

UB-211/212

DIGITAL BLOOD PRESSURE METER-FINGER

MAINTENANCE MANUAL

maintenance-UB 211/212-v.1.a

DIGITAL BLOOD PRESSURE METER-FINGER
(UB-211US-HA)



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1. Description

The Finger-Type Blood Pressure Meter Models UB-211/212 employ oscillometric method for measurement and incorporate the Electronically Controlled Exhaust Valve (ECEV). Oscillometric method is a technique of measuring blood pressure based on pressure vibration through a finger cuff.

The ECEV is an electronically controlled exhaust valve for which exhaust volume is controlled by the CPU. This valve functions as a constant speed exhaust valve and rapid exhaust valve.

The ECEV resolves the problems of earlier models which uses a constant speed exhaust valve that could not maintain constant exhaust speed under varying conditions caused by finger circumference, for example, to obtain accurate results.

The LCD panel alternately displays systolic blood pressure using the three high-order digits/diastolic blood pressure using the three low-order digits and pulse rate. The LCD panel also displays pulse detection and indicates low battery power and a cuff slide too tight.

The cuff slide unit has a tightness detector for which the LCD panel displays the "too tight" mark.

The inflation value is controlled by the CPU. If there is insufficient inflation, the instrument automatically reinflate.

Power supply uses two "AA" size batteries (for about 300 measurements), it has auto-power-off function.



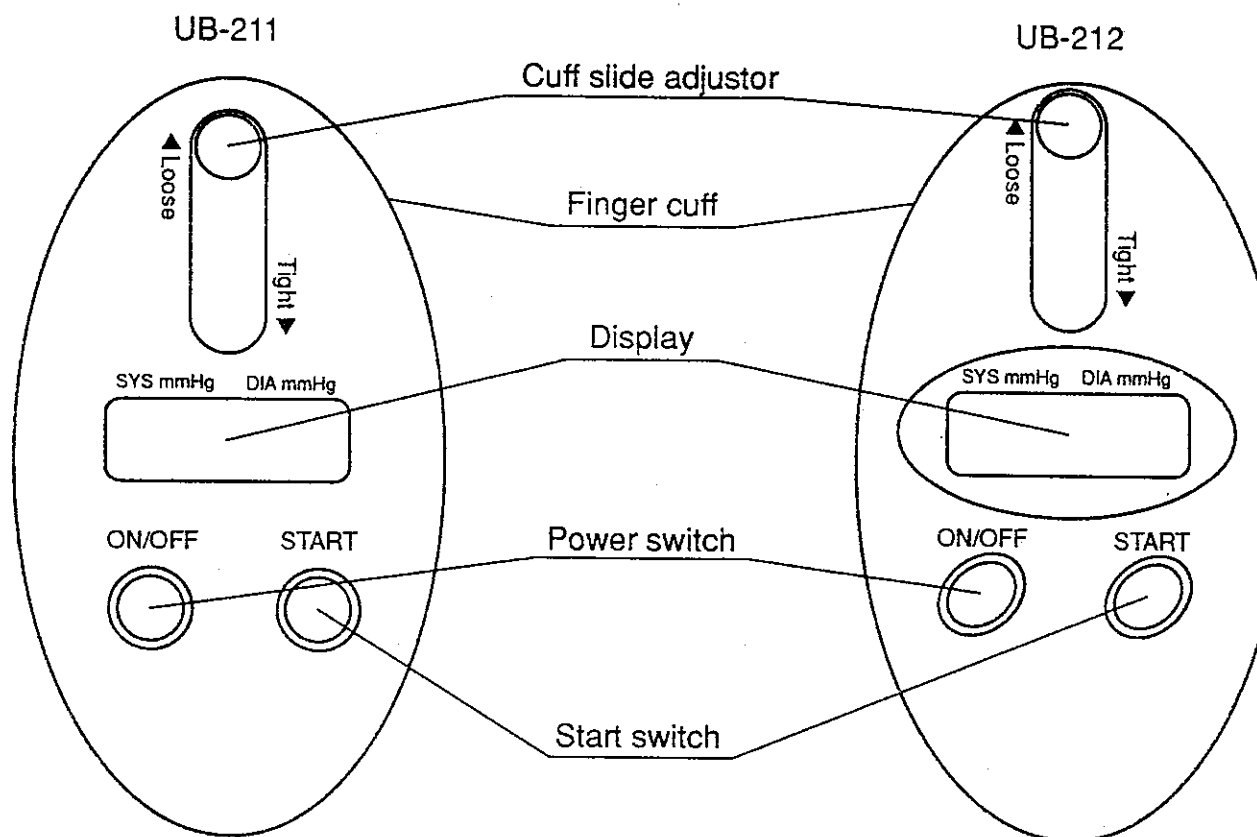
2. Specifications

1) Display	Digital display
2) Measurement method	Oscillometric Method
3) Measurement range	Pressure: 0 to 280 mmHg Pulse: 40 to 200 beats/minute
4) Accuracy	Pressure: Within ± 4 mmHg Pulse: Within $\pm 5\%$ of reading
5) Inflation	Automatic, using an electric pump
6) Deflation	Automatic, using ECEV
7) Exhaust	Automatic, rapid exhaust system using ECEV
8) Pressure detection	Capacitance-type pressure sensor
9) Power supply	2 "AA" size batteries
10) Battery life	Approximately 300 measurements twice a day (Ambient temperature: 22°C (Approx. 71°F), use manganese batteries)
11) Operating temperature/ humidity	+10 to +40°C 30 to 85% RH
12) Storage temperature/ humidity	-10 to +60°C 10 to 95% RH
13) Weight	Approx. 240g with batteries
14) Dimensions	80 (W) x 140 (H) x 55 (D) mm (3-1/8" x 5-1/2" x 2-1/8")
15) Measurement parts	Left or right index finger
16) Finger diameter range	18 to 27 mm (Approx. 3/4" to 1-1/16")

