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I. Information Introduction

1. Company Overview

1.1 Registered Name: Nanjing Perlove Medical Equipment Co., Ltd.

1.2 Registered Address: No.97, Wangxi Road, Jiangning District, Nanjing 211122, China.

1.3 Production Name: Nanjing Perlove Medical Equipment Co., Ltd.

1.4 Production House: No.97, Wangxi Road, Jiangning District, Nanjing 211122, China.

1.5 Production Address: No.97, Wangxi Road, Jiangning District, Nanjing 211122, China.

1.6 Contact: Tel: 86-25-87187780, Fax: 86-25-87187780

1.7 After-sale Service Department: 86-25-87187780

1.8 Medical Instrument Manufacturing Enterprise License No.: S.S.Y.J.X.S.C.X. No. 20030034

2. Product Information

2.1 Product Name: High Frequency Mobile C-arm System

2.2 Specifications: PLX112B1

2.3 Medical Instrument Registration Certificate No.: JSFDA Certified NO. 20172301756

2.4 Product technical requirement No.: JSFDA Certified NO. 20172301756

2.5 Production Date: See the product nameplate.

2.6 Use period: Ten years.

2.7 Manual version: Version No.: P412B1.04.1EM, Revision date: 2021.9.14

II. General Descriptions

1. Product Features

The unit has the following features:

- a) High frequency high voltage generator and monoblock.
- b) 3-fileds image intensifier.
- c) Human characteristic parameter setting, user-friendly LCD graphical interfaces.
- d) Mechanical movement, image processing, parameter adjustment, operation mode selection and unique hand controller for long-distance operation.
- e) Motorized supporting arm for space saving and improve the stability of the equipment.
- f) Compact appearance, easy to maintain.

2. Scope of application

The unit is mainly used for fluoroscopy and photography.

3. contraindication

Pregnant women and breast-feeding women are not suitable.

4. Equipment Classification

According to the type of protection from electric shock, the unit is classified under Group I.

According to the degree of protection from electric shock, the unit is classified under “Others”.

According to the degree of liquid inlet protection, the unit is classified under IPX0.

This equipment can't be operated in mixed gas of flammable anesthetic gas and air or mixed gas of flammable anesthetic gas and O₂ or N₂O.

According to the work mode classification, the unit is classified under intermittent load continuously work mode.

The unit has the spare parts of signal input and output.

The unit is a mobile instrument.

5. Environmental Conditions

5.1 Temperature: 10°C ~ 40°C

5.2 Relative Humidity: 30% ~ 75%

5.3 Atmospheric Pressure: 700hPa ~ 1060hPa

6. Power Supply Condition

6.1 Voltage: Single-phase 220V±22V

6.2 Frequency: 50/60Hz

6.3 Inner resistance: ≤1Ω

6.4 Capacity: long-time 2.5kVA, momentary 8kVA

6.5 Current release characteristic: 16A

6.6 Perfect protective earth terminal, the ground resistance should be less than 1Ω to promise the reliability of protective earth.

6.7 We suggest you to use 400W UPS together with the image process workstation to connect the computer and LCD, avoid of the damage to computer because of unexpected power outages.

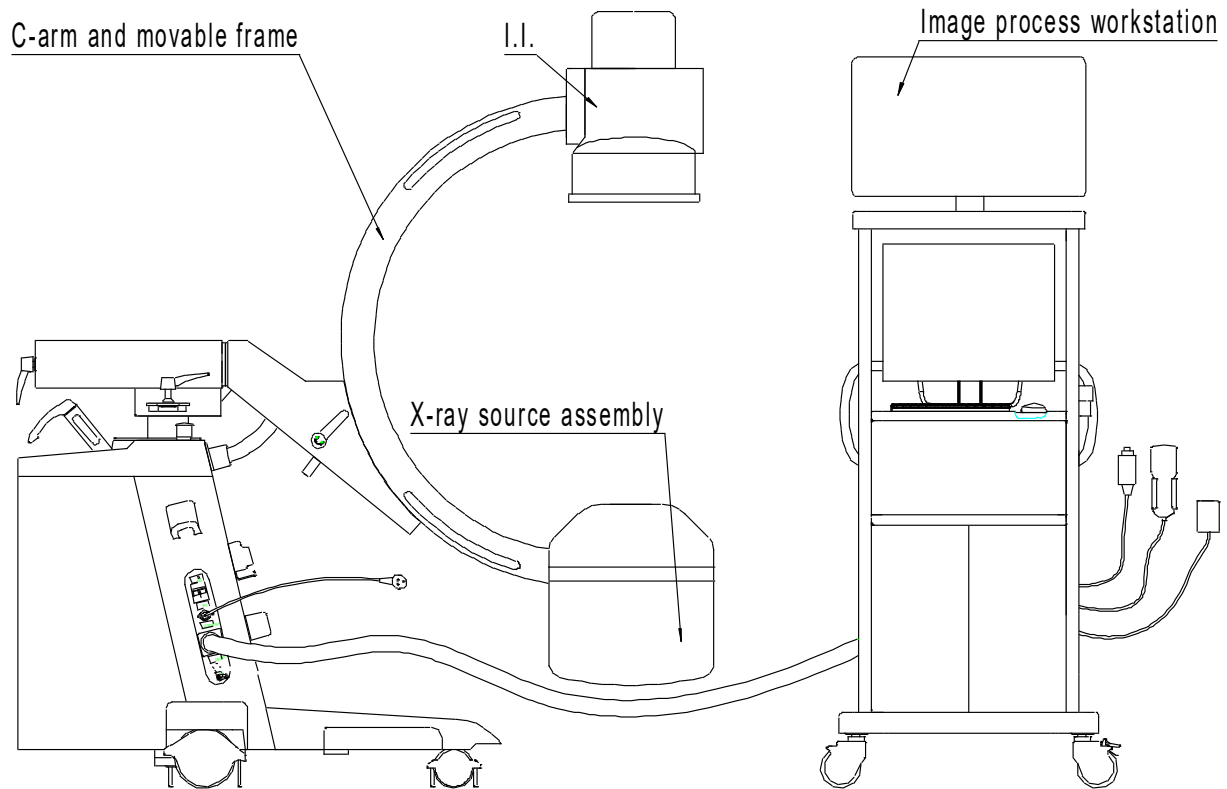


Caution: DO NOT connect the unit to a temporary generator with smaller capacity than required, or connect in parallel to circuit that has been loaded with other electric loading devices such as electric welding machine.

III. Structural Feature and Operating Principle

1. Primary Structure

The unit is composed of x-ray source assembly (monoblock), image intensifier, C-arm and removable rack and image process workstation. Among these, x-ray source assembly (monoblock), image intensifier, C-arm and removable rack are suitable used in patient environment.



2. Definition of Signs

	Caution		High voltage warning		Radiation
	Ready(green lamp)		X-ray exposure(yellow)		Fault(red lamp)
	Large focus		Small focus		Emergency stop
	Function on		Function off		Move direction

3. Working Principles

3.1 High Voltage Circuit

The high voltage that is needed by X-ray tube is rectified from commutating current 220V to DC 300V which is added to inverter, producing 40 kHz

inverting frequency square wave. Then it is increased to the set voltage value by passing the transformer in the X-ray generator's components and the voltage doubling circuit. Voltage regulation is conducted by the means of phase shifting control mode.

3.2 Filament Circuit

The voltage needed by X-ray tube for lighting up filament is provided by filament power panel. After the DC 24V is adjusted, DC voltage adjustable within a certain range is produced, then the 1kHz square wave inverted from the DC voltage through the circuit is delivered to the filament transformer to energize the filament after being isolate.

3.3 Control Circuit

Controlled by high speed intelligent micro-chip, the unit can achieve data storage, data communication, state detection, mA output control and mAs digital close loop control, etc.

IV. Technical Specifications

1. X-ray source components

1.1 X-ray tube

1.1.1 X-ray tube models: KL10-0.6/1.8-125SBR

1.1.2 Target material: Tungsten target

1.1.3 Anode Type: Fixed anode

1.1.4 Peak value of voltage: 125kVp

1.1.5 Focus nominal value: 0.6/1.8

1.1.6 Target angle: 15°

1.1.7 Standard axis: the midperpendicular through x-ray source assembly window

1.1.8 Deviation between focus and standard axis: < 1mm

1.1.9 The angle between target and standard axis: 15°

1.1.10 Nominal anode input power: 5.3kW

1.1.11 Anode heat capacity: 35.5kJ

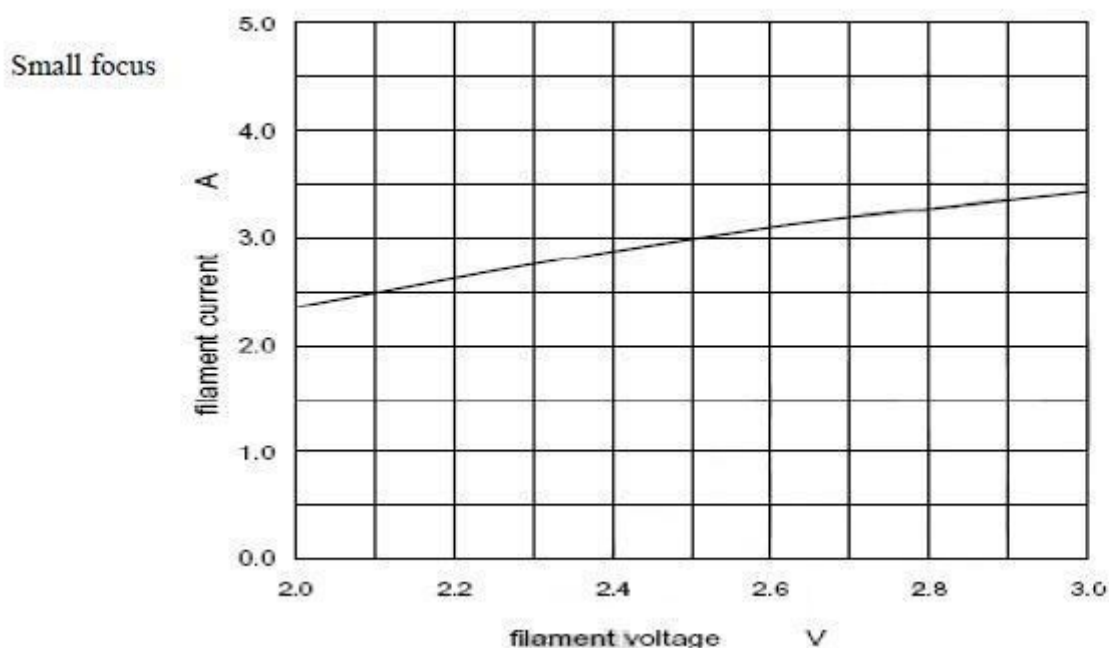
1.1.12 Maximum continuous cooling rate: 600W

1.1.13 The minimum amount of inherent filtration: 0.8mmAl

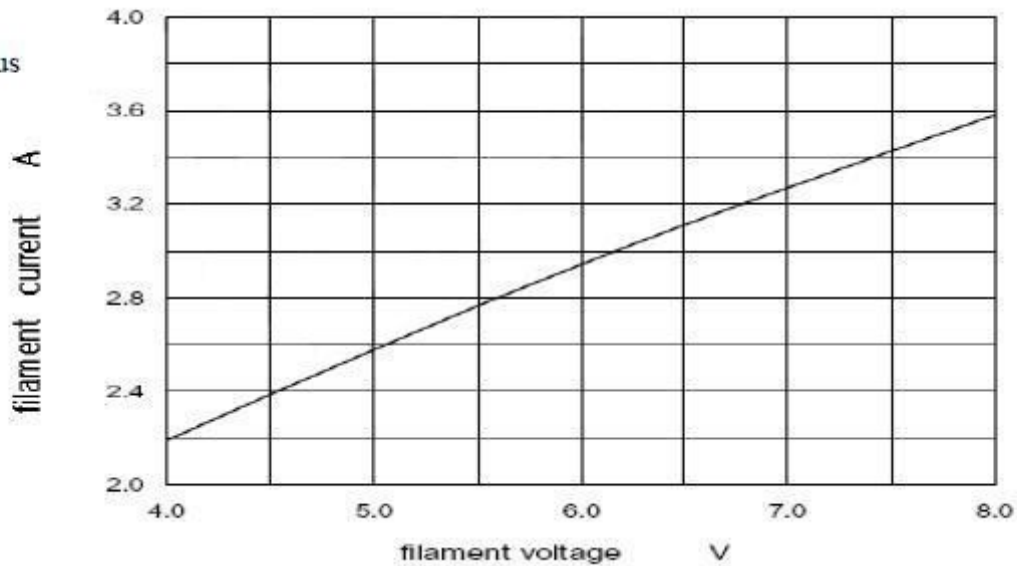
1.1.14 Power supply of high voltage generator: high voltage inverter power supply G101

