UA-777

DIGITAL BLOOD PRESSURE METER

MAINTENANCE MANUAL

maintenance-UA 777-v.1.b 1/11/2000 PH

DIGITAL BLOOD PRESSURE METER

A&D Company, Limited

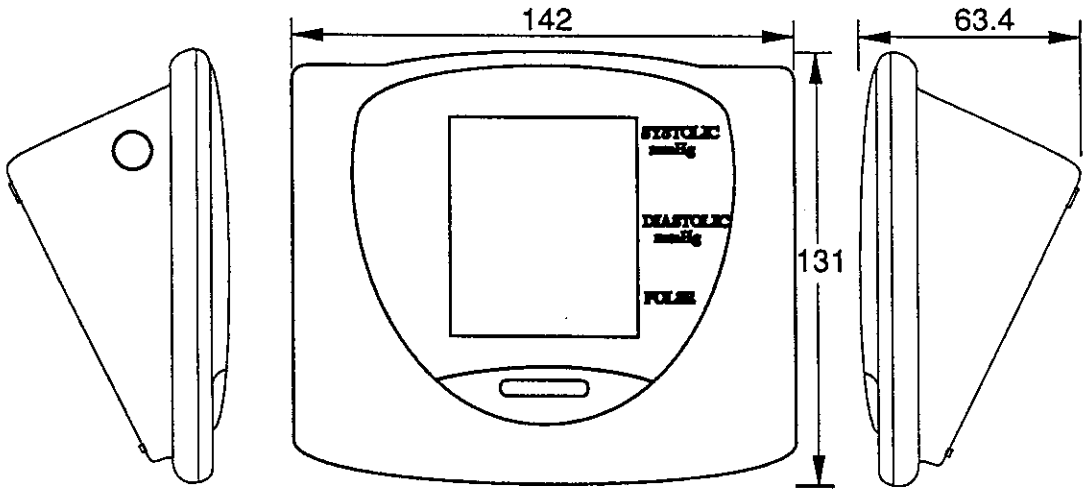
Table of Contents

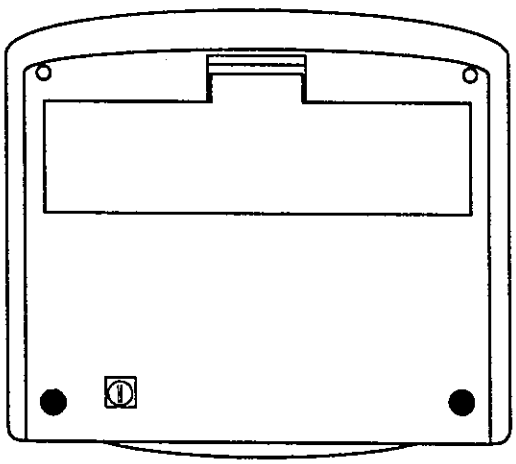
UA-777 Digital Blood Pressure Meter
Maintenance Manual 93/09/08

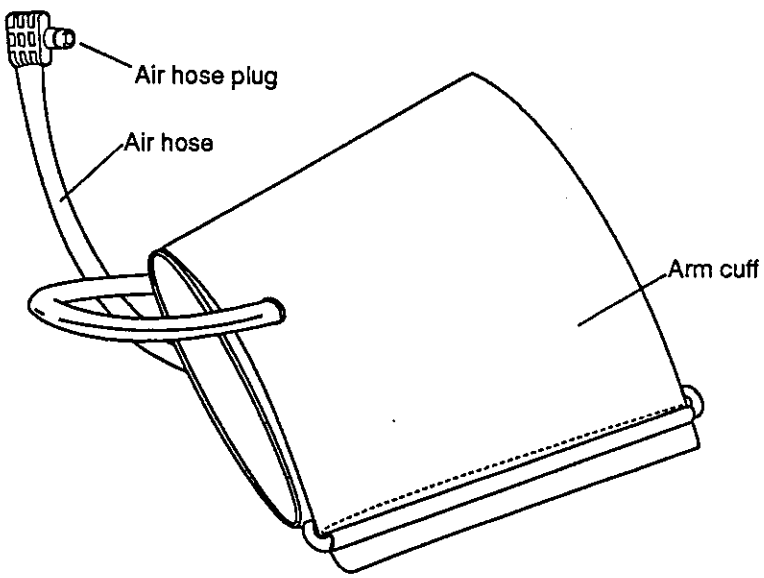
Specifications

1)	Measurement Method	Oscillometric
2)	Measurement Range	20~280 mmHg (Blood Pressure) 40~200 P/MIN. (Pulse)
3)	Accuracy	±3 mmHg or 2% of measured value (Blood Pressure) ±5% (Pulse)
4)	Cuff Inflation	Multiple setting automatic pressurization using a micropump
5)	Cuff deflation	Automatic constant-air-release valve system
6)	Rapid Exhaust	Automatic by internal air-release valve
7)	Pulse Wave Detection	Manschettor
8)	Power source	6VDC, 4 x 1.5V "AA" OR "AM3" batteries
9)	Battery life	Approx. 4 months usage of 3 min. per day
10)	Weight	Approx. 360 grams.
11)	Dimensions	142 (W) x 131 (D) x 63.4(H) mm
12)	Operating environment	50~100° F. at less than 85% R.H.
13)	Storage environment	15~130° F. at less than 95% R.H.
14)	Display	Liquid crystal type.

