

MX7/MX7 Exp/MX7T/MX7S/MX7 Pro/Vaus7/Zeus7/Zeus/ME7/ME7

Exp/Anesus ME7/Anesus ME7 Pro/Anesus ME7S/Anesus

ME7T/Ana/Anesus Vaus/Anesus Zeus/Crius ME7P/Crius ME7W/Anesus

ME7P/Anesus ME7W/Emerus ME7P/Emerus ME7W/MX7P/MX7W/ME7

Pro/ME7S/ME7T

MX8/MX8 Exp/MX8T/MX8S/MX8 Pro/Vaus8/Zeus8/Vaus/Crius ME8P/Crius

ME8W/Anesus ME8P/Anesus ME8W/Emerus ME8P/Emerus

ME8W/MX8P/MX8W/Anesus ME8/ME8/Emerus ME8/ME8 Pro/ME8S/Crius

ME8/ME8T

Diagnostic Ultrasound System

Service Manual (Advanced)

Version 7.0

2 Maintenance

2.1 Overview

The ultrasound system does not require regular preventative maintenance such as calibration or adjustments to the hardware and transducers. Periodic cleaning and quality inspection described in this chapter are recommended.

2.2 Maintenance

2.2.1 Tools, Measuring Instruments and Consumables

Table 2-1 List of tools and measuring instruments

Tool/Measuring Instrument	Quantity	Remarks
Plastic or resin container	1	For holding normal saline, capable of accommodating two ultrasound probes
Soft brush	1	About a toothbrush size, with a soft brush head
Small plastic pot	1	For holding soapsuds
Safety tester	1	See Part III Appendix: 3 Electrical Safety Maintenance.

Table 2-2 List of tools and measuring instruments

Consumable	Quantity	Remarks
Aluminum foil	About 1 m	/
Normal saline solution	About 1000 mL	Half of the container volume to immerse the probe (concentration 0.85–0.95%)
Mild soapsuds	About 400 mL	/
Dry soft cloth/cotton cloth	5	/

2.2.2 Regular Maintenance Items

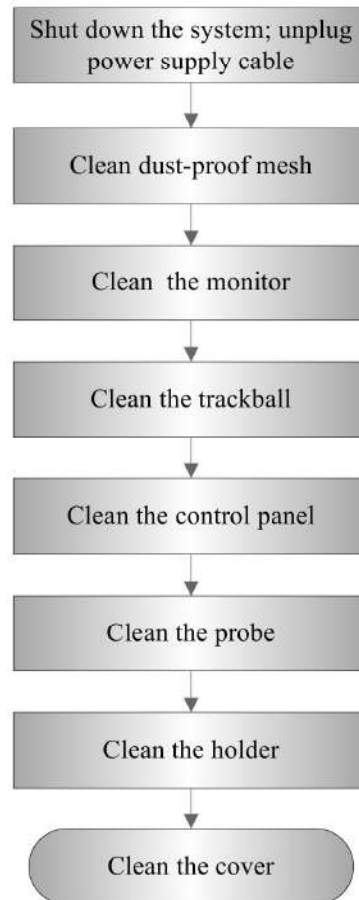
Table 2-3 Maintenance items and frequency

No.	Item	Recommended Frequency	Maintenance Personnel		Method
			Terminal User	Engineer	
1	Cleaning the dust filters	1 time/month	•	•	

No.	Item	Recommended Frequency	Maintenance Personnel		Method
			Terminal User	Engineer	
2	Cleaning the display	1 time/month	•	•	See Part I Service Scenarios: 2.2.3 Daily Maintenance.
3	Cleaning the trackball	1 time/month	•	•	
4	Cleaning the control panel	1 time/month	•	•	
5	Cleaning the probe (head)	Each time after being used	•	•	
6	Cleaning the probe cable and connector shell	1 time/month	•	•	
7	Cleaning the holders (including probe holder and medical ultrasonic couplant holder)	1 time/month	•	•	
8	Cleaning the shell	1 time/month	•	•	
9	Cleaning the peripherals	1 time/month	•	•	
10	Checking the probe surface	1 time/day	•	•	
11	Checking the power cable and power plug	1 time/month	•	•	
12	Checking the batteries	1 time per 3–6 months	•	•	
13	Checking peripherals and accessories	1 time/year	•	•	
14	Mechanical safety check	1 time/year	•	•	
15	Electrical safety check	1 time/year		•	

