

VetiX S300/VetiX S350/VetiX S380

Veterinary Digital Radiography System

Service Manual

Version: 1.0

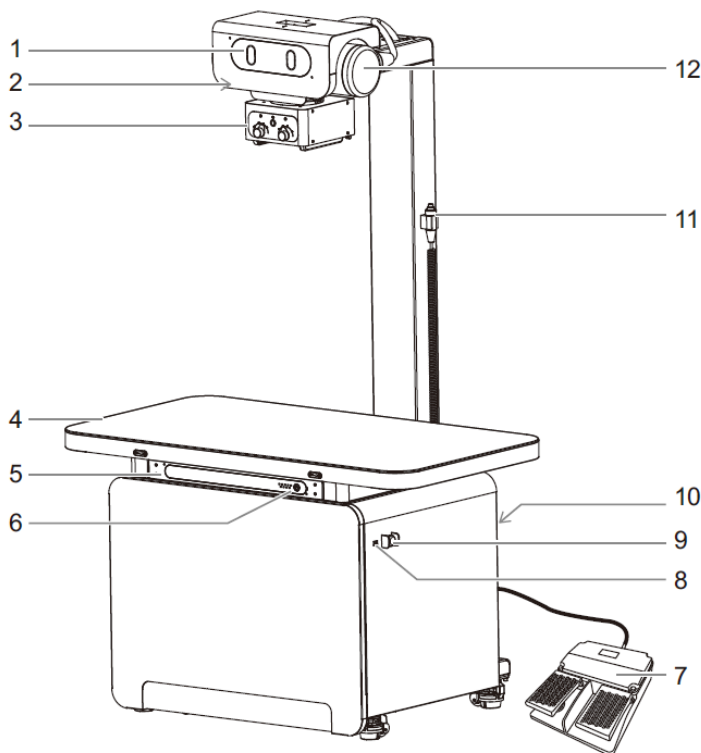
1 Product Overview

1.1 Intended Use

It is clinically indicated for digital radiography of the chest, abdomen, bone and soft tissue.

1.2 System Overview

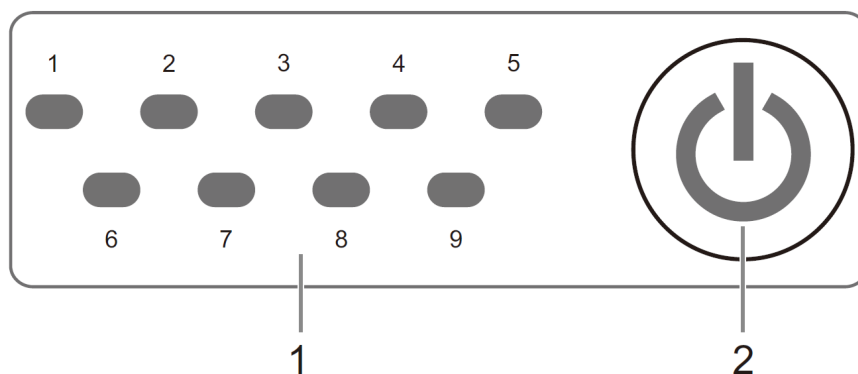
1.2.1 Introduction to System Components



No.	Name	Description
1	Exposure indicator	Indicates the exposure status.
2	iVocal microphone	Built-in microphone for voice control.
3	Beam limiting device	Used to adjust the size of the X-ray field.

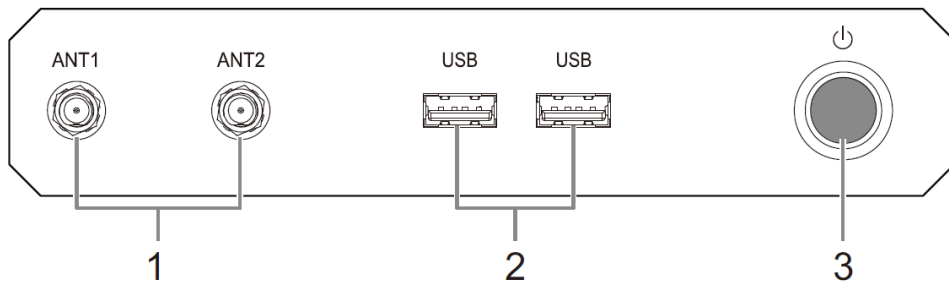
No.	Name	Description
4	Stationary floating table	Used to place animals for radiographic examinations.
5	Flat panel detector (FPD)	Used to receive X-rays.
6	Power button/Indicator panel	Turn on/off the system. Indicates the operating status of the system.
7	Foot switch	Left button: used to adjust the position floating table. Right button: used to control exposure.
8	USB port	Used to connect USB devices.
9	Emergency switch	Press the emergency switch, the exposure stops, and the power indicator on the control box blinks continuously. When you turn the emergency switch, the button bounces instantly, the exposure and the machine motion function is restored. After the system is fully started, the power indicator on the control box stops blinking and keeps on.
10	Image acquisition workstation host computer	The workstation has the operator console control software installed to manage animal and image information.
11	Exposure handswitch	Used to control the exposure of the system.
12	Tube-collimator Assembly	Used to emit X-rays.

1.2.2 Indicator panel



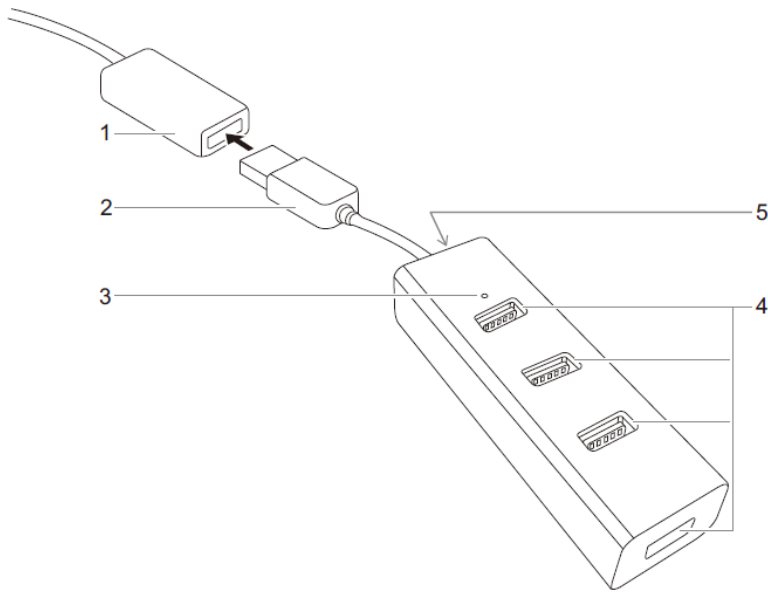
No.	Name	Description
1	Component indicators status	Indicator 1: AC power supply indicator. Remains on after the AC power supply is connected.
		Indicator 2: Power-on/off status of the high voltage generator.
		Indicator 3: Indicator of the workstation.
		Indicator 4: Hard disk indicator of the workstation.
		Indicator 5: Reserved.
		Indicator 6: 12 V output power supply indicator.
		Indicator 7: 24 V output power supply indicator.
		Indicator 8: Sticky indicator of the left key of the footswitch
		Indicator 9: Emergency stop status indicator.
2	Power on/off indicator	<ul style="list-style-type: none"> • Standby: Off • Startup state: Steady on • In the startup/shutdown process: Flashing

1.2.3 Image acquisition workstation main unit panel



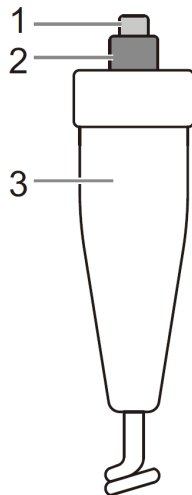
No.	Name	Description
1	Antenna interfaces	Reserved.
2	USB ports	Used to connect USB devices.
3	Computer power button	Turn on/off the computer. NOTE: For engineer use only.



1.2.4 USB-Hub components



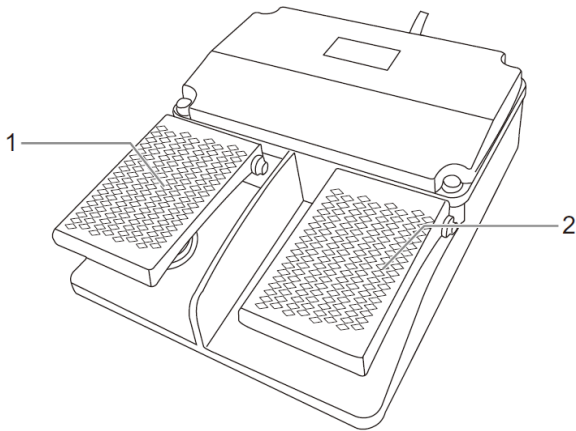
No.	Name	Description
1	Host USB extension cable port	Used to connecting USB devices.
2	USB plug	Used to connect to the host USB extension cable port.
3	Indicator	Lights up when connected.
4	USB port (Type-A)	Used to connecting USB devices. It is only used to connect the keyboard and mouse. Do not connect other devices.
5	USB port (Micro B)	Reserved.

1.2.5 Exposure hand switch



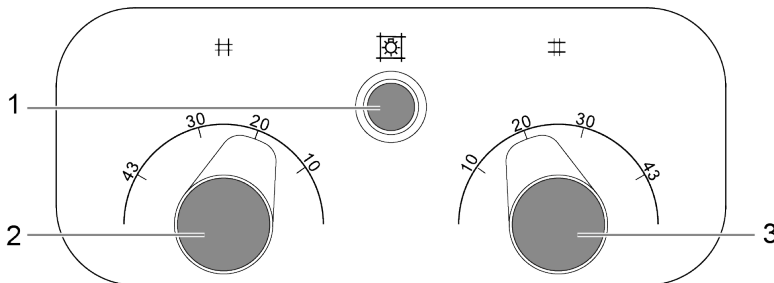
No.	Name	Description
1	Prepare button	<ul style="list-style-type: none"> Off: OFF position is when no pressure is applied to the button on the head of the handswitch.  <ul style="list-style-type: none"> Prepare: PREPARE is the middle position on the handswitch. When it is partially pressed, the system starts the X-ray tube and is ready to make an exposure. If the button is released, it returns to the OFF position <ul style="list-style-type: none"> Expose: When the button on the exposure handswitch is fully pressed, it is in the EXPOSE position. 
2	Expose button	
3	Handle	For holding the hand switch.

