

ALP K2®

Service Manual

for Digital Blood Pressure Monitor

Model No.K2-051

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1. DESCRIPTION

The Model WS-970 is an Auto Inflation Wrist Digital Blood Pressure Monitor. The readings in each function are digital displayed on LCD panel.

STATUS INDICATION shows Palpatory Wave and Battery Weak.

ERROR MESSAGE CODE includes Battery Weak, it is impossible to measure the blood pressure accurately.

BATTERY POWER is monitored always the battery remnant is shown on the display.

AUTOMATIC AIR INFLATION inflates the cuff pressure by an internal air pump.

AUTOMATIC AIR DUMP VALVE dumps the pressure in the cuff automatically when the measurement is over or error has been occurred.

AUTOMATIC POWER SHUT OFF;

The unit will automatically turn off if it is not operated for about 3 minutes or more.

IRREGULAR PULSE RHYTHM INDICATION

Heart mark flashing in measurement result display indicates irregular pulse rhythm.

2. Specifications

2-1. Model	WS-970-03	
2-2. Classification	CLASS II a	
2-3. Function	① Blood Pressure Measuring	
	② Pulse Rate Measuring	
	③ Automatic Power Shut Off	
	④ 5 Error Indication	
2-4. B.P.M. Specifications		
(1) Measuring Method	Cuff Oscillo-Metric	
(2) Measuring Position	Wrist	
(3) Coverage wrist circumference	125mm ~ 215mm	
(4) Pressure detection	Pressure to Frequency Converter	
(5) Pressure indicating (Cuff Pressure)	① Units	mmHg EN1060-1 6
	② Range	0 - 300 mmHg EN1060-3 7.7.1
	③ Resolution	1mmHg EN1060-3 7.7.2
	④ Zero setting	Automatic zero setting EN1060-3 7.4.4
(6) Measuring range	① Systolic	50- 250 mmHg Cuff Pressure
	② Diastolic	40- 180 mmHg Cuff Pressure SYS-DIA >10mmHg
	③ Pulse Rate	40 - 160 Beat/Min.
(7) Accuracy	① Pressure	± 3 mmHg EN1060-1 7.1.1
	② Pulse rate	± 5 % of Reading
(8) Cuff inflation	Automatic Inflation System (Air Pump)	
(9) Preset pressure	180mmHg (Fixed)	
(10) Cuff deflation	Electromagnetic deflation Control Valve (ECV)	
(10) Deflation rate	5.5 mmHg/sec.	
(11) Rapid Exhaust	Automatic Exhaust (ECV) EN1060-3 7.4.3	
(12) Cuff system	① Cuff of Wrist	
	② Locking Mech-Velcro	
	③ Bladder Size	52mm(W) × 128mm(D)
	④ Cuff Size	66mm(W) × 280mm(D)

(13) Indicator	13Digits+ 2 Indicators LCD.Display EN1060-1 5	
	① 13 Digits Display	<ul style="list-style-type: none"> • Date/Time • Systolic • Diastolic • Pulse rate • Memory No.
(14) Memory	② Indicators	<ul style="list-style-type: none"> • Palpatory wave (Heart mark) • Irregular pulse • Weak battery
(15) Microcomputer	① Systolic Diastolic and Pulse rate	
	② 30 measurement results × 1 and averages	
	③ Memory Data Average (SYS. DIA. PUL.)	
(16) Power Source	8Bit Microcomputer	TMP86CH29AU A205147-03
(17) Power consumption	LR03 Type (AAA Size) 2 pcs. EN1060-3 7.3.1	
(18) Operating TEMP./Humidity	2W (Max.)	
(19) Storage TEMP./Humidity	+10 °C to +40 °C /85% RH or below EN1060-1 7.1.2.2	
(20) Main unit size	-5 °C to +50 °C /85% RH or below EN1060-3 7.5.1	
(21) Main unit weight	64 mm (W) × 66.5 mm (D) × 28.8 mm (H)	
	Approx. 100 gm (Not Including Batteries)	
2-5. Safety system	Cuff Pressure > 330mmHg → Rapid Exhaust	
2-6. Electrical safety	EN1060-1 7.2.1	
2-7. Resistance to vibration & shock	EN1060-1 7.2.2	
2-8. Air Leakage	EN1060-3 7.4.1	
2-9. Electromagnetic compatibility	EN1060-3 7.5.3	
2-10. Stability of the cuff pressure indication	EN1060-3 7.6	
2-11. Overall system accuracy	EN1060-3 7.9	
2-12. Lay a pipe system	See "10.Exploded Views" P19	
2-13. Operating manual	English , Spanish	
2-14. Accessories	Non	
2-15. Life	5 Year	

3. PRINCIPLES OF OPERATION

3-1. Operation of Each Unit

These units operate as follows:

