UA-751

DIGITAL BLOOD PRESSURE METER

MAINTENANCE MANUAL

maintenance-UA 751-v.1.a 92/07/01

DIGITAL BLOOD PRESSURE METER

A&D Company, Limited

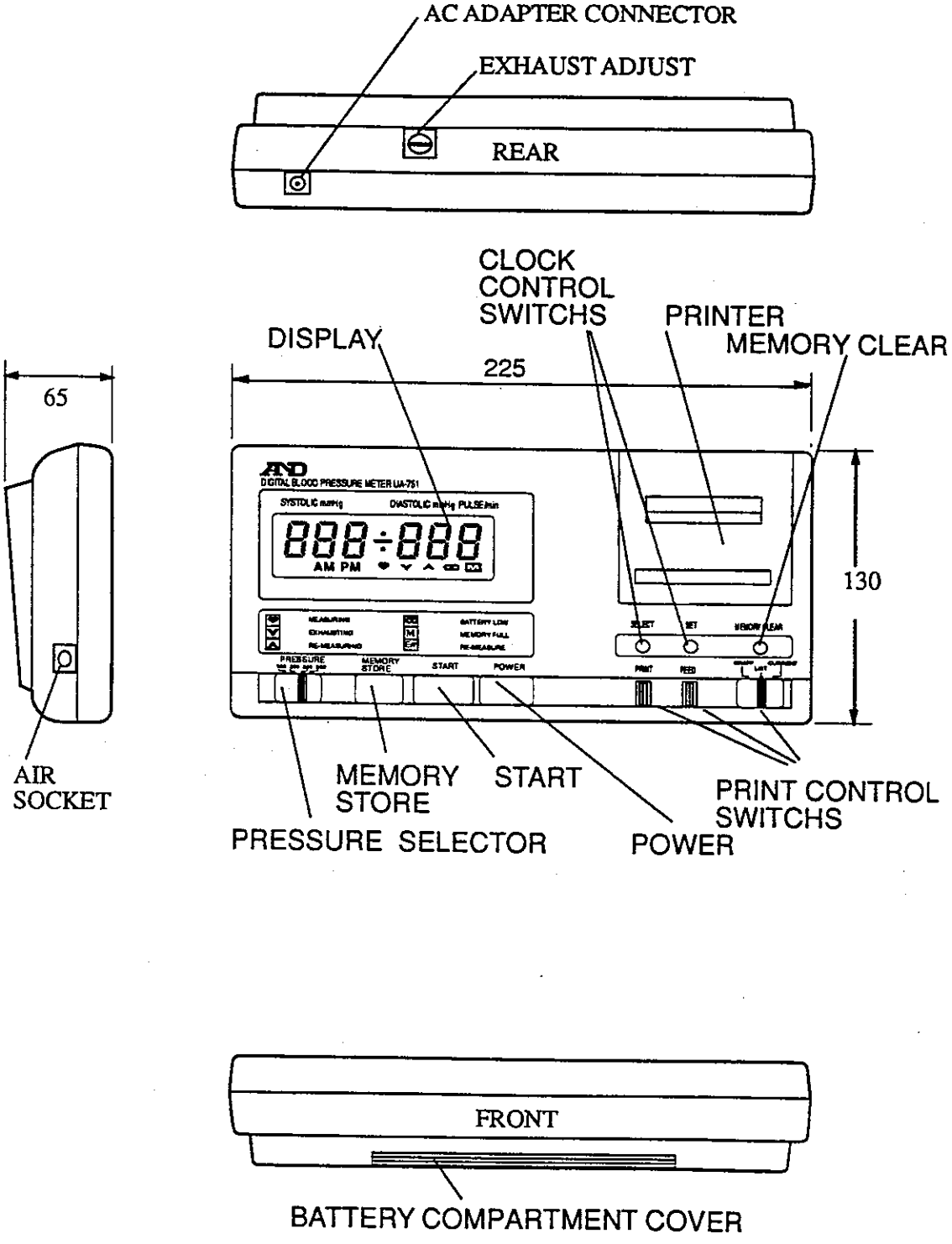
Table of Contents

UA-751 Digital Blood Pressure Meter
Maintenance Manual 92/07/08

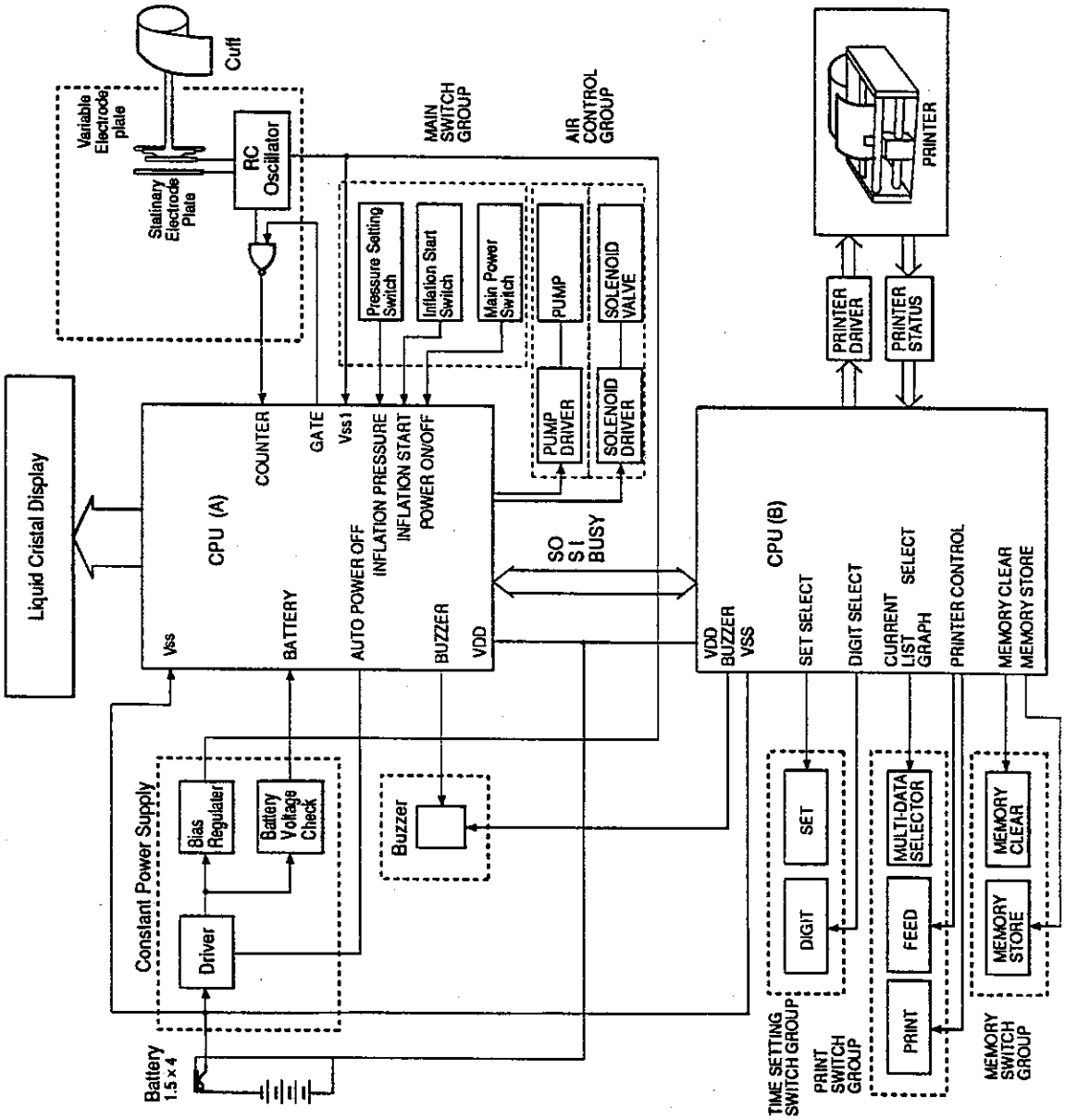
Specifications

1)	Measurement Method	Oscillometric
1)	Display	Digital, 17mm height character LCD
3)	Measurement Range	20~280 mmHg (Blood Pressure) 40~200 pulses per minuet (Pulse)
4)	Accuracy	Pressure Transducer/Indicator accuracy within ±3 mmHg or 2% whichever greater Pulse Rate within ±5% of reading
5)	Pressurization	Automatic using a diaphragm type micropump
6)	Pressure setting	Four steps; 160, 200, 240, 280mmHg
7)	Cuff deflation	Adjustable constant exhaust speed valve
8)	Rapid Exhaust	Electro-magnetic type valve controlled by a microprocessor.
9)	Pulse wave detection	Manschettor/Pressure Transducer in the air system
10)	Power source	6VDC, 4 x 1.5V "C" type batteries
11)	Battery life	6 months (used for 3 minutes a day)
12)	Weight	Approx. 590g
13)	Dimension	225 (W) x 130 (D) x 65 (H) mm
14)	Operating environment	+10~40°C/less than 85%R.H.
15)	Storage environment	–20~55°C/less than 95%R.H.

Outline Drawing



Block Diagram



Operational Description

1) CPU A (IC 1)

The main CPU is a single chip C-MOS microprocessor, containing 4K × 8 bits of ROM, and 256 words RAM. It is constructed of a standard logic circuit, a 16 bit counter for the pressure transducer and includes an LCD driver for the display.

CPU B (IC 2)

The SUB-CPU is a single chip C-MOS microprocessor dedicated to storing measurement data, providing time data and controlling the printer through a printer driver IC.

2) Pressure Transducer (Sensor)

The pressure transducer is a pressure/capacitance conversion type. The transducer consists of a variable electrode plate 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 (IC 6)

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 (IC 5, Q9 - Q12, IC 2,Q18 and Q19)

This section consists of a custom IC and switching power supply. The switching supply provides a -9V to the custom IC which in turn provides regulated voltages to the microprocessors and the pressure transducer oscillator. Part of IC2, Q18 and Q19 control the - 6V for the printer circuits.