1.2.6 Foot switch



No.	Name	Description
1	Left pedal	Used to adjust the position of the stationary floating table.
2	Right pedal	Used to perform the exposure operation.

1.2.7 Collimator



No.	Name	Description
1	Indicator time limit switch	Turn on or off the light field indicator.
2	Horizontal light field adjusting knob	Rotate the time field clockwise to zoom out the time field, and rotate it counterclockwise to zoom out the time field.
3	Vertical light field adjusting knob	Rotate the time field clockwise to enlarge the time field, and rotate it counterclockwise to enlarge the time field.

1.3 Specifications

Parameter		Specifications
Mechanical Parameters	Column height	$\leq 2000\text{mm}$
	SID	$\geq 1050\text{mm}$
	Size of table top	1200 mm \times 650 mm. Tolerance: ± 20 mm
	Bed top height	770 mm. Tolerance: ± 20 mm
	Table Top Movement	Four-way floating
		Stroke: Horizontal $\geq \pm 100$ mm, vertical $\geq \pm 50$ mm
Load	$\geq 80\text{Kg}$	
Electric power	Output power	32kW
	Nominal electrical power	32kW(320 mA, 100 kV, 0.1 s)
	Maximum output power	32kW(320 mA, 100 kV)
Loading Factors and Control	Tube voltage/kV	40 kV~125 kV. The minimum step is 1 kV and the deviation is $\leq \pm 10\%$.
	Tube current/mA	10 mA~500 mA. Deviation $\leq \pm 20\%$
	Loading time/ms	1 ms~8000 ms. Deviation $\leq \pm (10 \% + 1\text{m}\%)$
	Current-time product/mAs	0.1mAs~125mAs. Deviation $\leq \pm (10 \% + 0.2 \text{ mA}\%)$
	Exposure technique	kV-mA-ms
kV-mAs		
Flat panel detector	Scintillator fluorescent material	CsI
	Detector array material	a-Si
	Effective size of FPD	43 \times 43 cm. The deviation does not exceed 5%.
	Pixel matrix	3072 \times 3072 pixels
	Pixel spacing	140um

Parameter		Specifications
	Quantum detection efficiency(DQE)	The typical DQE values are 0.56, 0.42, 0.35, 0.29, 0.25, 0.21, 0.17, and 0.11 at spatial frequencies of 0 lp/mm, 0.5 lp/mm, 1.0 lp/mm, 1.5 lp/mm, 2.0 lp/mm, 2.5 lp/mm, 3.0 lp/mm, and 3.5 lp/mm for doses of RQA5 and 10 μ Gy. The deviation does not exceed -0.06, and the upper limit is excluded.
Workbench display	Screen range	≥ 21 inches
	Type	Color, LCD
	Point distance	≤ 0.294 mm
	Resolution	1920 \times 1080 supported
	Maximum brightness	≥ 250 cd/m ²
Image Acquisition Workstation Host	CPU	Intel Core 2.0 GHz or above
	Memory	≥ 4 GB
	Hard disk	≥ 250 GB
	Operating system	Windows 10 Enterprise LTSC, 64 bit
	With Image Processing System	Console control software
Imaging Performance	Image size	≥ 430 mm \times 430mm
	Collection Matrix	$\geq 3072 \times 3072$ pixels
	Spatial resolution	≥ 3.6 lp/mm
Physical Specifications	Dimensions(Width \times Height \times Depth)	(1200 \pm 20) \times (810 \pm 20) \times (1895 \pm 20) mm
	Weight	235 \pm 10kg

2 Installation Instructions

2.1 Equipment room preparation

2.1.1 Equipment Room Space Requirements

- Exam room area: $\geq 2.5 \times 1.5 \text{ m}^2$

The corner or concave-convex part of the room needs to be removed from the concave-convex part to calculate the net size of the room.

- Room height: $\geq 2.2 \text{ m}$

Lower than this height may affect the normal operation of the device. Contact your service engineer or your distributor.

- Door width ($\geq 0.9 \text{ m}$)

2.1.2 Protection Requirements

Warning

The equipment must be installed in an effective X-ray shielding site.

- There should be Ionizing radiation warning signs, radiological protection precautions and eye-catching work Status Indicators outside the equipment room.
- The layout of the equipment room should be reasonable, and the positions of doors, windows and pipeline openings should be avoided; Do not stack sundries irrelevant to the diagnostic work of the device. The equipment room should be equipped with power exhaust device and well ventilated.
- The wall where the main X-ray beam faces in the camera room should have the protection thickness of 3 mm lead equivalent, and other side walls should have the protection thickness of 2 mm lead equivalent.
- Properly set the positions of the doors, windows and pipeline openings of the machine room. The doors and windows of the machine room should have the same protective thickness with their walls. The ceiling and floor (excluding the top floor) of the equipment room in a multi-storey building should meet the shielding thickness requirements in the corresponding irradiation direction.

- The customer must ensure that the equipment room meets the requirements for environmental protection, use of X-ray equipment, and local regulations. The inspection room (including the doors and observation windows) shall be equipped with radiation protection in strict accordance with local regulations and approved by relevant departments after installation. Qualified constructors are required to construct the inspection room.

2.1.3 Environmental requirements

- Operating Environment
 - Temperature: 10°C~38°C
 - Relative humidity: 20 %~75%
 - Barometric pressure: 62kPa~106kPa
- Storage and transportation environmental conditions:
 - Temperature: -20°C~55°C
 - Relative humidity: 20 %~90%, non-condensing
 - Barometric pressure: 62kPa~106kPa

2.1.4 Ground Requirements

Level the cement floor and ceramic tile floor. If they are wooden floors, reinforce the floor at the installation site and ensure that the cement layer is 100 mm deep and the bearing capacity is not less than 1200 kg/m².

If there are electric circuits, pneumatic circuits, and fluidic circuits below the ground, the hospital has the responsibility and obligation to inform in advance. If the hospital fails to fulfill its notification obligations, the consequences are irrelevant to Mindray.

2.1.5 Wiring

Cabling holes are required from the operation room to the exam room. For the above-ground holes, it is required that there are 500 mm long, 100 mm wide, and 50 mm high holes on one side of the inspection room wall, and cover the surface with 2 mm lead skin.

2.1.6 Warning signs of radiation hazards

There must be conspicuous warning signs and indicators of radiation hazards outside the equipment room. When the indicator is on, close the machine room door and do not allow others to enter without permission.

2.1.7 Power Distribution Requirements

Warning

- The power input cable used on site must pass CE/TUV/UL certification.
- If the system is connected to other equipment and instruments, the leakage current must comply with the requirements of GB1. Otherwise, an isolation transformer needs to be added to the external device.

Note:

- When the grid power supply is unstable, users need to add voltage stabilizer such as UPS (the rated output power is recommended to be 30% higher than the rated input power of the whole unit) to meet the power distribution requirements of the system.
- A circuit breaker is required. The specification of the main circuit breaker provided by the user must comply with local regulations and have a remote control switch.

Power Distribution Requirements

.Chemistry	.Description
Input voltage	100 -240VAC. Grounding wire
Voltage fluctuation	The voltage fluctuation is within $\pm 10\%$. The system ensures normal performance
Frequency(Hz)	50/60 Hz
Frequency fluctuation(Hz)	± 1 Hz
Input power kVA	≥ 2.0 kVA

Cable Specifications

- The data in this section are calculated based on the nominal voltage and the AWG cable, the conversion between the AWG cable and the metric mm² cable is shown in the following table:

.AWG	.Diameter(Inch)	.Diameter(Mm)	.Cable section(mm ²)
7	0.1443	3.67	10.55
6	0.1620	4.11	13.30
5	0.1819	4.62	16.77
4	0.2043	5.19	21.14

.AWG	.Diameter(Inch)	.Diameter(Mm)	.Cable section(mm ²)
3	0.2294	5.83	26.65
2	0.2576	6.54	33.61
1	0.2893	7.35	42.39
1/0	0.3249	8.25	53.46
2/0	0.3648	9.27	67.40
3/0	0.4096	10.40	84.97
4/0	0.46	11.68	107.16

- The ground wire should be at least the same diameter as the power supply cable and not less than AWG1/0. Connect the ground wire from the rear of the high-voltage generator to the distribution cabinet/main grounding point, and use the same tube as the power supply cable.
- Selecting the correct cable diameter is critical to the proper and stable operation of the system. The wire diameter is affected by the high-voltage generator power, power supply line voltage and transmission distance. The voltage drop of the line voltage during loading can be up to 5%.
- System electrical requirements:

.Chemistry	.Description
Voltage	100-240V AC
Current	18A
Input power kVA	2kVA
Standby power consumption	1 kVA
Earth leakage current	≤ 10 mA

2.2 Tools

.No.	.Tool Name	.Model	.Unit
1	Adjustable wrench	0-350mm	PCS
2	Open-end wrench	8*10	PCS
3	Tape	5M	PCS

.No.	.Tool Name	.Model	.Unit
4	Inner hexagon spanner (1 suite)	Metric system	Set
5	Cross screwdriver	(Large.Medium.Small)	Set
6	Flathead screwdriver	(Large.Medium.Small)	Set
7	Multimeter	General	PCS
8	Diagonal pliers	General	PCS
9	Sharp nose pliers	General	PCS
10	Cable tie	100mm	PCS

2.3 Packaging Information

.Chemistry	.Description
Package Name	System
Dimensions(MM)	1650*1150*1030
Quantity(PCS)	1
Weight(Kg)	Weight: 220

.Chemistry	.Description
Package appearance	
Packing List	/

2.4 Unpacking Procedure

Before unpacking, confirm the total number of cartons and check whether the cartons are damaged. If any, notify the carrier or agent immediately.

Check whether the total number of the goods is complete and whether the outer packing box is intact.