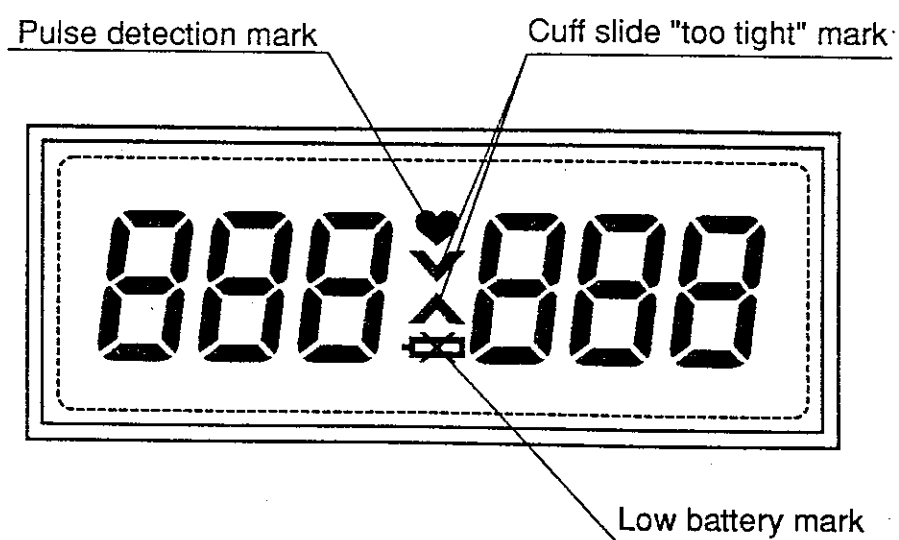


3. Display and Controls

□ Front view

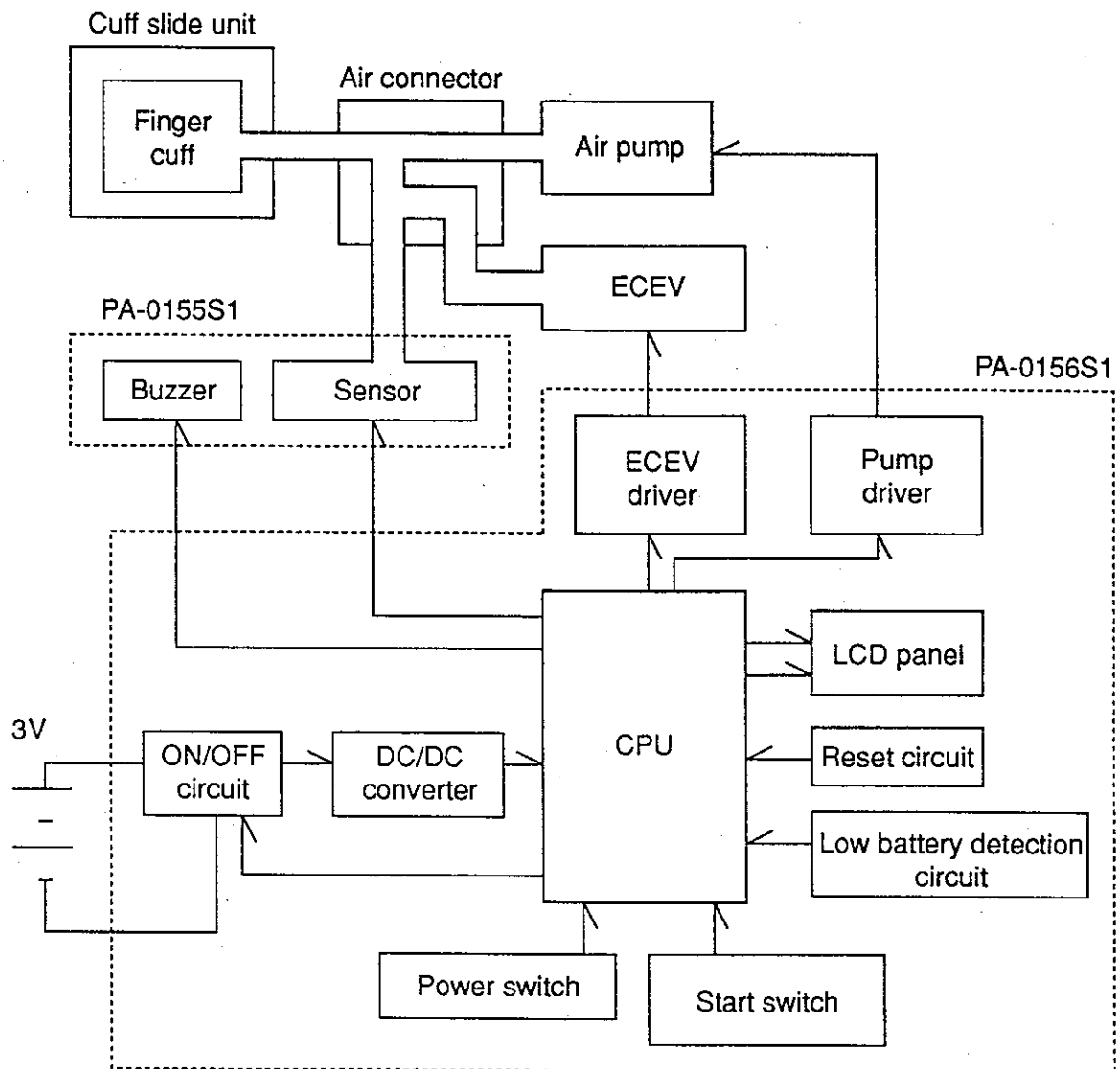


□ LCD Display





4. Block Diagram





5. Hardware Description

The hardware consists of a main board (PA-0156S1) and sensor board (PA-0155S1). The following describes the circuits.