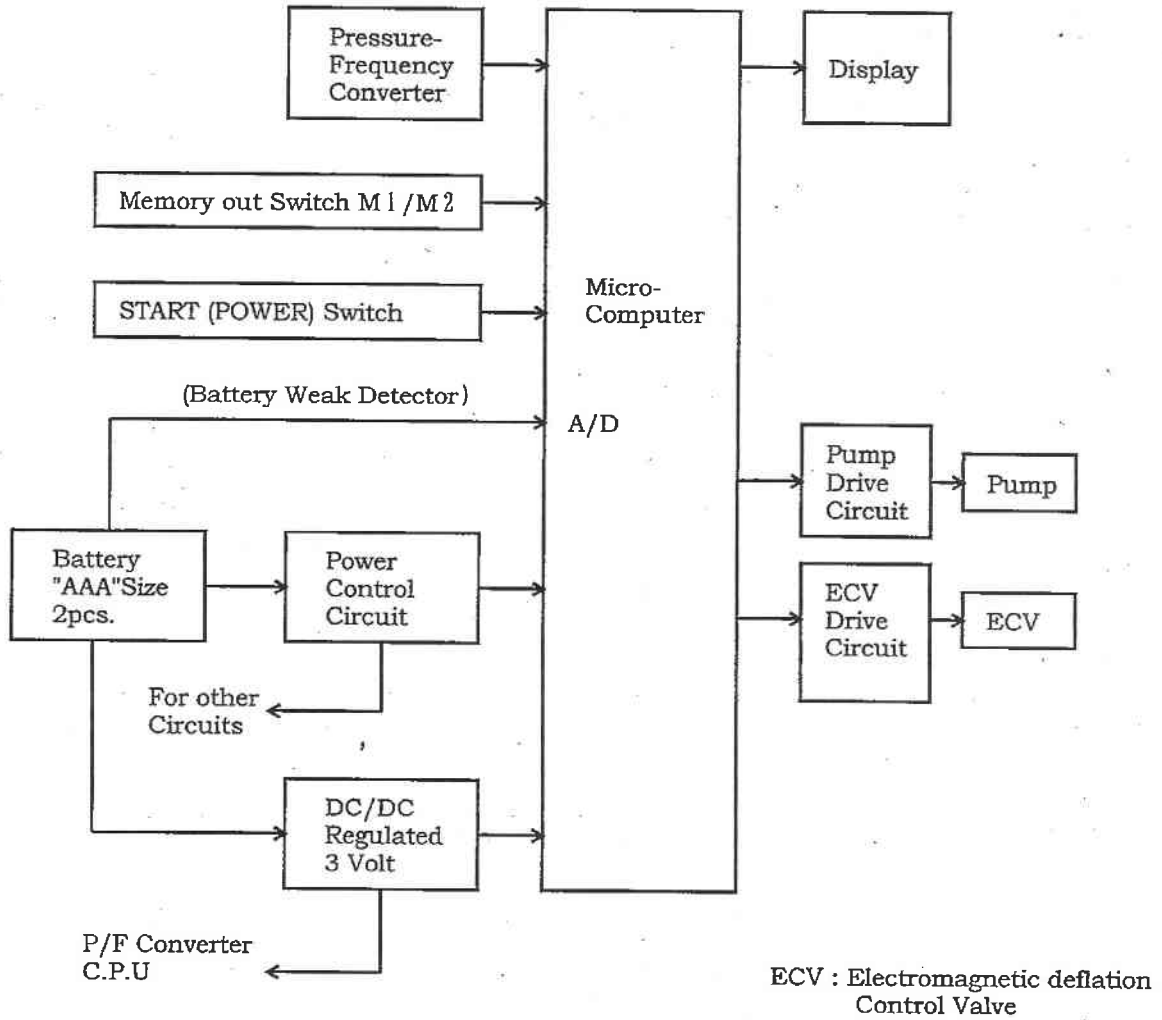


FIG. 3-1 Block Diagram

a) Pressure Sensor

Elastic capsule. Capsule is inflated by pressure.

Parallel Plate variable capacitor;

Gap of parallel plate are changed by inflation.

CR oscillator;

Oscillation frequency are changed by capacitance change.

Frequency Counter;

Frequency are counted by counter and digital output is took in to the computer.

(The counter is included in to the computer IC chip)

b) Others

Power supply control circuit;

Receives the control signal from the microcomputer to turn the power on and off to units other than the microcomputer.

Display Unit;

Displays cuff pressure, maximum blood pressure, minimum blood pressure, pulse rate and information messages.

Electromagnetic deflation control valve (ECV) drive circuit;

ECV drive circuit controls the air exhaust speed regularly during blood pressure measuring by the controlling signal from the microcomputer.

It exhausts the air rapidly after the measuring or when "Err" indicating.

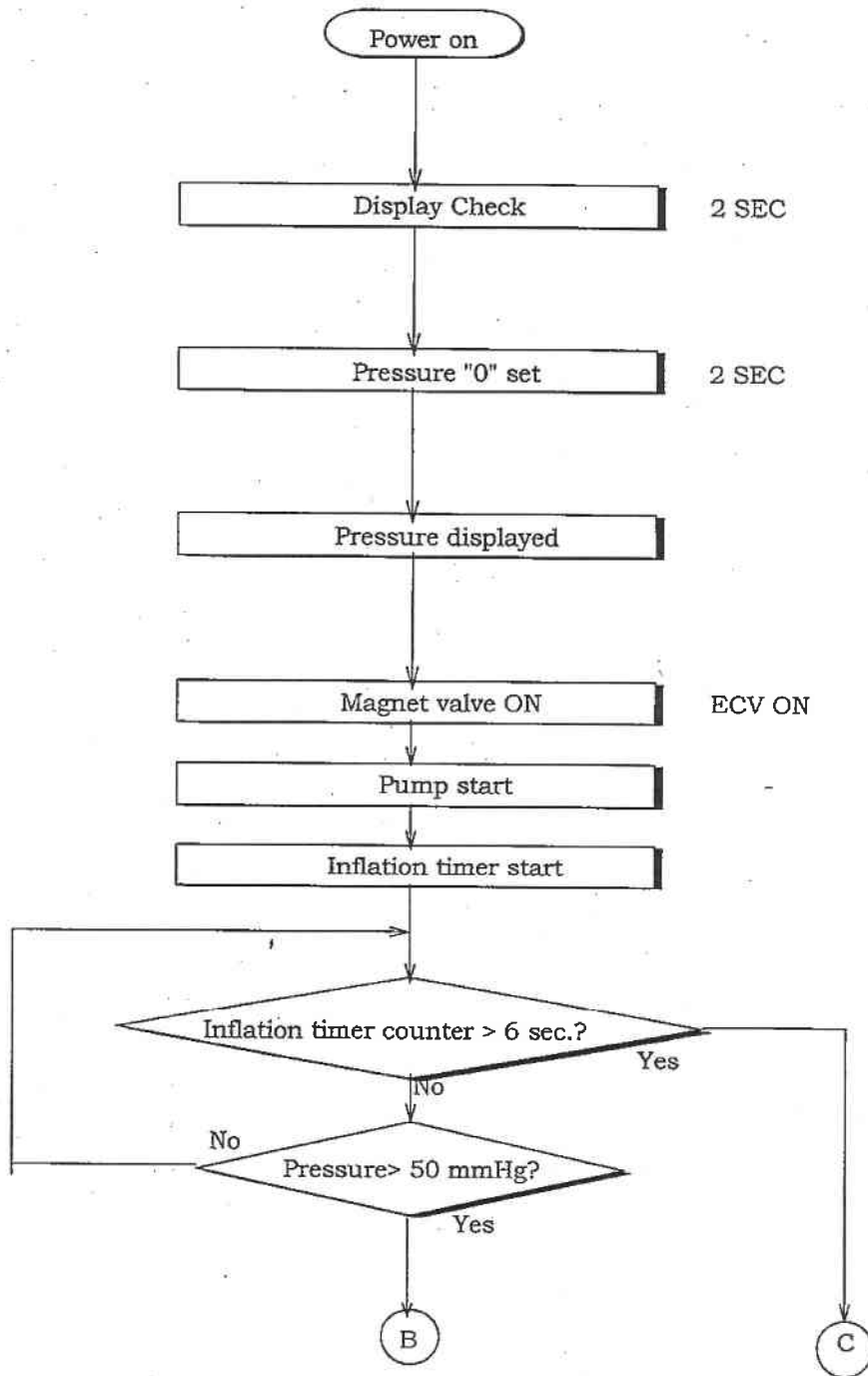
Pump drive circuit;

