. Safety

### 3.1 General Safety

**WARNING►**

You must be familiar with the contents of the present operating instructions in order to be able to operate the system as intended. Read and understand the present operating instructions before operating the system.

It is important to observe all directions, safety instructions and warnings!

**WARNING►**

The responsibility for management of use and maintenance of medical equipment lies in a user.

**WARNING►**

Never modify the equipment! Please contact our service agency if it is necessary to modify the device.

When an APPLIANCE COUPLER or MAINS PLUG or other separable plug is used as an insulating means, ME equipment should not be positioned in a way that makes it difficult to operate the disconnecting device.

If an abnormality occurs during product operation, turn off the power to the device and stop its functions by pressing the emergency stop button.

**Operation ►**

Only properly trained personnel are allowed to operate the system.

**Assembly and service►**

Only authorized personnel are allowed to assemble the system and to provide technical service. The necessary qualifications can only be obtained by attending a training course provided by the manufacturer.

**WARNING►**

Never use the system if you suspect any electrical or radiation-generating components to be defective or if the system exhibits unexpected malfunctions!

**WARNING►**

Always be sure that audible and visual communication between the operator and patient are established throughout the entire examination. If necessary, communication must be maintained through technical means, for instance, an intercom.

**Cybersecurity►**

- In the event of a cyber security incident, contact the manufacturer's emergency number and wait for instructions from the administrator until further action is taken.
- The software used on the device should be a product that does not engage in encrypted communication for data and should only be used within the hospital's closed network. Additionally, ensure the use of a PC with security systems such as a firewall and antivirus software.

**Pediatric Patient ►**

- Health care professionals and hospital administrators take special care in reducing radiation exposure to pediatric patients by following these steps:
- Discuss the rationale for the examination with the patient and/or parent to ensure a clear understanding of benefits and risks.
- Reduce the number of inappropriate referrals (i.e., justify X-ray imaging exams) by: determining if the examination is needed to answer a clinical question.
- considering alternate exams that use less or no radiation exposure, such as ultrasound or MRI, if appropriate, and checking the patient's medical imaging history to avoid duplicate exams.
- Use special care when imaging patients outside the typical adult size range.
- Use the pediatric protocols or technique charts included as following table:

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**Age categories**

| Name    | Definition   |
|---------|--------------|
| Newborn | 0-6 months   |
| Baby    | 6-18 months  |
| Child   | 18-36 months |
| Small   | 3-7 years    |
| Normal  | 8-12 years   |

**Pediatric protocols**

| Age categories | Newborn |     | Baby |     | Child |     | Small |     | Normal |     |
|----------------|---------|-----|------|-----|-------|-----|-------|-----|--------|-----|
| Bodypart       | kVp     | mAs | kVp  | mAs | kVp   | mAs | kVp   | mAs | kVp    | mAs |
| Skull AP       | 73      | 4   | 73   | 6.3 | 73    | 8   | 73    | 10  | 73     | 12  |
| Skull LAT      | 70      | 4   | 70   | 6.3 | 70    | 8   | 70    | 10  | 70     | 12  |
| Chest AP       | 63      | 1.6 | 66   | 1.6 | 66    | 1.6 | 70    | 1.2 | 73     | 1.6 |
| Abdomen AP/PA  | 63      | 2   | 66   | 2   | 66    | 2.5 | 70    | 4   | 73     | 5   |
| Pelvis         | 63      | 2   | 66   | 2   | 66    | 2.5 | 70    | 4   | 73     | 5   |

- Source: Journal of Medical Radiation Sciences
- Title : A paediatric X-ray exposure chart
- Issue Year : 2014

\* Please refer to the FDA website for details on pediatric information.

<https://www.fda.gov/radiation-emitting-products/medical-imaging/pediatric-X-ray-imaging>

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### 3.2 Safety from Explosion or Electric Shock

**WARNING►**

Do not use the system in an atmosphere containing combustible gas. The system is not an AP device. Its use in an atmosphere containing combustible gas carries the risk of fire or explosion.

**WARNING►**

Do not use disinfectant sprays that are flammable or could cause an explosion. The vapor from a disinfectant spray may ignite, causing life-threatening or serious injuries and damage to the system.

**WARNING►**

To avoid the risk of electric shock, this equipment must only be connected to a supply with protective earth.

### 3.3 Risk of Collision

**WARNING►**

Ensure that there are no persons and objects in the range of the tube assembly movement. Please keep the safe distance to prevent any collision or unnecessary stop of the operation.

**WARNING►**

Ensure that the patient does not use the control grip as a handle.

### 3.4 Radiation Safety

The system produces X-rays. If you do not observe the safety measures and precautions required by your local radiation protection regulatory body, these X-rays can be hazardous both to operating staff and other persons.

**Maximum Permissible Dose (MPD)**

Many kinds of researches on effects or influences about X-radiation provide basics about maximum permissible dose. These research results were used for ICRP to recommend Maximum Permissible Dose but it is hard to define exactly and it is updated from time to time with new research result. For occupational exposures, the ICRP 60 recommends that the MPD accumulated shall not exceed the following limits:

- Annual effective dose 50 mSv
- Annual dose for the lens of the eye 150 mSv
- Annual dose for all other parts of body 500 mSv

**WARNING►**

The system is intended for procedures where the skin dose may be so high that there is a risk of deterministic effects, even if the system is used as intended.

**WARNING►**

The system may only be operated by personnel who has undergone radiological training.

**WARNING►**

The relevant radiation protection regulations of the country of installation must be observed.

**WARNING►**

In order to avoid unintentional radiation, the hand switch must be hung up on the hand switch support when the system is switched on, but not in use.

**WARNING►**

Always be aware that any material brought into the path of radiation between the patient and the image receptor (e.g. film) will have a negative influence on the image quality as well as on the patient dose.

**WARNING►**

Operator's operation of X-ray function should be operated and X-ray examined only in a designated

place(Shielded room).

### 3.5 Radiation Protection

#### Protection of staff

Staff members who stay within the radiation controlled area must wear X- Protection of staff ray protective clothing.

#### Protection of the patient

- To minimize the radiation burden of the patient, you must keep the source/skin Distance as large as possible.
- In addition, radiation should not be irradiated when the distance between the source and the patient's skin is less than 20 cm.

#### WARNING►

When you initiate radiation and no live image is displayed although all necessary settings have definitely been made, please contact your after-sales service center!

### 3.6 Electromagnetic Compatibility

Medical electrical equipment requires special precautionary measures with respect to EMC and must be installed and put into service in accordance with the EMC guidelines contained in the accompanying documents.

Portable and mobile RF communications equipment may interfere with medical electrical equipment.

All operating modes of the system have been considered in the EMC tests. There are no exceptions to the rules.

Only conductors, connecting cables and accessories that are specified by the manufacturer may be used.

#### WARNING►

Using components other than those specified may result in increased electromagnetic emissions or reduced electromagnetic immunity.

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### 3.7 Disposal

The meaning of the symbol on the product, its accessory or packaging indicates that this product shall not be treated as household waste. Please, dispose of this equipment at your applicable collection point for the recycling of electrical & electronic equipment waste. In the European Union and Other European countries which there are separate collection systems for used electrical and electronic product. By ensuring the correct disposal of this product, you will help prevent potentially hazardous to the environment and to human health, which could otherwise be caused by unsuitable waste handling of this product. The recycling of materials will help conserve natural resources, please do not therefore dispose of your old electrical and electronic equipment with your household waste. For more detailed information about recycling of this product, please contact your local city office, your household waste disposal service or the shop where you purchased the product.



### 3.8 Service Information

Technical support and purchase of accessories are available at below contacts.

Manufacturer: DRTECH

Address: Suite No.1, 2 Floor / Suite No. 2, 3 Floor, 29, Dunchon-daero 541 beon-gil, Jungwon-gu, Seongnam-si, Gyeonggi-do, 13216, Republic of Korea

Phone: +82-31-730-6805

Fax: +82-31-730-6899

E-mail: [drtech@drtech.com](mailto:drtech@drtech.com)

Homepage: <http://www.drtech.com>

### 3.9 Service Life

The system's service life is 10 years, and is limited to systems that receive the prescribed maintenance checks.

### 3.10 Disinfection and cleaning

- Wipe it with a dry cloth slightly damped with a neutral detergent.
- Do not use solvents such as alcohol, thinner or benzene. Doing so may damage the surface of the equipment.
- The power should be switched off and equipment should be unplugged before cleaning.
- The exterior of the array can be cleaned with 70% alcohol solution can also be used.

### 3.11 Temperature limitation (Applied parts)

- Max temperature : max. 43.0 °C
- Contact time :  $t < 1\text{min}$
- Patient contact time should not exceed 1 minute.

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## Chapter 4

# Product Configuration

## Diagnostic X-ray System

**[EXSYS DEXi]**

  
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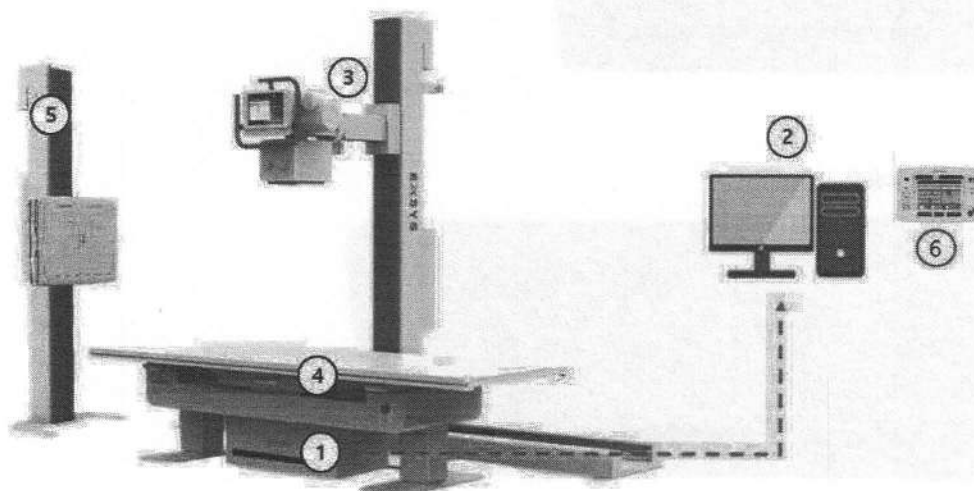
  
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## 4 Product Configuration

### 4.1 Product Configuration

EXSYS DEXi is a device that diagnoses patients using X-rays and consists of an X-ray generator, a tube support device, a patient table, a bucky stand, a collimator, a console, and a hand switch.

### 4.2 Product Appearance



| NO | Function                  | Function Description                                                                     |
|----|---------------------------|------------------------------------------------------------------------------------------|
| 1  | Generator                 | Adjusts the X-ray dose according to the X-ray irradiation conditions set in the console. |
| 2  | Console                   | Display and save acquired images, set and display X-ray irradiation conditions           |
| 3  | Tube Stand                | A device that rotates the X-ray tube left, right, forward and backward.                  |
| 4  | Patient Table             | The bed on which the patient lies for X-ray taking.                                      |
| 5  | Bucky Stand               | A device that allows the patient to stand for X-ray taking.                              |
| 6  | Generator Console(option) | Set and display X-ray irradiation conditions                                             |

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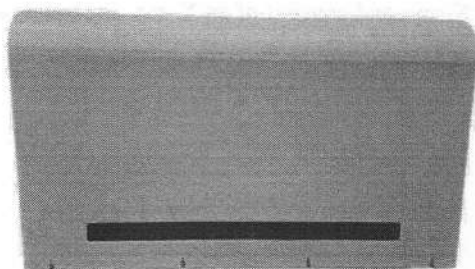
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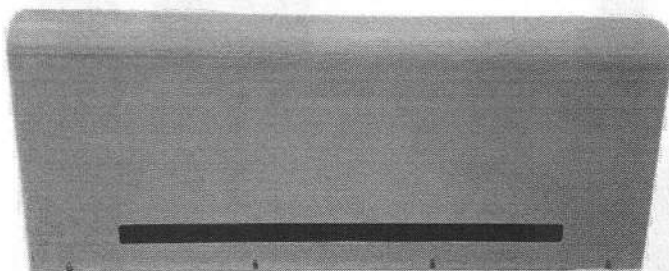
### 4.3 Configuration of Major Parts

#### 4.3.1 Configuration of X-ray generator (DXG-40S, DXG-40P, DXG-50T)

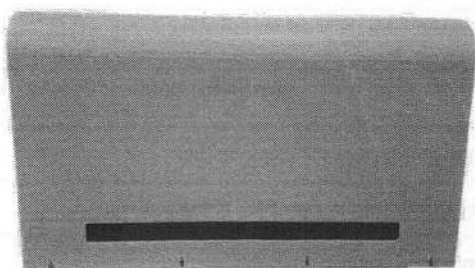
##### 1) DXG-40S



##### 2) DXG-40P



##### 3) DXG-50T



#### Product Functions

It is a device that adjusts the X-ray value according to the X-ray irradiation conditions set in the EConsole. The adjusted data is input to the high voltage transformer and outputs the high voltage and tube filament voltage to the X-ray tube.

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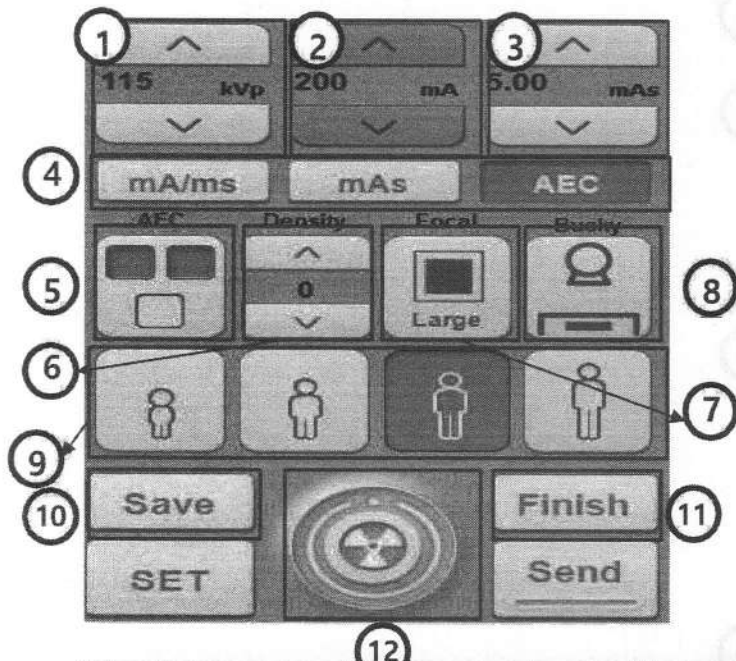
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## 4.3.2 Configuration of EConsole 1

## 4.3.2.1 EConsole1

## Product Functions

It sets X-ray irradiation conditions and transmits the set data to the generator, displays the set X-ray irradiation conditions, and displays the image acquired after X-ray irradiation.



| NO | Function                          | Description of Functions                                   |
|----|-----------------------------------|------------------------------------------------------------|
| 1  | Tube voltage control button       | Adjust the tube voltage.                                   |
| 2  | Tube current control button       | Adjust the tube current.                                   |
| 3  | Irradiation time control button   | Adjust the irradiation time.                               |
| 4  | Mode selection button             | Select mA/ms, mAs, or AEC Mode.                            |
| 5  | Chamber sensor location selection | Select the location of the selected sensor in the chamber. |
| 6  | Chamber sensitivity control       | Adjust the sensitivity of the selected chamber sensor.     |
| 7  | Focal spot indication             | Display the current focal spot.                            |
| 8  | Bucky selection                   | Select the bucky to be used.                               |
| 9  | Body size selection               | Select the body size of the patient.                       |
| 10 | Recorded image saving button      | Save the recorded image.                                   |
| 11 | Image recording finish            | Finish image recording and move to patient list.           |
| 12 | X-ray status indication           | Indicate X-ray operation status.                           |

For details about operation, refer to the User Manual for the EConsole1 (DRT-MAN-055)

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## 4.3.2.2 EConsole2

## Product Functions

It sets X-ray irradiation conditions and transmits the set data to the generator, displays the set X-ray irradiation conditions, and displays the image acquired after X-ray irradiation.



| NO | Function                                                                 | Description of Functions                                                                                                                                         |
|----|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Bucky setting                                                            | Receptor Type will be changed by clicking the icons                                                                                                              |
| 2  | Body size selection                                                      | Select the body size of the patient.                                                                                                                             |
| 3  | Tube Voltage (kVp), Tube Current (mA), Tube Current Amount (mAs) setting | Adjust the tube voltage, tube current and irradiation time. When clicking the tube current amount icon (mAs), the unit can be changed to exposure time (seconds) |
| 4  | Focus                                                                    | Configure the Focal Size                                                                                                                                         |
| 5  | Chamber sensor location selection                                        | Select the location of the selected sensor in the chamber.                                                                                                       |

For details about operation, refer to the User Manual for the EConsole2 (DRT-MAN-176)

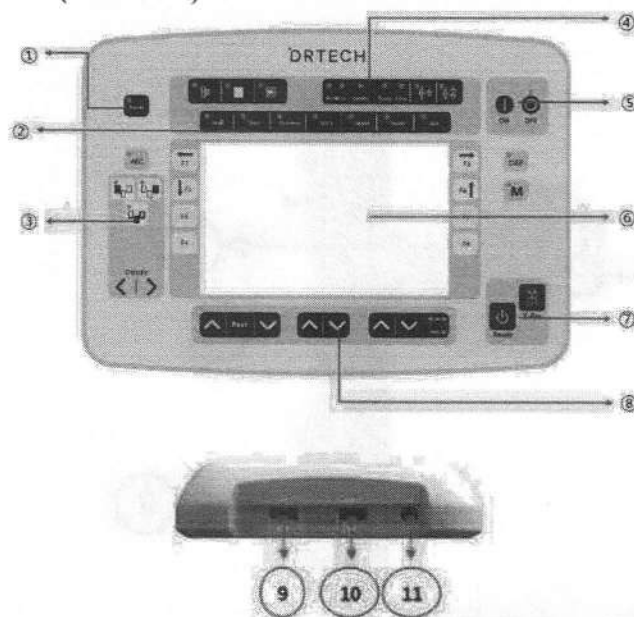
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## 4.3.3 Generator Console(DXG-CON)



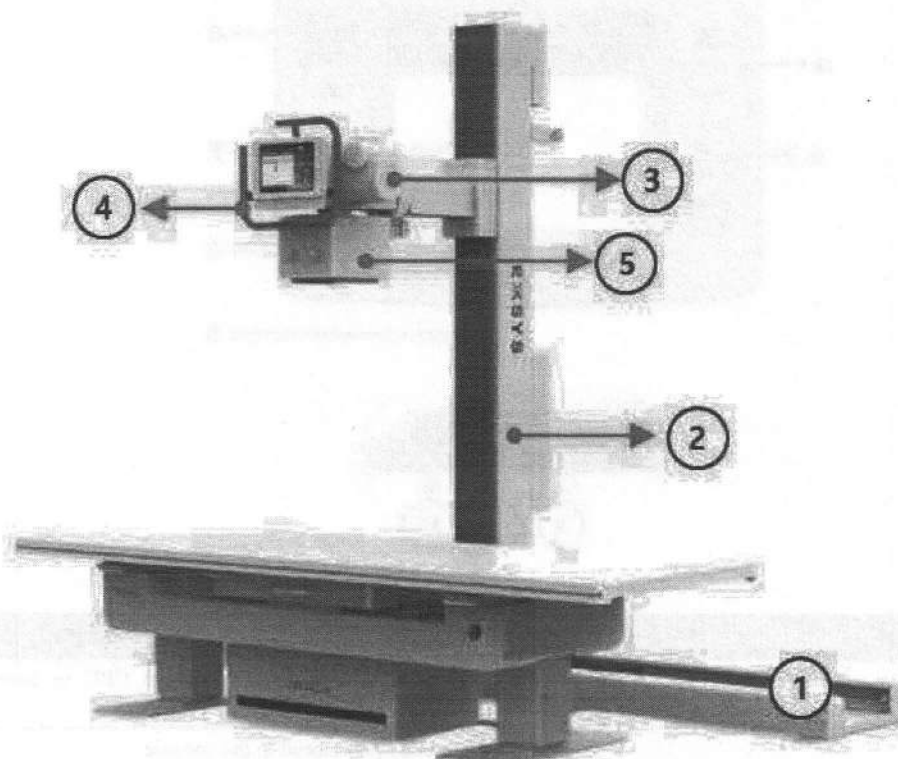
| NO | Function                             | Description of Functions                                                            |
|----|--------------------------------------|-------------------------------------------------------------------------------------|
| 1  | Reset Switch                         | Reset the Error status occurring in the Main CPU in case of product malfunction.    |
| 2  | APR                                  | Select the patient body part stored in the console.                                 |
| 3  | AEC function                         | Choose AEC functionality, chamber position, and sensitivity adjustment.             |
| 4  | Operating status indication          | Indicate the generator's operating status with LED lamps.                           |
| 5  | Power ON/Off                         | On/Off switch for generator power supply.                                           |
| 6  | LCD Display                          | Display the configured X-ray examination conditions and generator operating status. |
| 7  | X-Ray exam switch                    | Ready and X-ray operation switches for X-ray examination                            |
| 8  | X-ray irradiation conditions control | Switches to adjust KV, mA, mAs, and time.                                           |
| 9  | Communication port                   | Communication port connected to the PC.                                             |
| 10 | Communication port                   | Communication port connected to the generator's MIO board                           |
| 11 | Hand Switch                          | Port connected to externally operated Ready and X-Ray switches.                     |

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#### 4.3.4 Tube Stand (DTS-M)



## Product Functions

It is a device that is fixed on the floor and rotates the X-ray tube device upward, downward, to the left or right, and lateral movement.

| NO | Function                | Description of Functions                                                                                                                                                |
|----|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Floor rail              | Rail that moves the tube support device to the left or right.                                                                                                           |
| 2  | Stand                   | A column that moves the tube device upward or downward.                                                                                                                 |
| 3  | X-ray tube              | Electromagnetic tube that generates X-ray.                                                                                                                              |
| 4  | Tube handle and console | Handle to rotate tube device.<br>It consists of two consoles: a Membrane OP Console that can be operated manually and an LCD Console (System OP) with a touch-type LCD. |
| 5  | Collimator              | Device to control the X-ray irradiation area.                                                                                                                           |

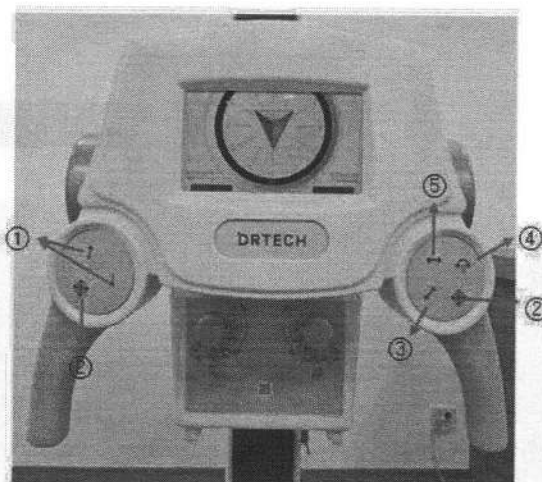
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## 1) Membrane OP Console HandleBar

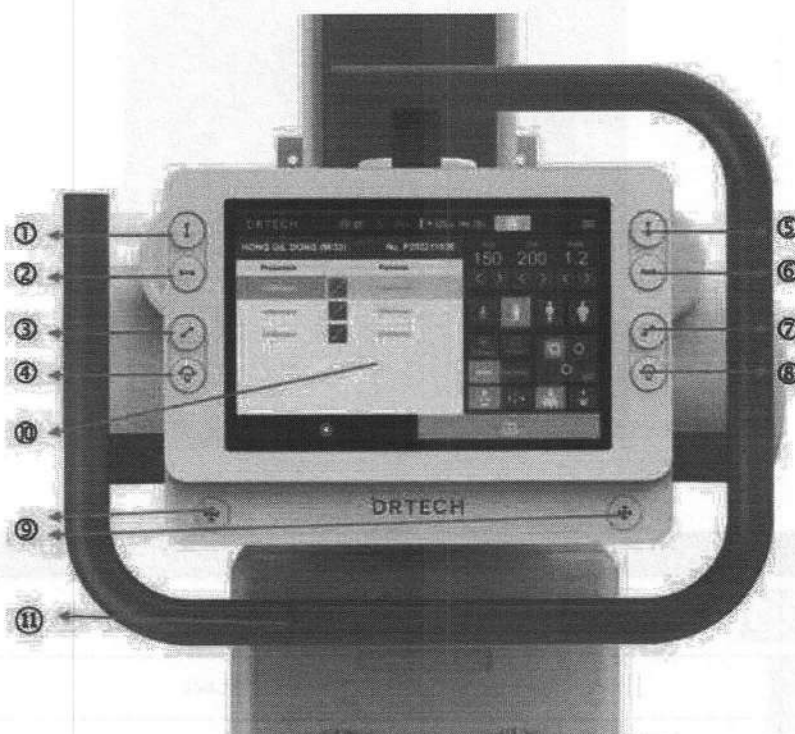


| NO | Switch | Function                                | Description of Functions                       |
|----|--------|-----------------------------------------|------------------------------------------------|
| 1  |        | Lock switch for UP and DOWN             | Move the X-ray tube up and down.               |
| 2  |        | Lock Free button                        | Unlock All Lock                                |
| 3  |        | Y-axis movement lock/release button.    | Lock or release the Y-axis magnetic clamp.     |
| 4  |        | Tube rotation axis lock/release button. | Lock or release the tube rotation axis magnet. |
| 5  |        | X-axis movement lock/release button.    | Lock or release the X-axis magnetic clamp.     |

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## 2) System OP Console HandleBar



| NO | Switch | Function                                | Description of Functions                                                                                                                |
|----|--------|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| ①⑤ |        | Lock switch for UP and DOWN             | Press the switch to release the electromagnet locking device and then move the X-ray device up and down.                                |
| ②⑥ |        | X-axis movement lock/release button.    | Press the switch to release the electromagnet locking device and then move the X-ray device left and right.                             |
| ③⑦ |        | Y-axis movement lock/release button.    | Lock or release the Y-axis magnetic clamp.                                                                                              |
| ④⑧ |        | Tube rotation axis lock/release button. | Lock or release the tube rotation axis magnet                                                                                           |
| ⑨  |        | Lock Free button                        | Press the switch to release the electromagnet fixing device and then manually rotate the X-ray tube device up and down, left and right. |
| ⑩  |        | LCD                                     | Please refer to the next page for detailed instructions.                                                                                |
| ⑪  |        | Handle & Lock Free button               | The ALL Lock release switch operates a mechanism that holds and moves the X-ray device when it is in motion.                            |

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## LCD Console (System OP)



| NO | Function                                   | Description of Functions                          |
|----|--------------------------------------------|---------------------------------------------------|
| 1  | Detector Status                            | Icons show the current status of X-ray exposure.  |
| 2  | Patient information                        | Patient information display.                      |
| 3  | Prescription                               | Prescription display.                             |
| 4  | Irradiation condition check and adjustment | Irradiation condition check and adjustment.       |
| 5  | Collimator Controller                      | Set and display the collimator.                   |
| 6  | System Controller                          | Set and display the current configuration status. |

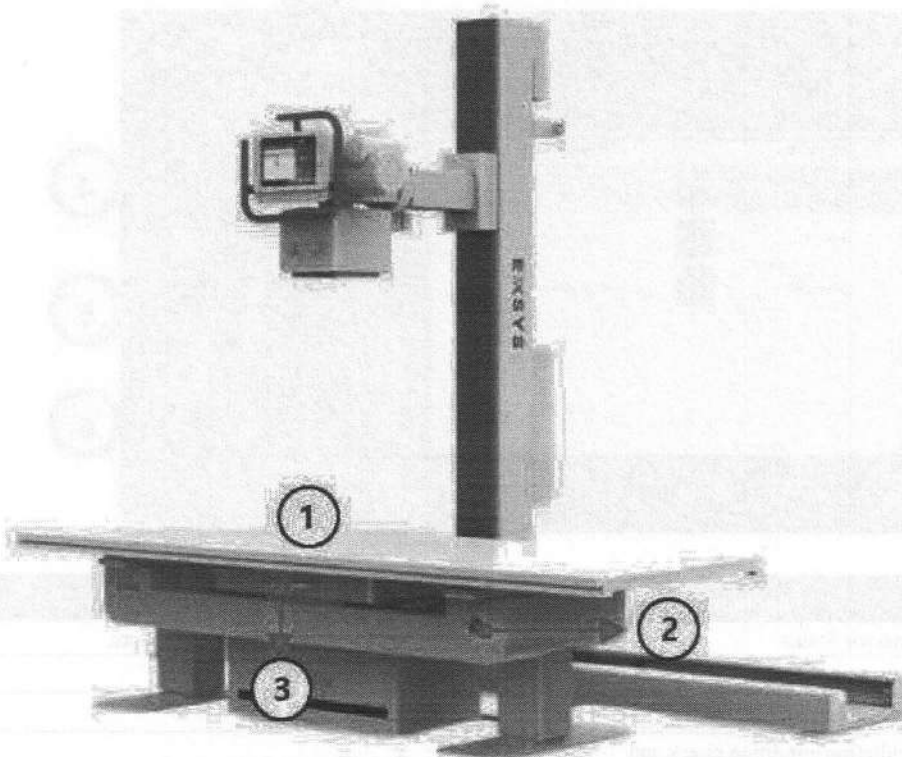
## System Controller

| NO | Symbol                                                                              | Description of Functions                       |
|----|-------------------------------------------------------------------------------------|------------------------------------------------|
| 1  |  | Select the variable filter.                    |
| 2  |  | Select the collimating size.                   |
| 3  |  | Enable or disable the auto align function.     |
| 4  |  | Enable or disable the bucky tracking function. |
| 5  |  | Select the Bucky (None/Table/Stand)            |

Please refer to the System OP User Manual (DRT-MAN-172) for more details.

## 4.3.5 Patient table

## 4.3.5.1 4 way table (DPT-4A / DPT-4B)

**Product Functions**

It is a table on which the patient is laid down during an X-ray examination.

The 4-way table can move forward, backward, left, and right.

| NO | Function         | Description of Functions                                                                                                                                                                    |
|----|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Table top        | The plate on which the patient lies down for X-ray examination.                                                                                                                             |
| 2  | Emergency Switch | Emergency Power Cut-off Button<br>If an abnormality occurs during operation of this device, the power to the device and its functions can be stopped by pressing the emergency stop button. |
| 3  | Cassette Box     | The detector, grid and AEC Chamber are inside the box.                                                                                                                                      |

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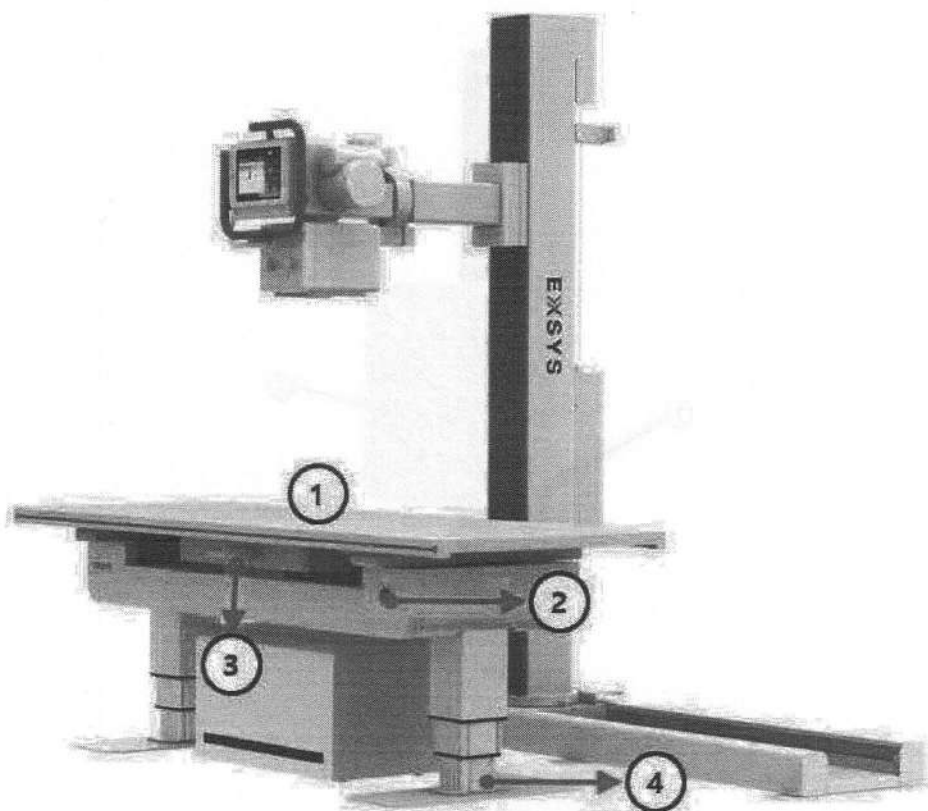
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## 4.3.5.2 6 way table (DPT-6A / DPT-6B)



## Product Functions

It is a table on which the patient is laid down during an X-ray examination.

The 6-way table can move up, down, forward, backward, left, and right..

| NO | Function         | Description of Functions                                                                                                                                                                     |
|----|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Table top        | The plate on which the patient lies down for X-ray examination.                                                                                                                              |
| 2  | Emergency Switch | Emergency Power Cut-off Button<br>If an abnormality occurs during operation of this device, the power to the device and its functions can be stopped by pressing the emergency stop button.  |
| 3  | Cassette Box     | The detector, grid and AEC Chamber are inside the box.<br>- DPT-4A : Bucky table for Detectors with sizes of 43x43 and 36x43 (cm)<br>- DPT-4B : Bucky table for Detectors size of 43x57 (cm) |
| 4  | Lift             | A lift that moves the table up and down.                                                                                                                                                     |

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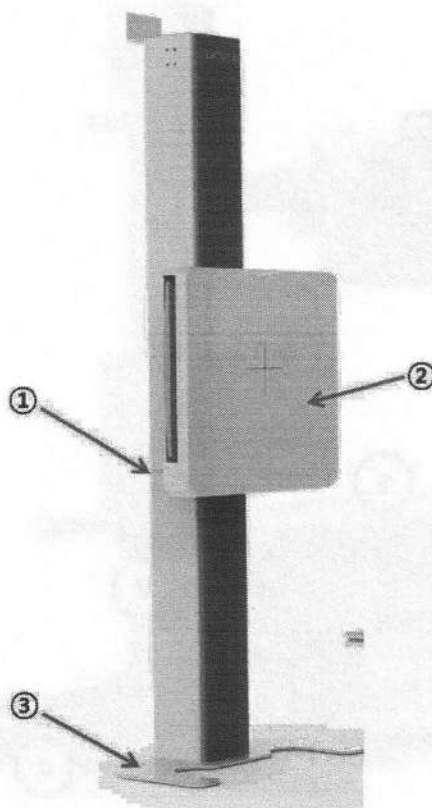
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## 4.3.6 Bucky Stand

## 1) DBS-43M



## Product Functions

It is a stand on which the patient stands and is photographed. The Bucky device to which the X-ray detector can be mounted is moved up and down according to the patient's photographing part, and the Bucky device is fixed by an electromagnet.

| NO | Function            | Description of Functions                                             |
|----|---------------------|----------------------------------------------------------------------|
| 1  | Handle              | A handle held by the patient according to the photographing position |
| 2  | Detector Receptacle | A device to move to the left and right with detector.                |
| 3  | Fixed Plate         | Plate to support the bucky stand on the floor.                       |

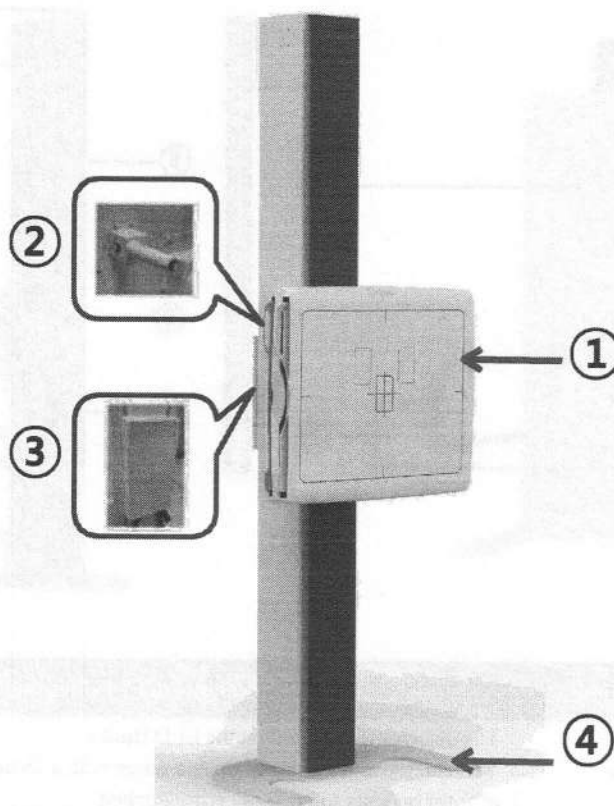
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### Product Functions

It is a stand on which the patient stands and is photographed. The Bucky device to which the X-ray detector can be mounted is moved up and down according to the patient's photographing part, and the Bucky device is fixed by an electromagnet.

| NO | Function         | Description of Functions                                                                                                                                                                                                                                                                                             |
|----|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Bucky            | <ul style="list-style-type: none"> <li>The detector is mounted on the bucky.</li> <li>You can move it vertically up and down with a fixture to adjust the height of it for patients to be X-ray radiography.</li> <li>The Grid is a detachable type of vertical and horizontal.</li> <li>Applied part (A)</li> </ul> |
| 2  | Operating Switch | You can rotate the bucky and adjust the height of bucky.                                                                                                                                                                                                                                                             |
| 3  | Control Box      | The electronic components are assembled inside this box.                                                                                                                                                                                                                                                             |
| 4  | Base             | The base is used for supporting the weight of the 4357 Detector Bucky Stand.                                                                                                                                                                                                                                         |

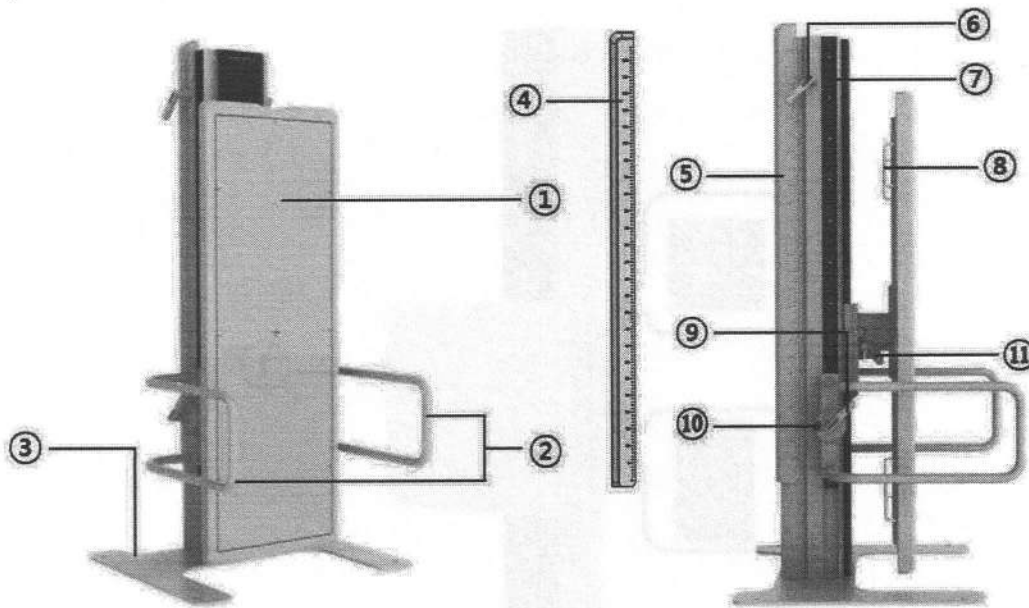
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3) LLD 129 WITH ROTATION



| NO | Function                          | Description of Functions                                                                                                                                          |
|----|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | LLD Bucky                         | The detector is mounted on the LLD Bucky. You can move it vertically up and down with a fixture to adjust the height of it for patients to be X-ray radiographed. |
| 2  | Support                           | The support is used for supporting the body of patient. You can rotate the support horizontally or vertically, and adjust the height adequate for patient.        |
| 3  | Base                              | The base is used for supporting the weight of the LLD Bucky Stand.                                                                                                |
| 4  | Lead ruler                        | The lead ruler is mounted on the LLD Bucky Stand to measure the length. The ruler with a magnet can be mounted and removed.                                       |
| 5  | Lead ruler cradle                 | You can keep the lead ruler in the cradle when not using the ruler.                                                                                               |
| 6  | Top and bottom locks of the Bucky | You can adjust the top and bottom position of the Bucky by applying and releasing the lock.                                                                       |
| 7  | Support rail                      | The rail is used for adjusting the height of the support.                                                                                                         |
| 8  | Bucky handle                      | Bucky handle is used for rotating or adjusting the height of the LLD Bucky.                                                                                       |
| 9  | Top and bottom locks of support   | You can adjust the top and bottom position of the support by applying and releasing the lock.                                                                     |
| 10 | Rotation lock of support          | You can adjust the angle of the support by applying and releasing the lock.                                                                                       |
| 11 | Bucky rotation lock of support    | You can adjust the angle of the Bucky by applying and releasing the lock.                                                                                         |

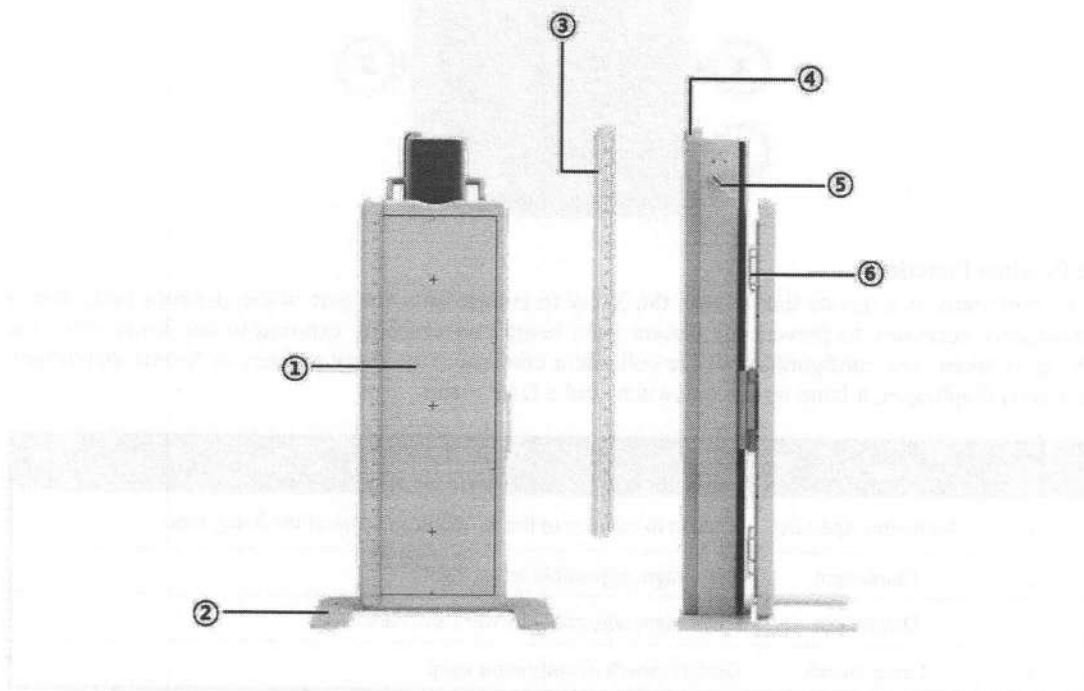
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## 4) LLD 129 COMPACT



| NO | Function                          | Description of Functions                                                                                                                                          |
|----|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | LLD Bucky                         | The detector is mounted on the LLD Bucky. You can move it vertically up and down with a fixture to adjust the height of it for patients to be X-ray radiographed. |
| 2  | Base                              | The base is used for supporting the weight of the LLD Bucky Stand.                                                                                                |
| 3  | Lead ruler                        | The lead ruler is mounted on the LLD Bucky Stand to measure the length. The ruler with a magnet can be mounted and removed.                                       |
| 4  | Lead ruler cradle                 | You can keep the lead ruler in the cradle when not using the ruler.                                                                                               |
| 5  | Top and bottom locks of the Bucky | You can adjust the top and bottom position of the Bucky by applying and releasing the lock.                                                                       |
| 6  | Bucky handle                      | Bucky handle is used for rotating or adjusting the height of the LLD Bucky.                                                                                       |

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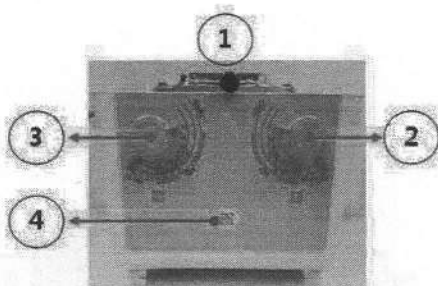
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## 4.3.7 Collimator

## 1) M-38



## ■ Product Functions

The collimator is a device that adjusts the X-ray to expose only the part of the patient's body that is absolutely necessary to prevent the patient from being unnecessarily exposed to the X-ray when the X-ray is taken. The configuration of the collimator consists of an X-ray emitter, an X-axis diaphragm, a Y-axis diaphragm, a lamp operation switch, and a DAP meter.

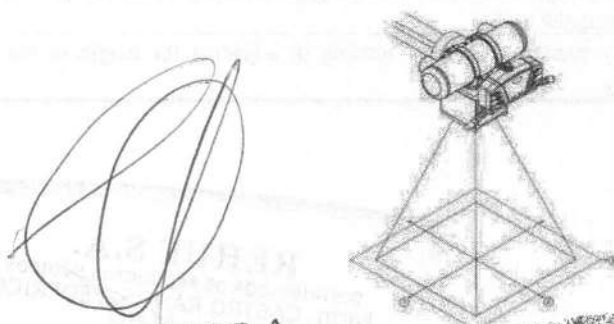
| NO | Function           | Description of Functions                                       |
|----|--------------------|----------------------------------------------------------------|
| 1  | Radiation Aperture | Bracket to connect to the radiation aperture of the X-ray tube |
| 2  | Diaphragm          | Diaphragm adjustable left or right                             |
| 3  | Diaphragm          | Diaphragm adjustable forward and backward.                     |
| 4  | Lamp switch        | On/Off switch of collimator lamp                               |

Check the difference between the set X-ray irradiation field and the effective surface of the image acquired by the X-ray detector, and the difference between the four sides and the set area should not exceed  $\pm 2\%$ .

After adjusting the distance between the X-ray detector and the X-ray tube focal to 1m, check the X-ray, and check the difference in the effective surface of the image compared to the set area.

The irradiation area of the X-ray detector is 43X43cm at 100cm SID between the X-ray detector and the X-ray tube focal.

The irradiation area of the X-ray detector at SID 100cm should be within 43X43cm  $\pm 2\%$ .



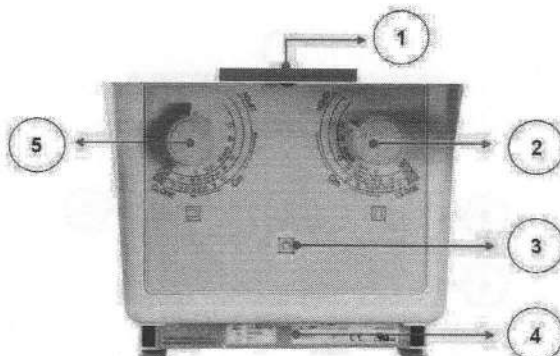
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## ■ Configuration



### • Figure1

- (1) This is connected to the emission of the X-ray tube.

### • Figure2

- (1) Turn this aperture knob to adjust the irradiated area of the X-ray.
- (2) Adjust the Y-axis knob (Figure 2), hold the knob (Figure 2) and turn it clockwise to increase the irradiation area. Turn it counterclockwise to reduce the irradiation area.

### • Figure3

- (1) Before the X-ray irradiation, the lamp is operated as a method for confirming the X-ray irradiation area, and it is the lamp operation switch (Figure 3).
- (2) The operation of this collimator lamp is "ON" by pressing the operation switch (Figure 3). The lamp operation is "ON" for 30 seconds after the switch operation and automatically "Off" after 30 seconds.

### • Figure4 (Optional)

- (1) When the DAP meter (Figure 4) is applied, it is fixed at the end of the collimator.

### • Figure5

- (1) Turn this aperture to adjust the irradiated area of the X-ray.
- (2) Adjust the X-axis knob (Figure 5), hold the knob (Figure 5) and turn it clockwise to increase the irradiation area and counterclockwise to reduce the irradiation area.

## ■ Collimator movement

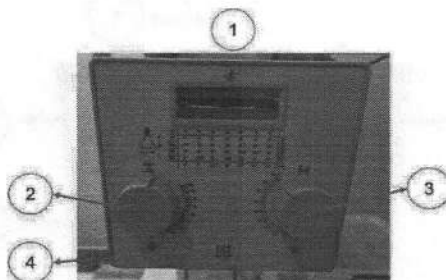
- (1) Move the tube stand to the patient's X-ray exposure point.
- (2) The minimum distance between the Tube Focal and Detector surface should be at least 100 cm.
- (3) The X-ray tube device can be moved up to 100cm from the table shooting position.
- (4) The X-ray tube device can move up to 100cm or 180cm from the bucky stand imaging position.

## ■ Collimator Lamp operation

- (1) Press the Lamp operation switch.
- (2) The lamp goes off automatically after about 30 seconds after the switch is turned on.
- (3) Adjust the X-ray irradiation area by adjusting the X and Y axis knobs while the lamp is on.
- (4) If the Lamp is turned off while adjusting the X-ray irradiation area, press the Lamp operation switch to turn the Lamp ON again.
- (5) After adjusting the X-ray irradiation area, press the X-ray Exposure switch to take an X-ray.



## 2) R 221/A DHHS



## ■ Product Functions

The collimator is a device that adjusts the X-ray to expose only the part of the patient's body that is absolutely necessary to prevent the patient from being unnecessarily exposed to the X-ray when the X-ray is taken. The configuration of the collimator consists of an X-ray emitter, an X-axis diaphragm, a Y-axis diaphragm, a lamp operation switch.

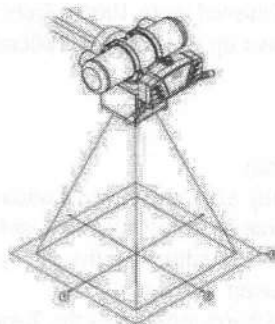
| NO | Function           | Description of Functions                                       |
|----|--------------------|----------------------------------------------------------------|
| 1  | Radiation Aperture | Bracket to connect to the radiation aperture of the X-ray tube |
| 2  | Diaphragm          | Diaphragm adjustable left or right                             |
| 3  | Diaphragm          | Diaphragm adjustable forward and backward.                     |
| 4  | Lamp switch        | On/Off switch of collimator lamp                               |

Check the difference between the set X-ray irradiation field and the effective surface of the image acquired by the X-ray detector, and the difference between the four sides and the set area should not exceed  $\pm 2\%$ .

After adjusting the distance between the X-ray detector and the X-ray tube focal to 1m, check the X-ray, and check the difference in the effective surface of the image compared to the set area.

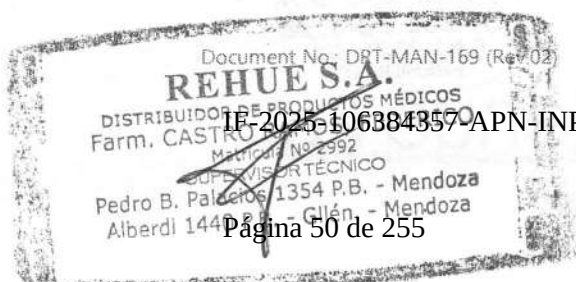
The irradiation area of the X-ray detector is 43X57cm at 135cm SID between the X-ray detector and the X-ray tube focal.

The irradiation area of the X-ray detector at SID 135cm should be within 43X57cm  $\pm 2\%$ .



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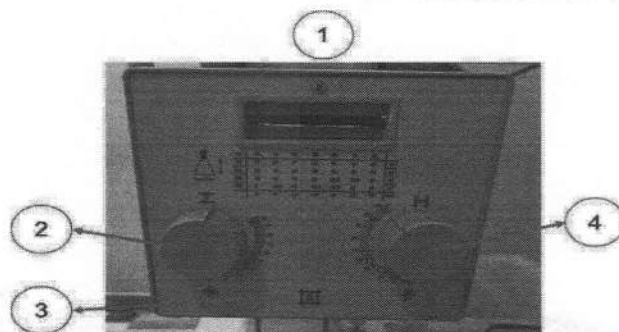
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## ■ Configuration



### ● Figure1

(1) This is connected to the emission of the X-ray tube.

### ● Figure2

(1) Turn this aperture knob to adjust the irradiated area of the X-ray.

(2) Adjust the Y-axis knob (Figure 2), hold the knob (Figure 2) and turn it clockwise to increase the irradiation area. Turn it counterclockwise to reduce the irradiation area.

### ● Figure3

(1) Before the X-ray irradiation, the lamp is operated as a method for confirming the X-ray irradiation area, and it is the lamp operation switch (Figure 3).

(2) The operation of this collimator lamp is "ON" by pressing the operation switch (Figure 3). The lamp operation is "ON" for 30 seconds after the switch operation and automatically "Off" after 30 seconds.

### ● Figure4

(1) Turn this aperture to adjust the irradiated area of the X-ray.

(2) Adjust the X-axis knob (Figure 4), hold the knob (Figure 4) and turn it clockwise to increase the irradiation area and counterclockwise to reduce the irradiation area.

## ■ Collimator movement

(1) Move the tube stand to the patient's X-ray exposure point.

(2) The minimum distance between the Tube Focal and Detector surface should be at least 100 cm.

(3) The X-ray tube device can be moved up to 100cm from the table shooting position.

(4) The X-ray tube device can move up to 100cm or 180cm from the bucky stand imaging position.

## ■ Collimator Lamp operation

(1) Press the Lamp operation switch.

(2) The lamp goes off automatically after about 30 seconds after the switch is turned on.

(3) Adjust the X-ray irradiation area by adjusting the X and Y axis knobs while the lamp is on.

(4) If the Lamp is turned off while adjusting the X-ray irradiation area, press the Lamp operation switch to turn the Lamp ON again.

(5) After adjusting the X-ray irradiation area, press the X-ray Exposure switch to take an X-ray.

