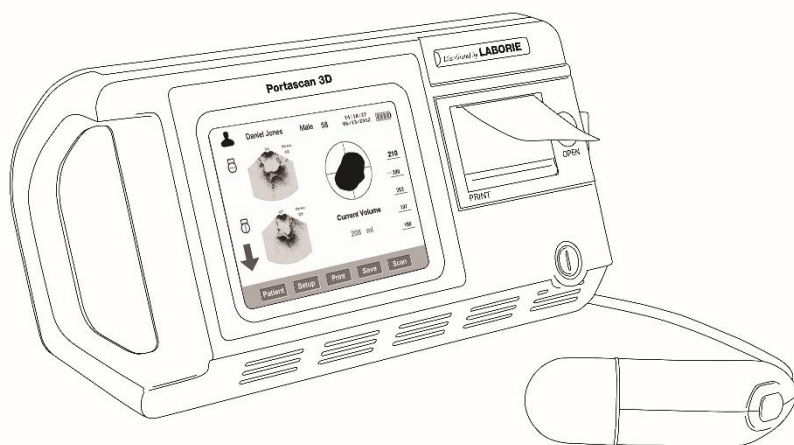


PORTASCAN 3D

Service Manual



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1. STRUCTURE OF THE PRODUCT

The components of Portascan 3D are shown in Table 1.

TABLE 1: STRUCTURE AND FUNCTION DESCRIPTION

NO.	PARTS NAME	FUNCTION DESCRIPTION
1	Digital Part of Mainboard	Consisting of CPU, RAM, Crystal Oscillator, ADC, DAC and peripheral circuit to achieve software operation, system control, data acquisition, imaging, bladder intellectual recognition, battery power management and volume measuring algorithm etc.
2	Analog Part of Mainboard	Consisting of pulse transmission circuit, echo receiving and magnification circuit to achieve ultrasound pulse transmission, echo receiving, magnification and processing functions.
3	Battery Interface Board	For connecting the battery to the power input of the main board.
4	Key Switch Board	For initiating the main unit power
5	3D Ultrasound Probe	Consisting of 2.5 MHz transducer, two step-motor, mechanical transmission mechanism, probe housing and cable. The slave motor drives the ultrasound transducer to do 120° sector scanning; the main motor is used to drive the 180° axial rotating of the motor and ultrasound transducer and then realize 3 dimensional scanning.
6	Thermal Printer	For data and images printing output
7	LCD Monitor and Inverter	To display human-computer interface, ultrasound image of

NO.	PARTS NAME	FUNCTION DESCRIPTION
		bladder section, bladder projection drawing and bladder volume.
8	Touch Screen and Controller	Operation interface control and realizing HCI
9	Lithium Battery Charger	Recharging the lithium battery
10	Lithium Battery	Providing power for the system, 3000mAH capacity and more than 300 recharging cycles.
11	Shielding Case	Shielding measure for EMC test
12	Housing Case	ABS injection housing case

Connecting cables between the electronic units are shown in Table 2.

TABLE 2 CONNECTING CABLE LIST

NO.	CABLE DESCRIPTION	NOTES
1	Power cable between battery interface board and digital part of the mainboard	Line to Line plus in red and black
2	Probe socket connecting cable	4-pin plug on the mainboard
3	LCD data cable	2x20 double row plug, connecting with LCD
4	LCD Back light unit control cable	6-pin flat cable plug
5	Thermal printer connecting cable	5-pin plug
6	Power indicator connecting cable	4-pin plug
7	Touch screen control cable	4-pin plug
8	Power switch connecting cable	2-pin plug
9	Motor control cable	8-pin plug
10	USB connecting cable	5-pin plug

NOTE: Please refer to *Fig. 8* for the cable connection.

2. PRINCIPLE OF OPERATION

The main parts of the product include main board, LCD, touch screen, 3D ultrasound probe, thermal printer and rechargeable lithium battery. The operation principle is describe in *Fig. 1*.

3D ultrasound probe consists of 2.5 MHz transducer, two step-motor, mechanical transmission mechanism, probe housing and cable. The slave motor drives the transducer to do 120° sector scanning. Main motor drives the motor and transducer to do 180° axial rotating. Then 3D scanning is achieved.

The transducer emits ultrasound wave into the human body with excitation of electric pulse and then receives the reflected signals from the bladder. The urine inside the bladder is low echo area and forms strong reflection at the wall of the bladder. Amplitude discrimination method can easily help to recognize the reflected waves at the bladder anterior and posterior walls and then calculate the distance between the two walls. Cross section area can be calculated with integral calculation method after the scanning is obtained. Then control signal is emitted for 15° rotation of the main monitor and then the scanning for next cross section is initiated. The bladder volume can be calculated with integral calculation method after the scanning of the 12 cross sections is finished.

To guarantee the correct probe location, pre-scanning function is designed to show the ultrasound image of the bladder. Users may adjust the position of probe to make sure that the whole bladder is within the sector scanning area, and then start scanning. A measuring result can be obtained based on these steps.

The product utilizes lithium battery for power supply considering the operation requirements of ward. To ensure that the product can work continuously for enough long time, economical and effective power consumption was thoroughly considered when power management circuit was designed. When the product has not been operated for a long time after switching on, the LCD back light will be switched off automatically. Automatic Power-off function is also designed to effectively utilize battery power.

Measuring result output can be achieved through thermal printer or inner memory.

3. UNIT QUALITY INSPECTION

3.1 ACCURACY

A phantom is used to test the accuracy of volume readings. Inside the phantom is a simulated bladder with a volume mentioned on each unit.

Take 5 scans and check if the highest and lowest one from the 5 readings are within the tolerance.

Caution! Please tune the gain value up to 40dB when being inspected on the phantom, and tune the gain value back down to 20dB after the inspection!

NO.	REQUIREMENTS	REMARKS
1	Tolerance $\leq \pm 15\%$	40 dB Gain on Phantom 20 dB Gain on Human

3.2 FUNCTIONS

Test each function in routine operations according to the user's manual.

In this test item, we focuses on touch screen button, probe button, interface display and printing.

NO.	REQUIREMENTS	REMARKS
2	Touch Screen Button Probe Button Interface Display Printing	

3.3 APPEARANCE

This test item is focused on color, text labeling, scratch marks and spots.

Check whether plastic parts bubble, crack, deform or overflow, whether operational and adjustment mechanisms are flexible and secure, and whether fastening pieces are tightly fastened.

NO.	REQUIREMENTS	REMARKS
3	Colour	Uniform colour, No scratches or spots, clear and fast text labeling
	Plastic Components	No bubbling, cracking, deformities or overflowing
	Operational Adjustment Mechanisms	& Flexible and secure, all components tightly fastened

4. COMMON FAULTS AND TROUBLESHOOTING

4.1 POWER SWITCH

Check if the battery is completely plugged into the slot and locked, and check if the battery power is sufficient.