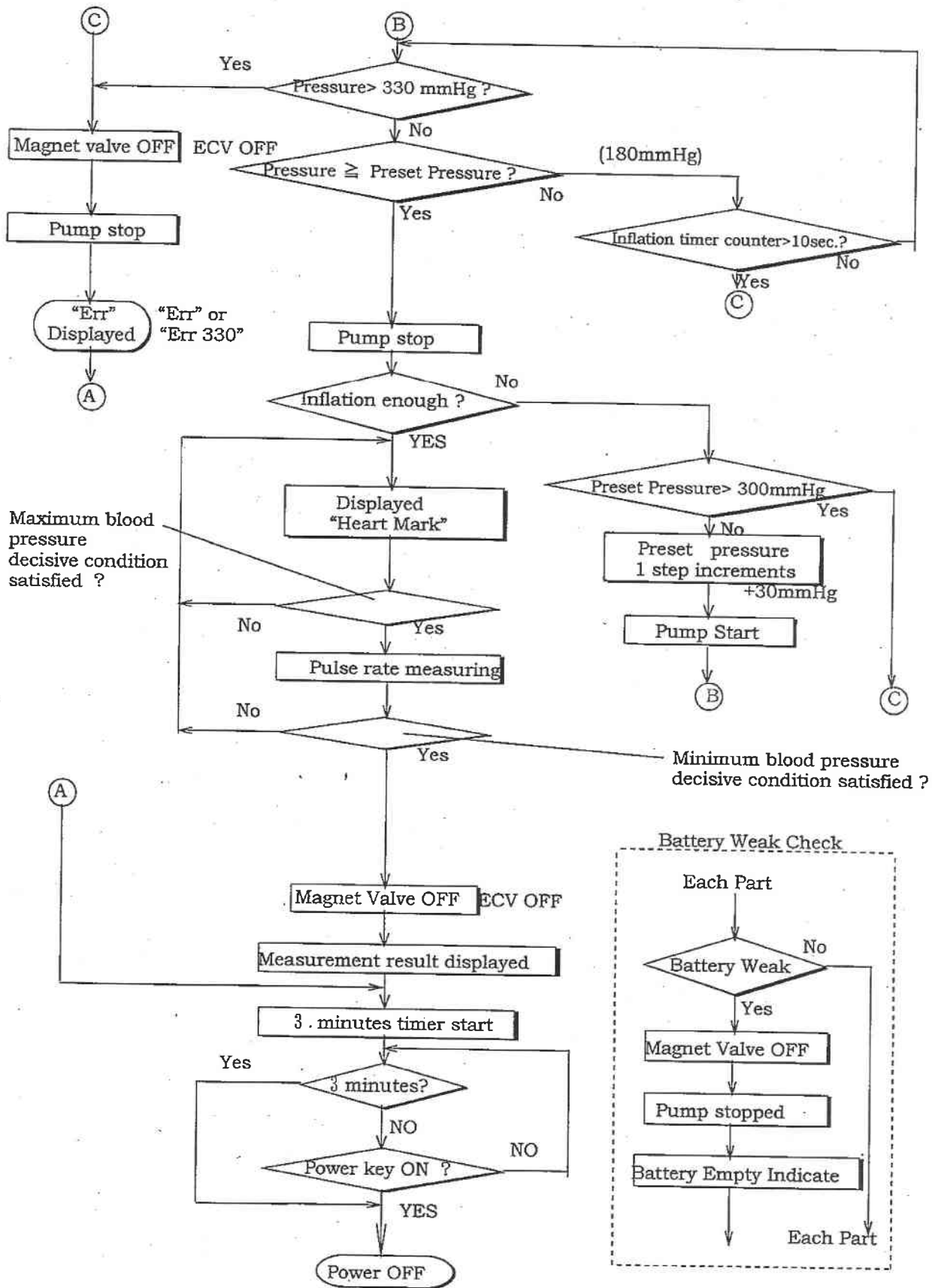
Controls starting and stopping of the pump.

c) Microcomputer

According to the information received, the microcomputer controls the P/F converter, blood pressure measuring sequence and LCD display drive.

3-2 Flow Chart of Operation





3-3 Air Circuit;

The air circuit is composed of the following;

Pump : Used during an increase of pressure.

Electromagnetic deflation control valve

: Used for constant air exhaustion at the time of measurement.

: Used after the measurement.

Cuff : To tighten the left or right wrist.

Pressure Sensor : Frequency are changed by pressure

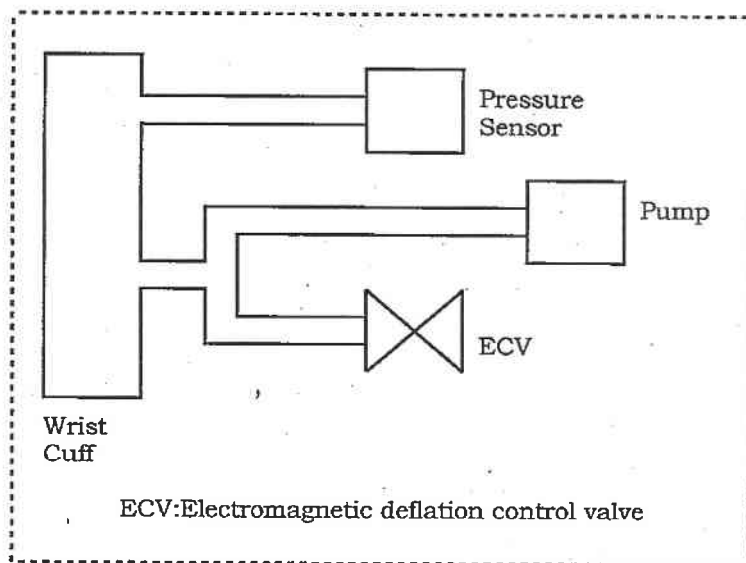


FIG. 3-2 Air Circuit

4. OPERATING INSTRUCTION

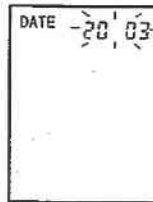
4-1 Power Supply

1) In case using battery

Take off battery cover left side of main body and insert 2 pieces of LR03 type batteries to fit polarity indication.

4-2 Time set up

4-5) Date and time setting



The unit goes the time setting mode when batteries are installed.

Adjust "year" with the memory M1 (+) or M2 (-) button and set with the start/stop button.

Year is selectable from 2003 to 2030.



Adjust "month" with the memory M1 (+) or M2 (-) button and set with the start/stop button.



Adjust "day" with the memory M1 (+) or M2 (-) button and set with the start/stop



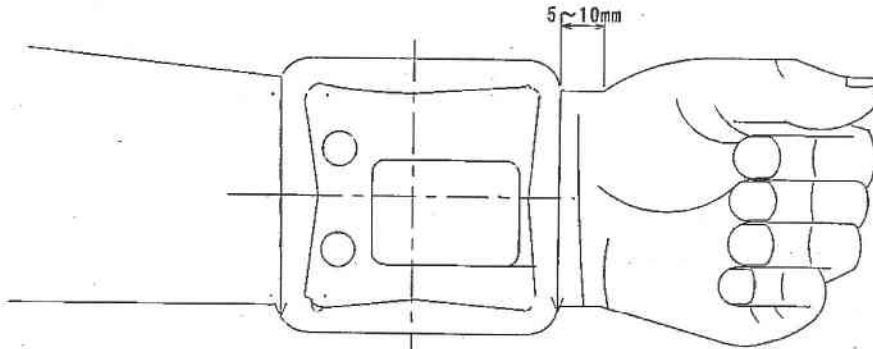
Adjust "hour" with the memory M1 (+) or M2 (-) button and set with the start/stop button.



Adjust "minute" with the memory M1 (+) or M2 (-) button and set with the start/stop button.

4-3 Measurement Procedures

- 1) Wrap the Cuff around the upper left wrist.
Face upwards the palm of the hand, make the body position in the center of the palm, and wrap the cuff tightly to the wrist, leaving no space between the cuff cloth.



In case you wear a wrist watch on your left wrist, please wrap cuff after you put off it. The position of the individual when being measured may be either lying down or sitting. In the sitting position however make sure that the location on the left wrist to be measured is about at the same height as the heart and that the forearm is extended naturally on the table and does not move.

- 2) Push the "START" switch to automatically inflate cuff to the Optimum pressure.
- 3) Pressure start to descend. Please do not move your body as possible as you can later.
- 4) Further descending cuff pressure, indication mark for "Heart mark" flashing to notice pulse wave when the pulse wave begin to generate.
- 5) Further descending cuff pressure and when come to minimum blood pressure, display for "Heart mark" flashing also disappear.
- 6) Minimum, maximum blood pressure and pulse rate is displayed.
- 7) Measurement is completed above all steps. Then the unit will automatically exhaust the air from the cuff.
- 8) If you forget to turn the power switch to off after completion of measurement, it will be automatically turned off after the 3 minutes.
- 9) In case you take measure again, you should repeat from item 2) to 7).