### NOTE►

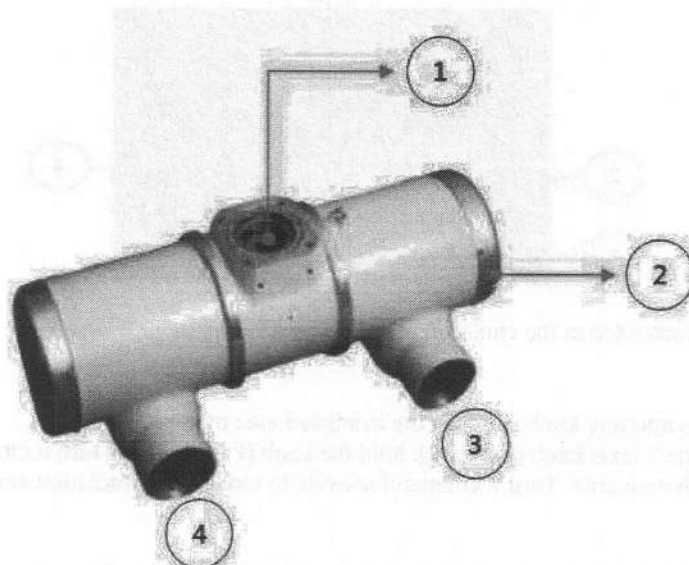
Even with X-Ray shooting with the Collimator Lamp on, there is no problem of X-Ray exposure.

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Alberdi 1440 P.B.

## 4.3.8 X-Ray tube (E7239X, E7242X, E7884X)



## Description of Product Functions

X-ray tube is selected according to the X-ray output, and the function of the X-ray tube is the same for models. As a vacuum tube that generates X-rays, it is composed of a filament for heat electron emission, a high pressure input part, and a radiation aperture.

| NO | Function           | Description of Functions                                          |
|----|--------------------|-------------------------------------------------------------------|
| 1  | Radiation Aperture | Aperture to which the generated X-ray is radiated.                |
| 2  | Wiring connector   | A connector that wires tube anode stator, temp SW. etc.           |
| 3  | Anode              | Receptacle to which the positive high voltage cable is connected. |
| 4  | Cathode            | A receptacle to which negative high voltage cable is connected.   |

  
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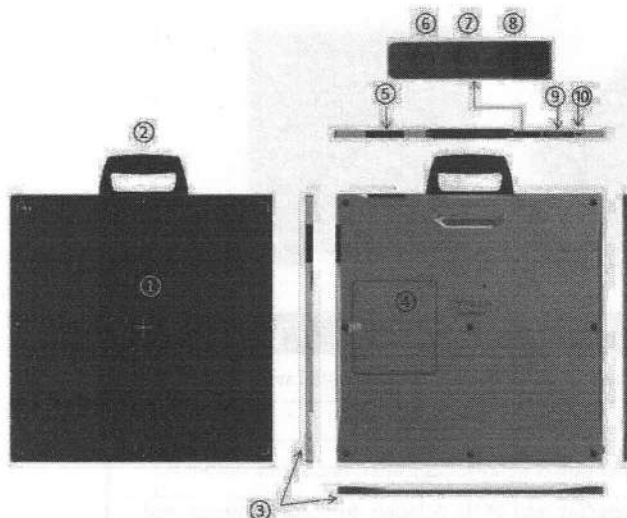
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## 4.3.9 Detector (Option)

(1) EVS 4343W, EVS 4343WP, EVS 3643W, EVS 3643WP



| No. | Function            | Description of Functions                                                                            |
|-----|---------------------|-----------------------------------------------------------------------------------------------------|
| 1   | Active area         | The part that acquires an image with a TFT panel coated with Scintillator                           |
| 2   | Handle              | Handle used when moving                                                                             |
| 3   | Detector Case       | Case to fix and protect TFT panel and operating circuit                                             |
| 4   | Battery pack        | Power to the detector                                                                               |
| 5   | Antenna             | Image data transmission by wireless communication                                                   |
| 6   | Display button      | Button to check network mode or detector IP                                                         |
| 7   | AP button           | Button to switch network                                                                            |
| 8   | Power Button        | Power ON/OFF button                                                                                 |
| 9   | Status display part | Status display to check power, network connection information, network mode and detector IP address |
| 10  | Connector           | Power supply and LAN cable connection through USB type C to Ethernet connection                     |

  
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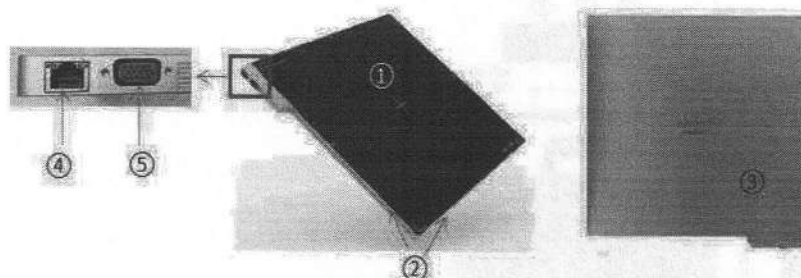


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## (2) EVS 4343A, EVS 3643A, EXPD 4343P, EXPD 3643P



| No. | Function          | Description of Functions                                                        |
|-----|-------------------|---------------------------------------------------------------------------------|
| 1   | Active area       | The part that acquires an image with a TFT panel coated with Scintillator       |
| 2   | Detector Case     | Case to fix and protect TFT panel and driving circuit                           |
| 3   | Operation circuit | Circuit part consisting of power supply, controller, and signal output IC       |
| 4   | POE port          | Port that connects Detector and POE Adapter to receive power and transmit video |
| 5   | Generator port    | Port connected to X-ray Generator                                               |

  
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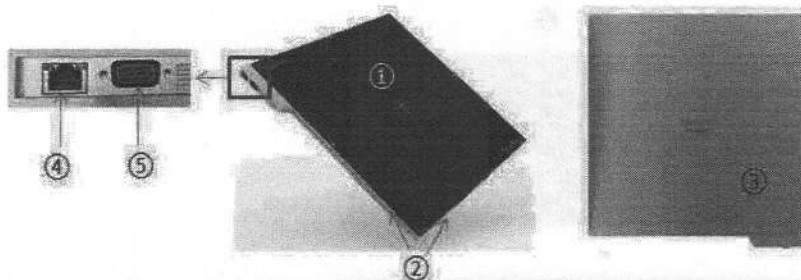
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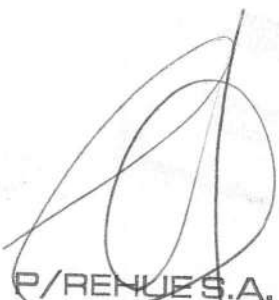
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## (3) EXPD 3643D, EXPD 4343D



| No. | Function          | Description of Functions                                                        |
|-----|-------------------|---------------------------------------------------------------------------------|
| 1   | Active area       | The part that acquires an image with a TFT panel coated with Scintillator       |
| 2   | Detector Case     | Case to fix and protect TFT panel and driving circuit                           |
| 3   | Operation circuit | Circuit part consisting of power supply, controller, and signal output IC       |
| 4   | POE port          | Port that connects Detector and POE Adapter to receive power and transmit video |
| 5   | Generator port    | Port connected to X-ray Generator                                               |

  
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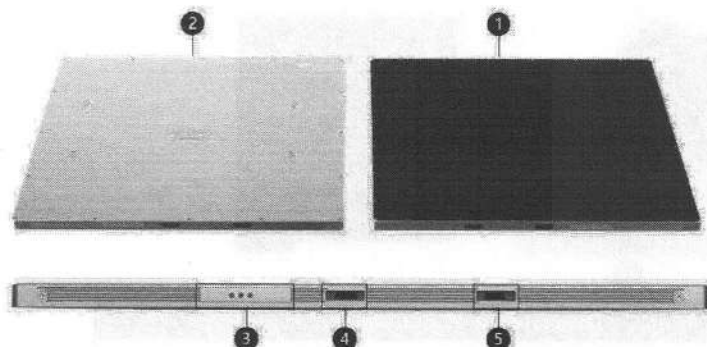
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## (4) EXPD 4343S



| No. | Function           | Description of Functions                                                                       |
|-----|--------------------|------------------------------------------------------------------------------------------------|
| 1   | Active area        | The part that acquires an image with a TFT panel coated with Scintillator                      |
| 2   | Detector Case      | Case to fix and protect TFT panel and driving circuit                                          |
| 3   | LED display        | Display the Detector status with LEDs.                                                         |
| 4   | External SYNC Port | Connected to the X-ray System Generator to match the operating status.                         |
| 5   | PWR/Ethernet port  | Connected to the Detector and Adaptor/PC to supply power and transmit images through the port. |

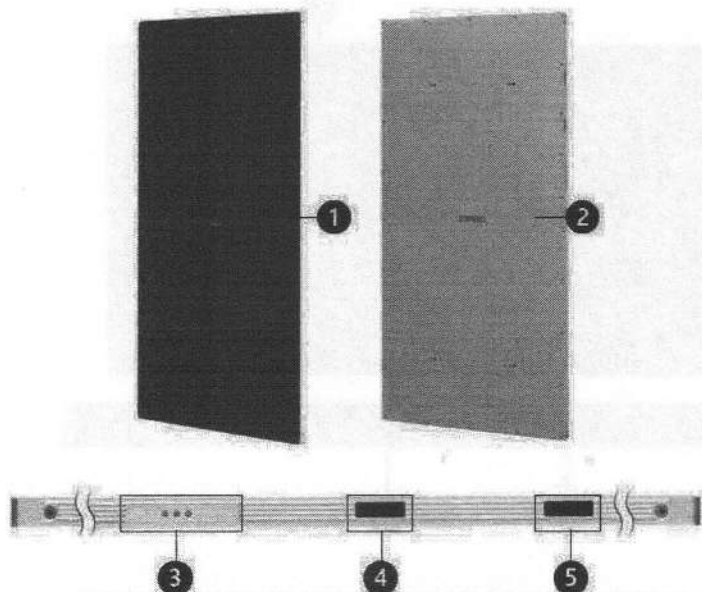
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## (5) EXPD 86P, EXPD 86PG, EXPD 129P, EXPD 129PG



| No. | Function           | Description of Functions                                                                       |
|-----|--------------------|------------------------------------------------------------------------------------------------|
| 1   | Active area        | The part that acquires an image with a TFT panel coated with Scintillator                      |
| 2   | Detector Case      | Case to fix and protect TFT panel and driving circuit                                          |
| 3   | LED display        | Display the Detector status with LEDs.                                                         |
| 4   | External SYNC Port | Connected to the X-ray System Generator to match the operating status.                         |
| 5   | PWR/Ethernet port  | Connected to the Detector and Adaptor/PC to supply power and transmit images through the port. |

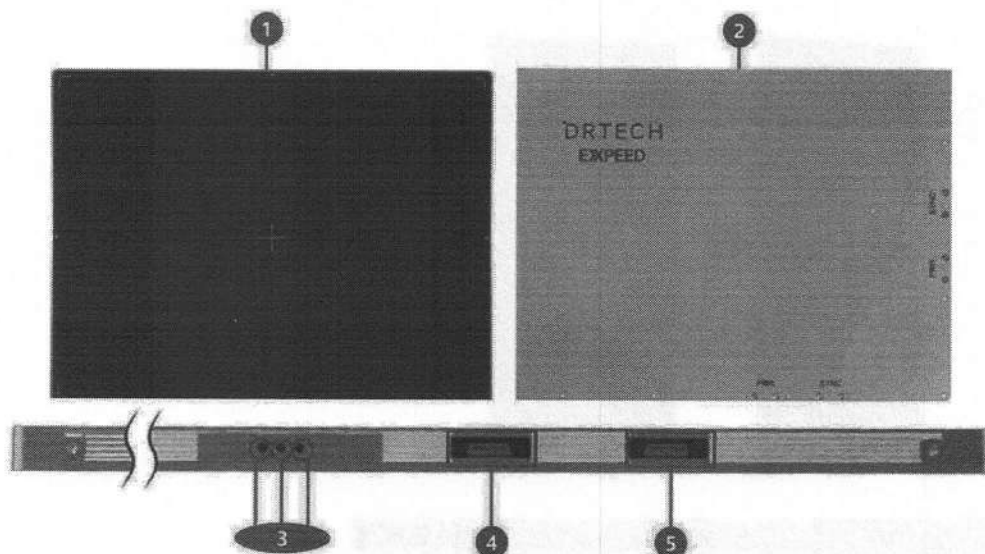
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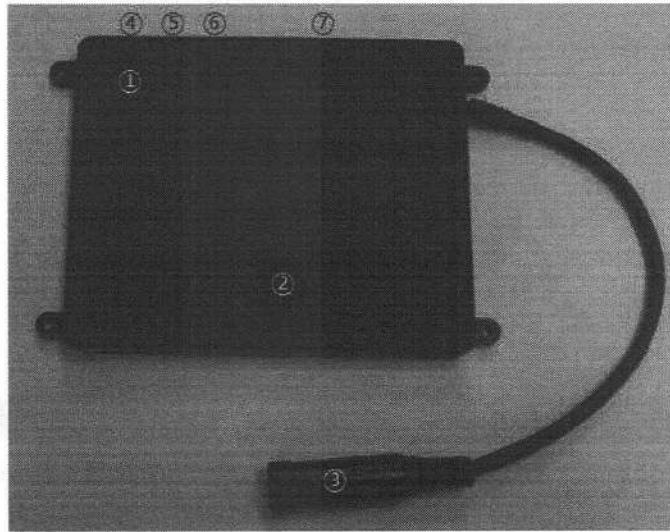
| No. | Function      | Description of Functions                                                                                                                                              |
|-----|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Active area   | The part that acquires an image with a TFT panel coated with Scintillator                                                                                             |
| 2   | Detector Case | Case to fix and protect TFT panel and driving circuit                                                                                                                 |
| 3   | LED display   | Display the Detector status with LEDs.                                                                                                                                |
| 4   | PWR Port      | Port that the POE (POWER / Ethernet) cable is connected, connecting the detector and adapter / PC to supply power and transmit image. (Includes Lan cable within 20m) |
| 5   | SYNC Port     | The port to which the External SYNC Cable is connected matches and synchronizes the operational status of the X-ray System Generator.                                 |

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## 4.3.10 Wireless Detector Charger (Option)



| No. | Function                            | Description of Functions                     |
|-----|-------------------------------------|----------------------------------------------|
| 1   | EVS-WPCS Base                       | Main body of wireless charger                |
| 2   | IRDA Window                         | IRDA Window : IRDA communication window.     |
| 3   | Power Connection Cable              | Cable to supply power                        |
| 4   | Debug Connector                     | When debugging, necessary connector terminal |
| 5   | ID Switch                           | Device id setting dip switch.                |
| 6   | Indicate LED Connector : for cradle | LED display when connected to Cradle         |
| 7   | Indicate LED Connector : for system | LED display when connected to System         |

  
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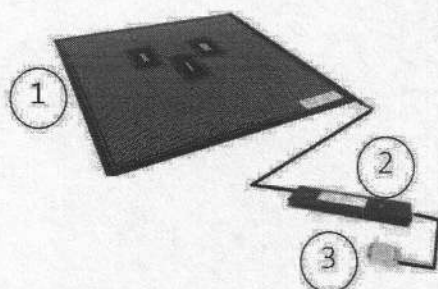
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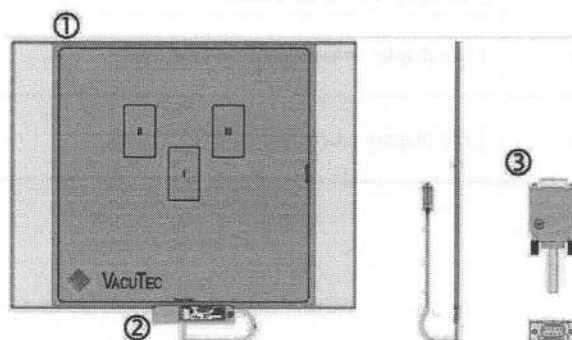
## 4.3.11 AEC Chamber (Option)

## (1) SSMC 601 (Manufacturer : Claymount)



| No. | Function          | Description of Functions                                                                                  |
|-----|-------------------|-----------------------------------------------------------------------------------------------------------|
| 1   | Measuring Chamber | Detects the amount of X-rays transmitted through the patient and transmits a signal to the pre-amplifier. |
| 2   | Pre-amplifier     | Amplifies the signal input from the Measuring Chamber and delivers it to the control circuit.             |
| 3   | Signal connector  | Wiring connection between pre-amplifier and control circuit                                               |

## (2) AEC Chamber – DRTech (Manufacturer : VacuTec)



| No. | Function          | Description of Functions                                                                                  |
|-----|-------------------|-----------------------------------------------------------------------------------------------------------|
| 1   | Measuring Chamber | Detects the amount of X-rays transmitted through the patient and transmits a signal to the pre-amplifier. |
| 2   | Pre-amplifier     | Amplifies the signal input from the Measuring Chamber and delivers it to the control circuit.             |
| 3   | Signal connector  | Wiring connection between pre-amplifier and control circuit                                               |

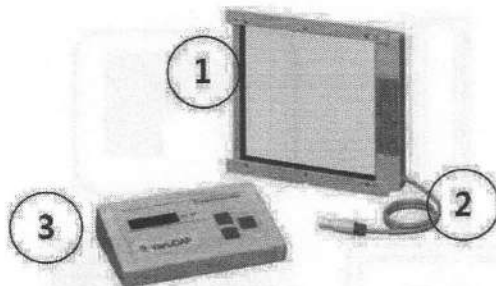
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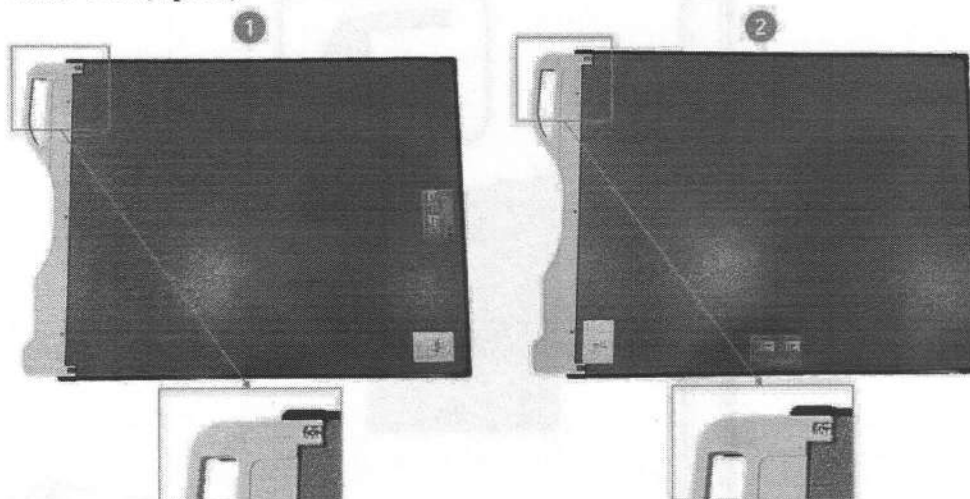
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## 4.3.12 DAP (Option)



| No. | Function          | Description of Functions                                        |
|-----|-------------------|-----------------------------------------------------------------|
| 1   | Measuring Chamber | Detects X-ray dose and transmits a signal to the display device |
| 2   | Signal connector  | Wiring connection between pre-amplifier and control circuit     |
| 3   | Display           | Displays the X-ray dose detected by the Measuring Chamber       |

## 4.3.13 Grid (Option)



| No. | Function        | Description of Functions                                                          |
|-----|-----------------|-----------------------------------------------------------------------------------|
| 1   | Vertical Grid   | Vertical grid for x-ray imaging when taking images in the vertical direction.     |
| 2   | Horizontal Grid | Horizontal grid for x-ray imaging when taking images in the horizontal direction. |

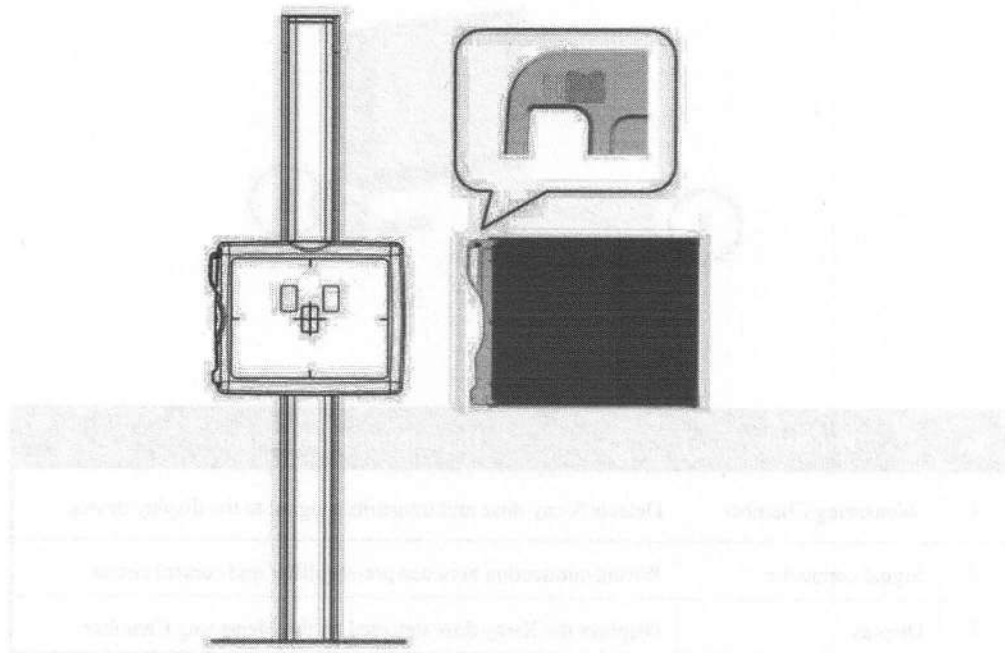
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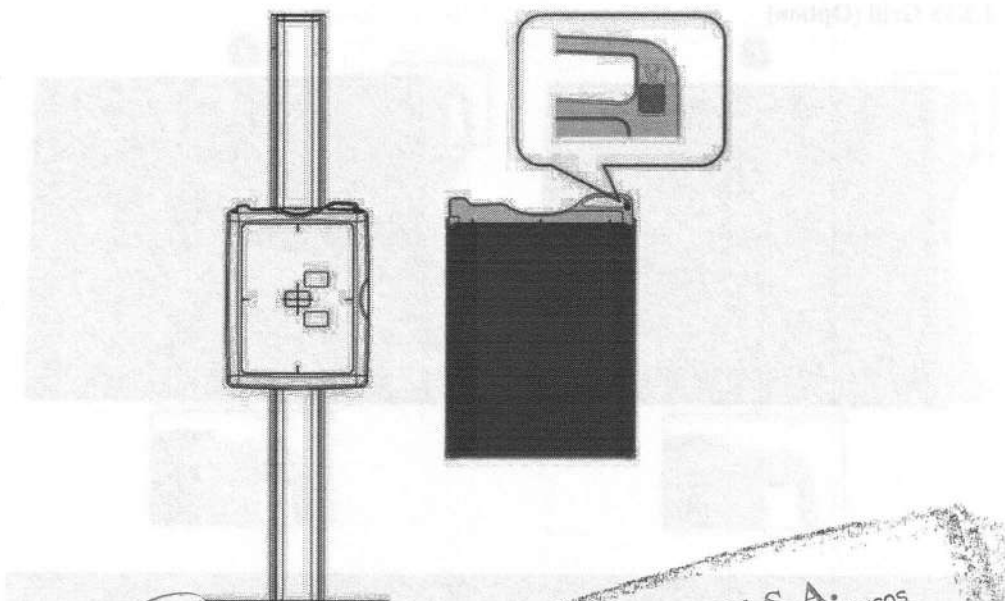
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- Image of a Grid being mounted on a Bucky stand (DBS-57M)



[Horizontal Grid]



[Vertical Grid]

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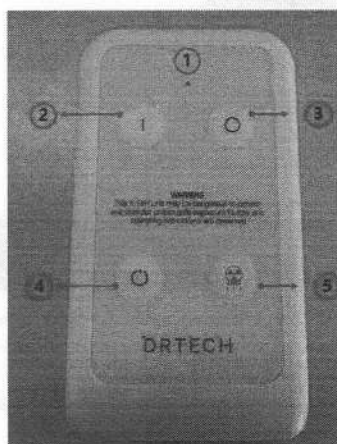
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## 4.3.14 Mini Console (Option)



| No. | Function        | Description of Functions                       |
|-----|-----------------|------------------------------------------------|
| 1   | Hand switch     | Preparation for examination, X-ray examination |
| 2   | Mini console    | Main device                                    |
| 3   | Connector cable | Connector cable connecting to the control unit |



| No. | Function             | Description of Functions                               |
|-----|----------------------|--------------------------------------------------------|
| 1   | Indicator            | When the generator power is on, the green LED turn on. |
| 2   | Generator On Switch  | Turn on the generator                                  |
| 3   | Generator Off switch | Turn off the generator                                 |
| 4   | Ready Switch         | Make the generator ready for operation.                |
| 5   | X-Ray Switch         | Make the X-Ray irradiated.                             |

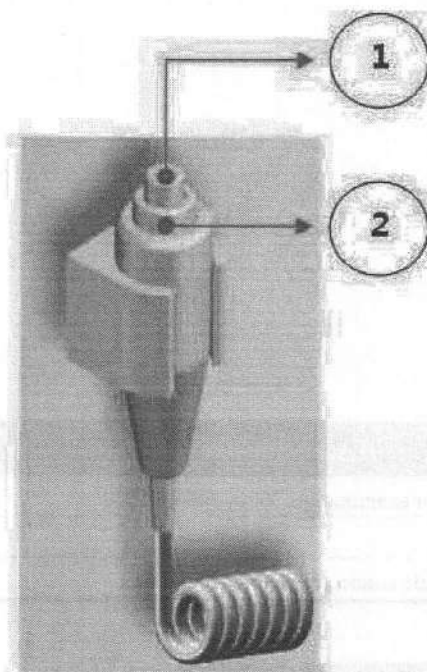
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## 4.3.15 Hand Switch (Accessories)

**Description of Product Functions**

As a switch for X-ray irradiation, it activates Ready and X-Ray.

Used with generator console(DXG-CON) or mini console.

| NO | Function     | Description of Functions                |
|----|--------------|-----------------------------------------|
| 1  | Ready Switch | Make the generator ready for operation. |
| 2  | X-Ray Switch | Make the X-ray irradiated.              |

  
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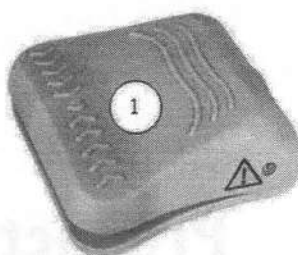
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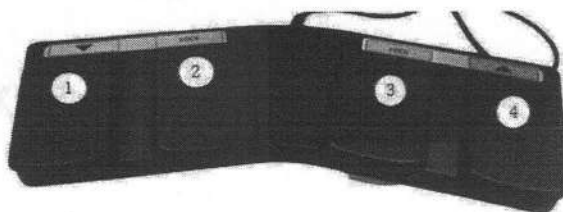
## 4.3.16 Foot Switch (Accessories)

- For 4 way table (DPT-4A)



| NO | Function            | Description of Functions                                             |
|----|---------------------|----------------------------------------------------------------------|
| ①  | Unlock brake button | Controls the operation of the electromagnet through switch operation |

- For 6 way table (DPT-6A)



| NO   | Function        | Description of Functions               |
|------|-----------------|----------------------------------------|
| ①    | DOWN switch     | Switch to go DOWN the Table            |
| ②, ③ | All lock switch | All Lock Release Switch for the Table. |
| ④    | UP switch       | Switch to go UP the Table              |

  
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## Chapter 5

# Product Specification

## Diagnostic X-ray System

**[EXSYS DEXi]**

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## 5 Specifications

### 5.1 Product Size and Weight

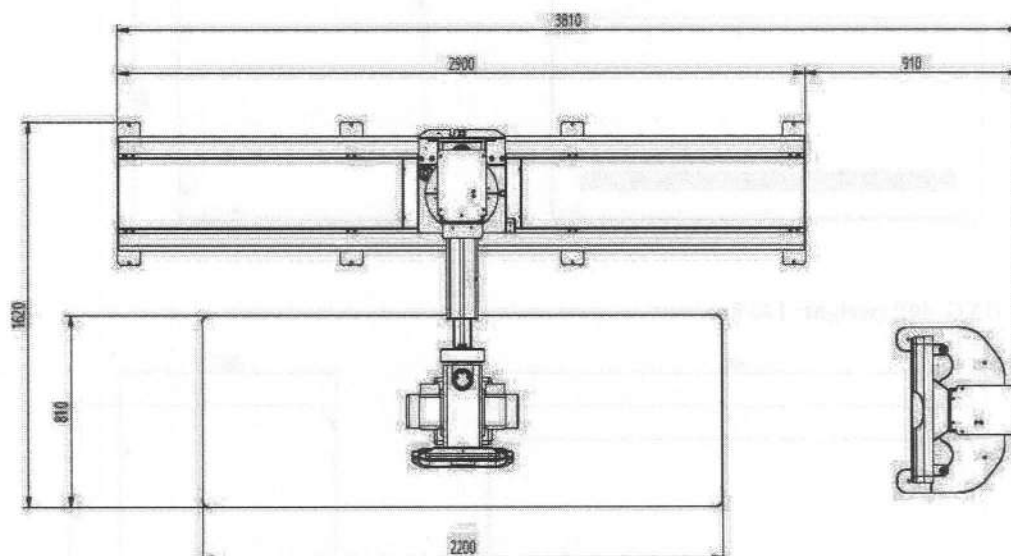
The size unit is mm, the tolerance range is within  $\pm 10\%$ , the weight unit is kg, and the tolerance is within  $\pm 10\text{kg}$ .

#### ► CAUTION

Product dimensions and weights presented below are before packaging and may vary according to revision or options.

#### 5.1.1 Size of EXSYS DEXi

System total size



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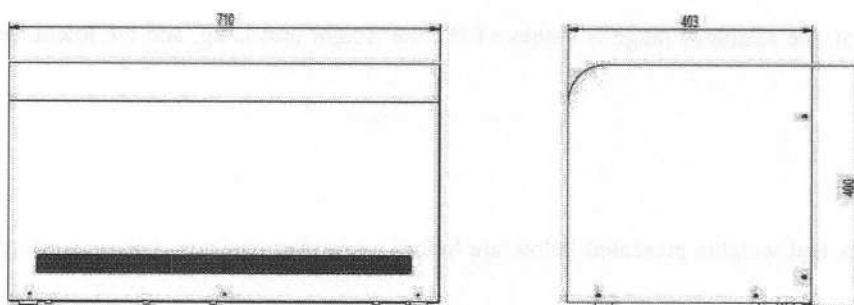
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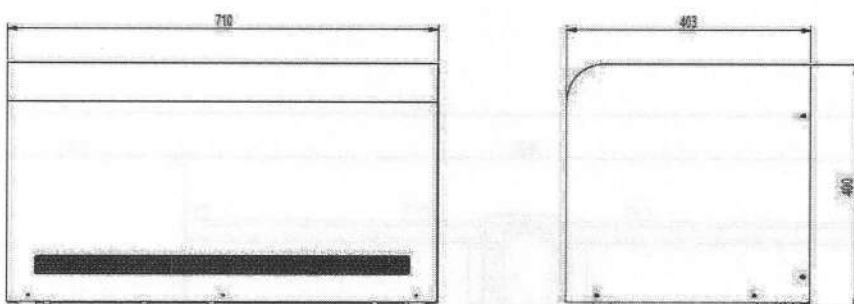
## 5.1.2 Dimensions and weight of major parts

### 5.1.2.1 X-ray generator

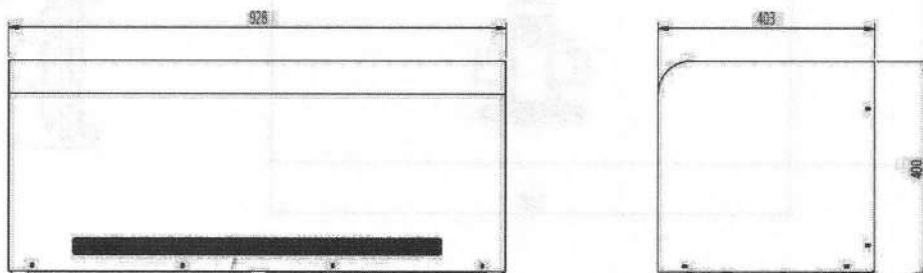
#### ■ DXG-40S (weight: 110 kg)



#### ■ DXG-50T (weight: 110 kg)



#### ■ DXG-40P (weight: 140 kg)



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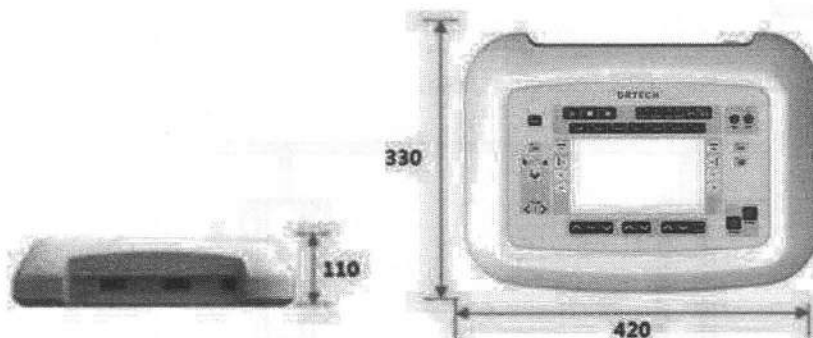
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**5.1.2.2 Generator Console(DXG-CON) (weight: 6 kg)**



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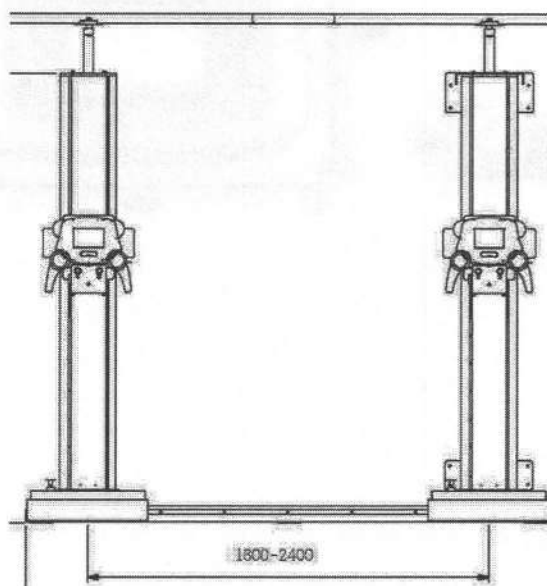
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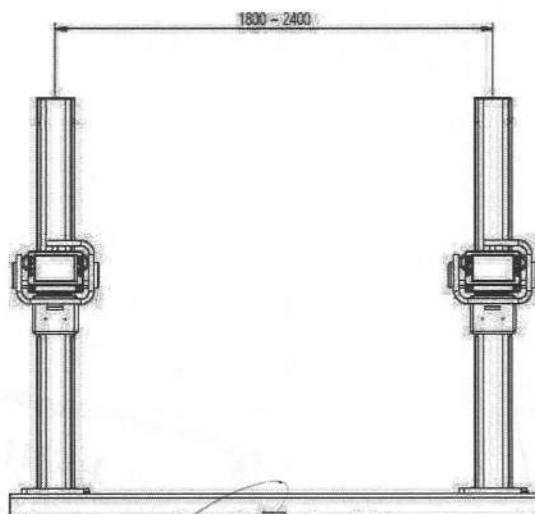
## 5.1.2.3 X-ray tube support device

## ■ Moving distance horizontal

## 1) Membrane OP Console HandleBar (weight: 250kg)



## 2) System OP Console HandleBar (weight: 250kg)



Rehue s.a.

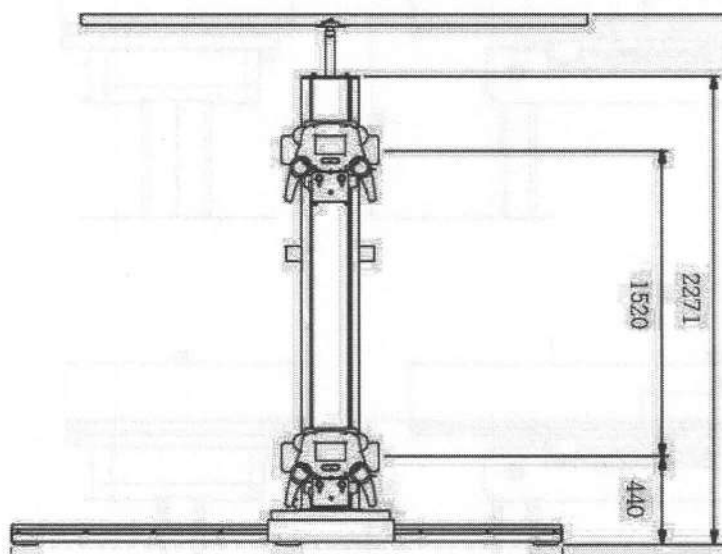
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Calle Vigor 169 (Roca)  
Calle 1354 P.B. - Mendoza  
Pedro Pablo Kallén - Mendoza  
Alberdi 14

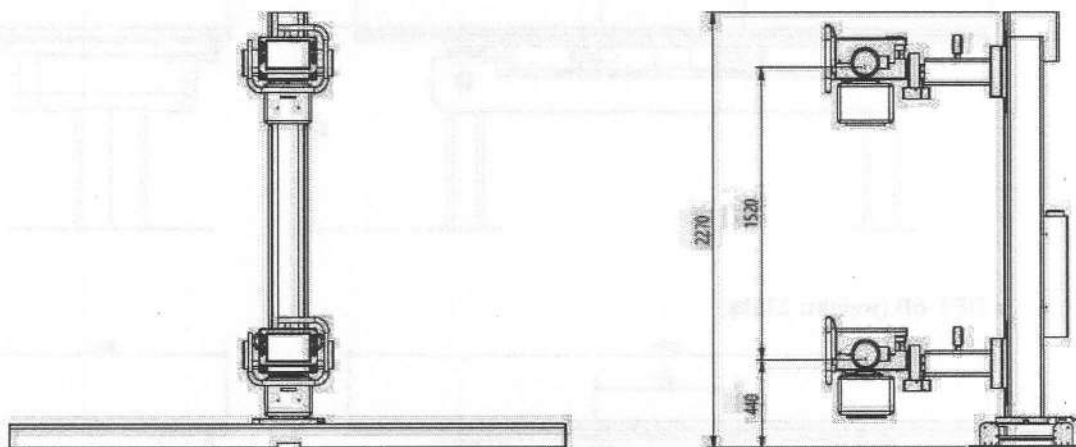
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## ■ Moving distance upward and downward

## 1) Membrane OP Console HandleBar



## 2) System OP Console HandleBar



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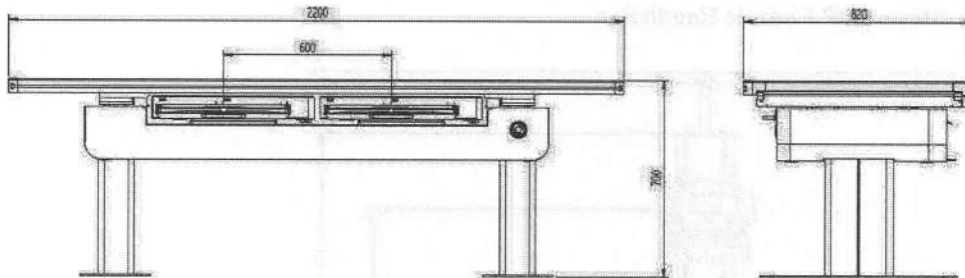
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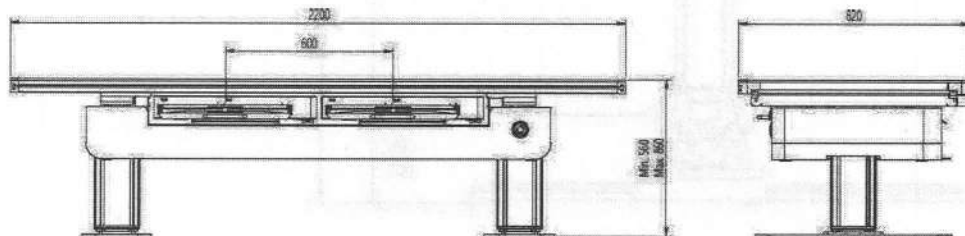
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## 5.1.2.4 Patient Table

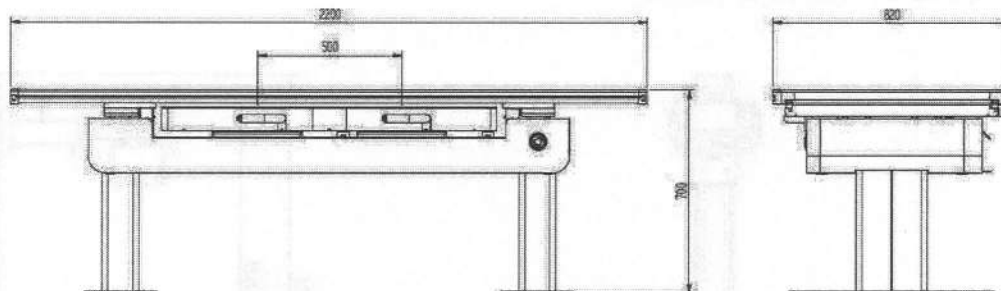
## ■ DPT-4A (weight: 215kg)



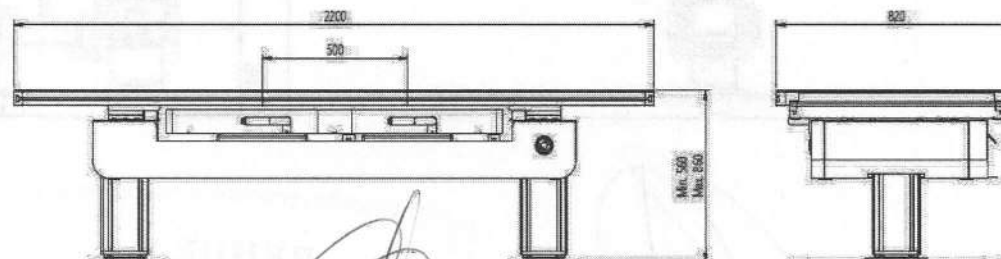
## ■ DPT-6A (weight: 225kg)



## ■ DPT-4B (weight: 215kg)



## ■ DPT-6B (weight: 225kg)



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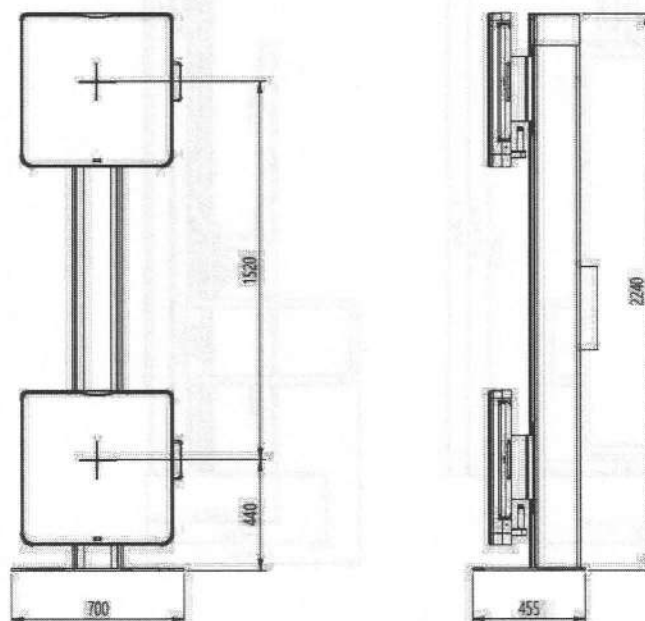
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Alberdi 1440

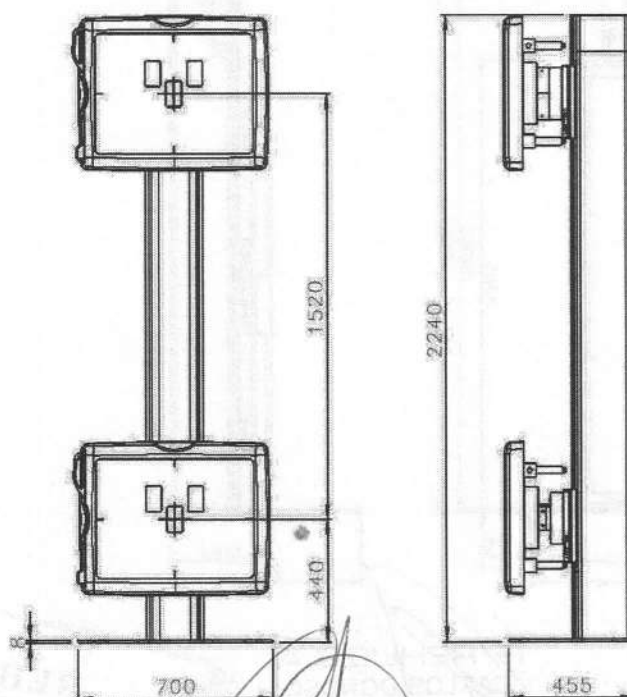
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### 5.1.2.5 Bucky stand

#### ■ DBS-43M (weight: 130 kg)



#### ■ DBS-57M (weight: 130 kg)



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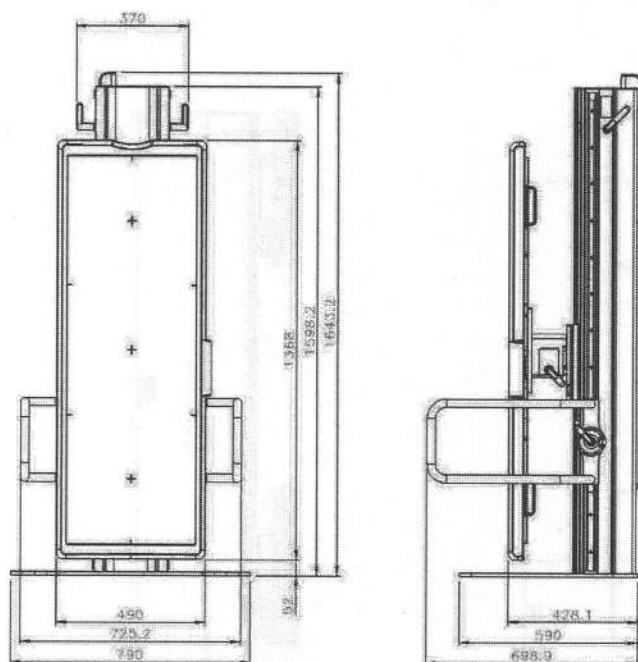
Matrícula N° 2992

SUPERVISOR TÉCNICO

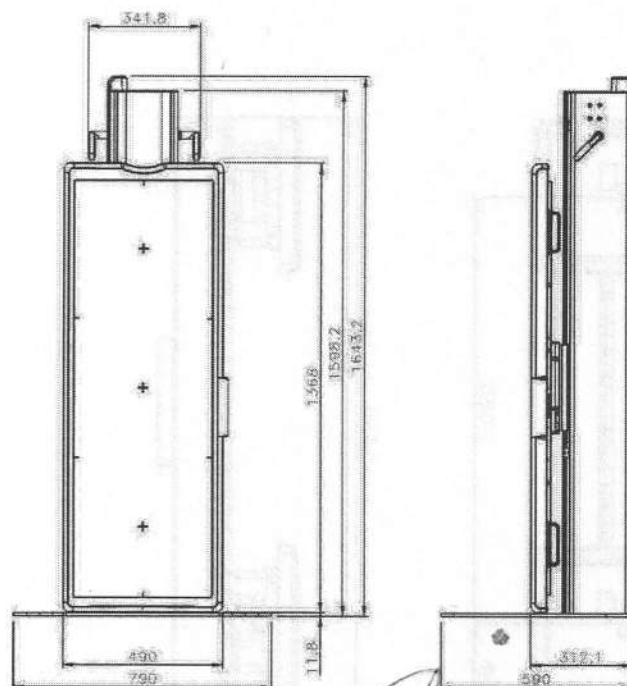
Pedro B. Palacios 1354 P.B. - Mendoza

Alhard 1440 - Glén. - Mendoza

### ■ LLD 129 WITH ROTATION (weight: 155 kg)



### ■ LLD 129 COMPACT (weight: 129 kg)



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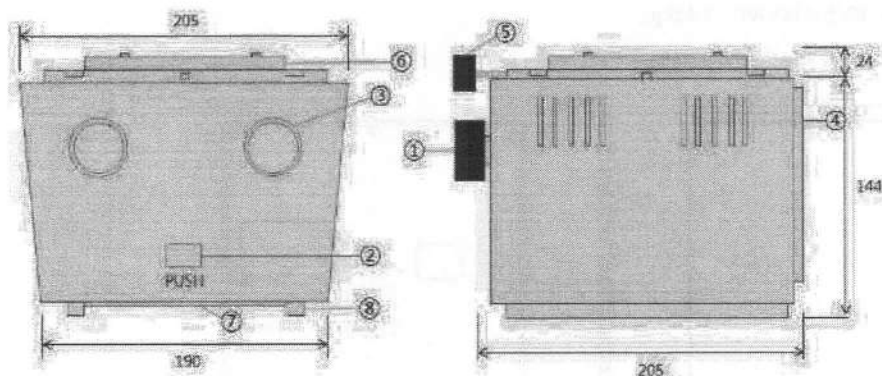
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Dpto. CASTRO RAMOS, FEDERICO  
SUPERVISOR VET 09 (Rev. 02)  
Palacios 1354 P.B. - Mendoza  
Alberdi 1410 - San Juan - Mendoza

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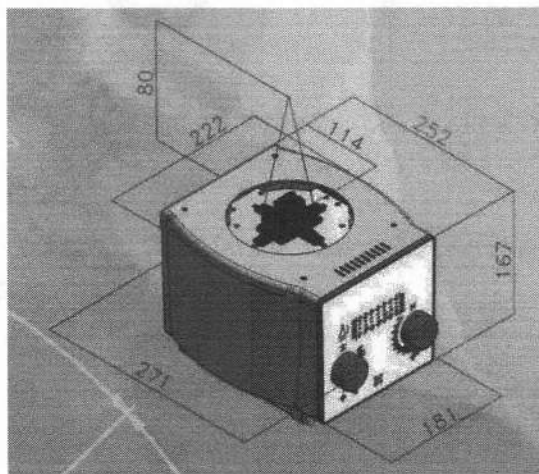


### 5.1.2.6 Collimator (weight: 5 kg)

- M38 (weight : 5 kg)



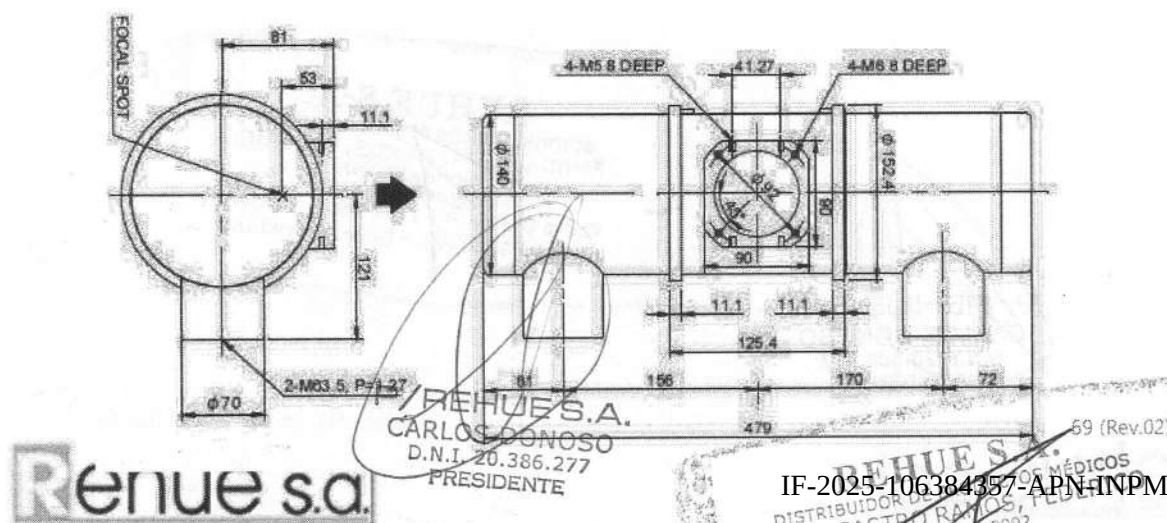
- R 221/A DHHS (weight : 8.4 kg)



### 5.1.2.7 X-ray Tube (weight: 16.0kg)

- E7239X, E7242X, E7884X

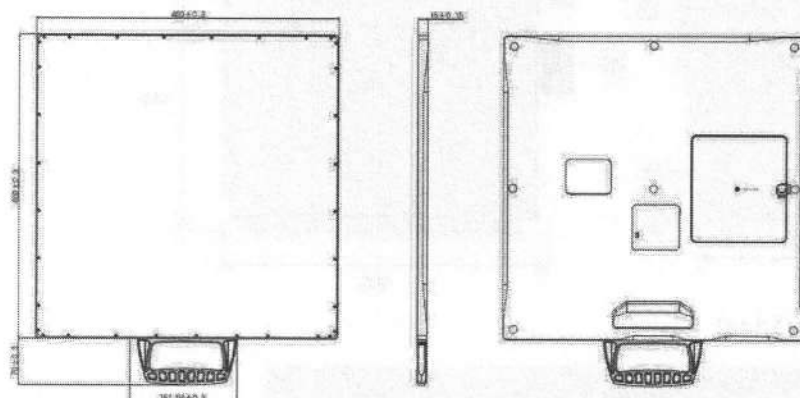
E7239X, E7242X and E7884X are identical in dimensions and weight..