Do as follows:

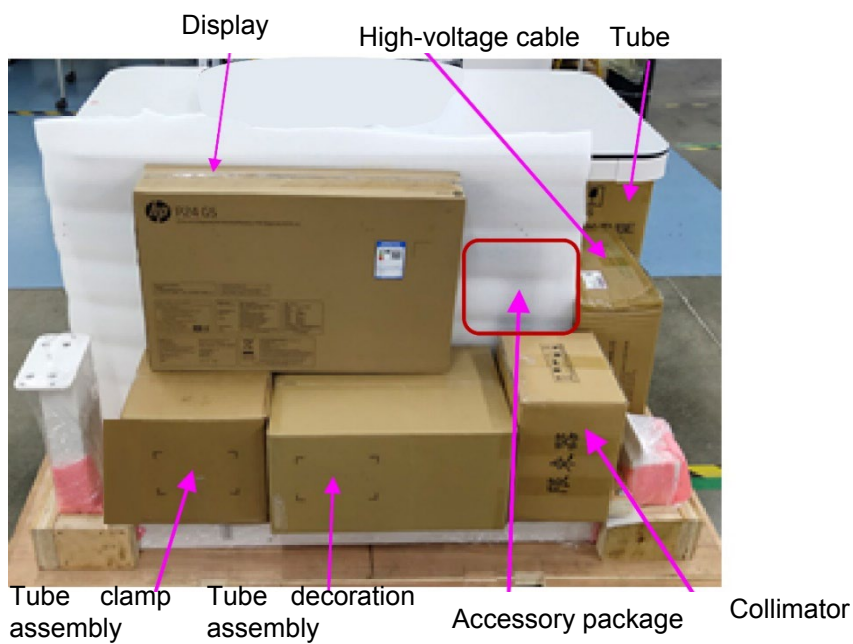
1. Remove the upper cover and all the latches on the four side covers.



2. Remove the stretched film and foam from the cradle and take out the front cover.



3. Take out the display box, collimator box, accessory box, High voltage cable, flat box, and tube box and unpack them.



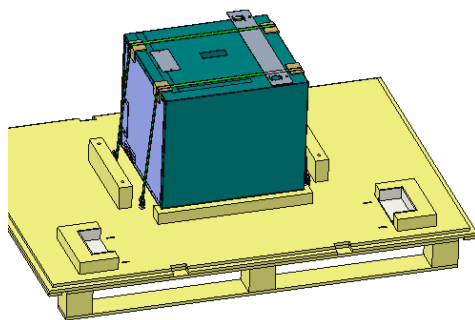
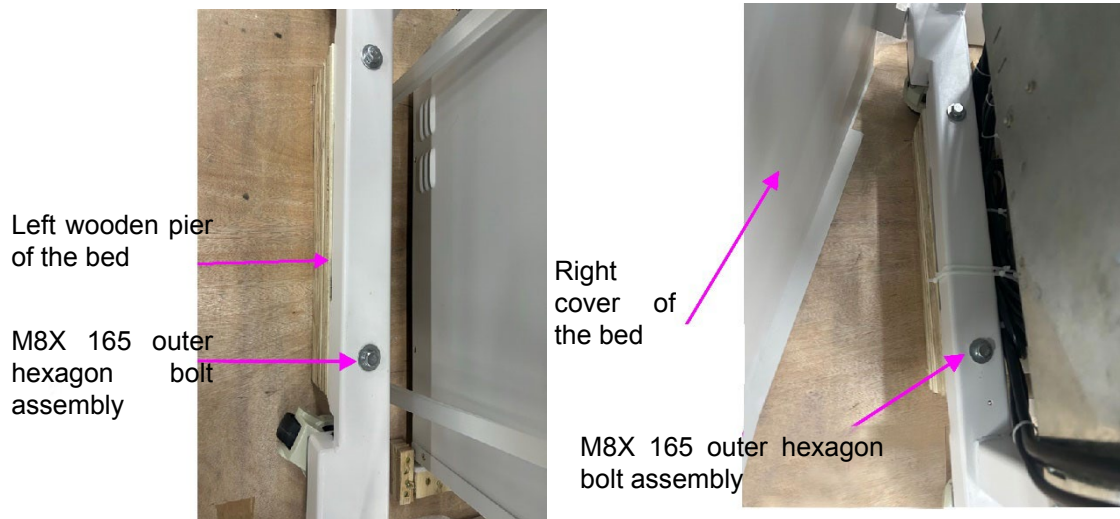
Flat panel detector

Mouse-keypad kit

4. Take out the computer main unit box, collimator box, accessory box, and High voltage cable from the rack and unpack them.



5. Take out the columns, remove the right cover and left cover of the patient table, remove the four M8 × 165 hexagon socket cap head bolts on the left and right sides of the patient table assembly, install the left and right side covers, and then remove the patient table.



6. Remove the binding straps and wrapping film, and then remove the high-voltage generator.

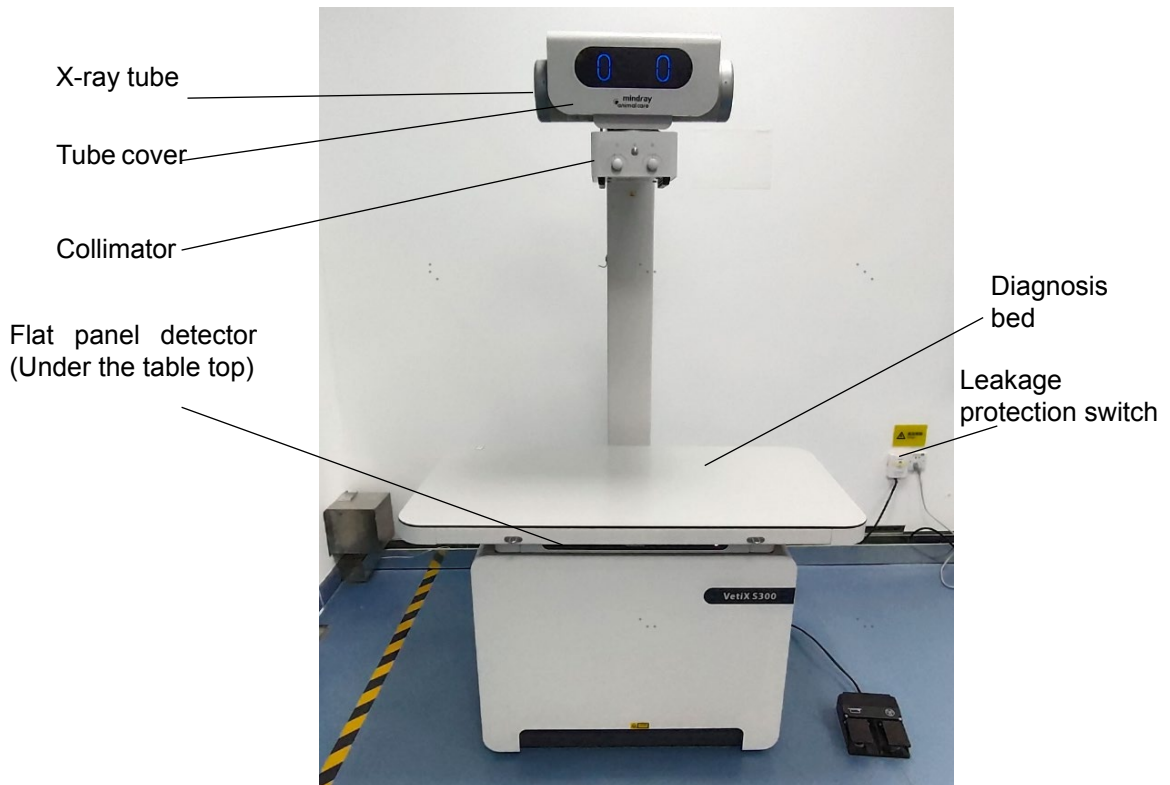
High-voltage
paper
protection
corner
Packing belt



7. Finally, place the equipment in the specified position in the equipment room, and check whether the appearance of the frame is damaged.

2.5 Installation Procedure

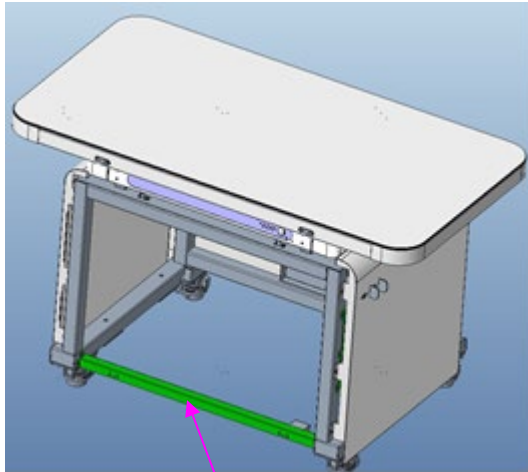
2.5.1 Main components of the system



2.5.2 Remove the table top assembly and the rear cover of the translation module

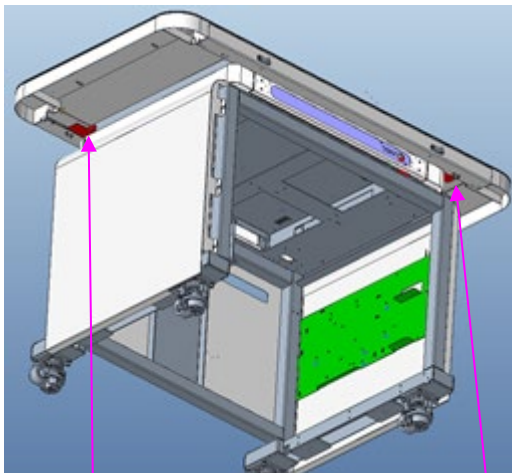
Do as follows:

1. Remove the front lower support of the bed frame.



Front lower support of the bed frame

2. Remove the horizontal limit sheet metal (2 pieces of red sheet metal).



Horizontal limit sheet metal

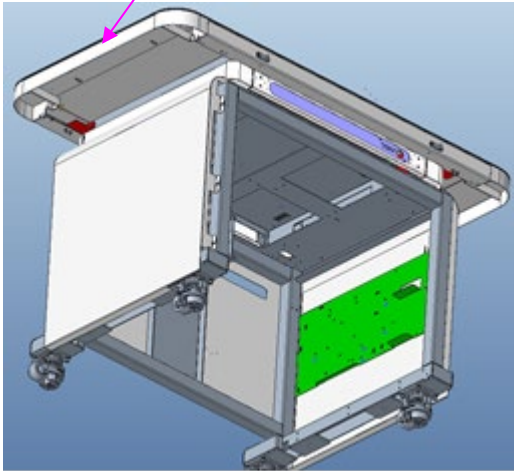
Horizontal limit sheet metal

3. Remove the left and right plates of the bed frame on the left of the gantry.

Note:

Remove the four M5×8 hexagon socket cap head screws and the two M5×10 cross countersunk head screws for use in installing the left and right plates of the bed frame.