Main board (PA-0156S1)

☐ Power on/off circuit

This circuit turns the supply of power to all circuits on/off. When the power switch is pressed, the CPU is turned on and outputs the ON signal to turn all circuits on.

When the power switch is pressed again, the CPU outputs the OFF signal to turn all circuits off.

☐ DC/DC converter

Increases the power supply voltage from 3V to 5V.

☐ Low battery detection circuit.

Detects when the battery voltage is too low.

☐ Pump driver

Controls the air pump via the CPU.

☐ Reset circuit

The power-on-reset circuit resets the CPU if circuit voltage drops below approximately 3V.

☐ ECEV driver

This circuit receives a control signal from the CPU and converts it into a voltage corresponding to control the ECEV.

* Maximum voltage is approximately 140V.



Sensor board (PA-0155S1)

- ☐ The sensor board is a CR oscillator that includes a pressure sensor (capacitance component), and a NOR gate and resistor (resistance components).

When pressure is increased, sensor capacitance is increased and oscillation frequency becomes lower.

The CPU on the PA-0156S1 counts the frequency during a constant period and outputs it as a pressure value.

The pressure value can be adjusted by turning the pressure adjustment screw.



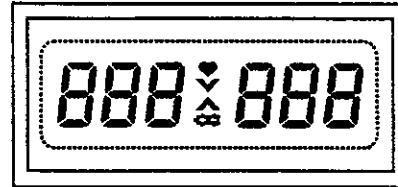
6. Software Description

☐ Power on

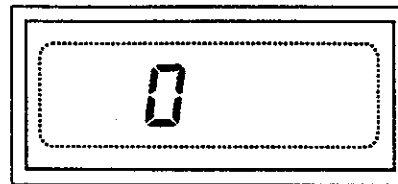
When power is turned on, the LCD panel displays all segment marks in about one second, then the instrument samples pressure zero point.

When the LCD panel displays "0," sampling is completed.

Immediately after power-on



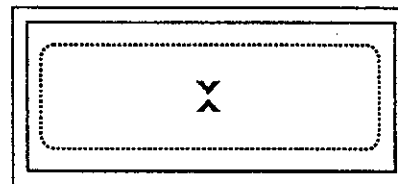
Zero point sampling completed



☐ Before measurement

Insert index finger into the finger cuff, then set the cuff slide adjuster to "Tight" until the "x" mark is displayed.

Cuff slide "too tight" mark



☐ Inflation setting

The inflation value is set to approximately 180 mmHg, although this value may be slightly high depending on cuff slide adjuster tightness.

A value between 180 and 320 mmHg can also be set by pressing the START switch continuously.

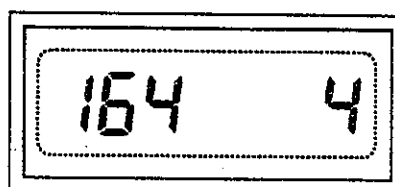
☐ Measurement

When the START switch is pressed, finger cuff pressure is displayed using the three high-order digits.

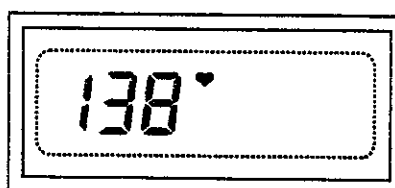
When inflation is completed, deflation will begin. The constant exhaust speed per second (up to 13) is displayed using the three low-order digits.

When the instrument detects a pulse, the constant exhaust speed value goes off and the "♥" mark flashes in synchronization with the pulse rate.

Measurement in progress
Before a pulse is detected

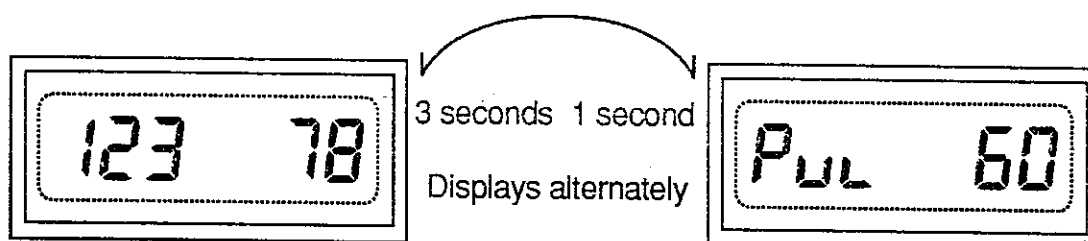


Measurement in progress
After pulse is detected



☐ Measurement completed

The LCD panel alternately displays systolic blood pressure using the three high-order digits, diastolic blood pressure using the three low-order digits in three seconds, and displays "PUL" and the pulse rate in one second.

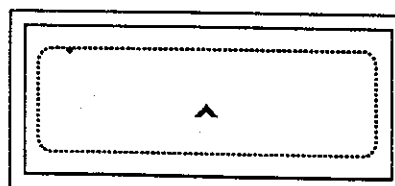


☐ Insufficient inflation

If insufficient inflation is detected, the instrument reinflate until insufficient inflation is not detected at 220 mmHg and 260 mmHg.

If insufficient inflation is detected at 260 mmHg, the instrument executes rapid exhaust operation with a beep and displays the "Λ" mark.

Insufficient inflation mark



☐ Over inflation

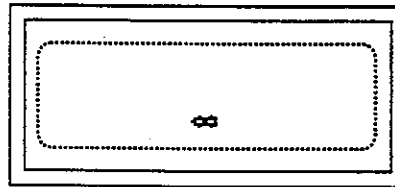
If finger cuff pressure exceeds 320 mmHg, the LCD panel displays "320" using the three low-order digits and executes rapid exhaust with a beeping sound.