### 5.1.2.8 Detector

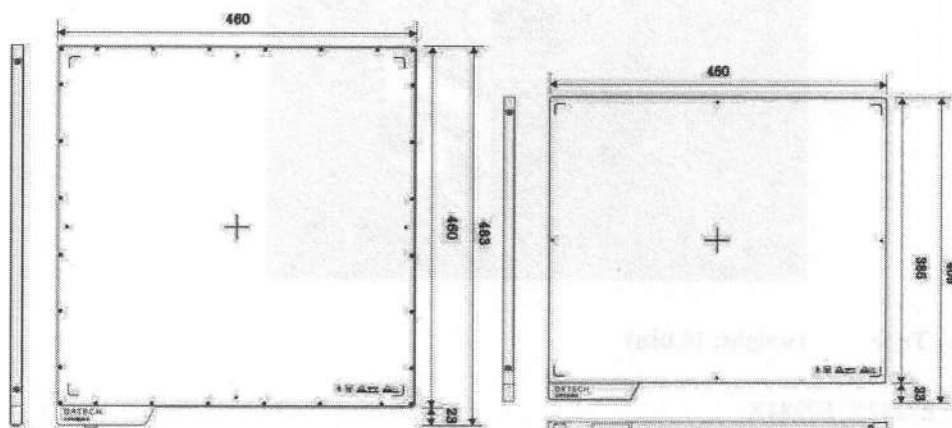
(1) EVS 4343W, EVS 4343WP - 3.45kg,

(2) EVS 3643W, EVS 3643WP - 2.98kg



(3) EXPD 4343P, EVS 4343A - 4.3kg,

(4) EXPD 3643P, EVS 3643A - 3.5kg



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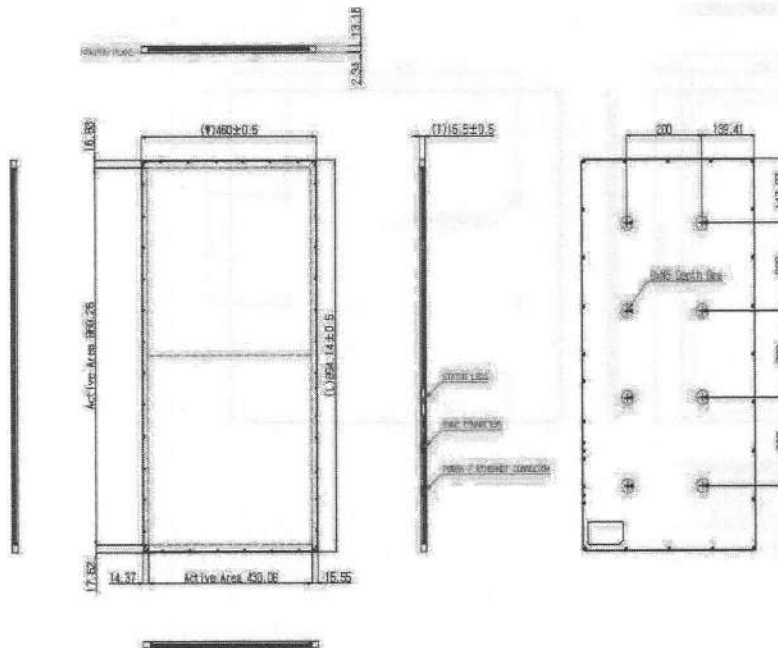
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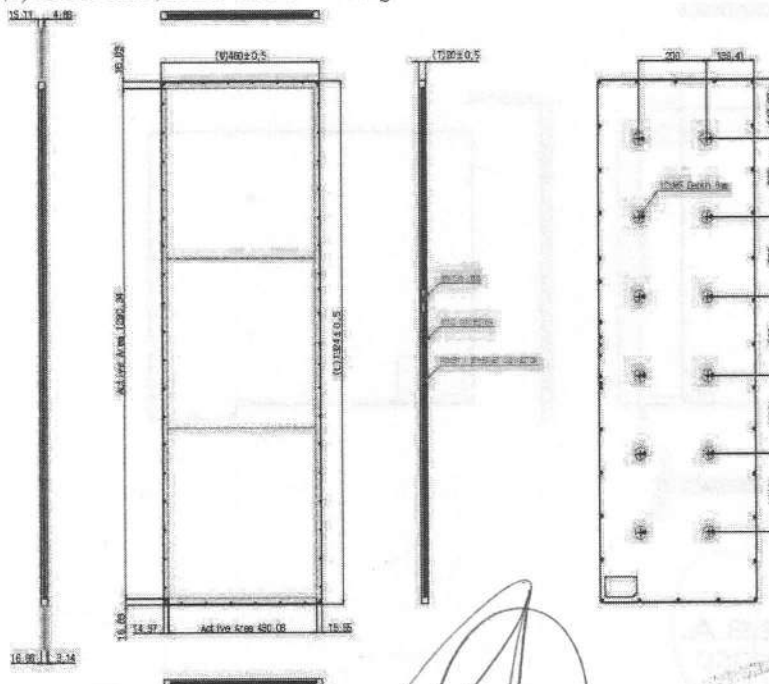
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(5) EXPD 86P, EXPD 86PG – 6.3kg,



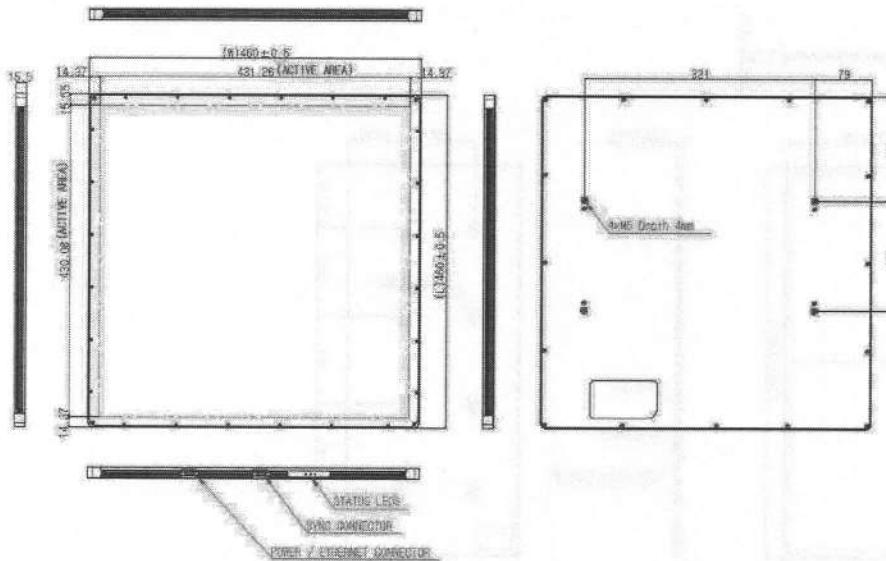
(6) EXPD 129P, EXPD 129PG – 10kg



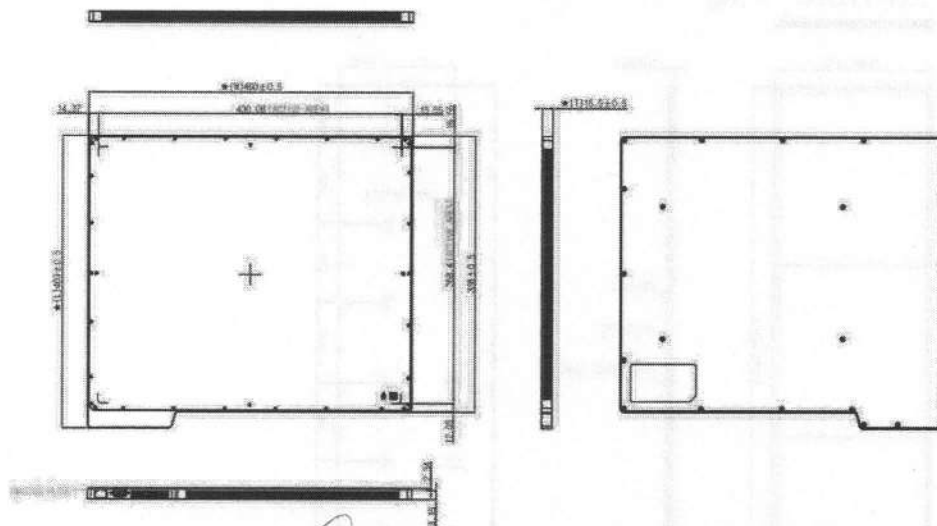
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(7) EXPD 4343S – 4.63kg



(8) EXPD 3643D – 3.5kg

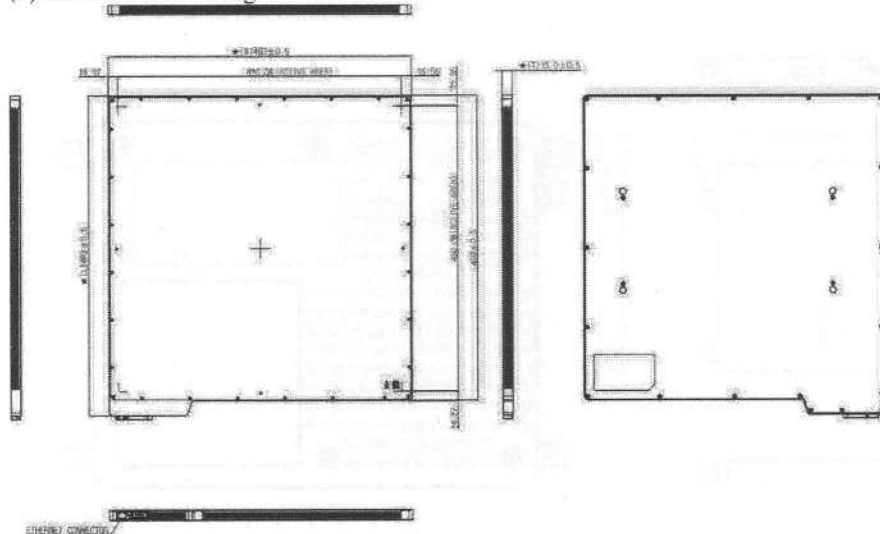


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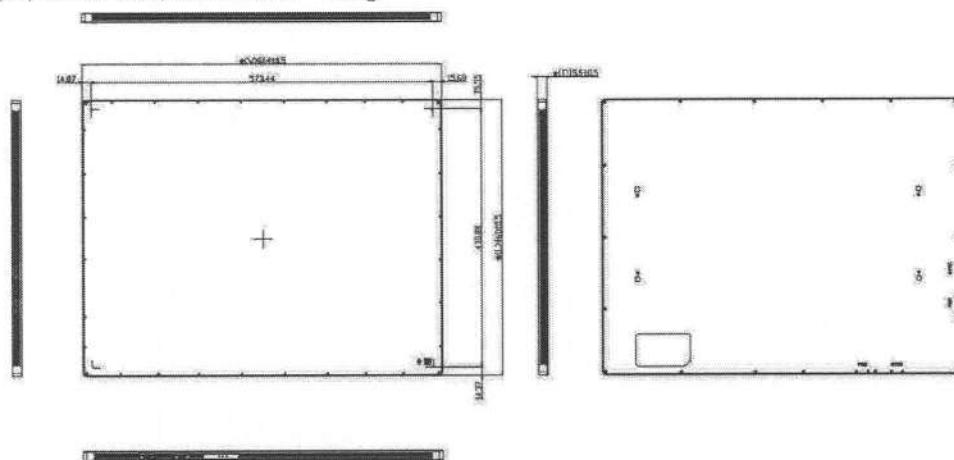
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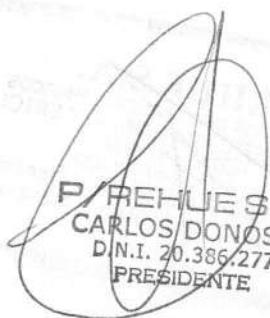
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(9) EXPD 4343D – 4.3kg



(10) EXPD 4357, EXPD 4357P – 4.8kg



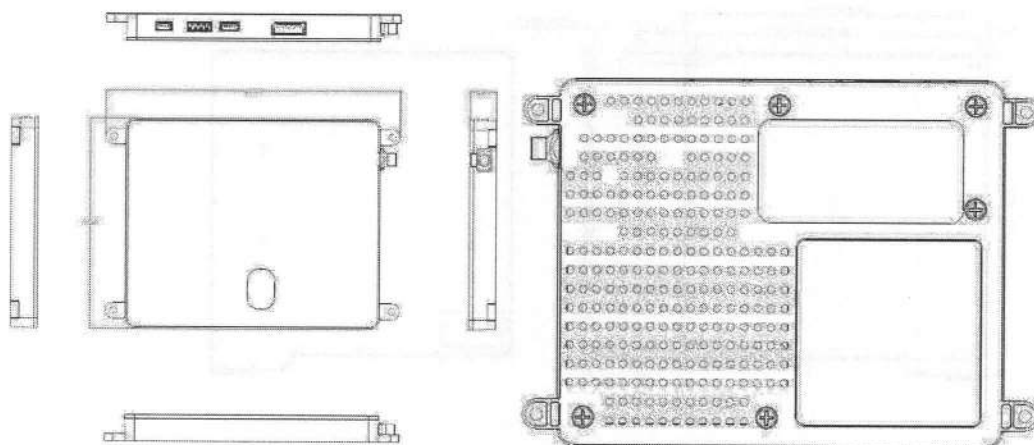
  
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**5.1.2.9 Wireless Detector Charger (weight: 0.15kg)**



  
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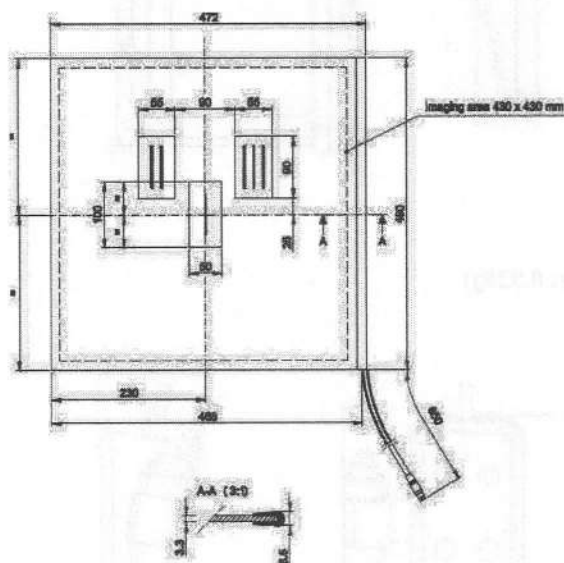
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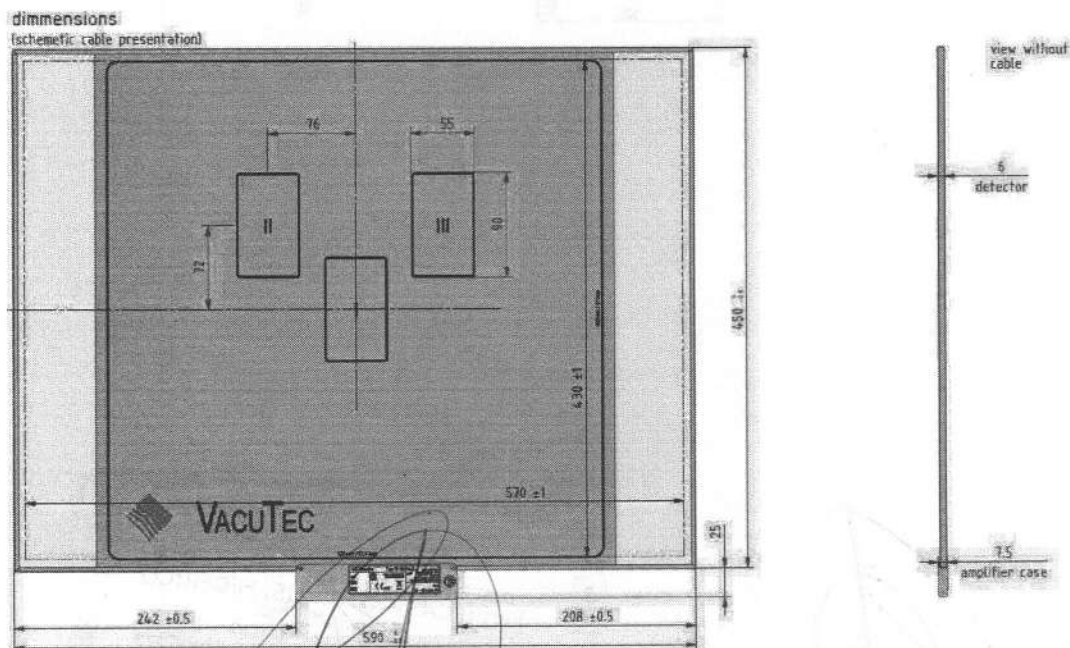


### 5.1.2.10 AEC ion-Chamber

(1) SSMC 601 (Manufacturer : Claymount) (weight: 9.5 kg)



(2) AEC Chamber – DRTech (Manufacturer : VacuTec)

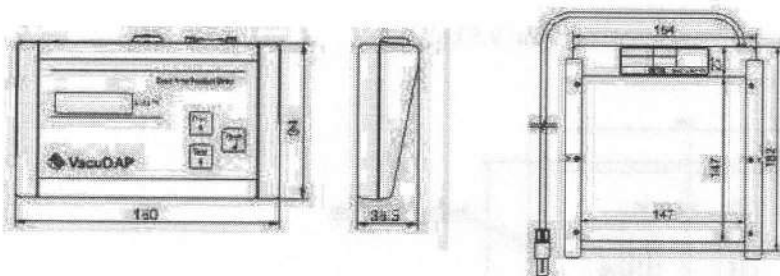


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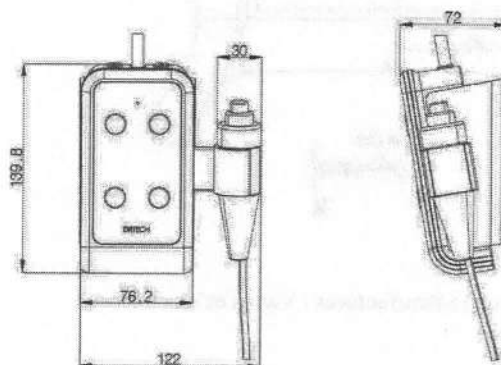
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5.1.2.11 DAP (weight: 1.4kg)



5.1.2.12 Mini Console (weight: 0.92kg)



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## 5.2 Product Performance

## 5.2.1 Product Specifications

| Items                                  | Description                                                                                                                                                                                                                              |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rating                                 | <b>Model Name :</b><br>EXSYS DEXi-D401S-FRM, EXSYS DEXi-A401S-FRM,<br>EXSYS DEXi-D402S-FRM, EXSYS DEXi-A402S-FRM                                                                                                                         |
|                                        | 220-230 V~, 50/60 Hz<br>Stand-by: 230 VA<br>Exposure : 70 kVA                                                                                                                                                                            |
|                                        | <b>Model Name :</b><br>EXSYS DEXi-D401P-FRM, EXSYS DEXi-A401P-FRM                                                                                                                                                                        |
|                                        | 100V/ 220-230 V~, 50/60 Hz<br>Stand-by: 350 VA<br>Exposure : Nominal < 3 kVA (Peak current, kVA: 130 A, 28 kVA)                                                                                                                          |
|                                        | <b>Model Name :</b><br>EXSYS DEXi-D402P-FRM, EXSYS DEXi-A402P-FRM                                                                                                                                                                        |
|                                        | 220-230 V~, 50/60 Hz<br>Stand-by: 350 VA<br>Exposure : Nominal < 3 kVA (Peak current, kVA: 130 A, 28 kVA)                                                                                                                                |
| Protection type against electric shock | <b>Model Name :</b><br>EXSYS DEXi-D503T-FRM, EXSYS DEXi-A503T-FRM                                                                                                                                                                        |
|                                        | 230 V3~, 50/60 Hz, 350 VA (Stand-by), 82 kVA (Exposure)<br>380 V3~, 50/60 Hz, 600 VA (Stand-by), 80 kVA (Exposure)<br>400 V3~, 50/60 Hz, 600 VA (Stand-by), 80 kVA (Exposure)<br>480 V3~, 50/60 Hz, 720 VA (Stand-by), 90 kVA (Exposure) |
|                                        | Class I                                                                                                                                                                                                                                  |
|                                        | Type B applied parts                                                                                                                                                                                                                     |
|                                        | Ordinary Equipment : IPX0<br>(Detector : IP54)                                                                                                                                                                                           |
|                                        | 4 way table foot switch : IPX4<br>6 way table foot switch : IPX6                                                                                                                                                                         |
| Water ingress protection               |                                                                                                                                                                                                                                          |
| Methods of sterilization               | Not applicable, cleaning only                                                                                                                                                                                                            |
| Usability in an oxygen environment     | Not applicable                                                                                                                                                                                                                           |
| Mode of operation                      | Non-continuous operation<br>(Resting time : Min. 5 min at max. mAs condition)                                                                                                                                                            |

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## 5.2.2 PC Console (option)

The PC console (EConsole) controls the generator and displays its status. The irradiation value can be changed through the PC console (EConsole), and it indicates whether or not the current generator can irradiate X-rays.

## 5.2.3 X-ray generator

## (1) X-ray Generator (40kW) – DXG-40S

| Items                        | Description                                                                                               |
|------------------------------|-----------------------------------------------------------------------------------------------------------|
| Maximum output capacity      | 40kW                                                                                                      |
| Line rating                  | AC 220-230V~, 50/60Hz, Single phase                                                                       |
| kV range                     | Min. 40 kV ~Max.125kV, 1kV step                                                                           |
| mA range                     | Min. 10 mA to Max.500mA                                                                                   |
| Irradiation time range       | Min. 1msec to Max. 10sec                                                                                  |
| Interval time After Exposure | 1minute at 100KV, 400mA, 100msec.                                                                         |
| Accuracy                     | kV $\leq \pm(3\%+1kV)$ , mA $\leq \pm(5\%+1mA)$ , ms $\leq \pm(10\%+1ms)$ ,<br>mAs $\leq \pm(5\%+0.2mAs)$ |
| Output rating                | 500mA@80kV at 100msec                                                                                     |
|                              | 400mA@100kV 100msec (max. 40 kW Rating)                                                                   |

## (2) X-ray Generator (50kW) – DXG-50T

| Items                        | Description                                                                                               |
|------------------------------|-----------------------------------------------------------------------------------------------------------|
| Maximum output capacity      | 50kW                                                                                                      |
| Line rating                  | AC 230V/380V/400V/480V~, 50/60Hz, Three phase                                                             |
| kV range                     | Min.40 kV ~Max.150kV, 1kV step                                                                            |
| mA range                     | Min. 10 mA to Max.630mA                                                                                   |
| Irradiation time range       | Min. 1msec to Max 10sec                                                                                   |
| Interval time After Exposure | 1minute at 100KV, 630mA, 100msec.                                                                         |
| Accuracy                     | kV $\leq \pm(3\%+1kV)$ , mA $\leq \pm(5\%+1mA)$ , ms $\leq \pm(10\%+1ms)$ ,<br>mAs $\leq \pm(5\%+0.2mAs)$ |
| Output rating                | 630mA@80kV at 100msec                                                                                     |
|                              | 500mA@100kV 100msec (max. 50 kW Rating)                                                                   |

## (3) X-ray Generator (40kW) – DXG-40P

| Items                        | Description                                                                                               |
|------------------------------|-----------------------------------------------------------------------------------------------------------|
| Maximum output capacity      | 40kW                                                                                                      |
| Line rating                  | AC 100V / 220-230V~, 50/60Hz, Single phase                                                                |
| kV range                     | Min. 40 kV ~Max.125kV, 1kV step                                                                           |
| mA range                     | Min. 10 mA to Max.500mA                                                                                   |
| Irradiation time range       | Min. 1msec to Max. 10sec                                                                                  |
| Interval time After Exposure | 1minute at 100KV, 400mA, 100msec                                                                          |
| Accuracy                     | kV $\leq \pm(3\%+1kV)$ , mA $\leq \pm(5\%+1mA)$ , ms $\leq \pm(10\%+1ms)$ ,<br>mAs $\leq \pm(5\%+0.2mAs)$ |
| Output rating                | 500mA@80kV at 100msec                                                                                     |
|                              | 400mA@100kV 100msec (max. 40 kW Rating)                                                                   |

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## 5.2.4 Generator Console(DXG-CON)

**Generator Console (DXG-CON) Specification**

- 1) Type: Microprocessor control & LCD display
- 2) Indication meter: kV, mA, mAs or msec
- 3) mA setting: 10mA to 630mA ( $\pm 5\%$ )
- 4) kV setting: 40kV to 150KV ( $\pm 5\%$ )
- 5) Time setting: 10msec ~ 10sec
- 6) Anatomical mode (APR): 1290 preset anatomical programs
- 7) AEC function (option)
- 8) DAP function (option)

  
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## 5.2.5 X-ray tube

## (1) E7239X

|                            |                                                                                 |
|----------------------------|---------------------------------------------------------------------------------|
| Focal Spot size            | Small: 1.0mm, Large: 2.0mm                                                      |
| Anode Heat Capacity        | 140kHU                                                                          |
| Target angle               | 16°                                                                             |
| Tube Voltage               | Max. 125kV                                                                      |
| Anode Rotation speed       | 50 Hz: Minimum 2700 min <sup>-1</sup> , 60 Hz: Minimum 3200 min <sup>-1</sup> . |
| Anode Stator Input Voltage | Stating: Max. AC220V, Running: Max. AC60V                                       |
| Anode Stator Input power   | Stating: Max. 2000W, Running: Max. 150W.                                        |
| Inherent filtration value  | 0.9mmAl @75kV                                                                   |
| Weight                     | 16kg                                                                            |

## (2) E7242X

|                            |                                                                                 |
|----------------------------|---------------------------------------------------------------------------------|
| Focal Spot size            | Small: 0.6 mm, Large: 1.5 mm                                                    |
| Anode Heat Capacity        | 200kHU                                                                          |
| Target angle               | 14°                                                                             |
| Tube Voltage               | Max. 125kV                                                                      |
| Anode Rotation speed       | 50 Hz: Minimum 2700 min <sup>-1</sup> , 60 Hz: Minimum 3200 min <sup>-1</sup> . |
| Anode Stator Input Voltage | Stating: Max. AC220V, Running: Max. AC60V                                       |
| Anode Stator Input power   | Stating: Max. 2000W, Running: Max. 150W.                                        |
| Inherent filtration value  | 0.9mmAl @75kV                                                                   |
| Weight                     | 16kg                                                                            |

## (3) E7884X

|                            |                                                                                 |
|----------------------------|---------------------------------------------------------------------------------|
| Focal Spot size            | Small: 0.6 mm, Large: 1.2 mm                                                    |
| Anode Heat Capacity        | 300kHU                                                                          |
| Target angle               | 12°                                                                             |
| Tube Voltage               | Max. 150kV                                                                      |
| Anode Rotation speed       | 50 Hz: Minimum 2700 min <sup>-1</sup> , 60 Hz: Minimum 3200 min <sup>-1</sup> . |
| Anode Stator Input Voltage | Stating: Max. AC220V, Running: Max. AC60V                                       |
| Anode Stator Input power   | Stating: Max. 2000W, Running: Max. 150W.                                        |
| Inherent filtration value  | 0.9mmAl @75kV                                                                   |
| Weight                     | 16kg                                                                            |

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## 5.2.6 Collimator

## (1) M-38

|                           |                              |
|---------------------------|------------------------------|
| Structure                 | Manual adjustment method     |
| Inherent filtration value | 1.2mmAl @75kV                |
| Illuminance               | 160 Lux or more              |
| Input power               | AC 24V                       |
| Dimension / weight        | 225(W)x222(D)x180(H)mm / 5kg |
| Option                    | DAP-attachable type          |

## (2) R 221/A DHHS

|                           |                                |
|---------------------------|--------------------------------|
| Structure                 | Manual adjustment method       |
| Inherent filtration value | 2.0mmAl @75kV                  |
| Illuminance               | 160 Lux or more                |
| Input power               | AC 24V                         |
| Dimension / weight        | 271(W)x222(D)x167(H)mm / 8.4kg |

## 5.2.7 Tube Stand (DTS-M)

|                                        |                                           |
|----------------------------------------|-------------------------------------------|
| Type                                   | Floor-supported type                      |
| Operation method                       | Manual                                    |
| Up and down movement distance          | Within 1520 mm $\pm$ 10%                  |
| Left and right movement distance       | Within 2400 mm $\pm$ 10%                  |
| Forward and backward movement distance | 250mm $\pm$ 10%                           |
| Tube device rotation                   | $\pm 180^\circ$ ( $\pm 2^\circ$ )         |
| Grid Device                            | Inherent Filtration: 0.8mmAl              |
| GRID                                   | 103Line/Inch, Ratio: 10:1. FD: 34~44Inch. |
| Input power                            | DC 24V                                    |
| Fixed method                           | Electromagnet                             |

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## 5.2.8 Bucky stand

## (1) DBS-43M

|                         |                                         |
|-------------------------|-----------------------------------------|
| Type                    | Floor-supported type                    |
| Operation method        | Manual                                  |
| Vertical Movement Range | 1520mm $\pm$ 10%                        |
| Grid Device             | Inherent Filtration: 0.8mmAl            |
| GRID                    | 103Line/Inch, Ratio: 10:1, FD:40~72Inch |
| Input power             | DC24V                                   |
| Fixed method            | Electromagnet                           |

## (2) DBS-57M

|                         |                                         |
|-------------------------|-----------------------------------------|
| Type                    | Floor-supported type                    |
| Operation method        | Manual                                  |
| Vertical Movement Range | 1520mm $\pm$ 10%                        |
| Grid Device             | Inherent Filtration: 0.8mmAl            |
| GRID                    | 103Line/Inch, Ratio: 10:1, FD:40~72Inch |
| Input power             | 100-240 V~, 50/60 Hz, 50 VA             |
| Fixed method            | Electromagnet                           |

## (3) LLD 129 WITH ROTATION

|                                          |                      |
|------------------------------------------|----------------------|
| Type                                     | Floor-supported type |
| Operation method                         | Manual               |
| Vertical Movement Range                  | 635 mm $\pm$ 10mm    |
| Bucky rotation Angle                     | 0~90° ( $\pm$ 2°)    |
| Support Stand Vertical Movement Distance | 950 mm $\pm$ 10mm    |
| Support Stand Rotation Angle             | 0~90° ( $\pm$ 2°)    |

## (3) LLD 129 COMPACT

|                         |                      |
|-------------------------|----------------------|
| Type                    | Floor-supported type |
| Operation method        | Manual               |
| Vertical Movement Range | 635 mm $\pm$ 10mm    |

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## 5.2.9 Patient Table

## (1) DPT-4A

|                                 |                             |
|---------------------------------|-----------------------------|
| Table Top                       | 2200 x 820mm                |
| Fixed method                    | Electromagnet               |
| Table Top Horizontal Movement   | 0~800 mm $\pm$ 10%          |
| Table Top Longitudinal Movement | 0~250 mm $\pm$ 10%          |
| Bucky Horizontal Movement       | 0~600 mm $\pm$ 10%          |
| Table Material                  | Laminate: 1.5mm AL at 100kV |
| Grid                            | Oscillating                 |
| Foot Switch                     | 1 pedal                     |
| Patient Weight                  | 215kg                       |

## (2) DPT-6A

|                                 |                             |
|---------------------------------|-----------------------------|
| Table Top                       | 2200 x 820mm                |
| Fixed method                    | Electromagnet               |
| Table Top Horizontal Movement   | 0~800 mm $\pm$ 10%          |
| Table Top Longitudinal Movement | 0~250 mm $\pm$ 10%          |
| Bucky Horizontal Movement       | 0~600 mm $\pm$ 10%          |
| Table Vertical Movement         | 0~300 mm $\pm$ 10%          |
| Table Material                  | Laminate: 1.5mm AL at 100kV |
| Grid                            | Oscillating                 |
| Foot Switch                     | 4 pedal                     |
| Patient Weight                  | 225kg                       |

## (3) DPT-4B

|                                 |                             |
|---------------------------------|-----------------------------|
| Table Top                       | 2200 x 820mm                |
| Fixed method                    | Electromagnet               |
| Table Top Horizontal Movement   | 0~800 mm $\pm$ 10%          |
| Table Top Longitudinal Movement | 0~250 mm $\pm$ 10%          |
| Bucky Horizontal Movement       | 0~500 mm $\pm$ 10%          |
| Table Material                  | Laminate: 1.5mm AL at 100kV |
| Grid                            | Oscillating                 |
| Foot Switch                     | 1 pedal                     |
| Patient Weight                  | 215kg                       |

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## (4) DPT-6B

|                                 |                             |
|---------------------------------|-----------------------------|
| Table Top                       | 2200 x 820mm                |
| Fixed method                    | Electromagnet               |
| Table Top Horizontal Movement   | 0~800 mm $\pm$ 10%          |
| Table Top Longitudinal Movement | 0~250 mm $\pm$ 10%          |
| Bucky Horizontal Movement       | 0~500 mm $\pm$ 10%          |
| Table Vertical Movement         | 0~300 mm $\pm$ 10%          |
| Table Material                  | Laminate: 1.5mm AL at 100kV |
| Grid                            | Oscillating                 |
| Foot Switch                     | 4 pedal                     |
| Patient Weight                  | 225kg                       |

  
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## 5.2.10 High Voltage Cable

|                         |                      |
|-------------------------|----------------------|
| Connector Configuration | Common, Small, Large |
| Operating Voltage       | DC 150 kV            |

## 5.2.11 DAP Meter (optional)

|                        |                                                                       |
|------------------------|-----------------------------------------------------------------------|
| DAP Rate               | Minimum 0.01uGy m <sup>2</sup> /s ~ Maximum 0.01uGy m <sup>2</sup> /s |
| Attenuation equivalent | < 0.5 mm Al                                                           |
| Active area            | 140x140 mm                                                            |
| DAP sensor dimension   | 180x154x17mm                                                          |

## 5.2.12 AEC Chamber (optional)

## (1) SSMC 601 (Manufacturer : Claymount)

|                                                               |                                |
|---------------------------------------------------------------|--------------------------------|
| Field                                                         | 3 Field (Use 3 Fields)         |
| Output reproducibility                                        | < 0.02 coefficient of variance |
| Exposure time range                                           | Min 4 msec to Max. 5 s         |
| Typical sensitivity at 80 kV, total filtration 25 mm Aluminum | 1.3 x 10 <sup>-9</sup> A/μGy/s |
| Attenuation equivalent                                        | < 0.5 mmAl                     |
| Dose range                                                    | 0.1 to 100 μGy                 |
| X-ray energy range                                            | 40~150kV                       |

## (2) AEC Chamber – DRTech (Manufacturer : VacuTec)

|                        |                                |
|------------------------|--------------------------------|
| Field                  | 3 Field (Use 3 Fields)         |
| Output reproducibility | < 0.02 coefficient of variance |
| Exposure time range    | Min 1 msec to Max. 10 s        |
| Attenuation equivalent | < 0.75mmAl                     |
| Dose range             | 0.5 to 1000 μGy                |
| X-ray energy range     | 40~150kV                       |

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## 5.2.13 Detector (optional)

|                                             |                                                                                                                                                                                                                                                                                    |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>EVS4343 W / EVS 4343WP</b><br>(Wireless) | <ul style="list-style-type: none"> <li>▪ Detecting Area: 430 mm x 430 mm.</li> <li>▪ Detector Type: TFT-amorphous Silicon (CsI), TFT IGZO (CsI)</li> <li>▪ Detector elements pitch: 140 <math>\mu</math>m</li> <li>▪ mage size (in pixels): X=3072 Y=3072</li> </ul>               |
| <b>EVS 3643W / EVS 3643WP</b><br>(Wireless) | <ul style="list-style-type: none"> <li>▪ Detecting Area: 358 mm x 430 mm.</li> <li>▪ Detector Type: TFT amorphous Silicon (CsI), TFT IGZO (CsI)</li> <li>▪ Detector elements pitch: 140 <math>\mu</math>m</li> <li>▪ mage size (in pixels): X=3072 Y=3072</li> </ul>               |
| <b>EVS 4343A / EXPD 4343P</b><br>(Wired)    | <ul style="list-style-type: none"> <li>▪ Detecting Area: 430 mm x 430 mm.</li> <li>▪ Detector Type: TFT amorphous Silicon (CsI), TFT IGZO (CsI)</li> <li>▪ Detector elements pitch: 140 <math>\mu</math>m</li> <li>▪ mage size (in pixels): X=3072 Y=3072</li> </ul>               |
| <b>EVS 3643A / EXPD 3643P</b><br>(Wired)    | <ul style="list-style-type: none"> <li>▪ Detecting Area: 360 mm x 430 mm.</li> <li>▪ Detector Type: TFT amorphous Silicon (CsI), TFT IGZO (CsI)</li> <li>▪ Detector elements pitch: 140 <math>\mu</math>m</li> <li>▪ mage size (in pixels): X=2560 Y=3072</li> </ul>               |
| <b>EXPD 4343S</b><br>(Wired)                | <ul style="list-style-type: none"> <li>▪ Detecting Area: 430 mm x 430 mm.</li> <li>▪ Detector Type: TFT IGZO (CsI)</li> <li>▪ Detector elements pitch: 140 <math>\mu</math>m</li> <li>▪ mage size (in pixels): X=3072 Y=3072</li> </ul>                                            |
| <b>EXPD 3643D / EXPD 4343D</b><br>(Wired)   | <ul style="list-style-type: none"> <li>▪ Detecting Area: 430 mm x 430 mm.</li> <li>▪ Detector Type: TFT IGZO (CsI)</li> <li>▪ Detector elements pitch: 140 <math>\mu</math>m</li> <li>▪ mage size (in pixels): X=3072 Y=3072</li> </ul>                                            |
| <b>EXPD 86P / EXPD 86PG</b><br>(Wired)      | <ul style="list-style-type: none"> <li>▪ Detecting Area: 430 mm x 860 mm.</li> <li>▪ Detector Type: TFT amorphous Silicon (CsI), TFT amorphous Silicon (GoS)</li> <li>▪ Detector elements pitch: 140 <math>\mu</math>m</li> <li>▪ mage size (in pixels): X=3072 Y=6144</li> </ul>  |
| <b>EXPD 129P / EXPD 129PG</b><br>(Wired)    | <ul style="list-style-type: none"> <li>▪ Detecting Area: 430 mm x 1290 mm.</li> <li>▪ Detector Type: TFT amorphous Silicon (CsI), TFT amorphous Silicon (GoS)</li> <li>▪ Detector elements pitch: 140 <math>\mu</math>m</li> <li>▪ mage size (in pixels): X=3072 Y=9216</li> </ul> |
| <b>EXPD 4357 / EXPD 4357P</b><br>(Wired)    | <ul style="list-style-type: none"> <li>▪ Detecting Area: 430 mm x 570 mm.</li> <li>▪ Detector Type: TFT IGZO (CsI)</li> <li>▪ Detector elements pitch: 140 <math>\mu</math>m</li> <li>▪ mage size (in pixels): X=3072 Y=4096</li> </ul>                                            |

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## 5.2.14 Wireless Detector Charger (optional)

|               |                                   |
|---------------|-----------------------------------|
| Input Voltage | ▪ DC 12V ( $\pm 10\%$ ) / over 3A |
| Output Power  | ▪ DC 10V /1.4A (14W)              |
| Dimensions    | ▪ 115.8 mm x 94.8 mm x 12 mm      |

## 5.2.15 Max attenuation equivalent

|                                                                              |                         |
|------------------------------------------------------------------------------|-------------------------|
| Front panel of flat Panel X-ray detector                                     | ▪ 0.6 mmAl (at 100 kVp) |
| Flat panel digital X-ray detector receptacle (including cover, grid and AEC) | ▪ 1.2 mmAl (at 100kVp)  |
| Patient Table                                                                | ▪ 1.2mmAl (at 100 kVp)  |

  
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## 5.2.16 Others

|                              |                                                                                                                                                                                                                                                                                       |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Recommended PC Specification | <ul style="list-style-type: none"><li>▪ CPU : Intel i5-6500</li><li>▪ RAM : 4GB</li><li>▪ HDD : SSD 128GM/ HDD1T</li><li>▪ VGA : GTX1050</li><li>▪ ODD : DVD RW</li><li>▪ OS : windows 10 64bit</li><li>▪ Display Size : 24 inch</li><li>▪ Display Resolution : 1920 x 1080</li></ul> |
| Recommended Detector         | <ul style="list-style-type: none"><li>▪ Rating: 0.64 A, 56 Vdc</li><li>▪ Use only detectors approved by international standards.</li></ul>                                                                                                                                            |

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## Chapter 6

# Preparation before Installation

## Diagnostic X-ray System

**[EXSYS DEXi]**

  
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## 6 Preparation before installation

### 6.1 Introduction

This chapter explains how to unpack and install EXSYS DEXi. Read the manual carefully and refer to it when installing. Also, check the list of ordered items before installation, and after installation, organize the item confirmation data and forward them to the orderer.

#### ► WARNING

If any signs of product damage are found during unpacking, you should stop the installation and notify the sales agent of the facts to take action before proceeding with the next operation.

#### ► WARNING

If it is not installed or wired according to the method suggested in this chapter, or if the cable is damaged, the power switch should not be operated.

#### ► WARNING

Before installation, be sure to read the manual.

### 6.2 Operating Environment

- Ambient temperature: 10°C ~ 40°C
- Humidity: 30% RH to 75% RH
- Air pressure: 800hPa ~ 1,060hPa
- Altitude : Max. 2000 m

### 6.3 Transport and Storage Conditions

- Temperature: -10°C ~ 60°C
- Humidity: 10% RH ~ 90% RH
- Air pressure: 800hPa ~ 1,060hPa

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#### 6.4 Power Requirements

- Input power: Single phase or Three Phases AC
- Frequency: 50/60Hz
- Standard Voltage:
  - DXG-40P(40kW) : 100 / 220-230 V~
  - DXG-40S(40kW) : 220-230 V~
  - DXG-50T(50kW) : 230/380/400/480 V3~
- Voltage variation range:  $\pm 10\%$  of standard voltages
- Supply Impedance: 100, 110, 120 V:  $1.0\Omega$  or less, 200, 220, 230, 240 V:  $4.0\Omega$  or less
- Earth terminal: Earth resistance of  $100\Omega$  or less
- The wire thickness of the X-Ray Generator and the capacity of the overload breaker are as shown in the table below, and the wire thickness may vary according to the installation environment and wire length.

| Generator model | Maximum capacity of overload breaker [A] | Voltage[V]                        | Power line thickness (3m standard) |
|-----------------|------------------------------------------|-----------------------------------|------------------------------------|
| DXG-40S         | 100                                      | 220-230 V~ $\pm 10\%$             | Over $25\text{mm}^2$               |
| DXG-50T         | 75                                       | 230V/380V/400V/480 V3~ $\pm 10\%$ | Over $20\text{mm}^2$               |
| DXG-40P         | 16                                       | 100V/220-230 V~ $\pm 10\%$        | Over $0.75\text{mm}^2$             |

#### 6.5 Tools required for Installation

When installing the product, prepare the following basic tools. Additional installation tools may be required, if necessary.

- Hand tools and standard service tools (eg. screwdriver, hexagon range set, etc.)
- Hammer drill, nipper, pliers
- Multi tester, Oscilloscope
- Leakage current tester for measurements according to IEC 60601-1
- Assorted cable ties
- Measurement and leakage current tester capable of testing according to IEC60601-1.
- Measurement and protective earth tester capable of testing according to IEC60601-1.

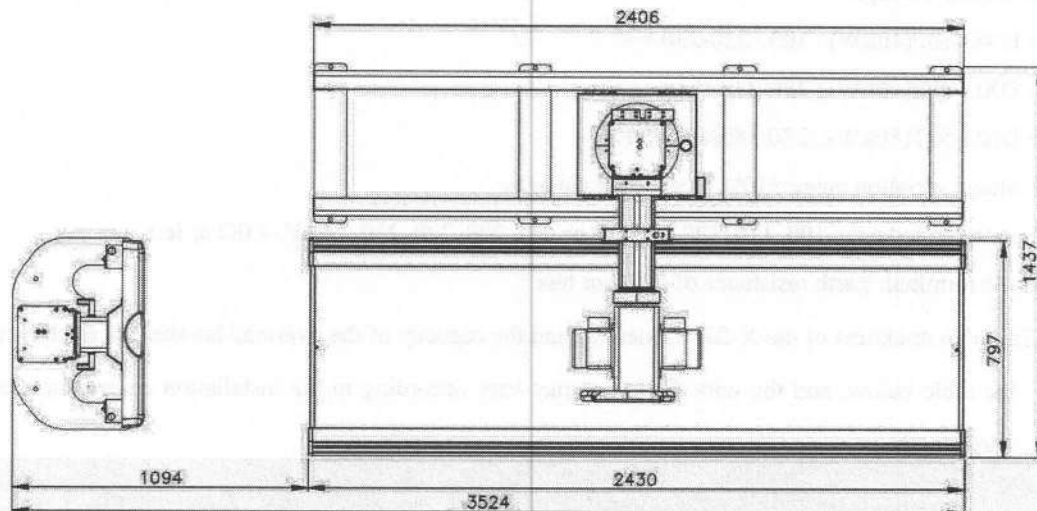
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## 6.6 Installation Space

### 6.6.1 Product Installation Space



### 6.6.2 Floor and Wall Conditions

#### ■ Distance from Wall

When moving the device to its maximum, the device should be installed at least 50 cm away from the wall.

#### ■ Ground condition

The horizontal state must be maintained, and if the horizontal state is not maintained, the operation state of the product may be unstable. Therefore, the horizontal state of the floor must be maintained.

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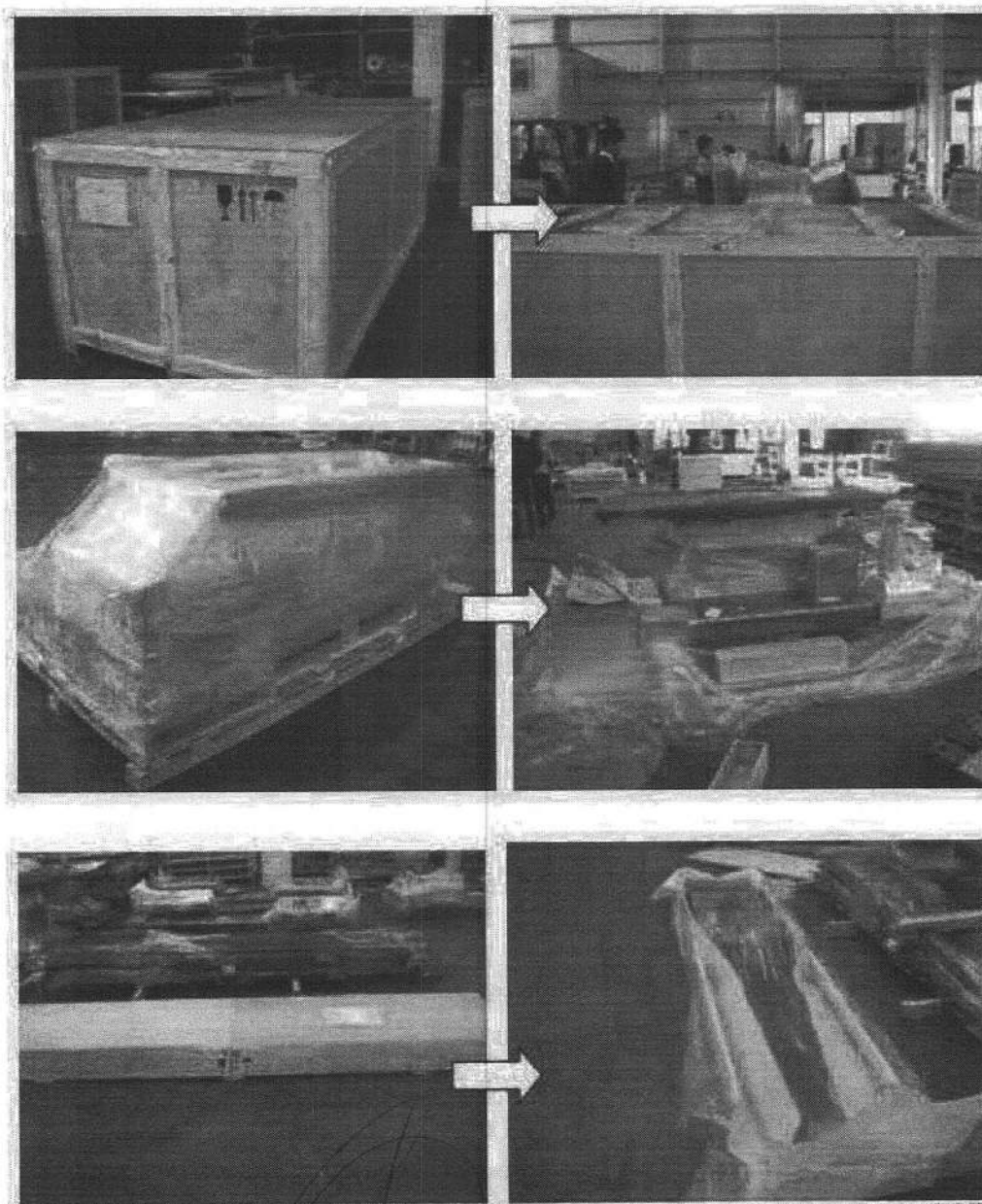


## 6.7 Unpacking

6.7.1 Move the product to the installation space.

6.7.2 Unpack the product by removing the top and sides of the packaging box.

6.7.3 When receiving the product, check whether there is any damage inside or outside the product. If there is any damage, stop unpacking, and notify the place of order or the customer support department of DRTECH.



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## 6.7.4 Condition of packaged product

(Depending on the option selected, the composition of the packaged product may vary.)

| Item Name       | Size / Weight                                 | Quantity<br>(Unit: each) |
|-----------------|-----------------------------------------------|--------------------------|
| X-ray generator | Refer to "Clause 5.1 Product Size and Weight" | 1                        |
| X-Ray tube      |                                               | 1                        |
| Collimator      |                                               | 1                        |
| Tube stand      |                                               | 1                        |
| Patient table   |                                               | 1                        |
| Bucky stand     |                                               | 1                        |
| Tube stand Rail |                                               | 1                        |
| Detector        |                                               | 1                        |
| Accessories     |                                               | 1                        |

6.7.5 After unpacking, check the manual and other documents, and check if the following parts are included.

- X-ray generator
- X-ray tube
- Tube stand, patient table, bucky stand (optional)
- Generator Console (optional)
- Collimator
- Detector (optional)
- High voltage cable
- AEC Chamber (optional)
- DAP meter (optional)
- Accessories (optional)

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**6.8 Countermeasures in Case of Product Damage**

If the received product is different from the ordered product, or if the product is damaged, contact the ordering office or DRTECH's customer support department for action.

**► NOTE**

Carefully remove the packaging. Sharp tools may damage the contents.

**► CAUTION**

The product is heavy and should not be lifted or moved by a single person without proper equipment or assistance.