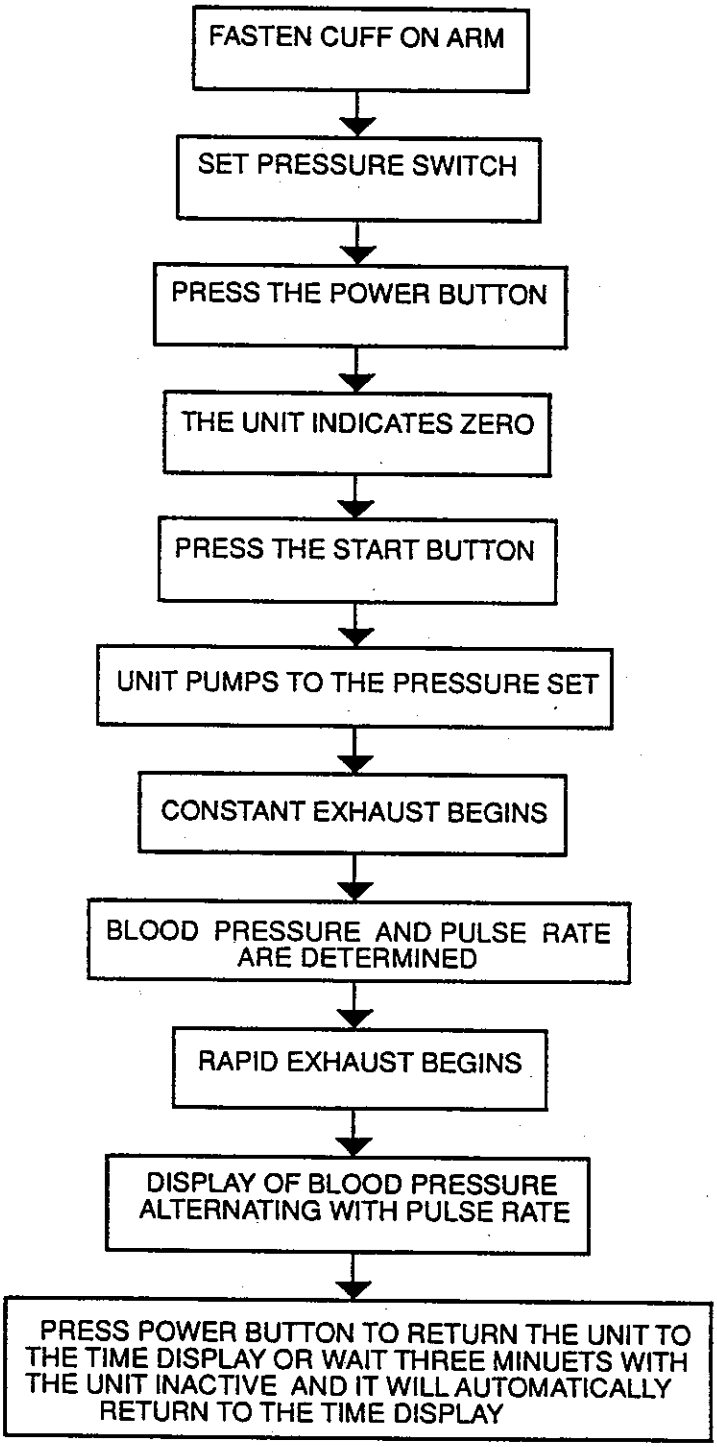
VDD = 0V	Common (positive battery terminal)
VSS1 = -4V	Measure at pin 3 of IC5
VSS2 = -6V	Measure at pin 31 of IC 2
VSS3 = -6V	Measure at pin 9 of IC 4
VSS = -6V	Measure at the negative battery terminal
Boost = -9V	Measure at pin 2 of IC5

5) Beeper Oscillator (part of IC 1)

When the set pressure (160/200/240/280 mmHg) has been reached during the inflation process, and the initial pulse pressure waves have been detected, this condition will be indicated by a "beep" from a piezo-electric beeper, driven by an oscillator which operates at a frequency of approximately 4 KHz.

Measurement Sequence

1) Measurement sequence (simplified)



2) Measurement Sequence with unit displaying the time.

a) Press the "POWER" key

All LCD segments will appear and the beeper will sound for one second. Next, all LCD segments will be blanked and the exhaust mark (V) will appear. The unit will perform internal zero calibration. When completed, "0" will be displayed and the instrument is ready for measurement.

b) 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.

c) Set "PRESSURE" setting switch

Use the "PRESSURE" switch to select a pressurization value. This value should be 30 to 40mmHG higher than your normal systolic blood pressure.

d) "START" key

When the "START" key is pressed, the pump will begin pressurizing the cuff. The pump will stop when the selected pressure value is reached. At this point, the constant-speed exhaust begins.

e) 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.

f) 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 pressure determination is complete, the beeper will sound.