If finger cuff pressure drops to 0 mmHg, the instrument turns power off automatically.

☐ Low battery indication

If battery voltage drops to $2.3V \pm 0.1V$ or lower, the LCD panel displays the "⚡" mark. If low battery power is detected at power-on, the "⚡" mark flashes and the instrument becomes inoperable.

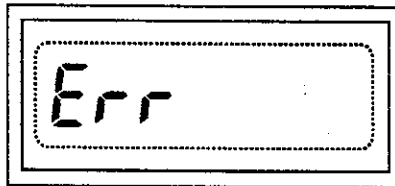
Low battery mark



☐ Error indication

If finger cuff pressure varies during deflation because of finger movement, for instance, the LCD panel displays "Err" using the three high-order digits and rapid exhaust operation is executed.

Error display





7. Troubleshooting

This section describes the symptoms, causes and treatments of troubles.

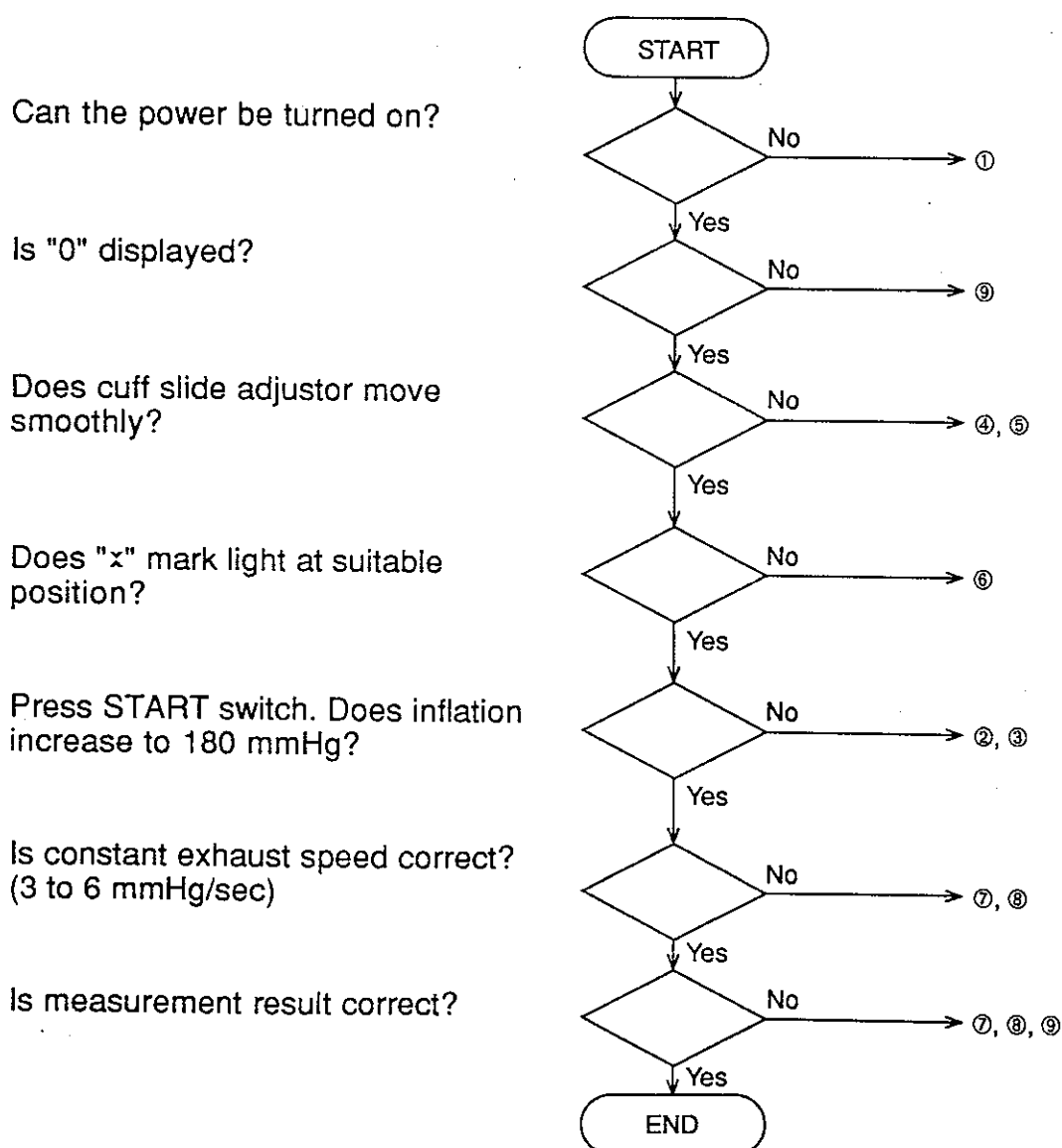
In case of "cannot measure" or "too much error," confirm that the measurement method is correct.

Pressure accuracy should be checked after repair. See Section "9. Pressure Reading Adjustment" for details.

See Section "8. Repair Procedure" for details on replacing parts.

Step 1 Performance check chart

Check the symptom against the flowchart, find the corresponding number circled on the right side of the chart, then proceed to step "2) Troubleshooting table".