Left and right plate assemblies of bed frame

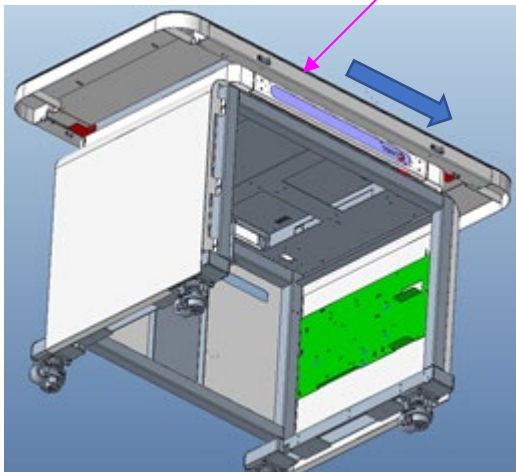


4. Pull out the table top assembly from the table frame from left to right.

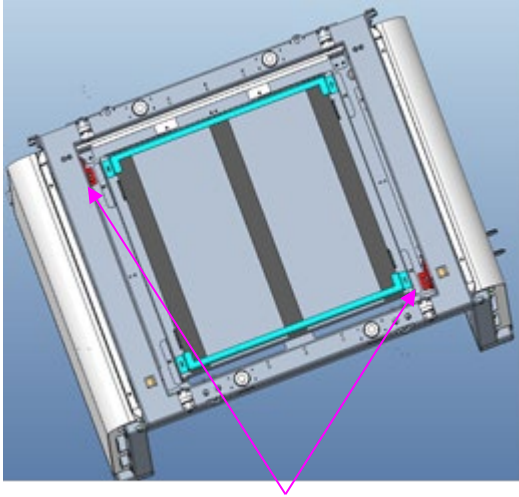
Note:

Check if the buffer cover on the magnet is loose during aspiration. If yes, reinstall the buffer cover.

Table Top Assembly

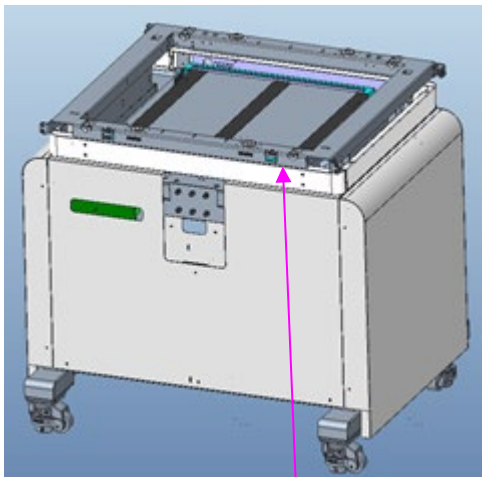


5. Remove the vertical limit sheet metal (2 pieces of red sheet metal).



Vertical limit sheet metal

6. Remove the rear cover of the translation module.

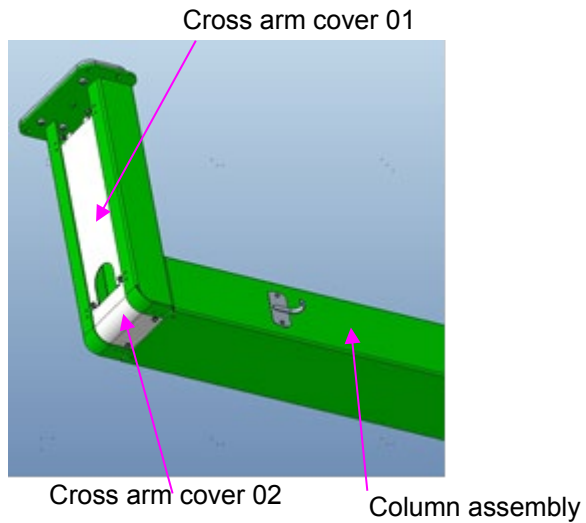


Rear cover of the translation module

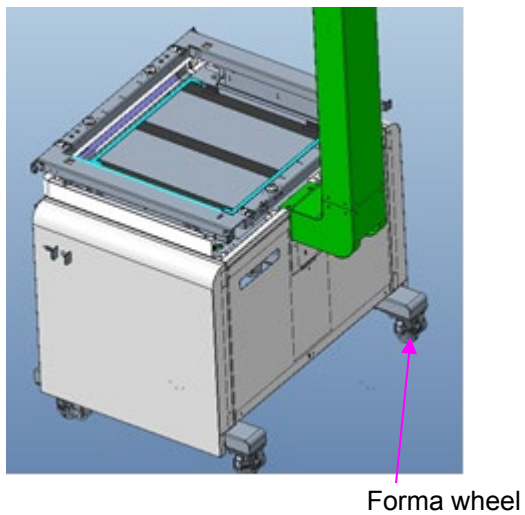
2.5.3 Installing the Post Assembly

Do as follows:

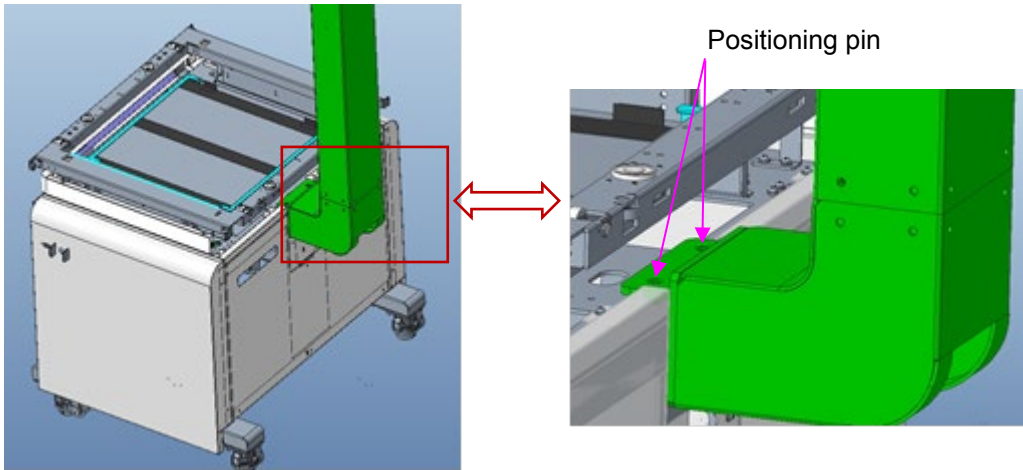
1. Remove the horizontal arm cover 01 and the horizontal arm cover 02 in turn.



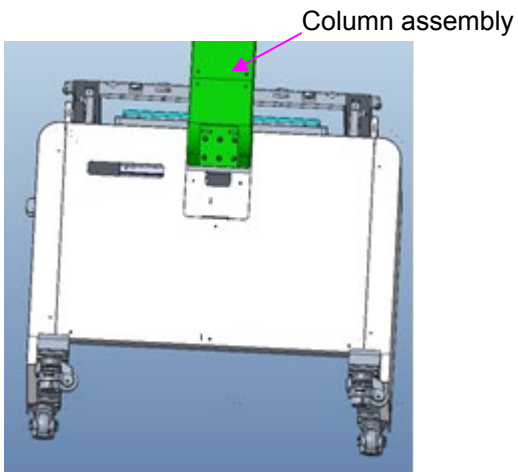
2. Rotate the turntable on the FOMA wheel counterclockwise to raise the 4 FOMA wheel rollers on the gantry. The gantry is fixed without sliding.



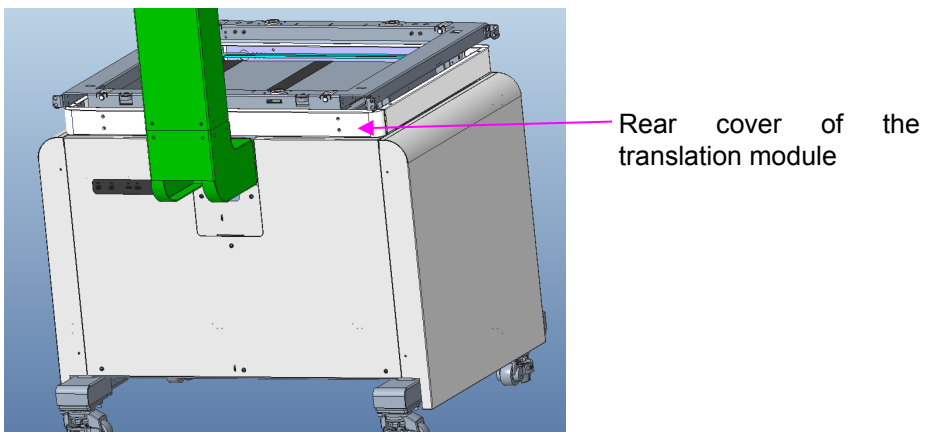
3. Install the column assembly onto the bed frame assembly. Insert the two positioning pins of the column assembly into the pin holes of the bed frame assembly to the end.