g) Rapid exhaust

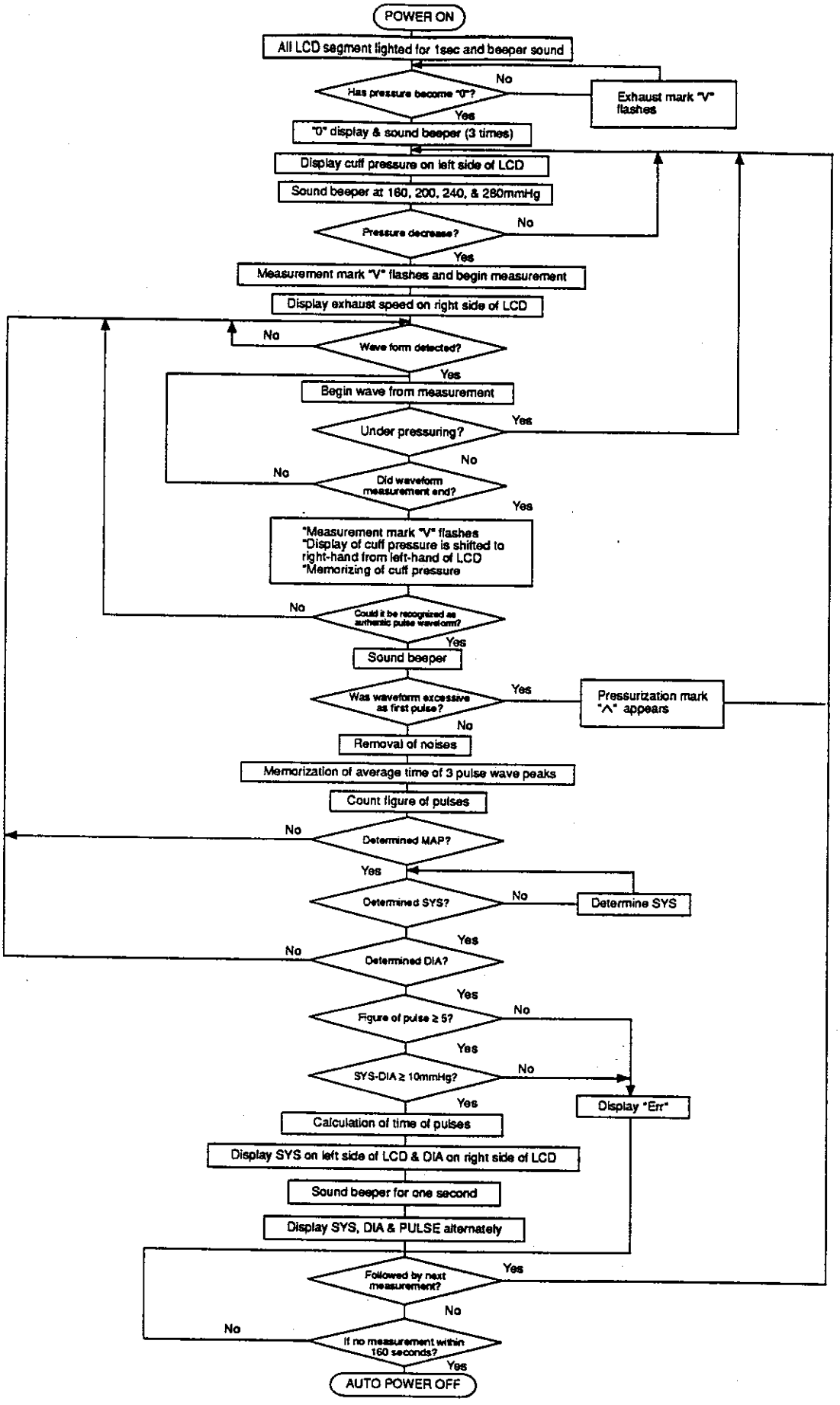
When the measurement sequence has completed, a solenoid valve opens and the air in the cuff is rapidly exhausted.

h) Pulse display

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

i) Power off

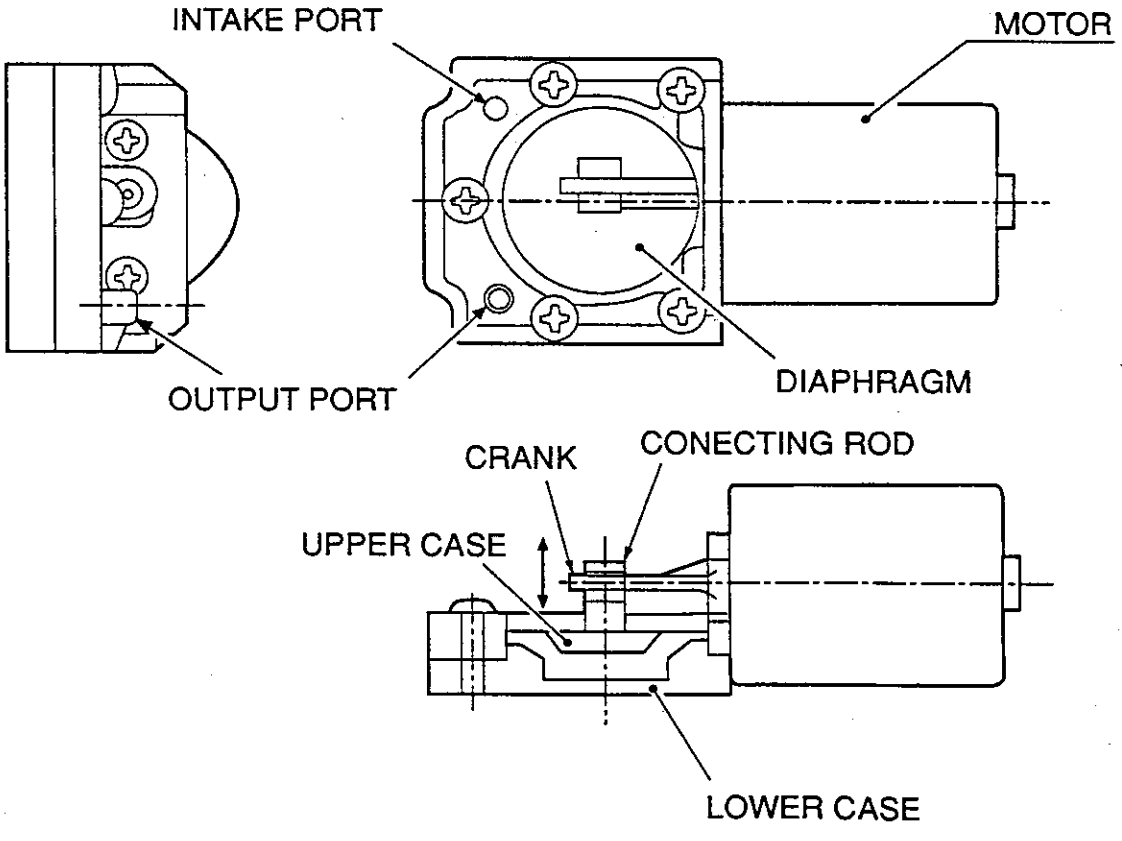
After completion of the measurement, press the "POWER" key to turn the instrument off, or simply allow the unit to remain unused for three minutes, and the unit will automatically switch to the time display.