1.1.15 Power unit of filament: filament module BXF01

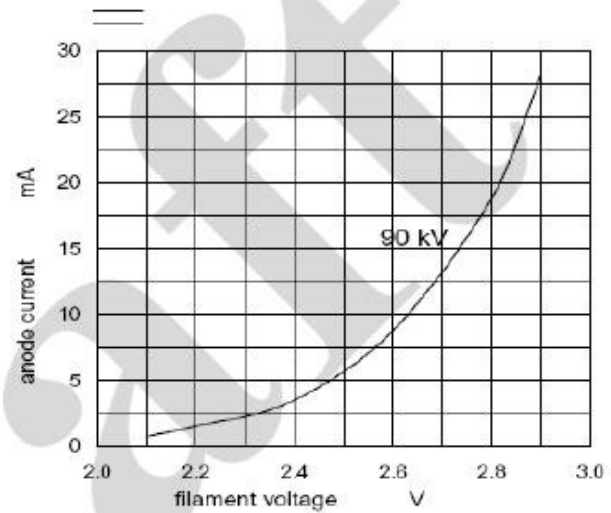
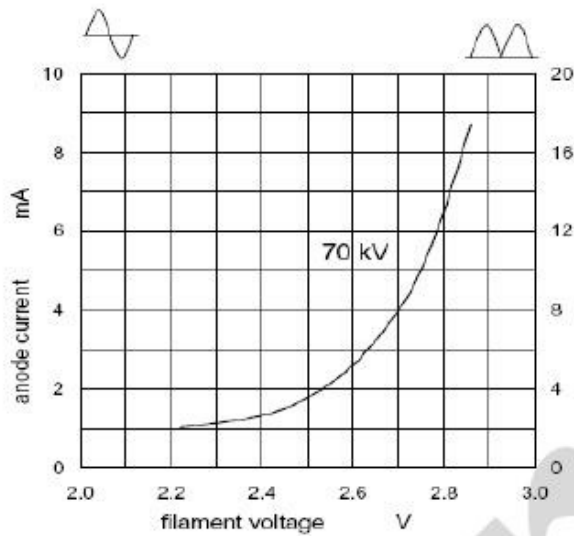
1.1.16 Filament characteristic, filament emission characteristics:



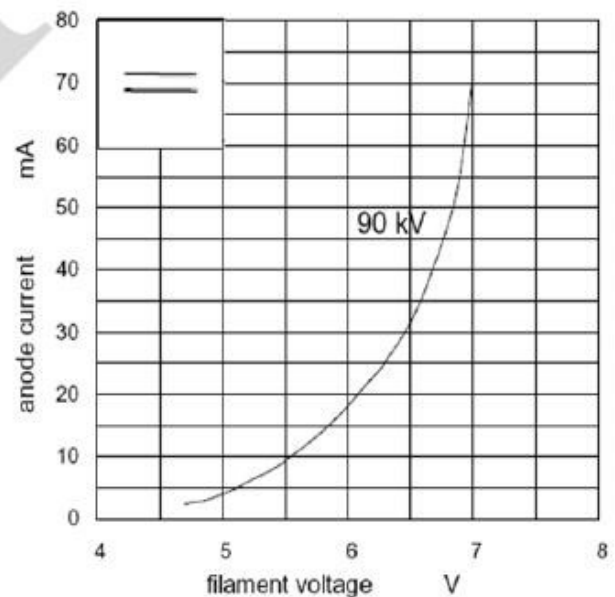
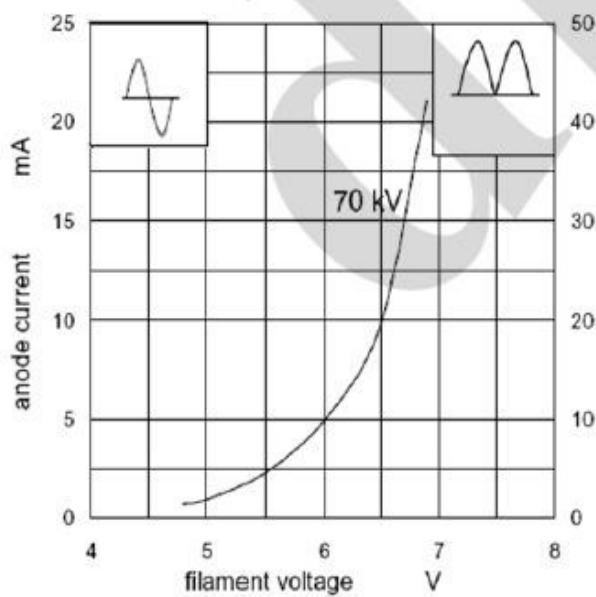
Large focus



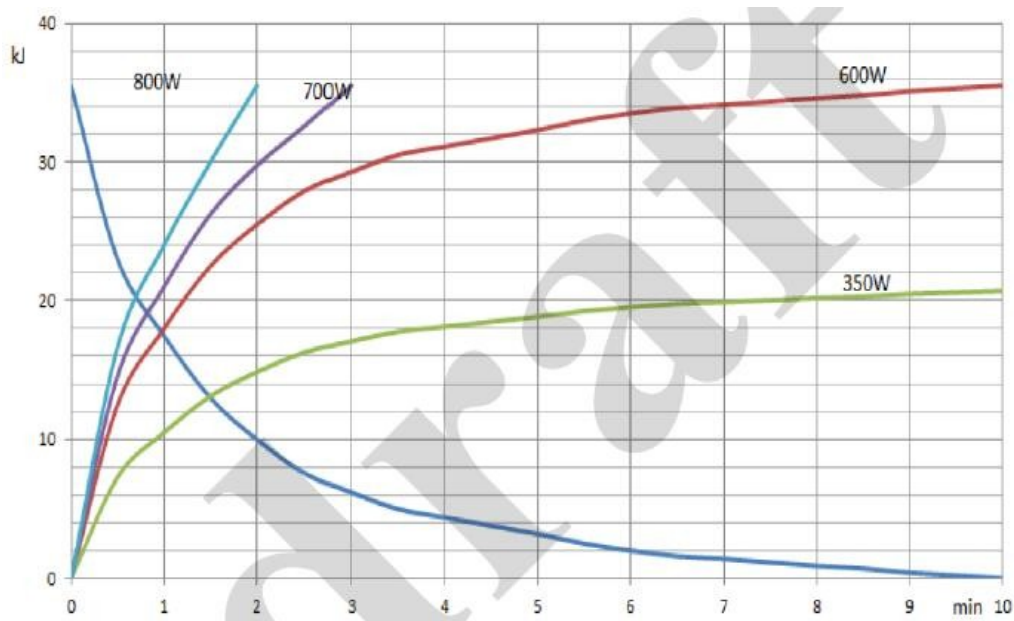
Small focus



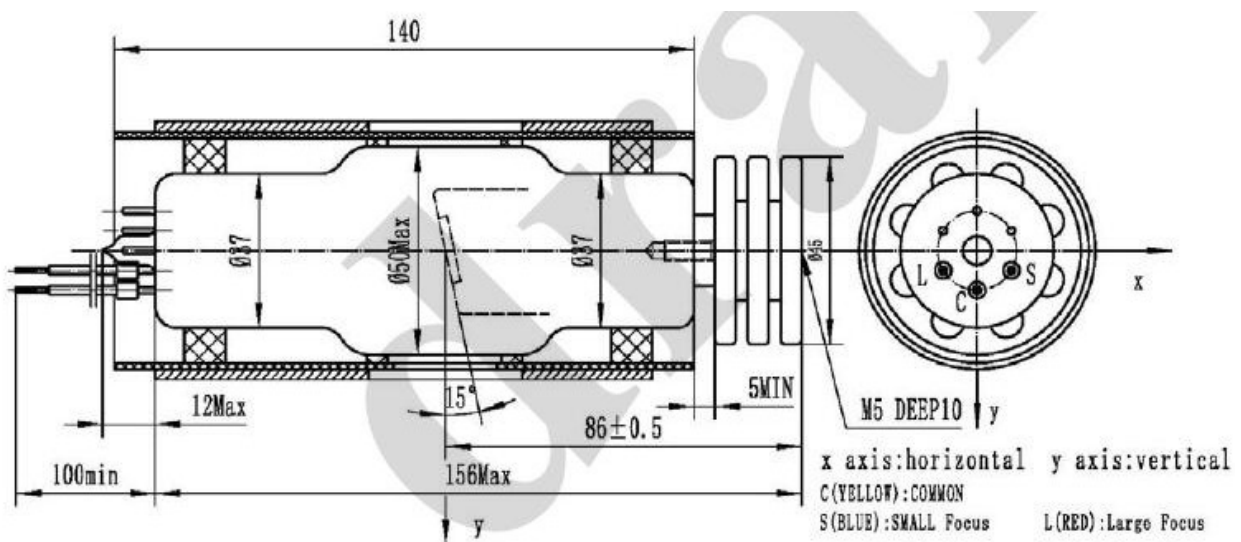
Large focus



1.1.17 Anode heating cooling curve



1.1.18 Overall dimension



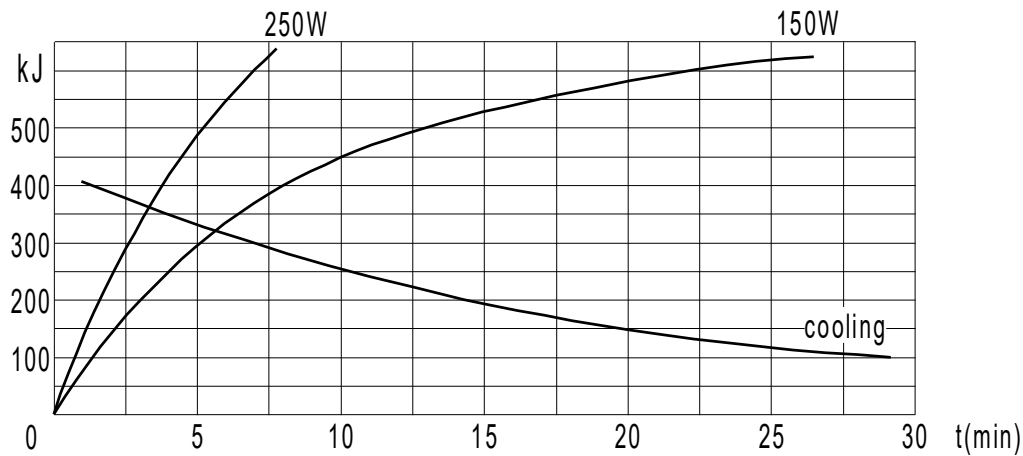
1.2 X-ray tube assembly

1.2.1 X-ray tube assembly model: 102B

1.2.2 Maximum continuous cooling rate: 60W

1.2.3 Maximum heat capacity: 650kJ (867kHu)

1.2.4 X-ray source component heating and cooling curve refer to following figure



1.2.5 Target angle: 15°

1.2.6 Standard axis: the midperpendicular through x-ray source assembly window

1.2.7 The angle between target and standard axis: 15°

1.2.8 Division: Class I type B

1.2.9 Cooling medium: transformer oil; Cooling method: natural cooling

1.2.10 Running mode: intermittent load, work continuously

1.2.11 Baseline loading conditions: 120kV, 2mA

1.2.12 Stated maximum input energy per hour: 400mAs

1.2.13 Leakage radiation in loading status: running under standard loading status based on maximum input energy per hour, one meter from focus, 100cm² cover area, the average air kerma shall not exceed 1.0mGy/h.

1.2.14 Weight of x-ray tube assembly: 21kg

1.2.15 X-ray source components of the total filtration: ≥2.5mmAl

1.2.16 Nominal x-ray tube voltage: 120kV

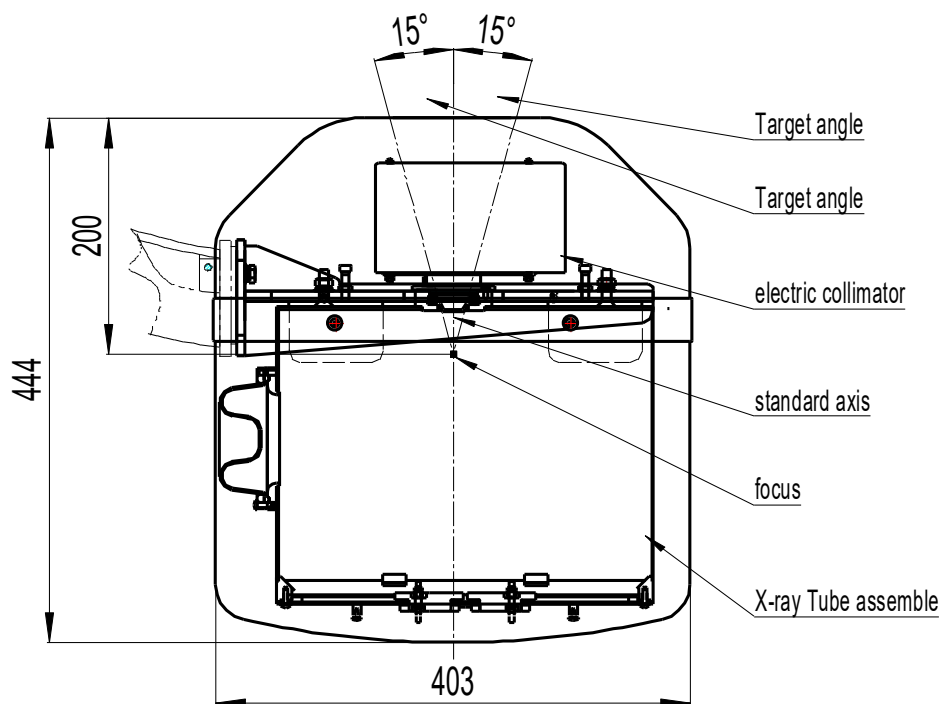
1.2.17 Power supply of high voltage generator: high voltage inverter power supply G101

1.2.18 Power unit of filament: filament module BXF01

1.2.19 Condition of transportation and storage

- a) Environmental temperature of packed x-ray tube assembly should be:
 $-20^{\circ}\text{C} \sim +60^{\circ}\text{C}$, relative humidity: 10% ~ 100% non-condensable gases,
 atmospheric pressure: 500hPa ~ 1060hPa in door.
- b) Transport requirement according to the contract order.

