TM-2421
TM-2021

INSTRUCTION MANUAL

Ambulatory blood pressure monitor

1440-3A-IE

A&D Company, Limited

CE 0366

TM2421C D0003
TM2021C K0003

Contents

Compliance

Compliance with FCC Rules

Please note that this equipment generates, uses and can radiate radio frequency energy. This equipment has been tested and has been found to comply with the limits of a Class A computing device pursuant to Subpart J of Part 15 of FCC rules. These rules are designed to provide reasonable protection against interference when equipment is operated in a commercial environment. If this unit is operated in a residential area it might cause some interference and under these circumstances the user would be required to take, at his own expense, whatever measures are necessary to eliminate the interference.
(FCC = Federal Communications Commission in the U.S.A.)

Compliance with European Directive 93/42 EEC for Medical Products

The device conforms to the following requirements: European Directive 93/42 EEC for Medical Products; Medical Products Act; European Standards for Electrical Medical Equipment EN 60601-1 (General Safety Provisions), EN 60601-2-30 (Particular Requirements for the Safety of Automatic Cycling Indirect Blood Pressure Monitoring Equipment) , EN 60601-1-2 and EN 55011 (Electromagnetic Compatibility); European Standards pertaining to Non Invasive Blood Pressure Instruments EN 1060-1 (General Requirements), EN 1060-3 (Supplementary Requirements for Electromechanical Blood Pressure Measuring Systems). The above is evidenced by the CE mark of conformity accompanied by the reference number of a designated authority. This device is designed for adults only.

Welcome!

Thank you for your Purchase!

The A&D TM-2421/2021 ambulatory blood pressure recorder enables you to accurately take a patient's blood pressure, automatically, at different preset times throughout a 24-hours period.
Recently, in the treatment of patients with hypertension, there has been an increasing need to prescribe medication according to the particular blood pressure fluctuation pattern of the patient. These patterns can be made more evident by using the TM-2421 recorder, and analysis by a physician. This manual will explain in simple language how this recorder works.

Patient

This blood pressure recorder is designed for an adult patient.

Environment

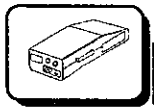
This blood pressure recorder is used in a hospital and / or patient`s home.

Features

- ❑ Measurement errors are few due to the combined use of the oscillometric method and Riva-Rocci Korotkoff method for blood pressure measurement.
- ❑ The lightweight compact TM-2421 recorder weighs a mere 390g.
- ❑ Up to four different measurement intervals can be set for a 24 hour period, in ten steps from OFF to 120 minutes within each division.
- ❑ Graphic and alphanumeric data output using a 58mm thermal printer.
- ❑ Ni-Cad cell provides for 300 measurements per charge.
- ❑ Quiet, high performance pump.
- ❑ Accurate measurement using a precise ceramic valve to control deflation speed.
- ❑ Activation buzzer can be switched off. The buzzer does not sound between the hours of 9 P.M. and 7 A.M.
- ❑ If measurement errors occur, the TM-2421 unit will automatically measure again five seconds later.
- ❑ Errors during measurement are indicated by code numbers.
- ❑ Any measurement interval can be set through an external computer and the RS-232C interface.
- ❑ Measurement results can be displayed or not as desired.
- ❑ The previous recorder (TM-2420) and processor (TM-2020) can also be connected to the processor (TM-2021) and recorder (TM-2421) respectively.

Out of the Box

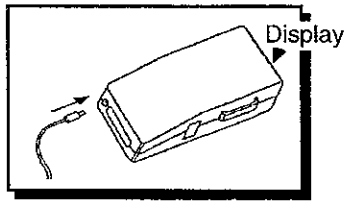
The TM-2421/2021 automatic ambulatory blood pressure monitoring system consists of the TM-2421 Recorder and the TM-2021 Processor which are purchased and shipped separately. This manual covers the operation of both units, and is included in both shipping cartons.