  
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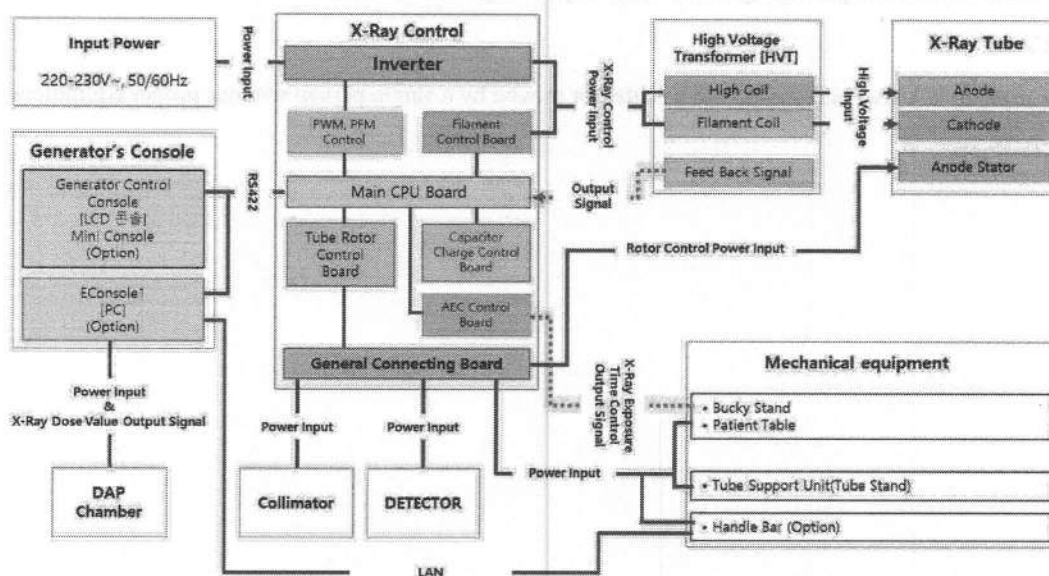
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## 6.9 Configuration of Major Parts

### 6.9.1 Wiring Diagram

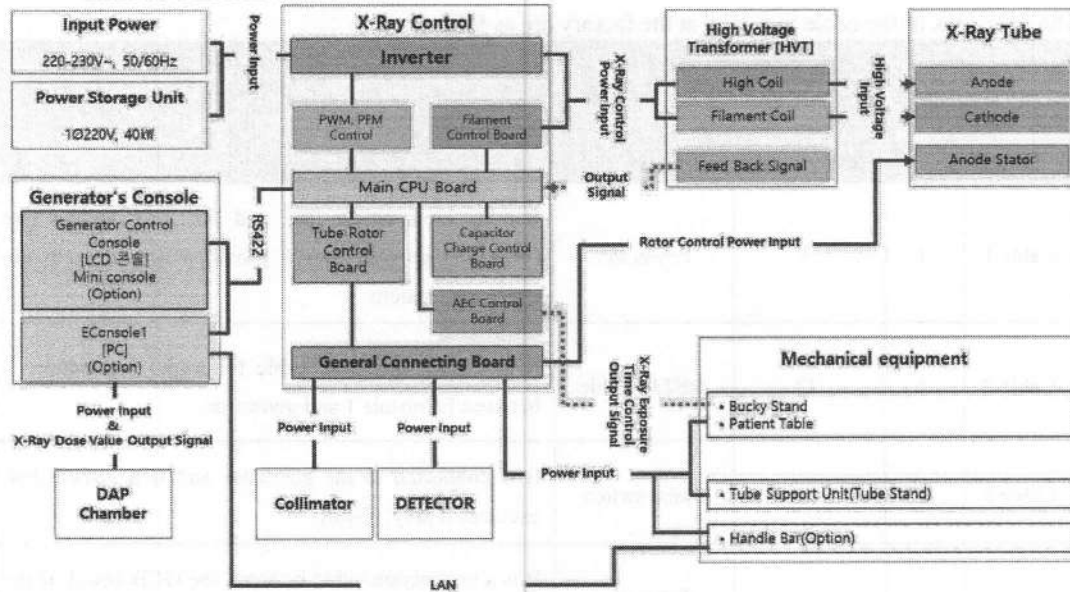
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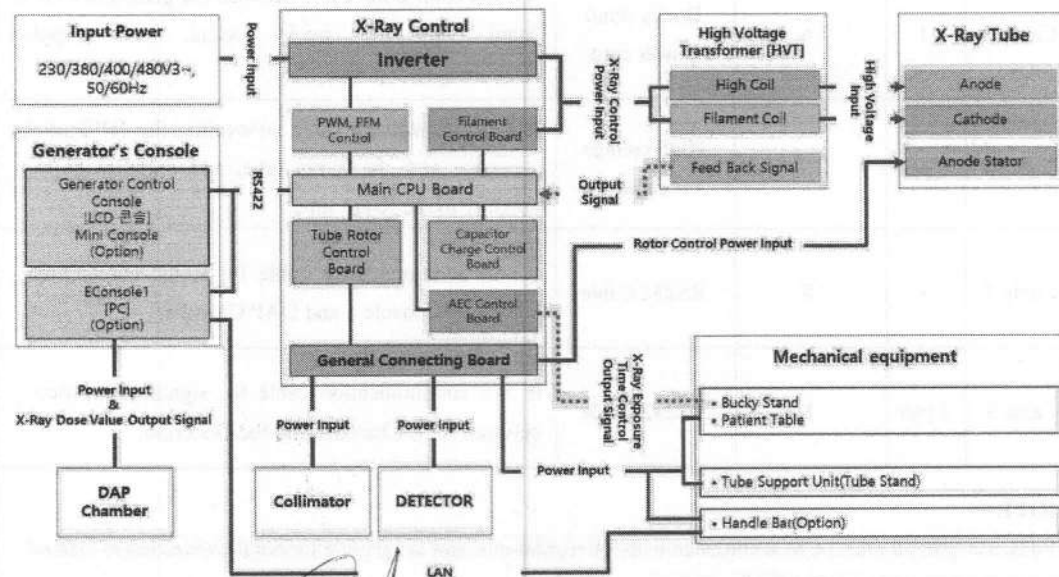
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2) EXSYS DEXi-D401P-FRM, EXSYS DEXi-A401P-FRM, EXSYS DEXi-D402P-FRM,  
EXSYS DEXi-A402P-FRM



3) EXSYS DEXi-D503T-FRM, EXSYS DEXi-A503T-FRM



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## 6.9.2 Functions and Information of Main Cables

The functions of the cable provided at the factory are as follows.

| Cable No                                                                                                                                                                | Quantity (each) | Cable length (Unit: m) | Function               | Note                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Cable 1                                                                                                                                                                 | 1               | 3                      | Power line             | It is an input power line, and 10, 230V power line (including ground line) is provided according to the generator capacity.                  |
| Cable 2                                                                                                                                                                 | 1               | 12                     | RS232 Cable            | It is a communication cable for signal connection between EConsole 1 and generator.                                                          |
| Cable 3                                                                                                                                                                 | 1               | 0.3                    | Hand switch            | It is connected to the generator and is a switch that executes Ready, X-Ray.                                                                 |
| Cable 4                                                                                                                                                                 | 1               | 8                      | Tube rotor wiring      | It is a connection cable between the GCB board of the generator and the tube stand, and supplies power to the tube rotor and the collimator. |
| Cable 5                                                                                                                                                                 | 1               | 6                      | Bucky stand power cord | It is the connection cable between the generator's GCB board and the bucky stand, and supplies electromagnetic power.                        |
| Cable 6                                                                                                                                                                 | 1 pair          | 6                      | High voltage cable     | It is a high-voltage cable connecting the HVT of the generator and the X-ray tube, and supplies high-pressure to the X-ray tube.             |
| Cable 7                                                                                                                                                                 | 1               | 8                      | RS232 Cable            | It is a communication cable for signal connection between EConsole 1 and DAP Chamber.                                                        |
| Cable 8                                                                                                                                                                 | 1 pair          | 8                      | RS232 Cable            | It is a communication cable for signal connection between AEC Chamber and the Generator                                                      |
| <b>NOTE</b><br>The power ground must be in accordance with the regulations, and the ground terminal connection is located next to the main fuse of the X-ray generator. |                 |                        |                        |                                                                                                                                              |

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## 6.9.3 Fuse capacity of main parts

| No. | Classification      | Fuse location           | Fuse name        | Size         | Fuse capacity | Quantity |
|-----|---------------------|-------------------------|------------------|--------------|---------------|----------|
| 1   | Generator (DXG-40S) | Main Power Fuse         | F1, F2,          | 78 x 30 x 60 | 500V, 80A     | 2        |
| 2   |                     | Generator Internal Fuse | F3, F4           | 10 x 38      | 500V, 6A      | 2        |
| 3   |                     | Rotor Board             | F901             | 5 x 20       | 250V, 10A     | 1        |
| 4   |                     | Filament Board          | F906             | 5 x 20       | 250V, 3.15A   | 1        |
| 5   |                     | CND Board               | F958, F955       | 5 x 20       | 250V, 10A     | 2        |
| 6   |                     | GC Board                | F959, F961       | 5 x 20       | 250V, 3.15A   | 2        |
| 7   |                     | GC Board                | F952, F955, F958 | 5 x 20       | 250V, 5A      | 3        |
| 8   |                     | GC Board                | F960             | 6 x 30       | 250V 10A      | 1        |
| 9   | Generator (DXG-50T) | Main Power Fuse         | F1, F2, F3       | 78 x 30 x 60 | 500V, 80A     | 3        |
| 10  |                     | Generator Internal Fuse | F4, F5           | 10 X 38      | 500V, 6A      | 2        |
| 11  |                     | Rotor Board             | F901             | 5 X 20       | 250V, 10A     | 1        |
| 12  |                     | Filament Board          | F906             | 5 X 20       | 250V, 3.15A   | 1        |
| 13  |                     | CND Board               | F958, F955       | 5 X 20       | 250V, 10A     | 2        |
| 14  |                     | GC Board                | F959, F961       | 5 X 20       | 250V, 3.15A   | 2        |
| 15  |                     | GC Board                | F952, F955, F958 | 5 X 20       | 250V, 5A      | 3        |
| 16  |                     | GC Board                | F960             | 6 X 30       | 250V 10A      | 1        |
| 17  | Generator (DXG-40P) | Main Power Fuse         | F1, F2,          | 10 X 38      | 400V, 32A     | 2        |
| 18  |                     | Generator Internal Fuse | F3, F4           | 10 X 38      | 500V, 6A      | 2        |
| 19  |                     | Rotor Board             | F901             | 5 X 20       | 250V, 10A     | 1        |
| 20  |                     | Filament Board          | F906             | 5 X 20       | 250V, 3.15A   | 1        |
| 21  |                     | CND Board               | F958, F955       | 5 X 20       | 250V, 10A     | 2        |
| 22  |                     | GC Board                | F959, F961       | 5 X 20       | 250V, 3.15A   | 2        |
| 23  |                     | GC Board                | F952, F955, F958 | 5 X 20       | 250V, 5A      | 3        |
| 25  |                     | GC Board                | F960             | 6 X 30       | 250V 10A      | 1        |
| 25  |                     | Charger Board           | F101             | 5 X 20       | 250V 6A       | 1        |
| 26  | Mechanical device   | Patient Table           | F1               | 5 x 20       | 250V 3.15A    | 1        |
| 27  |                     |                         | F2               | 5 x 20       | 250V 10A      | 1        |

## Chapter 7

### Installation

#### Diagnostic X-ray System

[EXSYS DEXi]

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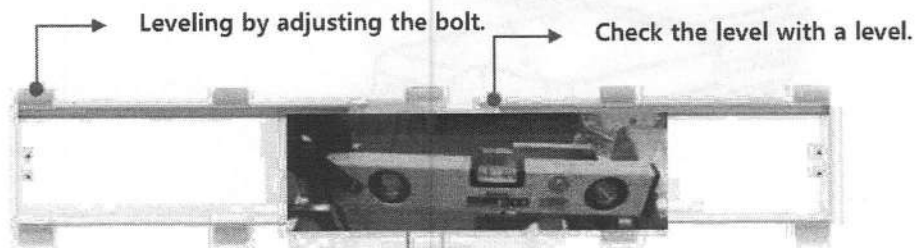
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## 7 Installation

### 7.1 Tube stand installation

#### 7.1.1 Floor rail installation

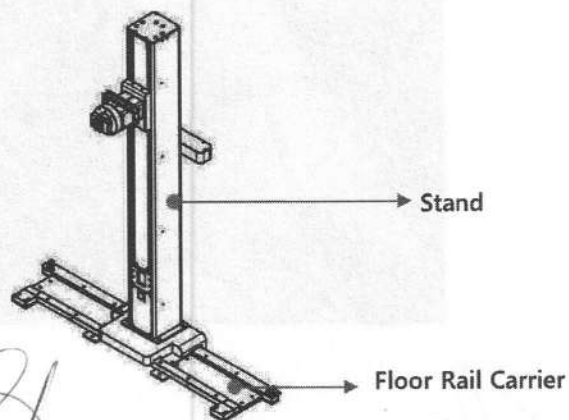
- Move the floor rail to the installation space.
- Place the floor rail on the installation site and use a tool to check the horizontal and vertical states.



- After checking the horizontal and vertical condition, make a hole for fixing the wedge anchor bolt with a drill.
- Insert the wedge anchor bolt into the fixing hole to fix it.

#### 7.1.2 Stand Fixation

- Put the stand on the installed floor rail carrier.

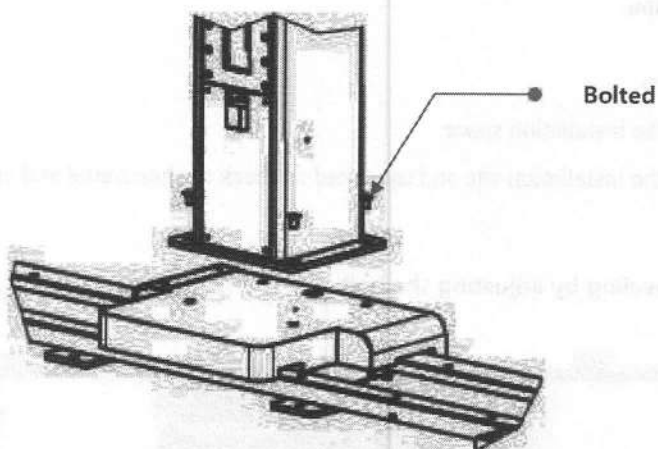


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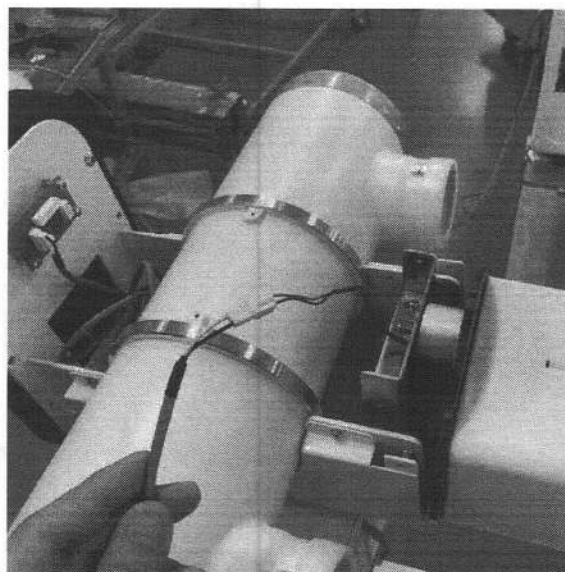
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- Fix the floor rail carrier and stand with bolts.



### 7.1.3 Tube device assembly

- Put the tube on the tube yolk and fix it.



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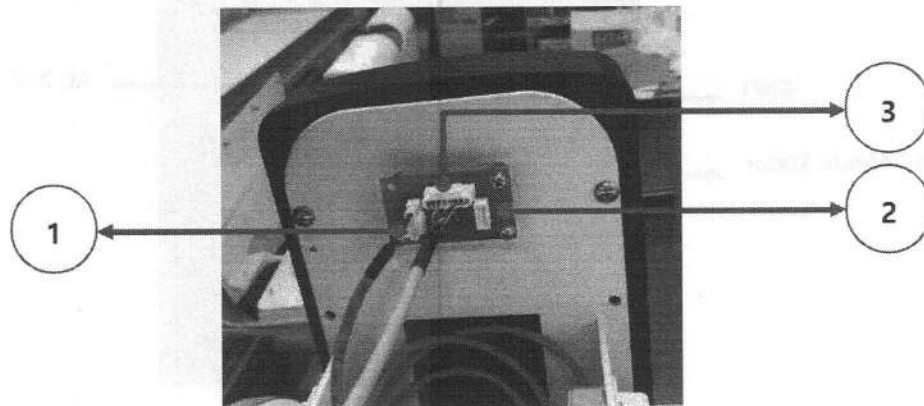
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#### 7.1.4 Wiring

- Connect the electromagnetic operation switch of the tube stand and the electromagnetic operation circuit.
- Electromagnetic wiring is divided into powers for the left, right, top, bottom, and rotation of tube stand.
- The switch for electromagnet operation is connected to the electromagnet operation circuit.

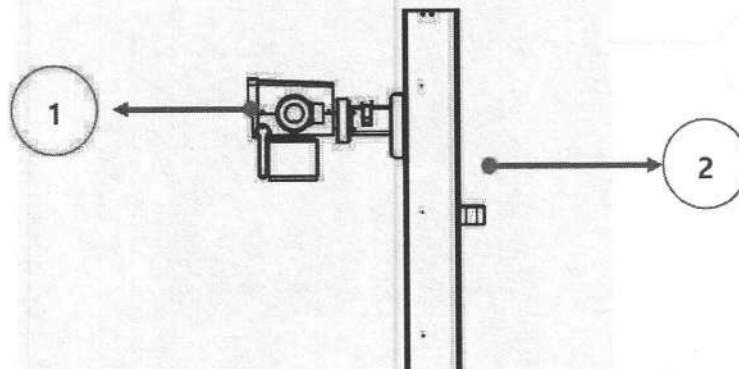


**Picture 1:** Connect with the left and right electromagnets of the tube stand.

**Picture 2:** Connect with the upper and lower electromagnets of the tube stand.

**Picture 3:** Connect with the tube rotating electromagnet of the tube stand.

- The electromagnet wiring circuit board is attached to the back side of the tube stand.



**Picture 1:** Electromagnet operation switch attachment position of tube stand

**Picture 2:** Electromagnet operation circuit board attachment position

#### ■ Wiring of Tube Anode Side

- Tube anode side wiring consists of anode stator, lock power, collimator power, and tube temperature switch.

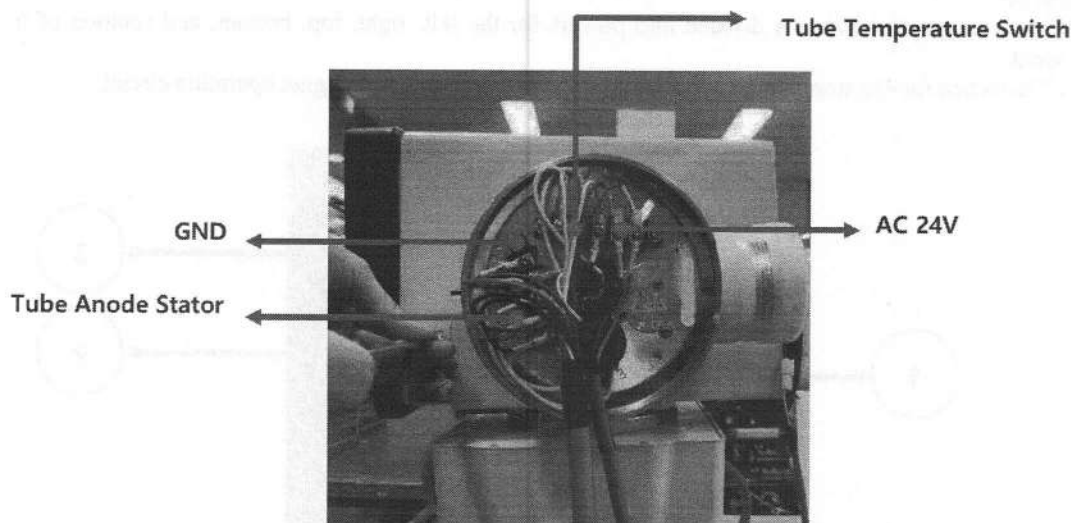
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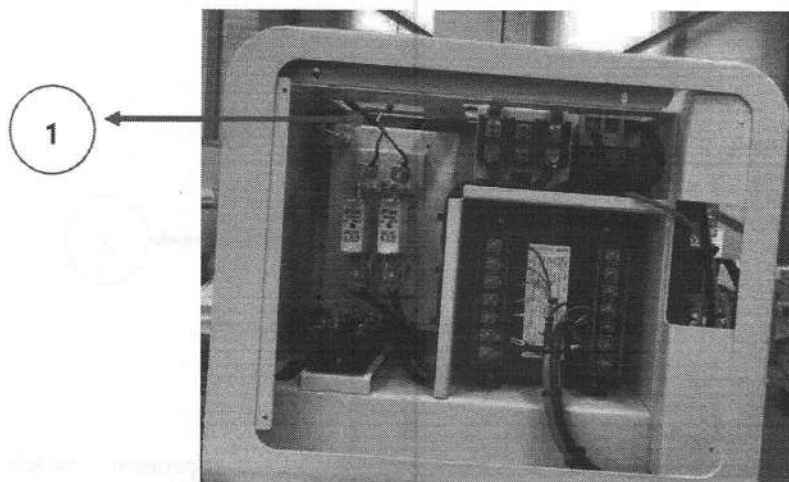
- Connect the tube anode side wiring and CON703 of generator GC board.



## 7.2 Generator installation

### 7.2.1 Input power connection

- Input power is single-phase, 230V~.
- It is an input power line that connects the provided 1Ø, 230V power line (including ground line) to the main fuse (Picture 1) according to the generator capacity.



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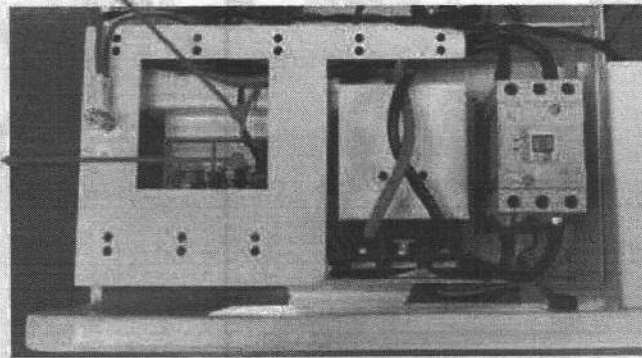


- Connect the input power line to the main fuse and the ground wire to the ground terminal.

GND terminal



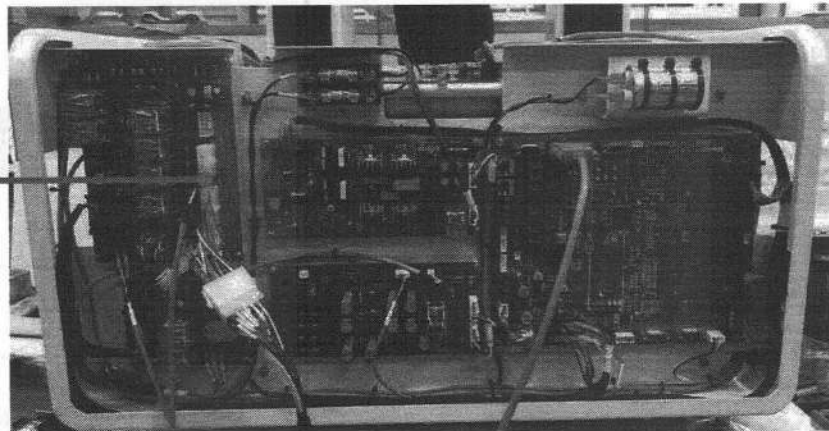
GND Symbol



### 7.2.2 Wiring of tube stand and bucky stand

- The power of Anode Stator and Collimator of the tube is connected to P805 (Picture 1) of the generator GC Board.

1



- PIN configuration of P805 of GC board is as follows.

| PIN | Signal | NOTES                   | Remark                                                                                                                      |
|-----|--------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 1   | SM     | SM (Stator Main Coil)   | The P805 connector of the GC board supplies voltage to the anode stator start coil and connects with the tube anode stator. |
| 2   | NC     | Use pins 1 and 6        |                                                                                                                             |
| 3   | SS     | SS (Stator Start Coil)  |                                                                                                                             |
| 4   | NC     | Use pins 3 and 8        |                                                                                                                             |
| 5   | SC     | SC (Stator COMMON Coil) |                                                                                                                             |
| 6   | SM     | Use pins 5 and 10       |                                                                                                                             |
| 7   | NC     |                         |                                                                                                                             |
| 8   | SS     |                         |                                                                                                                             |
| 9   | NC     |                         |                                                                                                                             |
| 10  | SC     |                         |                                                                                                                             |

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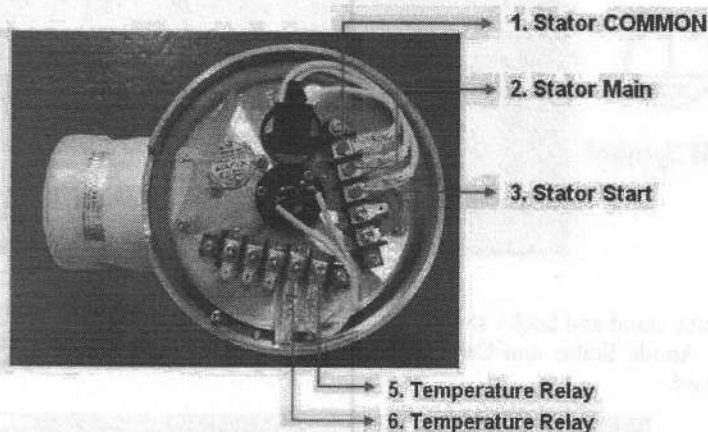
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■ Wiring the tube anode side.

- Connect the Temperature Relay attached to the Tube Anode Side to no. 13 and no.14 of P976 of Generator GC Board. (The generator stops working, when the tube gets overheated)
- Wire between P805 of GC Board and X-Ray Tube Anode Stator.
- Check the configuration of X-Ray Tube Anode Side.



- The wiring configuration between X-Ray Tube Anode Side and P805 of GC Board is as follows.

| NO | P805 of GC board |             |               | X-Ray Tube Anode Side |
|----|------------------|-------------|---------------|-----------------------|
|    | PIN NO           | P805 Wiring |               |                       |
| 1  | SM               | 1,6 PIN     | Stator Main   | 2. Stator Main        |
| 2  | NC               |             |               |                       |
| 3  | SS               |             |               |                       |
| 4  | NC               | 3. 8 PIN    | Stator Start  | 3. Stator Start       |
| 5  | SC               |             |               |                       |
| 6  | SM               |             |               |                       |
| 7  | NC               | 5, 10 PIN   | Stator COMMON | 1. Stator COMMON      |
| 8  | SS               |             |               |                       |
| 9  | NC               |             |               |                       |
| 10 | SC               |             |               |                       |

**WARNING ►**

X-ray tube positive stator wiring must be done correctly according to the X-ray tube manufacturer's recommendations.

**WARNING ►**

Do not connect the stator coil's COMMON terminal to the temperature relay of Tubes no. 5 and no. 6.

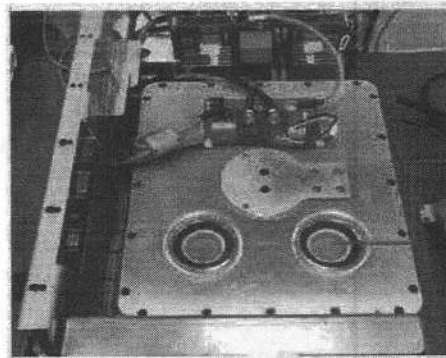
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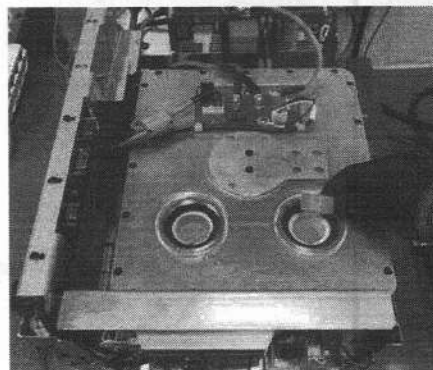
### 7.2.3 High voltage cable connection

- Connect the high-voltage cable between HVT's anode and cathode and X-Ray tube's anode and cathode.
- Before connecting the HV cables, always close the cover of the receptacle socket to prevent foreign substances from entering.

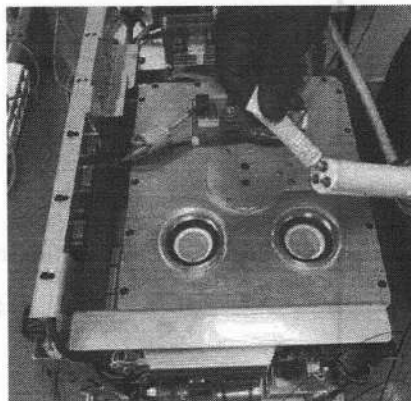


Receptacle  
socket cover

- Remove the receptacle socket cover for HV cable connection.



- Apply enough insulation silicon oil to the end of the plug of the HV cable.



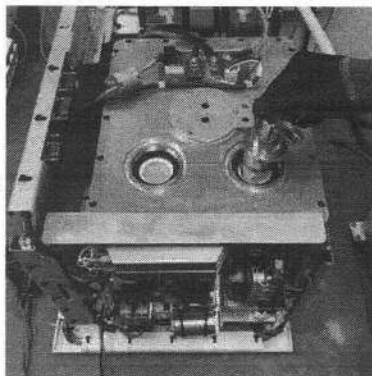
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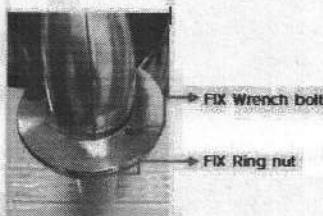
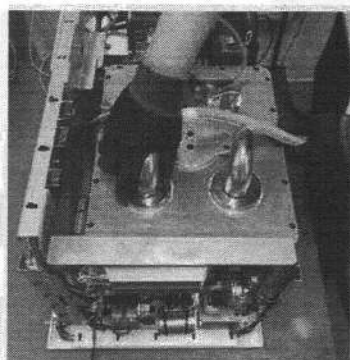
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- Insert HV cable plug into receptacle socket and connect.



- After locking the HV cable plug fix ring nut tight, fix the HV cable plug completely with the fix wrench bolt.



#### WARNING ►

Bushing terminal pins are elaborate and easy to damage, so care must be taken when handling them.

#### WARNING ►

HV Cable Plug and Receptacle socket must be kept clean at all times, and care must be taken not to get foreign substances.

#### WARNING ►

After the HV cable plug and receptacle socket are connected, the ring nut and wrench volt must be completely fixed. If the fixing condition is poor, it may cause high voltage discharge or other failure due to the poor socket connection.

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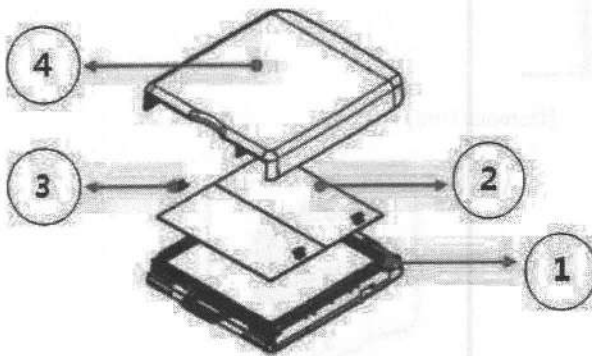
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#### 7.2.4 Install of Anti-Scatter GRID

- Since scattered X-rays after passing through the patient cause a significant adverse effect on image acquisition, Anti-Scatter GRID is used for the purpose of minimizing or removing scattered rays.
- Anti-Scatter GRID is installed on the Bucky device of the Bucky stand(DBS-43M) and four types of patient tables, and the installation method is as follows.
  - Remove the cover (Figure 4) from the Bucky device (Figure 1).
  - Separate the GRID fixing bracket (Figure 3) from the bucky device (Figure 1).
  - Put the GRID (Figure 2) on the GRID fixing frame of the Bucky device (Figure 1).
  - Fix the GRID (Fig. 2) placed on the GRID fixing frame with the GRID fixing bracket (Fig. 3).
  - Combine and fix the cover (Figure 4).



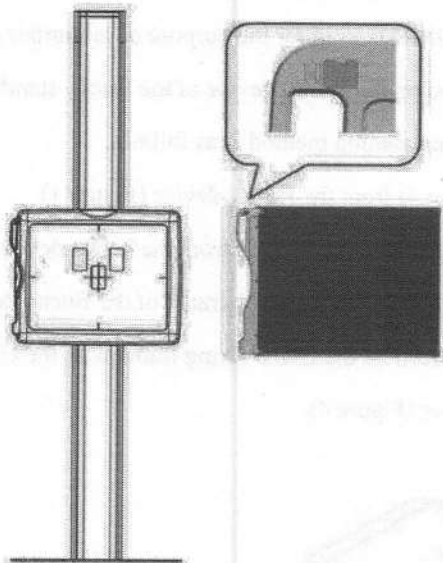
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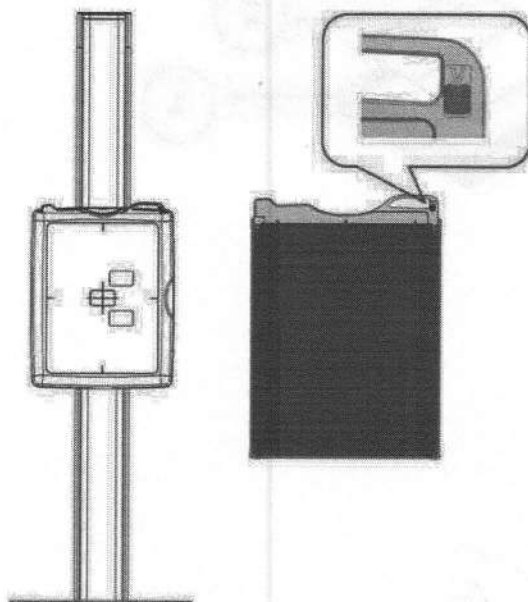
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- The Grid of DBS-57Mis a detachable type of vertical and horizontal.



[Horizontal Grid]



[Vertical Grid]

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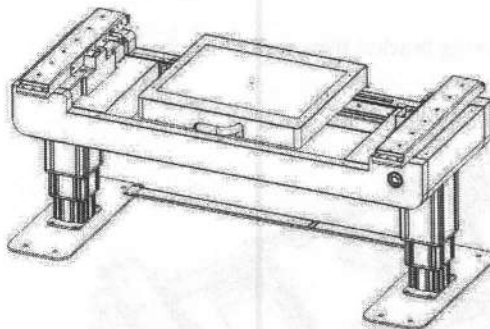
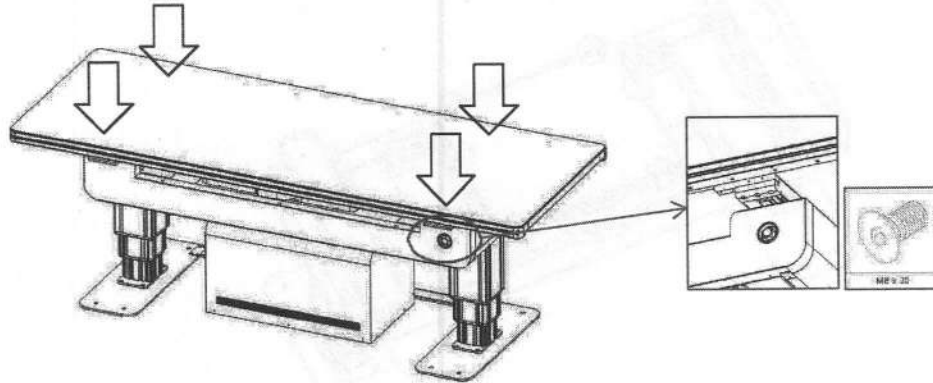
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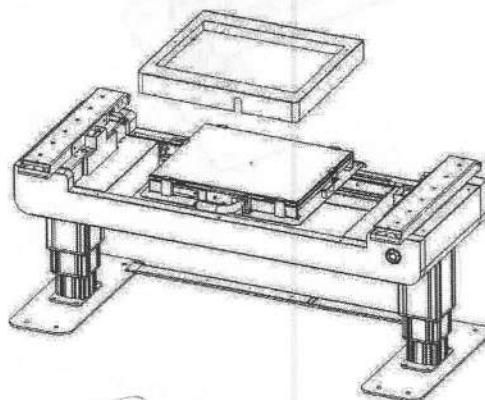


- Anti-Scatter grid and EXPD 4357 detector is installed on the bucky device, and the installation method is as follows.

- Remove the table-top of patient table(buck Stand proceeds from the next step.)



- Remove the cover from the bucky device



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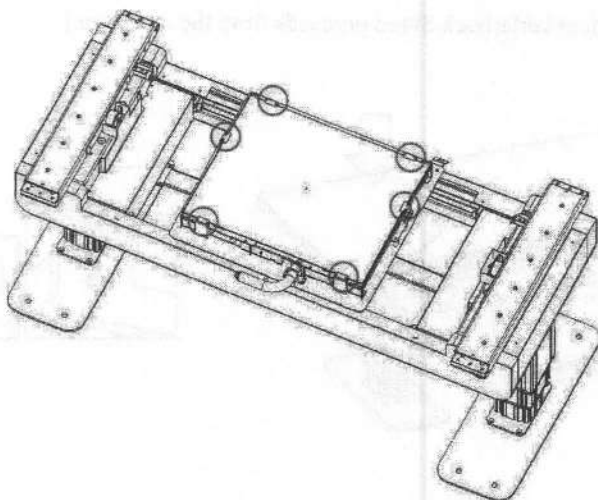
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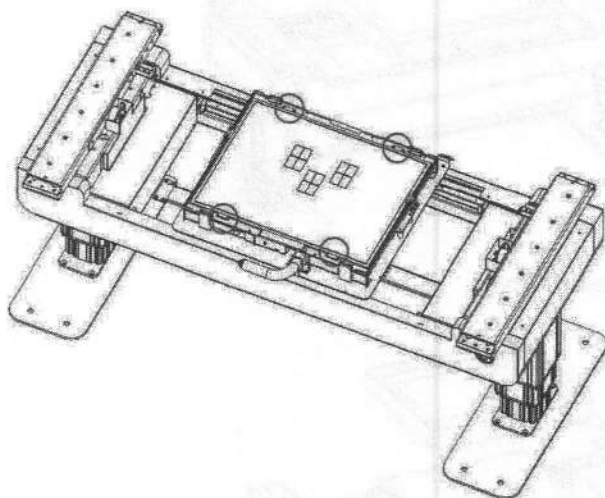
IF-2025-106384357-APN-INPM#ANMAT

- Detach the grid and detector fixing bracket from the bucky device.

1) Detach the grid fixing bracket from the bucky device.



2) Detach the AEC fixing bracket from the bucky device.



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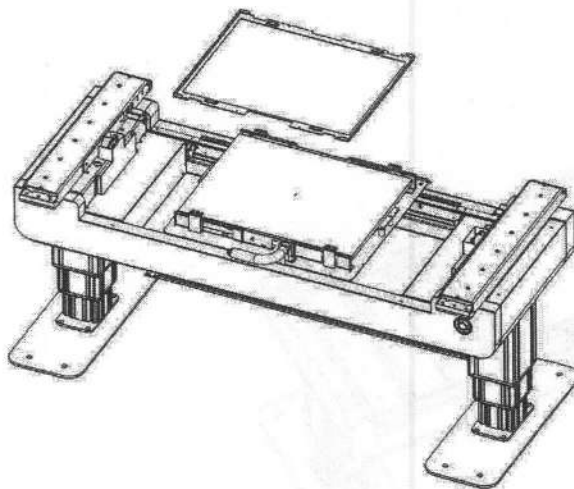
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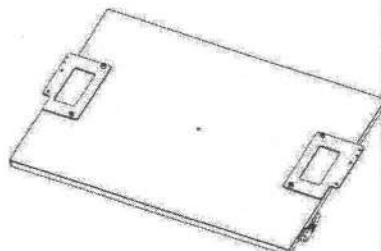
Document No.: DRT-MAN-169 (Rev.02)

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- Detach the AEC assembly guide from the bucky device.



- Put the EXPD 4357 Detector and attach the cables of the EXPD 4357 detector.
  - Attach the guide block to the detector



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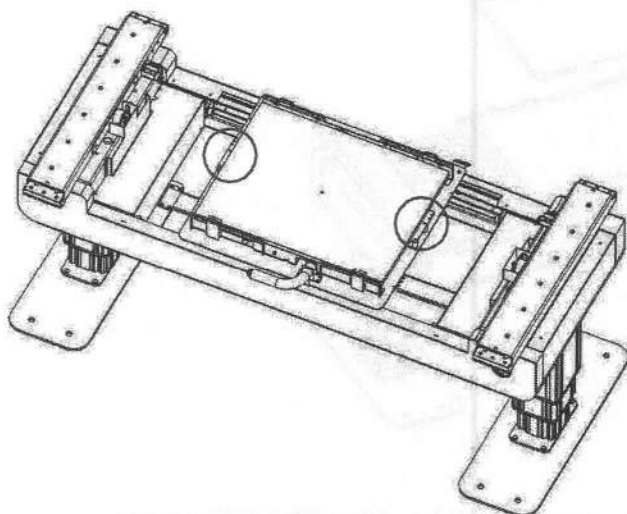
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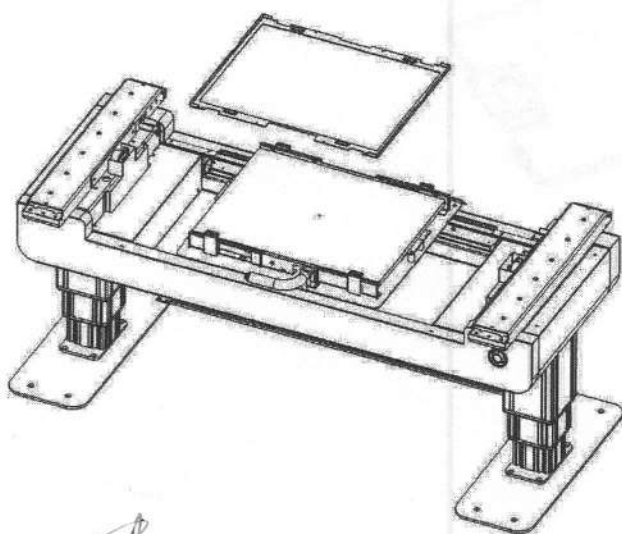
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- Attach the detector to the patient table.



- Put the AEC chamber on the AEC fixing frame of the bucky device.

- 1) Attach the AEC guide block.



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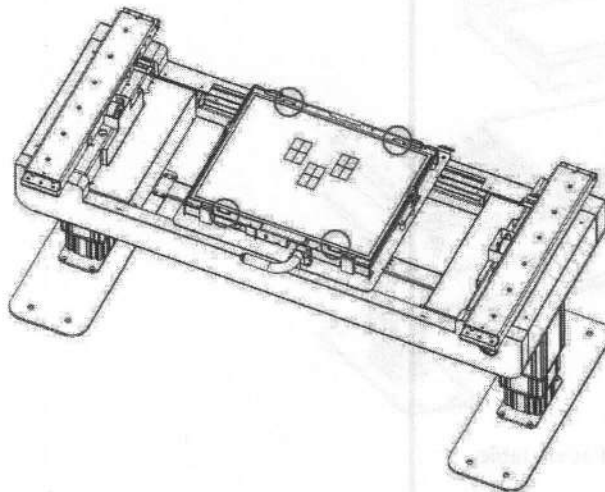
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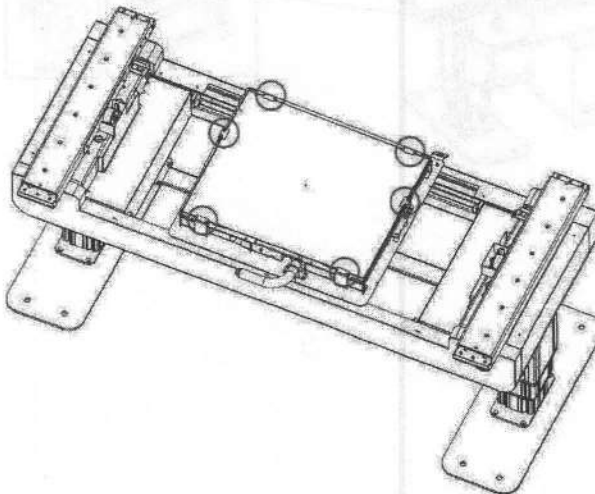
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2) Assemble the AEC chamber.



• Put the grid on the grid fixing frame of the bucky device

1) Attach the grid and detector fixing bracket from the bucky device.



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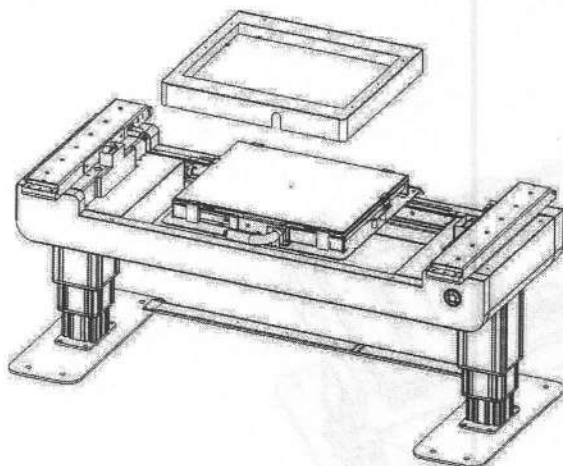
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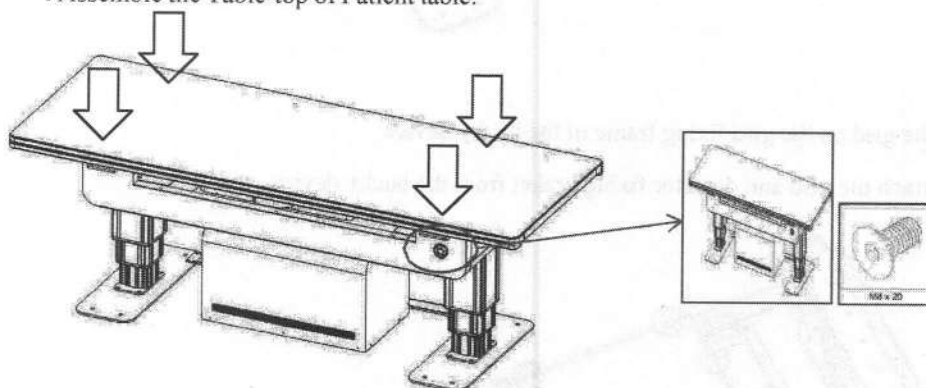
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- Attach the cover to the bucky device.



- Assemble the Table-top of Patient table.



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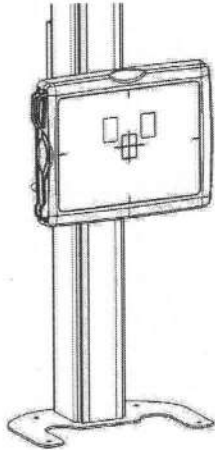
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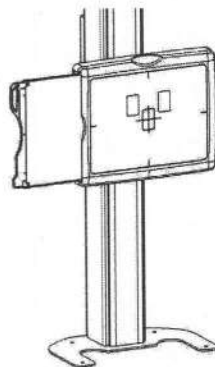
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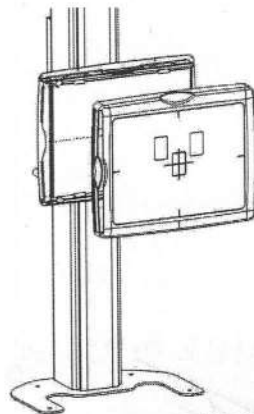
- Install the DBS-57M



- Remove the grid of the bucky stand.



- Remove the cover of the bucky stand.



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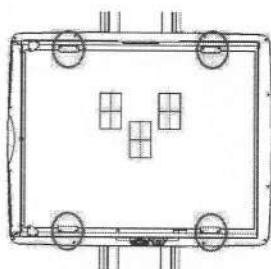
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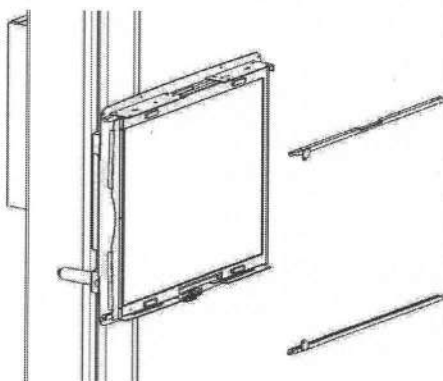
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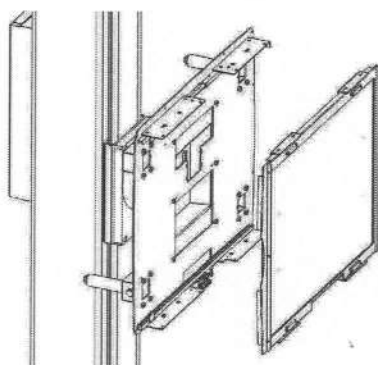
- Detach the AEC fixing bracket from the bucky device.



- Detach the front grid guide.



- Detach the detector attachment guide.



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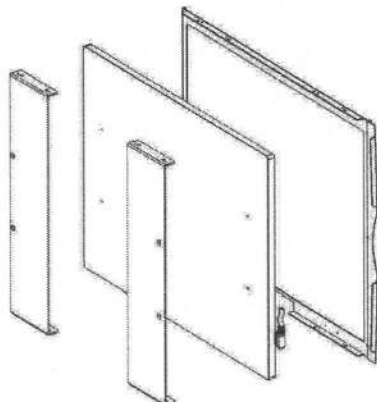
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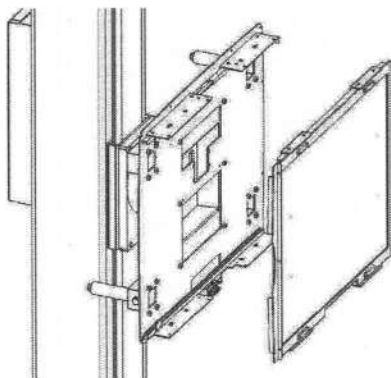
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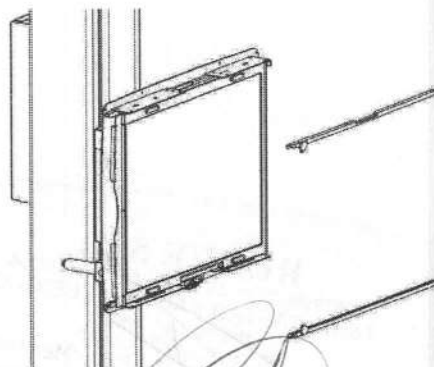
- Separate (replace) the detector from the attachment guide.



- Assemble the detector attachment guide.



- Assemble the front grid guide.



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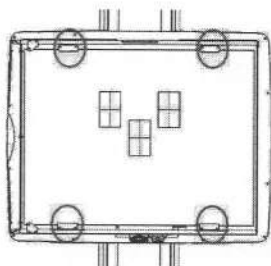
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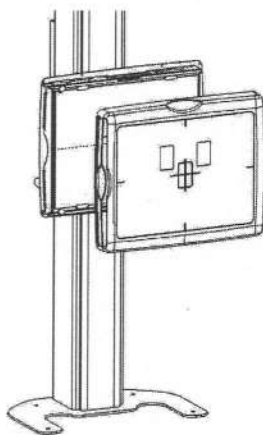
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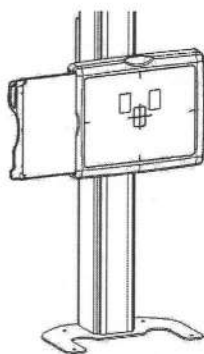
- Attach the AEC chamber to the bucky device using the fixing bracket.



- Attach the cover of the bucky stand.



- Attach the grid of the bucky stand.



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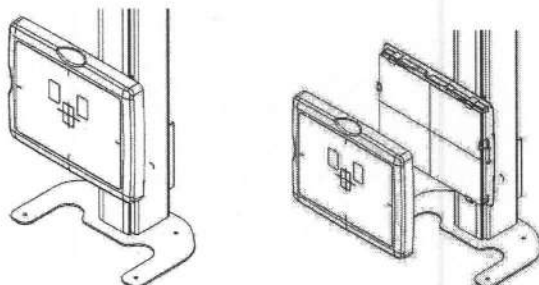
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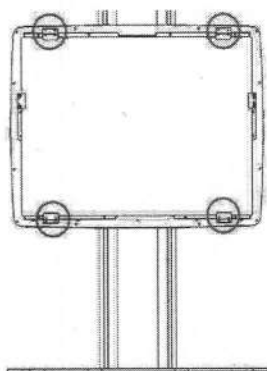
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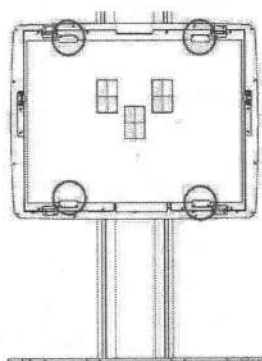
- Remove the cover of the bucky stand.



- Detach the grid fixing bracket from the bucky device.



- Detach the AEC fixing bracket from the bucky device.



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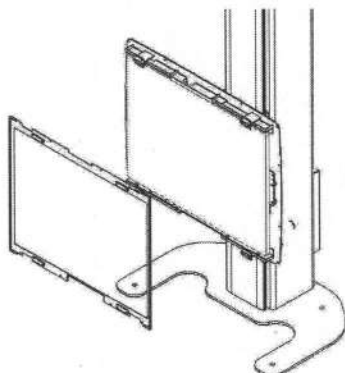
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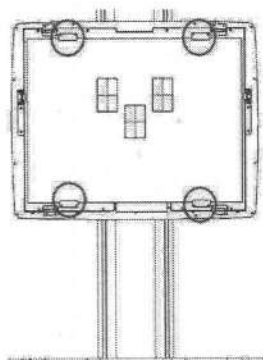
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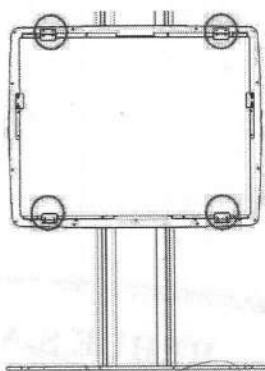
- Attach the AEC assembly guide from the Bucky device



- Assemble the AEC chamber..



- Attach the grid using the fixing bracket.



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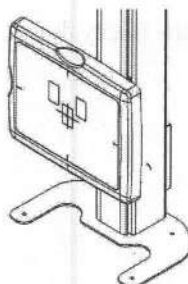
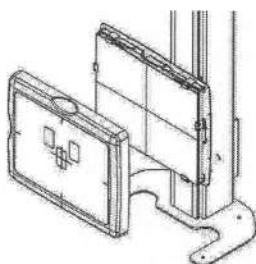


## EXSYS DEXi

Installation, Operation and Service Manual

## DRTECH

- Assemble the Bucky cover.



  
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### 7.2.5 Manufacturer's recommendations

- HV cable plug, receptacle socket, and high-voltage cable must be handled in a clean condition without moisture.
- Apply enough insulation silicon oil to the end of the plug of the HV cable.
- After filling the receptacle socket of the high voltage transformer with about 1cm~1.5cm of insulating oil, insert the HV cable plug to assemble.
- After inserting the HV cable plug into the high voltage transformer, fasten it with the assembly nut of the HV cable plug.
- After applying enough insulation silicon oil to the end of the plug of the HV cable, insert the HV cable plug into the GN X-ray tube, and fasten it with the assembly nut of the HV cable plug.

#### WARNING ►

Plugging the HV cable into the high-pressure transformer and X-ray tube should be done in a clean and dry state.

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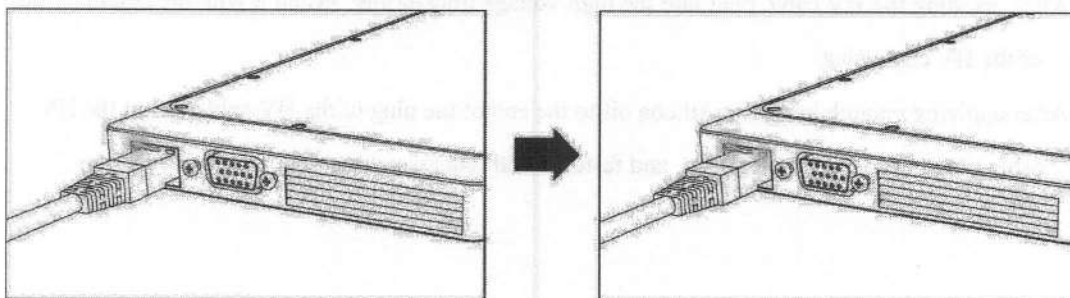
### 7.3 Detector installation

#### 7.3.1 Wired detector power supply

##### 1) Powering on the detector

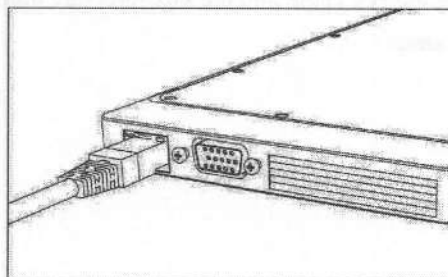
**i** Before operating the detector, start up the EConsole

- Plug in the LAN cable to the Product.
- Then plug in LAN cable and AC Power cable to POE Adaptor.
- Supply power to AC Power Cable.
- During the boot sequence of the detector, Power (Green) and Ready (Yellow) LED indicators are on.

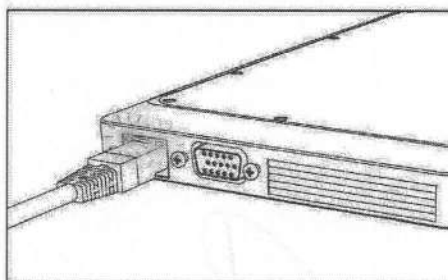


- Power LED (Green) lights up when detector booting is completed.

**i** When an Error occurs, the green and yellow LED do not flash up. See Troubleshooting



**i** When Power LED (Green) is blinking fast (0.5-second intervals) and Ready LED (Yellow) does not light up, see Troubleshooting.



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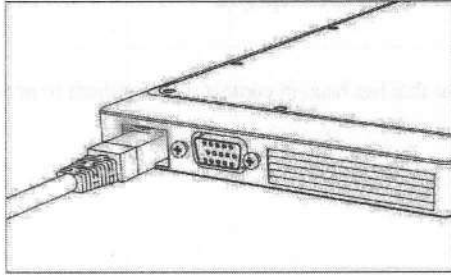
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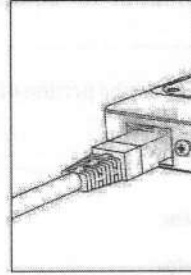
## 2) Conduct examination

For details about operation, refer to the **Operation Manual for the ECali1**.

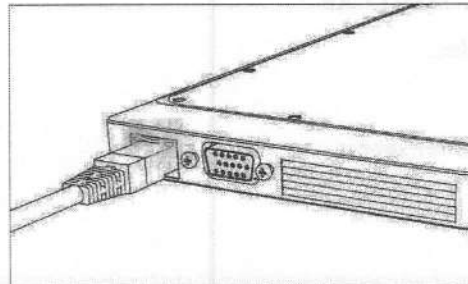
- ① Select the patient information or protocols on the screen and start the examination.



The Power LED (Green) and Ready LED (Yellow) light up during preparation for examinations.  
(Detector Ready)



The Power LED (Green) lights up and Ready LED (Yellow) is blinking (fast blink, 0.5-second intervals) when the detector and EConsole is changed to exposure ready status. (Detector Busy)



The Power LED (Green) lights up and Ready LED (Yellow) is blinking (normal blink, 1-second interval) when the detector and EConsole is changed to exposure ready status. (Exposure Status)

- Arrange the patient in the correct posture and position the detector aligning it with the target body part.
- Position the X-ray generator to adjust the exposure field.
- Check all conditions before exposure.
- Make sure that LED status lamps (POWER, READY, and Error) are lit. This means that the system is ready to start an examination

- i** A communication error has occurred when green & yellow Color LED flash simultaneously (fast blink, 0.5-second intervals). Please see Troubleshooting.
- i** When the Power LED (Green) flashes (normal blink, 1-second intervals), the detector is in detector selection status (Sleep).
- i** When the Power LED (Green) flashes (slow blink, 2-second intervals), the detector is in detector selection status (Detector Off). For adjustment of detector off time, please see ECali1 manual.

- The detector enters detector selection status automatically when it has not been used for a certain period of time.
- 
- ② Press the exposure switch of the X-ray generator. Images captured with the detector are transmitted to the EConsole and appear on the monitor screen.
- ③ Click the button for ending the examination images are stored automatically.
- To conduct examination for another patient, repeat the step(③).

**IMPORTANT**

Sterilize the portion of the detector that has been in contact with a patient to prevent infection

### 3) Powering off the detector

- Turn off the detector

- Select the POWER OFF button from EConsole.
- Power plug off of POE adaptor from the outlet.

\* Power Adaptor :

- Model Name : GT-96300-3656-T3-AP
- Manufacture : GlobTek, Inc.