1.2.20 Size:



1.2.21 Electrical connection: refer to the attached general wiring.

1.3. Collimator

1.3.1 Motor voltage: DC12V

1.3.2 Maximum radiation field: $\phi 230\text{mm}$ (SID: 1000mm)

1.3.3 Weight of collimator: 2kg

1.4 X-ray source assembly

1.4.1 Target angle: 15°

1.4.2 Basic shaft: the midperpendicular through x-ray source assembly window

1.4.3 The angle between target and basic shaft: 15°

1.4.4 The tolerance between focus and basic shaft: $<1\text{mm}$

1.4.5 Focus nominal value: 0.6/1.8

1.4.6 The equivalent inherent filtration: $\geq 3\text{mmAl}$

1.4.7 The radiation field: on the surface of image receiver, the maximum radiation field of x-ray which have been limited by collimator is $\phi 230\text{mm}$, any size of round and rectangle which is less than $\phi 230\text{mm}$ can be adjust by the button on control panel. The larger radiation field is, the larger SID. Depend on the requirement of photography, it is better to keep the SID larger, keep the body as close to the film as possible.

1.5 Laser

1.5.1 Usage

The laser of this Product is a cross laser made up of two linear lasers.

The laser trigger button is on the external side of the X-ray tube shell. The laser can be ignited by pressing this button. The laser can keep on about half a minute.

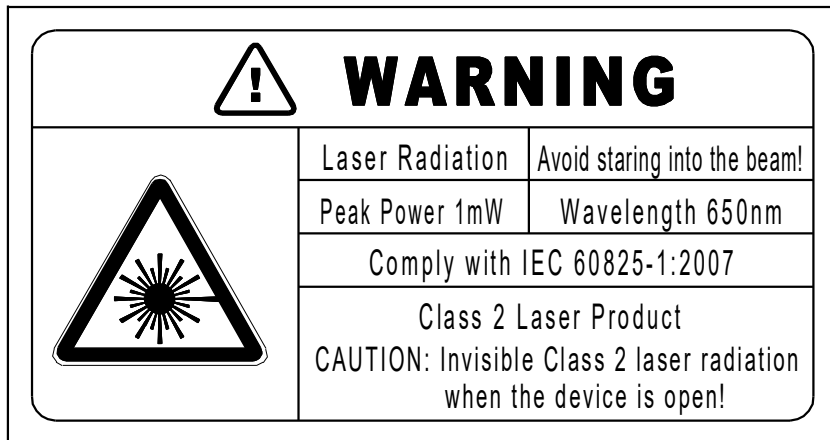
1.5.2 Adjustment

Normally, the cross center projected by the laser is located in the center of the flat-panel detector provided that there is no obstruction. If the laser indication is incorrect and has to be adjusted, please notify professional personnel to adjust.

1.5.3 Warning

Looking straight at laser or putting laser in anyone's eyes shall be avoided.

When laser goes into your eyes, you shall turn your head or close your eyes immediately so as to avoid laser-induced damage.



If this sign appears on the machine, it means laser radiation may hurt the human body. No patient or doctor shall look straight at laser beams. The laser provided for this Machine is Class 2 laser product with emission wavelength of 650nm and maximum output of 1mW.

2. Main inverter

2.1 Power type: single-phase power supply

2.2 Power Supply Voltage: 220V

2.3 Power Frequency: 50/60Hz

2.4 Maximum power output: 5kW

3. C-arm rack

3.1 C-arm sliding along the track: $\geq 120^\circ$, the deviation between indicate value and actual value should be during $\pm 5^\circ$ range.

3.2 C-arm rotates around the horizontal axis: $\geq \pm 180^\circ$, the deviation between indicate value and actual value should be during $\pm 5^\circ$ range.

3.3 Electric Column Lift stroke: $\geq 400\text{mm}$.

3.4 C-arm move forward and backward: $\geq 200\text{mm}$, the deviation between indicate value and actual value should be during $\pm 5\%$ range.

3.5 C-arm rotates around the vertical axis: $\geq \pm 15\%$.

3.6 SID: 1000mm , the deviation should be during $\pm 5\%$ range of standard value.

3.7 Arc depth: 670mm , the deviation should be during $\pm 5\%$ range of standard value.

3.8 Opening size: 760mm , the deviation should be during $\pm 5\%$ range of standard value.

3.9 Main wheel: $\pm 90^\circ$ rotation.

4. The main electrical parameters:

4.1 Maximum output power

The factors which affect the maximum output power

Continuous mode: 120kV , 4mA

Intermittent mode: 50kV , 100mA

4.2 Nominal power supply

Nominal power supply: 4.4kW , the corresponding load factor is 100kV , 4.5mAs (44mA , 0.102s)

4.3 Nominal tube voltage and corresponding maximum tube current

4.3.1 Intermittent mode: 120kV , 25mA

4.3.2 Continuous fluoroscopy mode: 120kV , 4mA

4.3.3 Pulse fluoroscopy mode: 120kV, 15mA

4.4 Nominal tube current and corresponding maximum tube voltage

4.4.1 Intermittent mode: 100mA, 50 kV

4.4.2 Continuous fluoroscopy mode: 4mA, 120 kV

4.4.3 Pulse fluoroscopy mode: 30mA, 70 kV

5. Load factor

5.1 Fluoroscopy mode

5.1.1 X-ray tube voltage

Adjust range: 40kV ~ 120kV continuously adjustable, step length 1kV.

Deviation of X-ray tube voltage should be no more than 10%.

5.1.2 X-ray tube current

The adjusting range of fluoroscopy tube current: continuous fluoroscopy: 0.3mA ~ 4.0mA, pulse fluoroscopy: 0.3mA ~ 30mA; adjusting method: continuous adjustable, between 0.3mA~8mA the step length is 0.1mA, between 8mA~30mA the step length is 1mA.

Deviation should be no more than 20%.

5.1.3 Pulse fluoroscopy load factors combination

kV range	Pulse fluoroscopy mA range
40kV~70kV	0.3mA~30mA
71kV~100kV	0.3mA~20mA
101kV~120kV	0.3mA~15mA

5.2 Photography Mode

5.2.1 X-ray tube voltage

Adjust range: 40kV ~ 120kV is continuously adjustable, length is 1kV.

Deviation should be no more than 10%.

5.2.2 mAs

Adjust range of mAs is 1mAs ~ 180mAs, adjust method: select from R'20 series, classified into 46 groups. Data of each group are as following:

1, 1.1, 1.25, 1.4, 1.6, 1.8, 2, 2.2, 2.5, 2.8, 3.2, 3.6, 4, 4.5, 5, 5.6, 6.3, 7.1, 8.0, 9, 10, 11, 12.5, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 71, 80, 90, 100, 110, 125, 140, 160, 180.

deviation $\leq \pm(10\%+0.2\text{mAs})$.

5.2.3 Radiography Mode Loading Factors Combination (Factory Set)

Voltage range	Loading tube current	Max exposure allowed	Voltage range	Loading tube current	Max exposure allowed
40~50kV	100mA	180mAs	81~90kV	50mA	100mAs
51~60kV	80mA	140mAs	91~100kV	44mA	63mAs
61~70kV	63mA	125mAs	101~110kV	32mA	40mAs
71~80kV	56mA	110mAs	111~120kV	25mA	32mAs

(Attention: there is no degradation between patient and image intensifier, however, if you use other assemblies (like operating table), it may cause degradation of x-ray, so that the operator should increase the parameters according to the reality)

V. Dimension and Weight

1. Dimension

Frame dimension: 177cm*82cm*194cm

Workstation dimension: 74cm*65cm*179cm

2. Net Weight

Net Weight: 335kg

VI. Installation and Adjustment

1. Notes

After opening the wooden packing, please read the operating manual carefully before installing the equipment. Remember to check and verify the accessories one by one according to the packing list. In case the equipment does not conform to the packing list or damage is found, please do not hesitate to contact our staff.

The working place for use, installation, and adjustment of this equipment should be equipped with power socket for power supply condition in line with operating manual, and connection for reliable protective ground wiring.

2. Installation

Take the hand switch connection, pedal switch connection, power supply connection, and protective ground wires out of the accessory case. Then

connect them according to the outside identification marking, and check whether all the sockets are reliable and whether the screws and screw caps are loose.

3. Adjustment

3.1 The unit has been adjusted by high precision instruments when leaving factory. However, owing to some reasons (like transportation, etc), the following checks and adjustments have to be performed after installation to ensure safe operation and maximum efficiency.

3.2 If there is no fault, power on the equipment, and turn on the workstation computer and monitor, examine whether the displays are normal and adjustment knobs are working regularly, at the same time, perform relevant adjustments and checks.

3.3 Inspect whether extending of auxiliary arm, ascending and descending of C-arm, and control state of restrictor are working regularly.

3.4 Press manual fluoroscopic mode in work mode selection interface. Adjust the kV value to 45kV, the mA value to 0.3mA. By stepping on Pedal switch, the X-ray indicator lamp (yellow) will light on  .

3.5 Power on the LCD screen, and adjust brightness and contrast knob to make the screen brightness properly. By stepping on the pedal switch, a bright circle will be shown on the LCD screen.

3.6 Enter into continuous fluoroscopy automatic mode, FLUORO kV and mA value will be adjusted automatically. step on pedal switch, the image on LCD

screen will adjust to certain brightness automatically.

3.7 Press pulse fluoroscopic mode, adjust the kV value to 45kV, the mA value to 4.1mA. By stepping on Pedal switch, the X-ray indicator lamp (yellow) will light on.

3.8 Photograph work mode: choose proper kV, mAs value according to different body parts. Press the touch screen key Enter or hand switch first gear, then press second gear of hand switch, the indicator lamp on control console will light after two seconds to remind that the unit is ready; the indicator lamp is green color. Press the hand switch, start exposure, the ready lamp go off, and the exposure lamp light on .after the exposure or loosen the hand switch in advance to finish the exposure, the x-ray indicator lamp go off, buzzer buzz twice. After the exposure, the equipment will test the heat capacity values and the time that you can do the next exposure automatically, the “HU” symbol will twinkle, the next exposure is available only if the twinkle finished.

VII. Use and Operation

1. Operation Summary

1.1 Control Panel



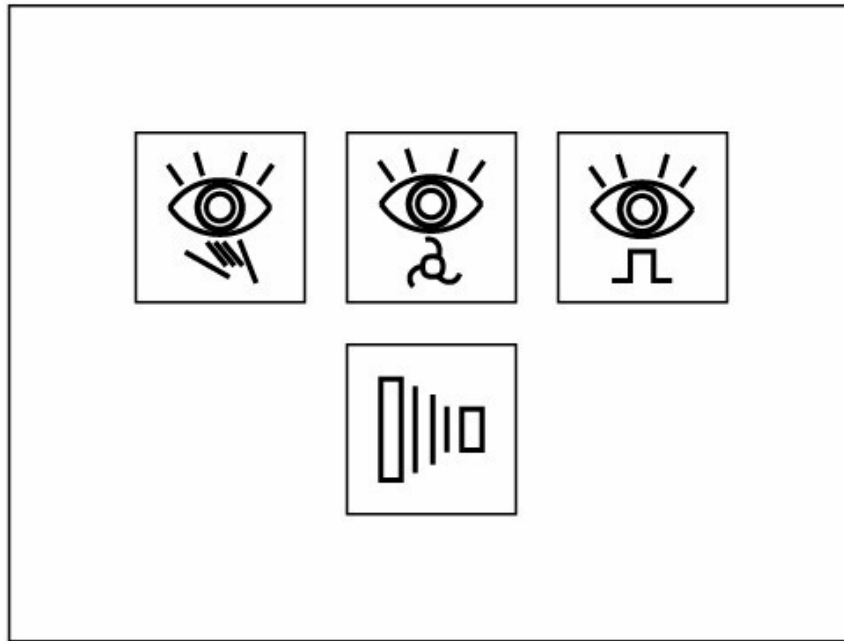
1.1.1 Definition of Function Keys

Button	Function
	Power on
	Power off
	Motor up Motor down
	X-ray ready indicator (green)
	X-ray source indicator (yellow)
	Alarm indicator (red)
	Collimator zoom in (left) and zoom out (right)
	Collimator open (left) and close (right)
	Collimator counterclockwise rotation (left) and clockwise rotation (right)