If the above is operated and no failure is detected, please open the housing case following 6. DISASSEMBLY OF THE MAIN UNIT, remove the shielding case and measure power input voltage of the digital board. The normal reading should be $12V \pm 5\%$.

1. If the voltage is abnormal, the problem may occur to the battery interface board, and corresponding measures should be taken. The battery interface board connects to the digital board power cable and battery, and is fixed at the back housing case with 4 screws (shown in Fig.4.1). Afterwards, please remove the battery interface board for checking or replacing.



Fig. 4.1 Battery Interface Board Position Sketch Map

2. If the voltage is normal, the problem may occur on the mainboard. This problem may be judged by substitution method. If problem with the digital part is identified, then the mainboard should be replaced.

4.2 PROBE

A. Physical Probe Issues

1. If the probe cracks and leaks oil, send it back to Service Center or the Manufacturer for further repair or replacement. Do not try to repair on your own.



Fig. 4.2.: Probe cracking

2. If the probe's rubber ring deteriorates, breaks, or is missing replace it with a new one. To restore the seal of the rubber ring, secure with a rubber based glue. If you are unable to do so, send it back to the Service Center or Manufacturer for further repair or replacement.
3. If the probe's motor doesn't vibrate or work properly send it back to Service Center or the Manufacturer for further repair or replacement. Do not try to repair.

B. Probe Button Malfunction

If there is no response when pressing the probe button:

1. Make sure that the probe and the main unit are well connected and then click "SCAN" key on the main interface. If the probe can work normally, the problem may occur to the probe. Please identify the problem with substitution method and replace the probe when necessary.
2. If the above measure does not work, please open the housing, remove the shielding cover and check probe socket connecting cable. Identify the problem with substitution method and replace the connecting cable when necessary.
3. If the above measures do not work, the problem may occur to main board. Please identify the problem with substitution method and replace the main board when necessary.

C. No Information is displayed when Probe Scans

1. Check if the probe cable is connected well with the probe socket. If the probe is well connected, so scanning with a normal probe. If there is a signal, the problem with the probe can be identified. The probe should be replaced to solve the problem.
2. If the replacing probe still produces no signal, then please open the housing case, remove the shielding case and check the signal cable at the soldered side of the analog board and probe socket connecting cable. If the problem is identified with substitution method, please replace the connecting cable to solve the problem.
3. If procedures 1. and 2. do not solve the problem, please check if the connecting cable (shown in Fig. 8) is well connected and identify the problem with the substitution method. Replace the connecting cable when necessary.
4. If the above-mentioned measures do not work, the problem may be with the main board. Please identify the problem with substitution method and replace the main board if necessary.

D. Probe Scan shows only a vertical line

If you have another probe, use it for test.

1. If system comes back to normal, this indicates that the probe with no image had signal transmission interruption. Please send the probe to the Service Center for repair or cable replacement.
2. If probe is changed and the system still has no image, this indicates that all system failed. Please send your unit and probe together to the Service Center for repair.
3. If you do not have spare probe, please send unit and probe together to the Service Center for repair.

E. Probe Connection Issues

Probe plug has a clip to lock the plug with the socket on the unit. Insertion or removal needs to pull the unlock sleeve to right to low the lock clip. If the plug is dirty, filled with dirt, gel, or oil, it will be hard to connect or remove.



Fig. 4.3: Disassemble the plug and use 70% alcohol solution to wash each component

4.3 DISPLAY

A. LCD Calibration

1. Check if there are irrelevant materials at the surrounding area of the screen and clear them off if there is.
2. Calibrate the touch screen for trouble shooting. Touch screen calibration guidance: Switch on the instrument while pressing the probe button and operators will enter

screen calibration interface.



Fig. 4.4 a) Touch Screen Calibration Interface

A cross mark appears after entering the touch screen calibration program (shown in Fig. 4.4 a).

Reminder: Make sure to touch the **surrounding area** of the cross.

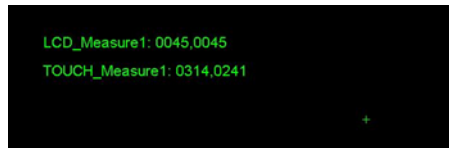


Fig. 4.4 b) Touch Screen Calibration Interface

Fig. 4.4 b) shows the coordinates of LCD and touchscreen and there will be a cross at the lower right corner of the screen. Please touch the surrounding area of the cross with the above-mentioned method. Based on the theory that two points makes one line, the corresponding relationship between the touch screen and LCD can be identified. Then operators may select the third point for verification, which is shown by Fig. 4.4 c).

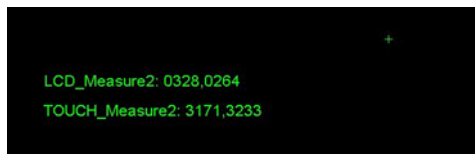


Fig. 4.4 c) Touch Screen Calibration Interface



Fig. 4.4 d) Calibration Completed Interface



Fig. 4.4 e) Recalibration Interface

Fig. 4.4 c) shows the coordinates of LCD and touch screen after second touching at the cross. Meanwhile, the third cross, used for verification of calibration, appears at upper right corner of the screen. Successful calibration will lead to the interface of *Fig. 4.4 d)* and then to main interface of the main unit. If the calibration fails, the instrument will enter the interface of *4.4 e)* and returns to interface of *Fig. 4.4 a)* in a while. Operators need to recalibrate the touch screen until calibration succeeds to enter main interface.

3. If procedures 1 and 2 do not work, operators may check the connecting cable between the touchscreen control board, the touch screen, and the touchscreen control cable to see if the cables are loose.
4. If the connecting cables are normal, please check the touch screen controller with substitution method. Replace the controller when necessary. Touch screen controller is fixed at the printer cover with 2 screws and can be removed by disassembling the connecting cables and removing the two screws. (*Fig. 4.4 f)*)

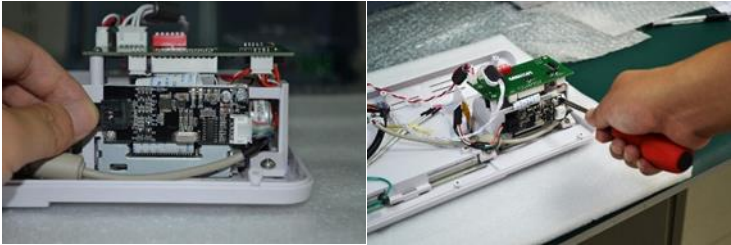


Fig. 4.4 f) Removing touch screen controller

5. If replacing controller does not work, the problem may have occurred to the digital part. Operators may identify the problem with substitution method and replace the main board if necessary.