POWER ON
All LCD segment lighted for 1sec and beeper sound
Has pressure become "0"?
No
Exhaust mark "V" flashes
Yes
"0" display & sound beeper (3 times)
Display cuff pressure on left side of LCD
Sound beeper at 160, 200, 240, & 280mmHg
Pressure decrease?
No
Yes
Measurement mark "V" flashes and begin measurement
Display exhaust speed on right side of LCD
No
Wave form detected?
Yes
Begin wave from measurement
Under pressuring?
Yes
No
No
Did waveform measurement end?
Yes
"Measurement mark "V" flashes
"Display of cuff pressure is shifted to right-hand from left-hand of LCD
"Memorizing of cuff pressure
No
Could it be recognized as authentic pulse waveform?
Yes
Sound beeper
Was waveform excessive as first pulse?
Yes
Pressurization mark "^" appears
No
Removal of noises
Memorization of average time of 3 pulse wave peaks
Count figure of pulses
No
Determined MAP?
Yes
Determined SYS?
No
Determine SYS
Yes
No
Determined DIA?
Yes
Figure of pulse ≥ 5?
No
Yes
SYS-DIA ≥ 10mmHg?
No
Yes
Display "Err"
Calculation of time of pulses
Display SYS on left side of LCD & DIA on right side of LCD
Sound beeper for one second
Display SYS, DIA & PULSE alternately
Followed by next measurement?
Yes
No
No
If no measurement within 160 seconds?
Yes
AUTO POWER OFF

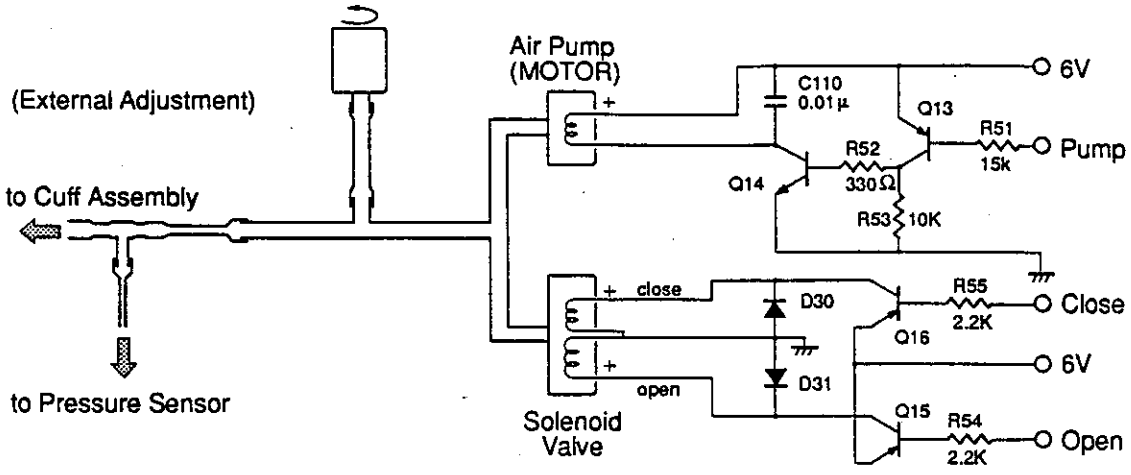
Inflation Pump & Exhaust Valve

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	67.5mm × 35mm × 26mm
Weight	Approx. 70 grams.

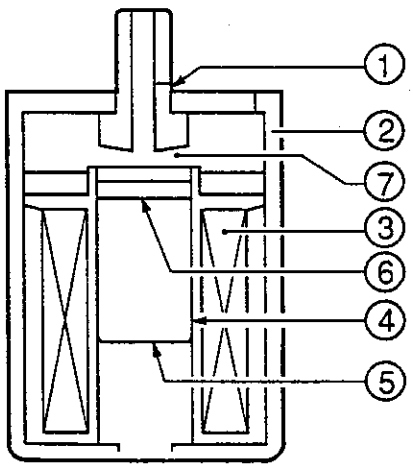


Construction Drawing of Pump Assembly



Block Diagram of Pump and Valve Assembly

Exhaust Valve



Solenoid Valve

Constructions

A. When performing measurements of blood pressure, the core is in the raised, or closed position. At the completion of a measurement, an electrical signal operates the drive coil, causing 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.

Check Sequence

1) Required Instruments

The instruments required for this procedure are as follows:

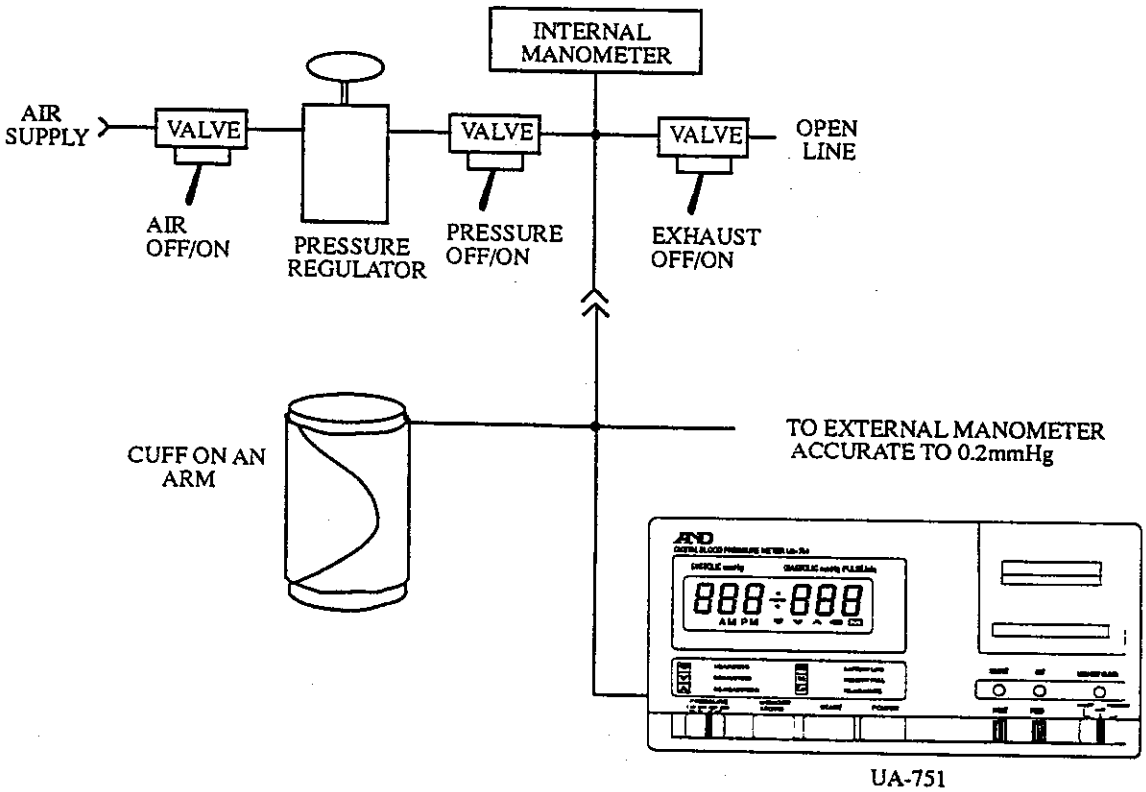
Digital Voltmeter (DVM)