2.2.3 Daily Maintenance

Figure 2-1 Cleaning flow



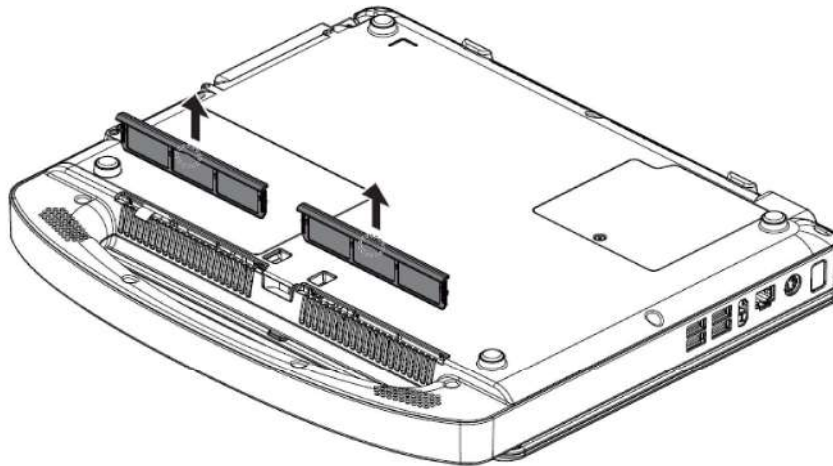
⚠ WARNING: Before cleaning the system, be sure to power down the system and remove the power cable. If you clean the system in the power-up state, an electric shock may be caused.

2.2.3.1 Cleaning the Dust Filters

Dust filters of the main unit

- Tool: soft brush
- Method:

Take off the dust filters on the side of the main unit.



⚠ CAUTION:

Clean all dust filters of the system periodically (once a month); otherwise, the system may be damaged. Cleaning times can be increased when the system is used in the open air or somewhere dust is more.

2.2.3.2 Clean the Display (Touch Screen)

Tool: dry soft cloth, clear water or wild soapsuds

Method: Clean the display and touch screen surface with a soft dry cloth. The display and touch screen with remaining stains can be wiped away using a cloth with a little clear water or wild soapsuds and then left for air drying.

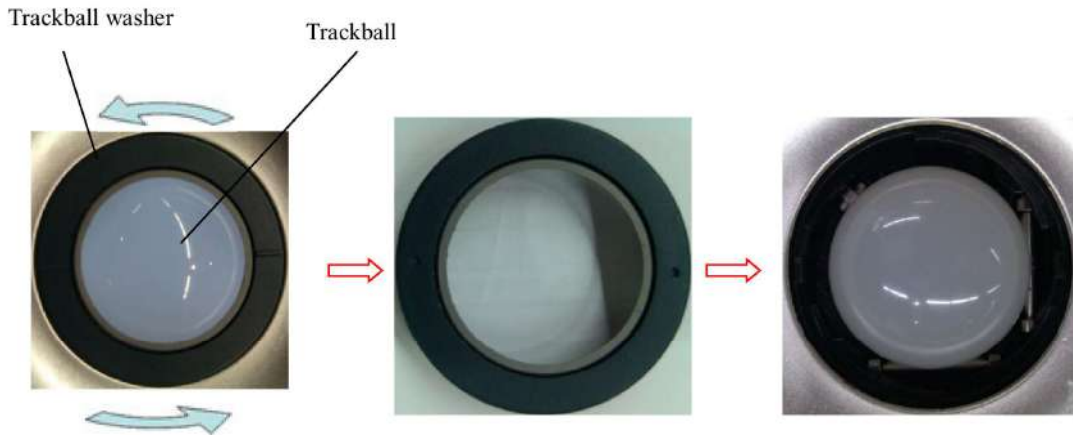
2.2.3.3 Cleaning the Trackball

The trackball is a man-machine interaction component and may easily carry dust into the module. Therefore, it must be regularly maintained to ensure system performance. When the cursor does not function flexibly, it may be because the trackball is contaminated by dust in the interior. In this case, disassemble the trackball and clean the dust inside it.