B. Abnormal Display of LCD (color error, screen flash, etc...)

Open the housing case following 6. DISASSEMBLY OF THE MAIN UNIT, remove shielding case and check if the back light unit control cable, LCD data cable are correctly and well plugged (as shown in Fig. 8). Connect these cables properly to exclude the problem.

1. If the above-mentioned procedure does not work, operators may judge if problem occurs to the main board with substitution method and replace the main board when necessary.

C. No Display On LCD

1. Follow 6. DISASSEMBLY OF THE MAIN UNIT to open the housing to remove the shielding case and check the LCD back light board control cable. Replace the connecting cable to solve the problem when necessary.
2. If the above-mentioned procedure does not work, operators may judge if problem occurs to the main board with Check the LCD data cable, and change the data cable when necessary to exclude the problem.
3. Measure the voltage of back light control cable pin, and check whether the voltage complies with the standards listed in LCD manual.

4. If the above-mentioned procedure does not work, operators may judge if the problem occurs to the main board with substitution method and replace the main board when necessary.

4.4. CLOCK

A. Abnormal Clock Display, Clock Resetting Can't Be Saved

1. Open the housing case to remove the shielding case and replace the clock battery on the main board to solve the problem. The battery is a SONY CR2032 (3V Lithium battery). Press the clip on the battery base and the old battery will pop up. Operators may equip a new battery at the battery base with the positive pole up and the negative pole down.
2. If the setting still can't be saved with the above measures, operators may check if the battery base is well welded and solve the problem accordingly.

4.5 PRINT

A. No Response When Pressing "Print"

1. Restart the instrument and there should be a mechanical running sound with the printer when turning on. If no sound is heard, operators may open the housing case, remove the shielding case and check the thermal printer power cable following
2. . Please replace the connecting cable when necessary.
3. If there is a printer running sound when the power is turned on, but the printer still does not work, operators may check the printer data cable (6), which is shown in *Fig. 8*.
4. If there is a printer running sound, and the connecting cables are normal but the printer does not work, the problem can be the printer. Please check if the problem occurs to the printer with the substitution method. The printer consists of a printing head and a printer board,

both of which are fixed at the printer cover. Remove the 4 screws following the below picture first and remove another 2 screws to get to the printer board and printer.

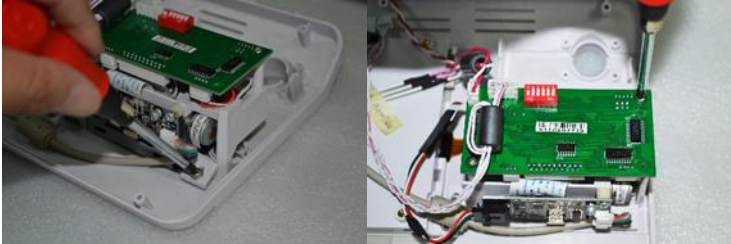


Fig. 4.5 Disassembly of the Printer

5. If procedures of 1. and 2. do not detect any abnormality, the problem may have occurred on the main board. Operators may decide with substitution method and replace the main board when necessary.

B. Thermal Paper Runs Normally But Not Printing Information When Pressing "Print"

Check if the thermal paper is placed in the opposite direction (thermal side facing up) and place the thermal paper correctly to solve the problem.

4.6 BATTERY

A. Recharging Failure with the Lithium Battery

1. Power on the charger and measure the no-load voltage of power output end with the digital multimeter and check if the voltage is $12.6V \pm 5\%$.
2. If no problem is detected from 1), the problem may occur to the battery. Recharge the low power lithium battery and observe if the charger indicator turns red. If the indicator remains green, then problem occurs to the battery. Please replace the battery to solve the problem.

5. CALIBRATION & VERIFICATION

5.1 TOUCH SCREEN CALIBRATION

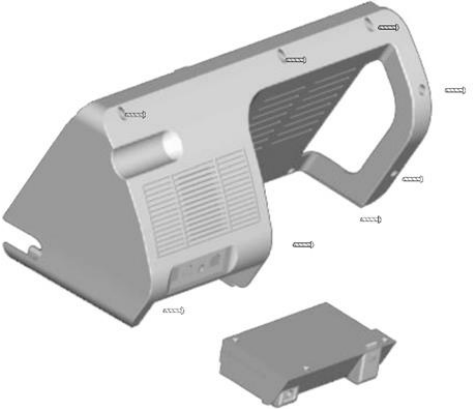
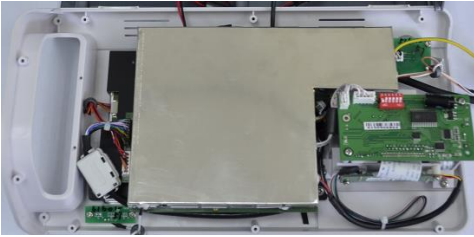
Refer to Section 4.3.A - LCD Screen Calibration

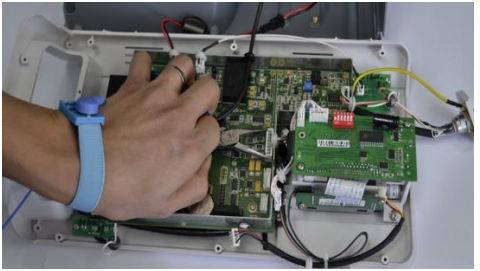
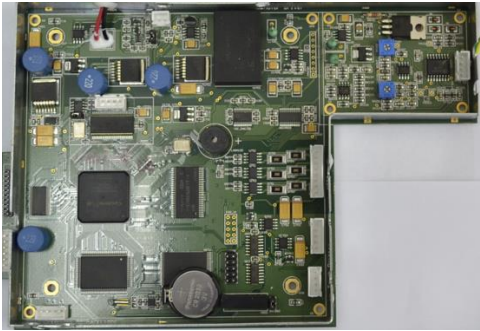

5.2 PROBE VERIFICATION

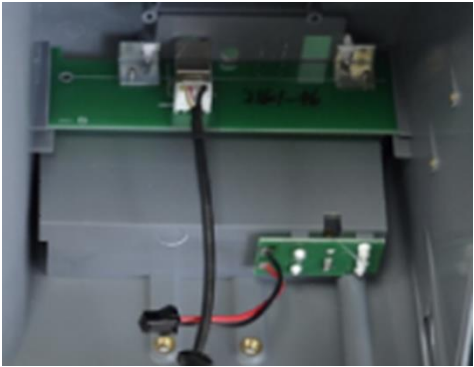


Probe is verified using a phantom bladder (BVL1004) at Gain 40 dB. The volume of the bladder is mentioned on its label $\pm 15\%$.