Step 2 Troubleshooting Table

	Symptom	Cause	Treatment
①	Power does not go on	Low battery	Replace battery
		Power cord came off	Soldering
		PA-0156S1 defective	Replace PA-0156S1 (Adjust pressure reading)
②	Pump does not move	Air pump broken	Replace LM-P08F000100
		Connector J1 came off	Connect J1 on PA-0156S1
③	No inflation	Tube came off	Connect the tube
		Tube broken	Replace UA4-5004
		Air connector broken	
		Finger cuff broken	Replace UA4-5005
		ECEV broken	Replace UA4-5009
④	Cuff slide adjustor does not move or too tight	Cuff slide unit broken	Replace UA4-5005
⑤	Cuff slide adjustor too loose		
⑥	Too tight mark does not appear	Connector J2 came off	Connect J2 on PA-0156S1
⑦	Constant exhaust speed too fast	ECEV broken	Replace UA4-5009
		Tube broken	Replace UA4-5004
		Air connector broken	
⑧	Constant exhaust speed too slow	ECEV broken	Replace UA4-5009
⑨	Pressure reading incorrect	Pressure reading adjusted incorrectly	Adjust pressure reading
		PA-0155S1 defective	Replace PA-0155S1 (Adjust pressure reading)
⑩	Appearance defective	—	Replace parts



8. Repair Procedure

□ Top case replacement

- Step 1** Remove two screws (UZ4-0011) using a Philips screwdriver.
- Step 2** Separate top case from bottom case.
- See Fig. 2.** Gently press both sides of bottom case for easy removal.

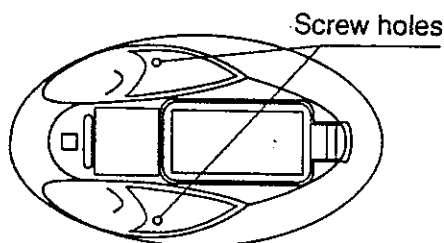


Fig. 1

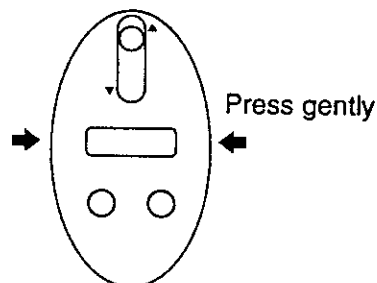


Fig. 2

□ PA-0155S1 and PA-0156S1 replacement

- Step 1** See Fig. 3. Remove the top case, then remove connectors J1 and J3.
- Step 2** See Fig. 4. Remove PA-0156S1 from stand-offs. (No screws.)
- Step 3** Remove two screws (UZ4-0011) on PA-0155S1.
- Step 4** Remove the power cord, then remove the PA-0155S1 and PA-0156S1 from bottom case.
- Step 5** See Fig. 5. Remove flat cable (J2) from PA-0155S1.
- Step 6** Replace defective parts. To reinstall parts, follow the removal procedure in reverse order.

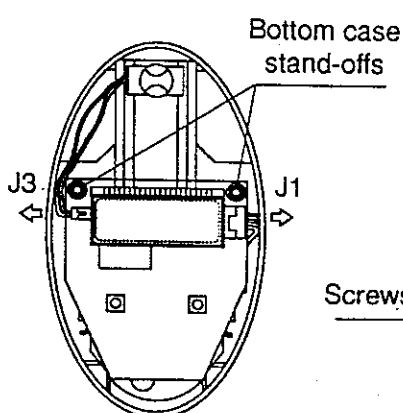


Fig. 3

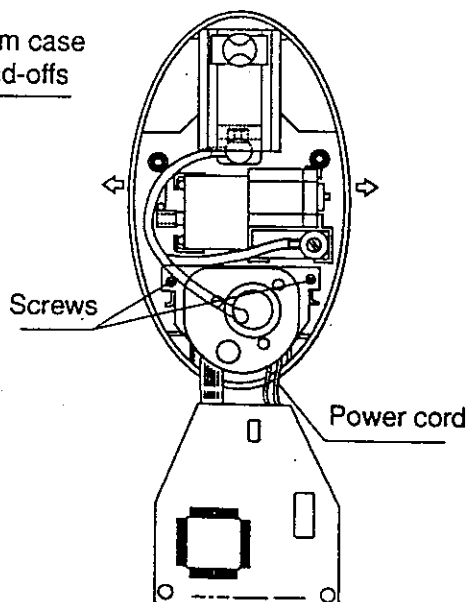


Fig. 4

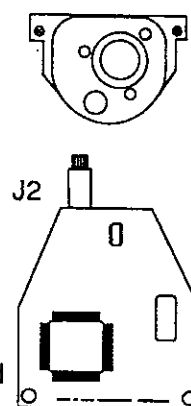


Fig. 5

□ Cuff slide unit (UA4-5005) replacement

Step 1 Remove top case.

Step 2 See Fig. 6. Remove seal.

Step 3 See Fig. 7. Remove blank panel (U4-4940) using screwdriver.

Caution: See Fig. 8. Do not scratch shaded face.

Step 4 See Fig. 7. Remove flat head screw (UZ4-0215) using a Philips screw-driver.

Step 5 See Fig. 9. Remove latch of bottom case by pressing side of the square hole with screwdriver.

Step 6 Remove cuff slide unit and air socket. Replace cuff slide unit.

Step 7 Connect air socket. See Fig. 10. Insert air socket between latches of bottom case using screwdriver.

Step 8 Fix cuff slide unit with flat head screw from the back of the bottom case.

Step 9 Attach blank panel.

Step 10 Attach seal.