1.2 Start-up interface and working mode selection interface

1.2.1 Turn circuit breaker to ON position, press to enter into the work

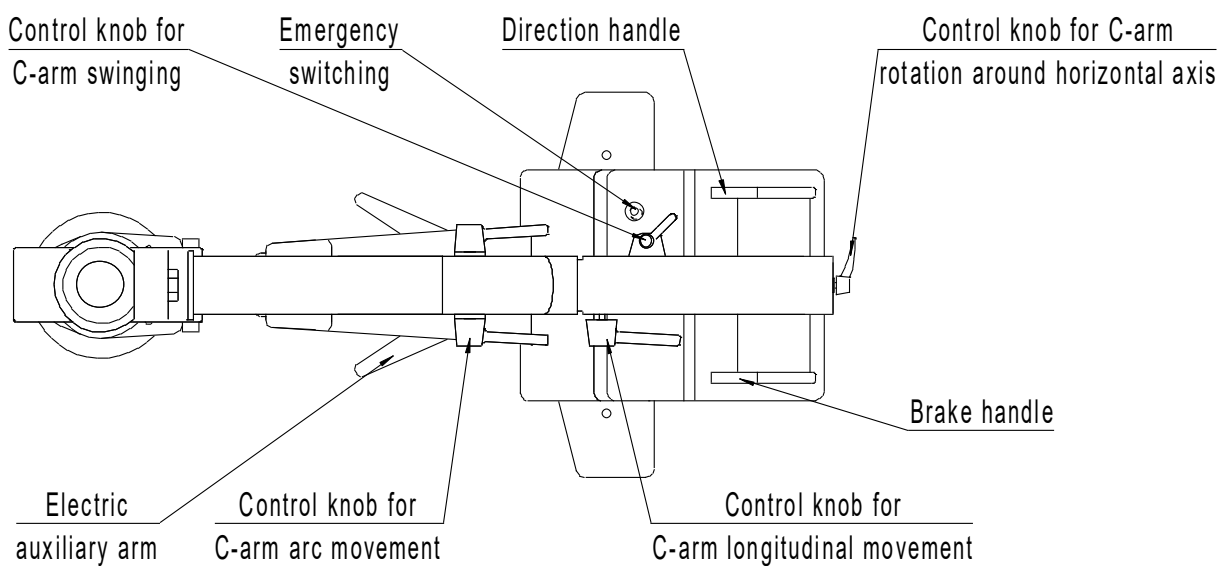
mode selection interface.



1.2.2 Work mode selection introduction

Touch screen button	Introduction
	Continuous fluoroscopy manual mode
	Continuous fluoroscopy automatic mode
	Pulse fluoroscopy mode
	Photography mode

1.3 C-arm positioning



1.3.1 According to the icons on control knobs, rotate each control knob first loosely then tightly for C-arm arc movement, C-arm swinging, C-arm longitudinal movement and C-arm rotation around horizontal axis, one by one, to make C-arm move accordingly.

1.3.2 Rotate the control knob for C-arm arc movement loosely, and C-arm will conduct 120° reciprocating arc movement in the slide way of wry-extending arm.

1.3.3 Loosen control knob for C-arm swinging; C-arm can make $\pm 15^\circ$ reciprocating swinging from left to right around the frame pillar. Loosen control knob for C-arm longitudinal movement, C-arm can make 200mm reciprocating straight movement along longitudinal slide way.

1.3.4 Loosen the control knob for C-arm rotation around horizontal axis, C-arm can make free rotation around the axes of slide rail together with wry-extending arm.

1.3.5 Seize direction handle and brake handle, and the equipment can move forward or backward.

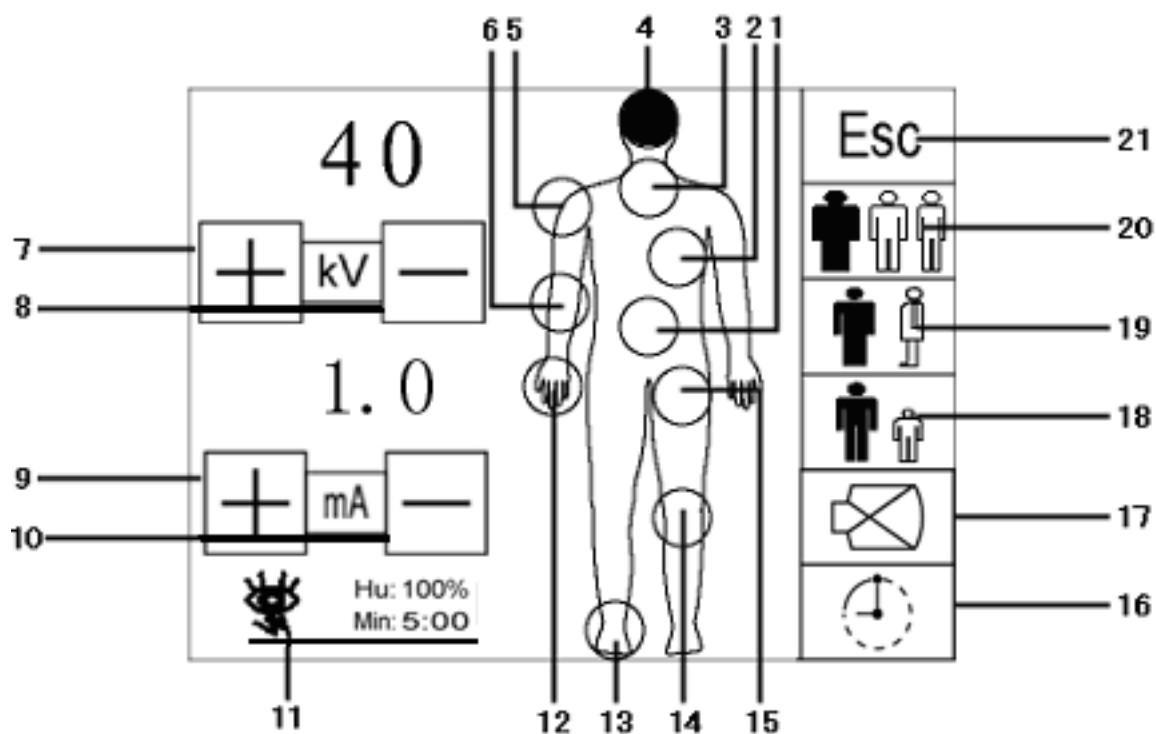
1.3.6 Seize direction handle and make a counter-clockwise rotation of 90°, at the same time, the bottom wheel under the controller will make corresponding movement, and the equipment can move transversely.

1.3.7 Hold brake handle and make a clockwise rotation of 90°, the bottom wheel under the controller will be braked. When the unit is powered on, the electric auxiliary arm spreads to such a degree that it cannot do corresponding movement any longer, the equipment has been located.

2. Fluoroscopy

2.1 Continuous fluoroscopy manual mode

2.1.1 Interface of continuous fluoroscopy manual mode:



2.1.2 The introduction of buttons on touch screen of continuous fluoroscopy manual mode.

Button No.	Function Specification
1	Physical characteristics-abdomen
2	Physical characteristics- cardiopulmonary
3	Physical characteristics-cervical spine
4	Physical characteristics-head
5	Physical characteristics-shoulder
6	Physical characteristics-elbow
7	kV up
8	kV down

Button No.	Function Specification
9	mA up
10	mA down
11	Present work mode (not a button, display only) Heating capacity display (not a button, display only) Countdown display (not a button, display only)
12	Physical characteristics-hand
13	Physical characteristics-foot
14	Physical characteristics-leg
15	Physical characteristics-crotch
16	Fluoroscopy time reset
17	Three view field control
18	Physical characteristics-adult or child
19	Physical characteristics-ortho or lateral position
20	Physical characteristics-fat, plump, normal, relatively thin, thin
21	Return, cancel

2.1.3 During fluoroscopy, buzzer will be voiced when remains 30 seconds, it reminder doctor that this operation has continued for 30 seconds. If needs continue fluoroscopy, then press re-set bottom 16, you can re-set the machine any time while during the operation.

2.1.4 Switch on the LCD screen.

2.1.5 Turn on circuit breaker to power on the machine; machine enters into

working mode interface.

2.1.6 Enter into continuous fluoroscopy manual mode, according to fluoroscopy position, press button 7, 8 to adjust KV. It can be continue adjusted by keep press. Press button 9, 10 to adjust mA, it can be continue adjusted by keep press.

After adjust proper parameters, press foot switch, X-ray lamp will turn light to start fluoroscopy. Release foot switch to complete fluoroscopy, x-ray lamp go off, the LCD screen will display the last image and this image can be processed on the work station.

2.1.7 Exit work mode: press return button 21 at present work mode to return to the work mode selection interface to choose other work mode.

2.2 Continuous fluoroscopy automatic mode

2.2.1 Continuous fluoroscopy automatic mode interface is similar to continuous fluoroscopy manual mode interface, only difference is the current work mode of button 11. The function of the touchable screen is the same as continuous fluoroscopy manual mode.

2.2.2 Enter into continuous fluoroscopy automatic mode; it is no need to adjust kV and mA under this mode. Meanwhile, the equipment can adjust KV and mA automatically according to different positions. Press the pedal switch and you can see the fluoroscopy position very clearly. Other operations and image processing is the same as continuous fluoroscopy manual mode.

2.3 Pulse fluoroscopy mode

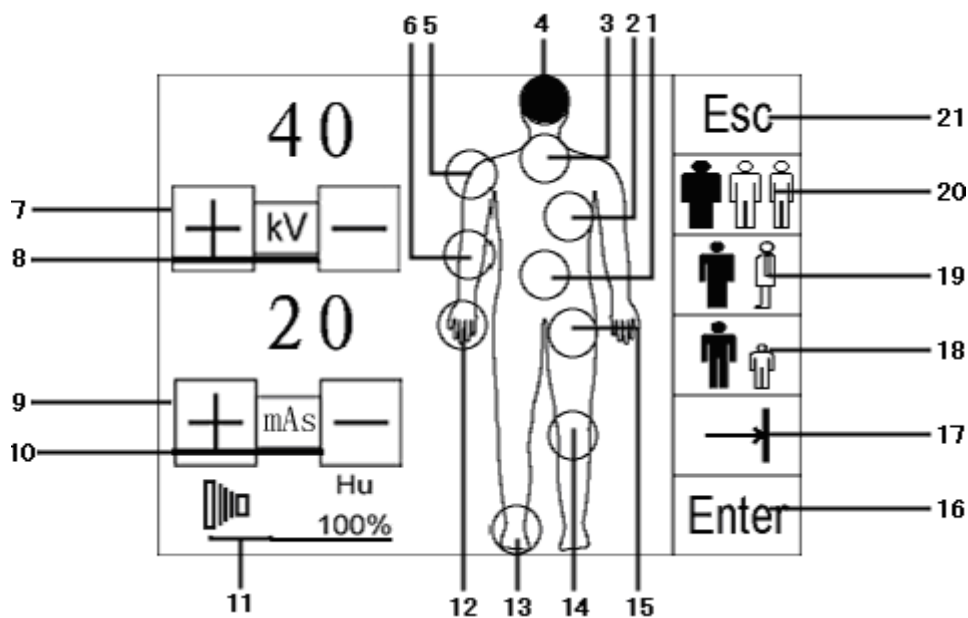
2.3.1 Interface of pulse fluoroscopy mode is similar to continuous

fluoroscopy manual mode, only difference is current work mode of button 11. The function of the touchable screen is the same as continuous fluoroscopy manual mode.

2.3.2 Enter into pulse fluoroscopy mode, detail operation and image processing method is same as continuous fluoroscopy manual mode.

3. Photography

3.1 The interface of photography work mode is as following:



3.2 Introduction of LCD touch screen button under photography mode

Button No.	Function Specification
1	Physical characteristics-abdomen
2	Physical characteristics- cardiopulmonary
3	Physical characteristics-cervical spine
4	Physical characteristics-head
5	Physical characteristics-shoulder

Button No.	Function Specification
6	Physical characteristics-elbow
7	kV up
8	kV down
9	mAs up
10	mAs down
11	Present work mode (not a button, display only) Heating capacity display (not a button, display only)
12	Physical characteristics-hand
13	Physical characteristics-foot
14	Physical characteristics-leg
15	Physical characteristics-crotch
16	Enter, confirm
17	Physical characteristics-parameter save
18	Physical characteristics-adult or child
19	Physical characteristics-ortho or lateral position
20	Physical characteristics-fat, plump, normal, relatively thin, thin
21	Return, cancel

3.3 Radiography operation

Press button 7 and 8 to adjust kV, press button 9 and 10 to adjust mAs, keep pressing the button for continuous adjustment. You can also choose proper kV and mAs value according to radiography human parameter list.

Press button 16, the X-ray ready lamp will light on after two seconds to indicate the equipment has ready. Re-press the hand switch, ready lamp will go off, radiography starts. X-ray indicator lamp light on at the same time; Radiography completes or release the hand switch in advance to finish the exposure, x-ray indicator lamp go off and buzzer twice.

After exposure, the equipment detects the temperature, calculates the value of the heating capacity and the interval of next exposure automatically. The sign “Hu” flashes until the next exposure is available.