4-4. MEMORY FUNCTIONS

- 1) Storing Measured Data.
Measured result is automatically stored either M1 or M2. Make sure which memory bank number is displayed before turning off the unit.

Each of two memory banks can store up to 30 results and their average. When the number of measurement exceeds 30, the oldest data will be deleted to record new data. You May decide which bank to store you measurement result to avoid data mixture someone else's, or May use two banks to save data measured in the morning and evening separately.

- 2) Press MEMORY BUTTON M1 or M2 to see stored data.

(When no measurements are stored, nothing will be displayed.)

The average of the stored result in the selected bank is displayed.

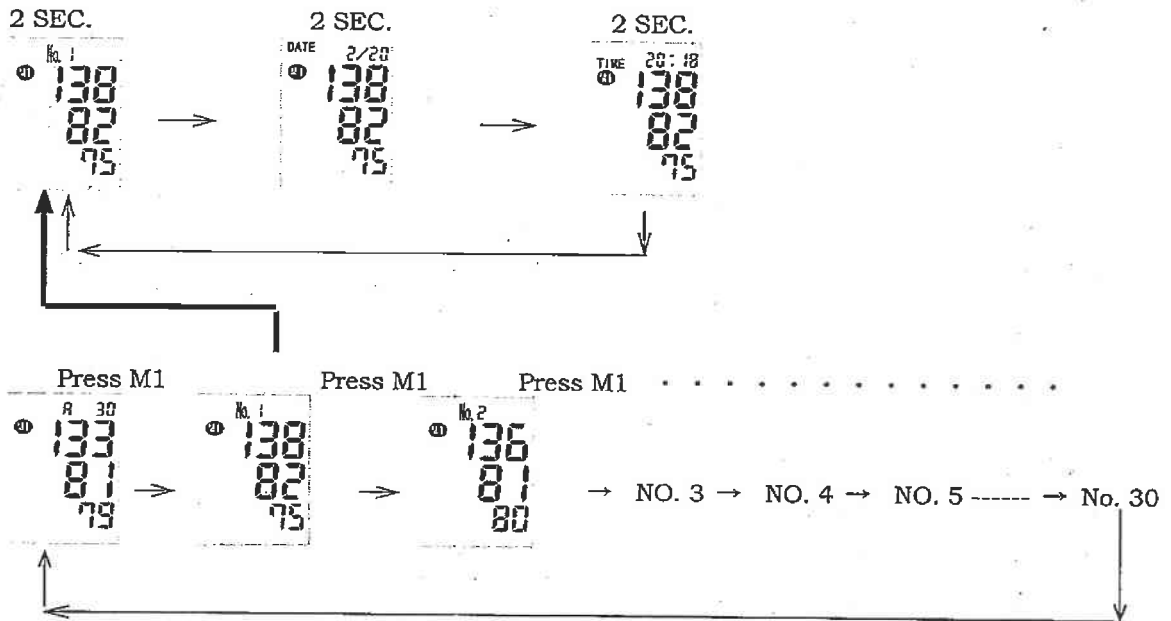
The latest result stored is displayed when there is only a single result and clock display remains when there are no result stored.

The indication at the top of the display changes from memory data and to time.

The memory data is displayed for approximately 30 seconds. Approximately 30 seconds after MEMORY BUTTON is released, the apparatus will turn off.

- 3) Press MEMORY BUTTON to move to next data.
The memory data number 1 is the latest among the stored data in the selected memory bank.
- 4) Every depression of the key switches among the memory data.
As MEMORY BUTTON is pressed, the memory data number increases; The bigger the number, the older the result.
- 5) Press START BUTTON and turn off the unit.

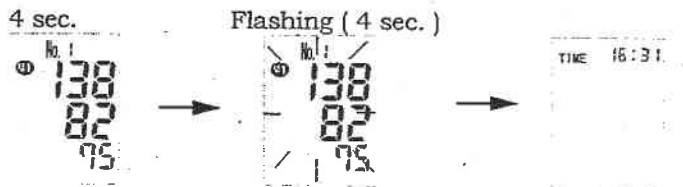
MEMORY DISPLAY



4-5 Deleting a single data

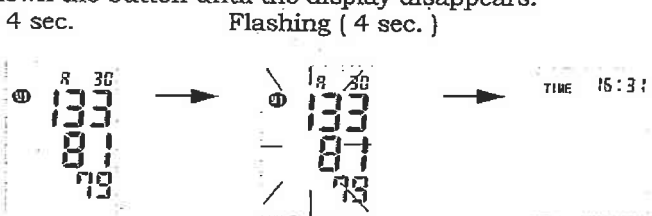
- 1) Show the data to be deleted following the steps in MEMORY FUNCTIONS.
- 2) Press and hold down MEMORY BUTTON M1 or M2 whichever the data is stored.
The displayed data start flashing.

Hold down the button until the display disappears.



4-6 Deleting all data in a bank

- 1) Press MEMORY BUTTON M1 or M2 and show the average of the bank to be deleted.
- 2) Press and hold down selected MEMORY BUTTON.
The displayed data start flashing.
Hold down the button until the display disappears.



5. ERROR DISPLAY

This blood pressure monitor displays an error message for mistake measurement method and weak battery.

In case displaying error message during measurement, please exhaust and please re-measure after confirming how to use.

5-1. Improper pressure

Err 330 *Inflation above 330 mmHg.

Err 1 *Noise is detected by moving body during measurement.

Err 2 *The inflation function is irregular. The cuff is damaged.

Err 3 *The exhaust speed is irregular.
The exhaust speed is higher than 9 mmHg/sec. or lesser than 2 mmHg/sec.

5-2. Weak battery

Weak battery provide inadequate voltage for operation of the unit.
Batteries need to be replaced.