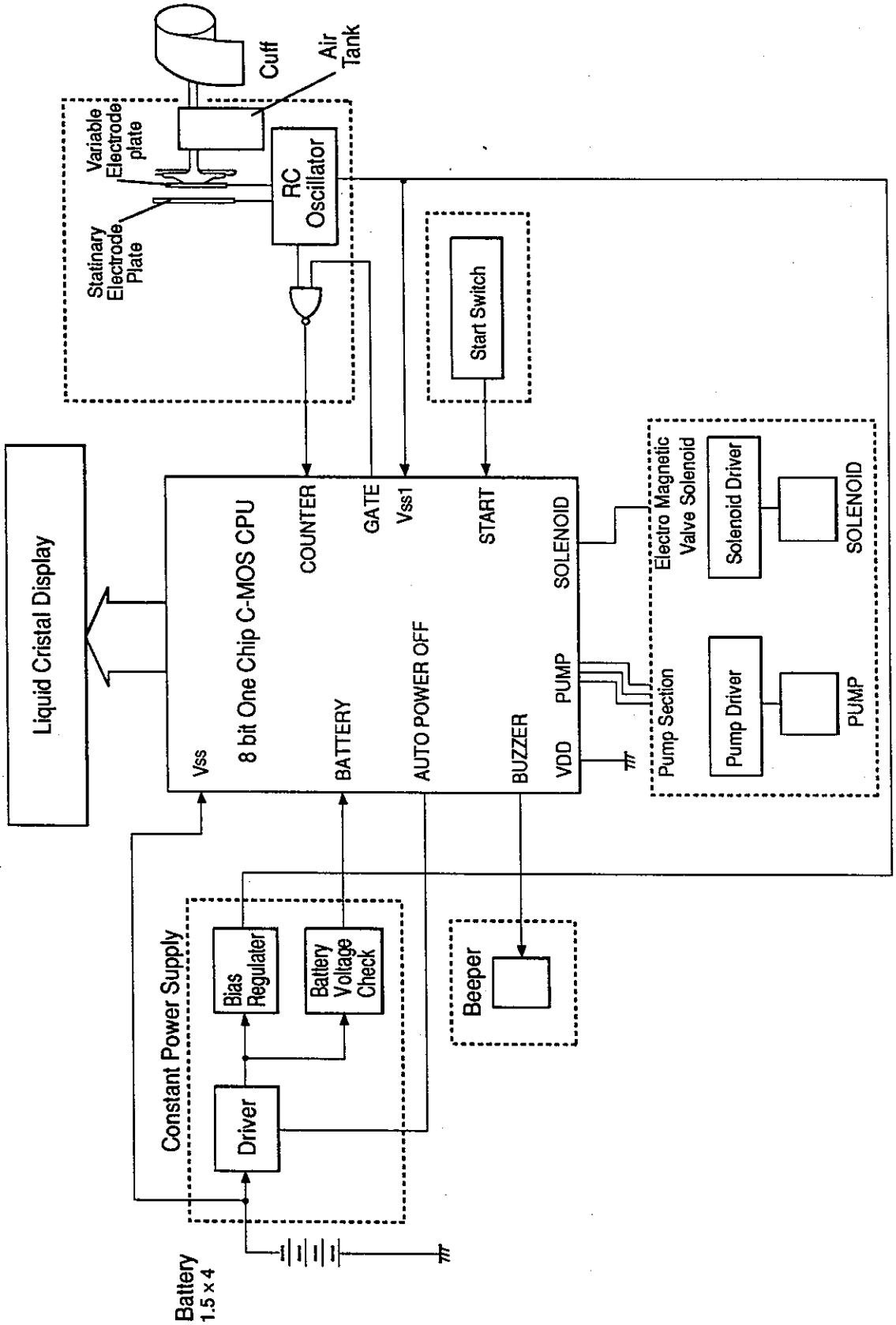
Outline Drawing







Block Diagram



Operational Description

1) CPU

The CPU is a single chip C-MOS microprocessor, containing 8K × 8 bits of ROM, and 256 words RAM.

It was constructed from a standard logic circuit and a 16 bit counter for the pressure transducer. It also includes an LCD driver which drives the display using 1/4 dynamic drive.

2) Pressure Transducer

The pressure transducer is a pressure/capacitance conversion type. The transducer consists of variable electrode plate, which is connected to a diaphragm, and a stationary electrode plate.

Mechanical displacement of the diaphragm is proportional to the pressure in the cuff. The capacitance of the transducer is proportional to (– 1/P).

3) Oscillator

The frequency of the oscillator corresponds to the pressure applied to the transducer. Changes in the oscillator frequency are measured by the microprocessor to detect pulse rate and blood pressure.

4) Power Supply

This section consists of a custom IC. The custom IC provides regulated voltages from the 6V supplied by the battery.

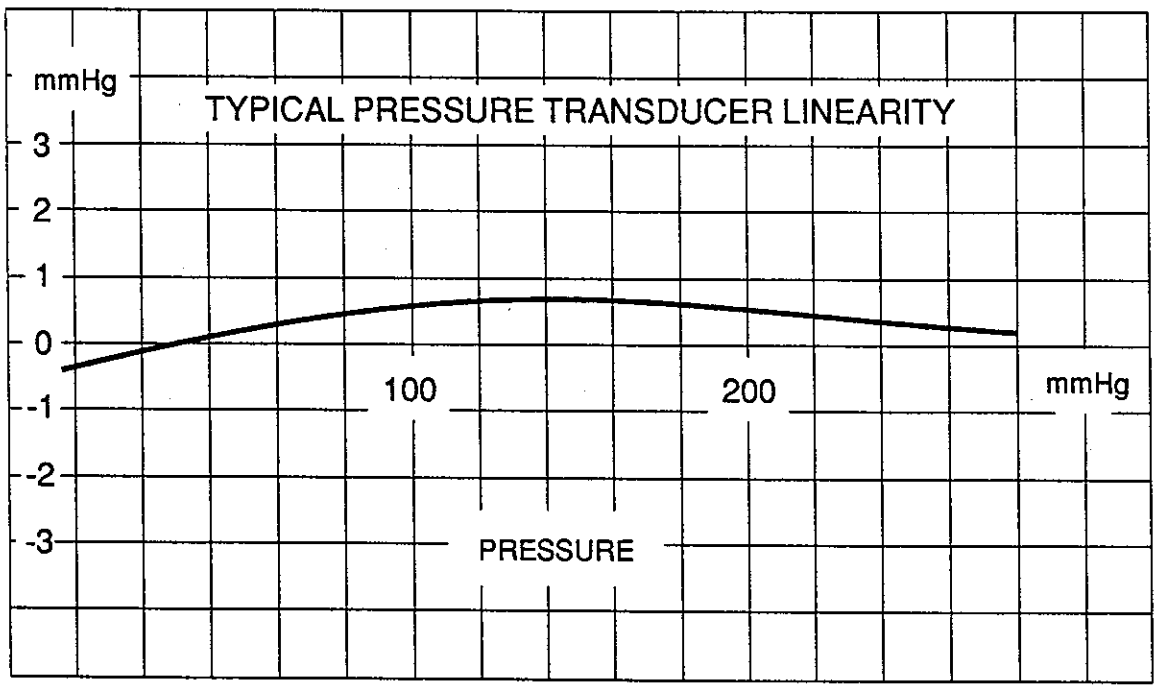
VDD	=	Common (positive terminal of the battery)
VSS1	= -4V	Measure at pin 3 of IC2
VSS	= -6V	Measure at pin 8 of IC2