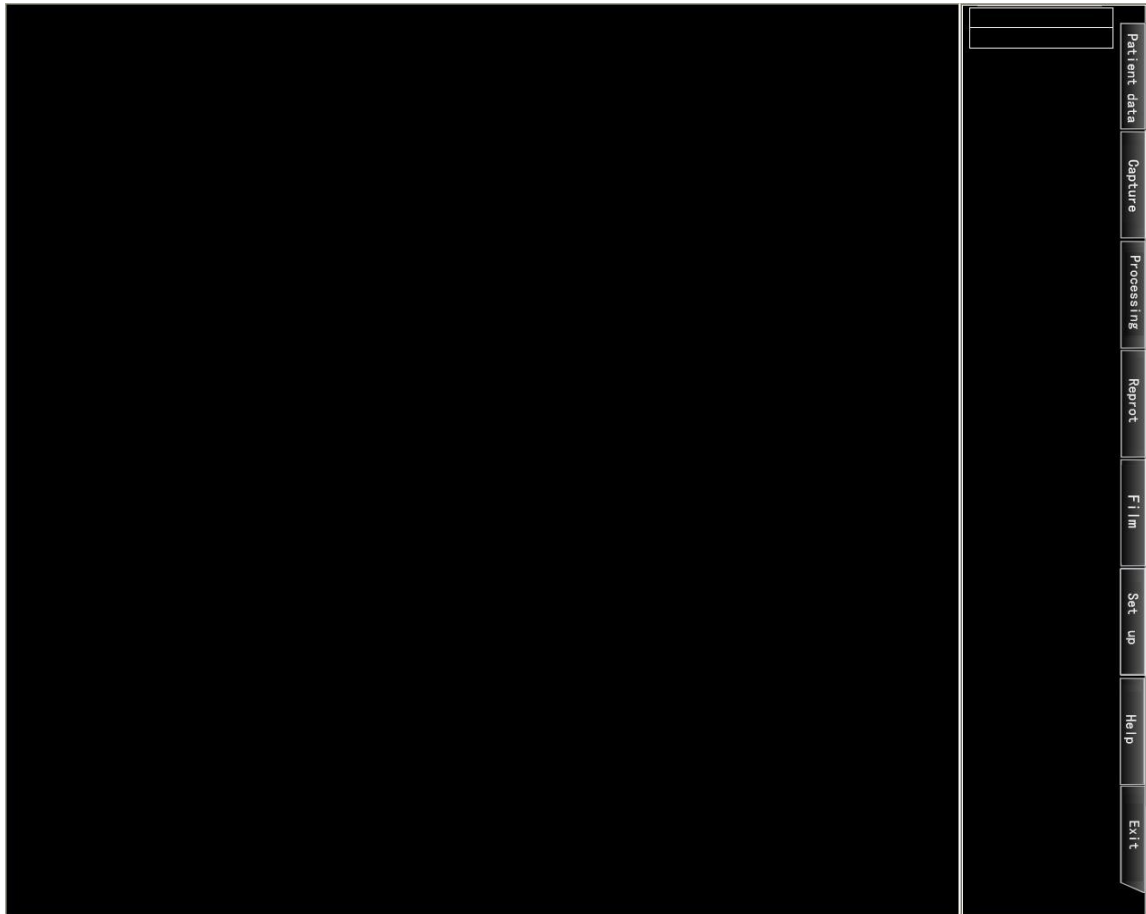
3.4 Modification of the physical radiography parameters

Choose the appropriate physical characteristics, including adult and child, normal position and cross position, sites and body shape. Then adjust kV and mAs, press button 17 physical characteristics- parameter reservation, press button 16 to confirm the reservation or press button 21 to exit the reservation.

4. Image process

The C-arm Image Workstation Software is the operating software installed on C-arm high frequency mobile surgical X-ray system. This software is a permanently installed diagnostic system intended to generate and control X-rays for examination of various anatomical regions. This workstation software has a number of medical applications, such as registering patients, acquiring images, viewing images, writing and printing diagnostic report, DICOM file sending, DICOM film printing, database backup and restore, etc,

which provide an effective means to manage medical image information for hospitals.



The detail usage please refer to the “Help” document in workstation software.

VIII. Safety Precautions

1. General Rules

The unit belongs to radiative unit and must only be used in compliance with the instructions indicated in this manual and not be used for other purposes other than medical fluoroscopy and radiography. Any improper operations will lead to damages to the equipment. The unit must only be used by personnel with the necessary knowledge in the field of radiation and

necessary training in use of x-ray units. Pay special attention to following notes:

- a) Ensure that there are no other people or obstruction within the range of the equipment mechanical movement so as to prevent damage to the equipment or people. After the orientation of the equipment is set, press the emergency off switch.
- b) The equipment should not be used unless the electric or mechanical faults have been eliminated.
- c) The equipment must be assembled with protective grounding connection (yellow- green wire) to certain location when operating the unit.
- d) The equipment can't be working in places saturated with vapors and/or flammable gases or explosives.
- e) Any modification to the unit must be approved by the manufacturer or its authorized service person.
- f) Regular inspection and maintenance must be done to the equipment.
- g) Do not overexert the knob and mix the locking and loosening directions.
- h) If the equipment has to be moved, lower the central height of C-arm as much as possible, recover the C-arm to close to the controller side, place X-ray generator close to the ground, to lower the center of gravity of the unit, and lock all the adjusting knobs.
- i) If there is any emergency (for example, the ascending and descending of the pillar are out of control), press the emergency off knob. At this time, certain parts of the power supply are cut off. Revolve the upper cover on

the emergency off knob clockwise after the elimination of the faults to enable it to restore its original position and restore the power supply.

- j) During examine, there need someone to keep watch on the situation of patient to avoid dangerous.
- k) All of the operation need to be operated under the user's manual; do not change the system by yourself.

2. Electric Safety

- a) Make sure the voltage of the electric grid, the input power and the inner resistance of the power supply that the unit is connected comply with power requirements.
- b) The unit must not be used in rooms that contain flammable and /or explosive gases.
- c) Disconnect the unit from the power supply socket before carrying out any cleaning, disinfection and/or sterilization.
- d) Always turn the unit off after use.
- e) Unplug the power cord before moving the device.
- f) The equipment has thermal circuit protection function, when the temperature in X-ray tube is higher than 60°C, it will turn-off automatically and reset after the temperature be normal.
- g) The socket under the workstation can only be used to connect the computer, LCD screen and printer. It can't be put on the floor nor connect the other socket or other instruments that is not the part of the system,

because it may cause fault or even the break of equipment.

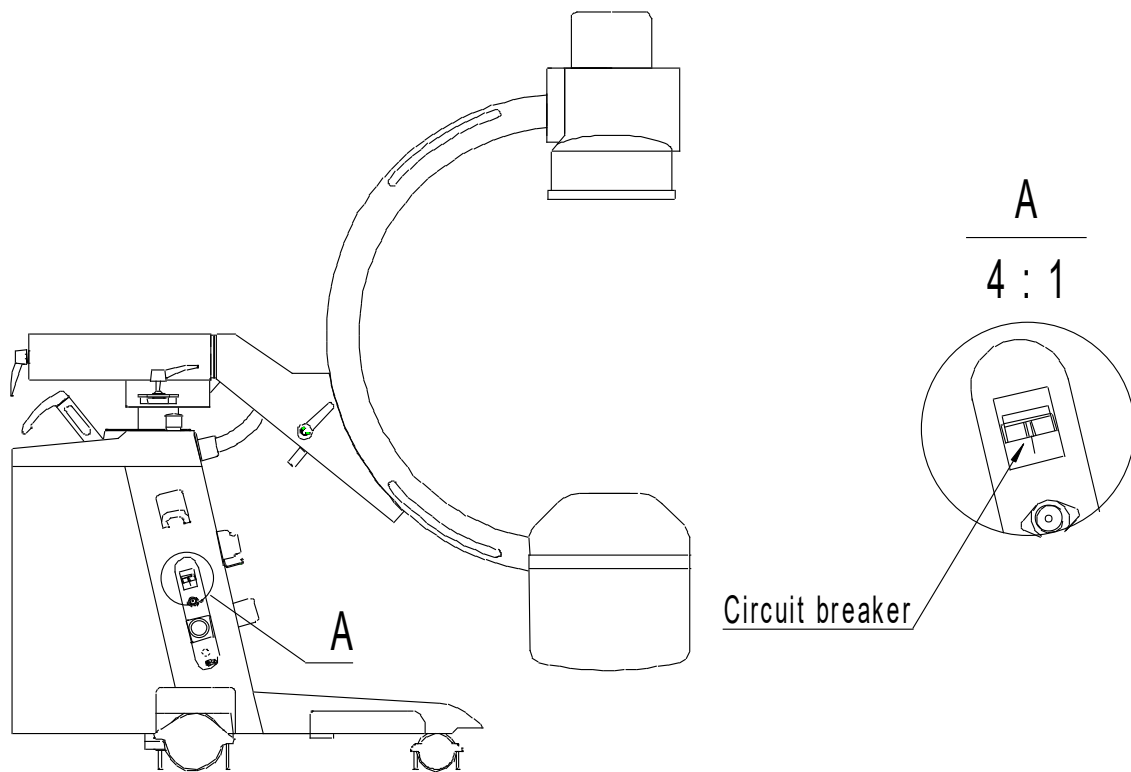


Caution: To protect the equipment from any damage, the unit can only be restarted five minutes later regardless of any reason after the power supply is cut off.

3. Circuit breaker

3.1 Model: DZ47-60.

3.2 The position of circuit breaker refer to the following picture

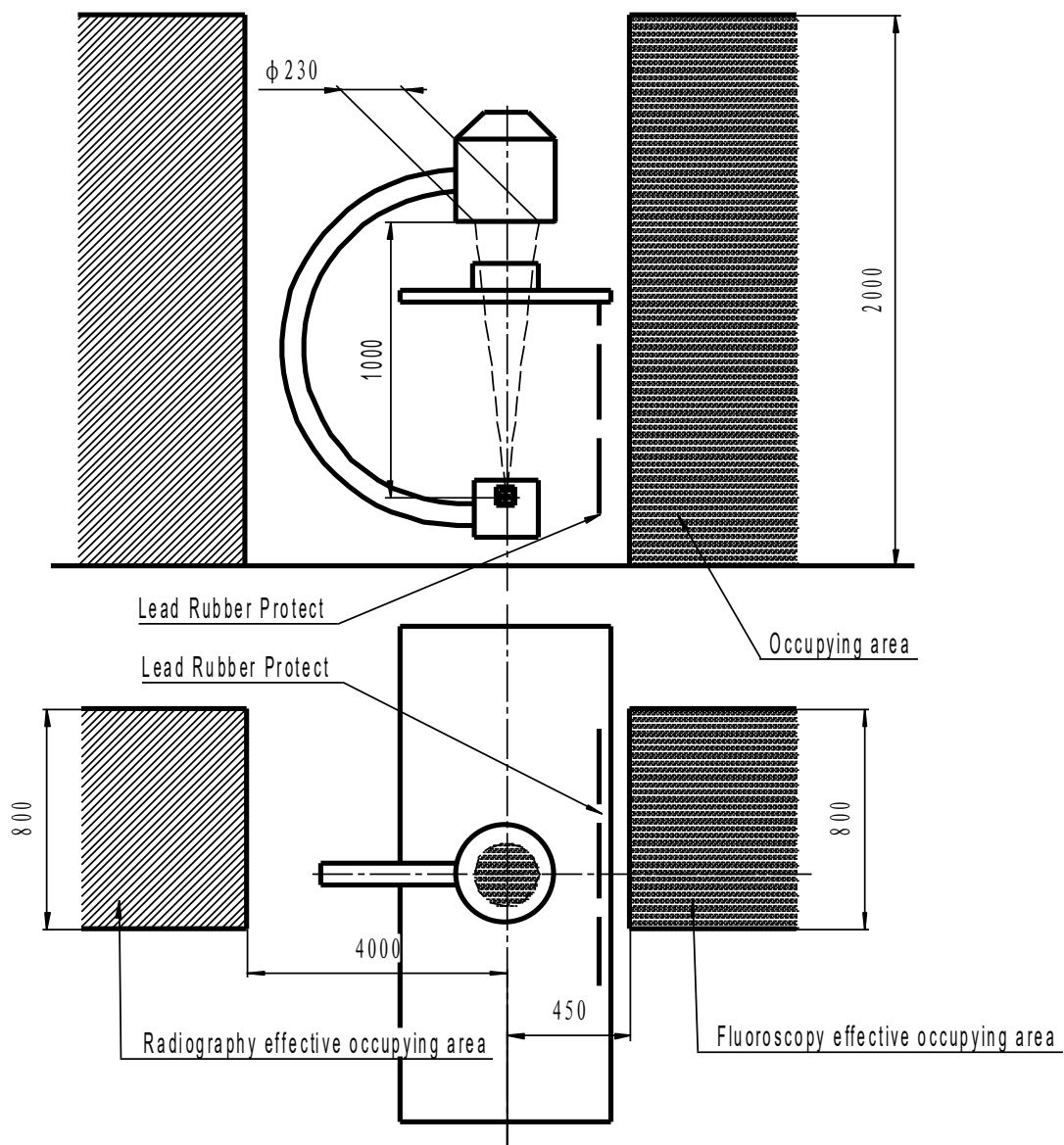


3.3 During the operation, if the circuit breaker shutdown automatically for more than twice continually, do not force to connect it! The correct method is to shut off the power and connect the professional maintenance person immediately.