4. Lock the column assembly to the bed frame assembly.



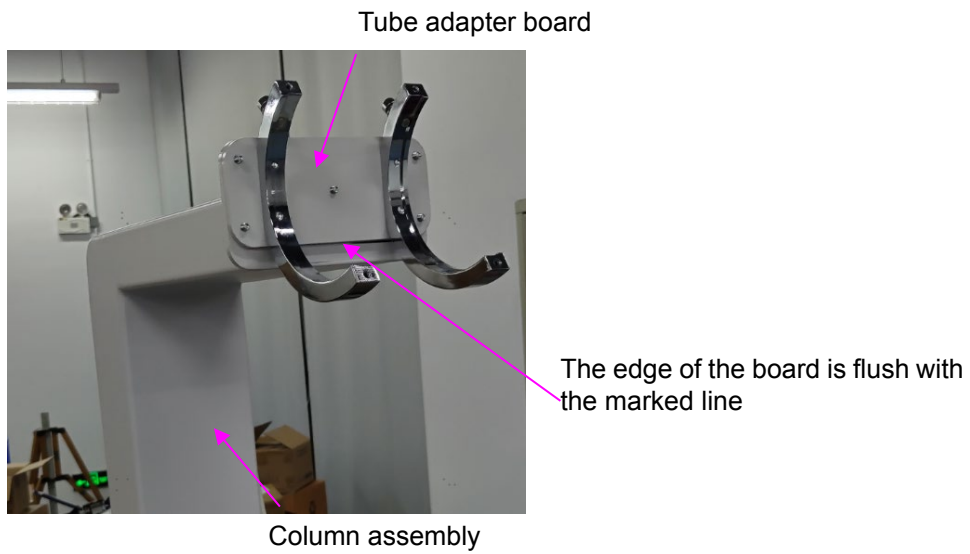
5. Assemble the rear cover of the translation module to the bed frame.



2.5.4 Installing the Tube

Do as follows:

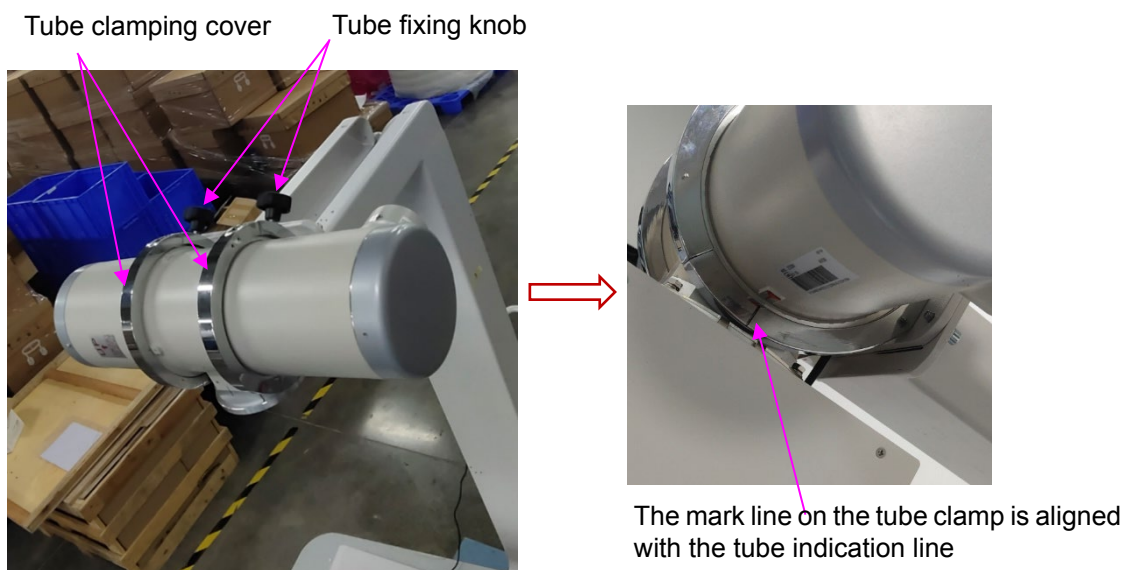
1. Install the tube adapter board on the column assembly.



2. Hang the tube on the holder. The shoulder of the tube fits the slot of the holder. Rotate the tube to make the X-ray window face down.



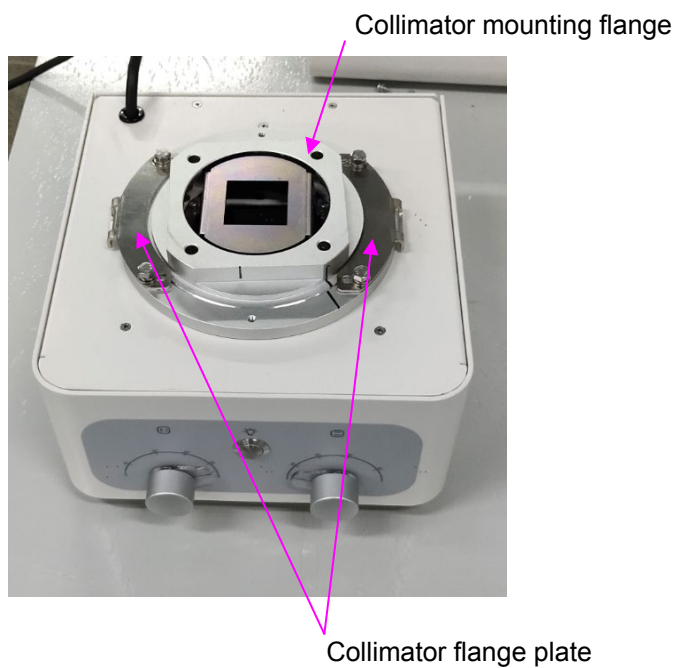
3. Install the tube holder and the tube fixing knob, and rotate and adjust the tube angle before locking to align the indicator line with the mark line.



2.5.5 Installing the collimator

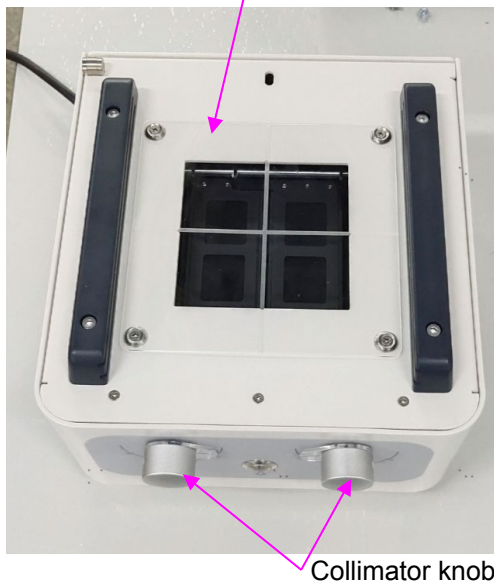
Do as follows:

1. Remove the flange of the collimator.



2. Open the transparent cover, take out the EPE foam from the lead window of the collimator, and install the transparent cover.

Transparent cover of collimator window



Collimator knob

3. Install the collimator flange onto the tube, and use four M6×20 inner hexagon screws to lock the collimator flange onto the tube.



Collimator flange

4. Align the mounting hole of the collimator flange with the flange of the collimator, and toggle the flange plate inward to hang the collimator on the flange of the collimator. Use an 8# open-ended wrench to tighten the four M5×16 hexagon screws on the flange plate of the collimator.



2.5.6 Installing the Tube Decoration Assembly

Do as follows:

1. Lead the microphone cable, indicator cable, collimator power cable, and rotary anode cable through the column cavity from bottom to top using a threading device.

Cable passing through the post: High voltage cable, collimator power cord, microphone cable, exposure indicator cable

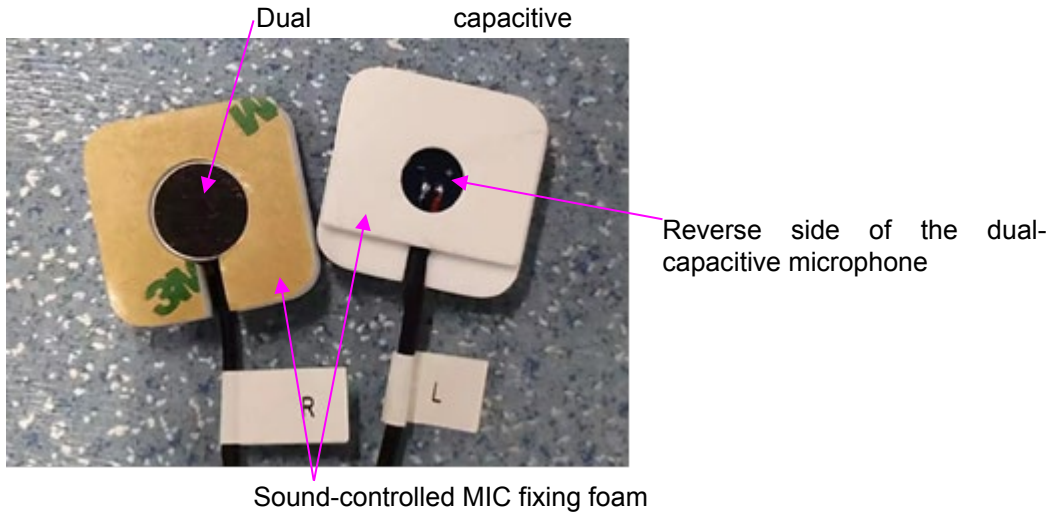


Column assembly

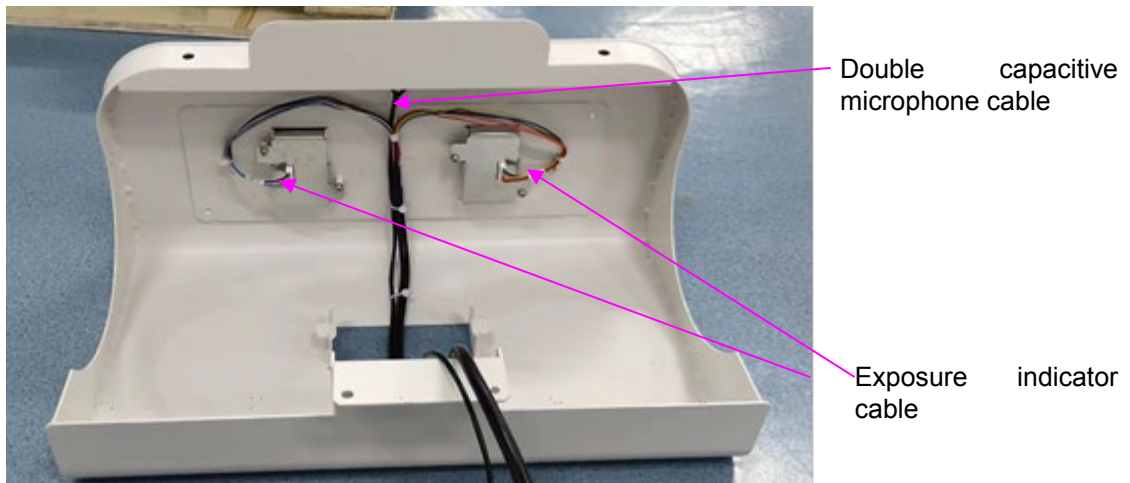
2. Install the dual capacitive microphone into the acoustic MIC fixing foam.