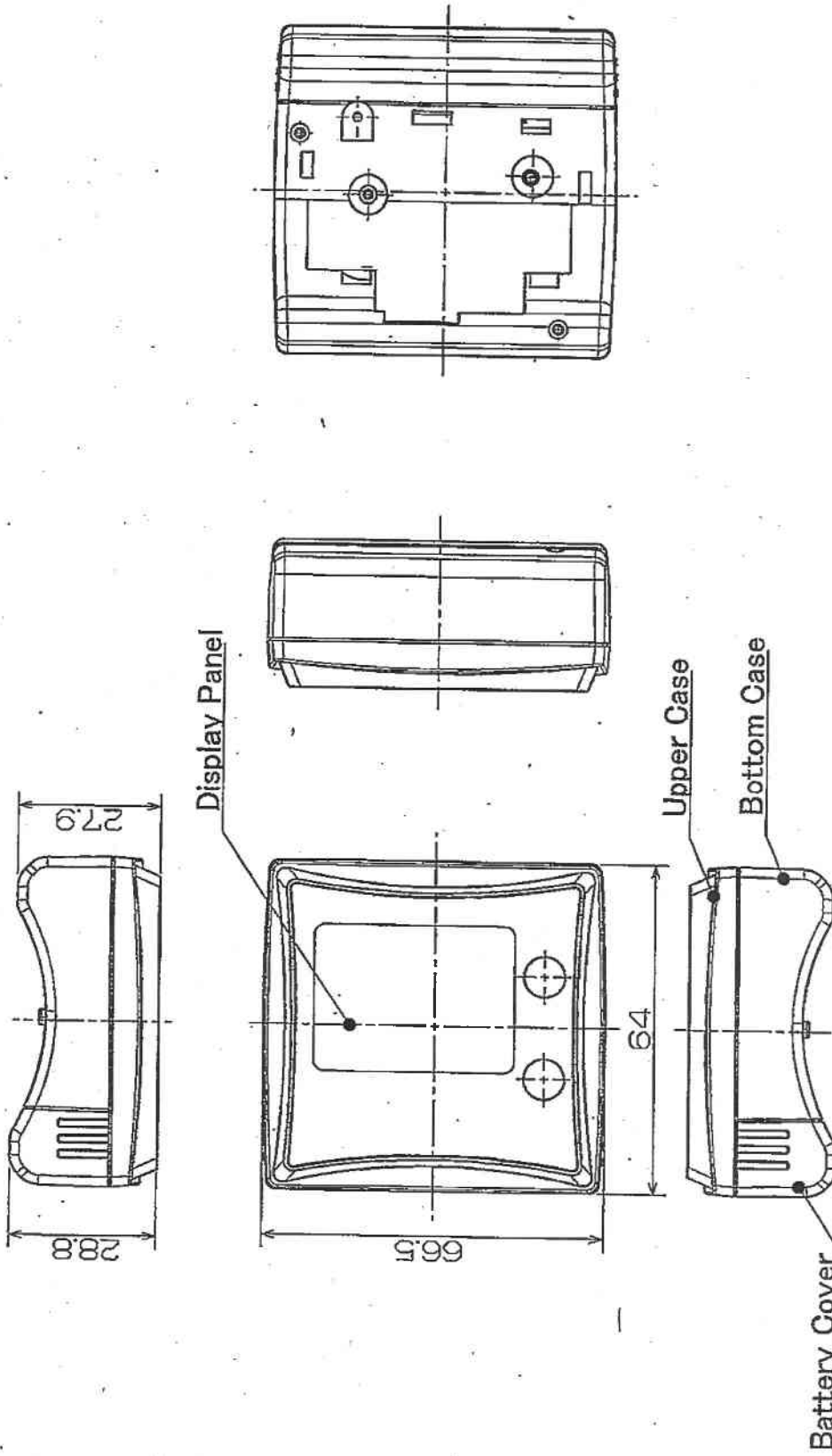
5-3. Irregular pulse rhythm indication

Heart mark flashing in measurement result display indicates irregular pulse rhythm. Irregular pulse rhythm can be because of arrhythmias. Although constant appearance of the indication under quiet measurements May suggest arrhythmias. Do not make any judgment on your own before consulting with your doctor.