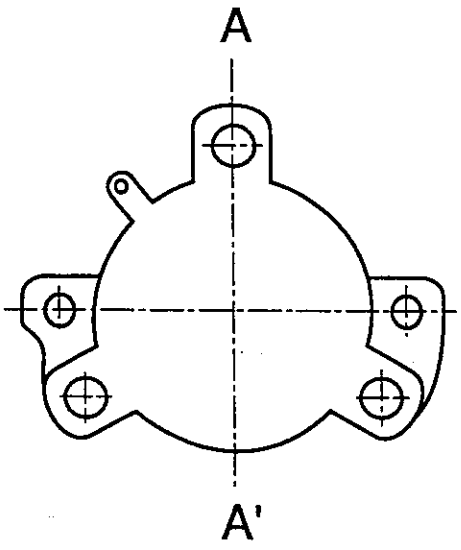
5) Beeper Oscillator

The "beep" from a piezo-electric beeper is driven by an oscillator which operates at a frequency of approximately 4 KHz.

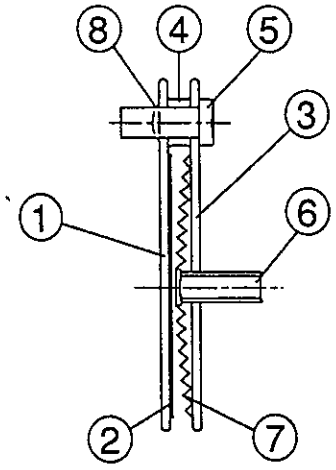
Pressure Transducer

Manufacturer	A&D Co. UP 0055 TYPE 6
Specifications	
Measurement Method	Capacitance Manometer
Measurement Range	0 to 300 mmHg
Overload Capacity	120%
C-F Converting	About 800 KHz at 0 mmHg
	About 500 KHz at 300 mmHg
Operating Temperature	10 ~ 40°C/85% RH
Linearity	±2 mmHg
Hysteresis	0.5 mmHg maximum
Temperature Coefficient	0.2 mmHg/°C (non condensing)
Dimensions	ø37 X 14 mm
Weight	Approx. 10 grams





FRONT VIEW



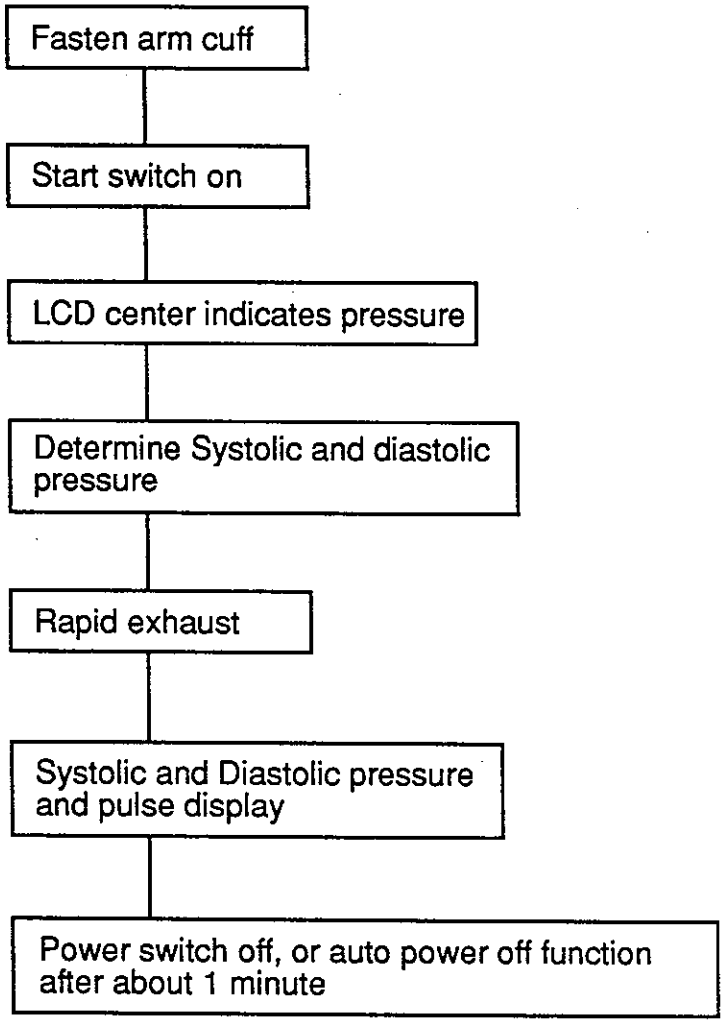
SECTION A - A'

PRESSURE TRANSDUCER

No.	Description	Material	JIS N0.
1	Stationary electrode plate	Cold cabon steel sheet	SPCC
2	Moving electrode plate	Carbon tool steel sheet	SK4M
3	Base	Cold carbon steel sheet	SPCC
4	Spacer	Polycarbonate	
5	Spacer holder	Polycarbonate	
6	Cap	Brass	
7	Diaphragm	Phosphor bronze	
8	Push nut	Stainless steel	CSP-3/4H SUS-304

Measurement Sequence

1) Measurement sequence (simplified)



2) Measurement Sequence

a) Arm cuff

Wrap the cuff around the upper arm and fasten it. Position the elbow so that it is about the same height as the heart.

b) Set "PRESSURE" setting switch

Move the slide switch on the blood pressure meter to set the pressurization value. This value should be 30 to 40mmHG higher than your normal systolic blood pressure.

c) "START" key

When the "START" key is pressed, all LCD segments will appear and the beeper will sound for one second.

The unit will perform internal zero calibration. When completed, "0" will be displayed and the instrument is ready for measurement and the pump will begin pressurizing the cuff.

The pump will stop when the set pressure value is reached At this point, the constant-speed exhaust begins.

d) Pressure display

After the constant-speed exhaust begin, the measurement mark (♥) will appear in the display and the exhaust speed will be displayed until the pulse (pulse pressure wave) is detected.

e) Blood pressure display

When the pulse pressure wave is first detected, the instrument begins to determine the blood pressure and the internal cuff pressure display switches to the right side of the LCD.