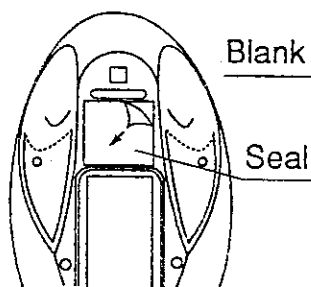


Fig. 6

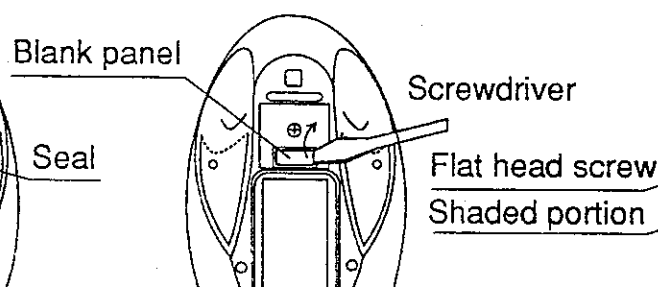


Fig. 7

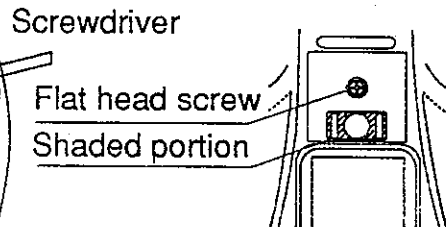


Fig. 8

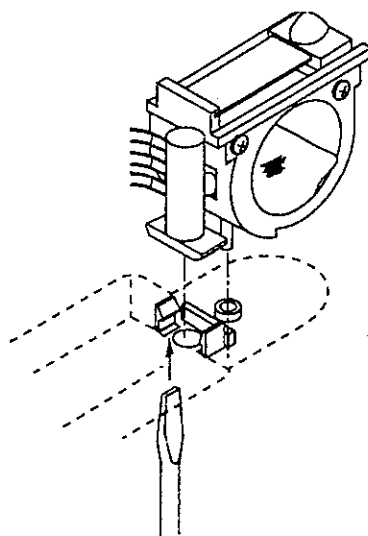


Fig. 9

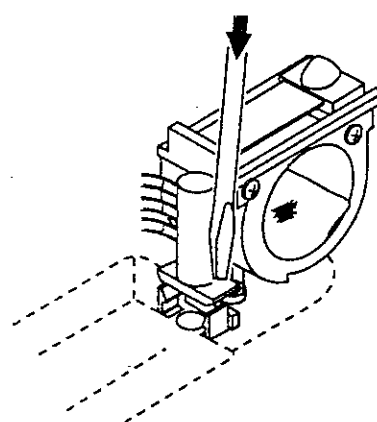


Fig. 10

□ Tube assembly (UA4-5004) replacement

- Step 1** See Section "3) Cuff slide unit replacement, steps 1 through 6". Remove cuff slide unit and air socket from bottom case. Remove tube assembly (air socket block) from cuff slide unit.
- Step 2** Remove tubes from PA-0155S1, air pump (LM-P08F000100) and ECEV (UA4-5009). Replace tube assembly.
- Step 3** See Fig. 11. Connect tube assembly to PA-0155S1, air pump, ECEV and cuff slide unit.
- Step 4** See Section "3) Cuff slide unit replacement, steps 7 through 10" for details on reinstalling the parts.

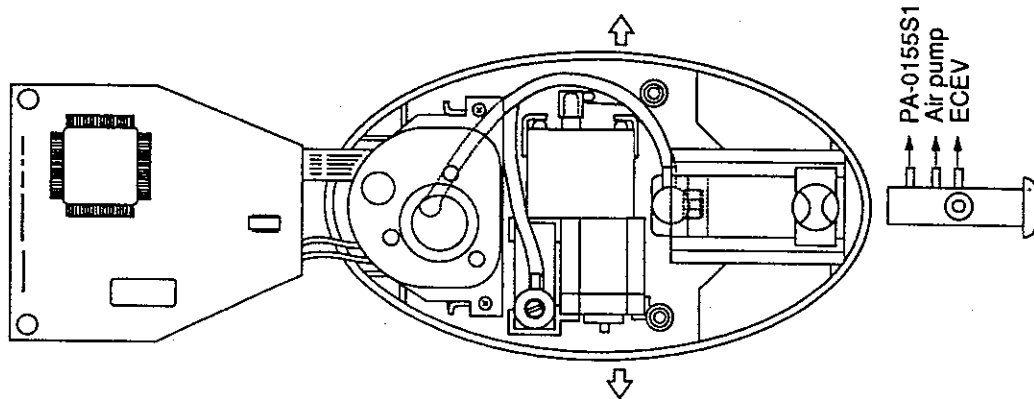


Fig. 11

□ LCD cover replacement

● For the Model UB-211

- Step 1** Remove top case.
- Step 2** See Figs. 12 and 13. Set slit of LCD cover (U3-1171) into top case latches. Press LCD cover upward, then hook lower latch to slit on LCD cover.

● For Model UB-212

- Step 1** See Fig. 14. Remove LCD plate of top cover. Replace LCD cover (U3-1172).