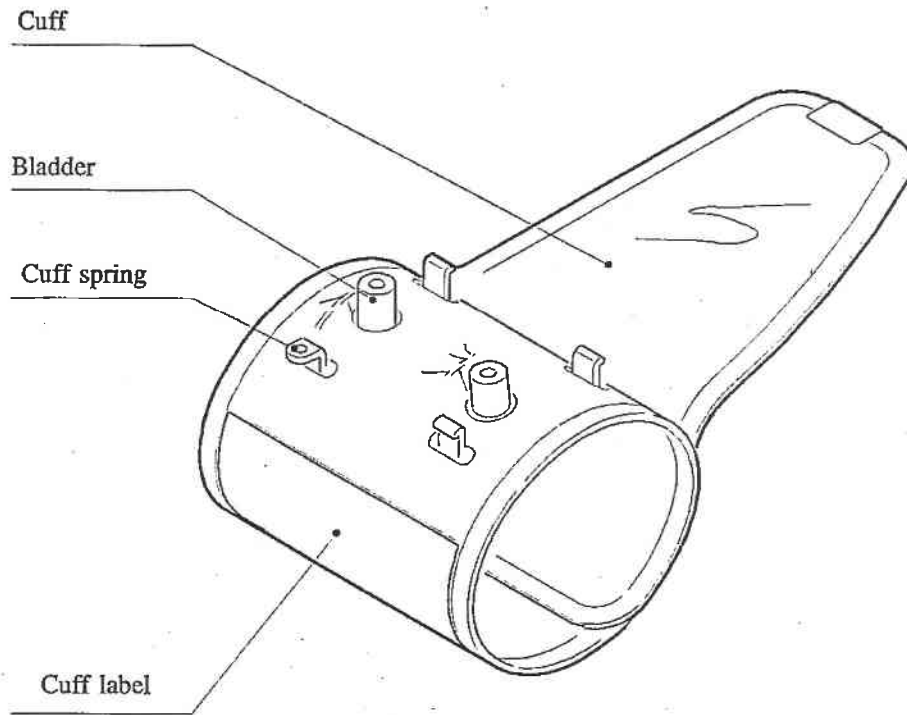


6. OUTSIDE DRAWING

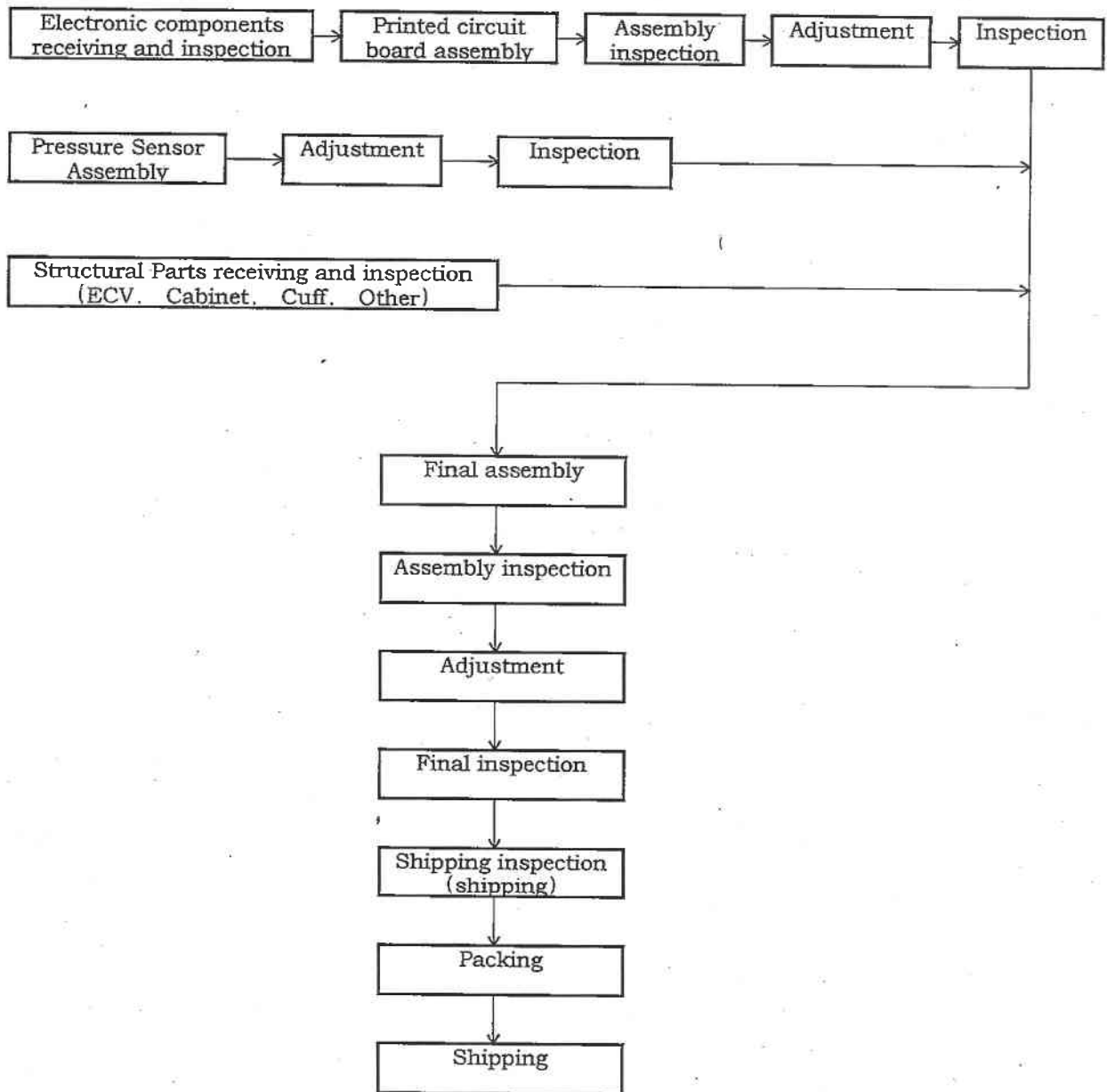
6-1. MAIN UNIT



6-2. CUFF UNIT



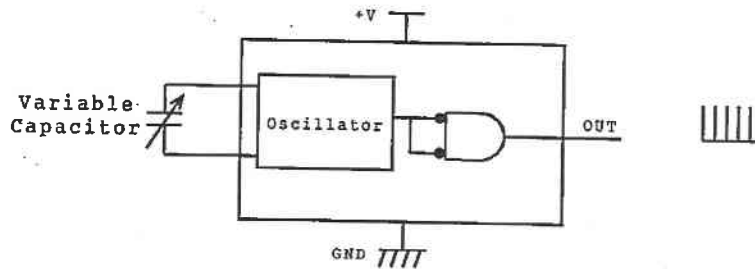
7. PRODUCTION PROCESS TABLE



8. PRESSURE SENSOR

8-1 Model : CS-100

8-2 Construction : Pressure / Frequency Converter



8-3 Usage Condition

(1) Pressure range	0 ~ 300 mmHg
(2) Safety over load	390 mmHg
(3) Compensation temperature range	0 ~ 50 °C
(4) Storage temperature range	-34 ~ 65 °C
(5) Humidity	85% Rh or below
(6) Power supply	3 V ±0.2V

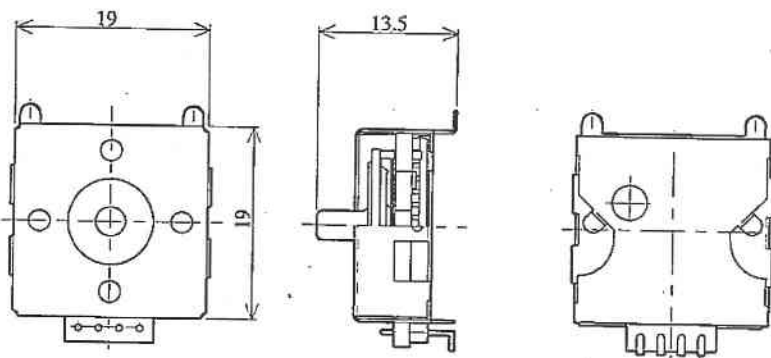
8-4 Outline

(1) Outline dimension	19 × 19 × H13.5mm
(2) Weight	Approx. 7g

8-5 Performance

(1) Output frequency	0 mmHg : 800 KHz ±300 KHz ··· f ₀ 300 mmHg : f ₀ -240 KHz
(2) Linearity	Within ±0.3 % of FS
(3) Hysteresis	Within ±0.3 % of FS
(4) Span drift	±1% (10 °C ~ 45 °C)

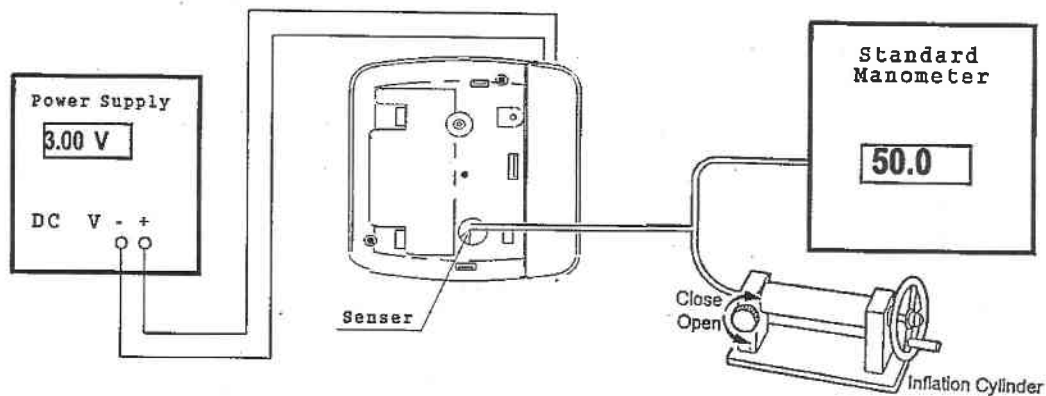
CS-100 Outline Drawing



9. PRESSURE ACCURACY TEST

Connection with Test Device

1. Connect a 3V DC power supply in off mode.
2. Connect the standard manometer and the inflation cylinder, then make it diverge to join the connector used for the pressure accuracy test on the unit.