4. X-ray Safety

Be sure to take precautions from X-ray before each exposure. Keep the following notes in mind:

- Reduce the time in exposure room as much as possible.
- Get away from the x-ray source as much as possible.
- During operation, the operator should take necessary measures to protect against radiation: use protective devices, wear x-ray protective coats, and take radiography in the significant zone of occupancy (refer to following figure) to reduce radiation to the minimum.



- d) Try to increase the total filter: to minimize the vision of radiation field to prevent too large scattering area, low dose exposure is better, it is good to keep longer SID (the distance between focus and patient) and keep the patient as close to image acquisition surface as possible.
- e) Avoid pregnant women and young children getting close to x-ray; if it is necessary to do inspection, the special expert solution need to be considered, decrease the dosage and take care of the radiation proof out of the exposure area.
- f) Take down the glass, removable denture, watch, hair pin and something else out of patient to avoid the image illusion.

5. EMC

5.1 Declaration

This equipment accord with the requirement of EMC standard of medical equipment in YY0505-2012.

This equipment will produce, use and radiate RF energy.

This equipment may cause radio disturbance to other medical equipment, non-medical equipment and telecommunication. In order to prevent this disturb, this equipment complies with radiation limit for Group I, Class A Medical Devices in YY0505-2012. However, we do not promise that this equipment do not disturb the other special devices.

5.1.1 Basic performance

- Adjust load factors to normal, radiography is available

- Image is normal, do not exist artifact or distortion to influence diagnostic.
- Do not has unexpected or uncontrolled alarm or failure.

The use of accessories, transducers, cables and other components made by non equipment manufacturers can lead to the increase of radio frequency emission, or cause the performance of this equipment to weaken. All connections of the peripherals must be shielded and grounded correctly. The use of no shielded or grounded connections may lead to radio frequency interference by the device.

The manufacturer is irresponsible for the use of an unauthorized connection or unauthorized change or modification of the equipment. If the user has made unauthorized changes or modifications, we may cancel the qualification of its operating equipment.

5.1.2 Equipment information

The PLX112B1 is suitable for all non household facilities, as well as all facilities that are not directly connected to the public low voltage grid.

The compatible accessories must be applied to the operating conditions recommended in the manual. Except for debugging and preheating, other equipment must be reset before and after use to ensure accurate measurement. Continuous exposure of the electromagnetic area (over test conditions) may lead to error diagnosis. Failure to comply with the recommendations may result in foggy diagnosis. Electromagnetic interference can be caused by the electromagnetic area environment produced by the nearby MRI equipment.

The above equipment typically installs EMC for this purpose.

5.2 Compatibility table

This equipment accord with the requirement of EMC standard of medical equipment in YY0505-2012.

According to the limitation and advice in table below, PLX112B1 is available in electromagnetic environment as described below.

- Electromagnetic emissions (table 1)
- Electromagnetic immunity (table 2 and table 3)
- The minimum recommended distance of portable/movable RF communication instrument and this equipment (table 4)

Together with the matched cable, this system accord with the requirement of EMC. If you need cables of different length, you can connect with the qualified after-sales representatives.

5.2.1 Guidance and Manufacturer declaration-electromagnetic emissions.

The customer or user of the PLX112B1 should ensure that the equipment is used in the following electromagnetic environment.

Table 1 Electromagnetic emission

Item	Conform		Electromagnetic environment	Remarks
	Test standard	YY0505 level requirements		
Radiofrequency emission	GB4824	Group I, Class A	PLX112B1 uses radiofrequency energy only for its internal functions, so its radiofrequency emission is very low, and it is unlikely to cause any interference to the nearby electronic devices. PLX112B1 is suitable for all non household facilities, as well as all facilities that are not directly connected to the public low voltage power grid (for household power supply).	

Harmonic distortion	GB/T 17625-1 IEC 61000-3-2	inapplicability	The PLX112B1 power supply system is not connected to the residential low voltage power supply network by non household and not directly connected to the residential low voltage power supply network, and it will not interfere with the residential electricity.	
Voltage fluctuation and flicker	GB/T 17625-2 IEC 61000-3-3,11	inapplicability	The PLX112B1 power supply system is not connected to the residential low voltage power supply network by non household and not directly connected to the residential low voltage power supply network, and it will not interfere with the residential electricity.	

5.2.2 Guidance and Manufacturer declaration-electromagnetic immunity

According to the test method of YY0505, in the immunity type test simulated in the laboratory, the essential performance of the system was unaffected and no artifact or ghost, no unexpected movement, no communication outage or false alarm arose.

Table 2 Electromagnetic immunity

Item	Test level		Conforming to the level	Remarks
	Test standard	YY0505 level requirements		
Electrostatic discharge immunity	GB/T 17626-2 IEC 61000-4-2	$\pm 8\text{kV}$ air	$\pm 8\text{kV}$ air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
		$\pm 6\text{Kv}$ contact	$\pm 6\text{Kv}$ contact	
Anti disturbance of electric rapid transient pulse group	GB/T 17626-4 IEC 61000-4-4	$\pm 2\text{kV}$ for power supply lines	$\pm 2\text{kV}$ for power supply lines	Mains power quality should be that of a typical commercial or hospital environment.
		$\pm 1\text{kV}$ for input/output lines(less than 3 meters not applicable)	$\pm 1\text{kV}$ for input/output lines	

Item	Test level		Conforming to the level	Remarks
	Test standard	YY0505 level requirements		
Surge protection immunity	GB/T 17626-5 IEC 61000-4-5	±2kV line(s) to line(s) ±1kV line(s) to line(s)	±2kV line(s) to line(s) ±1kV line(s) to line(s)	The quality of power should be standard commercial or medical use power
Voltage sags and interruption immunity	GB/T 17626-11 IEC 61000-4-11	<5%UT, (>95% dip in UT) for 0.5 cycle 40%UT, (60% dip in UT) for 5 cycle 70%UT(30% dip in UT) for 25 cycle <5%UT, (>95%% dip in UT) for 5 s	—— <5%UT, (>95%% dip in UT) for 5 s	The quality of the network power supply should be the typical commercial or hospital power environment quality. If the user needs to continue to work during the network power interruption, it is recommended to use uninterrupted power or battery.

Note: the above is only the type of test data, the actual situation may be changed.

Table 3 Electromagnetic immunity

Item	Test level		Conforming to the level	Remarks
	Test standard	YY0505 level requirements		
Transmission harassment of radio frequency field induction	GB/T 17626-6 IEC 61000-4-6	150KHz-80MHz 3V(effective value)	150KHz-80MHz 3V(effective value)	The portable and mobile radio frequency communication equipment and any part of PLX112B1 (including cable) should not be less than the recommended interval distance calculated according to the following formula. Recommended separation distance: $d=1.2\sqrt{P}$ $d=1.2\sqrt{P}, 80\text{MHz}\text{至}800\text{MHz}$ $d=2.3\sqrt{P}, 800\text{MHz}\text{至}2.5\text{GHz}$ Attention: P is the maximum output power rating of the transmitter of watts (W) according to the transmitter manufacturer. D is the recommended separation distance in meters (m) Field strengths from fixed RF transmitters, as
radiated susceptibility	GB/T 17626-3 IEC 61000-4-3	80MHz-2.5GHz 3V/m	80MHz-2.5GHz 3V/m	
Interference degree of power frequency magnetic field	GB/T 17626-8 IEC 61000-4-8	3A/m	3A/m	

Item	Test level		Conforming to the level	Remarks
	Test standard	YY0505 level requirements		
				determined by an electromagnetic site survey, should be less than the compliance level in each frequency range. Interference may occur in the vicinity of equipment marked with the following symbol: 

① 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 PLX112B1 is used exceeds the applicable RF compliance level above, the PLX112B1 should be observed to verify normal operation, if abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the PLX112B1.

② Over the frequency range 150kHz to 80MHz, field strengths should be less than 3V/m.

③ These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

5.2.3 The recommended distance of electromagnetic immunity

The PLX112B1 is intended for use in an electromagnetic environment in

which radiated RF disturbances are controlled. The customer or the user of the PLX112B1 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the PLX112B1 as recommended below, according to the maximum output power of the communications equipment.

Table 4 Recommended separation distances between portable and mobile RF communications equipment and the PLX112B1

power rating of transmitter (W)	Minimum distance according to frequency of transmitter (m)			Remarks
	150kHz~80MHz	80MHz~800MHz	800MHz~2.5GHz	
	$d=1.2\sqrt{P}$	$d=1.2\sqrt{P}$	$d=2.3\sqrt{P}$	
0.01	0.12	0.12	0.23	
0.1	0.38	0.38	0.74	
1	1.2	1.2	2.3	
10	3.8	3.8	7.3	
100	12	12	23	

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be determined 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.

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

5.3 Suggestion of operation

This equipment accord with the requirement of EMC standard of medical

equipment in YY0505-2012, PLX112B1 system is suitable for the hospital.

PLX112B1 should not be operated close or staked to other equipment, if necessary, operator should verify the normal work of the equipment.

Keep the recommended distance according to Table 4, and keep the frequency between 150 kHz and 2.5 GHz may reduce the interference on the image, however it is impossible to eliminate all of the disturbances. We can ensure that you can maintain the basic functions of this equipment and acquire steerable x-ray exposure continuously and safely based on this installation and operation requirements.

If you use other unspecified accessories like inverter or cable, it will result in the reduction of EMC of PLX112B1 system.

The medical staffs that in charge of this equipment ought to direct technical person, patient and other people near the equipment to fully comply with the requirements above.

IX. Troubleshooting

1. General Notes

1.1 Troubleshooting in this manual is aimed at resolving the ordinary faults in the X-ray unit. As for the faults in video system, please refer to relevant operating manual.

1.2 If there is any X-ray operation during repair, the operators should wear X-ray protective garments and protective glasses to minimize the X-ray

damages to people. To avoid safety accident, a single person is not allowed to operate the unit during repair in principle.

1.3 During the repair of image intensification video system and high voltage generator device, operate the equipment with great care, not only because they are expensive and fragile but also there is high voltage danger.

1.4 Never touch the circuit board with electric iron or screwdriver when the equipment is powered on.

1.5 Recommend to use oscillograph of above 100MHz during repairs.

1.6 Maintenance should be taken by well-trained & skilled technicians who have read the user's manual thoroughly and mastered the work principles. Otherwise, because of the improper adjustments to some parameters, it will have adverse effects to performance, even permanent damage to the unit.

2. Ordinary Faults in Electrical Parts

2.1 Check the circuit breaker position and power under the condition of power off.

2.2 Power supply the equipment, but the LCD displays nothing during fluoroscopy. Check whether the panel  lamp and indicator lamp of pedal switch is light on. Meanwhile, check the brightness of the LCD.

2.3 If it cannot carry out large dose photograph properly, check whether the electric grid voltage is too low and whether the power supply loop is overloaded.

2.4 If the circuit breaker trip when the equipment is power on, restart the

equipment. If the fault repeats, then the system is in a serious short circuit status.

3. Ordinary Faults in Mechanical Parts

If the ascending and descending of the pillar fail, check the emergency button, check the 24V power supply and the circuitry and electrical push rod.

4. Common x-ray fault

No x-ray, please check the connect condition of x-ray source component.

X-ray can't be controlled, please check the control circuit.

If the machine is in abnormal situation, please shutdown and restart it; after restart, if it is still not work, please connect us.

X. Maintenance

1. Equipment Maintenance Requirements

1.1 The equipment should have regular maintenance.

1.2 The mechanical safety may be reduced resulted from long-term use. Therefore, remember to check periodically whether the mechanical parts are tight and whether the brake device is reliable to protect patients or operators from damages.

1.3 The equipment should be managed by designated personnel, and the managing records should be set up for equipment.

1.4 The operator should receive proper training in order to perform regular inspection.

1.5 Designated personnel should be responsible for cutting off the power supply after operation and work.

2. Equipment Maintenance Schedule

Time intervals	Checking contents
Daily checking	Check whether the display and indicator lamps work regularly.
Weekly checking	Check whether the X-ray assembly leaks oil. Check whether there is abnormal sound during the exposure of X-ray assembly.
Half-yearly checking	Check the earth resistance value of the unit: ($< 0.1\Omega$). Check to eliminate the loosening of fixed screws on mechanical parts. Check the fixation and corruption condition of the circuit board; remove the dust on the surface with cleaner. Check whether the C-arm move freely and whether there is abnormal sound. Check whether all the operation handles works regularly and whether the unit moves freely. Check the center of X-ray tube assembly and the collimator.

3. Clean and Disinfection

It is prohibited to wash the equipment by water to prevent damages to the equipment. When cleanout and disinfection are needed, the power supply should be firstly cut off. Then, wipe the equipment with cotton fabric soaked by scour or disinfectant.



Caution: During the maintenance and checking of the equipment, the power supply must be cut off and the power supply socket must be pulled out. It is prohibited to operate the equipment with power on.

4. Tube test

After installation and before loading equipment for the first time, or before re-operating the equipment after idled for more than 3 months, tube test is necessary to remove the possible air inside the x-ray tube. The procedures are as follows:

- a) Set equipment under manual fluoroscopy mode, and turn off the Collimator. Adjust fluoroscopy mA value to 0.3mA.
- b) Adjust voltage to 50 kV, step down pedal switch to exposure 1 minute.
- c) Gradually increase voltage grade by grade, with each grade increasing by 5 kV and have a 1-minute exposure.
- d) When increasing to max 120 KV, step down pedal switch to exposure 1 minute, the tube test on fluoroscopy completes.
- e) If the tube current appears to be unstable when having an exposure,

decrease tube voltage to have the exposure again until tube current appears to be stable; and under this condition, have the exposure several times in succession to ensure that tube current has been stabilized, and then go on following step c) and d).

f) If everything is in good condition, tube test completes. The equipment can be taken into regular service.

g) If any unusual thing is found, please contact the after-sale service department of our company.