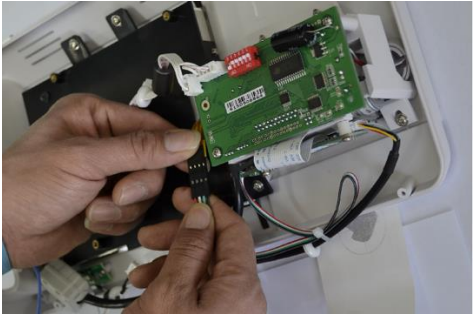

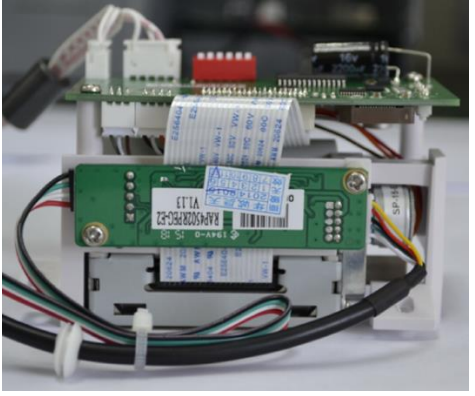
Refer to Section 9.4 Probe Verification and Calibration for more detailed procedure


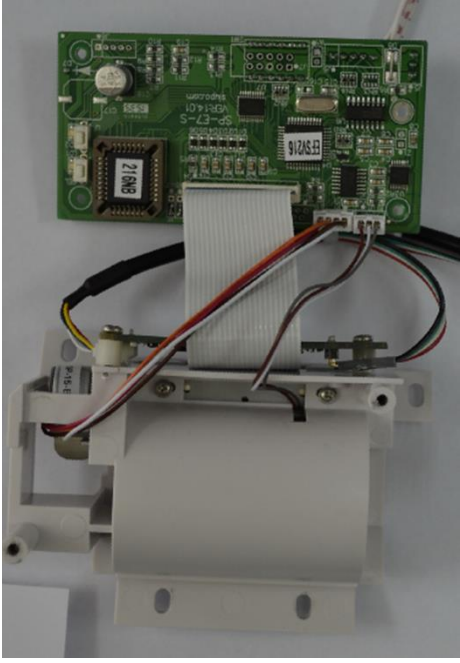

6. DISASSEMBLY OF THE MAIN UNIT

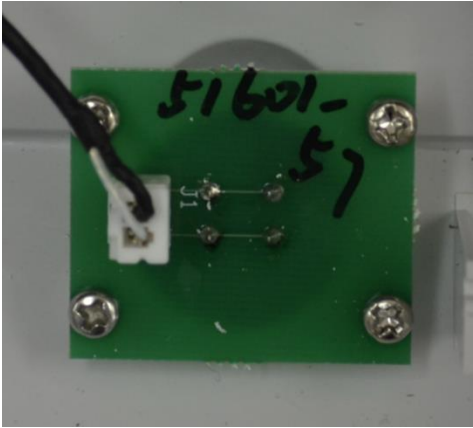

	STEP/ACTION	
1	Remove the 8 screws to separate the front and back covers of the housing case, as shown	
2	The shielding cover has no screw fixation, so it can be removed or re-mounted manually with help of tweezers	

	STEP/ACTION	
3	<p>Disconnect all the wires from the main board manually or using tweezers.</p> <p>Caution: please take appropriate anti-static measures before disconnection.</p>	
4	<p>Unscrew 4 screws securing the main board to remove from main unit.</p>	
5	<p>After the main board is removed, the remaining components fixed onto the front panel are LCD and touch screen, key switch board, printer and power indicator.</p>	

STEP/ACTION		
6	After the main board is removed, the remaining components fixed onto the rear panel are battery connector board and USB board (at right)	
7	The USB board is fixed by two screws on the rear panel.	
8	The battery connector board is fixed by 4 screws in the battery slot on the rear panel.	
<p>Caution: when you remount battery to the main unit, make sure the second pin from the top is not the metal one. Failure to do so, i.e., putting it upside down, will cause the battery to fail.</p>		

	STEP/ACTION	
9	<p>To disconnect the printer, the flat cable connecting the touch screen control board should be disconnected properly.</p>	
10	<p>To disconnect the printer, remove the 4 screws affixing it at all 4 corners.</p> <p>Note: touch screen control board is attached to bottom of the printer</p>	
11	<p>Unscrew the 2 screws that affix the touch screen control to the printer</p>	

STEP/ACTION		
12	<p>To remove the printer board, unscrew the 2 screws affixing it to the printer frame.</p>	
13	<p>The printer head is further fixed on the printer frame by two small screws.</p> <p>After removing the printer head, you may remove the printer assembly from the frame</p>	
14	<p>The power indicator board is fixed by 2 screws on both sides.</p> <p>You may remove the board by</p>	

STEP/ACTION		
	unscrewing the 2 screws	
15	<p>The key switch board is fixed by 4 screws on its 4 corners.</p> <p>Remove the board by unscrewing the 4 screws.</p>	
16	<p>The display assembly is comprised of an LCD and a touch screen, both fixed within a black frame.</p> <p>The frame is fixed on the front panel by 4 screws. You may remove the display assembly by unscrewing the 4 screws.</p>	

6.1 DISASSEMBLY TIPS

1. The shielding cover may be used for holding screws.

2. Screws should be identified clearly and grouped accordingly.
3. Anti-static measures must be taken to avoid unnecessary damage.
4. Some of the wires are thin, please handle them carefully.

6.2 MAIN COMPONENT LAYOUT

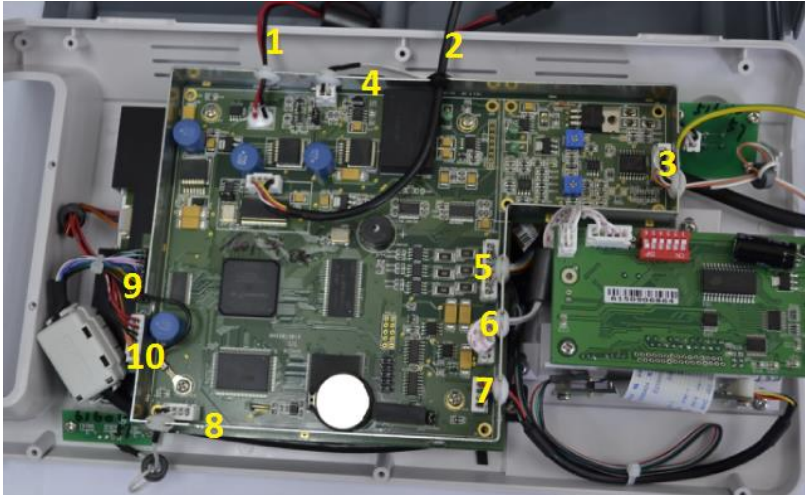


Fig. 6.2: Layout of components in main unit

The numbers in Fig. 6.2 correspond to the following wires and wire locations:

1. To battery connector board
2. To USB board
3. To probe socket
4. To Key switch board
5. To probe socket
6. To printer
7. To touch screen
8. To power indicator
9. To LCD
10. To LCD

7. CLEANING & MAINTENANCE

7.1 CLEANING MAIN UNIT

1. Use soft cloth with neutral detergent (e.g. diluted Bianex® Special Efficiency Multi-Enzymatic Cleanser) or water to clean the instrument surface. For further disinfection, use soft cloth with prepared disinfectant solution (Sporicidin Sterilizing and Disinfecting Solution) to wipe the instrument surface.
2. Remove the residual detergent or disinfectant with clean soft cloth dampened in sterile water, while keeping water and any other liquids away from the instrument. Make sure the device is completely dry before using.

7.2 CLEANING THE PROBE

A. Regular Cleaning

Use tissue to remove acoustic gel from probe after use.

Use soft cloth dampened with appropriate hospital cleaning agent (e.g. isopropyl alcohol, medical alcohol) to wipe the probe.

Disposable gloves, eye protection and liquid-proof gowns should be worn when cleaning soiled probe.

B. Deep Cleaning

For further cleaning, Bianex® Special Efficiency Multi-Enzymatic Cleanser is recommended according to the procedures below:

1. Prepare cleaning solution by adding 1-2ml Bianex® Special Efficiency Multi-Enzymatic Cleanser into 500ml of sterile water. Additional amounts may be required for hard-to-remove matter. The water temperature should be from 20°C to 64°C.
2. Immerse the part of probe under the indicating line into the container with 500ml cleaning solution for 5 minutes. (see Fig. 7.1 and Fig. 7.2).
3. Clean the probe carefully in the cleaning solution with a soft silk brush and shake it to wash; and then take it out and wipe off the cleaning solution with sterile cloth.
4. Rinse the cleaned probe by immersing them in 500ml sterile water for 1 minute.

5. Drain the probe and wipe it with sterile cloth.

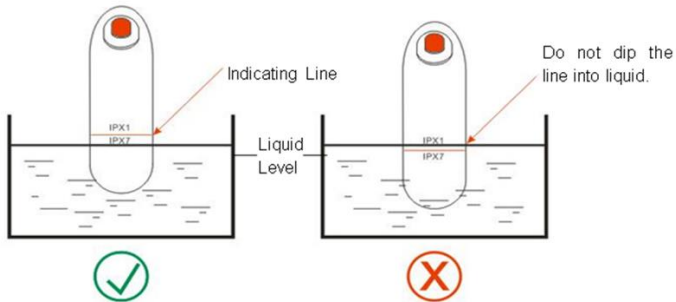


Fig. 7.1 Probe Immersion

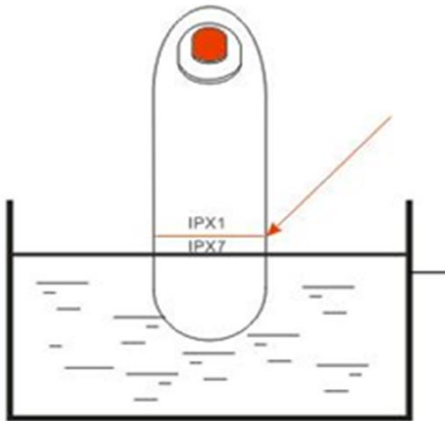


Fig. 7.2 Probe Immersion Levels IPX1 and IPX7

Level IPX1- Dripping Water: Effective against dripping water (vertically falling drops)

Level IPX7 – Immersion up to 1m: Ingress of water in harmful quantity shall not be possible when the enclosure is immersed in water under defined conditions of pressure and time (up to 1 m of submersion).

C. Sterilization

As non-critical devices, ultrasound probes only need to be cleaned and low-level disinfected between patient uses. Sporidicin Sterilizing and Disinfecting Solution is recommended for disinfection.

7.3 ROUTINE MAINTENANCE

When the device is frequently used,

- Use it in a clean and well-ventilated environment, where ambient temperature should be 5°C ~ 40°C, and relative humidity should be lower than 80%. Do not expose it to high temperature or direct sunshine.
- Avoid corrosive gas, flammable anesthetic gas mixed with air, oxygen or nitrous oxide.
- Avoid equipment with strong electromagnetic radiation or electromagnetic interference.
- Avoid use with cardiac defibrillators, or high-frequency surgical and therapy equipment.
- Avoid frequent turn-on and turn-off.
- Try to avoid falling or violent vibration, and take extra care on probes.

When the device is not used for a long time,

- Power on the device for 1 hour every month in humid areas or humid seasons.
- Take the battery out of the device, and store it properly.

8. CONNECTIONS ON MAIN BOARD

Fig 8 shows the connections between the main board and each interface.

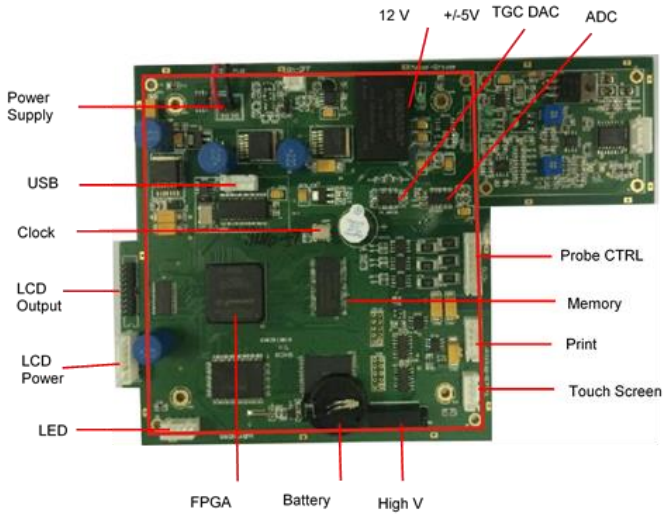


Fig. 5 Main Board and Interface Connections

Fig. 8.0: Main Board and Interface Connections

9. ADVANCED SERVICE

9.1 SYSTEM DEFAULT SETTINGS

A. Appearance

- Both the unit and probe have no scratch marks or spots.
- The screen shows uniform color and normal display when the unit is powered on.
- Click function bars on the screen, system shall respond accordingly.