Manometer (accurate to within ±0.2 mmHg)

Test system (accurate to within ±0.2 mmHg)

2) Power Supply Check

VDD (battery voltage)	Battery positive terminal
VSS -6V	Measure at battery negative terminal
Switching supply -9V	Measure at pin 2 of IC5
VSS1 -4V ±0.2V	Measure at pin 3 of IC5
VSS2 -6V	Measure at pin 31 of IC2
VSS3 -6V	Measure at pin 9 of IC4



TEST SYSTEM

1) Open the unit

2) Supply power to the unit without feeding pressure (after a few seconds "0" will appear on the LCD). Set the pressure switch to 160mmHg.

3) Press START, the rapid exhaust valve will close and the pump will run until the set pressure is reached, feed pressure (280 mmHg) to the unit

4) Compare the reading of the unit and that of the test system (or a standard manometer).

5) When the unit reads higher (or lower) than the standard gauge, turn the span trimmer on the PCB of the unit to the left (to the right) so that the reading of the unit increases (decreases).

   Example: When the reading of the unit is 285 and that of the standard reads 280.0, turn the span trimmer to the left so that the unit reads 289 – 291. And when the reading of the unit is 275, and that of standard reads 280.0, turn the span trimmer to the right so that the unit reads 269 – 271. Remove the adjustment tool prior to checking the accuracy of the unit as the tool will cause an error in the reading.

6) Then de-pressurize air from the test system and unit. Turn the power off (Press the power switch on the unit), then turn the power on again (the auto-zero system of the unit only works when you turn the power on).

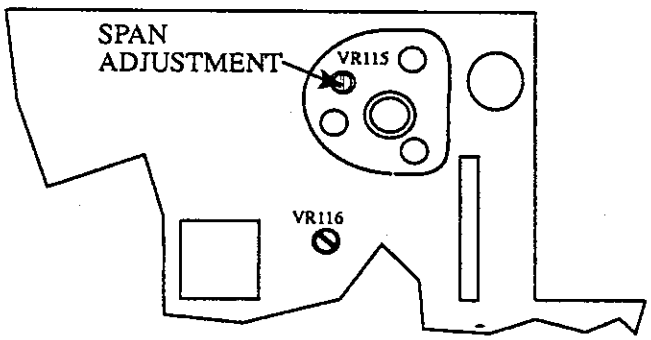
7) Press START, the rapid exhaust valve will close and the pump will run until the set pressure is reached, feed pressure (280 mmHg) to the unit

8) Please repeat steps 4 through 7 to make an accurate calibration of the unit. check the pressure accuracy at 50 mmHg and 160 mmHg (linearity of the sensor). If the accuracy is not within the stated specifications, try adjusting the unit again.

9) Set the print select switch to "CURRENT". Insert a length of paper in the printer and press the print key. Adjust VR116 carefully until the printer is printing plainly but not to dark. If set to dark, the print head will not last long.

10) Press "MEMORY STORE" to place a reading in memory. Take several readings and store them. Set the print selector to each position and print the data toverify that the memory circuits work properly.

11) Place the unit aside for at least 24 hours with the time displayed. Verify that the clock is keeping proper time. At the end of the time test, print out all of the data again in each position of the print select switch. If the memory is good, press "MEMORY CLEAR" and check that there is no data in memory.