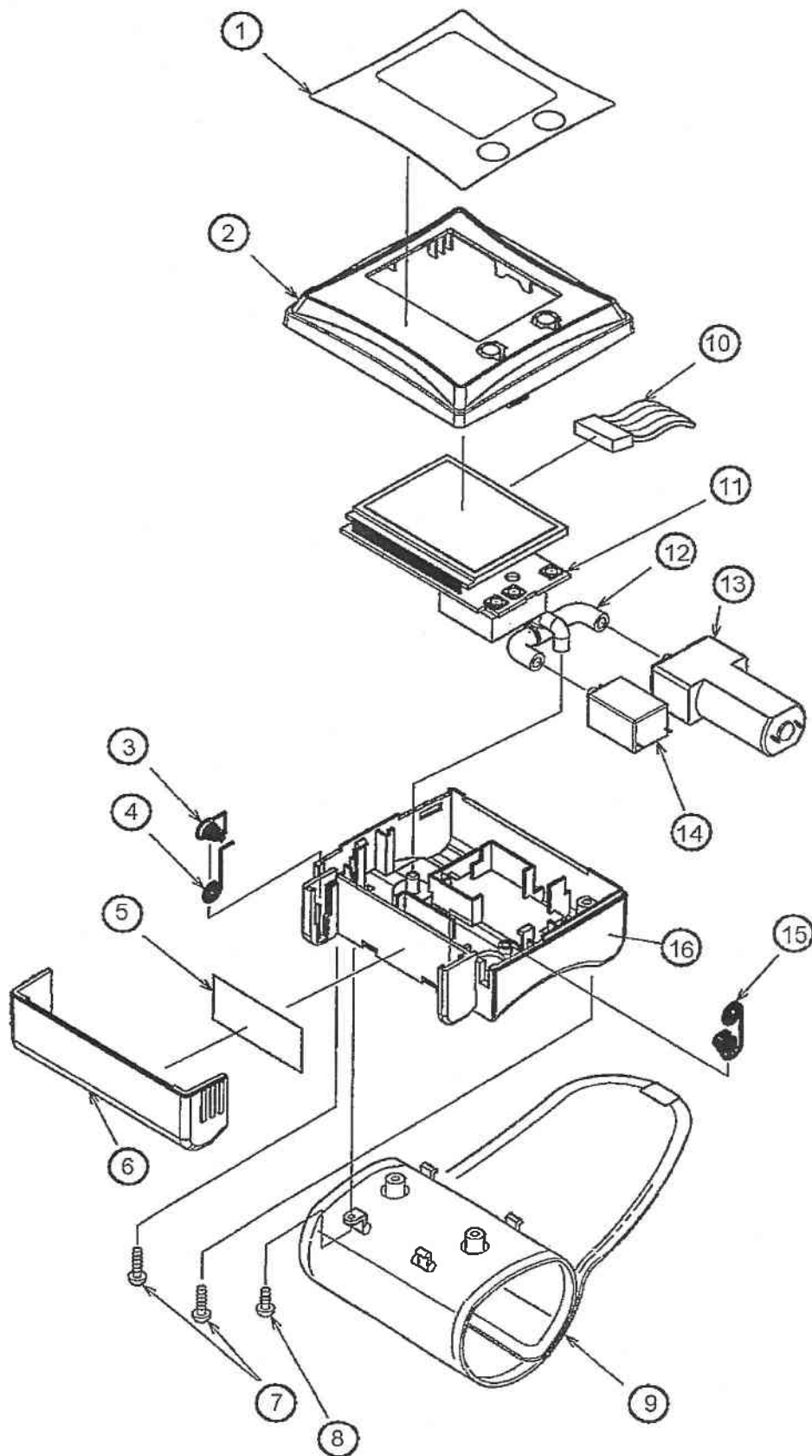


Test method

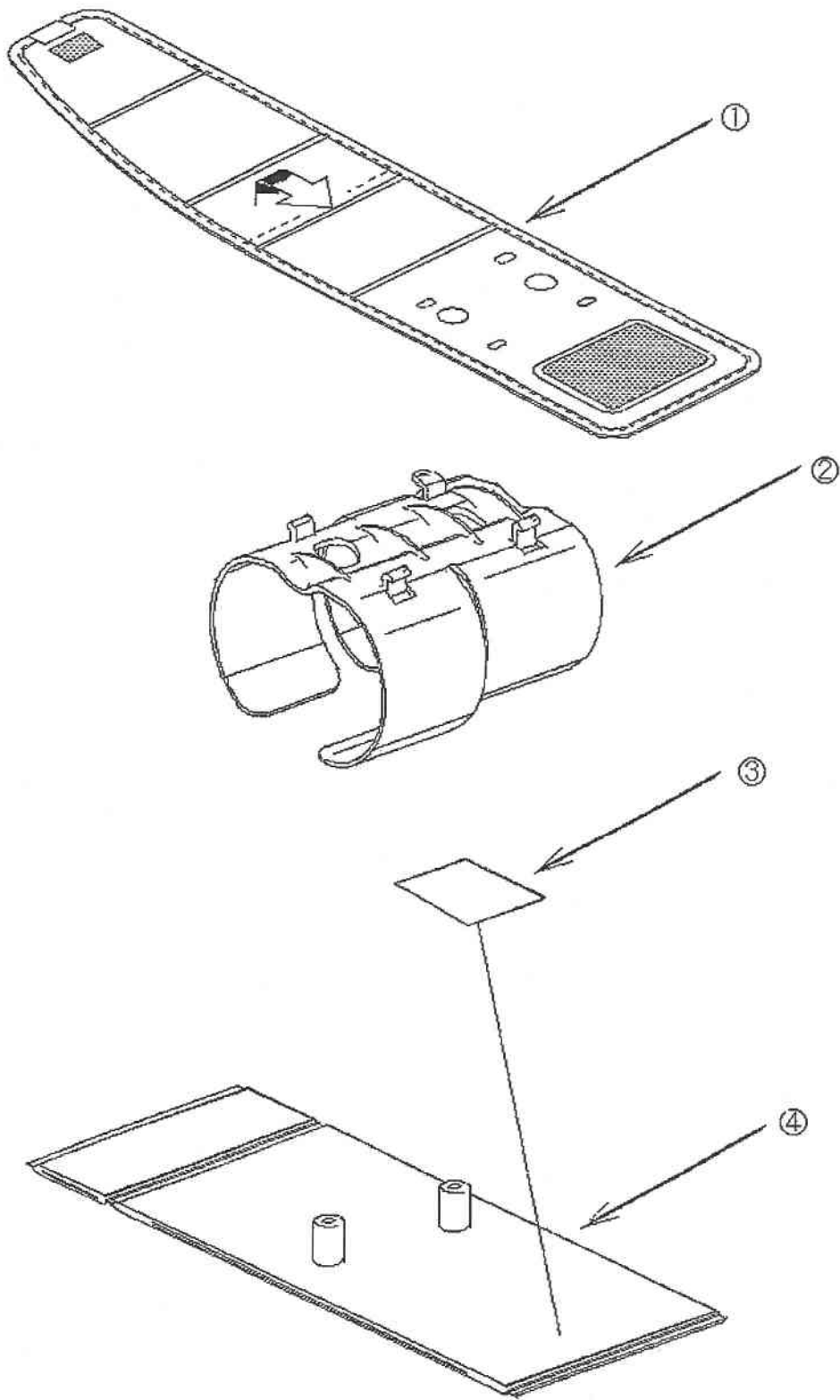
1. Open the inflation cylinder, then turn on the power supply.
2. Press the start switch and hold it until "0" starts to flash on the display. The unit goes to TEST MODE as two "0"s appear on the display.
3. Close the inflation cylinder, then turn the cylinder handle to inflate air until a reading of 50 mmHg on the standard manometer is obtained. At that time, the display of the unit should show "50 50" instead of the "0 0" mentioned Step 2 above. Both numbers "50 50" should not deviate too much 50 ± 3 at the most.
4. Do the check described in Step 3 above at 100,150,200,250, and 300 mmHg as well(± 3 mmHg).