Caution: when undertaking a test, DO NOT adjust mA and kV knobs after stepping on pedal switch.

If any unusual noise is noticed, disconnect power supply immediately and ask specialists to check. DO NOT turn on power supply until the trouble has been eliminated.

XI. Transportation and Storage

1. Transportation

1.1 Transit and protection should be well prepared according to the icons and/or symbols on the package box before transportation.

1.2 During transportation, if the road is in bad condition, the moving speed should not exceed 40km/h.

1.3 During transportation, if there is uneven road present, remember to check if the equipment is loose. Watch out for any collision during

transportation.

1.4 X-ray unit belongs to fragile devices, thus make sure not to collide during transportation, especially the expensive X-ray assembly and image intensifier. Remove and transit it as carefully as possible.

2. Storage

2.1 Environmental temperature: $-20^{\circ}\text{C} \sim +60^{\circ}\text{C}$

2.2 Relative humidity: 10% ~ 100% non-condensable

2.3 Atmospheric pressure: 500 ~ 1060hPa

2.4 The unit must be placed in shadow, dry, moisture-proof, ventilated places and places free of corrosive gas. DO NOT expose it in the open air.

XII. Disposal of the Rejected Machine

If the machine is correctly operated and properly maintained, it can be used for a period of 10 years. If the tube is broken, it can be sent back to our company for exchange with a new one. After the unit has served for 10 years, it may break down and cannot be repaired any more, then, the unit has to be disposed properly. The transformer oil in the x-ray generator has to be recycled by industrial oil recycling department; and the other components made from steels and coppers have to be disposed by the designated departments.

XIII. Quality Guarantee

1. Manufacturer Responsibility

The manufacturer is responsible for unit safety, reliability and performance related quality under the following circumstances:

- a) All the installation, adjustment, changes and maintenance are conducted by our staff or the staff authorized by us.
- b) The electric equipment used for this unit conforms to the technique requirements in this manual.
- c) The operators are well-trained technicians and they strictly operate the unit according to the requirements in this manual.

2. Three Guarantees

- a) Under the circumstance that the users abide by the terms and conditions mentioned above, we will repair the unit or replace the unit parts free of charge, even refund if the unit can't work properly owing to quality reasons within one year from delivery.
- b) If there is any damage resulted from ignorance of the above mentioned terms and conditions or the unit has expired the one-year guarantee period from delivery, we will repair or change the unit parts and accessories for users with moderate charge of the material and labor costs.
- c) We are responsible for the regular maintenance of the unit with proper use within 10 years.

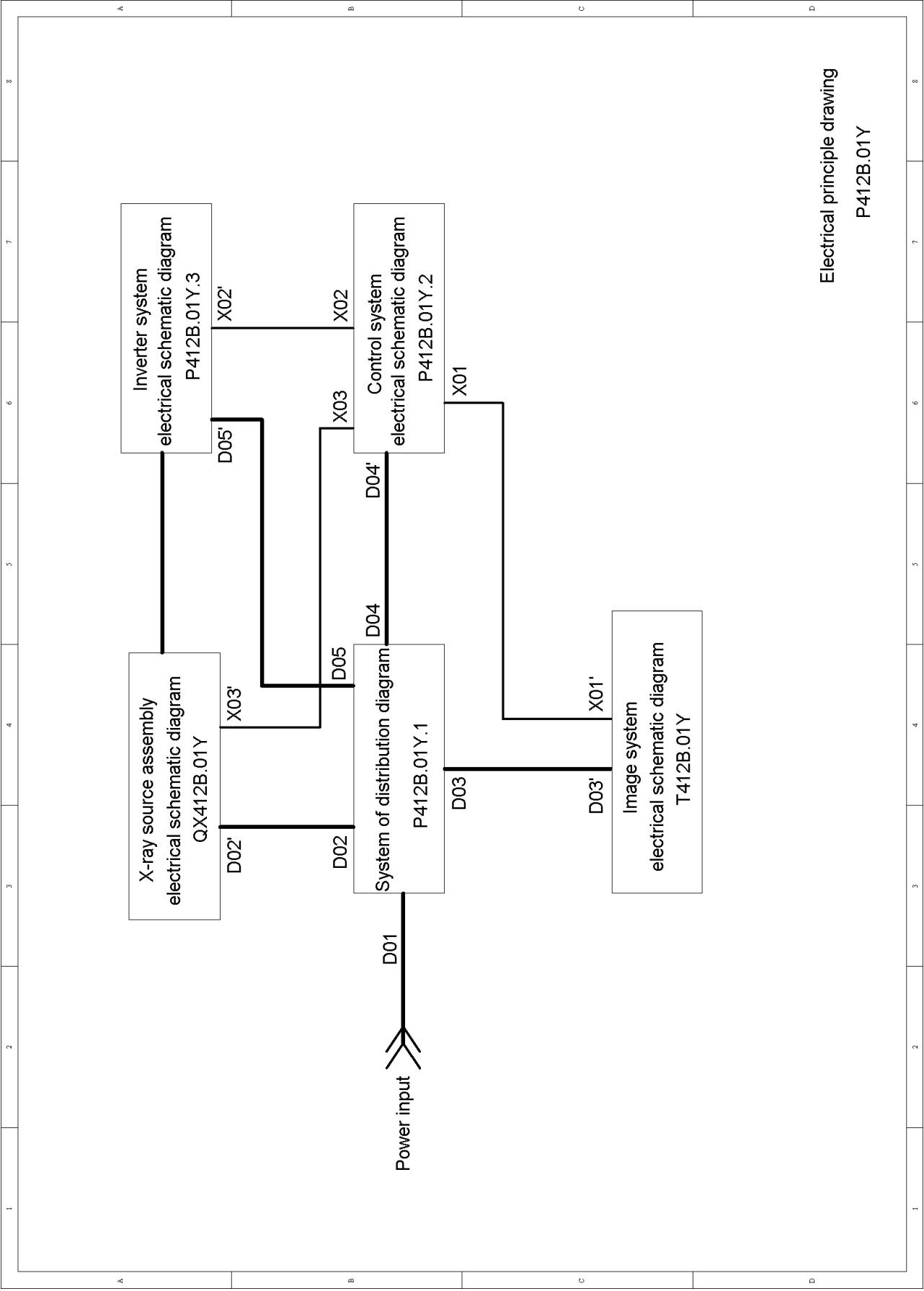
XIV. Appendix – The Overview of Graphs

The following graphs are attached at the end of the manual:

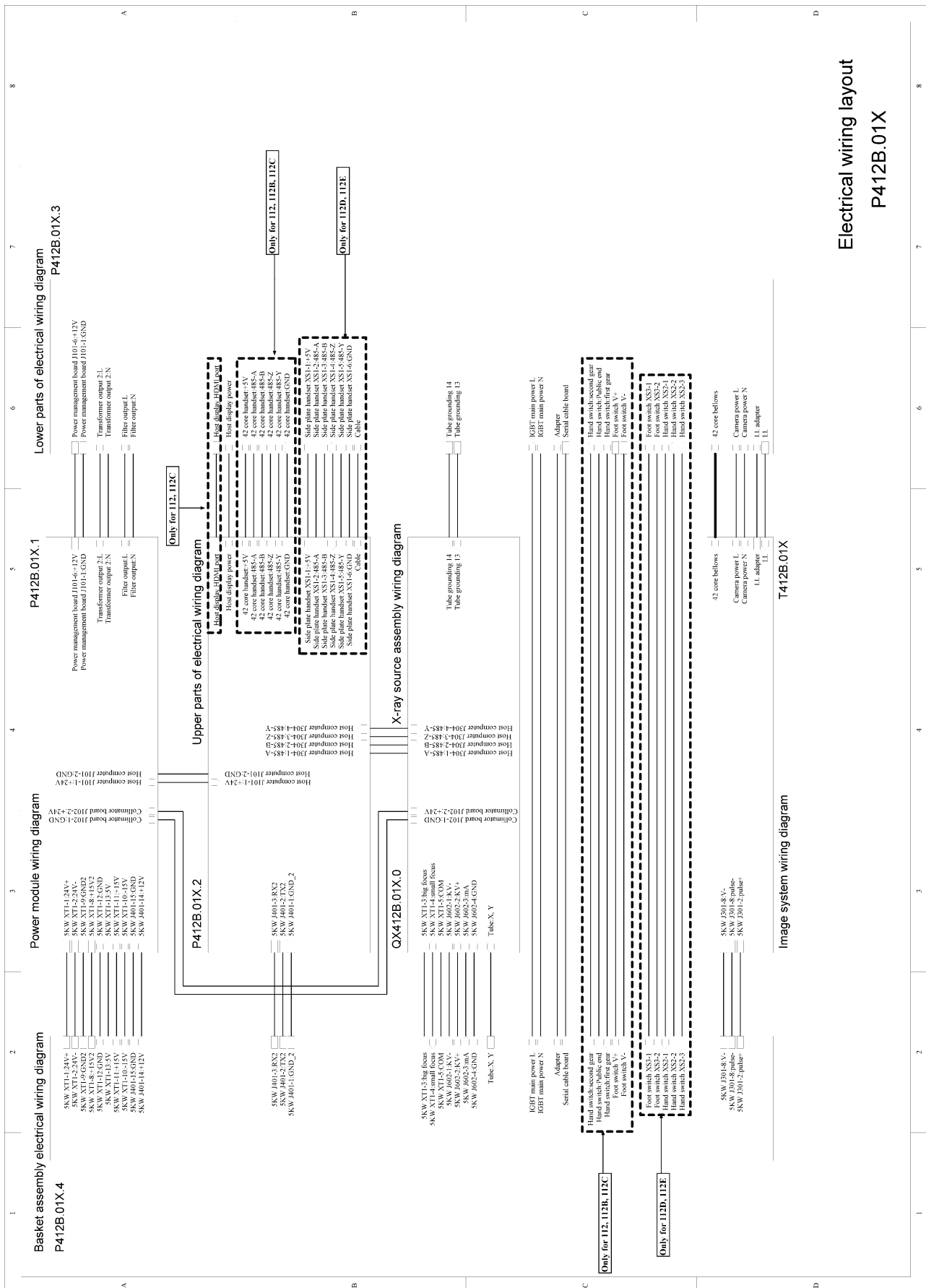
- a) Electrical principle drawing
- b) Electrical wiring layout
- c) System of distribution diagram
- d) Human body parameter table(for your reference)

Notes: After equipment purchase, we ensure that we provide you with necessary information for equipment repair, provided that we have confirmed your technicians can repair the unit effectively.

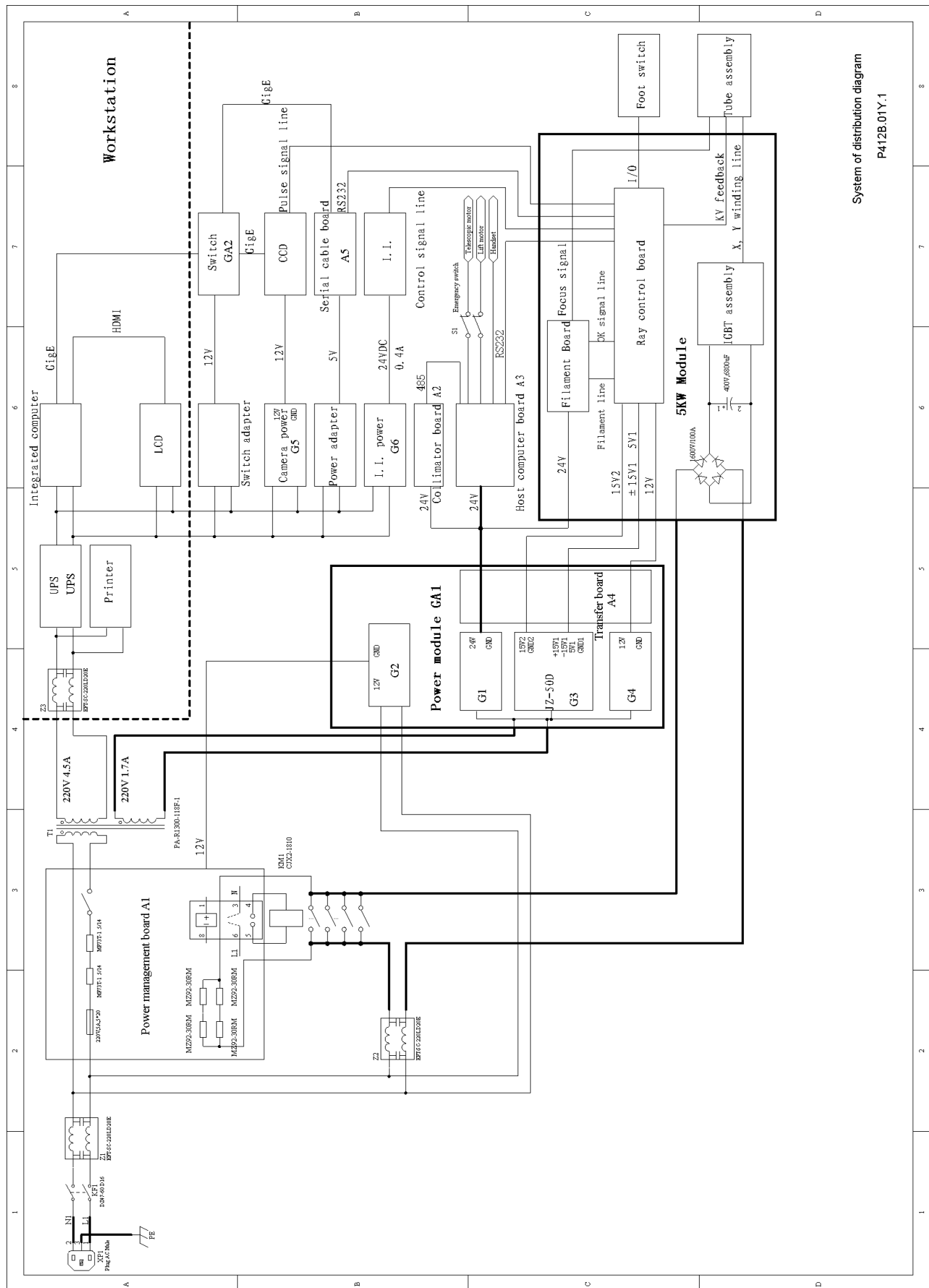
a) Electrical principle drawing



b) Electrical wiring layout



c) System of distribution diagram



d) Human body parameter table

For your reference only, the exact parameter setting needs to be judged by the situation of equipment, power condition and the condition of patient.