B. Gain

Click "SETUP", screen shall show the setup menu

Click "Gain", screen shall show the Gain=20.

NOTE: Gain=20dB is the most important system parameter for patient scan mode. If the Gain was set at other number, use arrow bars to adjust it back to 20dB.

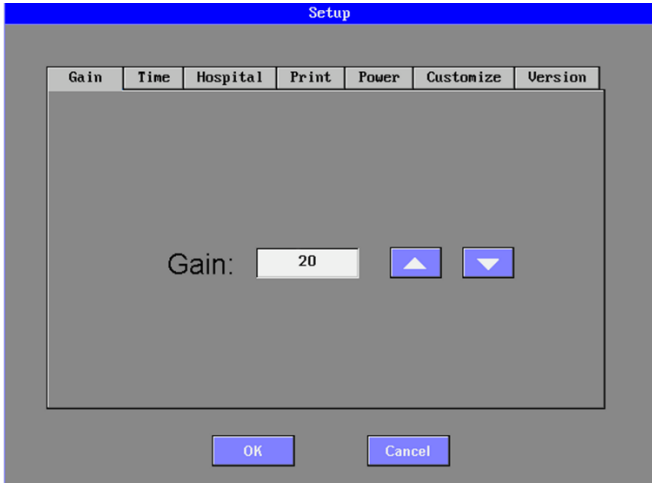


Fig. 9.1: Gain

C. Printer

Click printer bar get into print setup.

Printer default setting is "Bladder Image"

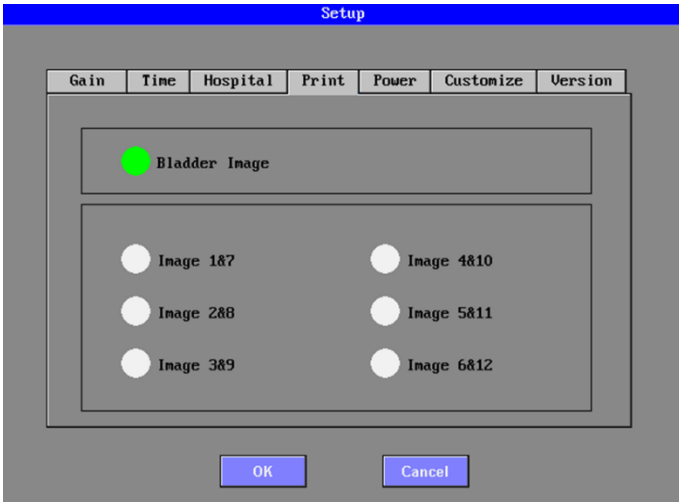


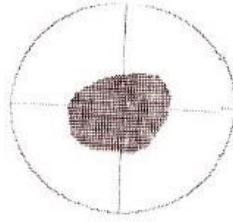
Fig. 9.2: Printer

At default setting:
"Bladder Image" only,
the system prints
bladder image only.

Laborie Portascan 3D

TIME : 2016-09-07 00:57:48
ID :
SEX : MALE
AGE :
NAME :

VOL : 143 ML

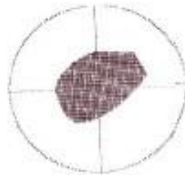


If other sectional images
are selected, they will
also print the images at
the selected section
accordingly.

Laborie Portascan 3D

TIME : 2016-09-07 00:58:36
ID :
SEX : MALE
AGE :
NAME :

VOL : 149 ML



9.2 DISPLAY UNIT

A. Touch Screen Cracks

Touch screen can be replaced easily. It is usually not necessary to replace all LCD units.

- a. Remove main board, disconnect all connectors;
- b. Remove four screws, separate LCD unit from front panel;

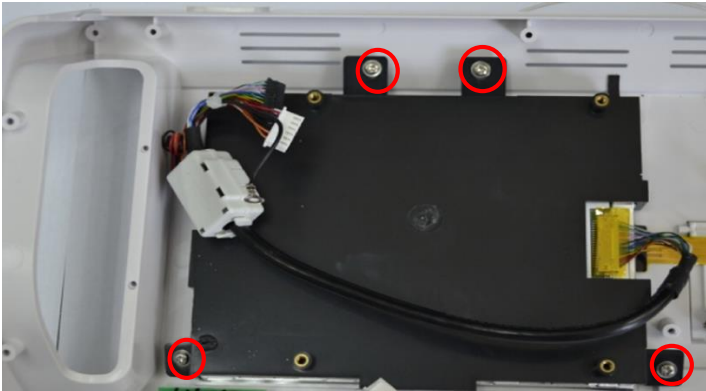


Fig. 9.3: Four screws securing the LCD display unit

- c. Remove four screws on LCD sides, pull out the cracked screen;

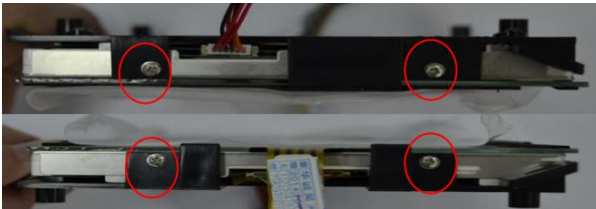


Fig. 9.4: Four screws securing the LCD display unit

- d. Slide in new screen with special care – it is **fragile!**
- e. Touch screen has a four-pin connector which can be connected at any direction. When we assemble it, we mark two white dots on each side of the connector. Please compare with the old screen, mark down right direction for connection.

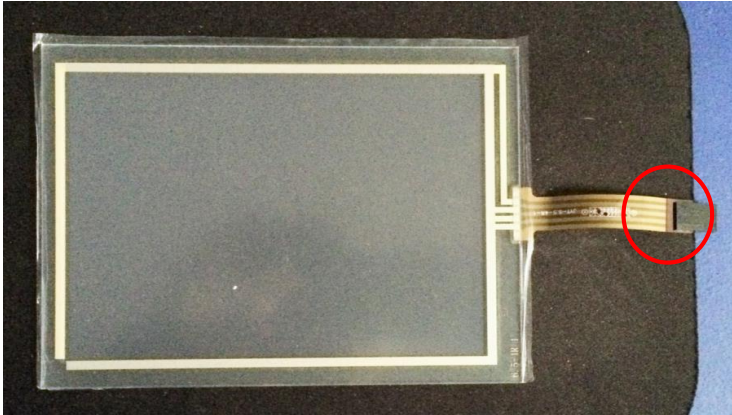
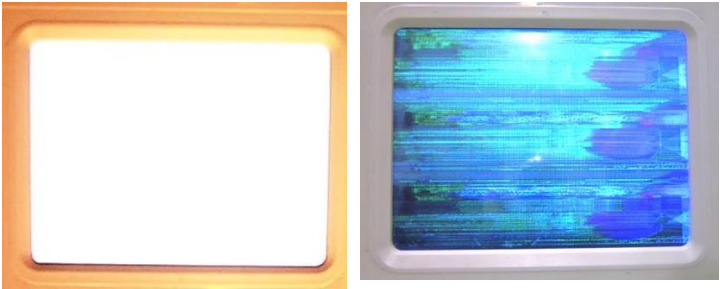