10. EXPLODED VIEWS

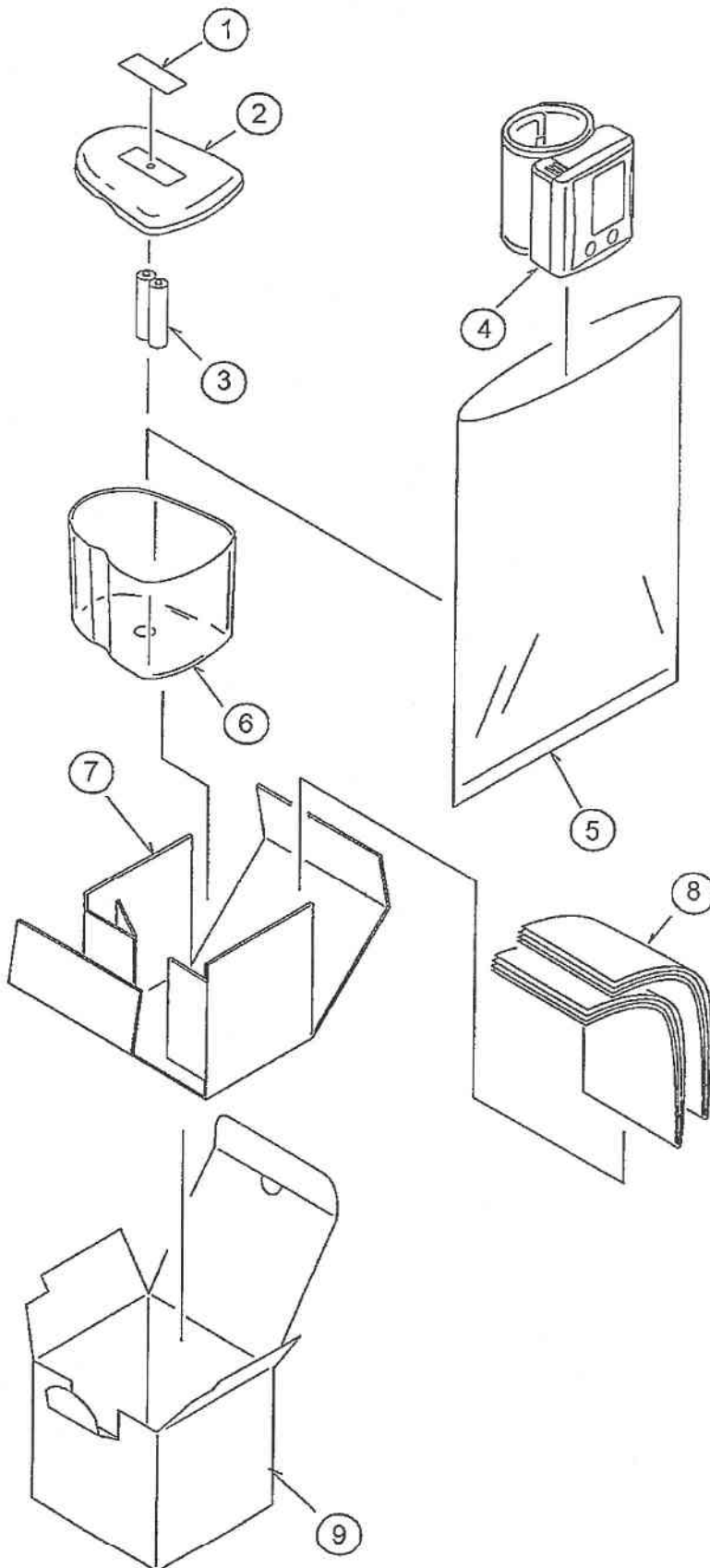
10-1. MAIN UNIT



10-2. CUFF UNIT



10-3. PACKING



11. PARTS LIST

MAIN UNIT

No.	Description	Part No.	Material technical date	Quantity /unit
1	Display Panel	B112391-1	PMMA	1
2	Upper Case	A112388-1	ABS	1
3	Battery Terminal -	A106382-1	Steel(Nickel Plating)	1
4	Battery Terminal +	A106381-1	Steel(Nickel Plating)	1
5	Battery Label	A108694-1	Paper	1
6	Battery Cover	A105929-4	ABS	1
7	Case Holding Screw	A100034-2008	Steel(Chromate treatment)	2
8	Cuff Holding Screw	A103015-2006	Steel(Chromate treatment)	1
9	Cuff Unit	A112761-1	-----	1
10	Connector Assembly	A208072-1	Nylon	1
11	PC Board Assembly	B251278-1	CEM3	1
12	Pre-formed tube	A106499-1	Latex	1
13	Air Pump (DP-131-01)	A112351-1	ABS+Steel	1
14	ECV(ECV-13-02)	A111573-1	PBT	1
15	Battery Terminal ±	A106383-1	Steel(Nickel Plating)	1
16	Bottom Case	A105928-4	ABS	1

CUFF UNIT

1	Cuff	A110671-1	PVC+Nylon	1
2	Cuff Spring	C110244-1	PP	1
3	Adhesive Tape	A103313-1020	Non woven cloth	1
4	Bladder	A110672-1	PVC	1

PACKING

1	Carry Label	A108603-1	Paper	1
2	Carry Cap	B102918-2	ABS	1
4	Main Unit	A112781-1	-----	1
5	Polyethylene Bag	A101702-10	PE-LD	1
6	Carry Box	B102920-1	PS	1
7	Spacer 620	A103261-1	Paper	1
8	Instructions (English)	A112760-1	Paper	1
8	Instructions (Spanish)	A113335-1	Paper	1
8	Gift Box	A112759-1	Paper	1
3	Battery "LR03"	A210248-1	-----	2

12. Trouble shooting

GENERAL PERFORMANCE

Each unit claimed to be defective should be rechecked to determine whether the problem is really due to a failure of the device. There are many cases where a customer returns the unit thinking it is defective when, in fact, it was simply handled improperly. Check the unit to determine if it is actually defective.

Note : that the accuracy of a blood pressure reading is affected by the following conditions.

1. Operating sequencePower switch must be turned on first of all.
2. Cuff wrapping adjustmentIf the cuff is too tight or too loose, inaccurate blood pressure readings may result.
3. wrist sizeApplicable circumference range is from;
125 to 215 mm. (Normal cuff)
4. Wrist movementMoving may give inaccurate readings, or no readings.
5. Wrist (Cuff) levelThe wrist must be at same level as the heart.
6. Low battery

CUSTOMER EDUCATIONS IF UNIT IS NOT OUT OF ORDER

If general performance of the unit is within the specifications, the reason for the return should be one of the following.

1. The readings did not agree with those from his or her doctor.
2. proper reading could not be obtained due to the special heart body characteristics peculiar to the particular user.

The following causes can be considered for item 1 above.

- Blood pressure varies according to changes in physical rhythm at different times of the day-morning, afternoon, evening, right after a meal, and / or any routine movement.
- State of mind(There are many people whose blood pressure increases in front of a doctor due to tension.)
- Ambient temperature (Blood pressure varies according to the season-summer, winter, etc.)
- Exercise and / or work

Detailed explanations to the customer should be provided for their better understanding of the variations in blood pressure readings and the theory of measurement.

The following causes can be considered for item 2 above.

- Abnormality in his or her circulation system(A skipped heartbeat or an irregular pulse will make a proper reading difficult.)
- Exceptionally low pulse level (A condition unique to that individual could cause a low pulse level.)

If a customer has something peculiar about his or her circulation system, it should be explained to him or her by their doctor. Most people with an irregular pulse will be able to read his or her blood pressure correctly after some training. However, the customer having such an abnormality should consult his or her doctor, if they have not already done so.

If a customer's pulse level is low, make another attempt to check their blood pressure. If a correct reading still cannot be obtained, he or she cannot use an electronic blood pressure monitor.

TROUBLE SHOOTING CHART

Symptom	Cause	Remedy
Cuff setting trouble	Broken cuff.	Replace the cuff.
Unit is inoperative	Batteries are too weak.	Replace batteries.
	Broken battery terminal or soldering.	Replace the bottom case assembly or resolder.
	Defective circuit.	Replace the circuit board.
No display	Poor parts soldering.	Resolder.
	Defective LCD or CPU.	Replace the circuit board.
Cannot inflate (pressure display does not increase.)	Defective pump.	Replace the pump.
	Defective tube.	Replace the tube.
	Defective bladder.	Replace the bladder.
	Defective pressure sensor or circuit.	Replace the circuit board.
Exhaust is too fast	Defective ECV.	Replace the circuit board and ECV.
	Bursting bladder.	Replace the bladder.
♥ does not flash	Circuit failure.	Replace the circuit board.
Systolic and diastolic is not measured	Circuit failure.	Replace the circuit board.
"Err" appears very often	Exhaust is too fast.	Replace the circuit board and ECV .
	(Bursting bladder.)	Replace the bladder.
	Circuit failure.	Replace the circuit board.
Inaccurate reading	Circuit failure.	Replace the circuit board.