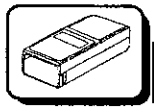
The TM-2421 Recorder

- If you have purchased a TM-2421 recorder, in the shipping carton you should find this manual, plus:
  - ❑ The 2421 Recorder unit.
  - ❑ Plastic Attaching Clip (to hold the TM-2421 on a belt, or attach it to the TM-2021).
  - ❑ Pressure Cuff.
  - ❑ An AC/DC adaptor (check that the AC input rating is correct).
  - ❑ Waist Holster - soft vinyl carrying case with strap.
  - ❑ Web belt (for use with Waist Holster or plastic clip).

Plug it In!



After you have unpacked your TM-2421 recording unit you will need to charge the unit before it can be tested. Please connect the AC adaptor to power and plug it into the TM-2421 unit - then continue to read this manual. Charging should take about 20~90 seconds. Please see page 12 if you have any questions on charging



The TM-2021 Processor

- If you have purchased a TM-2021 processor, in the shipping carton you should find this manual, plus:
  - ❑ The 2021 processor unit.
  - ❑ 5 rolls of paper for the processor's printer.
- If you have a charged TM-2421 recording unit ready, and are fully familiar with its operation, you can start using the unit immediately.

About this Manual

The following four pages give you most all of the information, in condensed form, you will need to know to operate your TM-2421 Recorder and the TM-2021 Processor. If you are unfamiliar with their operation, you may read these pages for an overview, then start on page 10, CUFF PLACEMENT, and read through the entire manual for detailed operational information. For everyone's safety, *please read all information carefully and be fully knowledgeable on these units before their use.*

Notes on General Use

Before Use

- ❑ Ensure the battery is charged, and all cords are properly connected.
- ❑ Using the TM-2421/TM-2021 together with other instruments could be dangerous and may lead to incorrect measurements.
- ❑ Make sure there are no inflammable substances in the area.

During Use

- ❑ Avoid spilling water on the unit. If the instrument gets wet, wipe it with dry cloth. Nothing should be placed on top of the unit. Do not hit or drop the unit.
- ❑ Ensure that the instrument is in proper working order and that the patient can be measured without harm.
- ❑ If abnormalities are present, discontinue use of the instrument.
- ❑ Make sure there are no inflammable substances in the area.
- ❑ The unit should be operated in environments with temperatures of between 10° ~ 40°C (50° ~104°F) and humidity of less than 85%.
- ❑ Avoid strong magnetic field and static electricity.
- ❑ Do not use this instrument with a defibrillator and a high frequency surgical equipment.

After Use

- ❑ If you not use instrument a long periode remove batteries.
- ❑ The unit should be stored away from heat, humidity, dust, salt and corrosive materials.
- ❑ The accessories and cord should be kept clean.
- ❑ If the arm cuff is folded too tightly or the rubber tube is folded for long periods, their service life may be shortened.
- ❑ Printer paper should be stored away from heat, direct sunlight, and humidity.
- ❑ Turn off the power switch after measurement.

Periodic Maintenance

- ❑ Periodically check the instrument and parts.
- ❑ The recorder is a precision instrument. Please check all functions (every year) periodically. Contact your nearest A&D office for this inspection.

Environmental Protection

- ❑ If you disuse the recorder, remove Ni-Cd battery from this recorder.
- ❑ Disuse Ni-Cd battery to its exclusive trash can because of recycling it.

Ni-Cd

Warning!

⚠ **Do not** modify the TM-2021 or TM-2421! The manufacturer will not be responsible for units that have been tampered with or changed in any way.

⚠ **Do not** replace batteries with commercially available NiCd batteries. Use only A&D batteries ordered from your dealer.

⚠ Data transmission can be interrupted by burst ploblems principally.