When the systolic and diastolic determination is complete, the measurement completed beeper sounds.

f) Rapid exhaust

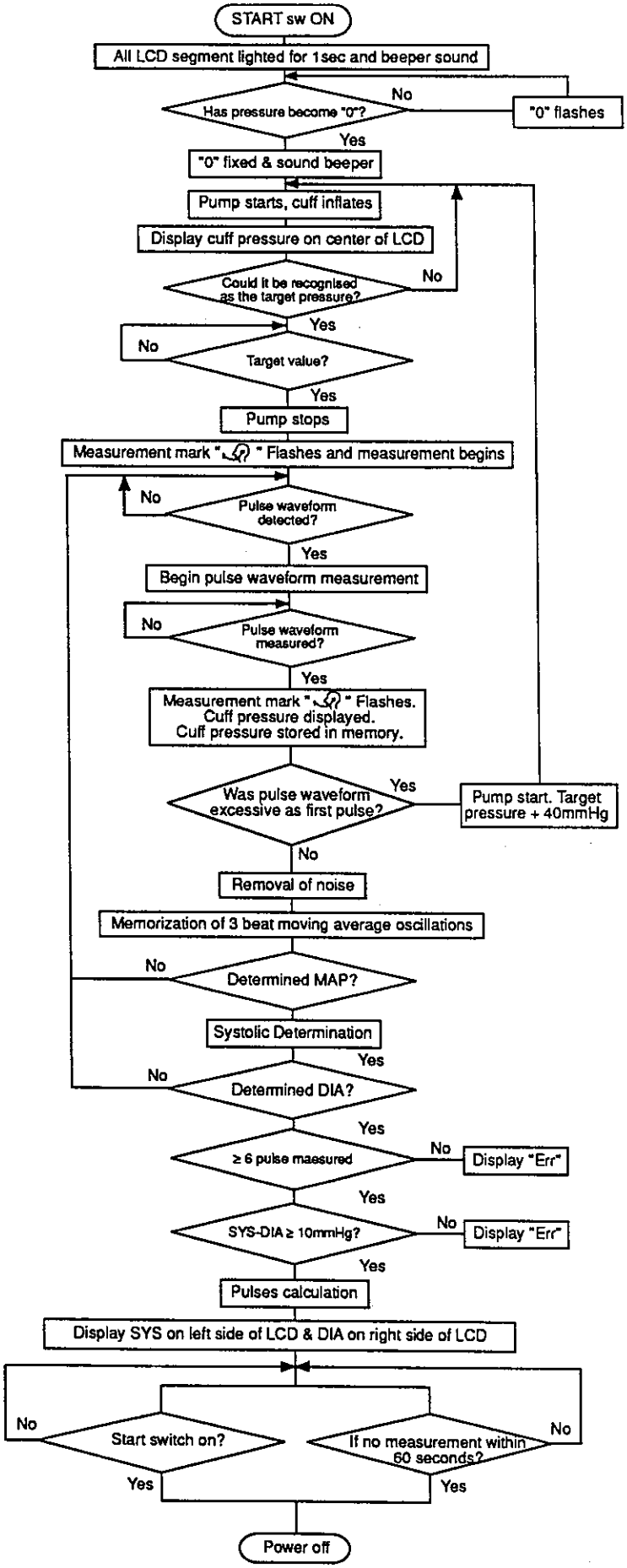
When the measurement sequence has completed, a solenoid valve opens and the air in the cuff is rapidly exhausted.

g) Pulse display

After the determination of the blood pressure values, the blood pressure and pulse are displayed alternately on the LCD.

h) Power off

After completion of the measurement, press the "START" key to turn the instrument off, or simply allow the unit to remain unused for three minutes, and the power will automatically be switched off.

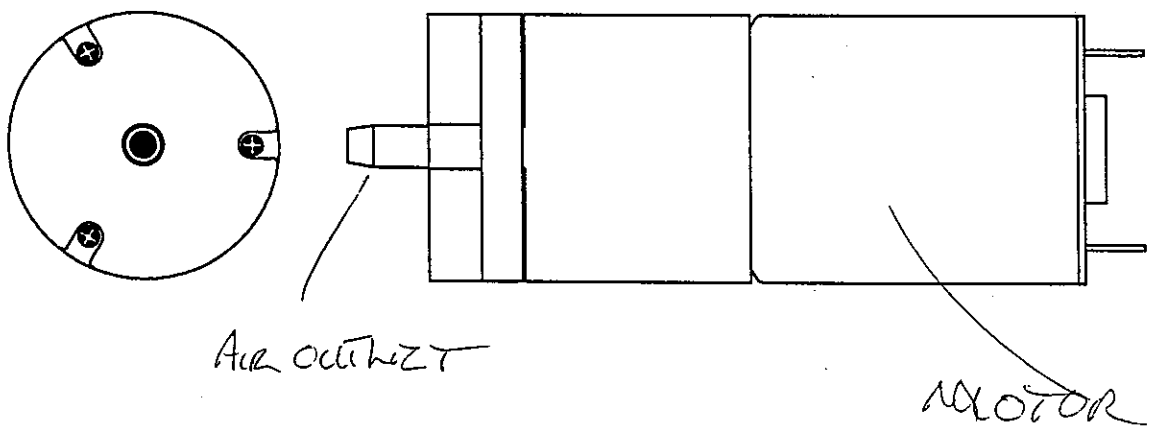

START sw ON
All LCD segment lighted for 1sec and beeper sound
Has pressure become "0"?
No
"0" flashes
Yes
"0" fixed & sound beeper
Pump starts, cuff inflates
Display cuff pressure on center of LCD
Could it be recognised as the target pressure?
No
Yes
No
Target value?
Yes
Pump stops
Measurement mark " " Flashes and measurement begins
No
Pulse waveform detected?
Yes
Begin pulse waveform measurement
No
Pulse waveform measured?
Yes
Measurement mark " " Flashes.
Cuff pressure displayed.
Cuff pressure stored in memory.
Was pulse waveform excessive as first pulse?
Yes
Pump start. Target pressure + 40mmHg
No
Removal of noise
Memorization of 3 beat moving average oscillations
No
Determined MAP?
Systolic Determination
Yes
No
Determined DIA?
Yes
≥ 6 pulse maesured
No
Display "Err"
Yes
SYS-DIA ≥ 10mmHg?
No
Display "Err"
Yes
Pulses calculation
Display SYS on left side of LCD & DIA on right side of LCD
No
Start switch on?
Yes
If no measurement within 60 seconds?
No
Yes
Power off