Fig. 9.5: Four-pin connector (circled)



Fig. 9.6: White dots marking correct orientation for connection

B. Blank or Altered Screen



After the unit is powered on, screen light is on but the unit shows a blank screen or messy color strips

Blank or messy color screen is usually caused by failed 18-pin LCD connection as below:

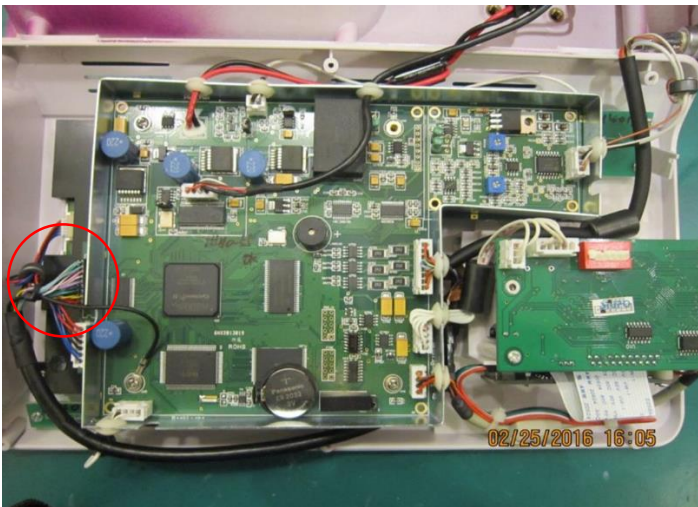


Fig. 9.7: 18-Pin LCD Connection (circled)

Check this 18-pin connector to find out any loosen or improper fit. Secured connection will solve the problem.

C. Reversed Screen Image

After the unit is powered on, LCD shows vertically reversed menu. The failure is commonly caused by LCD connector pop-

up. Remove main board to explore underneath LCD unit. Check the connector to find any loosened part or pop-up. Secured connection will solve the problem.

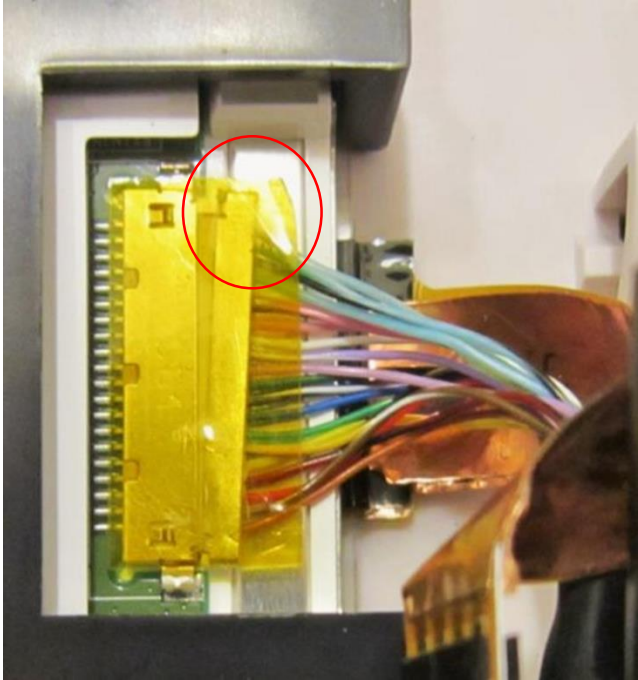


Fig. 9.8 : LCD Connection with pop-up (circled)

9.3 MAIN BOARD

Before June, 2014, the Bladder Scanner had two boards: Digital + Analog. After July, 2014, the Bladder Scanner integrated the two boards into one "Main Board" system.



Fig. 9.9: Two Board Unit



Fig. 9.10: Main Board Unit

A. Main Board Troubleshooting

ISSUE	TWO BOARD	MAIN BOARD
Failure of scan control	CPU fails. Replacing digital board can solve the problem.	Scan control IC (UD2, 74F08) failed. Please contact the service center to change the chip.
Unit does not power off	Contact service center to replace: Q453 IC 9933 and U450 IC 2950	Contact service center to replace: Q453 IC9933 and U450 IC 2950

ISSUE	TWO BOARD	MAIN BOARD
Other failure (unsure)	For all other unsure failure, please try by replacing digital, analog or main board accordingly. If the problem persists, send unit and probe to our service center.	

9.4 PROBE VERIFICATION & CALIBRATION

Probe is a complete device. It has three major parts:

- a. 2.5MHz transducer on top, transmitting and receiving ultrasound signals;
- b. Slave motor which continuously swings at 120° during scan;
- c. Main motor which runs 180° for each scan, with every 15° interval.

A. Initial Inspection

Check the probe for any cracks, oil leakage or any physical scratches.

Hold probe close to your ear, push and hold the switch, you can hear and feel the probe slave motor running. Slave motor will continuously swing at 120°. The good probe shall run smoothly and quickly without noise or abnormal vibration.

Release the switch, the main motor starts a 180° rotation, with every 15° interval. At same time, slave motor keeps swinging. The good probe shall run smoothly and quickly without noise or abnormal vibration.

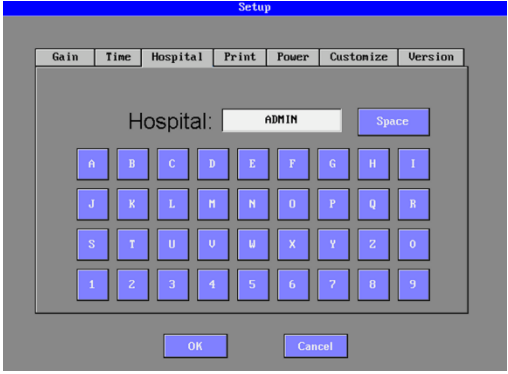
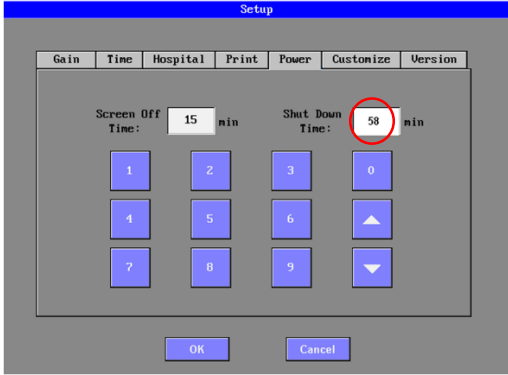
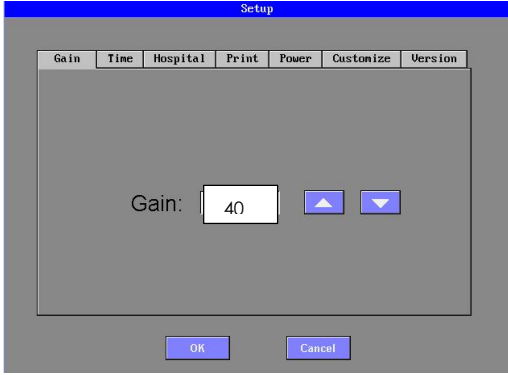
B. Verification