- Tool: tissue, dry soft cloth, wild soapsuds
- Method:

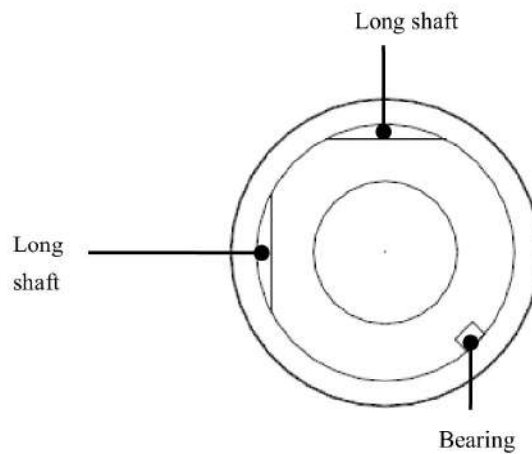
1. Disassembling the trackball:

Turn the trackball washer about 35° counterclockwise until it lifts, remove the washer and pull out the trackball. Exercise caution during operation to avoid dropping the trackball and thereby damaging it. If you cannot hold the trackball firmly when pulling it out, use adhesive plaster. The following figure shows the disassembly flow.



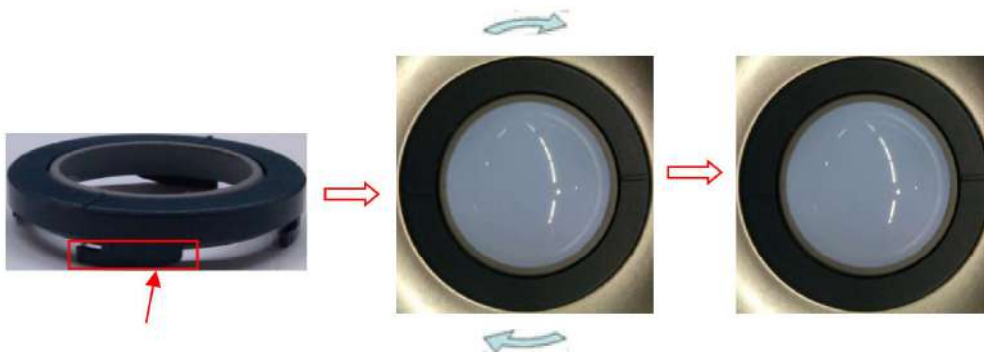
2. Cleaning

Clean the two long shafts, the bearing and the rotary ball with clean soft dry cloth or paper.



3. Installing the trackball:

Put the trackball back in the trackball mechanism and align the clamping ring with the top cover notches. Press the bulges on the ring with both hands and turn the washer 35° counterclockwise until the washer clicks and locks. As the bulges are flush with the top cover, the ring is secured. See the following figure.



2.2.3.4 Cleaning the Control Panel

- Note:**
- **Keyboard on the control panel should be cleaned periodically, otherwise, keys maybe blocked by dirt and buzzer dings, keys don't work.**
 - **The touch screen is cleaned in the same way as the control panel.**

Tool: mild soapsuds, dry soft cloth

Method: Use a dry soft cloth to clean up the dust on the surface of the control panel (including keys and encoder). Use a dry soft cloth immersed with a little wild soapsuds to wipe away remaining stains, and then use another dry soft cloth to wipe up the control panel or leave it for air drying. If it is difficult to clean the control panel, remove the caps of the encoders, and then use mild soapsuds to clean off.