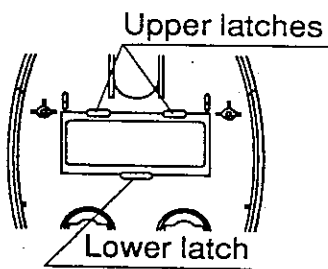


Fig. 12

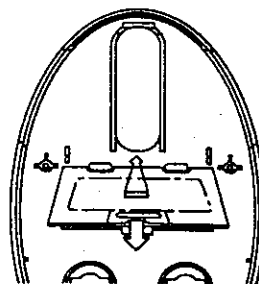


Fig. 13

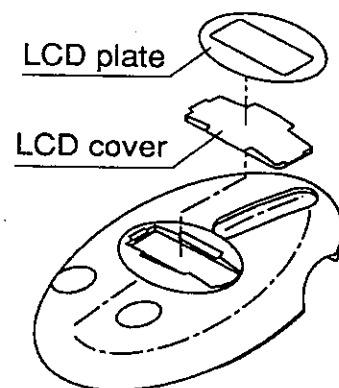


Fig. 14



9. Pressure Reading Adjustment

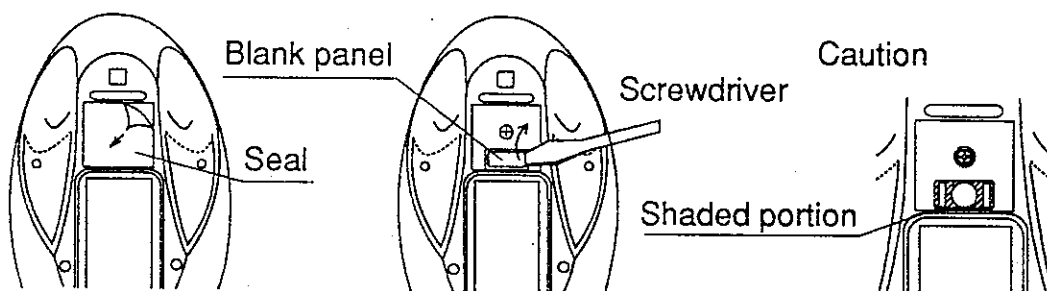
Test equipment and tools required

- Air plug for pressure adjustment (U4-5138)
- Low capacitance screwdriver
- Manometer or standard mercury pressure gauge (Any pressure measuring equipment)
- Compressor (Rubber ball, etc.)
- T-shape tube (U4-2474-C)
- Rubber tube (TQ-40750500BK)
- Forceps

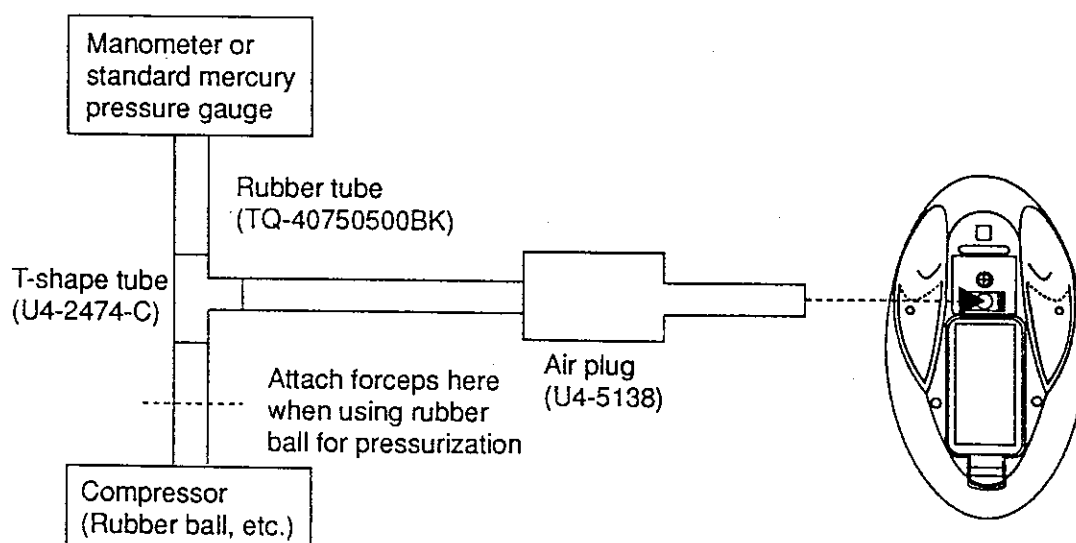
Step 1 Remove seal on rear of the instrument. Remove blank panel using screwdriver.



Caution: Do not scratch shaded portion. This will cause air leaks.



Step 2 See figure below for setup.



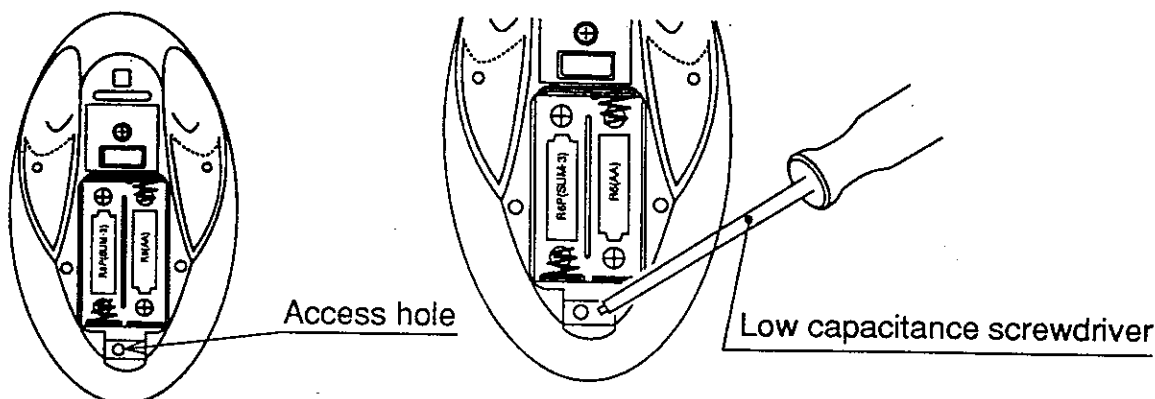
Step 3 Turn power on and confirm that "0" is displayed on LCD panel.

Step 4 Correctly connect air plug(U4-5138) to the instrument.

Step 5 Increase pressure to 280 mmHg by using compressor. Use precision manometer or mercury pressure gauge to monitor pressure.

When using rubber ball for inflation, close rubber tube with forceps to maintain pressure.

Step 6 If pressure reading is incorrect, proceed to step 7). Remove battery cover to access adjustment screw. The low capacitance screwdriver should be used for adjustment.