Constant Exhaust Speed

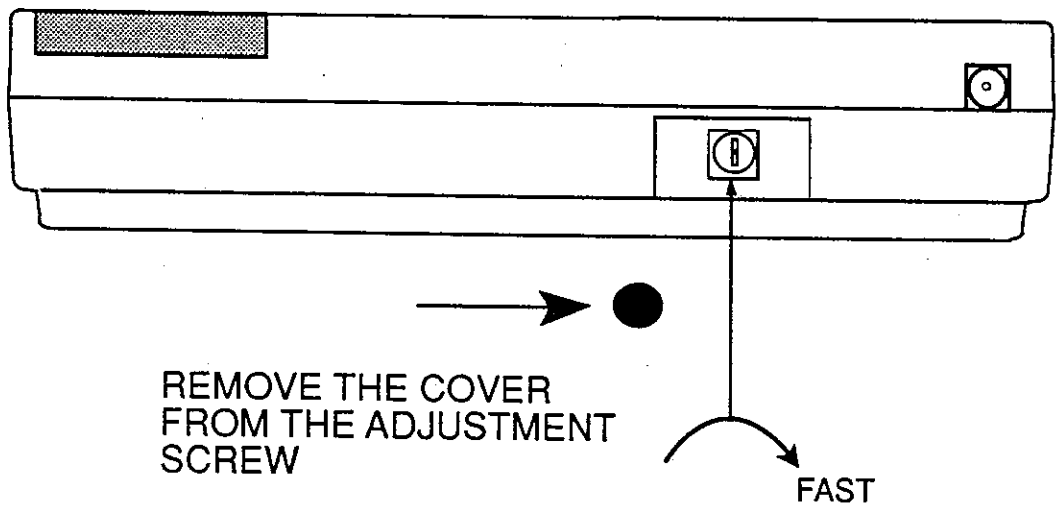
Disconnect the cuff and connect a 300CC air tank in it's place. Set the pressure switch to 200mmHg. Press the POWER button and allow the unit to "zero". Press the START button and pressurize the air tank.

Approximately 1 second after stop of pressurization the deflation speed per second will appear on the right side of the display.

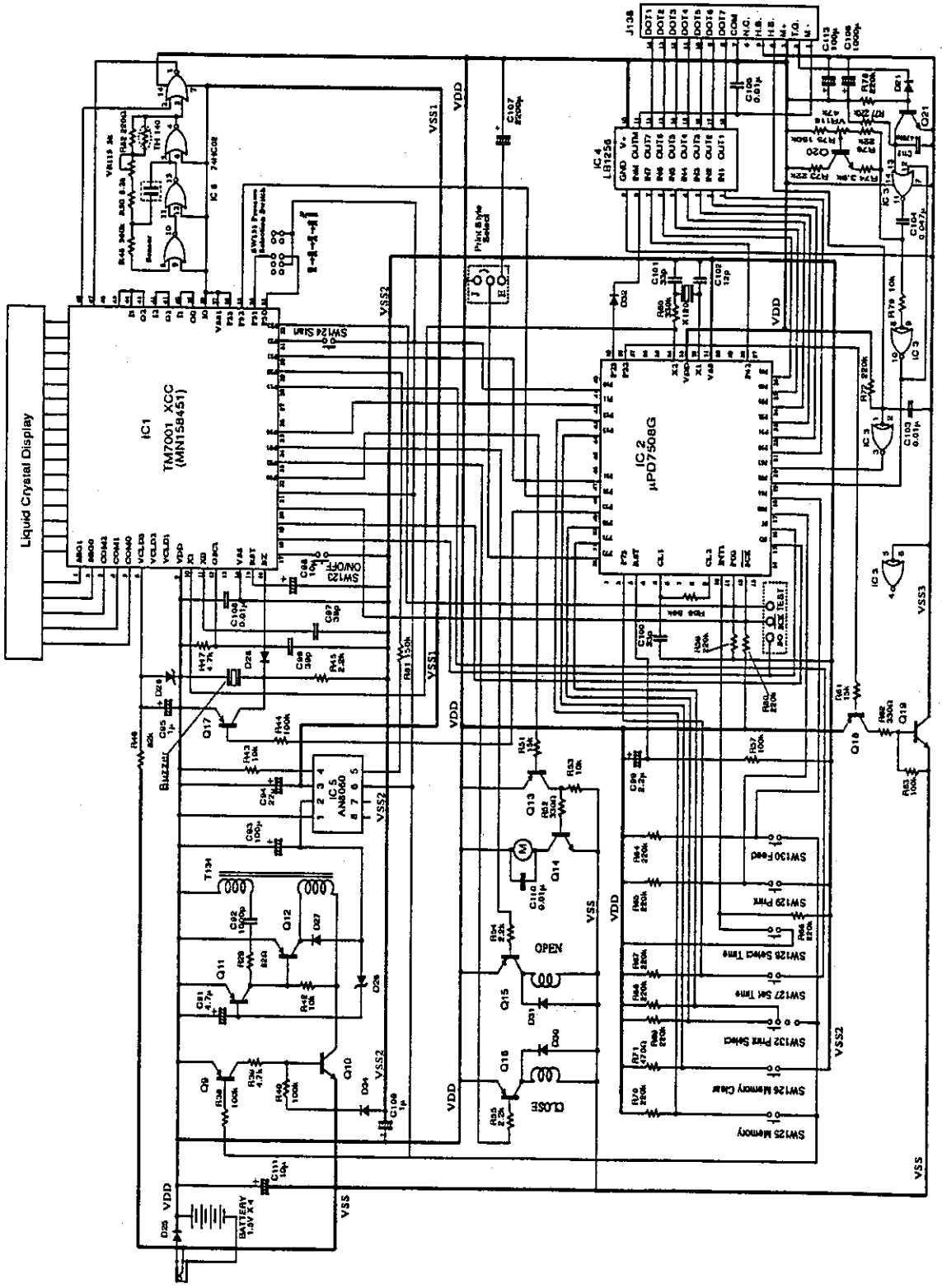
Adjust the deflation speed to 3-4mmHg/second at the cuff pressure range of 170-140mmHg by turning the adjustment screw. Turn it clockwise to increase the speed and counterclockwise to decrease.

If the adjustment screw has been turned to far, adjustment may be difficult. Try turning the adjustment screw clockwise several turns (you may not feel when the adjustment screw bottoms out as it is set in soft rubber), then counterclockwise three full turns. This should place the adjustment screw within range for proper adjustment.