2.2.3.5 Probe cleaning

- Note:** **The probe connector cannot be wiped up using a cloth immersed with water.**

Tool: mild soapsuds, dry soft cloth

Method:

1. Use a dry soft cloth to wipe away the dust on the probe head, connector shell, and cable.
2. Wipe off the dust on the probe connector or terminal by using a soft brush.
3. Use a dry soft cloth immersed with a little wild soapsuds to wipe away the remaining dust or stains on the cable surface or connector shell, and then leave it for air drying.

2.2.3.6 Cleaning the Holders

Tool: mild soapsuds, dry soft cloth, soft brush

Method:

1. Use a dry soft cloth to wipe away the dust inside and outside the probe and medical ultrasonic couplant holders and in gaps. Use a soft brush to wipe off the dust and stains in small intra-cavity probe holders or gaps.
2. For remaining stains, take of the holder, use a dry soft cloth immersed with a little wild soapsuds to wipe up the remaining stains outside or inside the holder, leave the holder for air drying, and then install it.
3. Medical ultrasonic couplant heater: Unplug the power cable of the medical ultrasonic couplant heater, and take off the heater. Use a dry soft cloth or a little soapsuds to clean the inside and outside of the heater. Use a soft brush to clean the holes. Use soapsuds to clean off the stains, and re-install it after air-dry.

2.2.3.7 Cleaning the Equipment Enclosure

- Note:** **For exposed interfaces or sockets such as probe sockets and interfaces on the IO board and power panel, use a soft brush to slightly wipe off the dust. It is prohibited to use a cloth immersed with water to clean these items.**

Tool: mild soapsuds, dry soft cloth

Method:

Use a dry soft cloth to wipe off the dust on the equipment enclosure (exposed part). Alternatively, use a dry soft cloth immersed with a little wild soapsuds to wipe away remaining stains, and then leave it for air drying.

2.2.3.8 Cleaning Peripherals

Clean actually configured peripherals and skip check items for those not configured.

Table 2-4 Peripheral cleaning list

No.	Item	Description
1	Color or black/white video printer	Use a soft dry cloth to clean off the dust and stains on the cover. Remove the cover to clean the inside of the printer. It is necessary to abide by the procedures in the user manual to clean the printer.
2	Graph/text printer	Use a soft dry cloth to clean off the dust and stains on the cover. Remove the cover to clean the inside of the printer. It is necessary to abide by the procedures in the user manual to clean the printer.
3	Footswitch	Use a dry soft cloth immersed with a little wild soapsuds to clean off the dust and stains on the keys and cables of the footswitch.
4	Barcode scanner	Use a dry soft cloth to clean the glass board of the scanner, and then clean off the dust on the cables and the support. If special cleaning is required, strictly follow the instructions in the scanner user manual.

2.2.4 Disinfecting the Main Unit

Only the system equipped with trackpad supports disinfection.

- ⚠ WARNING:**
- **Use only Mindray approved disinfectants and methods listed in this section to disinfect the main unit. Warranty does not cover damage caused by unapproved substances or methods.**
 - **Do not mix disinfectants, as hazardous gases may result.**
 - **We make no claims regarding the efficacy of the listed chemicals or methods as a means for controlling infection. For the method to control infection, consult your hospital's infection control officer or epidemiologist.**

- ⚠ CAUTION:**
- **Never immerse any part of the main unit in liquids or allow liquid to enter the interior.**
 - **Any contact of disinfectants with connectors or metal parts may cause corrosion.**
 - **Do not pour or spray any liquid directly on the main unit or permit fluid to seep into connections or openings.**


- If you spill liquid on the main unit, disconnect the power supply, dry the main unit, and contact your service personnel.
- Never use abrasive materials (such as steel wool or silver polish), or erosive cleaners (such as acetone or acetone-based cleaners).
- Dilute and use the disinfectants according to the manufacturer's instructions.
- Check the system after disinfection. If there is any sign of damage, remove it from use.
- Follow local regulations when selecting and using the disinfectant.
- Disinfectants listed in this section are used for disinfecting the housing of the main unit and the monitor only, not for disinfecting the probes or the trolley.
- During cleaning, wear medical gloves to prevent infection.