Note:

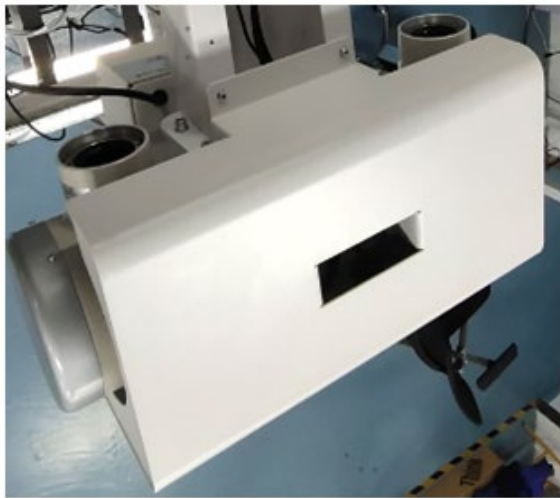
The front side of the microphone faces the side of the double faced adhesive tape.



3. Connect (009-00024 A-00) the LED-J1 end (two places) of the exposure indicator cable to the exposure indicator board terminal; Use cable ties to bind the exposure indicator cable and the double capacitive microphone cable on the cable bridge.



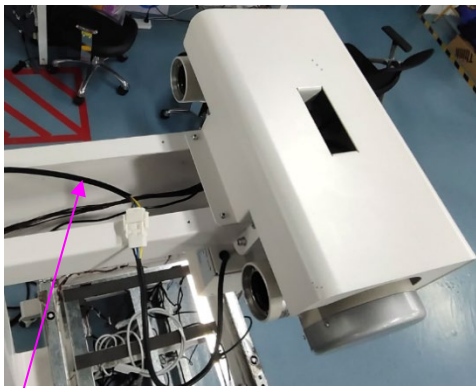
4. Install the tube decoration assembly on the column assembly.



2.5.7 Post routing

Do as follows:

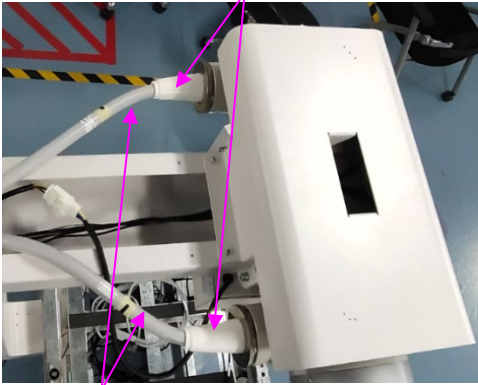
1. Connect the male connector of the collimator power cord to the female connector of the collimator cable.



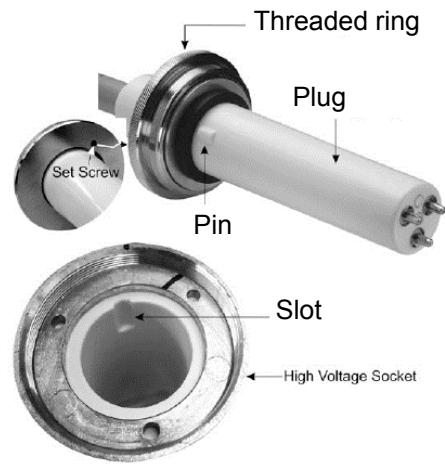
Collimator power cord

2. According to the positive and negative poles marked on the High voltage cable, daub insulating silicone grease on the High voltage cable plug, install it on the tube interface, tighten the cable nut, and then use the inner hexagon spanner to lock the fastening screw; The other end passes through the column and the cable inlet hole at the back of the bed and is placed under the bed for spare.

Coat the insertion part with insulating sealing silicone grease before insertion.



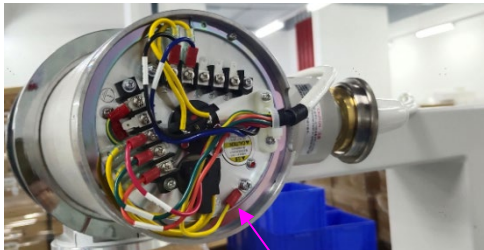
DC High voltage cable



3. Remove the tube cover with the cable hole on the tube (keep the screws attached).
4. Connect one end of the anode drive cable with Y-type terminal to the tube terminal according to the following table.

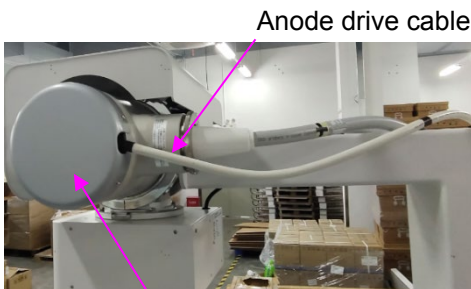
Identification of the anode drive cable	T1/K1	T2/k2	T3/K3	T5/K4	T6/K5
Tube base label	1	2	3	5	6

5. Connect the ground wire of the anode drive wire to the tube ground.



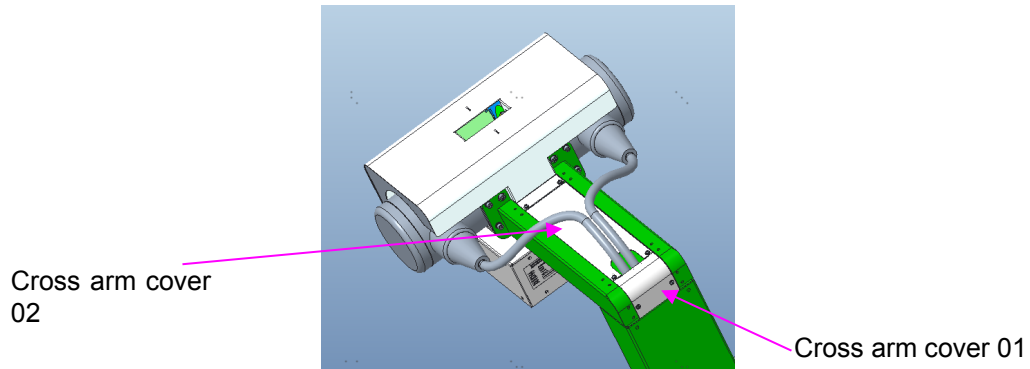
Ground wire

6. Install the tube cover onto the tube.



Tube cover

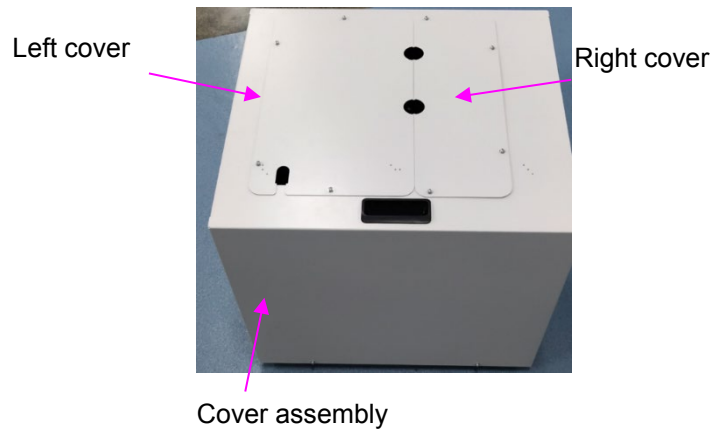
7. Install the horizontal arm cover 01 and the horizontal arm cover 02 in sequence.



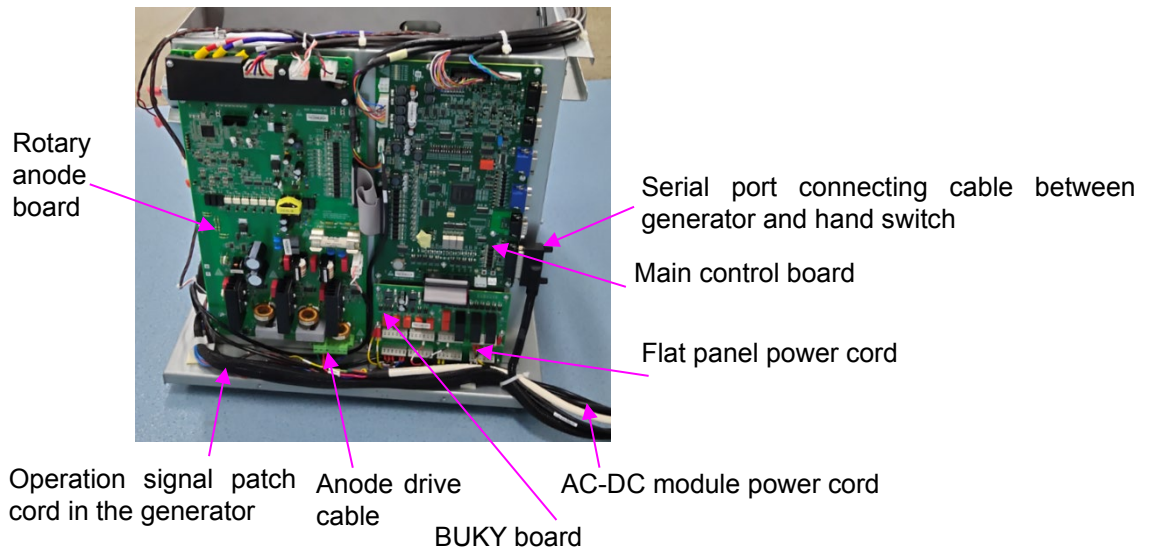
2.5.8 High-voltage generator cable

Do as follows:

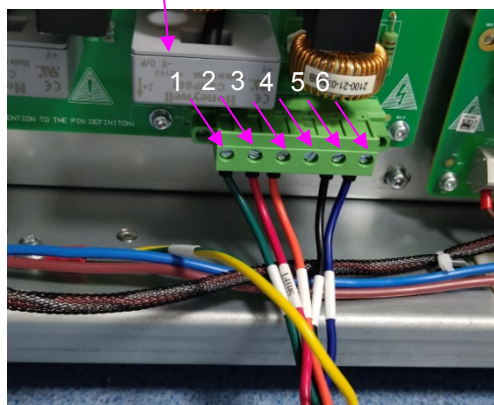
1. Remove the left and right covers and the cover assembly in turn.