Step 7 Under following conditions; Pressure value applied = A mmHg
Pressure reading displayed = B mmHg,
Remainder of A and B = C mmHg

$$A \text{ mmHg} - B \text{ mmHg} = \pm C \text{ mmHg}$$

When result is +C mmHg, turn the pressure adjustment screw with a screwdriver for reading of B - C mmHg

When result is -C mmHg, turn the pressure adjustment screw with a screwdriver for reading of B + C mmHg

Example: Pressure value applied = 280 mmHg
Pressure reading displayed = 273 mmHg

$$\begin{array}{ccc} 280 \text{ mmHg} & - & 273 \text{ mmHg} & = & +7 \text{ mmHg} \\ (A) & & (B) & & (C) \end{array}$$

$$\begin{array}{ccc} 273 \text{ mmHg} & - & 7 \text{ mmHg} & = & 266 \text{ mmHg} \\ (B) & & (C) & & (\text{Value to be adjusted}) \end{array}$$

Turn the adjustment volume with screwdriver for reading of 266mmHg.

Step 8 Reduce pressure and turn power off. Turn power on again and repeat steps 4) through 6) to obtain correct reading.

When correct reading is obtained, gradually reduce pressure and confirm that pressure readings at 150 mmHg and 50 mmHg are within ± 3 mmHg.

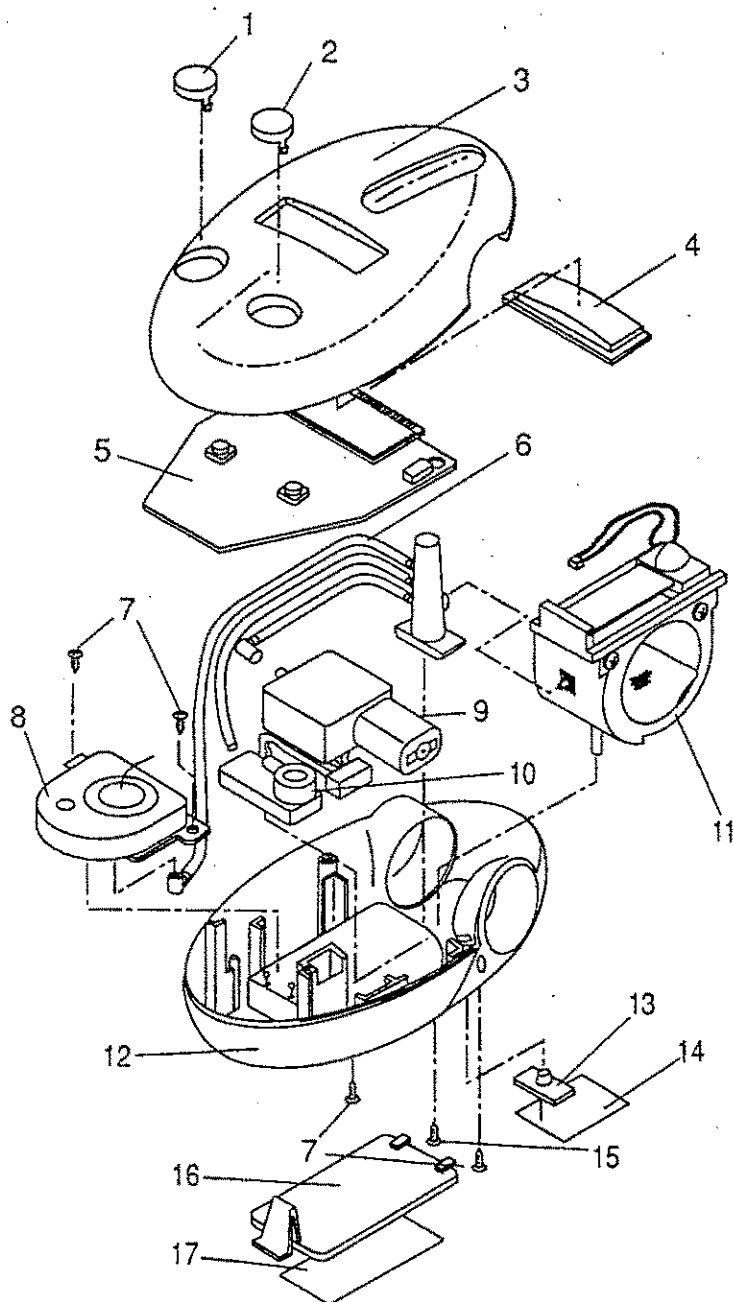
Step 9 Remove pressure control plug and attach blank panel.

To check blank panel position, confirm constant exhaust speed. When constant exhaust speed is correct, attach new seal.



10. Exploded View

UB-211



Replacement Parts List
(UB-211US-HA)

No.	Parts No.
1	U4-5002
2	U4-5008
3	U4-5000
4	U3-1171
5	PA-0156S1
6	UA4-5004
7	UZ4-0011
8	PA-0155S1
9	LM-P08F000100
10	UA4-5009
11	UA4-5005
12	U4-5001
13	U4-4940
14	U4-5007
15	UZ4-215
16	U4-5003
17	U4-5006



A&D Co., LTD.

1-243 Asahi, Kitamoto-shi, Saitama, 364-8585 JAPAN
Telephone: [81] (485) 93-1111 Fax: [81] (485) 93-1119

A&D INSTRUMENTS LTD.

<Authorized Representative Established in the European Community>
Abingdon Science Park, Abingdon, Oxford OX14 3YS ENGLAND
Telephone: [44] (1235) 550420 Fax: [44] (1235) 550485

A&D Medical Pty. Ltd.

32 Dew Street, Thebarton, South Australia 5031
Telephone: [61] (8) 8352 3033 Fax: [61] (8) 8352 7409