### 7.3.2 Wireless detector power supply

#### 1) Operating the detector

| Lamp Type |  | Operation |  | Network |
|-----------|-------------------------------------------------------------------------------------|-----------|--------------------------------------------------------------------------------------|---------|
|           | Ready                                                                               | Busy      | AP                                                                                   | Link    |
| Color     | ■ Green                                                                             | ■ Orange  | ■ Blue                                                                               | ■ Green |

\* The Network lamp is divided into two different lamps; AP (Blue) and LINK (Green) lamps.

#### 2) Powering on the detector



- Before operating the detector, start up the EConsole

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Press and hold the **POWER** button  
(approx. 1 second)

Operation lamp (Green) lights up



### 3) Register the detector and make connection to the EVS control system

Registration: AP(Blue) and LINK(Green)  
lamp blinks



- When the AP lamp is blinking once in 2 seconds, system is in wired mode.
- When the AP lamp is blinking twice in 2 seconds, system is in wireless mode (AP\_1).
- When the AP lamp is blinking 3 times in 2 seconds, system is in wireless mode (AP\_2).
- When the AP lamp is blinking 4 times in 2 seconds, system is in wireless mode (Detector AP)

**\*\*User can set value of AP\_1, AP\_2, in Ecali Program. Please refer to Ecalil Operation Manual (Calibration tool).**

Connection: Network connection between the internal wireless module of the detector and the wireless access point/EVS control system is secured automatically. The LINK (Green) lamp lights up when the detector is registered and the communication connection has been established.



- The LINK (Green) lamp does not light up when the detector is not registered or the communication connection is not established.
- When the READY (Green) and AP (Blue) lamp are blinking and LINK (Green) lamp does not light up, a communication error has occurred.

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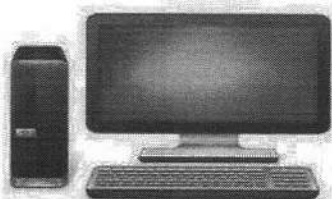
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## 4) Conduct examination

For details about operation, refer to the User Manual for the EConsole.

- ① Select the patient information or protocols on the screen and start the examination.



- The **READY** lamp color is changed from green to orange when the detector and EConsole change to exposure ready status.



- Arrange the patient in the correct posture and position the detector aligning it with the target body part.
- Position the X-ray generator to adjust the exposure field.
- Check all conditions before exposure.
- Make sure that Ready (Green) and LINK (Green) lamps are lit and AP lamp (Blue) is blinking. This means that the system is ready to start an examination



- A communication error has occurred when LINK lamp blinks.
- When the READY lamp (Orange) blinks slowly, the detector is in detector selection status (Sleep).  
The detector enters detector selection status automatically when it has not been used for a certain period of time.

- ② Press the exposure switch of the X-ray generator. Images captured with the detector are transmitted to the Ecali and appear on the monitor.

- ③ Click the button for ending the examination images are stored automatically.

- To conduct examination for another patient, repeat the step(③).



**IMPORTANT**

- Sterilize the portion of the detector that has been in contact with a patient to prevent infection

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**5) Powering off the detector****• Turn off the detector**

- ① Press the **POWER** button of the detector.
- ② All the **LED** lamps should be off.

- Select the **POWER OFF** button from EConsole.
- Power plug off of POE adaptor from the outlet.

**\* Power Adaptor 1(for detector) :**

- Model Name : MANGO60S-USB-PDA
- Manufacture : MEGMEET

**\* Power Adaptor 2(for battery charger) :**

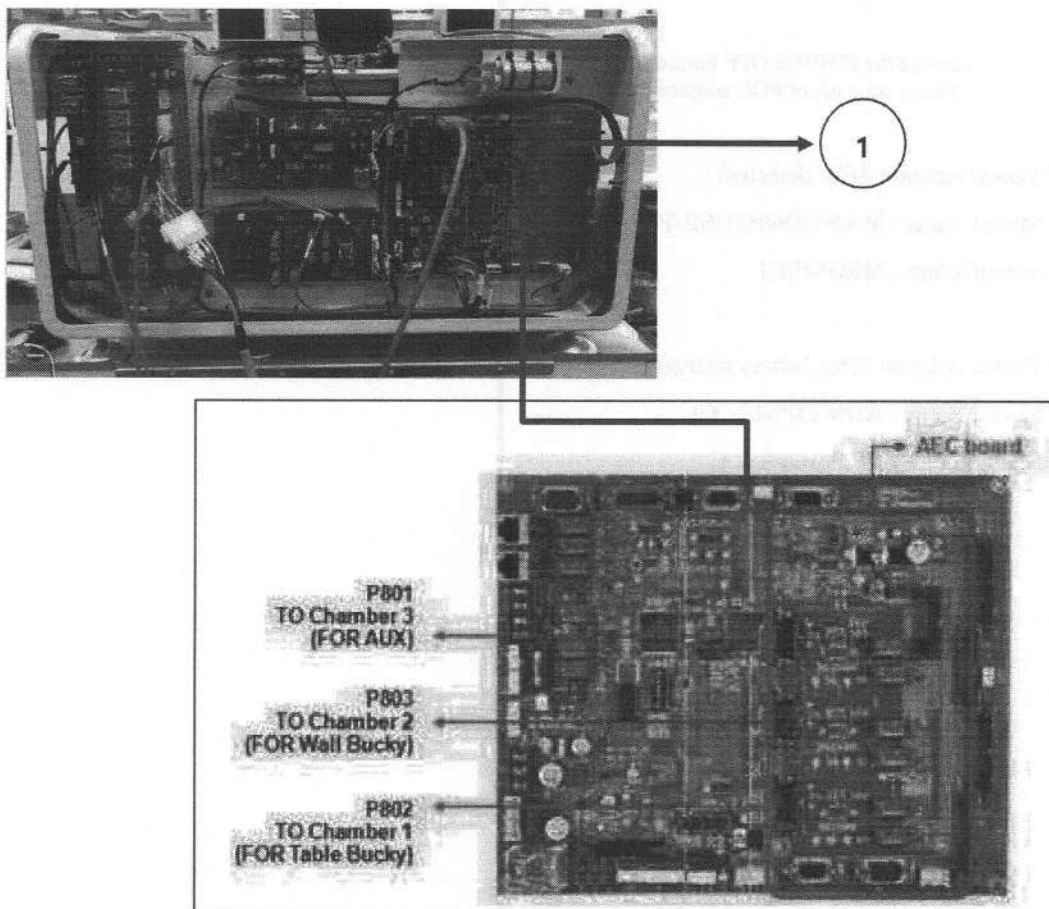
- Model Name : AHM85PS12- XA
- Manufacture : XP Power L L C

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## 7.4 AEC installation

7.4.1 AEC board is attached to the generator's MiO board (Picture 1).



7.4.2 AEC Board signals are composed as follows.

| PIN | Signal    | NOTES              | Remark                                                                                                                                                                                             |
|-----|-----------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | NC        |                    | The pin configuration of P801, P802, P803 is the same, and the auxiliary signal of the AEC chamber is connected to P801, and the table signal is to P803, and the upright stand signal is to P802. |
| 2   | Field II  |                    |                                                                                                                                                                                                    |
| 3   | Field I   |                    |                                                                                                                                                                                                    |
| 4   | Reset     | Reset / exposure   |                                                                                                                                                                                                    |
| 5   | AEC3 stop | Output signal ramp |                                                                                                                                                                                                    |
| 6   | Field III |                    |                                                                                                                                                                                                    |
| 7   | AEC3 -VDC | -12V               |                                                                                                                                                                                                    |
| 8   | AEC3 +VDC | +12V               |                                                                                                                                                                                                    |
| 9   | GND       | Shield             |                                                                                                                                                                                                    |

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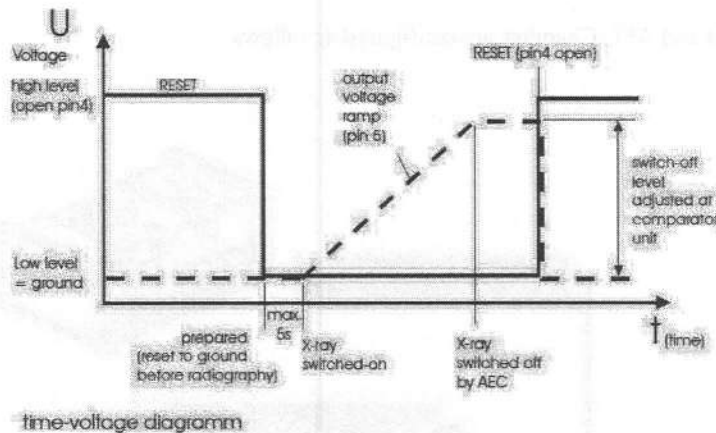
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AEC3

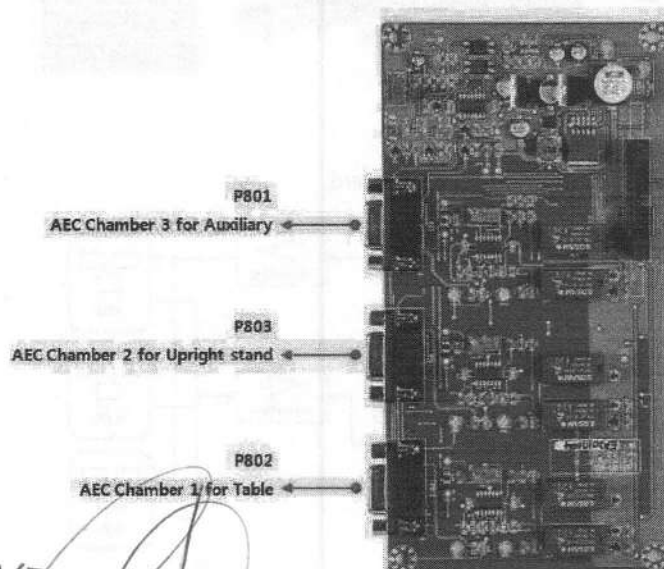
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7.4.3 Function and Performance Time Signal Chart of AEC Board is as follows.

- Time Signal Chart of AEC Board is as follows.



- AEC Board is installed together on the MiO Board.
- It is installed on the bucky table and the bucky stand in AEC chamber, and is connected by RS232 cable.
- AEC Board can connect 3 Chambers and can be applied to Bucky Table, Bucky Stand, and as auxiliary.



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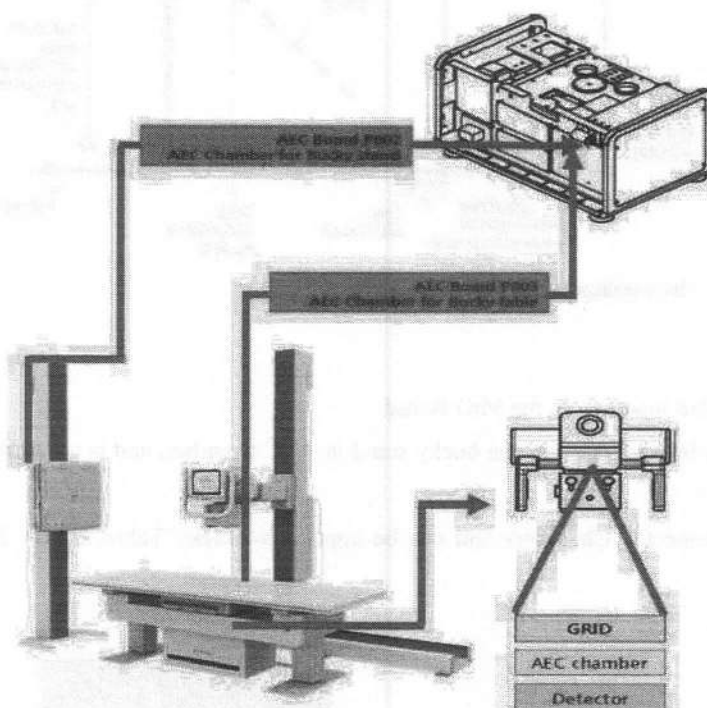
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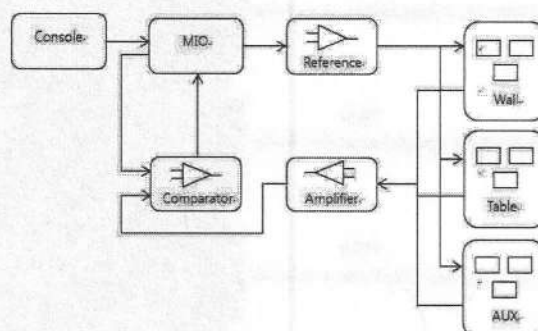
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|                                            |                                                                                                                                                                                     |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Shortest Irradiation Loading Factor</b> | kV Operating range: 40 kV~150 kV.<br>mA Operating range:<br>■ Small at 1msec, All large focals operate at over 100mA<br>■ At 10msec, it operates in the whole range of 10 mA~500 mA |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

- AEC Board and AEC Chamber are configured as follows.



- ### ■ Block Diagram of AEC Chamber Control board



- ### ■ AEC Chamber Setting

- The output signal from the chamber's pre-amplifier to the AEC board should be set to negative.
- Chamber signals differ depending on the manufacturer, so be sure to check them during

installation.

- RS232 is a communication port that is connected to P801, P802, P803 of AEC Chamber and AEC Chamber control board. The connector pin configuration is as follows.

**P802 connector pin configuration (FOR Table)**

| PIN | Signal    | NOTES              | Remark                                                                                                                                                                                             |
|-----|-----------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | NC        |                    | The pin configuration of P801, P802, P803 is the same, and the auxiliary signal of the AEC chamber is connected to P801, and the table signal is to P803, and the upright stand signal is to P802. |
| 2   | Field II  |                    |                                                                                                                                                                                                    |
| 3   | Field I   |                    |                                                                                                                                                                                                    |
| 4   | Reset     | Reset / exposure   |                                                                                                                                                                                                    |
| 5   | AEC1 stop | Output signal ramp |                                                                                                                                                                                                    |
| 6   | Field III |                    |                                                                                                                                                                                                    |
| 7   | AEC1 -VDC | -12V               |                                                                                                                                                                                                    |
| 8   | AEC1 +VDC | +12V               |                                                                                                                                                                                                    |
| 9   | GND       | Shield             |                                                                                                                                                                                                    |

**P802 connector pin configuration (FOR Bucky Stand)**

| PIN | Signal    | NOTES              | Remark                                                                                                                                                                                             |
|-----|-----------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | NC        |                    | The pin configuration of P801, P802, P803 is the same, and the auxiliary signal of the AEC chamber is connected to P801, and the table signal is to P803, and the upright stand signal is to P802. |
| 2   | Field II  |                    |                                                                                                                                                                                                    |
| 3   | Field I   |                    |                                                                                                                                                                                                    |
| 4   | Reset     | Reset / exposure   |                                                                                                                                                                                                    |
| 5   | AEC2 stop | Output signal ramp |                                                                                                                                                                                                    |
| 6   | Field III |                    |                                                                                                                                                                                                    |
| 7   | AEC2 -VDC | -12V               |                                                                                                                                                                                                    |
| 8   | AEC2 +VDC | +12V               |                                                                                                                                                                                                    |
| 9   | GND       | Shield             |                                                                                                                                                                                                    |

**NOTE►**

User manual for AEC chamber is provided separately.

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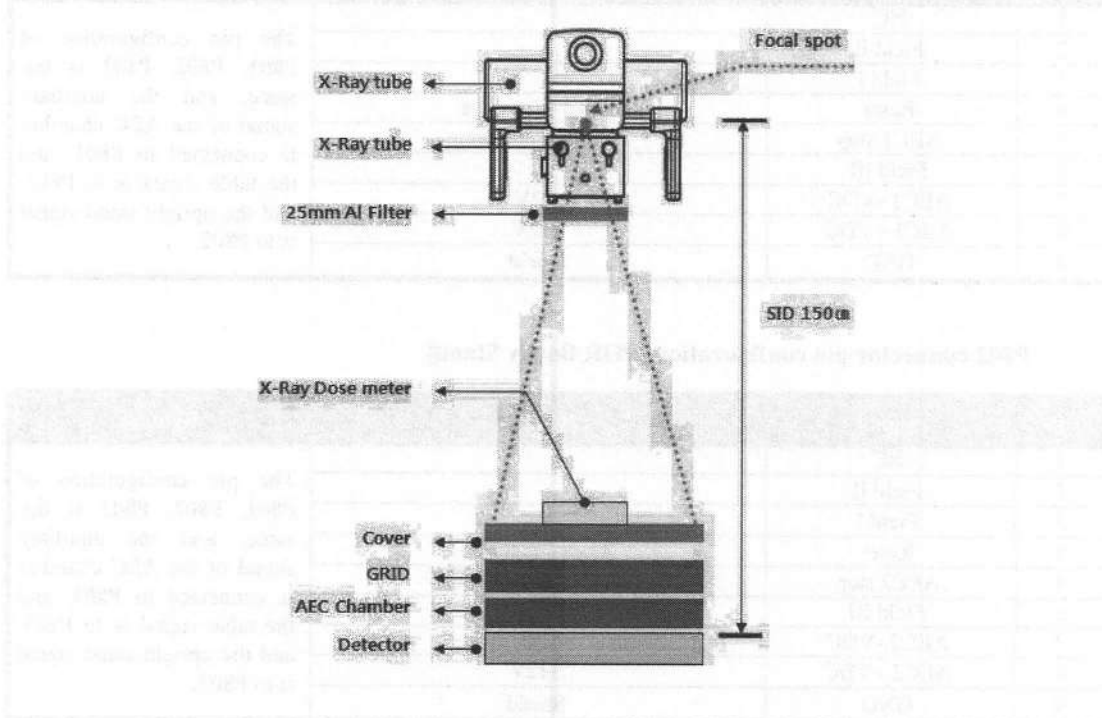
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## 7.4.4 AEC Chamber Calibration

In order to keep the AEC output constant, check the operation status of the AEC Chamber, and proceed with the check in the following order and method.

## ■ Test criteria



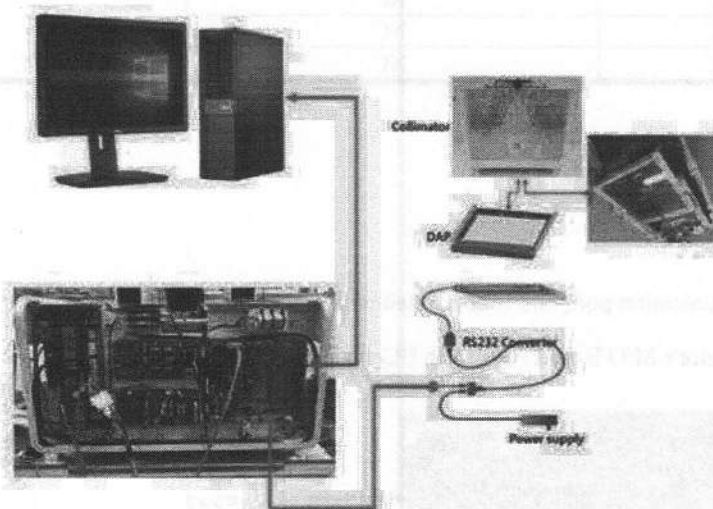
## ■ Test Methods

- (1) The distance between the X-Ray Tube Focal and Detector is 150cm.
- (2) Put a 25mm aluminum filter on the end of the collimator.
- (3) After installing the GRID, AEC Chamber, and Detector according to the test criteria, place the X-Ray Dose meter on the GRID.
- (4) Set X-Ray Factor to 70KV, 50mA, 100msec, AEC Chamber Density "0".
- (5) X-ray is irradiated.
- (6) Check the amount of X-Ray dose measured by the X-Ray Dose meter.
- (7) The standard value of the measured X-ray dose amount is 3.4uGy, and the measured value is checked.
- (8) If the reference value is low, raise the AEC Chamber Density level of the console by one step and irradiate the X-ray so that the reference value of the X-Ray Dose amount is 3.4uGy.
- (9) If the reference value is large, lower the AEC Chamber Density level of the console by one step and irradiate the X-ray so that the reference value of the X-Ray Dose amount becomes 3.4uGy.

- (10) When the standard value of X-ray dose is 3.4uGy, measure the voltage at TP2 of AEC Board.
- (11) The reference voltage of TP2 of AEC Board is -800mV. If the reference voltage is not correct, adjust VR31 to match the reference voltage.
- (12) End AEC Chamber Calibration.

### 7.5 DAP Meter Installation

- Assemble the DAP meter to the collimator.
- Connect the signal line of the DAP meter to P805 of the MiO Board.



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- The pin configuration of the DAP meter connector is as follows.

| PIN | Signal      | NOTES           | Remark                                                                                        |
|-----|-------------|-----------------|-----------------------------------------------------------------------------------------------|
| 1   | NC          | NC              | Communication port for DAP meter. MiO board P805 is connected to 13 and 14 of MAX3232C(U603). |
| 2   | M2DAPRX-IN  | IN, 13 of U603  |                                                                                               |
| 3   | M2DAPTX-OUT | OUT, 14 of U603 |                                                                                               |
| 4   | NC          | NC              |                                                                                               |
| 5   | GND         | GND             |                                                                                               |
| 6   | NC          | NC              |                                                                                               |
| 7   | NC          | NC              |                                                                                               |
| 8   | NC          | NC              |                                                                                               |
| 9   | NC          | NC              |                                                                                               |

**NOTE►**

User manual for DAP meter is provided separately.

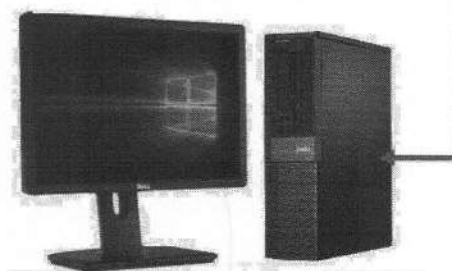
**7.6 EConsole 1 Connection**

- It is RS232 communication port, and is connected with communication cable.
- Connect the generator's MiO Board P802 with EConsole 1.



RS232

Communication Cable



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- P802 connector is connected to 13 and 14 of MiO board MAX3232C(U602), and the pin configuration is as follows.

| PIN | Signal       | NOTES                                | Remark                                                                   |
|-----|--------------|--------------------------------------|--------------------------------------------------------------------------|
| 1   | MiO RESET    | Q616 Base (CON2 MiO RESET)           | Connect P803 of Generator MIO Board and P803 of Console Connector Board. |
| 2   | M2CRX-IN     | RX (13 of U602)                      |                                                                          |
| 3   | M2CTX-OUT    | TX (14 of U602)                      |                                                                          |
| 4   | NC           | NC                                   |                                                                          |
| 5   | GND          | GND                                  |                                                                          |
| 6   | +V           | 30VDC                                |                                                                          |
| 7   | +V           | 30VDC                                |                                                                          |
| 8   | GND          | GND                                  |                                                                          |
| 9   | GND          | GND                                  |                                                                          |
| 10  | GND          | GND                                  |                                                                          |
| 11  | EEPROM Write | Connect with EEPROM WP               |                                                                          |
| 12  | M2MCON IN    | P803 RX (PC)                         |                                                                          |
| 13  | M2MCON OUT   | P803 TX (PC)                         |                                                                          |
| 14  | EXP. IN      | Connected to pin 2 EXP IN of P910.   |                                                                          |
| 15  | READY IN     | Connected to pin 3 READY IN of P910. |                                                                          |



**EXSYS DEXi**

Installation, Operation and Service Manual

**DRTECH**

## Chapter 8

# Calibration

## Diagnostic X-ray System

**[EXSYS DEXi]**

  
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## 8 Calibration

### 8.1 Generator Calibration

#### 8.1.1 Overview

This Generator calibration must be performed only by the calibration software program of Ecoray.

#### 8.1.2 Characteristics of calibration software program

- The calibration software program is operated on PC.
- It has functions for changing X-ray exposure parameters (eg kV, mA and selection of X ray tube) and can be saved.

#### 8.1.3 Tool and equipment for calibration

Calibration requires the following tool and equipment.

- Calibration software program of Ecoray (CD)
- Digital Voltmeter (DVM)
- X-ray kVp meter
- X-ray mA meter
- X-ray exposure time meter
- Radiation Dose meter
- Aluminum HVL attenuators for HVL measurements
- Others for equipment for calibration

#### 8.1.4 Check before calibration start

- Power input (Supply mains)
- Protective earth condition
- Tool and equipment for calibration
- Selected X-ray tube model, type reference of the per

  
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## 8.1.5 When to do calibration

| When to do                                                            | What to do                                | Remarks                      |
|-----------------------------------------------------------------------|-------------------------------------------|------------------------------|
| After product installation, including relocation                      | Calibration for X-ray exposure parameters | Refer to the chapter 4       |
| Periodic testing for maintenance<br>(Every six months or as required) | Calibration for X-ray exposure parameters | Refer to the chapter 4       |
| Replacement or repair of critical components                          | Calibration for X-ray exposure parameters | Refer to the chapter 4 and 6 |

## 8.1.6 Critical Components that could affects the product performance

Replacement or repair of critical components requires a calibration for X-ray exposure parameters.

Critical components are the followings:

- X-Ray tube assembly
- MiO Board (Main CPU Board)
- FnD Board (FET Driver Board)
- FILA Board (Filament Driver Board)
- HVT (high Voltage Transformers)
- High voltage cables

  
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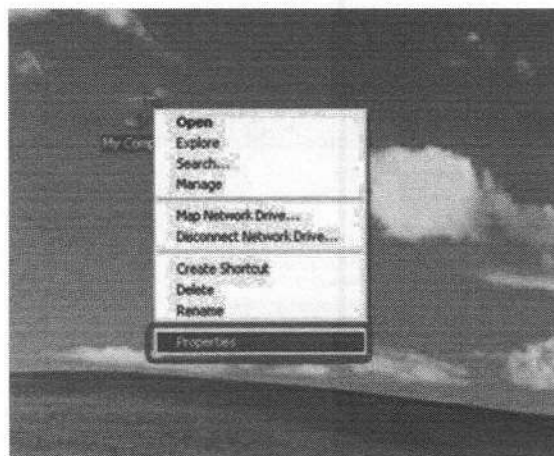
### 8.1.7 Installation of "USB to RS232 Converter Driver"

#### Specifications

- Identification: USB to RS232 Converter
- Confirmation of PC specifications
  - ✓ System: Pentium MMX 200MHz or higher
  - ✓ Operating System: Windows XP Service Pack2 or higher
  - ✓ USB Interface: USB 2.0 or higher (USB 2.0 recommended)
- The software for RS232 Driver is available on the website and the installation method refers to a manual which is accompanied the RS232 Converter.

#### Installation

- Turn on PC.
- Click "My Computer" icon from the wallpaper on PC to execute "Properties".
- Click "Properties".



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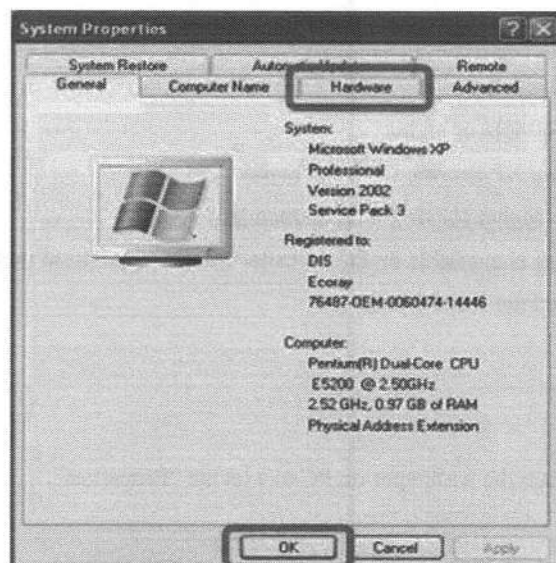
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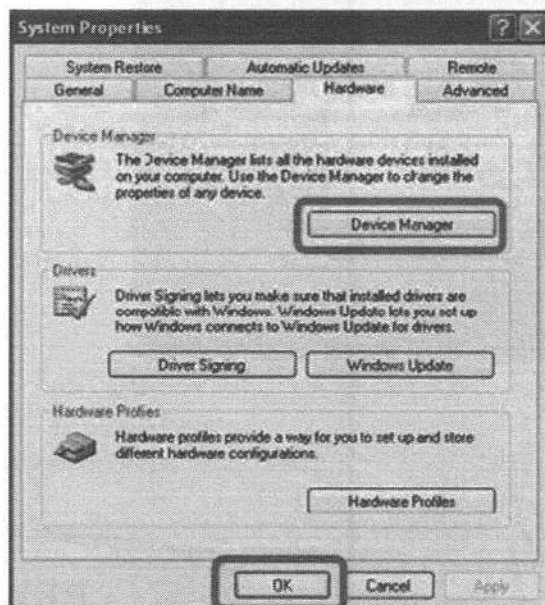
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- Click “Hardware”, then click “OK”.



- Click “Device Manager”, then click “OK”.



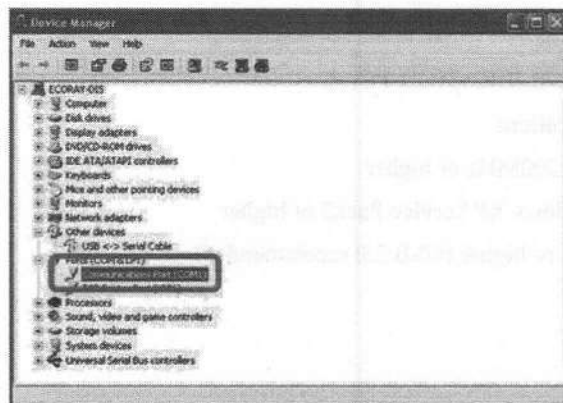
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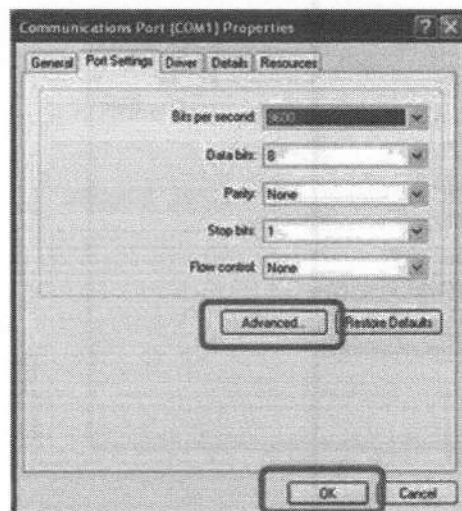
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- Click “Communications Port(COM1)”, then click “Port Settings”.



- Check the selected values.
- Click “Advanced”, then click “OK”.



- On the displayed “Advanced Setting for COM1”, select “Use FIFO buffers(requires 16550 compatible UART)”.
- Select a suitable one from COM1 to COM5, then click “OK”.
- Installation of “USB to RS232 Converter Driver” is finished

#### NOTE►

If you do not select a one from COM1 to COM5, this program would not operate.

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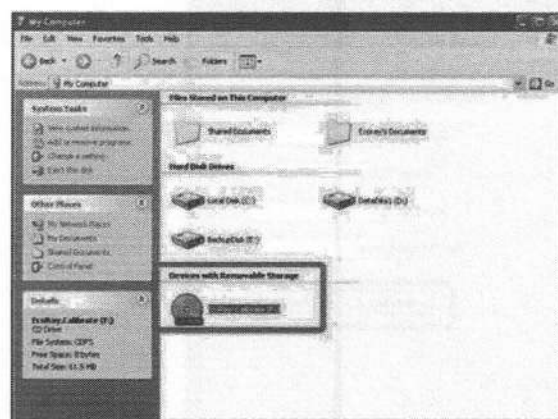
### 8.1.8 Installation of calibration software program

#### (1) Specifications

- Identification: ECO-GEN-CALIBRATION-PC-M
- Confirmation of PC specifications
  - ✓ System: Pentium MMX 200MHz or higher
  - ✓ Operating System: Windows XP Service Pack2 or higher
  - ✓ USB Interface: USB 2.0 or higher (USB 2.0 recommended)

#### (2) Installation

- Turn on PC.
- Insert the CD for calibration software program into PC.
- Click "My Computer" icon from the wallpaper.
- On the "Devices with Removable Storage" pane, double click "EcoRay Calibrate".



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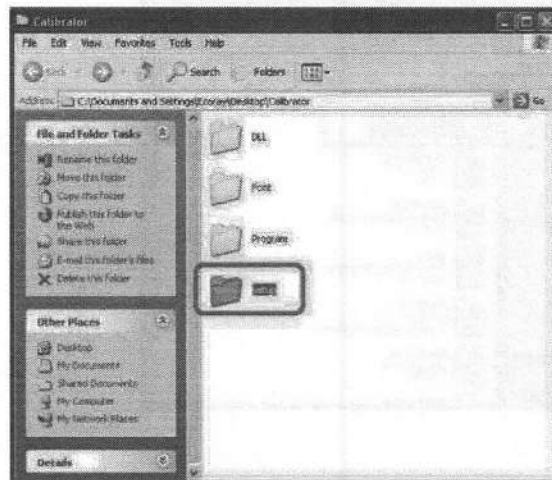
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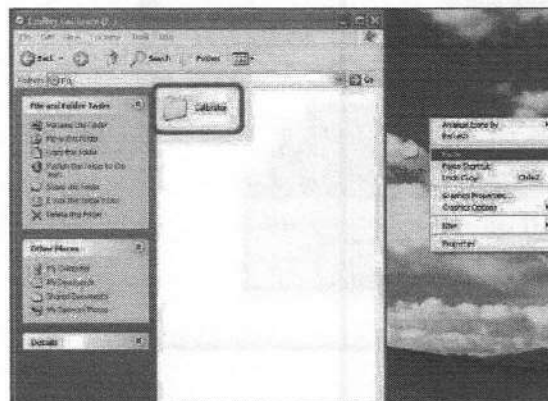
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- On the “Calibrate” pane, copy “Calibrate”.
- Move the “Calibrate” on the wallpaper.



- On the wallpaper, double click “Calibrate”.
- On the “Calibrate” pane, double click “Setup” file.



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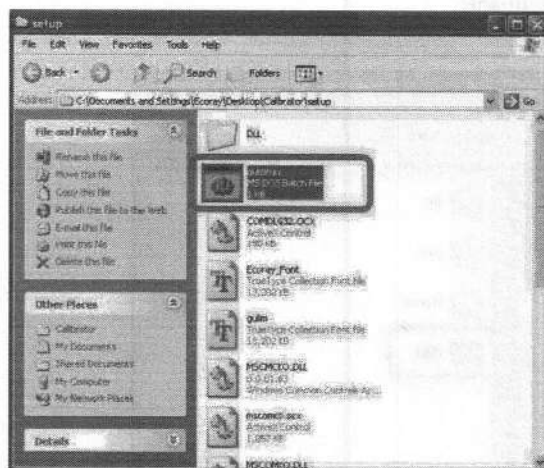
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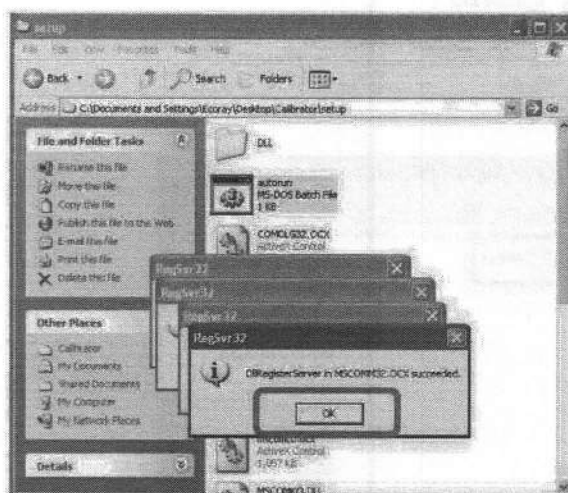
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- On the “Setup” pane, click “auto run” file.



- Click “OK” button.



Installation of calibration software program is finished.

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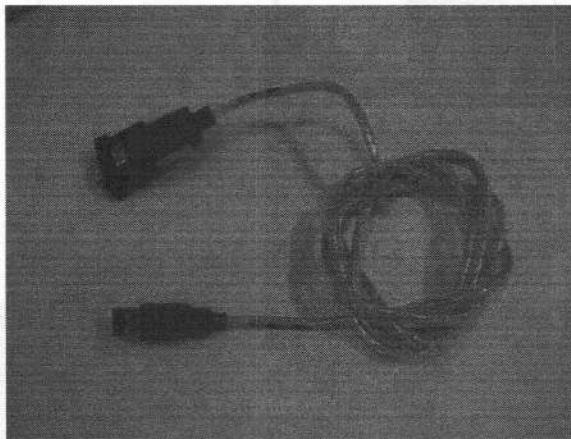
### 8.1.9 Preparations for the calibration

#### (1) PC

- Specifications: Refer to 7.1

#### (2) USB cable for “USB to RS232 Converter”

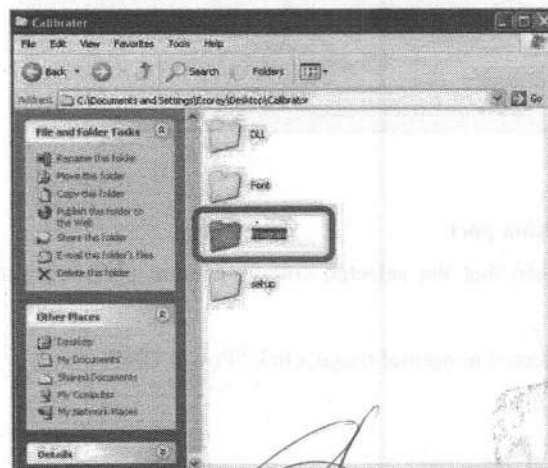
- This USB cable is generally available



### 8.1.10 Program execution for calibration

#### (1) Program execution of “Ecoray\_Calibrator”

- On the wallpaper, double click “Calibrate”.
- On the “Calibrate” pane, click “Program”.



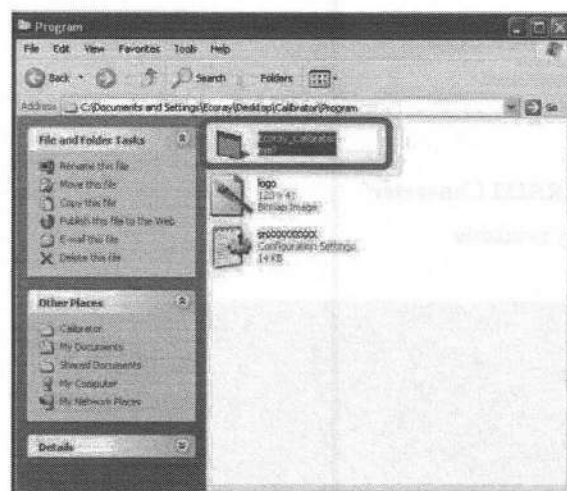
- On the “Program” pane, click “Ecoray\_Calibrator” file.

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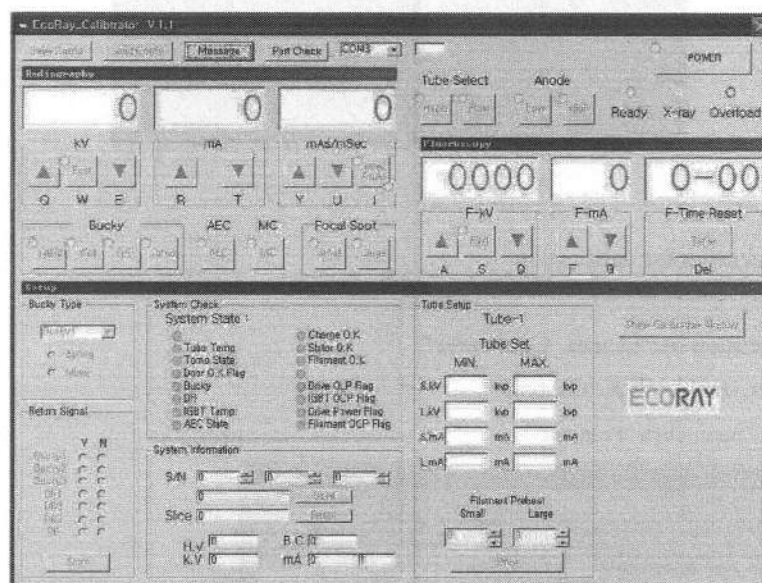
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• Then, it will be displayed as the following:



## (2) Selection of the communication port

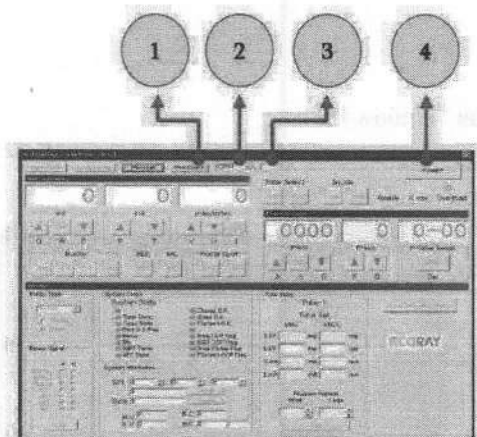
- Click "Port Check", and confirm that the selected communication port is a suitable one from COM1 to COM5.
- If the communication port is selected in normal range, click "Power ON".
- Execute "Operation & Setup Part"

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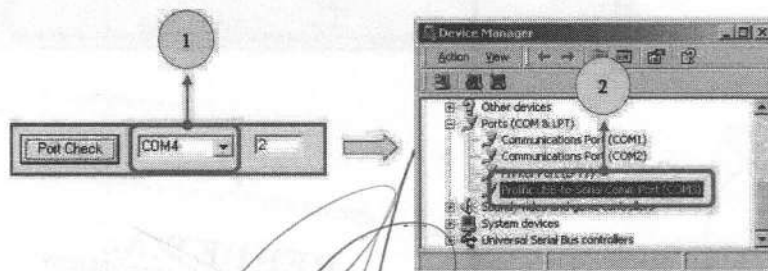
| No. | Functions                  | Description of functions                                |
|-----|----------------------------|---------------------------------------------------------|
| 1   | Port Check                 | Confirm setting for communication                       |
| 2   | Communication Port Check   | Confirm the selected communication port                 |
| 3   | Communication signal Check | Display the communication signal between PC and program |
| 4   | Power ON                   | Supply power to generator, when "Power ON"              |

**NOTE►**

If the communication port is not selected in normal range, "Power ON" button will not operate.

**(3) Reselection of the communication port**

- If the communication port is not selected in normal range, change the selection of "USB to RS232 Converter".
- The change the selection: Refer to 6.7
- Confirm the setting between PC and calibration program.



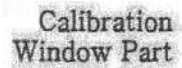
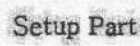
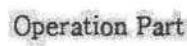
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### Operation, Setup, Calibration Window Part



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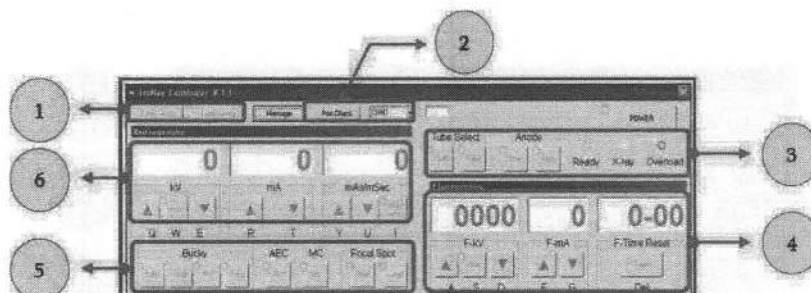
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## (1) Operation Part

- Possible select X-ray exposure parameters (eg kV, mA and selection of X-ray tube).



| No. | Functions                               | Description of functions                                                                                                       |
|-----|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| 1   | Saving data                             | Saving and output the calibration data.<br>(This function is only used in the manufacturing process)                           |
| 2   | Selection of communication port         | Selection of communication port between PC and calibration program.                                                            |
| 3   | Selection of X-ray tube functions       | Selection of the location and anode stator of X-ray tube.<br>Indication of the current state for ready, exposure and overload. |
| 4   | Indication of X-ray exposure parameters | Selection and indication of kV, mA and exposure time for fluoroscopy.                                                          |
| 5   | Selection of other functions            | Selection of bucky, AEC, MC and focal spot.                                                                                    |
| 6   | Indication of X-ray exposure parameters | Selection and indication of kV, mA and exposure time for radiography.                                                          |

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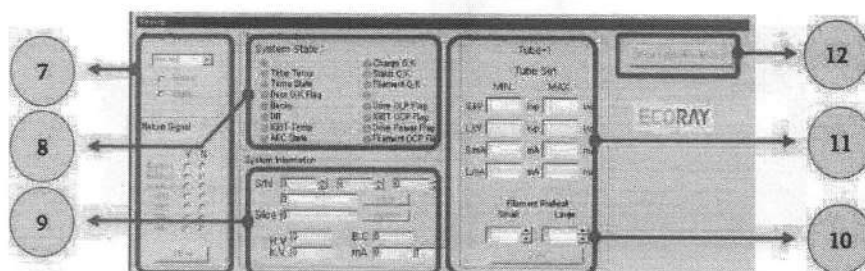
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## (2) Setup Part

- Possible select the capacity of generator and the filament preheat voltage.



| No. | Functions                             | Description of functions                                                         |
|-----|---------------------------------------|----------------------------------------------------------------------------------|
| 7   | Selection of bucky function           | Selection of each bucky operating mode.                                          |
| 8   | Indication of product failure         | Indication of product failure and description.                                   |
| 9   | Indication of data No.                | Indication of identification for calibration data and number of X-ray exposures. |
| 10  | Selection of filament preheat voltage | Selection of filament preheat voltage for "small or large filament"              |
| 11  | Selection of capacity of generator    | Selection of minimum or maximum value for "kV and mA"                            |
| 12  | Shoe calibration window               | Program execution for calibration window part                                    |

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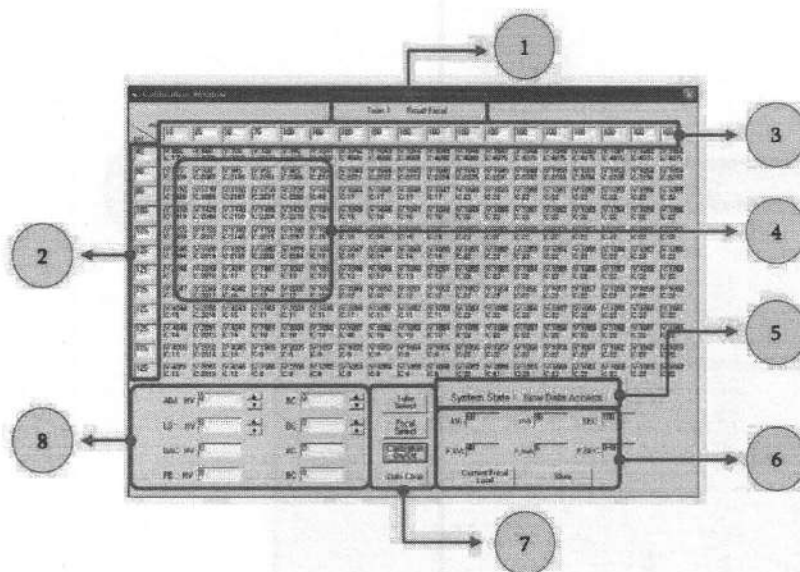
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**(3) Calibration Window Part**

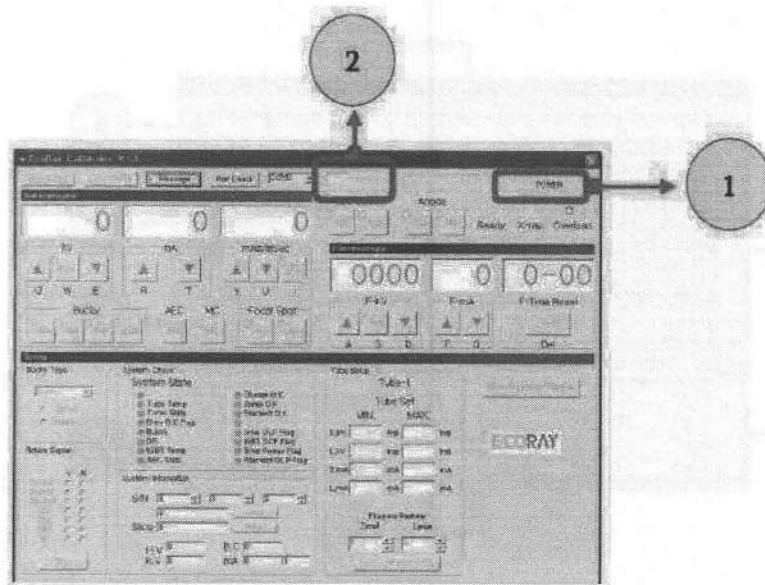
- Adjustment, indication and saving data of kV, mA.



| No. | Functions                               | Description of functions                                                                     |
|-----|-----------------------------------------|----------------------------------------------------------------------------------------------|
| 1   | Indication of X-ray tube, focal spot    | Indication of the location and focal spot of X-ray tube which is selected on the setup part. |
| 2   | Indication of kV                        | Indication of the kV range which is selected on the setup part.                              |
| 3   | Indication of mA                        | Indication of the mA range which is selected on the setup part.                              |
| 4   | Indication of data                      | Indication of the mA range which is inputted on the data input window.                       |
| 5   | Data up-load                            | Input data of the Mio CPU into calibration program.                                          |
| 6   | Indication of X-ray exposure parameters | Indication of kV, mA for fluoroscopy.                                                        |
| 7   | Selection of other functions            | Selection of filament focal, calibration On/Off, X-ray tube.                                 |
| 8   | Data input window                       | Input kV, mA for calibration.                                                                |

## 8.1.12 Calibration of radiography

## (1) Power ON



- Execute "Power ON" (see No 1 of the above fig).
- Then, it indicates 52 of data signal (input/output) address number (see No 2 of the above fig).
- Automatic start to "Operation Part & Setup Part".

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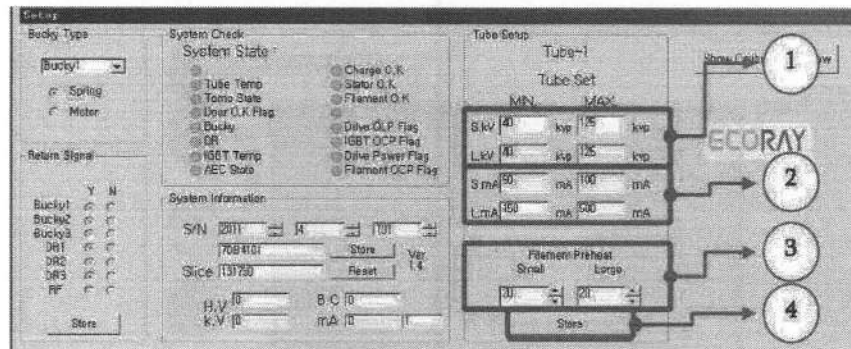
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## (2) Selection of capacity of generator



- Select min. and max. kV on the "Small Focal (S.kV)" (see No 1 of the above fig).
- Select min. and max. kV on the "Large Focal (L.kV)" (see No 1 of the above fig).
- Select min. and max. mA on the "Small Focal (S.mA)" (see No 2 of the above fig).
- Select min. and max. mA on the "Large Focal (L.mA)" (see No 2 of the above fig).
- Select filament preheat voltage for small and large focal spot (see No 3 of the above fig).

**NOTE►**

It is recommended that the filament preheat voltage selected by the manufacture does not change.

- Click "Store" for saving input data (see No 4 of the above fig).

**NOTE►**

Using the stored data of MiO Board (Main Input & Output Board) of generator, it can execute "Calibration Window Part" directly on "Show Calibration Window" without any selection of capacity of generator.

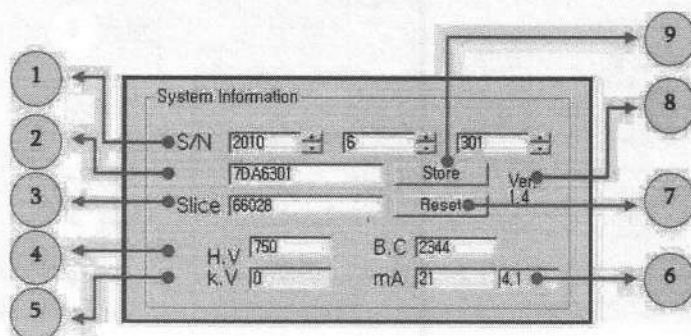
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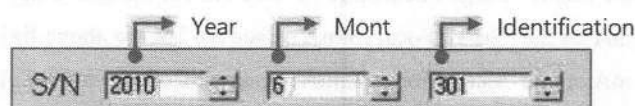
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## (3) Indication of calibration Data



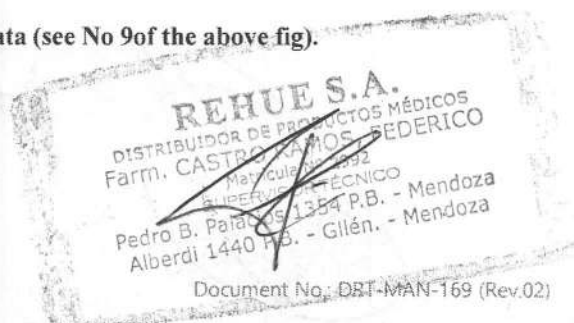
- The “S/N” indicates year, month and identification for calibration data (see No 1 of the above fig).  
The identification is assigned in regular sequence.



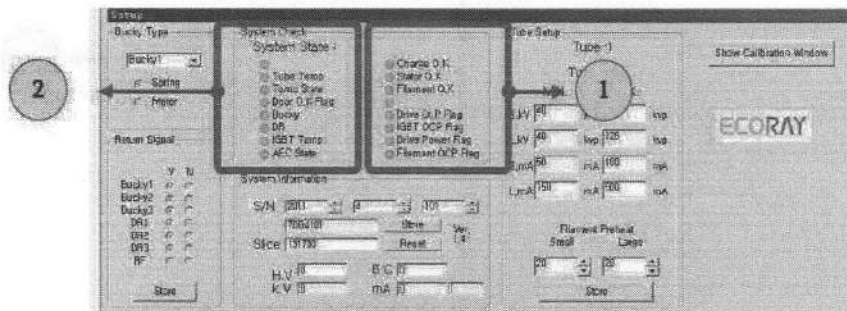
- The indication of “No 2” is only used in the manufacturing process (see No 2 of the above fig).
- The “Slice” indicates the number of X-ray exposures (see No 3 of the above fig).
- The “HV, BC” indicates the DAC values of kV and mA (see No 4 of the above fig). HV means kV of the DAC and BC means mA of the DAC.
- The “kV, mA” indicates the detected values of kV and mA on a high voltage Transformer (see No 5 of the above fig). It is detected by a detection circuit.
- The indication of “No 6” indicates the fixed 4.1 for calibration (see No 6 of the above fig).
- The “Reset” is only used in the manufacturing process (see No 7 of the above fig).
- The indication of “No 8” indicates the firmware version of MiO board (see No 8 of the above fig).
- MiO board means a “Main Input & Output Board” of generator

**NOTE►**

The “Store” indicates the function for saving data (see No 9 of the above fig).