2. Connect the generator, serial port cable of the hand switch, power cable of the control box, power cable of the AC-DC module, anode drive cable, and operation signal patch cord in the generator to the high-voltage generator board.



MAIN-1,2, COM3
TH1-5, TH2-6



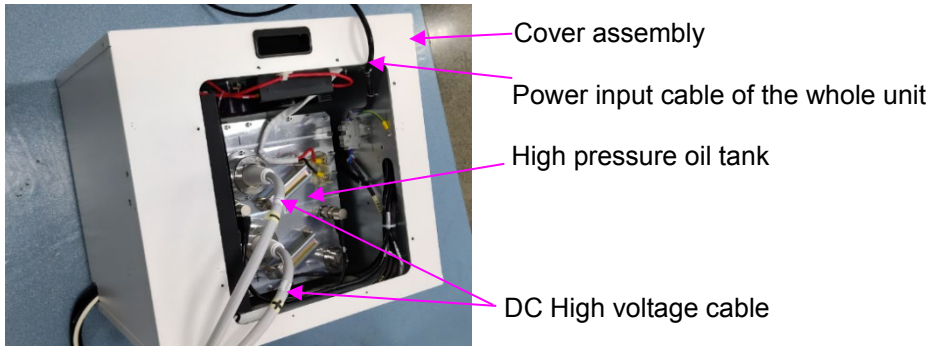


Auxiliary power board

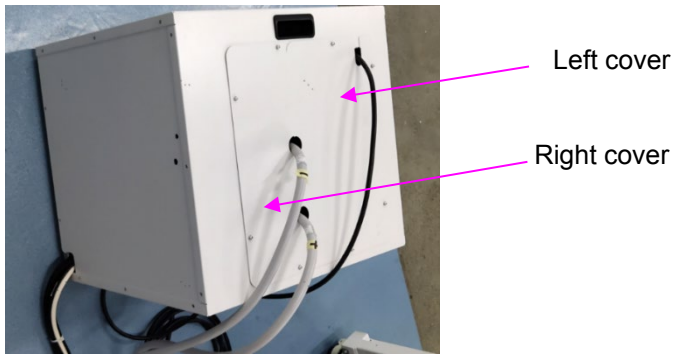
The following table lists the connection relationships:

.No.	.Name	.P/N	.Cable end	.High-voltage generator board end
1	Serial port connecting cable between generator and hand switch	009-00022A-xx	DB25 male port	Main control board DB25 female port
2	Flat panel power cord	009-003697 -xx	J4-19, J4-20	J4-19 and J4-20 on the BUKY board
3	AC-DC module power cord	009-00014A-xx	J5-26, J5-29	J5-26 and J5-29 on the BUKY board
4	Anode drive cable	009-00016A-xx	See Figure 14 C.	6PIN Phoenix terminal on the rotary anode plate
5	Operation signal patch cord in the generator	009-00027A-xx	J3-15 J2-10 J8-44 J8-43, J17, and J5	BUKY board, rotary anode board, and auxiliary power board

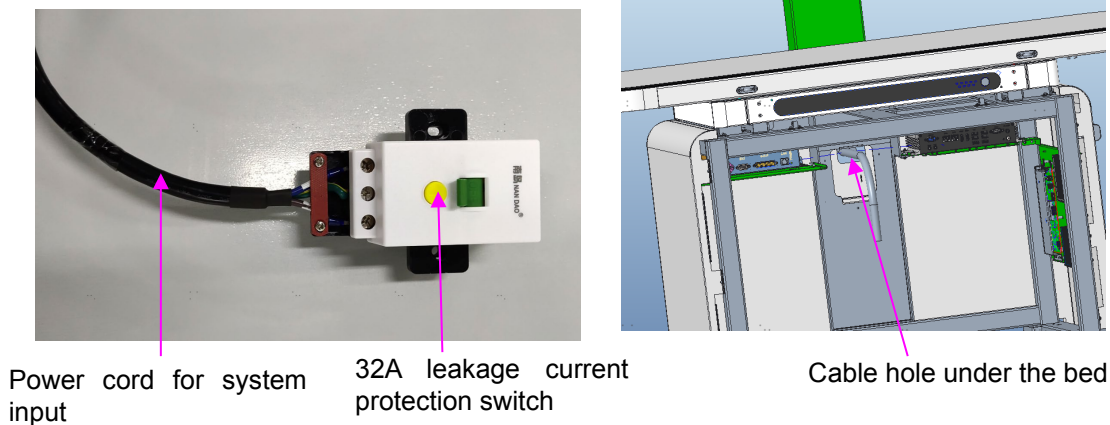
3. Install the cover assembly on the high-voltage generator.



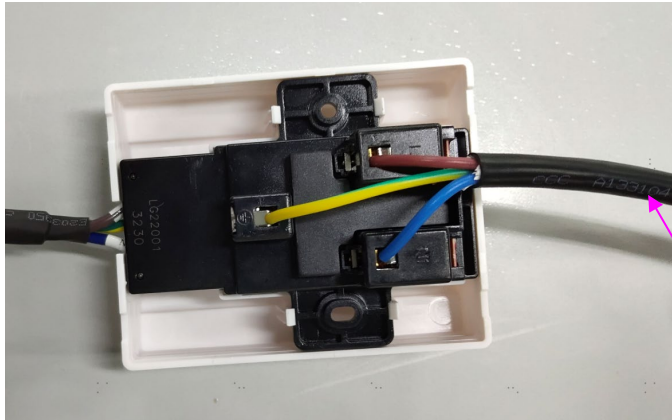
4. Install the positive and negative poles on the socket of the high-pressure oil tank according to the High voltage cable. Daub sealing insulating silicone before installation, tighten the cable nuts, and then use the hexagon wrench to tighten the retaining screws.
5. Install the left and right covers on the high-voltage generator.



6. Route the power input cable of the high-voltage generator through the inlet and outlet cable hole under the bed and connect it to the 32 A leakage current protection switch (purchased separately) according to the marked wiring.



7. Connect the 100-240 V wall power cord to the leakage current protection switch according to the label, and then install the leakage current protection switch on the wall cassette.

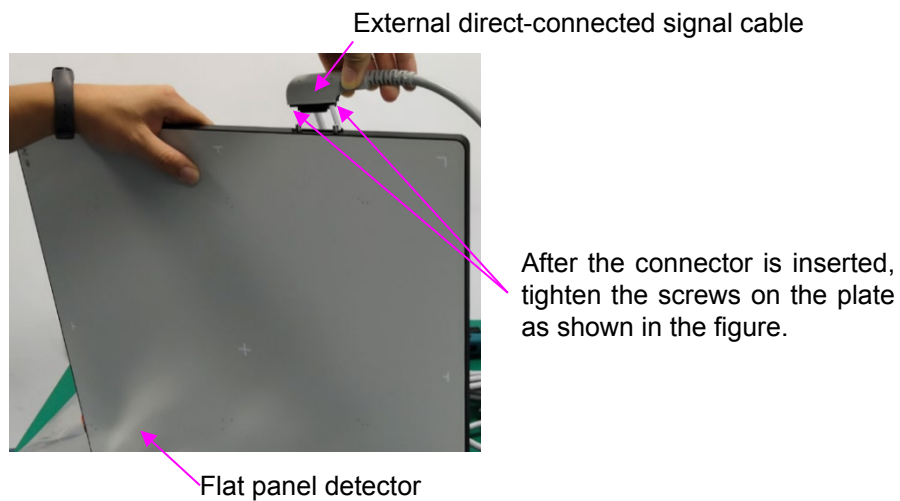


100-240 V wall power cord

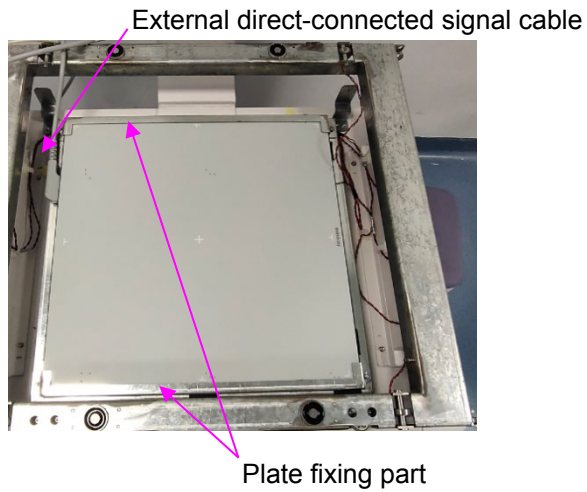
2.5.9 Flat panel detector Installation

Do as follows:

1. Assemble the external direct-connected signal cable 009-00017 A-xx to the Flat panel detector connection port with the two cross pan head screws attached to the Flat panel detector connection port.