Steps for Proper Use

Charge the TM-2421 Recorder	Make sure that the TM-2421 recorder is charged before giving it to a patient.
Connect the TM-2421 Recorder to the 2021 Processor	Connect the TM-2421 recorder to the TM-2021 processor.
Erase the old TM-2421 Data	Hold the CLEAR/OFF key down for 5 seconds to clear old data.
Set the Conditions & Intervals	Make sure that all Conditions and Intervals are set correctly - print
Disconnect the TM-2421 Recorder	Disconnect the TM-2421 recorder from the TM-2021 processor.
Attach Cuff & Connect ot	Attach the cuff on the patient and connect it to the recorder.
Set the TM-2421 Recorder switch to	Slide the TM-2421 recorder AUTO OFF/ON switch left to AUTO
Do a Trial	Push the START/STOP switch and do a trial measurement. Correct any errors.
Recorder Performs Automatic	The TM-2421 recorder performs its automatic measurement as set.
Patient performs additional EVENT or MANUAL readings	The patient performs any EVENT or MANUAL measurements as
Connect the TM-2421 Recorder	After measurements are completed, connect the TM-2421 & TM-2021
Print Out the Measurement Data	Print data or send it to the optional computer program.

Settings in Table Form

SELECT The SELECT key moves through the numbered settings in the T, C, and P modes.

▲ ▼ The ▲ and ▼ keys are used to select the variables in the mode settings.

CLEAR OFF The CLEAR•OFF key moves out of the modes without saving, or clears the TM-2421 memory.

ENTER / START The ENTER/START key stores setting changes, or starts printing.

CONDITION SET Condition Settings See page 18

1	**Pressure and BP Results Displayed** Settings: **0** - not Displayed **1** - Displayed
2	**Buzzer for Cuff Inflation?** Settings: **0** - no Buzzer **1** - Buzzer
3	**TM-2421 Recorder I.D. Number** Settings: **1** thru **99**
4	**Year** Settings: **1990** thru **2029**
5	**Month** Settings: January = **1**, thru December = **12**
6	**Day** Settings: **1** st, thru the **31** st
7	**Hour** Settings: ***AM*1**, thru ***PM*1**
8	**Minutes** Settings: **00** thru **59**

INTERVAL SET Interval Settings See page 20

1	**1st Interval Start Time.** Input the time you wish 1st measurement interval to start.
2	**1st Interval Measurement Repeat** Select of 1,3,5,10,15,20,30,60 or 120 min. repeat.
3	**1st Interval Stop, or 2nd Start Time.** Input time 1st interval to stop or 2nd to start.
4	**2nd Interval Measurement Repeat** Select OFF,1,3,5,10,15,20,30,60 or 120 min.
5	**2nd Interval Stop, or 3rd Start Time.** Input time 2nd interval to stop or 3rd to start.
6	**3rd Interval Measurement Repeat** Select OFF,1,3,5,10,15,20,30,60 or 120 min.
7	**3rd Interval Stop, or 4th Start Time.** Input time 3rd interval to stop or 4th to start.
8	**4th Interval Measurement Repeat** Select OFF,1,3,5,10,15,20,30,60 or 120 min.
9	**4th Interval Stop Time.** Select the time for the 4th measurment interval to stop.

12 = 12 P.M.Noon
13 = 1 P.M.
14 = 2 P.M.
15 = 3 P.M.
16 = 4 P.M.
17 = 5 P.M.
18 = 6 P.M.
19 = 7 P.M.
20 = 8 P.M.
21 = 9 P.M.
00 = 12 A.M. Midnight
10 = 10 A.M.

PRINT Printing Settings See page 22

0	**Table:** Measurements by Korotkoff method simply printed in table form. (Oscillometric printout in the event of a measurement error)
1	**Graph:** Measurements by Korotkoff method plotted in graph form. (Oscillometric printout in the event of a measurement error)
2	**Table:** Measurements by Oscillometric method simply printed in table form. (Korotkoff printout in the event of measurement error)
3	**Graph:** Measurements by Oscillometric plotted in graph form. (Korotkoff printout in the event of measurement error)
4	**Table:** Measurements by Korotkoff method simply printed in table form.
5	**Graph:** Measurements by Korotkoff plotted in graph form.
6	**Table:** Measurements by Oscillometric method simply printed in table form.
7	**Graph:** Measurements by Oscillometric method plotted in graph form.
8	Consecutive printout of 0 thru 7.
9	**Conditions and Settings:** Printout of internal settings.