## (4) System Check



- The indication of “No 1” indicates the state of product (see No 1 of the above fig).
- When the failure is detected, red indicator is lighting.
- When the red indicator is lighting, do not operating X-ray exposure.
- When the red indicator is lighting, reset PC and power of generator
- After reset, the red indicator is lighting still, it needs to repair.
- The indication of “No 2” indicates the state of other components and functions (see No 2 of the above fig). When it is connected in normal, green indicator is lighting. When it is not connected in normal, red indicator is lighting.

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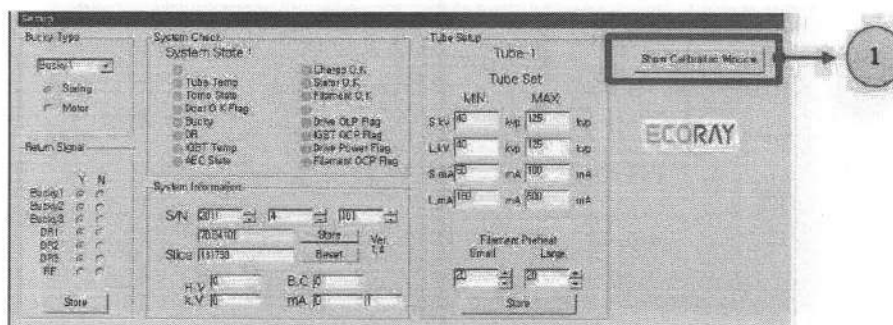
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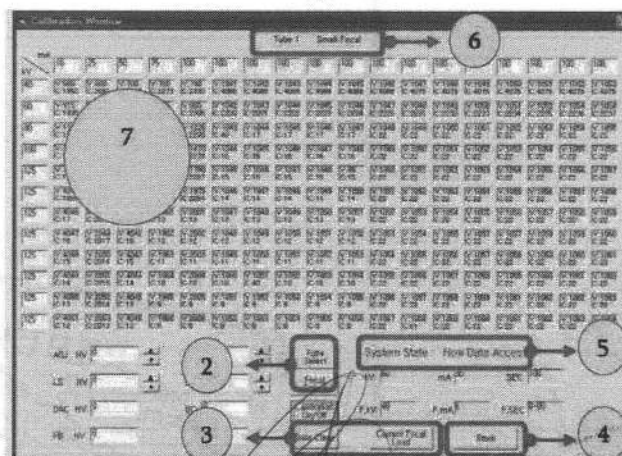
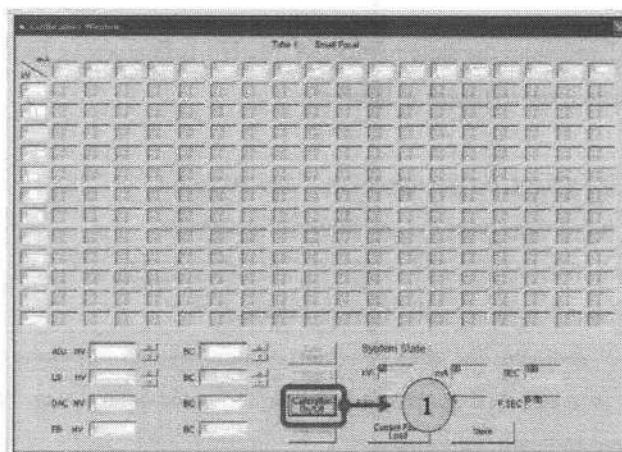
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## (5) Program execution for calibration



- Click "Show Calibration Window" (see No 1 of the above fig).



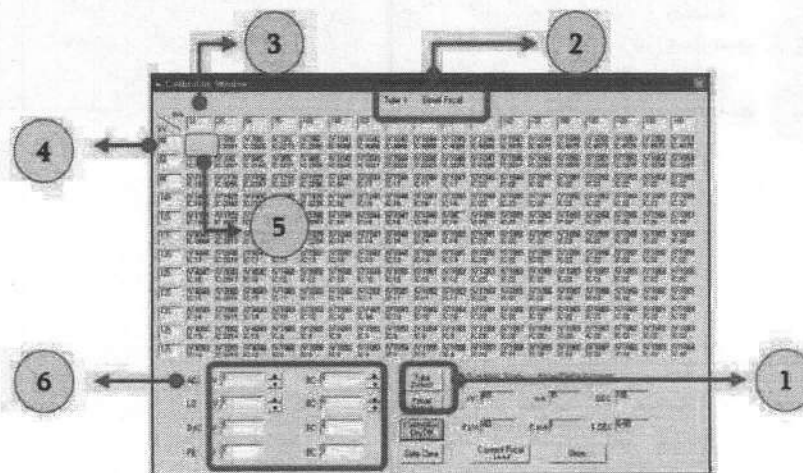
- Click “Calibration On/Off” (see No 1 of the above fig).
- The “System State” indicates “Now Data Access” (see No 5 of the above fig).
- When it indicates “Now Data Access”, the calibration data of MiO board move to a calibration program of PC automatically (see No 5 of the above fig).
- Note: MiO board means a “Main Input & Output Board” of generator
- When this calibration data has been moved, data table indicates the calibration data (see No 7 of the above fig).
- Select a suitable X-ray tube and focal spot (see No 2 of the above fig).
- Check the selected X-ray tube and focal spot (see No 6 of the above fig).
- The “Data Clear” and “Current Focal Load” are only used in the manufacturing process (see No 3 of the above fig).
- Click “Store” for saving input data (see No 4 of the above fig).

#### (6) Start calibration

- Install equipment for calibration. (Refer 3 of this chapter)
- Execute “Calibration window”.

#### (7) Selection of X-ray tube and small focal

- Select a suitable X-ray tube and small focal.
- Check the selected of focal (see No 2 of the above fig).



- Click the No 5 related to No 4 for min. kV and No 3 for min. mA (see No 3, 4, 5 of the above fig).

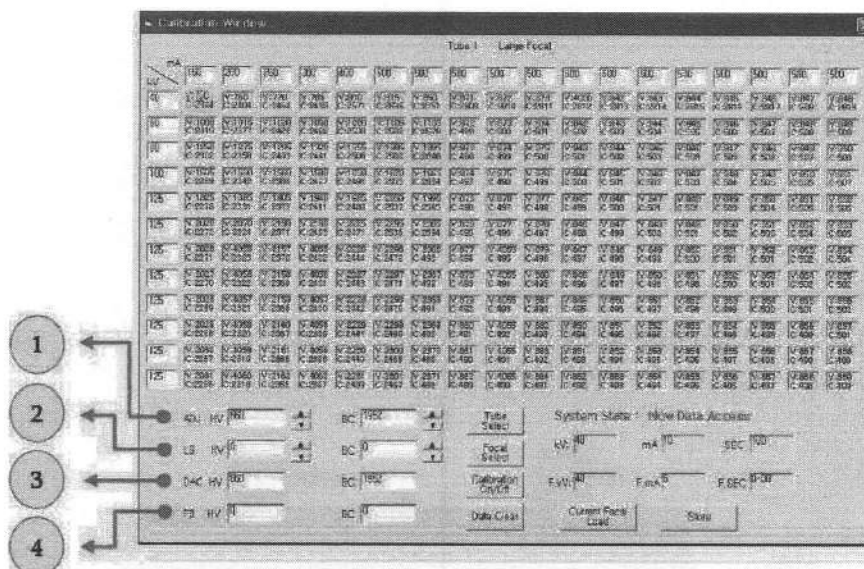
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- When click the No 5, the colume changes to yellow color. (see No 5 of the above fig).
- Check the selected data (see No 6 of the above fig).
- Execute "X-ray exposure".
- Note: Under pushing "Ctrl" on keyboard for "Ready", pushing "X" on keyboard for "X-ray exposure"
- Check the detected kV and mA (see No 6 of the above fig).
- On the "ADJ", change data (see No 6 of the above fig).
- Click "Enter" on keyboard.
- Execute "X-ray exposure".
- When the detected kV and mA are not incorrect, execute "X-ray exposure" again and change data.
- Click "Enter" on keyboard.



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**8.1.13 Sequence of calibration for radiographic mode****(1) Selection of kV, mA for calibration**

- kV: 40, 60, 80, 100, 125
- Small focal: 10, 25, 50, 75, 100mA
- Large Focal: 110mA

**(2) Sequence of calibration for small focal****Sequence of calibration, in case of small focal at 40 kV**

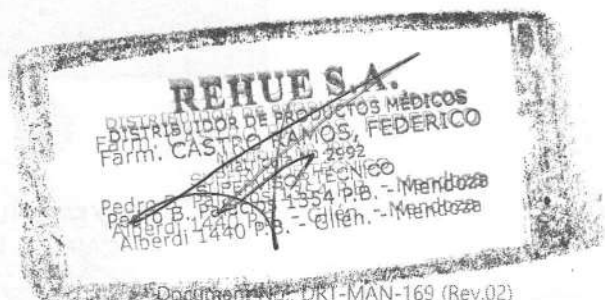
- Select 40 kV → Select 10mA → Execute "X-ray exposure" → Check the measured dose on the meter → Change data, if necessary → Click "Enter" on keyboard
- Select 40 kV → Select 25mA → Execute "X-ray exposure" → Check the measured dose on the meter → Change data, if necessary → Click "Enter" on keyboard
- Select 40 kV → Select 50mA → Execute "X-ray exposure" → Check the measured dose on the meter → Change data, if necessary → Click "Enter" on keyboard
- Select 40 kV → Select 75mA → Execute "X-ray exposure" → Check the measured dose on the meter → Change data, if necessary → Click "Enter" on keyboard
- Select 40 kV → Select 100mA → Execute "X-ray exposure" → Check the measured dose on the meter → Change data, if necessary → Click "Enter" on keyboard

For sequence of calibration At 60, 80, 100, 125, 150 kV, perform the same sequence at 40 kV.

Click "Store" for saving data.

For sequence of calibration at 60, 80, 100, 125, 150 kV, perform the same sequence at 40 kV.

  
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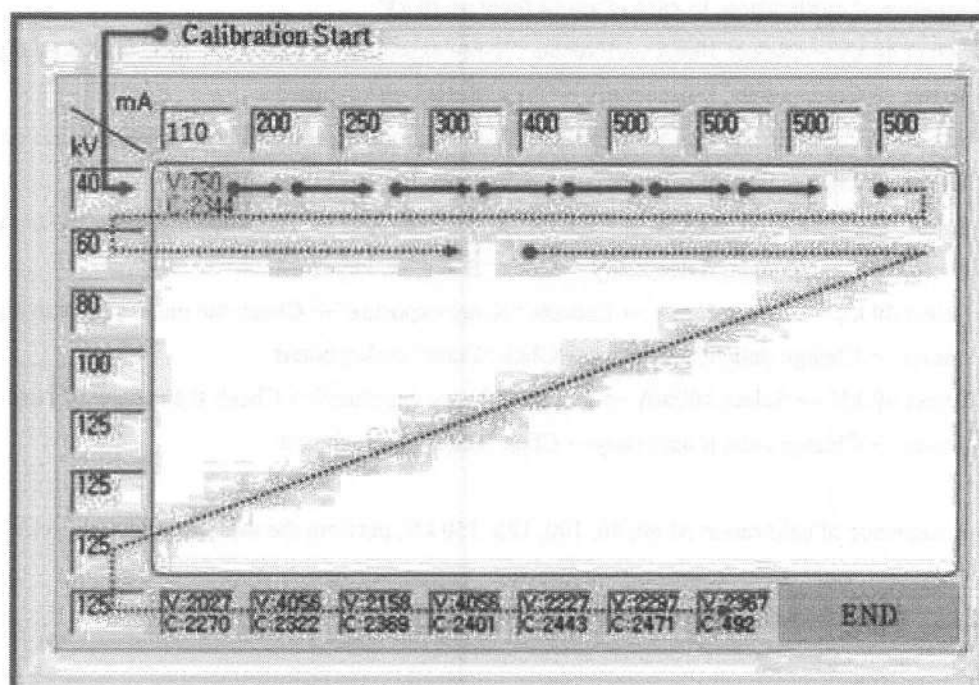
## (3) Sequence of calibration for large focal

## Sequence of calibration, in case of large focal at 40 kV

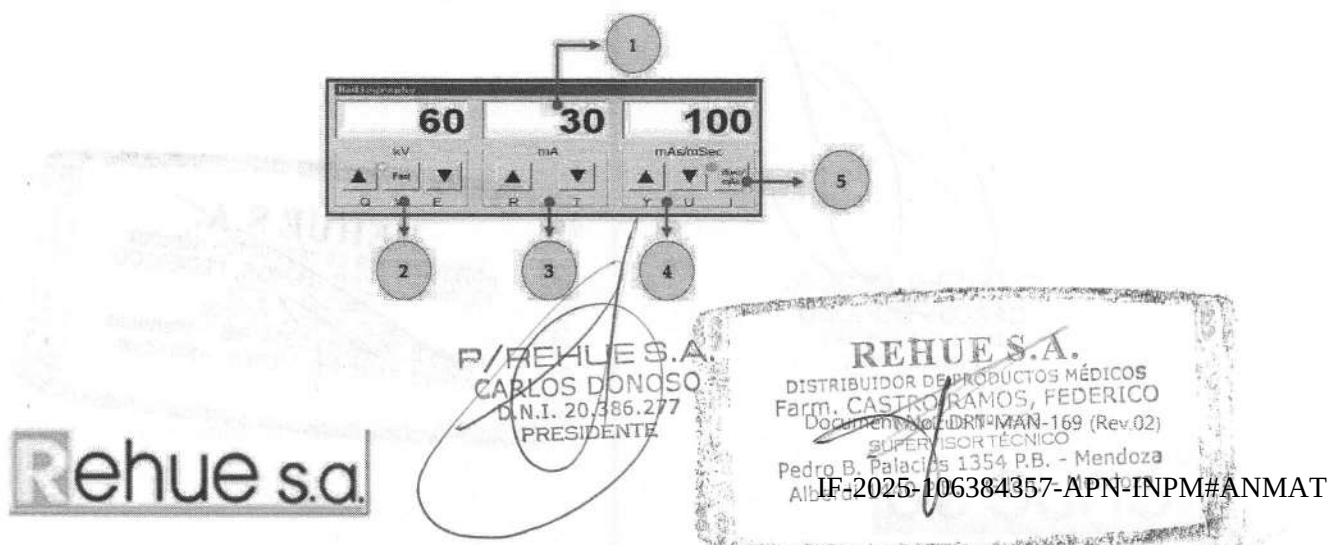
- Select 40 kV → Select 110mA → Execute "X-ray exposure" → Check the measured dose on the meter → Change data, if necessary → Click "Enter" on keyboard

For sequence of calibration at 60, 80, 100, 125, 150 kV, perform the same sequence at 40 kV.

## (4) Flow diagram for sequence of calibration

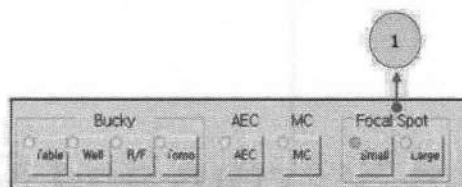


## (5) Confirmation of dose after calibration

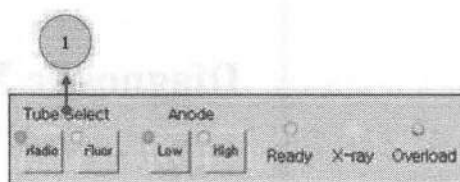




- Execute "Operation Part".
- The "No 1" indicates X-ray exposure parameters (kV, mA and exposure time) for radiography (see No 1 of the above fig).
- The "No 2" indicates adjustable kV (see No 2 of the above fig).
- The "No 3" indicates adjustable mA (see No 3 of the above fig).
- The "No 4" indicates adjustable mAs (see No 4 of the above fig).
- The "No 5" indicates selectable function for msec and mAs (see No 5 of the above fig).



- Select "Small or Large" on "Focal Spot" (see No 1 of the above fig).



- Select "Radio or Fluor" on
- "Tube Select" (see No 1 of the above fig).
- Execute "X-ray exposure".
- Check the measured kV, mA on the meter.

**NOTE►**

Under pushing "Ctrl" on keyboard for "Ready", pushing "X" on keyboard for "X-ray exposure"

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## Chapter 9

# System Startup and Shutdown

## Diagnostic X-ray System

**[EXSYS DEXi]**

  
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## 9 System Start / Shutdown

### 9.1 System Preparation

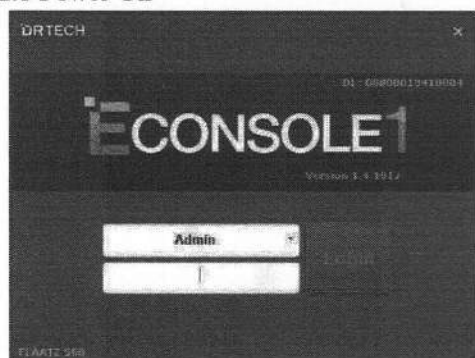
Before starting the system (e.g.: after transport), the accessories must be connected and the system must be powered on.

System operation should be performed under the following conditions.

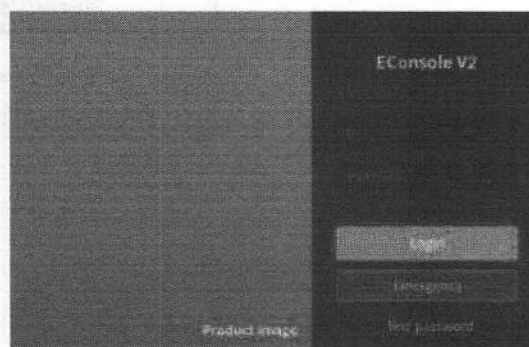
- ✓ Check the capacity, grounding and fuse of the overload breaker.
- ✓ Connect the power cable of the X-ray generator to the overload breaker installed in the X-ray room.
- ✓ Check the supply voltage.
- ✓ Check if there are any obstacles in the operating position of the system.
- ✓ Wear appropriate protective clothing.

### 9.2 Power On/Off

#### 9.2.1 Power On



EConsole1



EConsole2

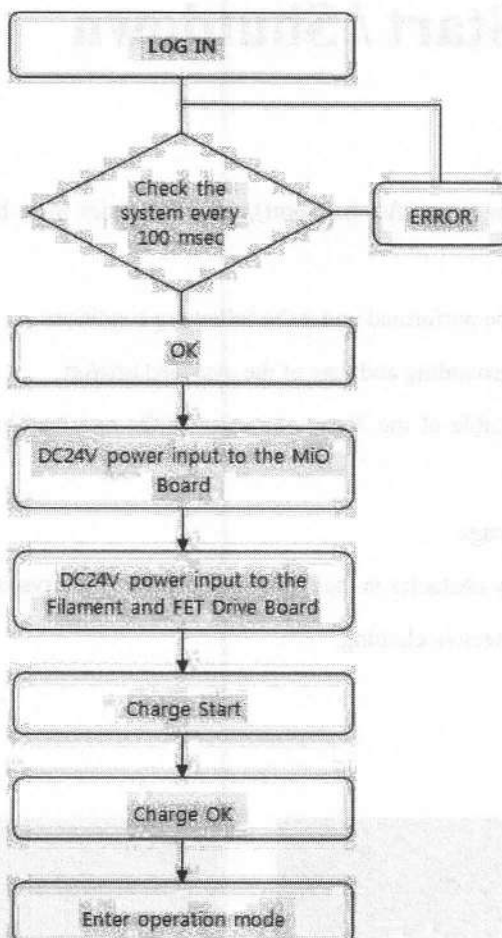
- (1) After logging in to EConsole, the generator power-on command is automatically transmitted.
- (2) After logging in to EConsole, it checks the product status by circuit, and after about 20 seconds at 100msec intervals, it switches to Operation mode if it is normal.
- (3) After logging in to EConsole, the loading factor for System Check is composed as follows.

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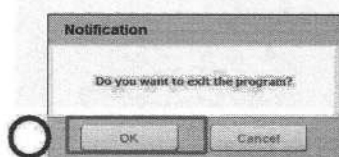
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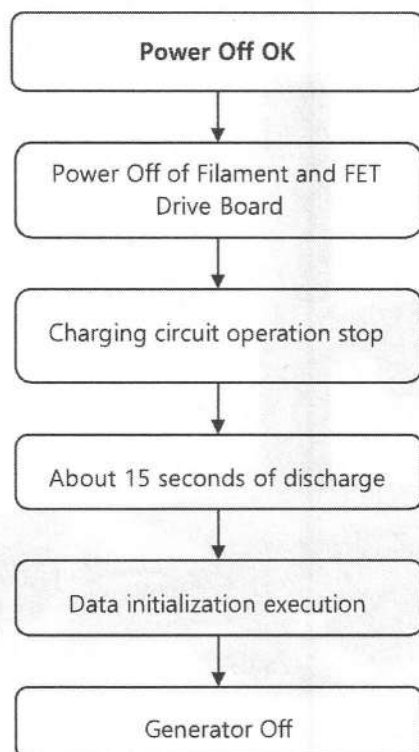
### 9.2.2 Power Off



- (1) If you click the logout button, a message to select whether to terminate EConsole appears.
- (2) When the OK button is pressed, EConsole is terminated and the generator power-off command is

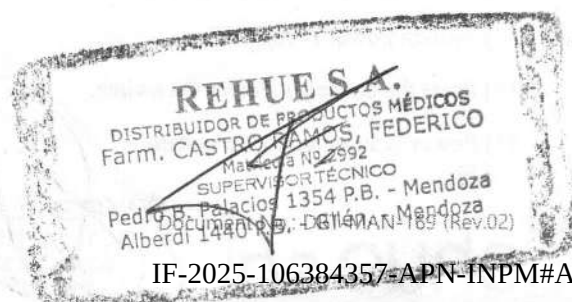
transmitted.

- (3) After pressing the OK button on EConsole, the system stops using about 15 seconds, and the loading factor for power off is composed as follows.



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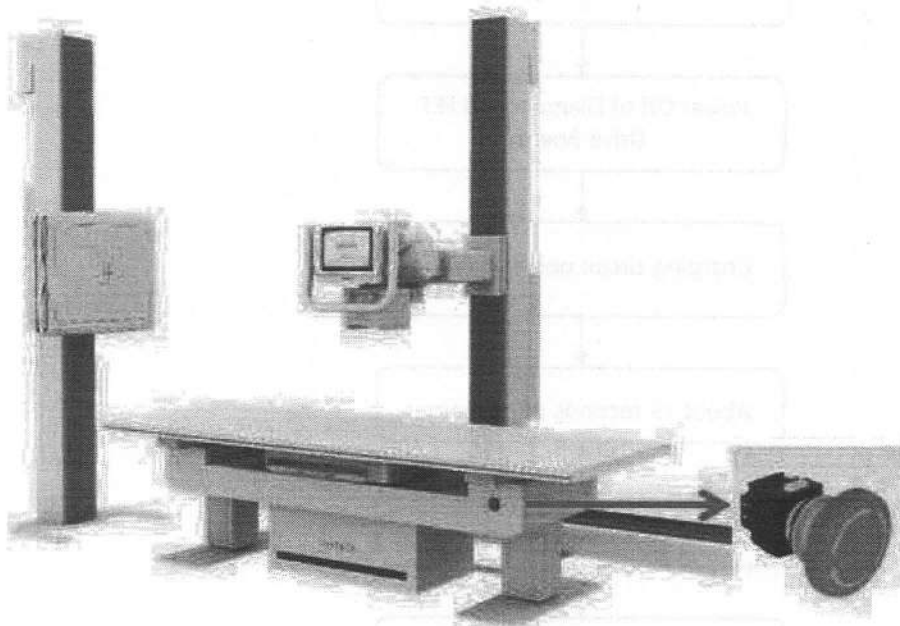
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### 9.3 Emergency Stop Switch

It is used to cut off the power supply of the system without using the power ON/Off switch of the console in an emergency. Unless it is an emergency, the power supply must be cut off using the power ON/Off switch of the console.



\* The term "STOP" is attached to the left of the Emergency Stop Switch.

#### 9.3.1 Emergency Stop Switch Operation

- (1) Press the emergency stop switch.
- (2) The system power is cut off immediately.
- (3) Patient data or images that are not saved may be lost.

#### 9.3.2 Return from Emergency Stop Switch Operation

- (1) Hold the switch handle and turn it to the right.
- (2) The switch handle rises upward.
- (3) System power is supplied.
- (4) Press the console's Power On switch.
- (5) Power is supplied to the system.

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**EXSYS DEXi**

Installation, Operation and Service Manual

**DRTECH**

## Chapter 10

### How to use

#### Diagnostic X-ray System

**[EXSYS DEXi]**

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## 10 How to use

### 10.1 EConsole1

\* Please refer to the EConsole1 User Manual(DRT-MAN-055) for more details.

### 10.2 EConsole2

\* Please refer to the EConsole2 User Manual(DRT-MAN-176) for more details.

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## Chapter 11

### Product Maintenance

#### Diagnostic X-ray System

**[EXSYS DEXi]**

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# 11 Product Maintenance

## 11.1 Overview

A thorough product maintenance is required for safe and reliable operation of EXSYS DEXi.

This chapter summarizes the main contents necessary for product users to determine product maintenance lists and management cycles when preparing a product maintenance plan.

## 11.2 Purpose of Product Maintenance

EXSYS DEXi is a device that requires product maintenance, and if product maintenance is neglected, the product performance may deteriorate and the product may be in an unstable operating state.

In addition, deterioration of product performance or unsafe product condition may cause injury or death, so thorough product maintenance is required.

The purpose of product maintenance is to secure stable patient diagnosis and patient safety through efficient product management.

## 11.3 Maintenance Procedure

- The product user prepares a product maintenance plan according to the maintenance lists and maintenance cycle, and conducts inspection according to the product maintenance cycle.
- The user sets the service items to be requested to the manufacturer, and negotiates service schedules, if necessary.
- After inspection, the user records and keeps the inspection details in the product maintenance plan.

## 11.4 Product Maintenance Lists and Inspection Cycle

The product user must prepare a specific product maintenance plan for each product maintenance list and then execute product maintenance.

The maintenance standards and inspection cycles of the products presented below are the minimum standards, and the product user must prepare and execute the product maintenance plan by adding more necessary details.

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| Classification                 | Maintenance Lists                                                                                                             | Inspector                            | Inspection cycle (more than once)                                                        |                       |          |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|------------------------------------------------------------------------------------------|-----------------------|----------|
|                                |                                                                                                                               |                                      | Daily                                                                                    | Monthly               | Annually |
| <b>Product Exterior Check</b>  | There should be no damage or broken parts on the outer surface of the product.                                                | user                                 | <input type="radio"/>                                                                    |                       |          |
|                                | The display device must work normally on the X-Ray console, etc.                                                              | user                                 | <input type="radio"/>                                                                    |                       |          |
|                                | Cables exposed to the outside should not be pressed, twisted, or disconnected.                                                | user                                 | <input type="radio"/>                                                                    |                       |          |
|                                | Various switches should work normally.                                                                                        | user                                 | <input type="radio"/>                                                                    |                       |          |
| <b>Operation State Check</b>   | There should be no noise or irregular changes in X-ray dose during generator operation or X-ray irradiation.                  | user                                 | <input type="radio"/>                                                                    |                       |          |
|                                | The generator's performance and operating conditions should be normal, and the radiation dose should be within the tolerance. | Service engineer                     |                                                                                          | <input type="radio"/> |          |
|                                | The performance and operating conditions of the mechanical device should be normal, and parts should not be damaged.          | Service engineer                     |                                                                                          | <input type="radio"/> |          |
| <b>Radiation Safety Check</b>  | It should be used after regular inspection in accordance with radiation safety management regulations.                        | Request to the relevant institution. | Comply with radiation safety management regulations.                                     |                       |          |
|                                | The product must be used by a person who has obtained the product license and the relevant qualifications.                    | user                                 | <input type="radio"/>                                                                    |                       |          |
| <b>Mechanical Safety Check</b> | The product should be used, if the wires of the working part of the bucky stand and tube stand are damaged.                   | Service engineer                     |                                                                                          | <input type="radio"/> |          |
| <b>Operation Environment</b>   | The product should not be installed or used in a place that does not comply with the radiation safety management regulations. | Request to the relevant institution. | Use after regular inspection in accordance with radiation safety management regulations. |                       |          |
|                                | Check whether the product user uses the product without any harmful factors from radiation exposure.                          | user                                 | <input type="radio"/>                                                                    |                       |          |

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**11.5 Preparation of Product Maintenance Plan**

11.5.1 The product user prepares and executes an annual product maintenance plan.

11.5.2 Product maintenance lists in the product maintenance plan must include the contents suggested in [12.4 Product maintenance lists and inspection cycle] , and product maintenance lists can be added, if necessary.

11.5.3 Product maintenance management ledger should be prepared and managed, and inspection records should be kept.

**11.6 Inspection Method****11.6.1 Product appearance inspection**

As a result of checking the following management lists, if there are traces of product colliding with other objects, switch failure or malfunction, or traces of pressing cables, ask a professional engineer for inspection.

| Maintenance Lists                                                                    | How to check                                                                                                          |
|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Check if there are any damaged or broken parts on the outer surface of the product.  | Visually check for signs of product collision with other objects or scratches during operation.                       |
| Display devices such as X-ray console and handlebar display should operate normally. | Visually check if the X-ray irradiation conditions set in the console are displayed in the same way on the handlebar. |
| Cables exposed to the outside should not be pressed, twisted, or disconnected.       | Visually check if the exposed cable has any signs of collision with other objects or scratches during operation.      |
| Various switches should work normally.                                               | Check if no operation or malfunction occurs by pressing the function switch on the console.                           |

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### 11.6.2 Operation State Check

As a result of checking the following management lists, if abnormal noise occurs or irregular X-ray dose changes during the generator operation or X-ray irradiation, ask a service engineer for inspection and take action.

In case of damage or failure of parts, it must be replaced with a part that meets the standards.

| Maintenance Lists                                                                                                             | How to check                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| There should be no noise or irregular changes in X-ray dose during generator operation or X-ray irradiation.                  | Irregular changes in X-ray dose should be checked every day, and if necessary, you must contact a service engineer and take actions.                  |
| The generator's performance and operating conditions should be normal, and the radiation dose should be within the tolerance. | If an irregular change in X-ray dose occurs or if the X-ray dose is out of the tolerance range, you must contact a service engineer and take actions. |
| The performance and operating conditions of the mechanical device should be normal, and parts should not be damaged.          | In the event of damage to parts, you must contact a service engineer and take actions.                                                                |

### 11.6.3 Radiation Safety Check

- (1) The product user must obtain a product use license from the relevant institution before using it, and only person with the relevant qualification should use the product.
- (2) Radiation safety inspection should be conducted by the relevant institution, and the device should be used after regular inspections in accordance with the radiation safety management regulations.

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#### 11.6.4 Mechanical Safety Check

The product should not be used, if the parts such as the bucky stand, wires of the operating part of the tube stand, the spring balance wire of the ceiling device, and the column wire are damaged. If the damaged parts are used, the product performance may deteriorate and it may injure the human body due to system instability and unsafe product conditions. Therefore, mechanical safety check should be thoroughly carried out.

| Maintenance Lists                                                                                                                                                                                                                                       | How to check                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| The product should not be used if the bucky stand, wires of tube stand's operating parts, ceiling device's spring balance wires, and column wires are damaged.                                                                                          | Depending on the inspection cycle, maintenance must be carried out at least once a year, and measures must be taken after inquiring service engineers. |
| If two or more of the wires are damaged, the wires of the stand bucket, the wires of the working part of the tube stand, the wires of the spring balance of the ceiling device, or the wires of the column must be used only after replacing the wires. |                                                                                                                                                        |

#### 11.6.5 Operating Environment Check

The system should be installed and used in a place that meets the requirements of the radiation safety management regulations. Therefore, the product user must obtain a product use license from the relevant institution and periodically check whether the radiation of the X-ray chamber is leaking or not.

| Maintenance Lists                                                                                                             | How to check                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| The product should not be installed or used in a place that does not comply with the radiation safety management regulations. | Check if the product is being used in a place that does not comply with radiation safety management regulations.               |
| Check whether the product user uses the product without any harmful factors from radiation exposure.                          | Check if it is installed in a place suitable for radiation safety management regulations and that the condition is maintained. |

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**11.6.6 Cable Check**

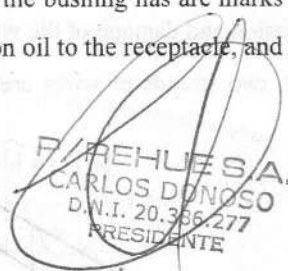
- Check with product user or service engineer.
- Check if various cables are connected and fixed properly.
- Check the external condition of the cable.

**11.6.7 Console and Handlebar Check**

- Check with product user or service engineer.
- Check the wiring and operation status of the console hand switch.
- Set X-ray irradiation conditions on the console and check the X-ray operation status by irradiating.
- After setting the X-ray irradiation condition to the overload condition on the console, check the overload, error message, or warning display.
- Check the status of the console switch operation.
- Check if the signals of PC, DAP, AEC, DR SW, etc. connected to the console are normal.

**11.6.8 HVT (High voltage transformer) Check**

- Check with product user or service engineer.
- Check for signs of moisture around the HVT.
- Check the wiring status and ground wire fixed status of HVT.
- Check the HVT for signs of oil leakage.
- If traces of oil leakage are found in HVT, check if the tank cracks, and check the oil level. (normal: The oil level is within 15mm from the upper surface of the HVT, and check at least once a year)
- If any signs of oil leakage are found in HVT, clean it with a dry cloth.
- Check the tightness of the HVT high voltage cable bushing and receptacle.
- After removing the high-voltage cable from the HVT, check the state of the high-voltage cable bushing. If the bushing has arc marks or the parts are bad, wipe the bushing with a dry cloth and apply silicon oil to the receptacle, and request a service engineer to check it.



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**11.6.9 Generator Check**

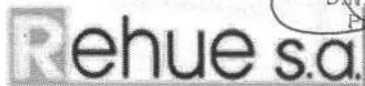
- Inspection should be carried out by service engineer.
- Check for signs of moisture around the generator.
- Check the voltage supplied to the generator.
- Check the voltage supplied to the main boards.
- Check the condition of the internal parts of the generator, and check if there is any noise, heat, or smell.
- Check the fixed state of the parts assembled to the generator.
- Check the wiring status and ground wire fixed status of the generator.
- Check the tightness of the cable wired to the generator.
- Completely remove dust inside the generator with a dry cloth, brush, or air compressor.

**11.6.10 X-Ray Tube Check**

- Inspection should be carried out by service engineer.
- Check for signs of moisture around the X-Ray Tube.
- Check the wiring status and ground wire fixed status of the X-Ray Tube.
- Check the X-Ray Tube for any signs of oil leakage.
- If traces of oil leakage are found on the X-ray tube, check the tube housing for cracks.
- If traces of oil leakage are found on the X-Ray Tube, clean it with a dry cloth.
- Check the tightness of the bushing and receptacle of the high voltage cable.
- After removing the high-voltage cable, check the state of the high-voltage cable bushing. If the bushing is in poor condition, wipe the bushing with a dry cloth and apply silicone oil to the receptacle.
- Check the operation and noise condition of the tube anode rotor.

**11.6.11 Mechanical Device Check**

- Inspection should be carried out by service engineer.
- Check for signs of moisture around the equipment.
- Check the wiring condition of mechanical device and the ground wire fixed condition.
- Remove the upper cover of the ceiling, and check the abrasion and damage of the wire connected to the spring balance of the ceiling device. If more than two strands of wires are damaged, they should be replaced.



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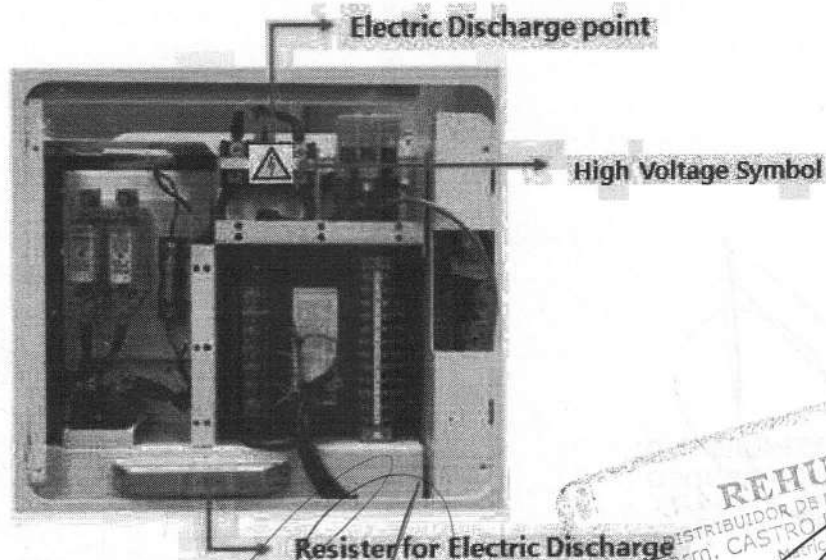
- Remove the upper cover of the ceiling, and check the abrasion and damage of the wire connected to the column of the ceiling device. If the wires are damaged by more than 2 strands, they should be replaced.
- Remove the upper cover of the ceiling, and check the safety device of the ceiling device.
- Remove the front cover of the bucky stand, and check the abrasion and damage of the wire connected to the bucky device. If the wire is damaged by more than 2 strands, it should be replaced.
- Remove the front cover of the tube stand, and check the abrasion and damage of the wire connected to the tube device. If the wire is damaged by more than 2 strands, it should be replaced.

#### 11.6.12 Detector Check

- Please refer to the detector manual. (Detector is optional)

#### 11.6.13 Precautions for maintenance

- After the generator power is turned off, the charging voltage in the circuit occurs, and when repairing the generator, the engineer must discharge the charging state in the circuit.
- Discharge method is to make the discharge resistance contact both ends of Electric Discharge point, and make the voltage between both ends of Electric Discharge point less than DC10V.
- After checking the voltage between both ends of the electric discharge point, proceed to maintenance.



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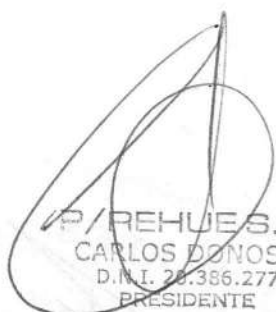
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## 11.7 List of Main Parts

The main parts required for service are as follows, and for other parts other than the main items, contact our customer management team.

| Application       | Part Name                | Part Model     | Quantity (each) | Factory release days after order |
|-------------------|--------------------------|----------------|-----------------|----------------------------------|
| Generator         | Generator                | DXG-40S        | 1set            | within 2 weeks                   |
|                   | Generator                | DXG-40P        | 1set            | within 2 weeks                   |
|                   | Generator                | DXG-50T        | 1set            | within 2 weeks                   |
|                   | HVT (high pressure tank) | ECORAD40-S HVT | 1               | within 2 weeks                   |
|                   | Main IO Control Board    | MiO Board      | 1               | within 2 weeks                   |
|                   | Filament Drive Board     | FND Board      | 1               | within 2 weeks                   |
|                   | Charge & Discharge Board | CND Board      | 1               | within 2 weeks                   |
|                   | Filament Board           | FILA Board     | 1               | within 2 weeks                   |
|                   | FET Block                | FET Block      | 1               | within 2 weeks                   |
|                   | Tube Rotor Control Board | LS Board       | 1               | within 2 weeks                   |
|                   | AEC Control Board        | AECBoard       | 1               | within 2 weeks                   |
|                   | General Connecting Board | GC Board       | 1               | within 2 weeks                   |
| X-Ray Tube        | X-Ray Tube               | E7239X         | 1               | within 4 weeks                   |
|                   |                          | E7242X         | 1               | within 4 weeks                   |
|                   |                          | E7884X         | 1               | within 4 weeks                   |
| Mechanical device | Electromagnet Board      | Lock Board     | 1               | within 2 weeks                   |
|                   | Electromagnet            | PMB Lock       | 1               | within 2 weeks                   |

  
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## Chapter 12

### Error Code

### Diagnostic X-ray System

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## 12 Error Code

When a problem occurs in the X-ray generator, EXSYS DEXi checks the circuit in real time and displays the error status on the console. The error code provides the engineer with necessary information for fault repair, and the error status for each fault is as follows.

| Order | Contents of LCD display window | Error status                                                                                                                                                       |
|-------|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | ERR_CHARGE_LINE_HIGH           | When the input power for charging the main capacitor is over 360V.                                                                                                 |
| 2     | ERR_CHARGE_LINE_LOW            | When the input power for charging the main capacitor is less than 264V                                                                                             |
| 3     | ERR_CHARGE_CAP_HIGH            | When the charged voltage of the main capacitor is over 360V.                                                                                                       |
| 4     | ERR_CHARGE_CAP_LOW             | When the charged voltage of the main capacitor is less than 264V                                                                                                   |
| 5     | ERR_ROTOR1                     | When the rotor is not connected in the low speed state.                                                                                                            |
| 6     | ERR_ROTOR2                     | When the rotor is not connected in high speed state.                                                                                                               |
| 7     | ERR_ROTORS                     | The order of wiring to the main, shift, and COM terminals of the rotor is different.                                                                               |
| 8     | ERR_ROTOR6                     | When the IGBT temperature of the rotor board is over 70 degrees.                                                                                                   |
| 9     | ERR_ROTOR7                     | When the FLAT cable connecting the Rotor board and Mio is not connected.                                                                                           |
| 10    | ERR_FILAMENT_CUR_HIGH          | When the current flowing through the tube filament is high.                                                                                                        |
| 11    | ERR_FILAMENT_CUR_LOW           | When the current flowing through the tube filament is low.                                                                                                         |
| 12    | ERR_FILAMENT_OFF_HIGH          | When current continues to flow through the tube filament under the power off state.                                                                                |
| 13    | ERR_PWR_HIGH                   | When the actual input voltage is higher than the value of the input voltage set in the console (setting range: within 20%~50%).                                    |
| 14    | ERR_PWR_LOW                    | When the actual input voltage is lower than the value of the input voltage set in the console (Setting range: within 20%~50%).                                     |
| 15    | ERR_STATOR_TEMP1               | When the temperature of the tube stator is high.                                                                                                                   |
| 16    | ERR_PROT_POWER                 | As a protection circuit, when the DC12V power of the FND board is more than 14V or less than 2.2V during X-ray irradiation.                                        |
| 17    | ERR_PROT_FET1_OCP              | As a protection circuit, when high current flows through FET block 1Block during X-ray irradiation, and in this case, need to adjust the current value with VR501. |
| 18    | ERR_PROT_FET2_OCP              | As a protection circuit, when high current flows through FET block 2Block during X-ray irradiation, and in this case, need to adjust the current value with VR502. |

|    |                                                                                                    |                                                                                                                                                   |
|----|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 19 | ERR_PROT_HV_OVP                                                                                    | As a protection circuit, when the output voltage of high voltage is over 150.5KV during X-ray irradiation.                                        |
| 20 | ERR_PROT_HV_OCP                                                                                    | As a protection circuit, when the output current of high voltage is 1100mA or more during X-ray irradiation.                                      |
| 21 | ERR_PROT_FIL_OCPSL                                                                                 | As a protection circuit, when the tube filament current is high during X-ray irradiation.                                                         |
| 22 | ERR_Door_Open                                                                                      | When the door to the x-ray room is not completely closed.                                                                                         |
| 23 | ERR_AEC_Chamber                                                                                    | When AEC board is not connected, there is no feedback from the chamber, or MiO board's DIP switch error occurs.                                   |
| 24 | ERR_DR_NO_RTN                                                                                      | When exposure OK signal is not returned from DR within 5 seconds after input of X-ray exposure signal, while DR is used in manual trigger method. |
| 25 | ERR_FET1_TEMP                                                                                      | When the temperature of FET block 1 is over 50°C or below -20°C.                                                                                  |
| 26 | ERR_FET2_TEMP                                                                                      | When the temperature of FET block2 is more than 50°C or below -20°C.                                                                              |
| 27 | 3 Phase Main Power Error                                                                           | When one of the three phases is missing.                                                                                                          |
| 28 | FET Block 1 Not Connected                                                                          | When FET block1 is not connected.                                                                                                                 |
| 29 | FET Block 2 Not Connected                                                                          | When FET block2 is not connected.                                                                                                                 |
| 30 | mA Calibration Data Error                                                                          | When IB DAC data is over 4000 among calibration data.                                                                                             |
| 31 | HV Calibration Data Error                                                                          | When HV DAC data is over 4000 among calibration data.                                                                                             |
| 32 | Tube select do not match'Rotor board Tube select'<br>select same Tube for'Rotor board Tube select' | Tube selection DIP switch setting of rotor board does not match with tube model of console setup.                                                 |
| 33 | HV Feedback Low<br>HVT Cable Not Connected                                                         | When the HV feedback value is 50% or less than the set KV during X-ray irradiation.                                                               |
| 34 | mA Feedback Low                                                                                    | When the HV feedback value is 50% less than the set mA during X-ray irradiation. (Operate only when the set value is higher than 50mA).           |
| 35 | Heat Unit Value Over<br>Wait 000 Sec For Tube Cooling                                              | When X-rays are irradiated with the selected tube, and more than 80% of the accumulated heat-unit value is being irradiated.                      |
| 36 | ERR_Ready_Time_OVER                                                                                | When Ready is maintained for more than 10 seconds without X-ray irradiation after executing Ready.                                                |
| 37 | ERR_Expo_Time_Stop                                                                                 | When the X-ray irradiation time is shorter than the set time.                                                                                     |
| 38 | Console MIO Communication Error                                                                    | When RS232 communication between Console and MiO is disconnected.                                                                                 |
| 39 | Console AUTO Cali Error                                                                            | When irradiated more than 50 times at one KV during auto calibration.                                                                             |
| 40 | Tube spec data not exist select another Tube                                                       | Unused function.                                                                                                                                  |
| 41 | Rotor Board CPU Not Response                                                                       | When there is no response from the MCU of the rotor board.                                                                                        |

## Chapter 13

### Troubleshooting

#### Diagnostic X-ray System

[EXSYS DEXi]

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## 13 Troubleshooting

### 13.1 Overview

When a problem occurs in the X-ray generator, the circuit is checked in real time and the error status displayed on the console of EXSYS DEXi. The fault details should be provided to the engineer with the necessary information for troubleshooting and quick after-service.

### 13.2 Tools used

The tools required for troubleshooting are as follows, and other necessary tools must be separately prepared by an engineer.

- ✓ Hand tool and service standard tool (eg. screwdriver, hexagonal range set, etc.)
- ✓ Nipper, pliers, multi tester, X-ray dose meter, service PC, oscilloscope

### 13.3 Repair Method according to Failure

When a problem occurs in the X-ray generator, the circuit is checked in real time and the error status is displayed on the console. The error status is displayed differently depending on the type of failure.

When an error occurs, the error status can be removed by pressing the reset switch on the console, but the error status may be displayed on the console display window even though the error status is removed by pressing the reset switch.

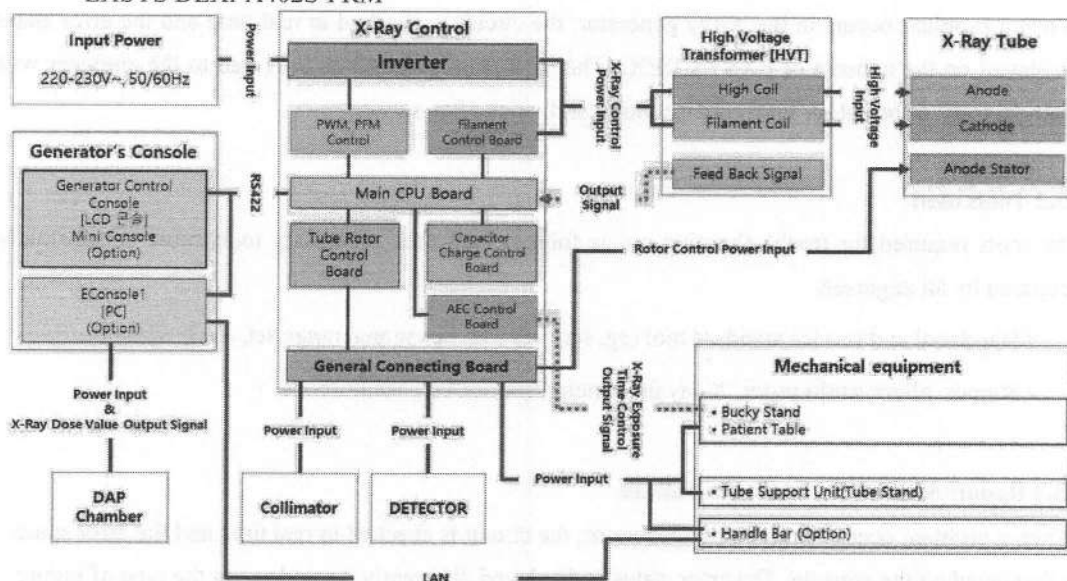


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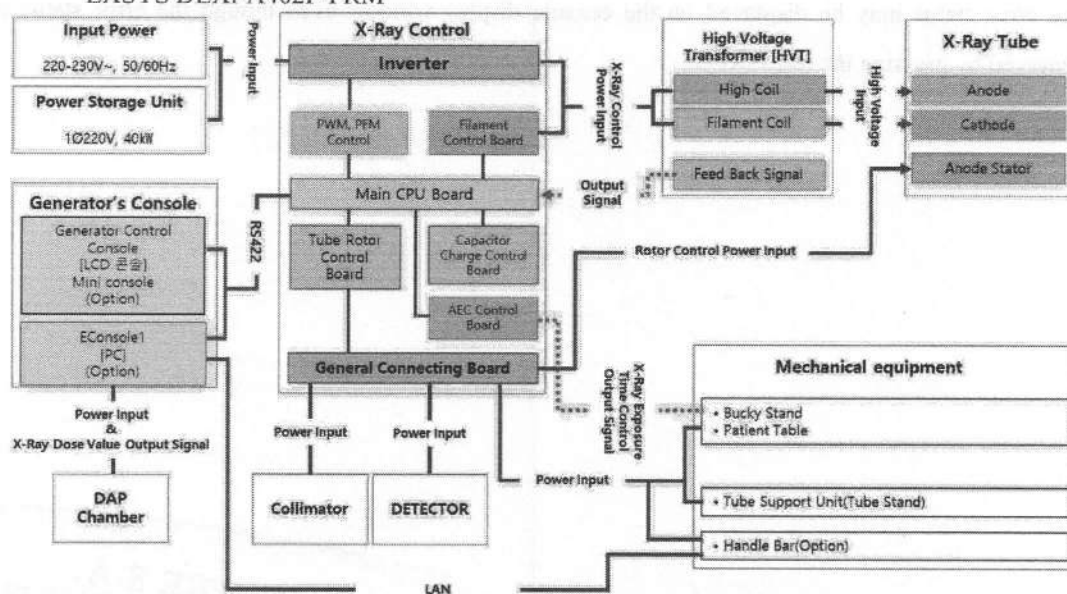
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## 13.4 Block Diagram

- 1) EXSYS DEXi-D401S-FRM, EXSYS DEXi-A401S-FRM, EXSYS DEXi-D402S-FRM,  
EXSYS DEXi-A402S-FRM



- 2) EXSYS DEXi-D401P-FRM, EXSYS DEXi-A401P-FRM, EXSYS DEXi-D402P-FRM,  
EXSYS DEXi-A402P-FRM



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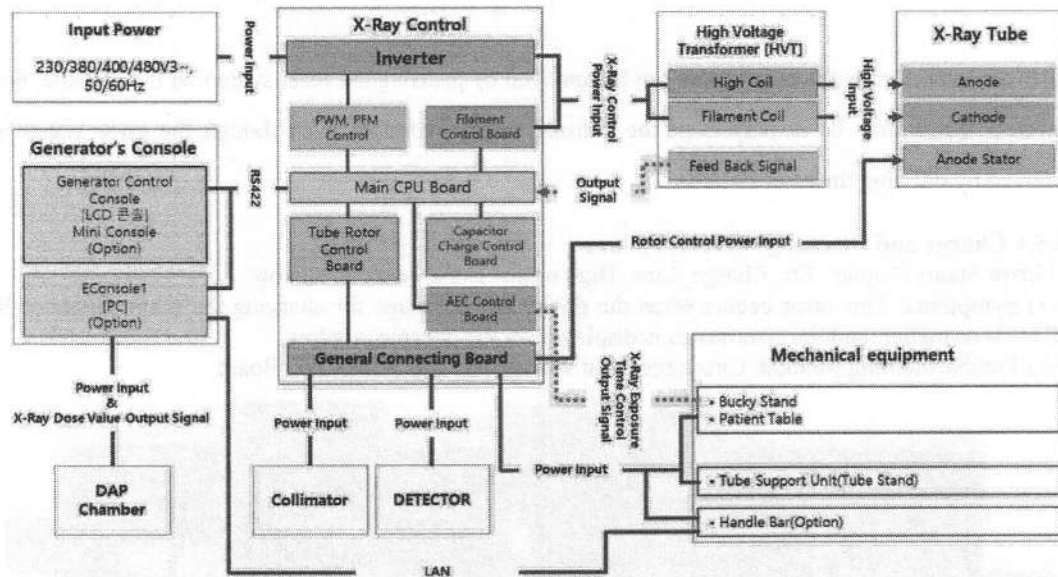
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3) EXSYS DEXi-D503T-FRM, EXSYS DEXi-A503T-FRM



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### 13.5 Repair Method according to Failure

When a problem occurs in the X-ray generator, the circuit is checked in real time and the error status is displayed on the console. The error status is displayed differently depending on the type of failure.

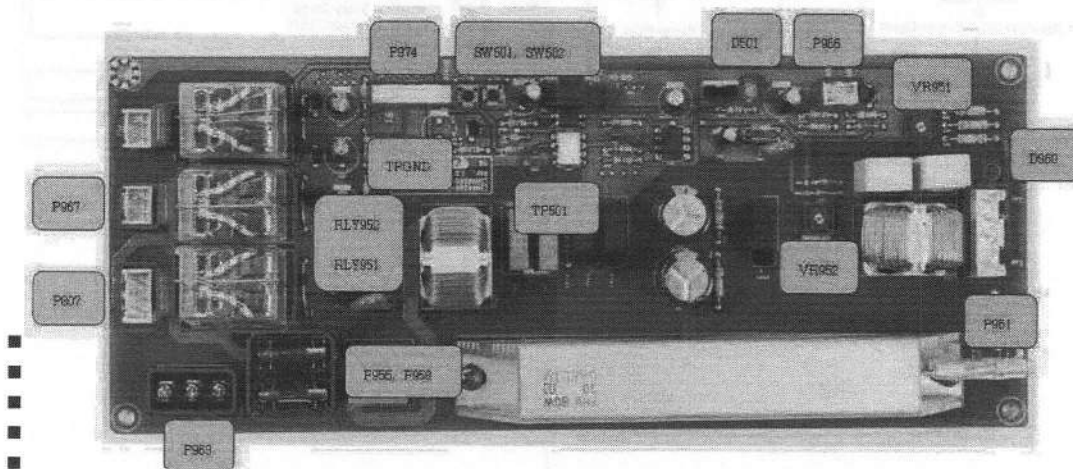
When an error occurs, the error status can be removed by pressing the reset switch on the console, but the error status may be displayed on the console display window even though the error status is removed by pressing the reset switch.

#### 13.5.1 Charge and Discharge Circuit Failure

(1) Error Status Display: Err\_Charge\_Line\_High occurs in the console window.

(1-1) Symptoms: This error occurs when the power input voltage for charging the main capacitor is DC340V or higher, and the error status is displayed on the console window.