d1) Manual fluoroscopy human body parameter table

parts	figure	Frontal Position				Lateral Position			
		adults		kids		adults		kids	
		kV	mA	kV	mA	kV	mA	kV	mA
head	Fat	80	1.8	68	1.4	75	1.6	65	1.2
	Plump	78	1.7	67	1.3	73	1.5	63	1.1
	Normal	75	1.6	65	1.2	70	1.4	60	1.0
	Relatively thin	72	1.5	62	1.1	67	1.3	59	0.9
	Thin	70	1.4	60	1.0	65	1.2	58	0.8
Spondyle	Fat	60	1.2	55	1.0	57	1.0	56	0.8
	Plump	59	1.1	54	0.9	56	0.9	55	0.8
	Normal	58	1.0	53	0.8	55	0.8	54	0.7
	Relatively thin	56	0.9	52	0.7	54	0.7	53	0.7
	Thin	55	0.8	50	0.6	53	0.6	52	0.6
Shoulder blade	Fat	65	1.2	55	1.0	65	1.2	55	1.0
	Plump	63	1.1	53	0.9	63	1.1	53	0.9
	Normal	60	1.0	50	0.8	60	1.0	50	0.8
	Relatively thin	59	0.9	49	0.7	59	0.9	49	0.7
	Thin	58	0.8	48	0.6	58	0.8	48	0.6
cardiopulmonary	Fat	75	1.5	60	1.2	75	1.5	60	1.2
	Plump	70	1.4	68	1.1	70	1.4	68	1.1
	Normal	65	1.2	55	1.0	65	1.2	55	1.0
	Relatively thin	62	1.1	53	0.9	62	1.1	53	0.9
	Thin	60	1.0	52	0.8	60	1.0	52	0.8
abdomen	Fat	80	2.0	65	1.2	90	2.5	70	2.0
	Plump	78	1.9	63	1.1	88	2.4	68	1.9
	Normal	75	1.8	60	1.0	85	2.3	65	1.8
	Relatively thin	70	1.6	57	0.9	80	2.1	63	1.7
	Thin	65	1.5	55	0.8	75	2.0	60	1.6
crotch	Fat	75	1.5	55	0.8	80	1.8	60	1.6
	Plump	73	1.4	54	0.7	78	1.7	58	1.5
	Normal	70	1.2	53	0.7	75	1.5	55	1.4
	Relatively thin	68	1.1	52	0.6	73	1.4	54	1.3
	Thin	65	1.0	50	0.6	70	1.3	53	1.2
Leg	Fat	63	0.9	52	0.8	63	0.9	52	0.8
	Plump	60	0.8	51	0.6	60	0.8	51	0.6
	Normal	55	0.8	50	0.6	55	0.8	50	0.6
	Relatively thin	53	0.7	48	0.5	53	0.7	48	0.5
	Thin	50	0.7	47	0.5	50	0.7	47	0.5

parts	figure	Frontal Position				Lateral Position			
		adults		kids		adults		kids	
		kV	mA	kV	mA	kV	mA	kV	mA
Feet	Fat	56	1.0	46	0.6	58	0.8	52	0.6
	Plump	55	0.9	45	0.6	57	0.8	51	0.6
	Normal	54	0.8	44	0.5	56	0.7	50	0.5
	Relatively thin	52	0.7	43	0.4	55	0.7	49	0.5
	Thin	50	0.6	42	0.4	54	0.6	48	0.4
elbow	Fat	52	0.7	46	0.7	52	0.7	46	0.7
	Plump	50	0.6	45	0.6	50	0.6	45	0.6
	Normal	48	0.6	44	0.5	48	0.6	44	0.5
	Relatively thin	47	0.5	43	0.5	47	0.5	43	0.5
	Thin	46	0.5	42	0.4	46	0.5	42	0.4
hand	Fat	45	0.4	43	0.4	45	0.4	43	0.4
	Plump	43	0.4	42	0.4	43	0.4	42	0.4
	Normal	42	0.4	42	0.3	42	0.4	42	0.3
	Relatively thin	41	0.4	41	0.3	41	0.4	41	0.3
	Thin	40	0.3	40	0.3	40	0.3	40	0.3

d2) Pulse fluoroscopy human body parameter table

parts	figure	Frontal Position				Lateral Position			
		adults		kids		adults		kids	
		kV	mA	kV	mA	kV	mA	kV	mA
head	Fat	80	5.6	68	5.2	75	5.4	65	5.0
	Plump	78	5.5	67	5.1	73	5.3	63	4.9
	Normal	75	5.4	65	5.0	70	5.2	60	4.8
	Relatively thin	72	5.3	62	4.9	67	5.1	59	4.7
	Thin	70	5.2	60	4.8	65	5.0	58	4.6
Spondyle	Fat	60	5.0	55	4.8	57	4.8	56	4.6
	Plump	59	4.9	54	4.7	56	4.7	55	4.6
	Normal	58	4.8	53	4.6	55	4.6	54	4.5
	Relatively thin	56	4.7	52	4.5	54	4.5	53	4.5
	Thin	55	4.6	50	4.4	53	4.4	52	4.4
Shoulder blade	Fat	65	5.0	55	4.8	65	5.0	55	4.8
	Plump	63	4.9	53	4.7	63	4.9	53	4.7
	Normal	60	4.8	50	4.6	60	4.8	50	4.6
	Relatively thin	59	4.7	49	4.5	59	4.7	49	4.5
	Thin	58	4.6	48	4.4	58	4.6	48	4.4
cardiopulmonary	Fat	75	5.3	60	5.0	75	5.3	60	5.0
	Plump	70	5.2	68	4.9	70	5.2	68	4.9
	Normal	65	5.0	55	4.8	65	5.0	55	4.8
	Relatively thin	62	4.9	53	4.7	62	4.9	53	4.7
	Thin	60	4.8	52	4.6	60	4.8	52	4.6
abdomen	Fat	80	5.8	65	5.0	90	6.3	70	5.8
	Plump	78	5.7	63	4.9	88	6.2	68	5.7
	Normal	75	5.6	60	4.8	85	6.1	65	5.6
	Relatively thin	70	5.4	57	4.7	80	5.9	63	5.5
	Thin	65	5.3	55	4.6	75	5.8	60	5.4

parts	figure	Frontal Position				Lateral Position			
		adults		kids		adults		kids	
		kV	mA	kV	mA	kV	mA	kV	mA
crotch	Fat	75	5.3	55	4.6	80	5.6	60	5.4
	Plump	73	5.2	54	4.5	78	5.5	58	5.3
	Normal	70	5.0	53	4.5	75	5.3	55	5.2
	Relatively thin	68	4.9	52	4.4	73	5.2	54	5.1
	Thin	65	4.8	50	4.4	70	5.1	53	5.0
Leg	Fat	63	4.7	52	4.6	63	4.7	52	4.6
	Plump	60	4.6	51	4.4	60	4.6	51	4.4
	Normal	55	4.6	50	4.4	55	4.6	50	4.4
	Relatively thin	53	4.5	48	4.3	53	4.5	48	4.3
	Thin	50	4.5	47	4.3	50	4.5	47	4.3
Feet	Fat	56	4.8	46	4.4	58	4.6	52	4.4
	Plump	55	4.7	45	4.4	57	4.6	51	4.4
	Normal	54	4.6	44	4.3	56	4.5	50	4.3
	Relatively thin	52	4.5	43	4.2	55	4.5	49	4.3
	Thin	50	4.4	42	4.2	54	4.4	48	4.2
elbow	Fat	52	4.5	46	4.5	52	4.5	46	4.5
	Plump	50	4.4	45	4.4	50	4.4	45	4.4
	Normal	48	4.4	44	4.3	48	4.4	44	4.3
	Relatively thin	47	4.3	43	4.3	47	4.3	43	4.3
	Thin	46	4.3	42	4.2	46	4.3	42	4.2
hand	Fat	45	4.2	43	4.2	45	4.2	43	4.2
	Plump	43	4.2	42	4.2	43	4.2	42	4.2
	Normal	42	4.2	42	4.1	42	4.2	42	4.1
	Relatively thin	41	4.2	41	4.1	41	4.2	41	4.1
	Thin	40	4.1	40	4.1	40	4.1	40	4.1

d3) Photography human body parameter table

parts	figure	Frontal Position				Lateral Position			
		adults		kids		adults		kids	
		kV	mA	kV	mA	kV	mA	kV	mA
head	Fat	82	50	77	45	73	45	72	40
	Plump	80	45	75	40	75	40	70	36
	Normal	75	40	70	36	70	36	68	32
	Relatively thin	72	36	68	32	68	32	65	28
	Thin	70	32	66	28	66	28	63	25
Spondyle	Fat	77	22	72	18	77	28	72	22
	Plump	75	20	70	16	75	25	70	20
	Normal	71	18	68	14	71	22	68	18
	Relatively thin	68	16	65	12.5	68	20	65	14
	Thin	66	14	63	11	66	18	63	12.5
Shoulder blade	Fat	73	32	72	28	73	32	68	28
	Plump	75	28	70	25	75	28	70	25
	Normal	72	25	65	20	72	25	65	20
	Relatively thin	68	20	60	16	68	20	60	16
	Thin	66	18	58	14	66	18	58	14

parts	figure	Frontal Position				Lateral Position			
		adults		kids		adults		kids	
		kV	mAs	kV	mAs	kV	mAs	kV	mAs
cardiopulmonary	Fat	82	22	72	16	90	40	80	36
	Plump	80	20	70	14	88	36	78	32
	Normal	75	14	65	10	85	32	74	28
	Relatively thin	70	10	60	8	80	28	70	25
	Thin	68	9	58	7.1	78	25	68	22
abdomen	Fat	80	56	75	45	88	71	85	45
	Plump	78	50	73	40	86	63	83	40
	Normal	73	40	68	32	83	50	78	36
	Relatively thin	68	32	65	28	80	45	74	32
	Thin	66	28	63	25	78	40	72	28
crotch	Fat	77	40	70	36	82	40	72	28
	Plump	75	36	68	32	80	36	70	25
	Normal	72	32	64	25	75	32	66	20
	Relatively thin	70	25	60	20	70	25	64	16
	Thin	68	22	58	18	68	22	62	14
Leg	Fat	67	14	62	11	67	14	62	11
	Plump	65	12.5	60	10	65	12.5	60	10
	Normal	60	10	56	8	60	10	56	8
	Relatively thin	58	8	52	6.3	58	8	50	6.3
	Thin	56	7.1	50	5.6	56	7.1	48	5.6
Feet	Fat	52	3.6	52	2.5	57	4.5	52	4
	Plump	50	3.2	50	2.2	55	4	50	3.6
	Normal	48	2.8	43	2.0	50	3.6	45	3.2
	Relatively thin	40	2.5	40	1.8	45	3.2	40	2.8
	Thin	40	2.2	40	1.6	43	2.8	40	2.5
elbow	Fat	57	5	52	3.6	62	5.6	52	4
	Plump	55	4.5	50	3.2	60	5.0	50	3.6
	Normal	50	4.0	45	2.8	54	4.5	45	3.2
	Relatively thin	45	3.6	40	2.5	50	4.0	40	2.8
	Thin	43	3.2	40	2.2	48	3.6	40	2.5
hand	Fat	57	2.5	52	1.6	62	2.8	52	1.8
	Plump	55	2.2	50	1.4	60	2.5	50	1.6
	Normal	50	2.0	45	1.25	52	2.2	48	1.4
	Relatively thin	45	1.8	40	1.1	50	2.0	40	1.25
	Thin	43	1.6	40	1.0	48	1.8	40	1.1