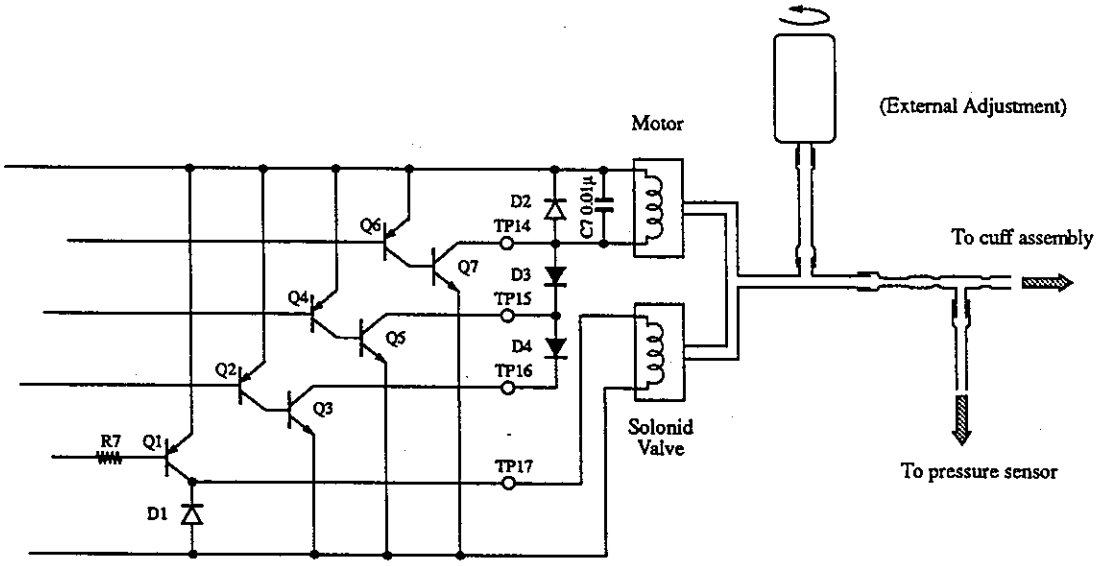
Inflation Pump & Exhaust Valve

Inflation Pump

Inflation method	Diaphragm type micropump, capable of repressurizing in the event of insufficient pressure for measurement
Pressurization ability	12 sec to 300 mmHg (with 300 cc tank)
Rapid exhaust	By solenoid valve 4 sec. from 300 mmHg to 20 mmHg (with 300 cc tank)
Leakage tolerance	15 mmHg per minute, at 300 mmHg
Operating temperature	10~40C/85%RH
Dimensions	71mm × ø27mm
Weight	Approx. 60 grams.

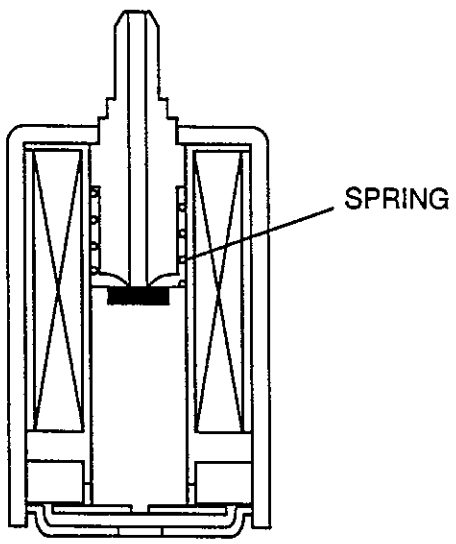
Construction Drawing of Pump Assembly





Block Diagram of Pump and Valve Assembly

Exhaust Valve



Solenoid Valve

A. When performing measurements of blood pressure, the core is in the raised, or closed position. At the completion of a measurement, the electrical signal that operates the drive coil is removed and spring then forces the core to drop, opening the valve for rapid exhaust.

B. When the pressure exceeds 320mmHg, an electrical signal causes the same operation as described in step A above.

C. When the power supply is OFF, the core returns to the lower position, opening the valve.

Troubleshooting

This section describes the symptoms, probable causes and solutions to problems.

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

Pressure accuracy should be checked after repair. See "Check Sequence"

Performance check chart

Check the symptoms against the flow chart, find the corresponding number circled on the right side of the chart, then proceed to the troubleshooting table

Step 1. Can the power be turned on?

Step 2. Is "0" displayed?

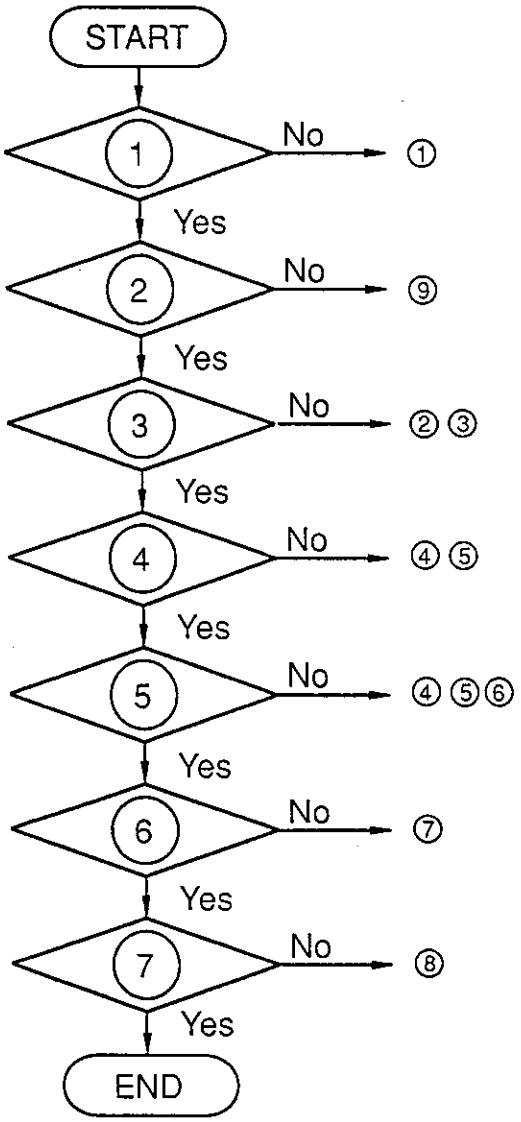
Step 3. Does the pump start and stop ok?