(1-2) Troubleshooting Method: Check the input voltage and check the CND Board



- Check voltage between No. 1 and No. 4 of P961 (normal: within 340VDC $\pm$ 5%)
- Check if there is a short between No. 1 and No. 2 of P966.
- After turning the generator "ON", check Relay RLY951 and RLY952 operation status (normal: Relay ON)

- Check P967 voltage (normal: within 220VAC $\pm$ 5%)
- Check voltage between No. 1 and No. 3 of P807 (normal: within 220VAC $\pm$ 5%)
- While pressing SW501, check the frequency between TPGND and TP501 (Normal: within 75kHz $\pm$ 0.5kHz)
- If the frequency between TPGND and TP501 is abnormal, adjust the frequency with VR952.

(2) Error status display: Err\_Charge\_Line\_LOW occurs in the console window

(2-1) Symptoms: This error occurs when the power input voltage for charging the main capacitor is less than DC290V, and the error status is displayed on the console window.

(2-2) Troubleshooting method: Check the input voltage and check the CND Board.

(2-3) Check the CND Board in the same way as

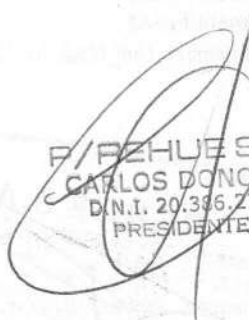
(1) Err\_Charge\_Line\_High in 12.3.1 Charging and Discharging Circuit Failure.

(3) Error status display: Err\_Charge\_CAP\_High occurs in the console window

(3-1) Symptoms: This error occurs when the charging voltage of the main capacitor is DC340V or higher, and the error status is displayed on the console window.

(3-2) Troubleshooting method: Check the input voltage and check the CND Board

- (4) Error status display: Err\_Charge\_CAP\_LOW occurs in the console window
- (4-1) Symptoms: This error occurs when the charging voltage of the main capacitor is DC290V or lower, and the error status is displayed on the console window.
- (4-2) Troubleshooting method: Check the input voltage and check the CND Board.
- (4-3) Check the CND Board in the same way as (3) Err\_Charge\_CAP\_High in 12.3.3 Charge and Discharge Circuit Failure.

  
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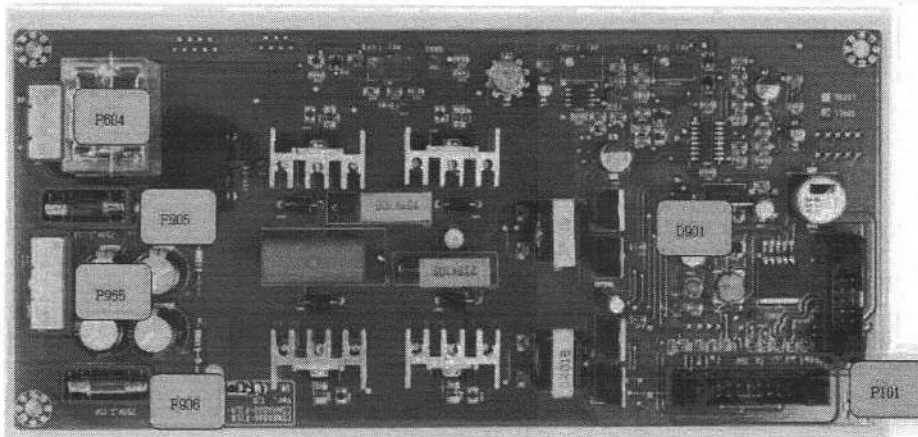
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### 13.5.2 Filament Circuit Failure

(1) Error Status Display: Err\_Filament\_Cur\_High occurs in the console window.

(1-1) Symptoms: When Ready, preheating voltage is converted to driving voltage. It is an error that occurs when the current flowing through the tube filament is high due to high driving voltage. Error status is displayed on the console window.

(1-2) Troubleshooting Method: Check the tube filament wiring and the filament board.



- Turn the generator on, and check with power on.
- Check the connection status of P101.
- Check the lighting status of D901 (normal: light on)
- Check the status of F906 and F905 fuse disconnection.
- Check voltage between No. 2 and No. 4 of P604 (Normal: within  $35 \pm 1$  VDC)
- Check voltage between No. 2 and No. 3 of P604 (Normal: within  $35 \pm 1$  VDC)
- Check voltage between No. 1 and No. 3 of P965 (Normal: within  $35 \pm 1$  VDC)
- Check voltage between No. 2 and No. 3 of P965 (Normal: within  $35 \pm 1$  VDC)
- Check voltage between No. 4 and No. 3 of P965 (Normal: within  $-35 \pm 1$  VDC)
- Check voltage between No. 5 and No. 3 of P965 (Normal: within  $-35 \pm 1$  VDC)

(2) Error status display: Err\_Filament\_Cur\_LOW occurs in the console window.

(2-1) Symptoms: Under Ready, preheating voltage is converted to driving voltage. It is an error that occurs when the current flowing through the tube filament is low due to low driving voltage. Error status is displayed on the console window.

(2-2) Troubleshooting method: Check the tube filament wiring and the filament board.

(2-3) Filament board check is done in the same way as (1) Err\_Filament\_Cur\_High in 12.3.3 Filament circuit failure.

(3) Error status display: Err\_Filament\_Off\_High occurs in the console window.

(3-1) Symptoms: It is an error that occurs due to disconnection of tube filament, circuit failure, and non-detection of feedback data, and the error status is displayed on the console window.

(3-2) Troubleshooting method: Check the tube filament wiring and the filament board.

(3-3) Check the filament board inspection in the same way as (1) Err\_Filament\_Cur\_High in 12.3.3 Filament circuit failure.

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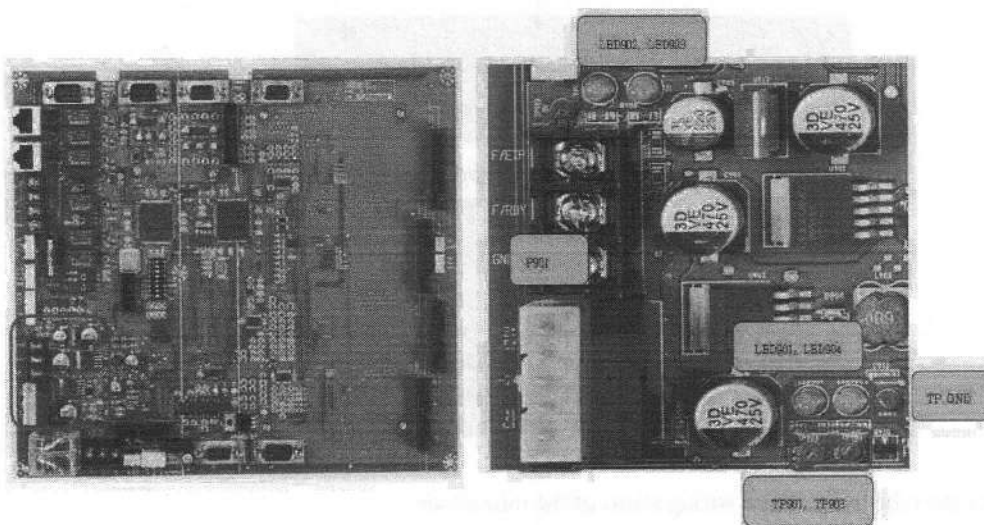
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### 13.5.3 MiO Board Power Circuit Failure

(1) Error Status Display: Err\_PWR\_High occurs in the console window.

(1-1) Symptoms: This error occurs when the voltage input to the MiO Board is higher than the standard, and the error status is displayed on the console window.

(1-2) Troubleshooting Method: Check the MiO Board.



- Check if LED 901, 902, 903, or 904 Green LED is on (normal: light on)
- Check voltage between No. 1 and No. 3 of P901 (Normal: within  $-24\text{VDC} \pm 1\text{VDC}$ )
- Check voltage between No. 1 and No. 4 of P901 (Normal: within  $+24\text{VDC} \pm 1\text{VDC}$ )
- Check voltage between No. 2 and No. 3 of P901 (Normal: within  $-24\text{VDC} \pm 1\text{VDC}$ )
- Check voltage between No. 2 and No. 4 of P901 (Normal: within  $+24\text{VDC} \pm 1\text{VDC}$ )
- Check voltage between TP GND and TP901 (Normal: within  $+12\text{VDC} \pm 1\text{VDC}$ )
- Check voltage between TP GND and TP903 (Normal: within  $+3.3\text{VDC} \pm 0.1\text{VDC}$ )
- Check voltage between TP GND and TP902 (Normal: within  $+5\text{VDC} \pm 0.5\text{VDC}$ )

(2) Error status display: Err\_PWR\_LOW occurs in the console window.

(2-1) Symptoms: This error occurs when the voltage input to the MiO Board is lower than the standard, and the error status is displayed on the console window.

(2-2) Troubleshooting method: Check the MiO Board.

(2-3) Filament board inspection should be done in the same way as (1) Err\_Filament\_Cur\_High of 12.3.4 MiO Board Power Circuit Failure.

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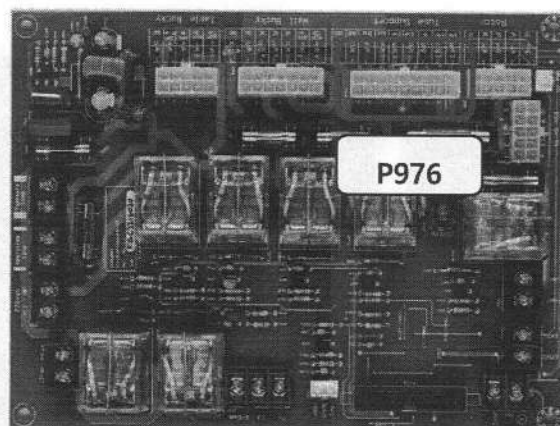
### 13.5.4 Tube Temperature Circuit Failure

(1) Error Status Display: Err\_Stator\_Temp 1 occurs in the console window.

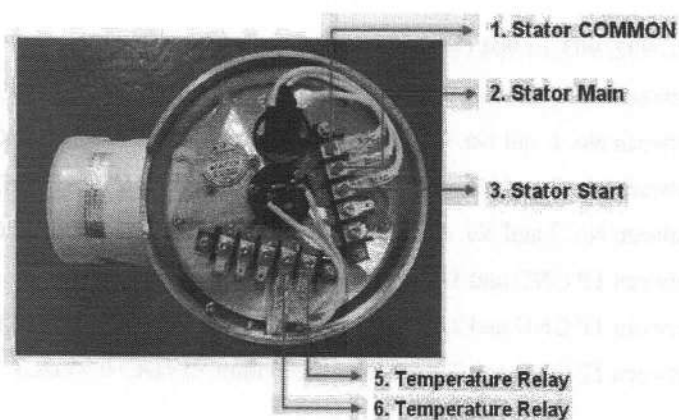
(1-1) Symptoms: This is an error that occurs due to tube temperature sensor failure or GC board failure by incorrect wiring, and the error status is displayed on the console window.

(1-2) Troubleshooting Method: Check the GC board and tube temperature wiring status.

Check the wiring status of P976 of GC board.



- Check the tube temperature wiring status of the tube anode.



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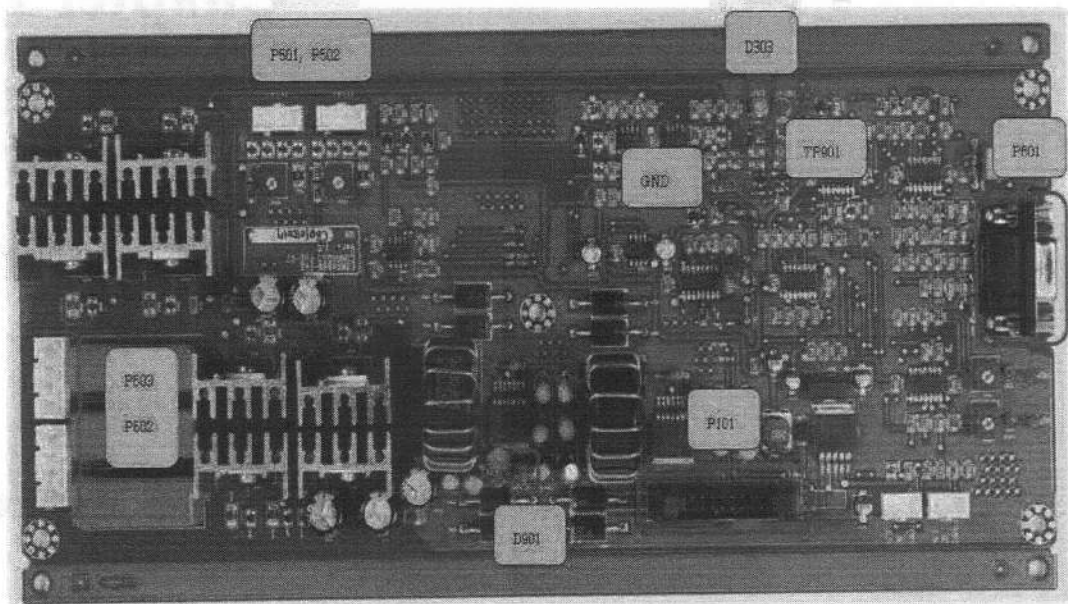


**13.5.5 FND Board Power Circuit Failure**

(1) Error Status Display: Err\_PROT\_Power occurs in the console window.

(1-1) Symptoms: It is an error that occurs when the 12VDC and 2.2VDC voltage of the FND board is inappropriate, and the error status is displayed on the console window.

(1-2) Troubleshooting Method: Check the FND Board.



- Check the connection status of P101 Connector.
- Check the connection status of P603 and P602 connectors.
- Check the connection status of P501 and P502 connectors.
- Check D303, D901 Green LED lighting status (normal: light on)
- Check voltage between GND and TP901 (Normal: within  $11.5\text{VDC} \pm 1\text{VDC}$ )

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## Chapter 14

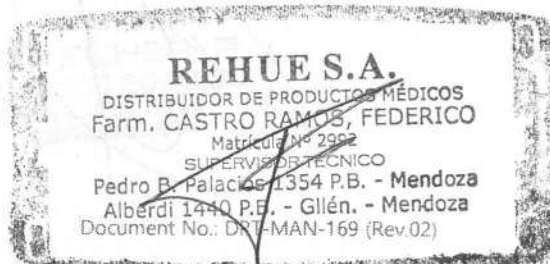
### Privacy and Security

#### Diagnostic X-ray System

**[EXSYS DEXi]**

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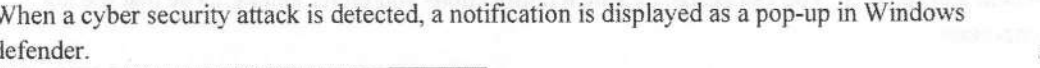
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Security protections included in the environment where this product will be used:

- The system should be connected to a secured network, not open to unintended users.
- The system should be physically secured in a way that it is not accessible for unintended users.
- Default application users and passwords should be replaced with customized users and passwords.
- External media devices containing images, patient data, reports, and logs should be secured.
- Remember to log out after operation.
- Please use authorized installer file when updating your software.
- In case a cybersecurity attack is detected, follow the steps below.



- When Windows defender detects a cyber security attack, the network where the attack was detected is blocked and the software is deleted.  
Reboot the device to see if cybersecurity attack detection continues.  
If the cybersecurity attack detection continues after rebooting, stop using the software and contact ORTECH's service engineer.

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## 14.2 System Protection

The EXSYS DEXi system must be configured and maintained in a way that continually protects Privacy and Security.

### 14.2.1 Malicious Software Protection

The computing environment is increasingly hostile, and threats continue to grow from malicious software, including computer viruses, worms, Trojan horses, denial of service attacks, and other malwares. Vigilant defense on many levels is required to keep systems free from compromise by malicious software. In most cases, effective protection requires cooperation and partnership between DRTECH and our customers.

Commercial antivirus software is commonly used on general-purpose computers to detect the presence of malicious software (virus, Trojan horse, worm, etc.). Anti-virus software is useful on general-purpose computers as they typically cannot be sufficiently hardened against the attack vectors used by malicious software.

Medical Devices however are single purpose (dedicated) devices that have controlled intended use, and thus often can be well hardened. Windows defender provides advanced security solutions. The controlled use of Windows defender is integrated into the EXSYS DEXi system.

#### 14.2.1.1 Virus and threat protection

Find malware and prevent it from installing or running on your device. You can turn this setting off for a while. But it will automatically turn back on.

Windows Defender Antivirus sends notifications with important information about your device's health and security. You can designate which notifications you prefer among those that are not important.

#### 14.2.1.2 Ransomware protection

Protect your device's files, folders and memory areas from unauthorized changes by unknown applications. If a program that does not have a certificate or is not listed in the database attempts to access data, the attempt is blocked. Window defender removes any potential problems by deleting suspicious files as soon as they occur. In addition, since Window provides Backup & Restore function, important functions can be protected.

#### 14.2.1.3 Upgrade Virus Definition and Scanning Engine

Windows Defender is an antivirus program installed by default in Windows. Windows Defender is updated according to Windows policy.

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### 14.3 System Change Management

#### 14.3.1 Security Updates Strategy

Windows Defender is an antivirus program installed by default in Windows. Windows Defender is updated according to Windows policy.

#### 14.3.2 Software Upgrade

If security vulnerabilities of application software and third-party components are monitored, a software upgrade is required. The software development procedure will follow DRTECH design change process.

The software upgrade distribution and installation are authorized to DRTECH qualified service engineer.

The field service engineer performs the installation on the system on the user site. During the installation, the system will verify the software version to avoid malicious software installation on the system.

If a problem occurs during software update, the service engineer can use the restore function of the Install file to revert the device configuration.

### 14.4 Disclosing Security-related Issues

We will determine whether and how to address identified security risks in the environment we intend to use through our problem-solving process. We will then establish activities to address these security-related issues and decide whether to disclose them based on the results of our impact assessment and an acceptable level of residual risk. If an issue is found in third-party source code for use with our software, we will notify the third party.

We will consider the following factors when conducting activities to timely notify regulatory authorities and product users about vulnerabilities in our supported products

- a) The potential impact (technical, for safety, effectiveness, security) of the vulnerability
- b) Public knowledge of the vulnerability
- c) Whether published exploits exist for the vulnerability
- d) The volume of deployed products that are affected
- e) The availability of an effective external control when no health software update is being provided

Vulnerability disclosures are communicated to users in the following ways

- Notification via email to affected customers

After a vulnerability is disclosed, we will include a periodic review of disclosed security-related issues to ensure that the issue is being addressed appropriately.

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## Chapter 15

### Appendix A. Electromagnetic Compatibility (EMC)

#### Diagnostic X-ray System

**[EXSYS DEXi]**

  
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# 15 Appendix A

## 15.1 Guidance and Manufacturer's Declaration

### 15.1.1 Electromagnetic Emissions

| Electromagnetic Emissions                                                                                                                                                         |                                                                                                                                                                                                             |                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| This system is intended for use in the electromagnetic environment specified below. The customer or the user of this system should ensure that it is used in such an environment. |                                                                                                                                                                                                             |                                                                                                                                                                                                                          |
| Emissions test                                                                                                                                                                    | Compliance                                                                                                                                                                                                  | Electromagnetic environment - guidance                                                                                                                                                                                   |
| RF emissions                                                                                                                                                                      | Group 1                                                                                                                                                                                                     | This system uses RF energy only for its internal functions. Therefore, its RF emissions are low and it is not likely to cause interference with nearby electronic equipment.                                             |
| CISPR 11                                                                                                                                                                          |                                                                                                                                                                                                             |                                                                                                                                                                                                                          |
| RF emissions                                                                                                                                                                      | Class A                                                                                                                                                                                                     | This system is suitable for use in all establishments except for domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes. |
| CISPR 11                                                                                                                                                                          |                                                                                                                                                                                                             |                                                                                                                                                                                                                          |
| Harmonic emissions                                                                                                                                                                | Not applicable                                                                                                                                                                                              |                                                                                                                                                                                                                          |
| IEC 61000-3-2                                                                                                                                                                     |                                                                                                                                                                                                             |                                                                                                                                                                                                                          |
| Power fluctuations/flicker emissions                                                                                                                                              | Not applicable                                                                                                                                                                                              |                                                                                                                                                                                                                          |
| IEC 61000-3-3                                                                                                                                                                     |                                                                                                                                                                                                             |                                                                                                                                                                                                                          |
| Note                                                                                                                                                                              | Do not use cables or parts other than those specified for use with this system. If cables and parts other than those specified for use with this system are used, the emission performance may be affected. |                                                                                                                                                                                                                          |

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## 15.1.2 Electromagnetic Immunity

## Electromagnetic Immunity

This system is intended for use in the electromagnetic environment specified below. The customer or the user of this system should ensure that it is used in such an environment.

| Immunity test                                                                                          | IEC 60601 test level                                                                                                                                                                                                                                                                 | Compliance level                                                                                                                                                                                                                                                                     | Electromagnetic environment - guidance                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Electrostatic discharge (ESD)<br>IEC 61000-4-2                                                         | ±8 kV contact<br>±15 kV air                                                                                                                                                                                                                                                          | ±8 kV contact<br>±15 kV air                                                                                                                                                                                                                                                          | Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.                                                                                                                                                    |
| Electrical fast transient/burst<br>IEC 61000-4-4                                                       | ±2 kV for power supply lines<br>±1 kV for input/output lines                                                                                                                                                                                                                         | ±2 kV for power supply lines<br>±1 kV for input/output lines                                                                                                                                                                                                                         | The mains power quality should comply with the requirements for a typical commercial or hospital environment.                                                                                                                                                                                     |
| Surge<br>IEC 61000-4-5                                                                                 | ±1 kV differential mode<br>±2 kV common mode                                                                                                                                                                                                                                         | ±1 kV differential mode<br>±2 kV common mode                                                                                                                                                                                                                                         | The mains power quality should comply with the requirements for a typical commercial or hospital environment.                                                                                                                                                                                     |
| Voltage dips, short interruptions and voltage variations on power supply input lines<br>IEC 61000-4-11 | < 0% of UT<br>(Decrease of > 100% of UT)<br>In 0.5 cycles<br>0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°<br>0% of UT<br>(Decrease of 100% of UT)<br>In 1 cycles<br>70% of UT<br>(Decrease of > 30% of UT)<br>In 30 cycles<br>< 0% of UT<br>(Decrease of > 100% of UT)<br>In 5 seconds | < 0% of UT<br>(Decrease of > 100% of UT)<br>In 0.5 cycles<br>0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°<br>0% of UT<br>(Decrease of 100% of UT)<br>In 1 cycles<br>70% of UT<br>(Decrease of > 30% of UT)<br>In 30 cycles<br>< 0% of UT<br>(Decrease of > 100% of UT)<br>In 5 seconds | The mains power quality should comply with the requirements for a typical commercial or hospital environment. If continuous operation of this system is required during a power outage, it is recommended that an uninterruptible power supply or batteries be used with the system power source. |
| Power frequency (50/60 Hz) magnetic field<br>IEC 61000-4-8                                             | 30 A/m                                                                                                                                                                                                                                                                               | 30 A/m                                                                                                                                                                                                                                                                               | Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.                                                                                                                                                         |
| Proximity magnetic fields in the frequency range 9 kHz to 13.56 MHz immunity<br>IEC 61000-4-39         | 65 A/m<br>134.2 kHz<br>PM 2.1 kHz<br>7.5 A/m<br>13.56 MHz<br>PM 50 kHz                                                                                                                                                                                                               | 65 A/m<br>134.2 kHz<br>PM 2.1 kHz<br>7.5 A/m<br>13.56 MHz<br>PM 50 kHz                                                                                                                                                                                                               | Resistance to magnetic fields was tested and applied only to surfaces of enclosures or accessories accessible during intended use                                                                                                                                                                 |

## Electromagnetic Immunity

## Caution

UT is the AC main voltage prior to application of the test level.

Do not use cables and parts other than those used for the current system.

If cables and parts other than those used for the current system are used, the immunity may be affected.

The EXSYS DEXi is intended for use in the electromagnetic environment specified below. The customer or the user of the EXSYS DEXi should assure that it is used in such an environment.

| Immunity test                 | IEC 60601 test level                                                         | Compliance level            | Electromagnetic environment - guidance                                                                                                                                                                                                                                                                                                  |
|-------------------------------|------------------------------------------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Conducted RF<br>IEC 61000-4-6 | 3 Vrms<br>150 kHz – 80 MHz                                                   | 3 Vrms                      | Mobile and mobile RF communications equipment should not be used closer to any part of the Ultrasound System, including cables, than the recommended separation distance. This is calculated using the equation applicable to the frequency of the transmitter.<br><br>Recommended Separation Distance<br>$d = 1.2\sqrt{P}$             |
| Radiated RF<br>IEC61000-4-3   | 6 Vrms<br>150 kHz – 80 MHz<br>In ISM bands<br><br>3 V/m<br>80 MHz to 2.7 GHz | 6 Vrms<br><br><br><br>3 V/m | $d=2.0\sqrt{p}$ 80 MHz to 2.7 GHz<br><br>Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).<br><br>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, should be |

less than the compliance level in each frequency range.b

Interference may occur in the vicinity of equipment marked with following symbol:



NOTE 1: At 80 MHz and 800 MHz, the higher frequency range applies.

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

a. Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy

To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the EXSYS DEXi is used exceeds the applicable RF compliance level above, the EXSYS DEXi should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the EXSYS DEXi.

b. Over the frequency range 150kHz to 80MHz, field strengths should be less than the compliance level 3V/m.

c. The ISM (Industrial, Scientific and Medical) bands between 150 kHz and 80 MHz are 6.765 MHz 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

  
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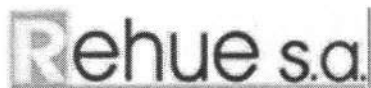
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The EXSYS DEXi is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. Mobile RF communications equipment should be used no closer than 30cm (12 inches) to any part of the EXSYS DEXi. Otherwise, degradation of the performance of this equipment could result.

| Immunity test                                                                                                                                                                                                                                                                                                      | Band a          | Service a                                                              | Modulation                             | IEC60601 test level | Compliance level |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------------------------------------------------------------|----------------------------------------|---------------------|------------------|
| Proximity fields from RF wireless Communications IEC61000-4-3                                                                                                                                                                                                                                                      | 380 - 390 MHz   | TETRA 400                                                              | Pulse modulation 18Hz                  | 27 V/m              | 27 V/m           |
|                                                                                                                                                                                                                                                                                                                    | 430 - 470 MHz   | GMRS 460<br>FRS 460                                                    | FM $\pm 5$ kHz deviation<br>1 kHz sine | 28 V/m              | 28 V/m           |
|                                                                                                                                                                                                                                                                                                                    | 704 - 787 MHz   | LTE Band13, 17                                                         | Pulse modulation 217 Hz                | 9 V/m               | 9 V/m            |
|                                                                                                                                                                                                                                                                                                                    | 800 - 960 MHz   | GSM800-900<br>TETRA 800<br>iDEN 820<br>CDMA 850<br>LTE Band 5          | Pulse modulation 18 Hz                 | 28 V/m              | 28V/m            |
|                                                                                                                                                                                                                                                                                                                    | 1700 - 1990 MHz | GSM 1800<br>CDMA 1900<br>GSM 1900<br>DECT<br>LTE Band 1,3,4,25<br>UMTS | Pulse modulation 217 Hz                | 28 V/m              | 28V/m            |
|                                                                                                                                                                                                                                                                                                                    | 2400 - 2570 MHz | Bluetooth<br>WLAN<br>802.11b/g/n<br>RFID 2450<br>LTE Band 7            | Pulse modulation 217 Hz                | 28V/m               | 28V/m            |
|                                                                                                                                                                                                                                                                                                                    | 5100 - 5800 MHz | WLAN<br>802.11a/n                                                      | Pulse modulation 217 Hz                | 9 V/m               | 9 V/m            |
| NOTE: If necessary to achieve the IMMUNITY TEST LEVEL, the distance between the transmitting antenna and the ME EQUIPMENT or ME SYSTEM may be reduced to 1m. The 1m test distance is permitted by IEC 61000-4-3.                                                                                                   |                 |                                                                        |                                        |                     |                  |
| a. For some services, only the uplink frequencies are included.<br>b. The carrier shall be modulated using a 50% duty cycle square wave signal.<br>c. As an alternative to FM modulation, 50% pulse modulation at 18 Hz may be used because while it does not represent actual modulation, it would be worst case. |                 |                                                                        |                                        |                     |                  |



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### 15.1.3 Recommended separation distances between portable and mobile communication equipment and the EXSYS DEXi

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

| Rated maximum output power of transmitter [W] | Separation distance according to frequency of transmitter [m] |                                        |
|-----------------------------------------------|---------------------------------------------------------------|----------------------------------------|
|                                               | IEC 60601-1-2: 2020                                           |                                        |
|                                               | 150 kHz to 80 MHz<br>$d = 1.2\sqrt{P}$                        | 80 MHz to 2.7 GHz<br>$d = 2.0\sqrt{P}$ |
| 0.01                                          | 0.12                                                          | 0.20                                   |
| 0.1                                           | 0.38                                                          | 0.63                                   |
| 1                                             | 1.2                                                           | 2.0                                    |
| 10                                            | 3.8                                                           | 6.3                                    |
| 100                                           | 12                                                            | 20                                     |

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

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

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

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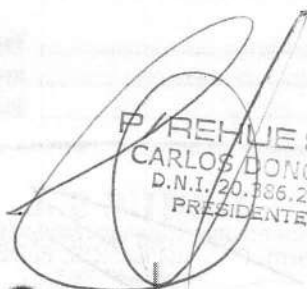
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## Chapter 16

### Appendix B. Component Technical Data

#### Diagnostic X-ray System

**[EXSYS DEXi]**

  
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# 16 Appendix B

## 16.1 X-Ray tube technical Data

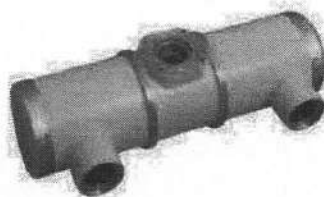
### ■ E7239X

**TOSHIBA**
**Technical Data TD**

ROTANODE  
E7239X  
E7239FX  
E7239GX

### Rotating Anode X-Ray Tube Housing Assembly

- ◆ Rotating anode X-ray tube housing assembly for the purpose of general diagnostic X-ray procedures.
- ◆ Specially processed Rhenium-tungsten faced molybdenum target of 74 mm diameter.
- ◆ These tubes have foci 2.0 mm and 1.0 mm, and are available for a maximum tube voltage 125 kV with Three-phase generator.
- ◆ Accommodated with IEC 60526 type high-voltage cable receptacles.



### General Data

IEC Classification ..... Class I

#### Electrical:

Circuit (Center-grounded) ..... Three-phase full-wave rectified

Nominal Tube Voltage:

Radiographic ..... 40 ~ 125 kV Max.

Nominal Focal Spot Value:

Large Focus ..... 2.0 mm

Small Focus ..... 1.0 mm

Nominal Anode Input Power (at 0.1s):

60 Hz

X-ray Coverage ..... 354 × 354 mm at SID 750 mm

Weight (Approx.) ..... 16 kg

High Tension Terminals ..... To meet the requirements of IEC 60526

Cooling Method ..... Natural or forced air

Tube Housing Model Number:

E7239X ..... XH-121

E7239FX ..... XH-126

E7239GX ..... XH-150

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E7239X / E7239FX / E7239GX

**Absolute Maximum and Minimum Ratings**

(At any time, these values must not be exceeded.)

|                                                    |                    |
|----------------------------------------------------|--------------------|
| <b>Maximum Tube Voltage:</b>                       |                    |
| Radiographic .....                                 | 125 kV             |
| <b>Maximum Voltage to Ground .....</b>             |                    |
| 65 kV                                              |                    |
| <b>Minimum Tube Voltage .....</b>                  |                    |
| 40 kV                                              |                    |
| <b>Maximum Tube Current:</b>                       |                    |
| Large Focus .....                                  | 570 mA             |
| Small Focus .....                                  | 340 mA             |
| <b>Maximum Filament Current:</b>                   |                    |
| Large Focus .....                                  | 5.1 A              |
| Small Focus .....                                  | 5.1 A              |
| <b>Filament Voltage:</b>                           |                    |
| Large Focus (At max. filament current 5.2 A) ..... | 7.7 ~ 10.4 V       |
| Small Focus (At max. filament current 5.2 A) ..... | 5.8 ~ 7.8 V        |
| <b>Filament Frequency Limits .....</b>             |                    |
| 0 ~ 25 kHz                                         |                    |
| <b>Average Input Power .....</b>                   |                    |
| 60 W (85 HU/s)                                     |                    |
| <b>(Repeated radiographic exposure)</b>            |                    |
| <b>Thermal Characteristics:</b>                    |                    |
| Anode Heat Storage Capacity .....                  | 100 kJ (140 kHU)   |
| Maximum Anode Heat Dissipation Rate .....          | 475 W (667 HU/s)   |
| Housing Heat Storage Capacity .....                | 900 kJ (1250 kHU)  |
| <b>Maximum Housing Heat Dissipation Rate:</b>      |                    |
| Without Air-circulator .....                       | 180 W (15 kHU/min) |

E7239X / E7239FX / E7239GX

**Environmental Limits**

|                                     |                   |
|-------------------------------------|-------------------|
| <b>Operating Limits:</b>            |                   |
| Temperature .....                   | 10 ~ 40 °C        |
| Humidity .....                      | 30 ~ 85 %         |
|                                     | (No condensation) |
| Atmospheric Pressure .....          | 70 ~ 106 kPa      |
| <b>Shipping and Storage Limits:</b> |                   |
| Temperature .....                   | -20 ~ 70 °C       |
| Humidity .....                      | 20 ~ 90 %         |
|                                     | (No condensation) |
| Atmospheric Pressure .....          | 50 ~ 106 kPa      |



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## Motor Ratings:

| Duty                            | Starting | Running |
|---------------------------------|----------|---------|
| Power source (Hz)               | 50/60    | 50/60   |
| Input power (W)                 | 1050     | 270     |
| Voltage <sup>1)</sup> (V)       | 200      | 100     |
| Current (A)                     | 6.0      | 3.0     |
| Min. Speed up <sup>2)</sup> (s) | 0.8      | 1.5     |
| Capacitor (µF)                  | 24       | 24      |

Note: 1) The every applied voltage must be never exceeded 110% of the above specification.

2) The speed-up time is allowed up to 110% of the above specification.

## Anode Speed:

|       |                             |
|-------|-----------------------------|
| 50 Hz | 2700 min <sup>-1</sup> Min. |
| 60 Hz | 3200 min <sup>-1</sup> Min. |

## Stator impedance:

|                          |        |
|--------------------------|--------|
| Common-Main Winding      | 27.5 Ω |
| Common-Auxiliary Winding | 58.0 Ω |

Resistance between Housing and Low Voltage Terminals 2 MΩ Min.

Normal operating range of the housing temperature 16 ~ 75 °C

## Mechanical:

Dimensions: See dimensional outline

Overall Length 479 mm

Maximum Diameter 152.4 mm

## Target:

Angle 18 degrees

Construction Rhenium-Tungsten faced Molybdenum

Permanent Filtration 0.9 mm Al / 75 kV IEC 60522 / 2003

Radiation Protection (To meet the requirements of IEC 60601-1-3):

Leakage Technique Factor 125 kV 4 mA

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**Warning****Warning to Interface with X-ray Generator****1. Housing Rupture**

Never input over-rated power to x-ray tube assembly.

If the input power is extremely higher than specification, it may cause the over temperature of anode, insert tube glass shatter and ultimately the following serious problems due to generating over-pressure by oil vaporization inside housing assembly.

In such a critical condition, the safety thermal switch can not protect x-ray tube even if it works.

- \* Housing sealing parts (cathode side) rupture
- \* Human injury including burns due to hot oil escape
- \* Fire accident due to flaming anode target

We strongly request that the x-ray generator should have a protective function which manages input power to x-ray tube assembly.

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## Cautions

### Caution to Interface with X-ray Generator

#### 1. Over Rating

X-ray tube assembly can be broken with applying just one over rated shot.

Please read the technical data sheets carefully and follow the instructions.

#### 2. Permanent Filtration

The total filtration and the distance between x-ray focal spot and human body are regulated legally.

They should be complied with the regulation.

#### 3. Safety Thermal Switch

X-ray tube assembly has safety thermal switch to prohibit further input power when the tube housing reaches to the temperature of switch-open.

The switch should be hooked up with the x-ray generator which control output power to x-ray tube assembly.

The switch is not recommended connecting stator coil in series circuit.

Even if the switch works, never turn the system power off and the cooling unit should be activated.

#### 4. Unexpected Malfunction

X-ray tube assembly may have the risk to be unexpectedly malfunctioning due to life termination or failure. If the serious problems caused by the above risk is expected, we recommend to have a contingency plan to avoid such a case.

#### 5. New Application

If you use the product with new application not to be mentioned in this specification or with different type of x-ray generator, please contact to us for confirming its availability.

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**Caution for Installation, Adjustment and Maintenance****1. Qualified Persons**

Only qualified persons who have technical training and professional knowledge can handle x-ray tube assembly.

**2. Fragile Glass**

X-ray tube is assembled with glass, therefore, it can be broken with the mechanical vibration or pulsed shock over  $19.6\text{m/s}^2$  (2G).

Careful handling is required to treat or transport.

**3. Ground Terminal**

X-ray tube assembly has ground terminal. Ground cable should be connected.

**4. High Voltage**

All x-ray tubes operate at voltages high enough to kill through electrical shock. Never touch the high voltage delivered plugs or terminals.

When direct access to such parts is required, the primary circuit should be disabled and high voltage capacitors/cables discharged.

**5. High Voltage Plug**

High voltage plug should be cleaned up and free from any physical damages. Silicon compound application is required for high voltage stability.

**6. Operation Atmosphere**

X-ray tube assembly is not allowed to use in the atmosphere of flammable or corrosive gas.

**7. Protective Cover**

X-ray tube assembly is not allowed to use without the protective cover attached.

**8. Handling**

Appropriate jig or tools are required for tube installation to avoid physical damages.

**9. Returning Tube**

X-ray tube assembly should be repackaged with the original material when it is returned back for quality examination in our factory.

Be careful to put the tube upside cathode. If the packaging is not proper, the tube may not be correctly examined.

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CARLOS DOMOSCO  
D.N.I. 20.386.277  
PRESIDENTE

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Matrícula 2992  
SUPERVISOR TÉCNICO  
Pedro B. PARRAS 1354 P.B. - Mendoza  
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**Caution in Operation****1. X-Ray Radiation**

X-ray tube assembly should have the beam limiting equipment mounted on the x-ray port to protect unnecessary radiation.

**2. Dielectric Oil**

X-ray tube assembly has dielectric oil contained for high voltage stability. As it is poisonous for human health, if it is exposed to the non-restricted area, it should be disposed as following to the local regulation.

**3. Operation Atmosphere**

X-ray tube assembly is not allowed to use in the atmosphere of flammable or corrosive gas.

**4. Lead Disposition**

X-ray tube housing is lined with lead to protect unnecessary radiation. As the lead powder or vapor is harmful for human health, it should be disposed as following to the local regulation or returned back to us with your cost of transportation. We dispose it in our facility with free of charge.

**5. X-ray tube housing temperature**

Do not touch on X-ray tube housing surface just after operation due to high temperature.  
Stay X-ray tube to be cooled.

**6. Any Malfunction**

Please contact to your system service person immediately, if any malfunction is noticed.

  
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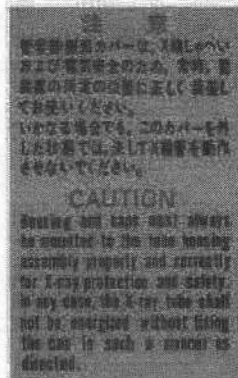
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### Caution Label

- (a) This label is a caution label to notify the user of the following point.  
"Housing end cap is used to protect the electric shock and x-ray leakage."

Attachment position: X-ray tube assembly housing end cap



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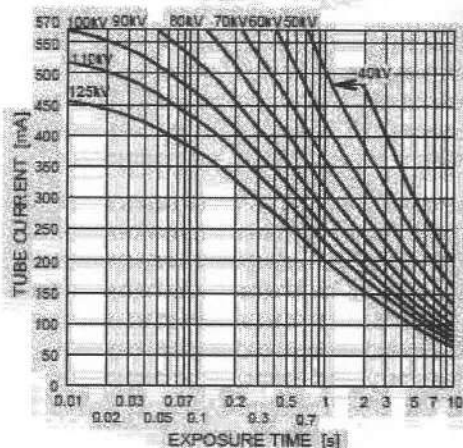
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**Maximum Rating Charts**

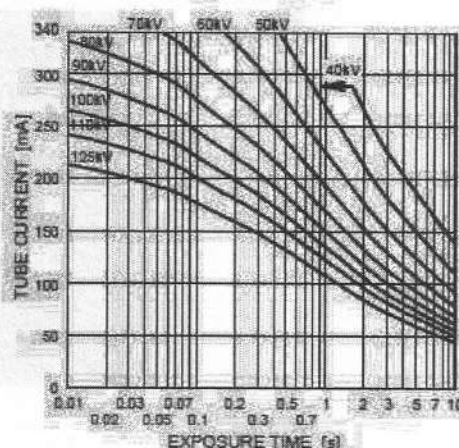
(Absolute Maximum Rating Charts)

Conditions : Tube Voltage Three-Phase  
Stator Power Frequency 60Hz

Focal Spot : 2.0 mm

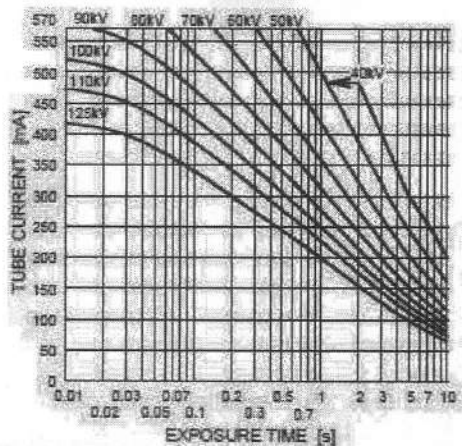


Focal Spot : 1.0 mm

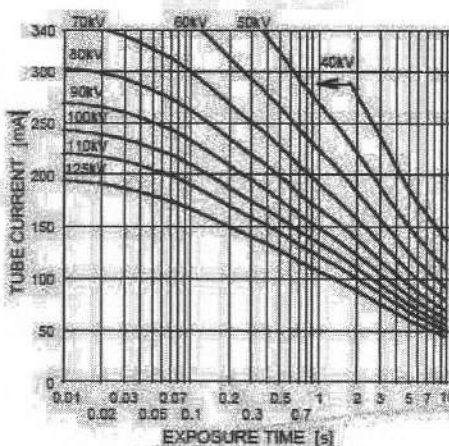


Conditions : Tube Voltage Three-Phase  
Stator Power Frequency 50Hz

Focal Spot : 2.0 mm



Focal Spot : 1.0 mm



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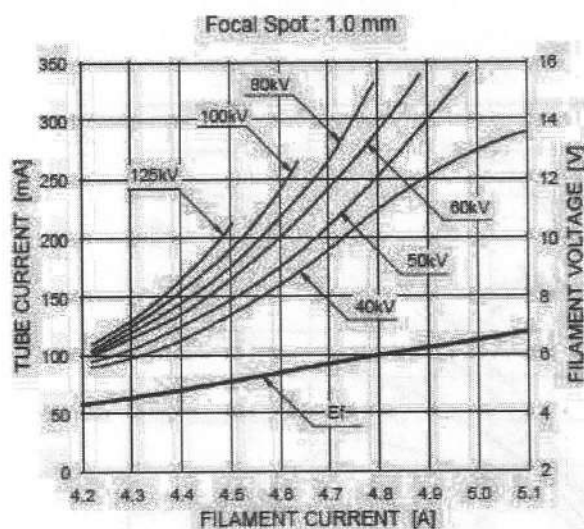
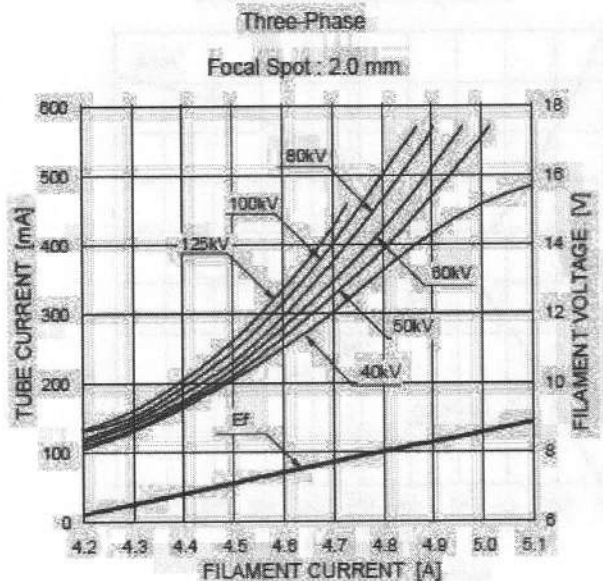
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## Emission &amp; Filament Characteristics



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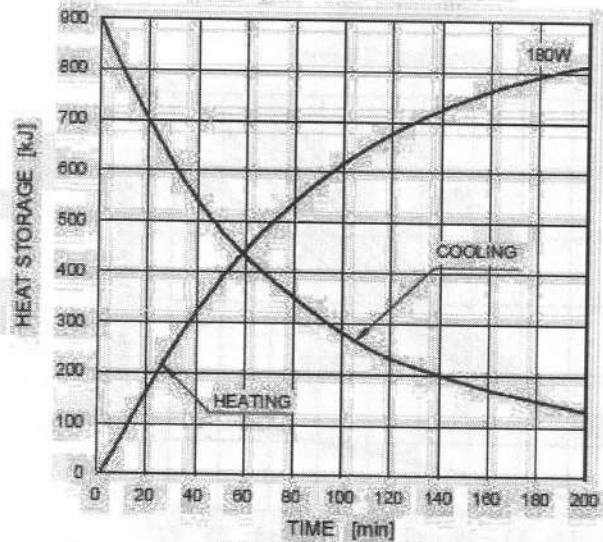
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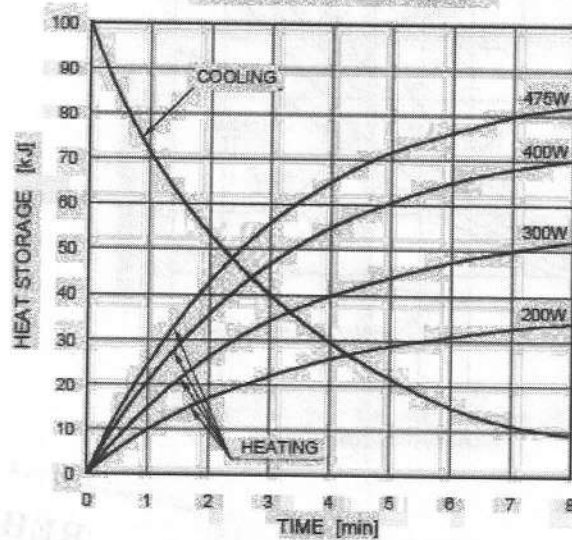
## Thermal Characteristics

### Housing Thermal Characteristics



Cooling Without Air Circulator

### Anode Thermal Characteristics



The heating curves are showing examples of average input power to the anode in operation.

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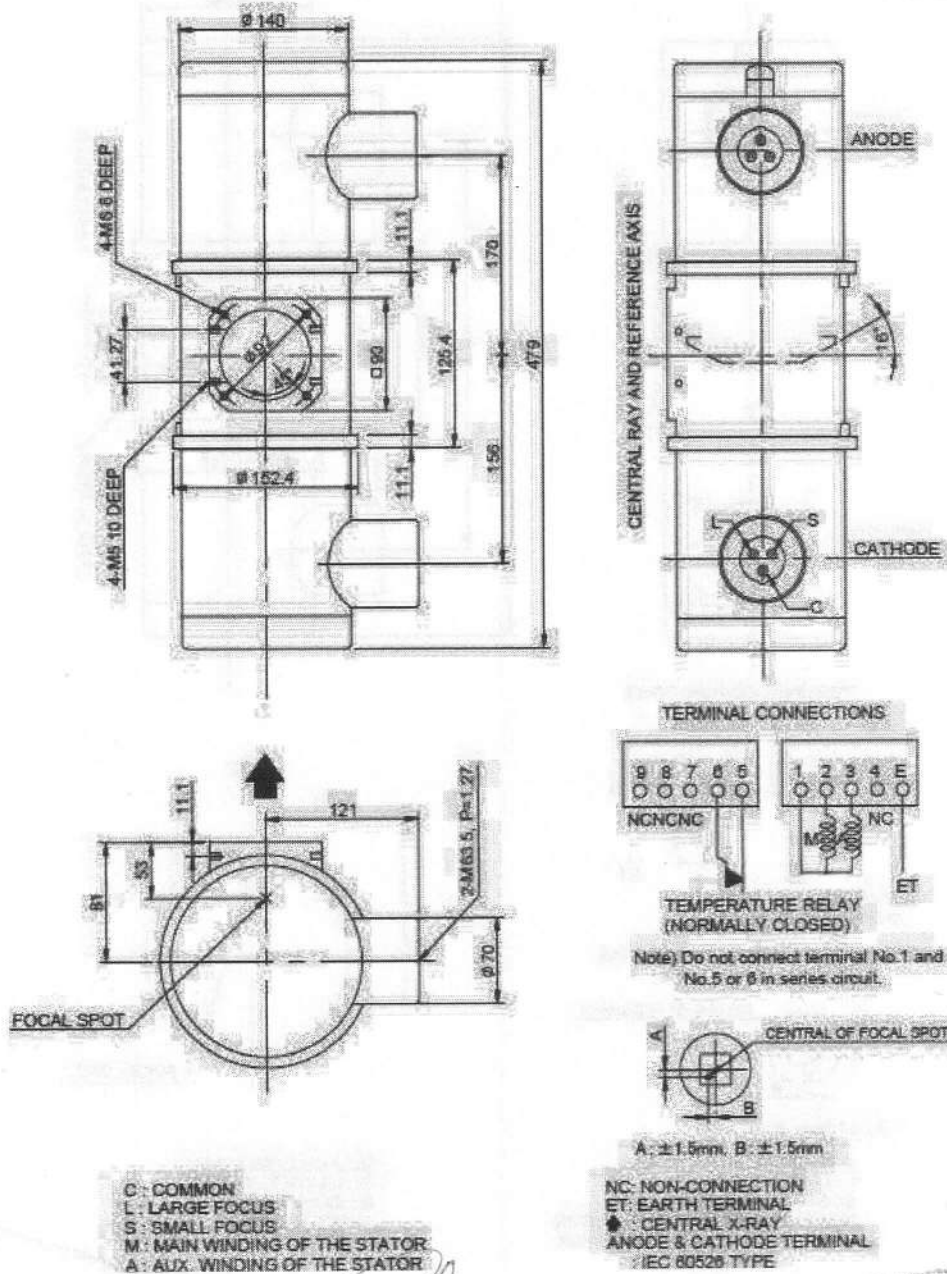
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### Dimensional Outline of E7239X

Unit mm



C: COMMON  
L: LARGE FOCUS  
S: SMALL FOCUS  
M: MAIN WINDING OF THE STATOR  
A: AUX. WINDING OF THE STATOR

NC: NON-CONNECTION  
ET: EARTH TERMINAL  
●: CENTRAL X-RAY  
ANODE & CATHODE TERMINAL  
IEC 80520 TYPE

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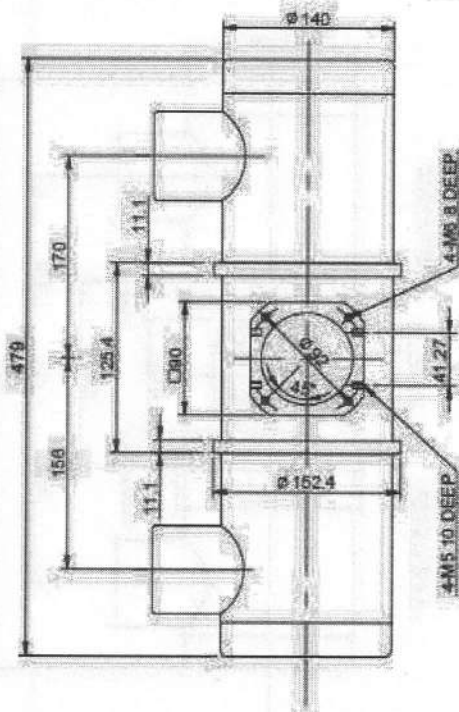
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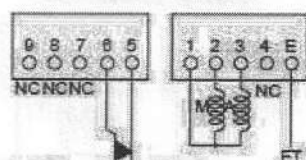


### Dimensional Outline of E7239FX

Unit mm



### TERMINAL CONNECTIONS



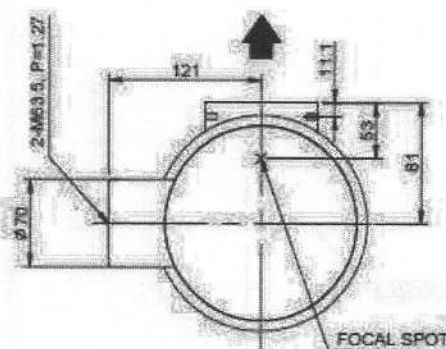
TEMPERATURE RELAY  
(NORMALLY CLOSED)

Note) Do not connect terminal No. 1 and No. 5 or 6 in series circuit.