Symbols

|	Turning on the recorder.
○	Turning off the recorder.
⎓	Direct current.
~	Alternating current.
1998	Date of manufacture.
⚠	Attention symbol. "See instruction for use."
⧈	Class II equipment.
	Type BF applied part.
CE 0366	CE marking.
S N	Serial number.

Cuff Placement

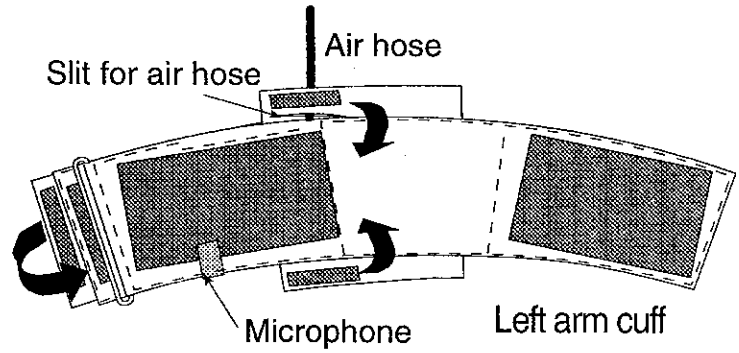
The cuff provided is for use on the left arm of an adult (recommended arm circumference of 8"~ 12.4".
This device uses the oscillometric and Korotkoff sound (K sound) detection methods. Note that failure to correctly wrap the cuff or position the microphones may result in Korotkoff method measurement errors.
The cuff contains two microphones: a" K sound microphone" for the Korotkoff method (location indicated by a yellow mark), and a" noise detection microphone."

CAUTION

- ❑ Do not press the air hose (do not block the air) to keep safty measurement.
- ❑ Stop the use, if the patient feels pain in his arm (or his circulation of blood is damaged). It needs to get doctor counsel.
- ❑ Check this cuff placement and the instrument by the doctor.
- ❑ Do not peel the rubber case of the microphone.

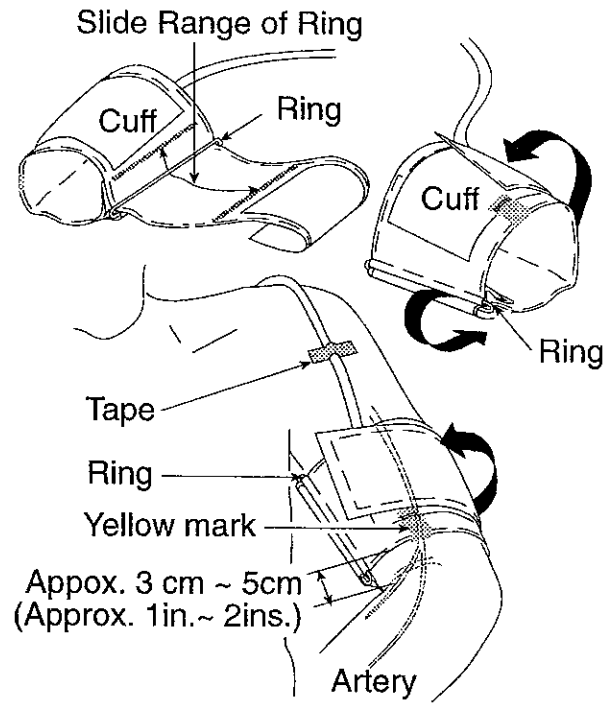
1 Good readings start with good placement of the cuff microphones on the patient's arm.

❑ Start by taking the pressure cuff and laying it as shown.



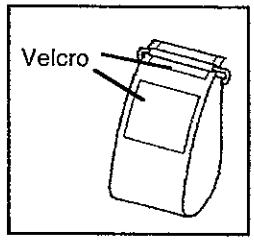
2 Attach the cuff on the skin so that the yellow mark is directly over the brachialis artery.