Step 4. Is the constant exhaust speed correct?

Step 5. is the measurement result correct?

Step 6. Is the rapid exhaust ok?

Step 7. Does the automatic power off function work correctly?



Troubleshooting Table

	Symptom	Probable Cause	Treatment
①	Power does not turn on	Low Battery	Replace battery
		Power lead broken	Resolder leads
		Main board may be defective	Replace main board and adjust pressure reading
②	Pump does not start	Air pump broken	Replace pump
		Connector J1 came off	Reconnect J1 on main board
③	No inflation	Tube came off	Reconnect tubing
		Tubing broken	Replace tubing
		Air connector broken	Replace air connector
		Cuff leaking	Replace cuff
		Constant exhaust valve defective	Replace the constant exhaust valve assy.
		Solenoid valve is defective	Replace the Solenoid valve assy.
④	Constant exhaust speed to fast	Constant exhaust valve defective	Replace the constant exhaust valve assy.
		Tubing broken	Replace tubing
		Air connector broken	Replace air connector
⑤	Constant exhaust speed to slow	Constant exhaust valve defective	Replace the constant exhaust valve assy.
		Tubing pinched	Replace tubing
⑥	Pressure reading is incorrect	Pressure reading adjusted incorrectly	Readjust the pressure reading
		Main board may be defective	Replace main board and adjust pressure reading
⑦	Rapid exhaust does not work	Solenoid valve is defective	Replace the Solenoid valve assy.
		Tubing pinched	Replace tubing
⑧	Automatic power off function does not work	Main board defective	Replace main board

Repair Procedure

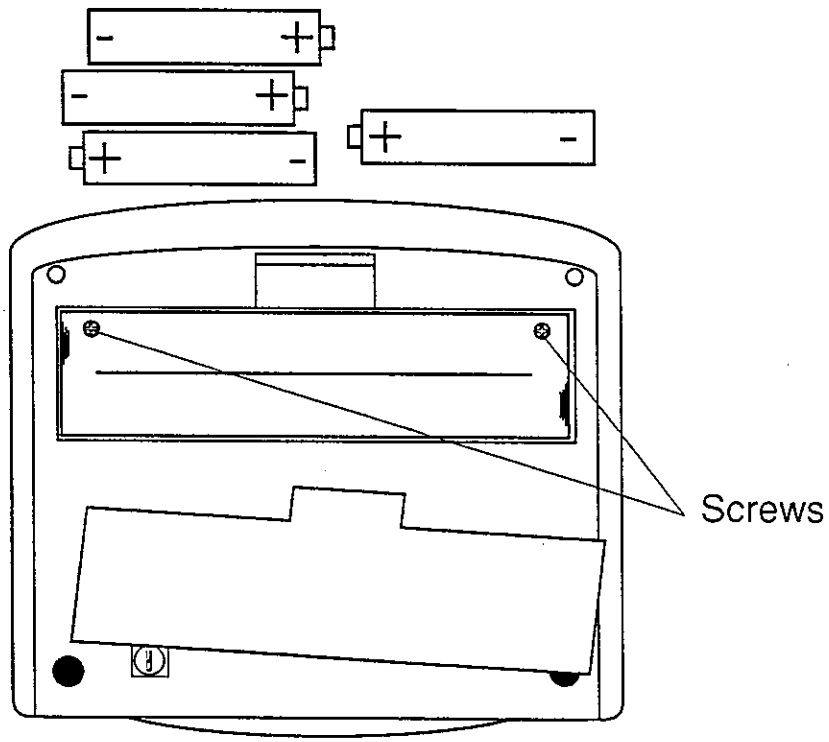
Top case removal

Step 1. Remove the battery compartment cover.

Step 2. Remove the batteries.

Step 3. Remove two screws shown in the drawing.

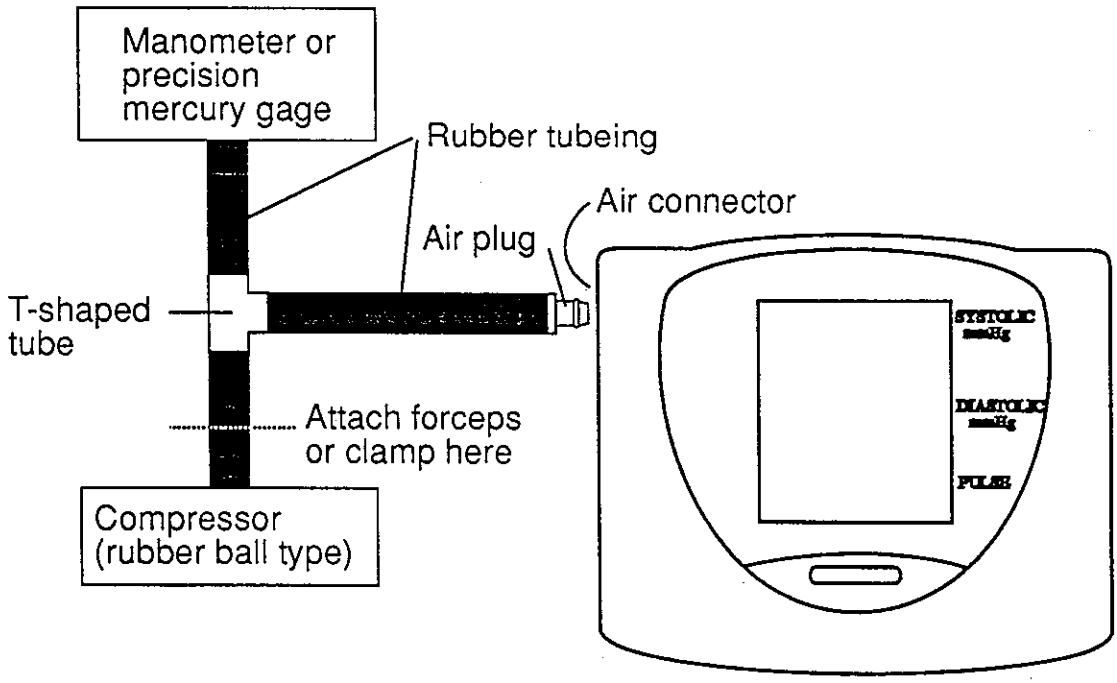
Step 4. Remove the upper case using caution not to damage the LCD display