A:  $\pm 1.5\text{mm}$ , B:  $\pm 1.5\text{mm}$

C: COMMON  
L: LARGE FOCUS  
S: SMALL FOCUS  
M: MAIN WINDING OF THE STATOR  
A: AUX. WINDING OF THE STATOR



NC: NON-CONNECTION  
ET: EARTH TERMINAL  
✦: CENTRAL X-RAY  
ANODE & CATHODE TERMINAL  
: IEC 80528 TYPE

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CENTRAL X-RAY  
ANODE & CATHODE TERMINAL  
IEC 60526 TYPE

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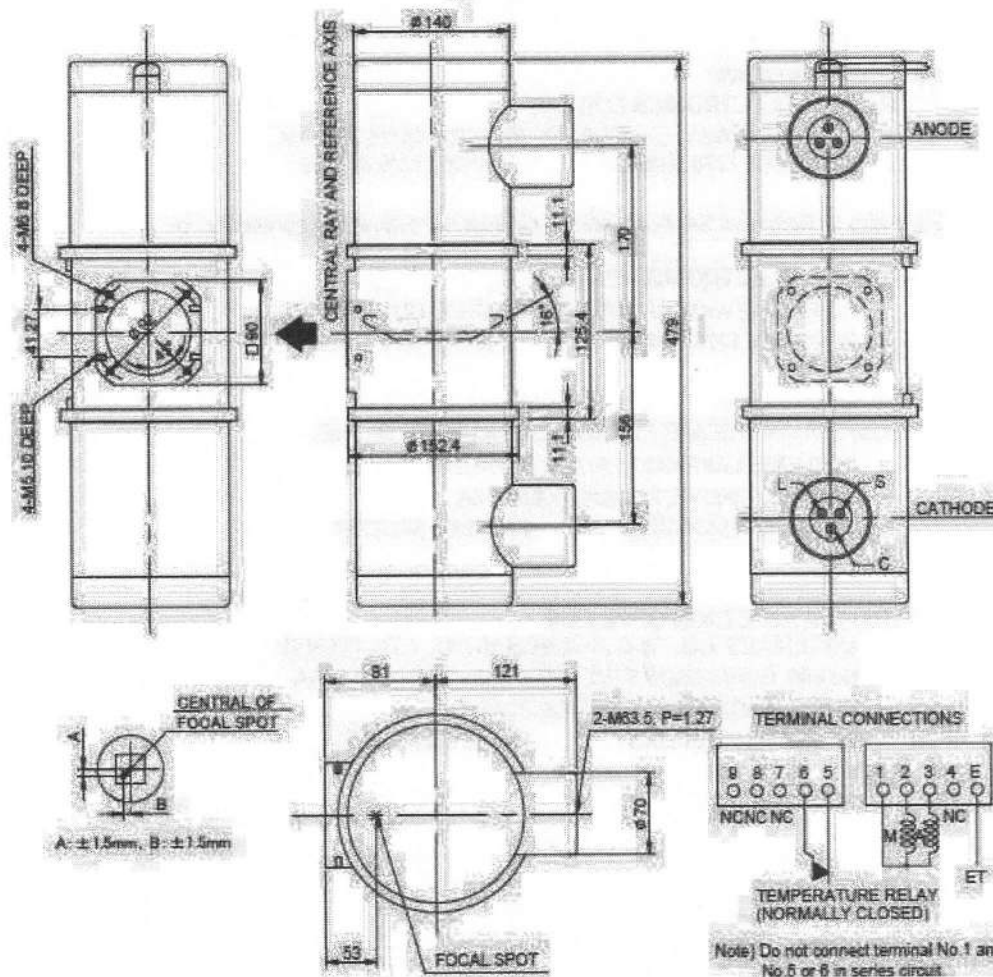
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E7239X / E7239FX / E7239GX

## Dimensional Outline of E7239GX

Unit mm



C : COMMON  
 L : LARGE FOCUS  
 S : SMALL FOCUS  
 M : MAIN WINDING OF THE STATOR  
 A : AUX. WINDING OF THE STATOR

NC : NON-CONNECTION  
 ET : EARTH TERMINAL  
 ▲ : CENTRAL X-RAY  
 ANODE & CATHODE TERMINAL  
 IEC 60526 TYPE

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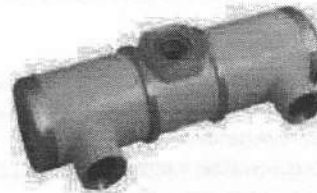
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## ■ E7242X

**TOSHIBA****Technical Data TD****ROTANODE****E7242X****E7242FX****E7242GX****Rotating Anode X-Ray Tube Housing Assembly**

- ◆ Rotating anode X-ray tube housing assembly for the purpose of general diagnostic X-ray procedures.
- ◆ Specially processed Rhenium-tungsten faced molybdenum target of 74 mm diameter.
- ◆ These tubes have foci 1.5 mm and 0.6 mm, and are available for a maximum tube voltage 125 kV with Three-phase generator.
- ◆ Accommodated with IEC 60526 type high-voltage cable receptacles.

**General Data**

IEC Classification ..... Class I Type B

**Electrical:**

|                                            |                                 |
|--------------------------------------------|---------------------------------|
| Circuit (Center-grounded) .....            | Three-phase full-wave rectified |
| Nominal Tube Voltage: .....                |                                 |
| Radiographic .....                         | 40 ~ 125 kV Max.                |
| Nominal Focal Spot Value: .....            |                                 |
| Large Focus .....                          | 1.5 mm                          |
| Small Focus .....                          | 0.6 mm                          |
| Nominal Anode Input Power (at 0.1s): ..... |                                 |
| Large Focus .....                          | 60 Hz                           |
| Small Focus .....                          | 50 kW                           |
| Small Focus .....                          | 18 kW                           |

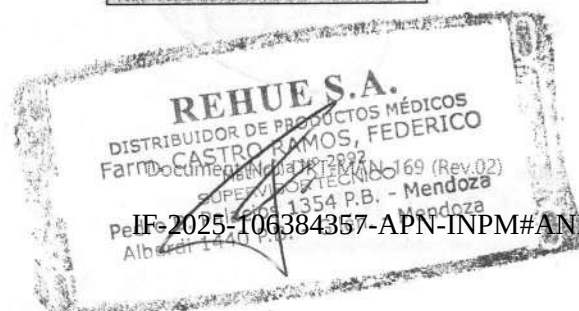
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 ★ The information contained herein may be changed without prior notice. It is therefore advisable to contact TETD before proceeding with the design of equipment incorporating this product.  
 ★ For further particulars apply to TETD.

**TOSHIBA ELECTRON TUBES & DEVICES CO., LTD.**

No. TE-E7242X/FX/GX 2004-11-01

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 Mendoza

E7242X / E7242FX / E7242GX

## Motor Ratings:

| Duty                            | Starting | Running |
|---------------------------------|----------|---------|
| Power source (Hz)               | 50/60    | 50/60   |
| Input power (W)                 | 1050     | 270     |
| Voltage <sup>1)</sup> (V)       | 200      | 100     |
| Current (A)                     | 6.0      | 3.0     |
| Min. Speed up <sup>2)</sup> (s) | 0.8      | 1.5     |
| Capacitor (μF)                  | 24       | 24      |

Note: 1) The every applied voltage must be never exceeded 110% of the above specification.

2) The speed-up time is allowed up to 110% of the above specification.

## Anode Speed:

|       |                             |
|-------|-----------------------------|
| 50 Hz | 2700 min <sup>-1</sup> Min. |
| 60 Hz | 3200 min <sup>-1</sup> Min. |

## Stator impedance:

|                          |        |
|--------------------------|--------|
| Common-Main Winding      | 27.5 Ω |
| Common-Auxiliary Winding | 58.0 Ω |

Resistance between Housing and Low Voltage Terminals

2 MΩ Min.

Normal operating range of the housing temperature

10 ~ 75 °C

## Mechanical:

|                  |                         |
|------------------|-------------------------|
| Dimensions       | See dimensional outline |
| Overall Length   | 479 mm                  |
| Maximum Diameter | 152.4 mm                |

## Target:

|                                                                   |                                       |
|-------------------------------------------------------------------|---------------------------------------|
| Angle                                                             | 14 degrees                            |
| Construction                                                      | Rhenium-Tungsten faced molybdenum     |
| Permanent Filtration                                              | 0.9 mm Al / 75 kV IEC 60522 / 2003    |
| Radiation Protection (To meet the requirements of IEC 60601-1-3): |                                       |
| Leakage Technique Factor                                          | 125 kV 4 mA                           |
| X-ray Coverage                                                    | 354 × 354 mm at SID 750 mm            |
| Weight (Approx.)                                                  | 16 kg                                 |
| High Tension Terminals                                            | To meet the requirements of IEC 60526 |
| Cooling Method                                                    | Natural or forced air                 |

## Tube Housing Model Number:

|         |        |
|---------|--------|
| E7242X  | XH-121 |
| E7242FX | XH-126 |
| E7242GX | XH-150 |

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E7242X / E7242FX / E7242GX

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

|                                                    |                    |
|----------------------------------------------------|--------------------|
| <b>Maximum Tube Voltage:</b>                       |                    |
| Radiographic .....                                 | 125 kV             |
| Maximum Voltage to Ground .....                    | 65 kV              |
| Minimum Tube Voltage .....                         | 40 kV              |
| <b>Maximum Tube Current:</b>                       |                    |
| Large Focus .....                                  | 800 mA             |
| Small Focus .....                                  | 290 mA             |
| <b>Maximum Filament Current:</b>                   |                    |
| Large Focus .....                                  | 5.3 A              |
| Small Focus .....                                  | 5.3 A              |
| <b>Filament Voltage:</b>                           |                    |
| Large Focus (At max. filament current 5.3 A) ..... | 10.6 ~ 14.4 V      |
| Small Focus (At max. filament current 5.3 A) ..... | 5.1 ~ 6.9 V        |
| Filament Frequency Limits .....                    | 0 ~ 25 kHz         |
| Average Input Power .....                          | 60 W (85 HU/s)     |
| (Repeated radiographic exposure)                   |                    |
| <b>Thermal Characteristics:</b>                    |                    |
| Anode Heat Storage Capacity .....                  | 142 kJ (200 kHU)   |
| Maximum Anode Heat Dissipation Rate .....          | 616 W (868 HU/s)   |
| Housing Heat Storage Capacity .....                | 900 kJ (1250 kHU)  |
| Maximum Housing Heat Dissipation Rate:             |                    |
| Without Air-circulator .....                       | 180 W (15 kHU/min) |

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E7242X / E7242FX / E7242GX

## Environmental Limits

## Operating Limits:

Temperature ..... 10 ~ 40 °C

Humidity ..... 30 ~ 85 %

(No condensation)

Atmospheric Pressure ..... 70 ~ 106 kPa

## Shipping and Storage Limits:

Temperature ..... -20 ~ 70 °C

Humidity ..... 20 ~ 90 %

(No condensation)

Atmospheric Pressure ..... 50 ~ 106 kPa

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E7242X / E7242FX / E7242GX

**Warning****Warning to Interface with X-ray Generator****1. Housing Rupture**

Never input over-rated power to x-ray tube assembly.

If the input power is extremely higher than specification, it may cause the over temperature of anode, insert tube glass shatter and ultimately the following serious problems due to generating over-pressure by oil vaporization inside housing assembly.

In such a critical condition, the safety thermal switch can not protect x-ray tube even if it works.

- \* Housing sealing parts (cathode side) rupture
- \* Human injury including burns due to hot oil escape
- \* Fire accident due to flaming anode target

We strongly request that the x-ray generator should have a protective function which manages input power to x-ray tube assembly.

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E7242X / E7242FX / E7242GX

**Cautions****Caution to Interface with X-ray Generator****1. Over Rating**

X-ray tube assembly can be broken with applying just one over rated shot.

Please read the technical data sheets carefully and follow the instructions.

**2. Permanent Filtration**

The total filtration and the distance between x-ray focal spot and human body are regulated legally.

They should be complied with the regulation.

**3. Safety Thermal Switch**

X-ray tube assembly has safety thermal switch to prohibit further input power when the tube housing reaches to the temperature of switch-open.

The switch should be hooked up with the x-ray generator which control output power to x-ray tube assembly.

Even if the switch works, never turn the system power off and the cooling unit should be activated.

**4. Unexpected Malfunction**

X-ray tube assembly may have the risk to be unexpectedly malfunctioning due to life termination or failure. If the serious problems caused by the above risk is expected, we recommend to have a contingency plan to avoid such a case.

**5. New Application**

If you use the product with new application not to be mentioned in this specification or with different type of x-ray generator, please contact to us for confirming its availability.

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E7242X / E7242FX / E7242GX

**Caution for Installation, Adjustment and Maintenance****1. Qualified Persons**

Only qualified persons who have technical training and professional knowledge can handle x-ray tube assembly.

**2. Fragile Glass**

X-ray tube is assembled with glass; therefore, it can be broken with the mechanical vibration or pulsed shock over  $19.6\text{m/s}^2$  (2G).

Careful handling is required to treat or transport.

**3. Ground Terminal**

X-ray tube assembly has ground terminal. Ground cable should be connected.

**4. High Voltage**

All x-ray tubes operate at voltages high enough to kill through electrical shock. Never touch the high voltage delivered plugs or terminals.

When direct access to such parts is required, the primary circuit should be disabled and high voltage capacitors/cables discharged.

**5. High Voltage Plug**

High voltage plug should be cleaned up and free from any physical damages. Silicon compound application is required for high voltage stability.

**6. Operation Atmosphere**

X-ray tube assembly is not allowed to use in the atmosphere of flammable or corrosive gas.

**7. Protective Cover**

X-ray tube assembly is not allowed to use without the protective cover attached.

**8. Handling**

Appropriate jig or tools are required for tube installation to avoid physical damages.

**9. Returning Tube**

X-ray tube assembly should be repackaged with the original material when it is returned back for quality examination in our factory.

Be careful to put the tube upside cathode. If the packaging is not proper, the tube may not be correctly examined.

  
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**E7242X / E7242FX / E7242GX****Caution in Operation****1. X-Ray Radiation**

X-ray tube assembly should have the beam limiting equipment mounted on the x-ray port to protect unnecessary radiation.

**2. Dielectric Oil**

X-ray tube assembly has dielectric oil contained for high voltage stability. As it is poisonous for human health, if it is exposed to the non-restricted area, it should be disposed as following to the local regulation.

**3. Operation Atmosphere**

X-ray tube assembly is not allowed to use in the atmosphere of flammable or corrosive gas.

**4. Lead Disposition**

X-ray tube housing is lined with lead to protect unnecessary radiation. As the lead powder or vapor is harmful for human health, it should be disposed as following to the local regulation or returned back to us with your cost of transportation. We dispose it in our facility with free of charge.

**5. X-ray tube housing temperature**

Do not touch on X-ray tube housing surface just after operation due to high temperature.  
Stay X-ray tube to be cooled.

**6. Any Malfunction**

Please contact to your system service person immediately, if any malfunction is noticed.

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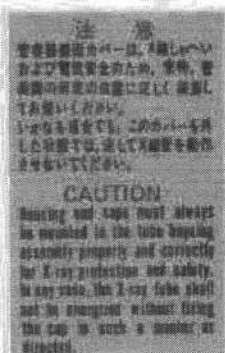
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**Caution Label**

- (a) This label is a caution label to notify the user of the following point.  
"Housing end cap is used to protect the electric shock and x-ray leakage."

Attachment position: X-ray tube assembly housing end cap



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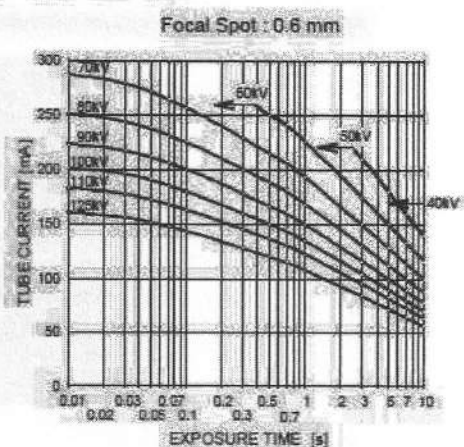
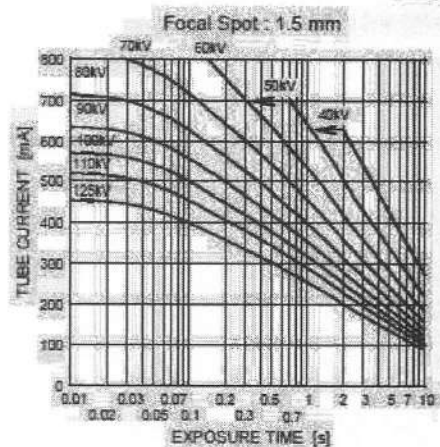


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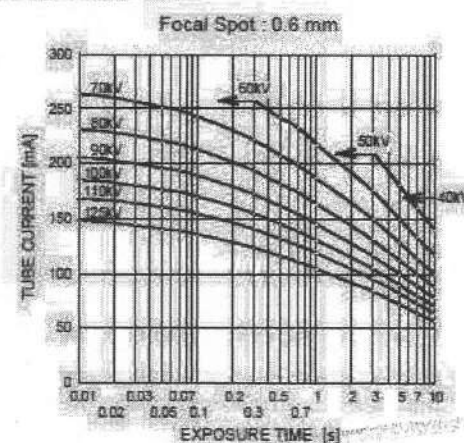
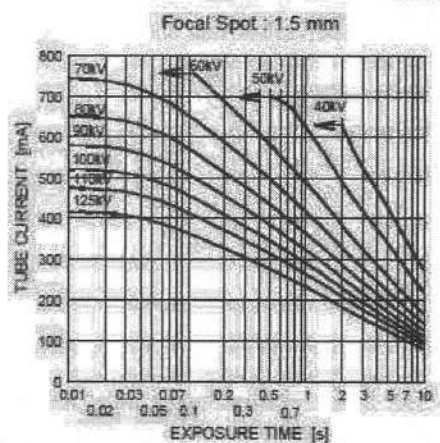
**Maximum Rating Charts**

(Absolute Maximum Rating Charts)

Conditions : Tube Voltage Three-Phase  
Stator Power Frequency 60Hz



Conditions : Tube Voltage Three-Phase  
Stator Power Frequency 50Hz



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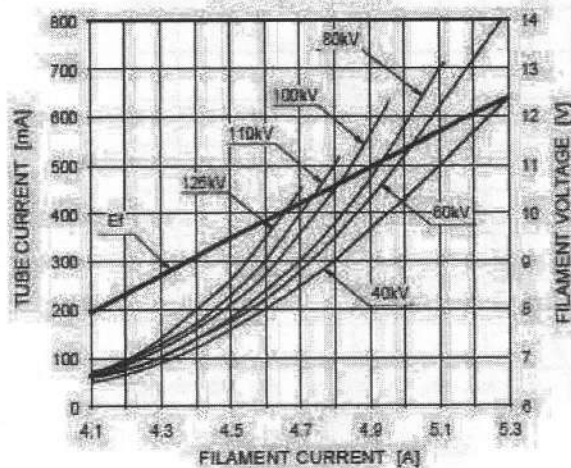
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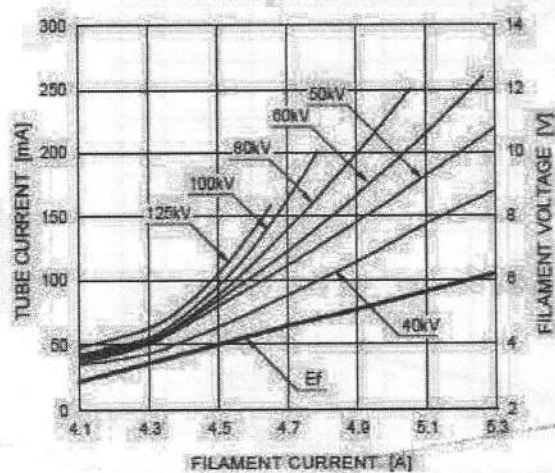
**Emission & Filament Characteristics**

Three-Phase

Focal Spot : 1.5 mm



Focal Spot : 0.6 mm



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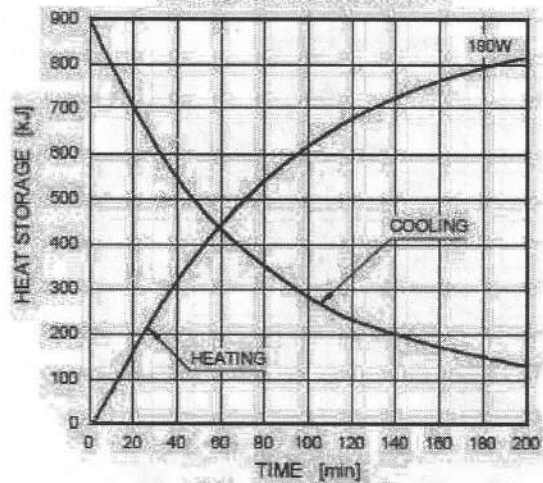
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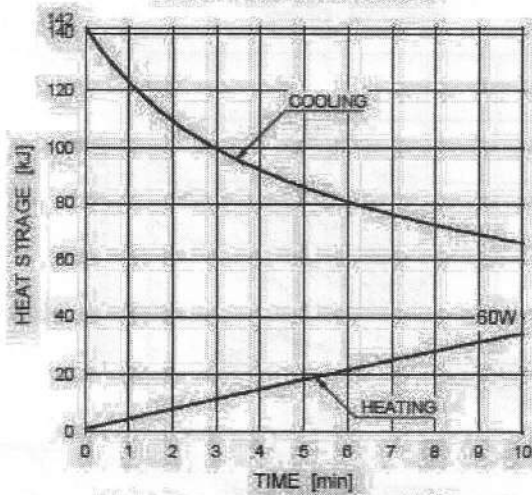
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**Thermal Characteristics****Housing Thermal Characteristics**

Cooling Without Air Circulator

**Anode Thermal Characteristics**

The heating curves are showing examples of average input power to anode in operation.

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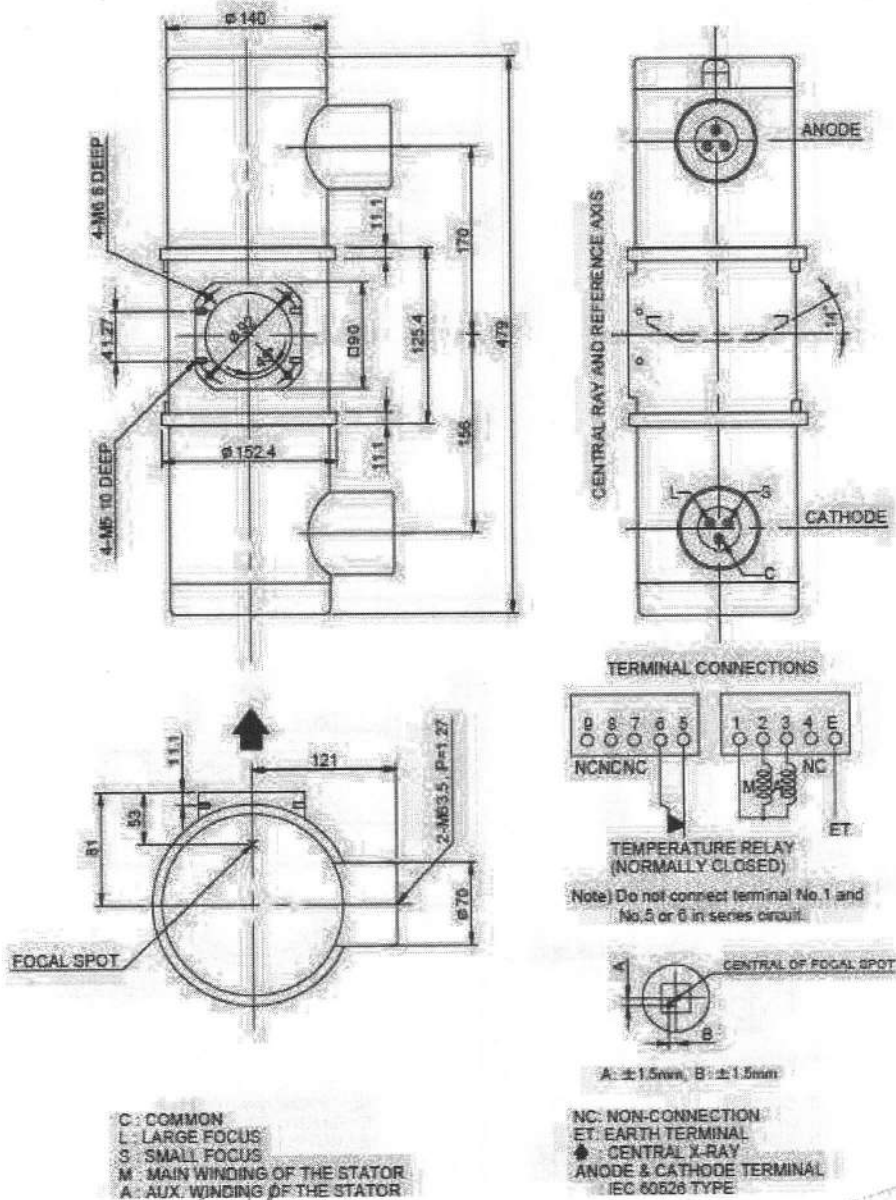
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Dimensional Outline of E7242X

Unit mm



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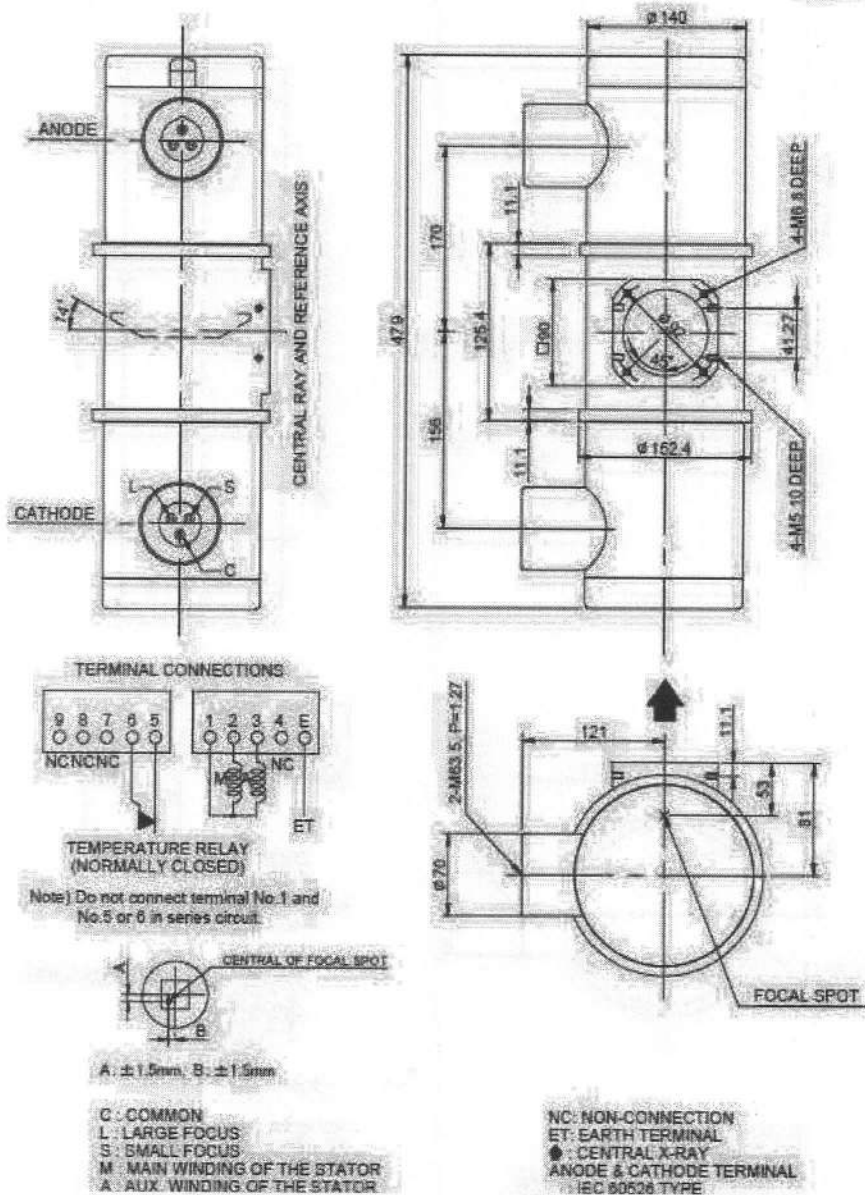
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E7242X / E7242FX / E7242GX

### Dimensional Outline of E7242FX

Unit mm



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E7242X / E7242FX / E7242GX

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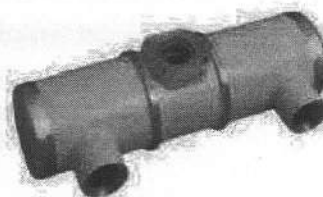
## ■ E7884X

Product Information **PI**

**ROTANODE™**  
**E7884X**  
**E7884FX**  
**E7884GX**

**Rotating Anode X-ray Tube Assembly**

- ◆ Rotating anode X-ray tube assembly for high energy radiographic operations.
- ◆ The heavy anode is constructed with specially processed rhenium-tungsten faced molybdenum target which is 74 mm diameter and has an improved coating to increase thermal emissivity.
- ◆ These tubes have foci 1.2 and 0.6, and are available for a maximum tube voltage 150 kV.
- ◆ Accommodated with IEC60526 type high-voltage cable receptacles.

**General Data**

IEC Classification (IEC60601-1:2005+A1:2012) ..... Class 1 ME EQUIPMENT

**Electrical:****Circuit:**

High Voltage Generator ..... Constant Potential High-Voltage Generator  
 Grounding ..... Center-grounded

**Nominal X-ray Tube Voltage:**

Radiographic ..... 150 kV

**Nominal Focal Spot Value:**

Large Focus ..... 1.2  
 Small Focus ..... 0.6

**Nominal Anode Input Power (at 0.1s):**

|             |       |       |
|-------------|-------|-------|
|             | 60 Hz | 50 Hz |
| Large Focus | 54 kW | 50 kW |
| Small Focus | 22 kW | 20 kW |

**Nominal Radiographic Anode Input Power:**

|             |       |       |
|-------------|-------|-------|
|             | 60 Hz | 50 Hz |
| Large Focus | 48 kW | 44 kW |
| Small Focus | 22 kW | 20 kW |

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 \* The information contained herein may be changed without prior notice. It is therefore, advisable to contact to CETD before processing with the design of equipment incorporating this product.

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## E7884X / E7884FX / E7884GX

## Motor Ratings:

Stator: XS-AL

|                             |      | Starting | Running |
|-----------------------------|------|----------|---------|
| Driven Frequency            | [Hz] | 50/60    | 50/60   |
| Input Power                 | [W]  | 910      | 83      |
| Voltage <sup>1)3)</sup>     | [V]  | 130      | 40      |
| Current <sup>2)</sup>       | [A]  | 7.8      | 2.3     |
| Min. Speed Up <sup>4)</sup> | [s]  | 0.8      | -       |
| Capacitor                   | [μF] | 44       | 44      |

Note: 1) Applied voltage between common and main terminal.

2) Common current.

3) The every applied voltage must be never exceeded 110% of the above specification.

4) The speed-up time is allowed up to 110% of the above specification.

## Anode Speed:

60 Hz ..... Minimum 3200 min<sup>-1</sup>50 Hz ..... Minimum 2700 min<sup>-1</sup>

## Stator Resistance:

Common-Main Winding ..... 9.4 Ω

Common-Auxiliary Winding ..... 28.3 Ω

Resistance Between Housing and Low Voltage Terminals ..... Minimum 2 MΩ

Normal Operating Range of the Housing Temperature ..... 16 ~ 75 °C

Mode of Operation ..... Intermittent

## Mechanical:

Dimensions ..... See dimensional outline

Overall Length ..... 479 mm

Maximum Diameter ..... 152.4 mm

## Target:

Anode Angle ..... 12 degrees

Diameter ..... 74 mm

Construction ..... Rhenium-Tungsten faced Molybdenum

## Filtration:

Permanent Filtration ..... 0.9 mm Al / 75 kV IEC60522:1999

Available Additional Filter combination (0.4 - 1.5 mm) ..... Maximum 2.4 mm Al / 75 kV

## Radiation Protection (In accordance with IEC60601-1-3:2008):

Leakage Technique Factor ..... 150 kV, 3.4 mA

X-ray Coverage ..... 430 × 430 mm at SID 1000 mm

Weight (Approx.) ..... 16 kg

High Voltage Receptacle ..... To meet requirements of IEC60526 Corrigendum 1:2010

Cooling Method ..... Natural or forced air

## Tube Housing Model Number:

E7884X ..... XH-121

E7884FX ..... XH-126

E7884GX ..... XH-150

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E7884X / E7884FX / E7884GX

### Absolute Maximum and Minimum Ratings

(At any time, these values must not be exceeded)

|                                                       |                    |
|-------------------------------------------------------|--------------------|
| Maximum X-ray Tube Voltage:                           |                    |
| Radiographic .....                                    | 150 kV             |
| Between Anode (or Cathode) and Ground .....           | 75 kV              |
| Minimum X-ray Tube Voltage .....                      | 40 kV              |
| Maximum X-ray Tube Current .....                      | See rating charts  |
| Large Focus .....                                     | 700 mA             |
| Small Focus .....                                     | 300 mA             |
| Maximum Filament Current:                             |                    |
| Large Focus .....                                     | 5.4 A              |
| Small Focus .....                                     | 5.2 A              |
| Filament Voltage:                                     |                    |
| Large Focus (At maximum filament current 5.4 A) ..... | 11.9 ~ 16.1 V      |
| Small Focus (At maximum filament current 5.2 A) ..... | 6.8 ~ 9.2 V        |
| Filament Frequency Limits .....                       | 0 ~ 25 kHz         |
| Continuous Anode Input Power .....                    | 142 W (200 HU/s)   |
| Thermal Characteristics:                              |                    |
| Anode Heat Content .....                              | 210 kJ (300 kHU)   |
| Maximum Anode Heat Dissipation .....                  | 870 W (1226 HU/s)  |
| X-ray Tube Assembly Heat Content .....                | 900 kJ (1250 kHU)  |
| Nominal Continuous Input Power:                       |                    |
| Without Air-circulator .....                          | 180 W (15 kHU/min) |

### Environmental Limits

|                              |                   |
|------------------------------|-------------------|
| Operating Limits:            |                   |
| Temperature .....            | 10 ~ 40 °C        |
| Humidity .....               | 30 ~ 85 %         |
|                              | (No condensation) |
| Atmospheric Pressure .....   | 70 ~ 106 kPa      |
| Shipping and Storage Limits: |                   |
| Temperature .....            | -20 ~ 70 °C       |
| Humidity .....               | 20 ~ 90 %         |
|                              | (No condensation) |
| Atmospheric Pressure .....   | 50 ~ 106 kPa      |

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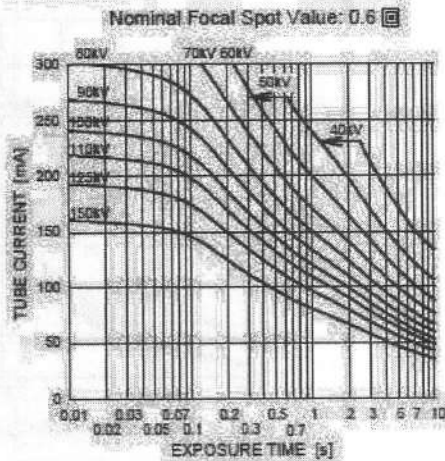
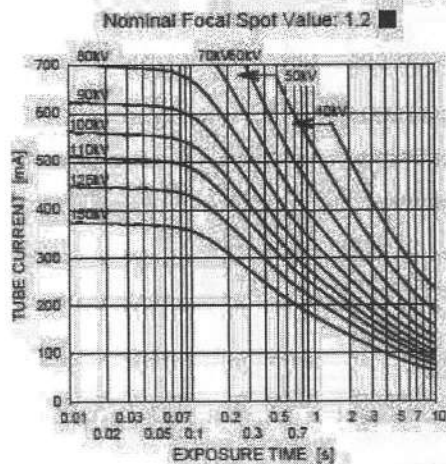
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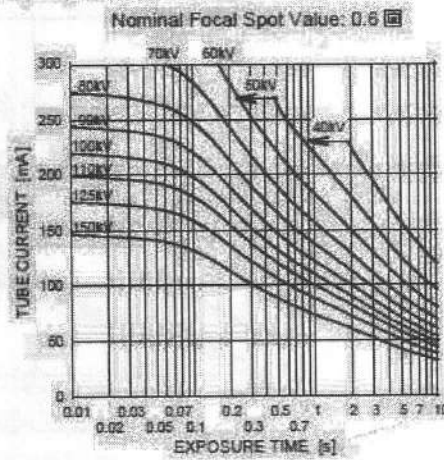
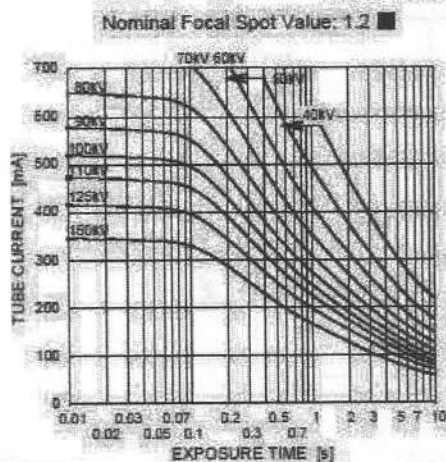
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### Maximum Rating Charts (Absolute Maximum Rating Charts)

Conditions: Tube Voltage  
Constant potential high-voltage generator  
Stator Power Frequency 60 Hz



Conditions: Tube Voltage  
Constant potential high-voltage generator  
Stator Power Frequency 50 Hz



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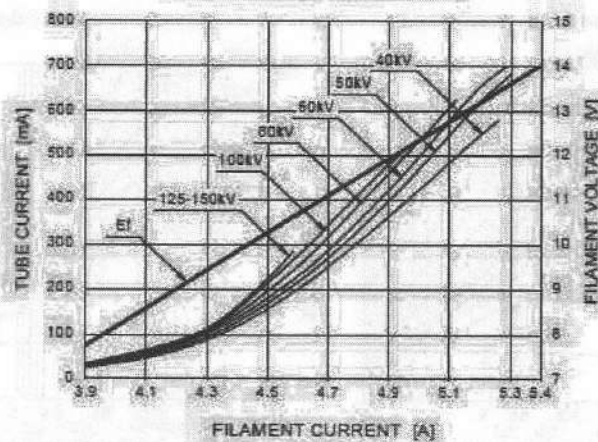


E7884X / E7884FX / E7884GX

**Emission & Filament Characteristics**

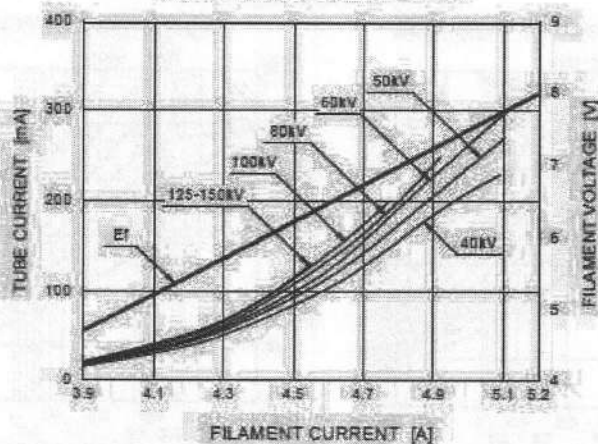
Constant potential high-voltage generator

Nominal Focal Spot Value: 1.2 ■



For Reference Only

Nominal Focal Spot Value: 0.6 □



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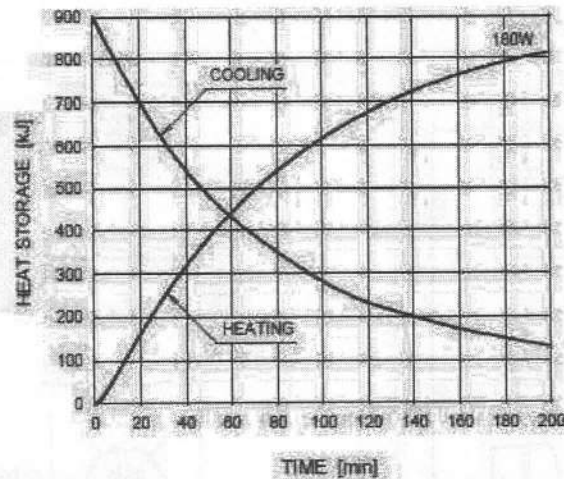
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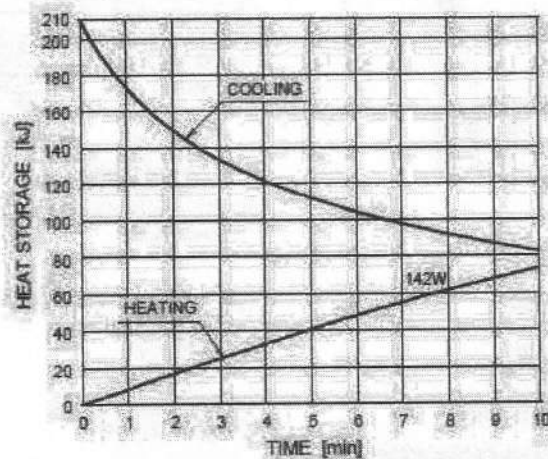
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## Thermal Characteristics

X-ray Tube Assembly Heating / Cooling Curve



Anode Heating / Cooling Curve



The heating curves are showing example of average input power to anode in operation.

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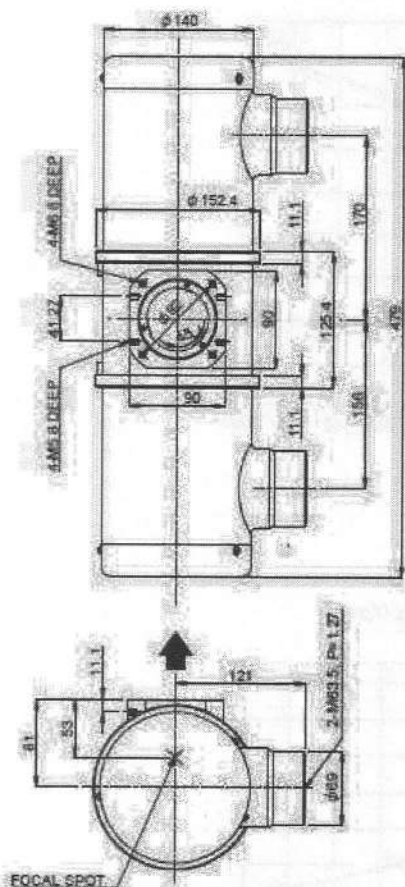
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E7884X / E7884FX / E7884GX

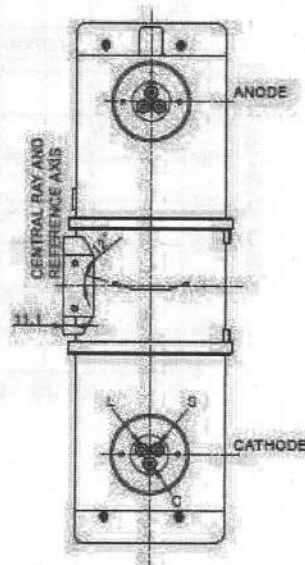
### Dimensional Outline of E7884X

Unit: mm

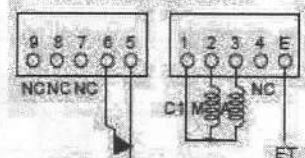


CATHODE TERMINAL  
C : COMMON  
L : LARGE FOCUS  
S : SMALL FOCUS

**TERMINAL CONNECTIONS**  
 C1 : COMMON  
 M : MAIN WINDING OF THE STATOR  
 A : AUX. WINDING OF THE STATOR  
 NC : NON-CONNECTION  
 ET : EARTH TERMINAL



### TERMINAL CONNECTIONS



**TEMPERATURE RELAY  
(NORMALLY CLOSED)**

Note) Do not connect terminal No.1 and No.3 or 5  
in series circuit.



-1.5mm ≤ A ≤ 1.5mm  
-1.5mm ≤ B ≤ 1.5mm

▲ CENTRAL X-RAY  
ANODE & CATHODE TERMINAL  
IEC60528 TYPE

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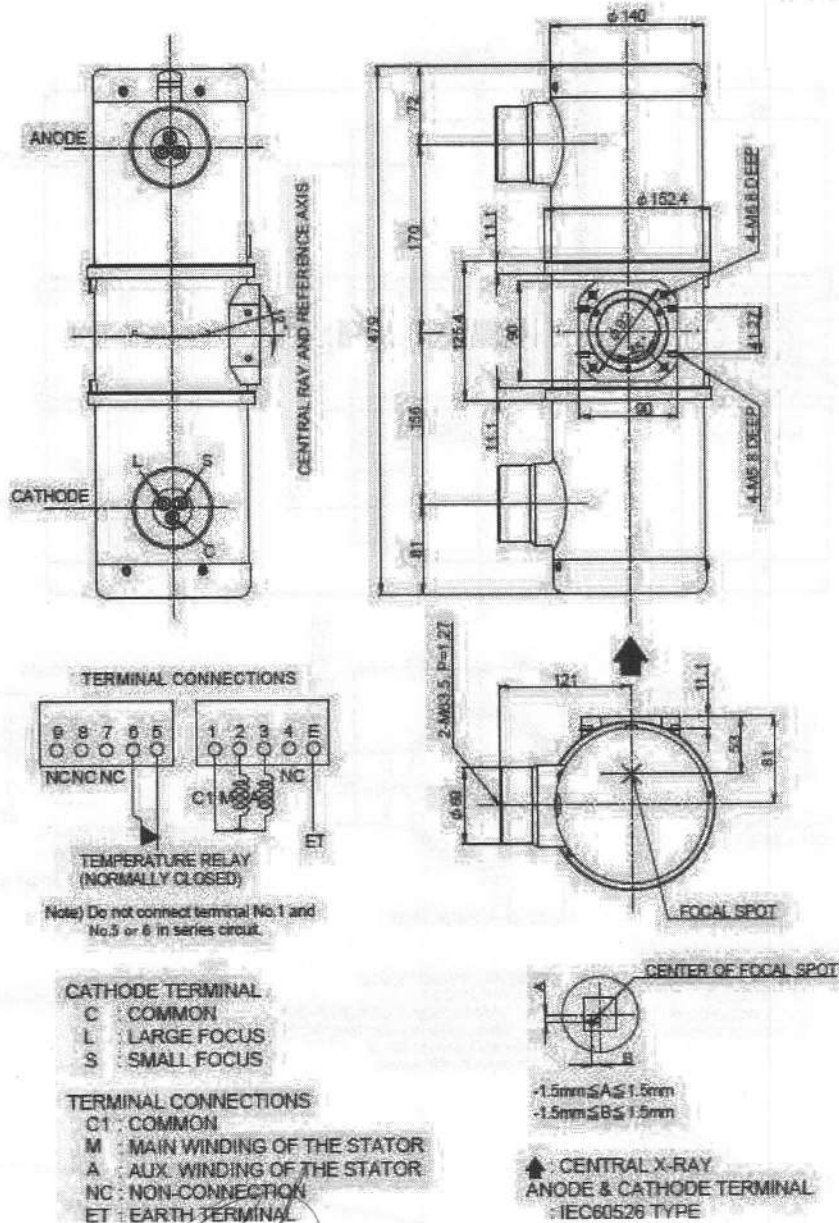
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E7884X / E7884FX / E7684GX

### Dimensional Outline of E7884FX

Unit: mm

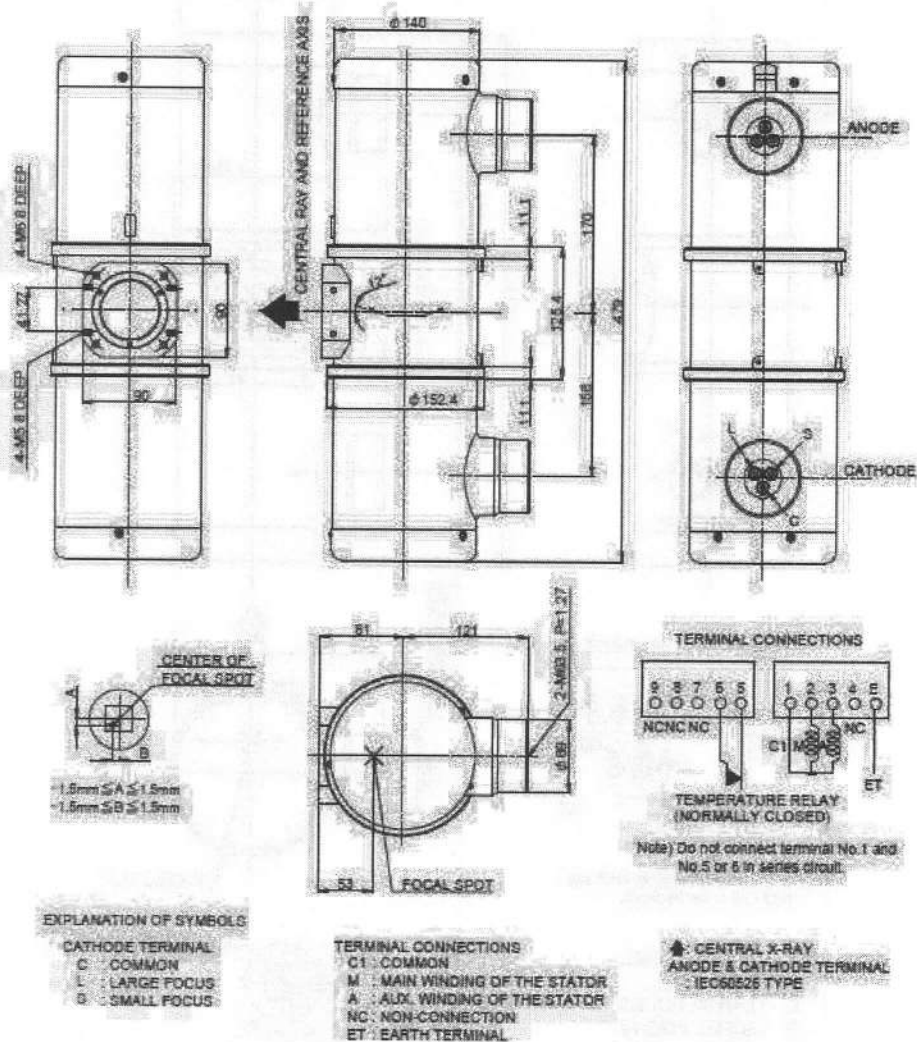


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## Unit: mm



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EXSYS DEXi

Installation, Operation and Service Manual

DRTECH

Chapter 17

Appendix C. Model Configuration

Diagnostic X-ray System

EXSYS DEXi

CANON ELECTRON TUBES & DEVICES CO., LTD.  
Marketing Engineering Group, Sales Department  
1385, Shimodetsumi, Okazaki-shi, Toyota 465-8535, Japan  
Tel: +81-267-25-5555 Fax: +81-267-25-5555  
<https://held.canon>

The head office of Canon Electron Tubes & Devices Co., Ltd. has been certified to meet all the requirements of Environmental Management System ISO14001.  
Canon Electron Tubes & Devices Co., Ltd. has been certified to meet all the requirements of Quality Management Systems ISO9001 and ISO13485.  
Product scope is referred to the following URL: <https://held.canon/en/home/quality.html>

PE-E7654X/FX/GX 2016-11

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## Chapter 17

### Appendix C. Model Configuration

#### Diagnostic X-ray System

**[EXSYS DEXi]**

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## 17 Appendix C

### 17.1 Model Configuration

The following is model configurations.

| Sub Model            | Generator | Collimator           | Tube   | Equipment  |                                                                |                                      | OP Console                                 |
|----------------------|-----------|----------------------|--------|------------|----------------------------------------------------------------|--------------------------------------|--------------------------------------------|
|                      |           |                      |        | Tube stand | Bucky stand                                                    | Patient Table                        |                                            |
| EXSYS DEXi-D401S-FRM | DXG-40S   | M-38<br>R 221/A DHHS | E7239X | DTS-M      | DBS-43M<br>DBS-57M<br>LLD 129 with Rotation<br>LLD 129 Compact | DPT-4A<br>DPT-6A<br>DPT-4B<br>DPT-6B | EConsole &<br>LCD Console (System OP)      |
| EXSYS DEXi-A401S-FRM | DXG-40S   | M-38                 | E7239X | DTS-M      | DBS-43M<br>LLD 129 with Rotation<br>LLD 129 Compact            | DPT-4A<br>DPT-6A                     | Membrane OP Console &<br>Generator Console |
| EXSYS DEXi-D402S-FRM | DXG-40S   | M-38<br>R 221/A DHHS | E7242X | DTS-M      | DBS-43M<br>DBS-57M<br>LLD 129 with Rotation<br>LLD 129 Compact | DPT-4A<br>DPT-6A<br>DPT-4B<br>DPT-6B | EConsole &<br>LCD Console (System OP)      |
| EXSYS DEXi-A402S-FRM | DXG-40S   | M-38                 | E7242X | DTS-M      | DBS-43M<br>LLD 129 with Rotation<br>LLD 129 Compact            | DPT-4A<br>DPT-6A                     | Membrane OP Console &<br>Generator Console |
| EXSYS DEXi-D401P-FRM | DXG-40P   | M-38<br>R 221/A DHHS | E7239X | DTS-M      | DBS-43M<br>DBS-57M<br>LLD 129 with Rotation<br>LLD 129 Compact | DPT-4A<br>DPT-6A<br>DPT-4B<br>DPT-6B | EConsole &<br>LCD Console (System OP)      |
| EXSYS DEXi-A401P-FRM | DXG-40P   | M-38                 | E7239X | DTS-M      | DBS-43M<br>LLD 129 with Rotation<br>LLD 129 Compact            | DPT-4A<br>DPT-6A                     | Membrane OP Console &<br>Generator Console |
| EXSYS DEXi-D402P-FRM | DXG-40P   | M-38<br>R 221/A DHHS | E7242X | DTS-M      | DBS-43M<br>DBS-57M<br>LLD 129 with Rotation<br>LLD 129 Compact | DPT-4A<br>DPT-6A<br>DPT-4B<br>DPT-6B | EConsole &<br>LCD Console (System OP)      |
| EXSYS DEXi-A402P-FRM | DXG-40P   | M-38                 | E7242X | DTS-M      | DBS-43M<br>LLD 129 with Rotation<br>LLD 129 Compact            | DPT-4A<br>DPT-6A                     | Membrane OP Console &<br>Generator Console |
| EXSYS DEXi-D503T-FRM | DXG-50T   | M-38<br>R 221/A DHHS | E7884X | DTS-M      | DBS-43M<br>DBS-57M<br>LLD 129 with Rotation<br>LLD 129 Compact | DPT-4A<br>DPT-6A<br>DPT-4B<br>DPT-6B | EConsole &<br>LCD Console (System OP)      |
| EXSYS DEXi-A503T-FRM | DXG-50T   | M-38                 | E7884X | DTS-M      | DBS-43M<br>LLD 129 with Rotation<br>LLD 129 Compact            | DPT-4A<br>DPT-6A                     | Membrane OP Console &<br>Generator Console |

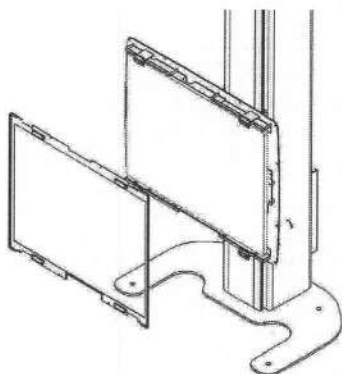
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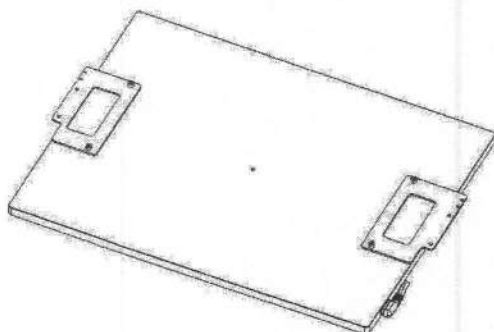
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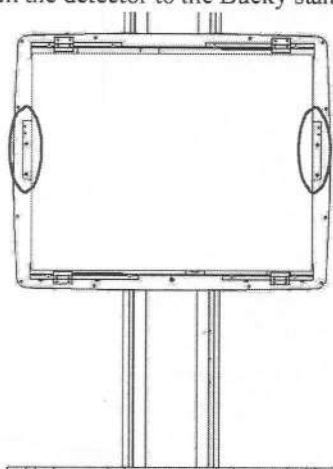
- Detach the AEC assembly guide from the bucky device



- Attach the guide block to the detector



- Attach the detector to the Bucky stand.



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**Hoja Adicional de Firmas**  
**Anexo**

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Miércoles 24 de Septiembre de 2025

**Referencia:** REHUE S.A. (PM 2406-27) ROTULOS E INSTRUCCIONES DE USO

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