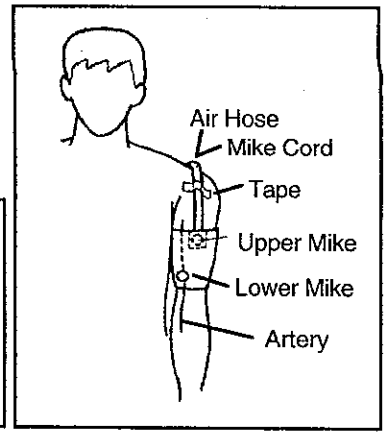
Space approx. 3 cm between the inside of elbow and the lower edge of the cuff.

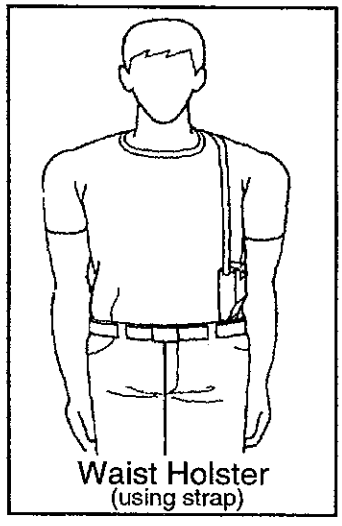


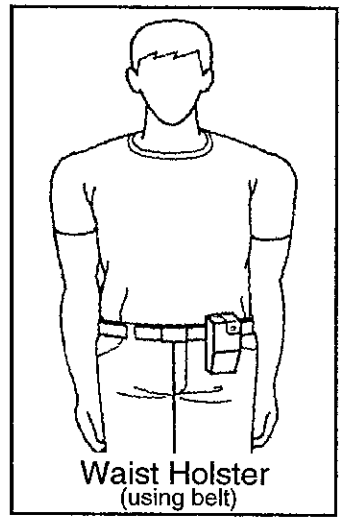
3 Positieon the cuff as shown and tighten comfortable firmly, but still allowing a finger to slide between cuff and arm.

- ❑ Lay the Air Hose and Mike Cord up to the shoulder and tap as shown.







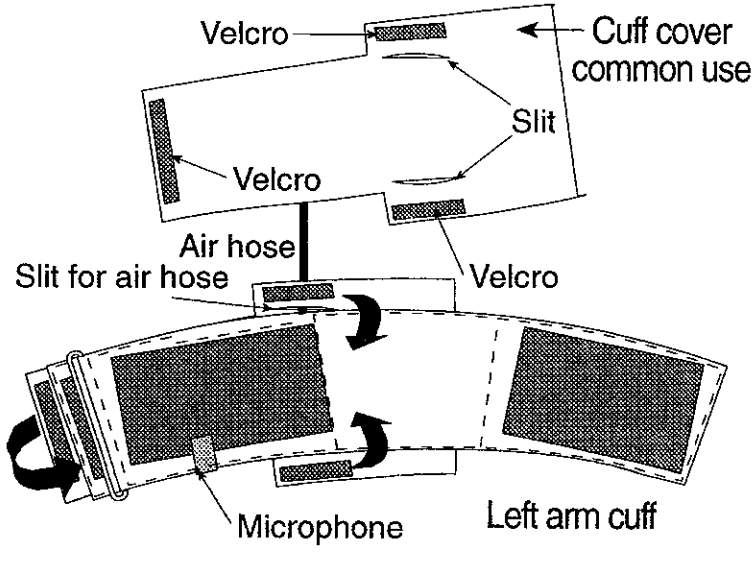


Cuff Cover Placement

- ❑ Using of Cuff-Cover

1 Pass the air hose through the slit.

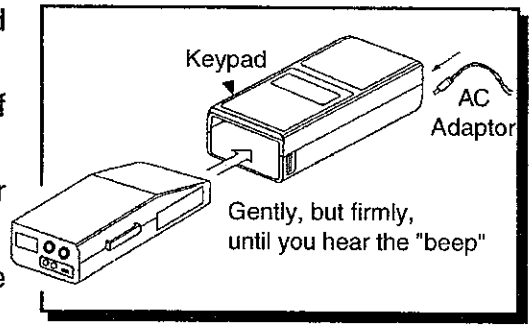
2 Place the cover on the cuff as shown. Link them using the three velcro strips.