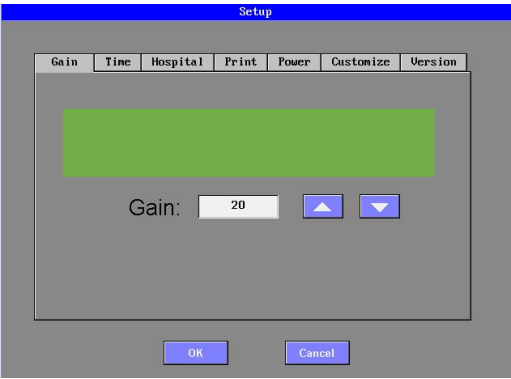
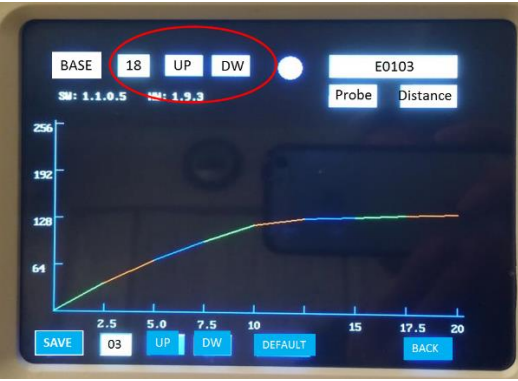
NO.	STEP	ACTION
1	Test a Scan	<p>Click "SETUP" on main screen, then click "GAIN";</p> <p>Use up/down arrow, set up Gain = 40dB, then press "OK";</p> <p>Insert probe into phantom, hold the scan switch. The image on the screen shall be round, clear-edging and repeatable in measured volume.</p>
2	Verify measuring accuracy	<p>Manufacturer's specification for accuracy is +/- 15%;</p> <p>Take five scans, and calculate the average volume reading;</p> <p>Based on phantom standard volume, verify the average reading fit or beyond the manufacturer's specification.</p>
3	Volume reading out of specification	<p>If probe average reading is under +/- 20% of manufacturer's specification, the probe can be calibrated with the unit (see Section C for details);</p> <p>If probe average reading is over +/- 20% of manufacturer's specification, please send it back to the Service Center for repair or replacement.</p>


C. Calibration

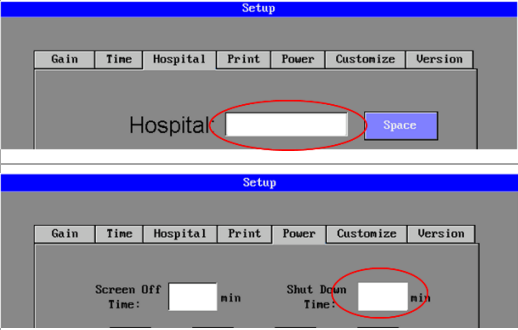
Probe calibration can reach higher accuracy for designated unit and probe.

Calibration requires unit, probe and phantom. By adjusting system base gain at the engineering interface, the designated unit and probe can reach the best adaptation, resulting in higher measuring accuracy.

STEP/ACTION		
1	<p>Click 'SETUP' and select 'HOSPITAL'</p> <p>Input 'ADMIN'</p>	
2	<p>Click 'TIME' and select 'Shut Down Time'</p> <p>Input number '58'</p>	
3	<p>Click "GAIN", adjust Gain = 40</p> <p>Click OK</p>	

STEP/ACTION		
4	Test Scans	Test five scans and record average volume readings
5	Click 'SETUP' Click 'GAIN' On gain interface, click anywhere in green zone (right)	
6	After clicking green zone, engineering interface will appear on screen	
7a.	Volume reading is below the specification: Calibrate it by decreasing the base gain i.e. System base gain = 18 129 ml phantom read 102 ml (7 ml below the specification) Use "DW" bar adjust the base gain = 16 Click "SAVE", "DEFAULT", "BACK", then "OK" Scan again to verify volume reading reaches in the spec.	

STEP/ACTION	
	<p>If not, repeat the procedure, set base gain = 14.</p> <p>Scan again until the satisfied reading reached.</p>
7b.	<p>Volume reading is higher than specification:</p> <p>Calibrate it by increasing the base gain</p> <p>i.e. System base gain = 18 With 129 ml phantom, scan read 153 ml (5 ml over the spec)</p> <p>Use "UP" bar adjust the base gain = 20</p> <p>Click "SAVE", "DEFAULT", "BACK" then "OK"</p> <p>Scan again to verify volume reading cut back in the spec.</p> <p>If not, repeat the procedure, set base gain = 22.</p> <p>Click "SAVE", "DEFAULT", "BACK" then "OK"</p> <p>Scan again until you get satisfied reading.</p>
8	<div style="display: flex; align-items: flex-start;"> <div style="flex: 1;"> <p>All phantom scan shall be at GAIN = 40.</p> <p>After calibration, adjust the GAIN back to GAIN = 20,</p> <p>Click OK</p> </div> <div style="flex: 2;">  </div> </div>

STEP/ACTION	
9	<div style="display: flex;"> <div style="flex: 1;"> <p>Change 'HOSPITAL' and 'SHUT DOWN TIME' back to original settings</p> </div> <div style="flex: 2;">  </div> </div>

NOTE: On engineering interface, DIV=03 is system default setting. Changing it may cause the system to fail. If changed by mistake, just click "DEFAULT", it will back to original default setting.



Fig. 9.11: System default setting DIV = 03 (circled)

10 DOCUMENTATION AND RECORDS

All service performed on a unit must be documented and recorded on a service record. The record must include unit serial number, user-claimed defect, initial inspection, defect found and all details regarding repairs.

One copy of the service record must be sent to LABORIE as per FDA regulations.