Pressure Adjustment Procedure

Test equipment and tools required

- Low capacitance screwdriver
- Manometer or precision mercury pressure gage
- Compressor (rubber ball type)
- T-shaped tube
- Rubber tubing
- Forceps (or hose clamp)



Step 1. Insert the batteries into the battery holder and press the start switch

Step 2. "0" is displayed on the LCD panel

Step 3. Increase the pressure to 280 mmHg by using the compressor. Use a precision manometer or mercury pressure gage to monitor the air pressure

When using a rubber bulb pump for inflation, close the rubber tube with forceps to maintain the pressure

Step 4. If the pressure reading is incorrect, remove the top case as described in the repair procedure to provide access to the adjustment screw

Step 5. Under the following conditions;

Pressure value applied = A mmHg

Reading displayed = B mmHg

Remainder if A - B =C mmHg

Use the formula A mmHg - B mmHg = ±C mmHg

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

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

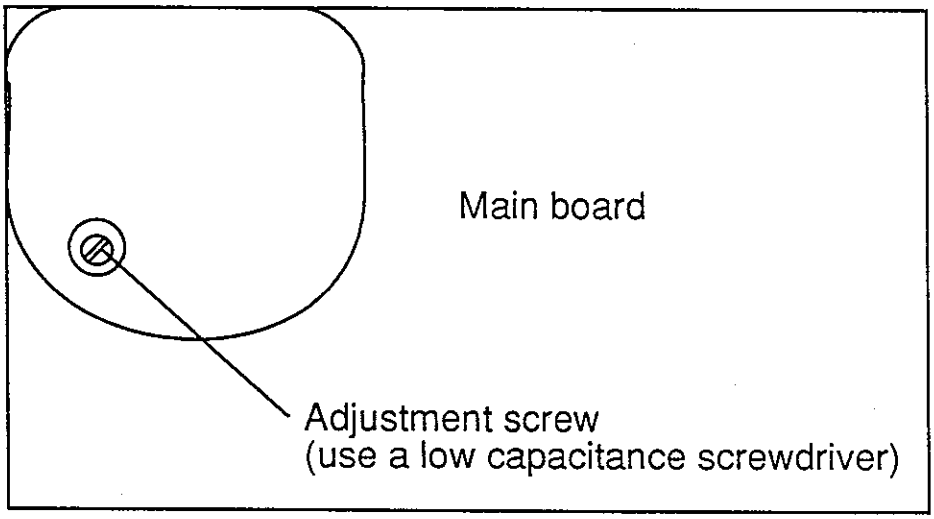
Example: Pressure value applied = 280 mmHg

Reading displayed = 273 mmHg

280 mmHg - 273 mmHg = +7 mmHg

273 mmHg - 7 mmHg = 266 mmHg

Adjust the reading to 266 mmHg



Step 6. Reduce the pressure to zero and turn the power off (press the start switch)

Step 7. Press the start switch turn the power on again (zero is set when the power is first turned on)

Step 8. Increase the pressure to 280 mmHg by using the compressor and check the accuracy of the display

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

Step 9. Remove the test setup air plug and attach the cuff to the air connector

Place the cuff on a plastic form about the size of a normal arm

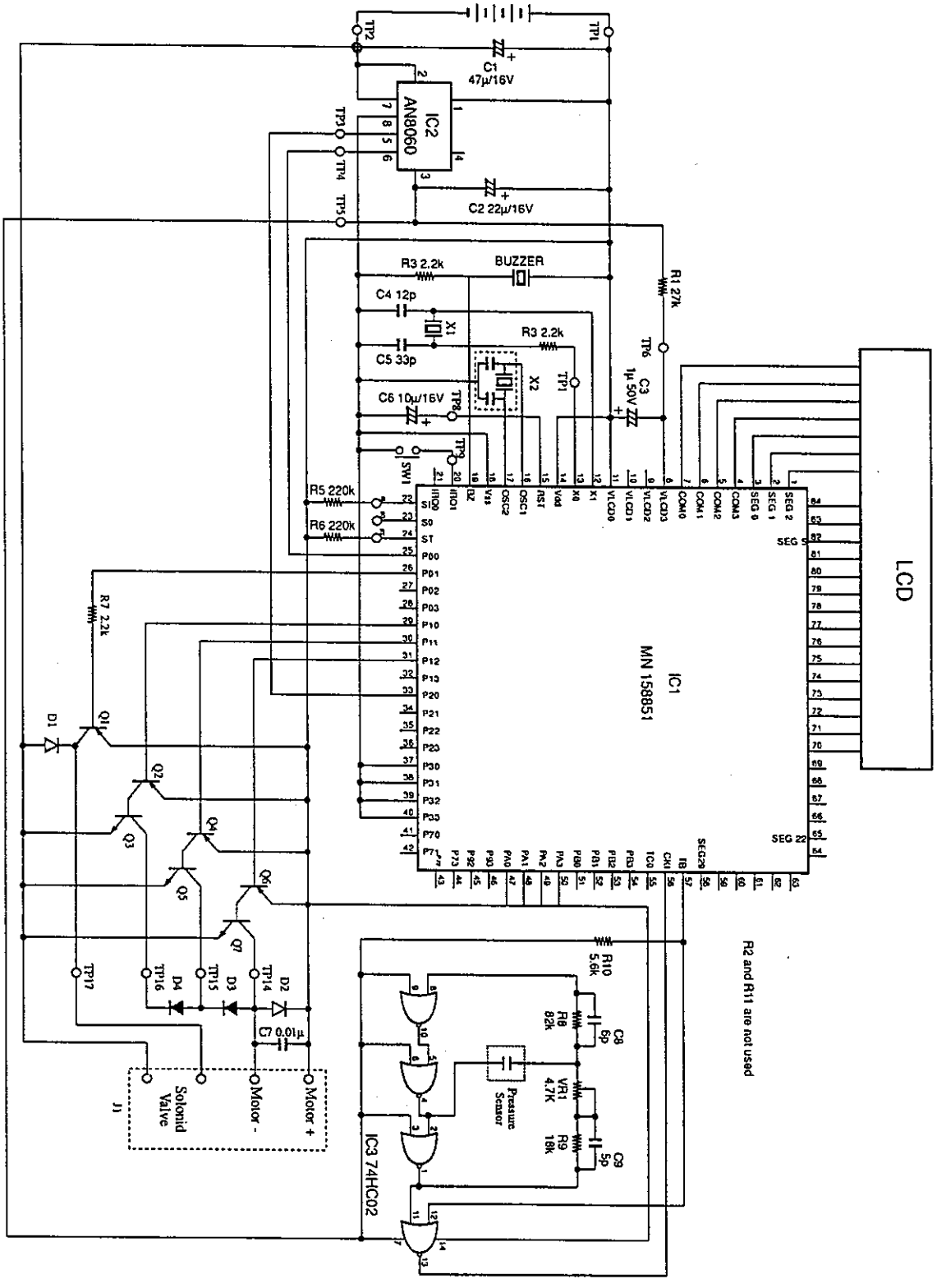
Press the start switch and pressurize the cuff to 160 mmHg