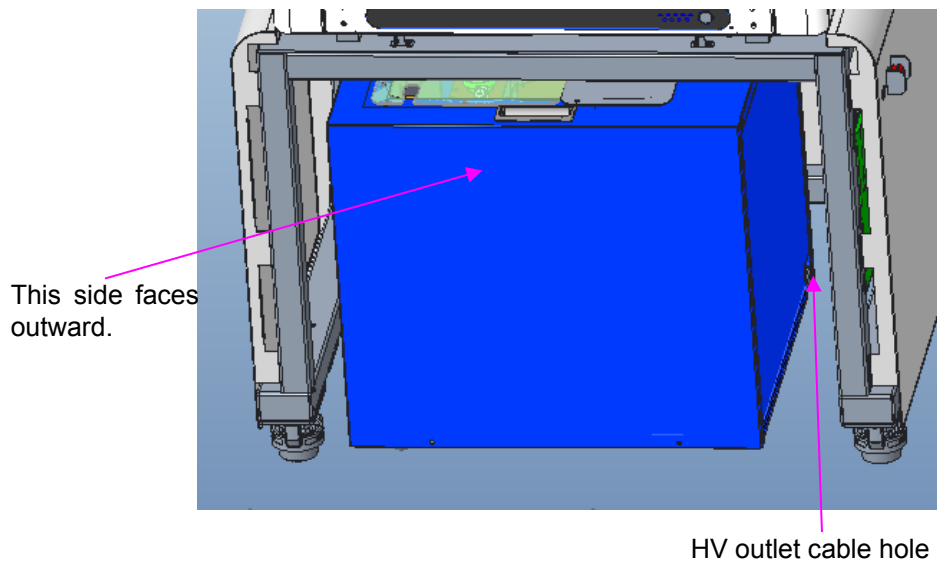
2. Install Flat panel detector on the supporting plate and fix it with the plate fixing parts.



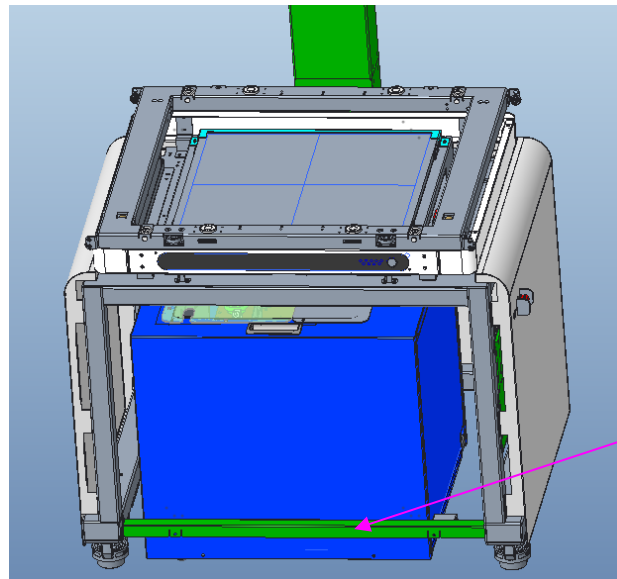
2.5.10 Installation of the table top assembly and the table body front cover

Do as follows:

1. Push the high generator into the bed.



2. Install the lower front support of the bed frame.



Front lower support of the bed frame

3. Install the table top cover (the two slots on the front cover align with the two clips on the table top, and then slide the table top assembly to the right). Refer to to remove the analyzer.

Note:

Do not use the four M5×8 hexagon socket cap head screws or the two M5×10 cross countersunk head screws that have been removed before, otherwise the table top may be broken.

When installing the table top assembly, push it in with the magnet unlocked, and then release the magnet to lock the table top. Then unlock the table top and push the table top to determine whether the table top is installed in place.

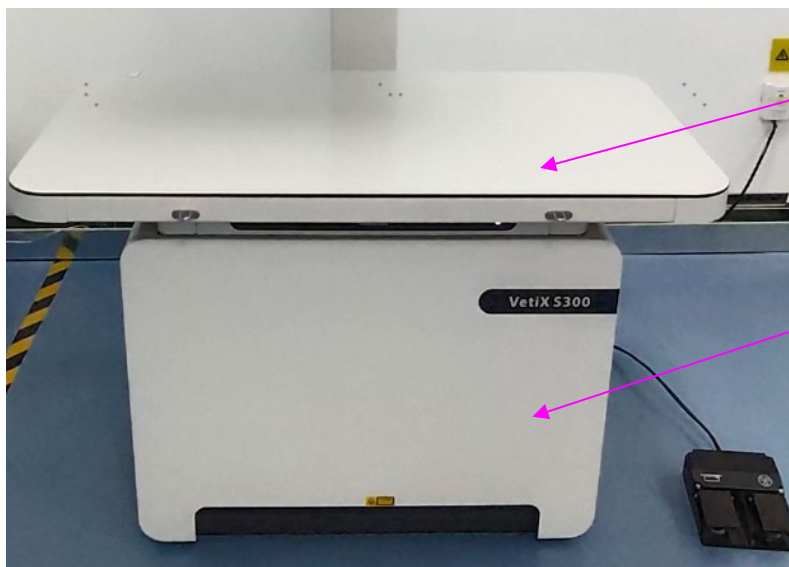


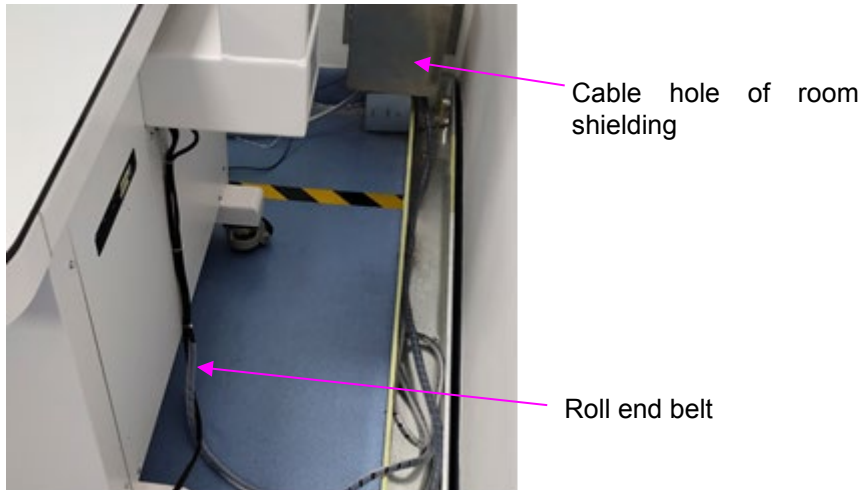
Table Top Assembly

Front cover of the bed

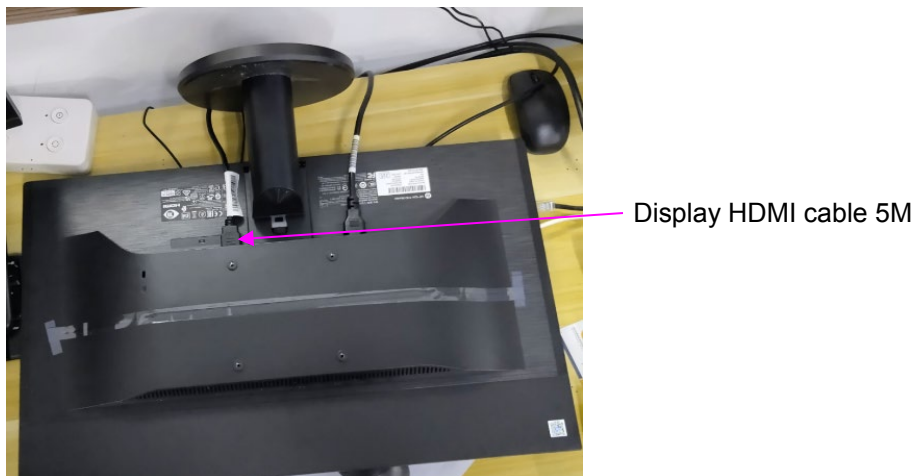
2.5.11 Installation of the display and exposure hand switch

Do as follows:

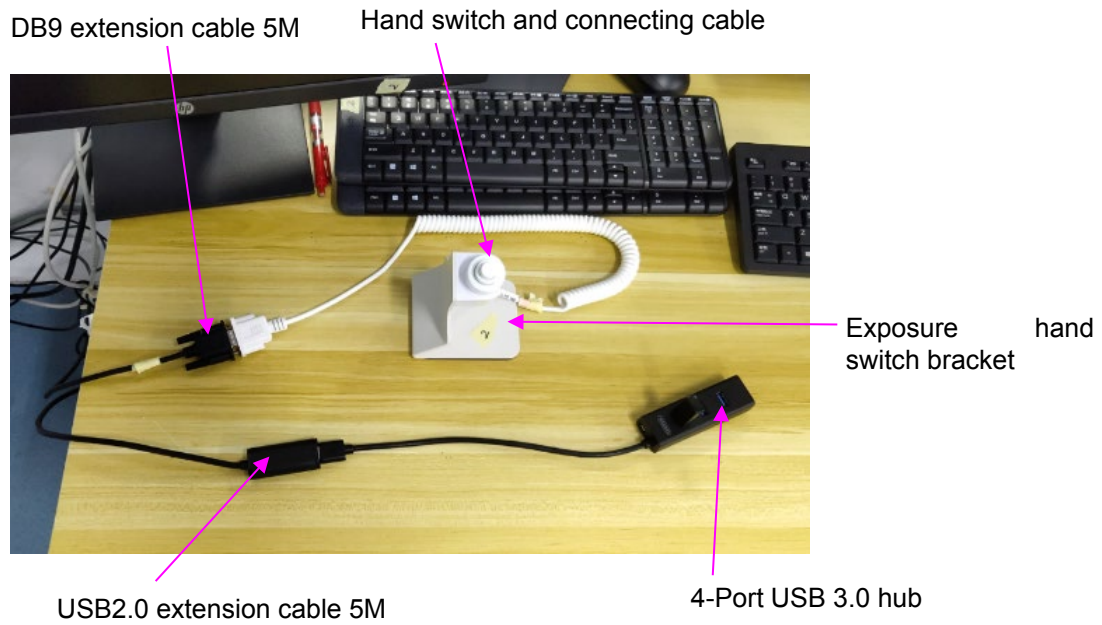
1. Pull the display HDMI cable 5M, DB9 extension cable 5M and USB2.0 extension cable 5M through the cable hole in room shielding and pull them out of room shielding.



2. Display HDMI cable 5M is connected to the display.



3. Connect the DB9 extension cable 5M to the hand switch and the connection cable.



4. Assemble the hand switch and the connection line to the exposure hand switch bracket.
5. Connect the 4-Port USB 3.0 hub to the USB2.0 extension cable 5M.