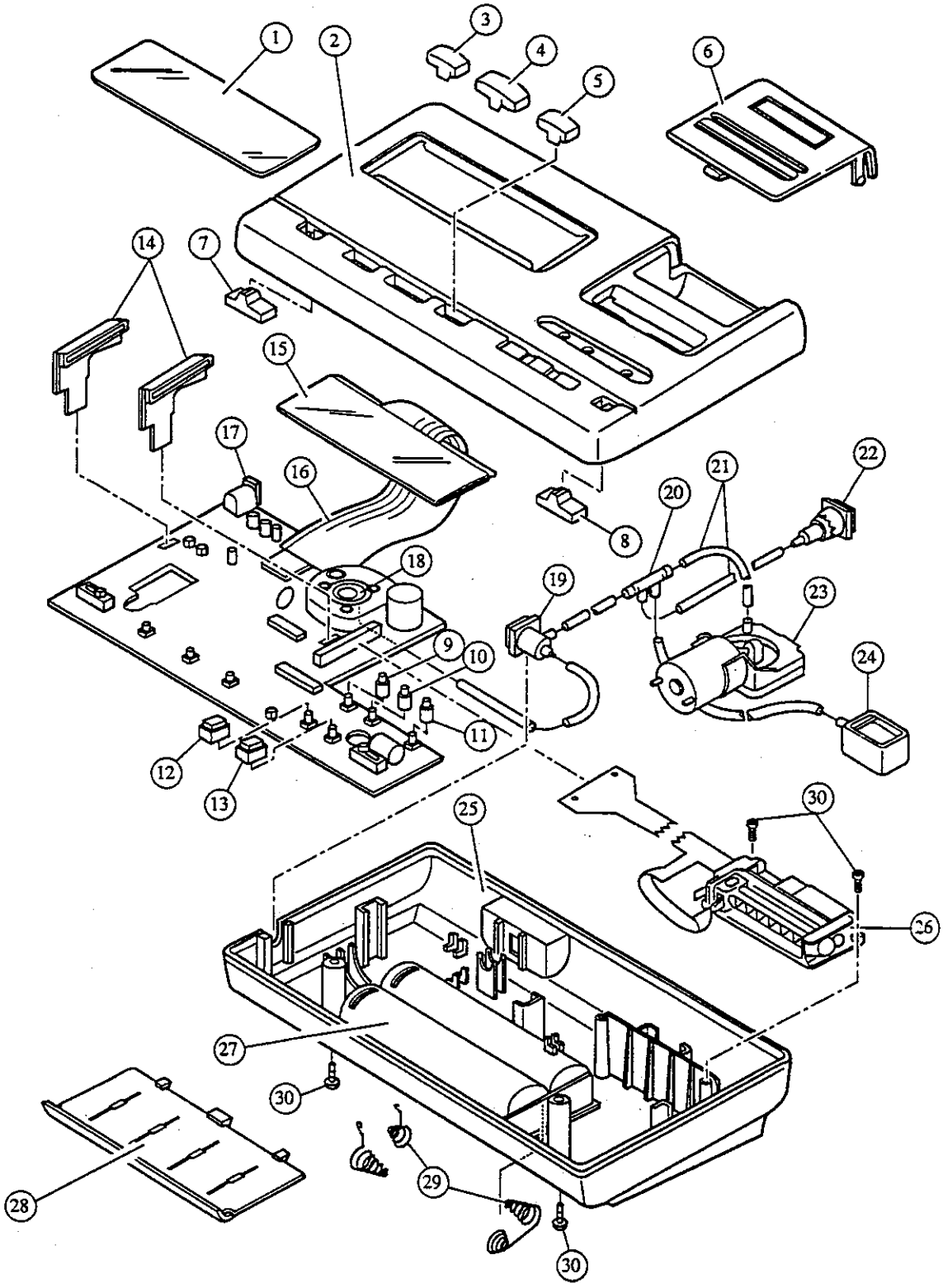
If the valve has been taken apart , it may be missing the valve block (a very small pointed plastic part), Adjustment of the screw will have no effect on the exhaust speed.



Circuit Diagram



Illustration



Exploded View

Parts List

Parts for UA 751

No.	Part name	Part No.
1	Display filter	U4-3578
2	Upper case	U4-3560
3	Keycap (MEMORY STORE)	U4-3551
4	Keycap (START)	U4-3203
5	Keycap (POWER)	U4-3201
6	Printer cover	U3-629
7	Keycap (slide switch)	U4-3344
8	Keycap (slide switch)	U4-3344
9	Keycap (round)	U4-3323
10	Keycap (round)	U4-3323
11	Keycap (round)	U4-3323
12	Keycap (square)	U4-3322
13	Keycap (square)	U4-3322
14	Display support	U3-630
15	Display LCD	VL-E-7210
16	Display cable	KH-21P150L060
17	External DC power connector	JP-HEC2305-01A
18	Sensor shield with buzzer	UA4-5178
19	Air socket	U4-2731-A
20	Air manifold	U4-3213
21	Silicone tube 2.3X4X65 2.3X4X120 2.3X4X130 3X5X90 3X5X130	TS-23400065TP TS-23400120TP TS-23400130TP TS-30500090TP TS-30500130TP
22	Constant exhaust valve assembly	UA4-2680-A
23	Pump assembly	UA3-572
24	Exhaust solenoid	LS-SS-068K-001C
25	Lower case (less battery holder)	U1-151-B
26	Printer assembly	EP-MTP201-24BJ
27	Battery holder	U4-3621
28	Battery compartment cover	U3-628
29	Battery terminal (negative) (positive) (jumper)	U4-3533-A U4-3534-B U4-3535
30	Screw (case) (printer)	UZ4-0011 UZ4-0031
	Main PC board (complete)	PA-0084S1

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