Watch the display reading, the rate of pressure drop between readings should be about 3 mmHg

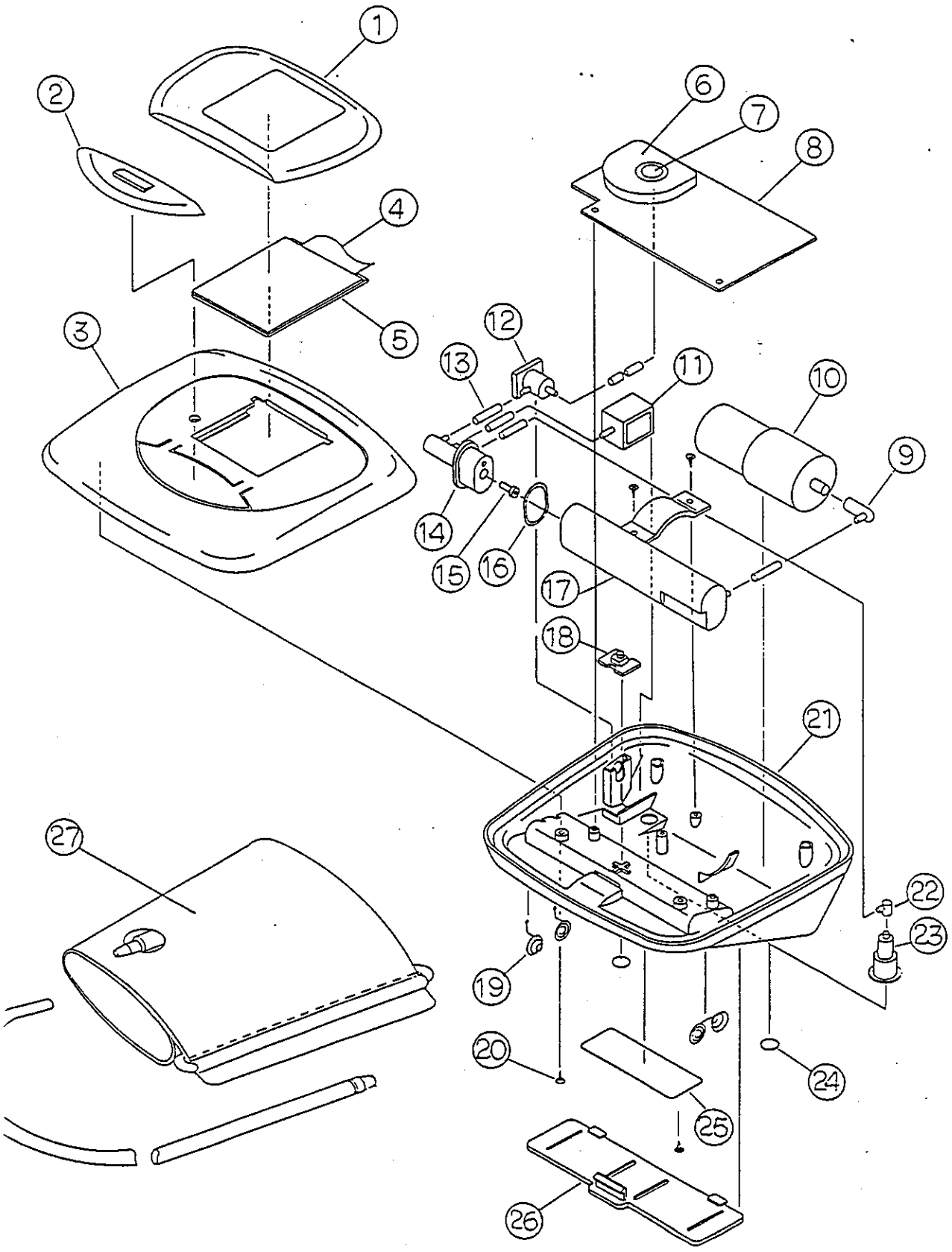
If necessary adjust the constant exhaust valve for 3 mmHg between readings

Step 10. Reassemble the case and test the instrument again.

Circuit Diagram



Exploded View



Parts List

Parts for UA-777

No.	Part name	Part No.
1	DISPLAY FILTER	U4-5414
2	KEY TOP	U4-5415
3	UPPER CASE	U3-1228
4	LCD CABLE BACKING	KH-22P150L060
5		VL-CG963-TS
6		UA4-5178
7	BLOOD PRESSURE SENSOR	UA3-602
8	MAIN BOARD ASSEMBLY	PA-0162S1
9	"L" TYPE CONNECTOR	U4-3609
10	AIR PUMP ASSEMBLY	LM-P05G0013
11	SOLENOID VALVE	LS-SS-0513-001C
12	AIR SOCKET	U4-4513
13	SILICONE TUBING	TS-23400020TP TS-23400130TP TS-30500020TP TS-30500020
14	AIR TANK TOP WITH MANIFOLD	U3-1214
15	RUBBER VALVE	U4-5340
16	"O" RING	U4-5354-A
17	TANK	U3-1213
18	START SWITCH	SK-EVQPAG05R
19	BATTERY TERMINAL (JUMPER) BATTERY TERMINAL (-) BATTERY TERMINAL (+)	U4-1512-A U4-3521 U4-5388
20	BINDING SCREW	UZ4-0011
21	LOWER CASE	U1-192
22	"L" TYPE CONNECTOR	U4-3242-A
23	SMALL CONSTANT EXHAUST VALVE ASSEMBLY	UA4-5348
24	RUBBER FOOT	U4-5347
25	SPECIFICATION LABEL	U4-5413
26	BATTERY COVER	U3-1189
27	CUFF WITH HOSE	UA4-5365

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