2.2.4.1 Compatible Disinfectants

The following table lists compatible disinfectants.

Product Name	Manufacturer	Type
75% alcohol	/	Solution
99.5% isopropyl alcohol	/	Solution
SONO™ ULTRASOUND WIPES	Advanced Ultrasound Solutions Inc.	Wipe
Schulke mikrozyd® Sensitive Wipes	Schulke	Wipe
Mikrobac Tissues	Bode Chemie Gmbh	Wipe
Sani-Cloth® Plus	PDI	Wipe

2.2.4.2 Disinfection Procedures

Note: The system has passed puncture test and leakage current test, and thus can be disinfected on power- on status: tap > bar in the left side of the touch screen to enter the Exam Main Menu screen and then select  to lock the system for 10 seconds to disinfect the system while the power is "On"

After cleaning, disinfect the system as follows.

1. Wear medical gloves to prevent infection.

2. Disinfect the main unit with disinfectant wipe or solution.

Follow the disinfectant manufacturer's recommended contact time and method.

Only the areas highlighted in gray color as shown in the following figure can be disinfected.

Do not disinfect the top cover, bottom cover, side panels around the main unit, manufacturer logo, any visible sockets or interfaces (such as probe socket, ventilation holes, dust-proof cover, loudspeaker, sockets or interfaces in the IO panel and power supply panel).



3. Remove any residue with a water-moistened soft cloth on the main unit.
4. Wipe off water on the main unit using sterile cloth or gauze. Do not dry the main unit by heating.

2.3 Check

2.3.1 General Check

Table 2-5 General checklist

No.	Item	Method
1	Probe	<ol style="list-style-type: none"> 1 Visual inspection: Check that the probe head is free from cracks and swelling. 2 Visual inspection: Check that the probe cable is free from aging and blistering. 3 Visual inspection: Check that the probe connector is not bent or damaged, or does not have missing pins.
2	Power cable and plug	<ol style="list-style-type: none"> 1 Visual inspection: Check that the power cable is free from buckling, cracks, and aging. 2 Manual inspection: Check that the power plug is secured reliably and does not loosen or crack, and that the preventing strip of the power cable is effective.

No.	Item	Method
3	Battery	<p>Check the battery performance regularly.</p> <ol style="list-style-type: none"> 1 Check whether the batteries can be charged properly during power-up. If the current battery level is 100% or the battery level increases after a period of time, the batteries can be charged properly. Generally, when the battery level is lower than 90%, it takes less than 5 minutes for the battery level to increase by 1%. When the battery level is higher than 90%, it takes a longer time for the battery level to increase by 1%. 2 After AC power is disconnected in the standby state, check whether the batteries can maintain the standby state based on the standby indicator.

2.3.2 System Function Check

System function check is an effective means to ensure product quality and can be performed when necessary. This check is optional during periodic maintenance.

Table 2-6 System function list

No.	Item	Method
1	B mode	Check the basic operations in B mode. Check the basic software and hardware controls which affect B-mode operation.
2	Color mode	Check the basic operations in Color mode. Check the basic software and hardware controls which affect color-mode operation.
3	Doppler mode (PW/CW)	Check the basic operations in Doppler mode. Check the basic software and hardware controls which affect Doppler-mode operation.
4	M mode	Check the basic operations in M mode. Check the basic software and hardware controls which affects M-mode operation.
5	Measurement (general 2D, M, and Doppler measurement, optional application measurement)	Scan the gray scale on body mark mode. Use controls to measure the accuracy of the distance and the area. Verify the measurement accuracy by employing the performance test.
6	Keyboard test	Test the keyboard to verify the keys on the keyboard.
7	LCD	Refer to LCD checking methods to check whether LCD display and parameters adjustment are normal.
8	Software menu testing	Test the display of software menus to ensure that the operation menus and interfaces can be accesses properly.

2.3.3 Checking Peripherals and Accessories

Skip relevant check items for modules or accessories not included in system configurations.