Connections

Connecting the TM-2421 & TM-2021

- ❑ Hold the processor with its display up and the recorder with its display to the front.
- ❑ Fully insert the recorder into the bottom of the processor.
- ❑ The buzzer will sound, and the processor display will be in the clock mode.
- ❑ Connect the TM-2421 AC Adaptor to the TM-2021 Processor if needed.



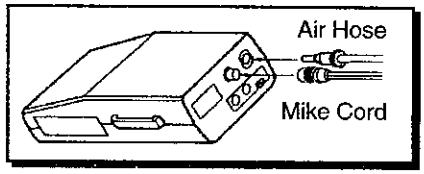
- ❑ If there's no tone and the display does not come ON, disconnect the recorder unit from the processor unit and insert it into the processor again.
- ❑ While the TM-2421 and the TM-2021 are connected, the TM-2421 will only work in the MANUAL B.P. MEASUREMENT mode (see p. 15).

⚠ **Do not** connect the TM-2021 processor to the TM-2421 recorder while a measurement is in progress.

⚠ **Do not** connect other product to the terminal of connecting the TM-2421 and the TM-2021

Connecting the Cuff to the TM-2421

- ❑ Screw the Air Hose connector into its appropriate hole.
- ❑ Connect the microphone connector from the cuff. Align the ▲ mark with microphone position on the main unit.
- ❑ Use a original cuff of accessory or option.



Connecting to the AC Adaptor

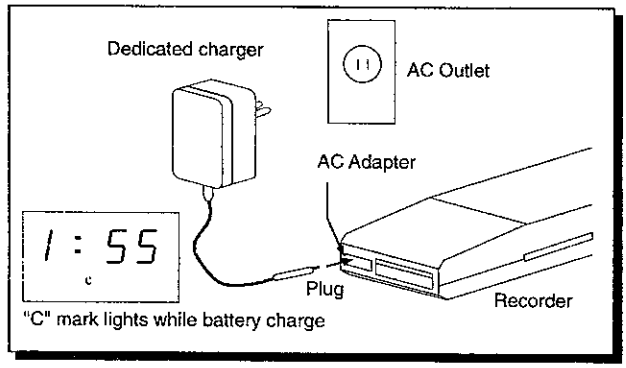
▶ **TM-2421 Recorder:** Battery charging

In following cases, charge the battery.

Before lending the unit to person to be examined.

"⊱" mark is being displayed.

❑ Disconnect the recorder from the processor.



❑ Connect the charger to mains outlet, then connect the charger's plug to AC ADAPTER of the recorder

❑ Several seconds after, beeper will sound and "C" mark will display on the recorder.

If the "C" mark does not light, reconnect the charger's plug.

❑ After battery charge is completed, the "C" mark goes off. The charge time is approximately 20 to 80 minutes. (The time depends on remaind capacity)

⚠ The measurement cannot be performed while battery charge. (Charger's plug is being connected to the recorder.)

When automatic measurement switch is "ON" while battery charge, the time display shows "OFF" until next measurement.

When the charge is completed, recharging cannot be made about 30 minutes even connect the charger.

The charge will stop for safety purpose when charge time exceeds 90 minutes.

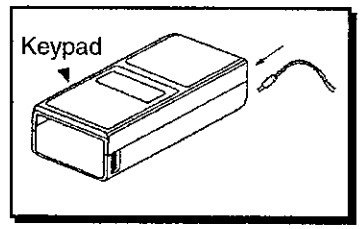
Set a timer and so on when the unit is used first time or the unit left for long periods of time without applying power.

After charge is completed, the recorder may become warmer.

❑ Use original AC adaptor only.

▶ The **TM-2021 Processor** can operate on the charge from the TM-2421 Recorder, or you can connect the TM-2421 Recorder's AC adaptor to power and plug it into the TM-2021 Processor.

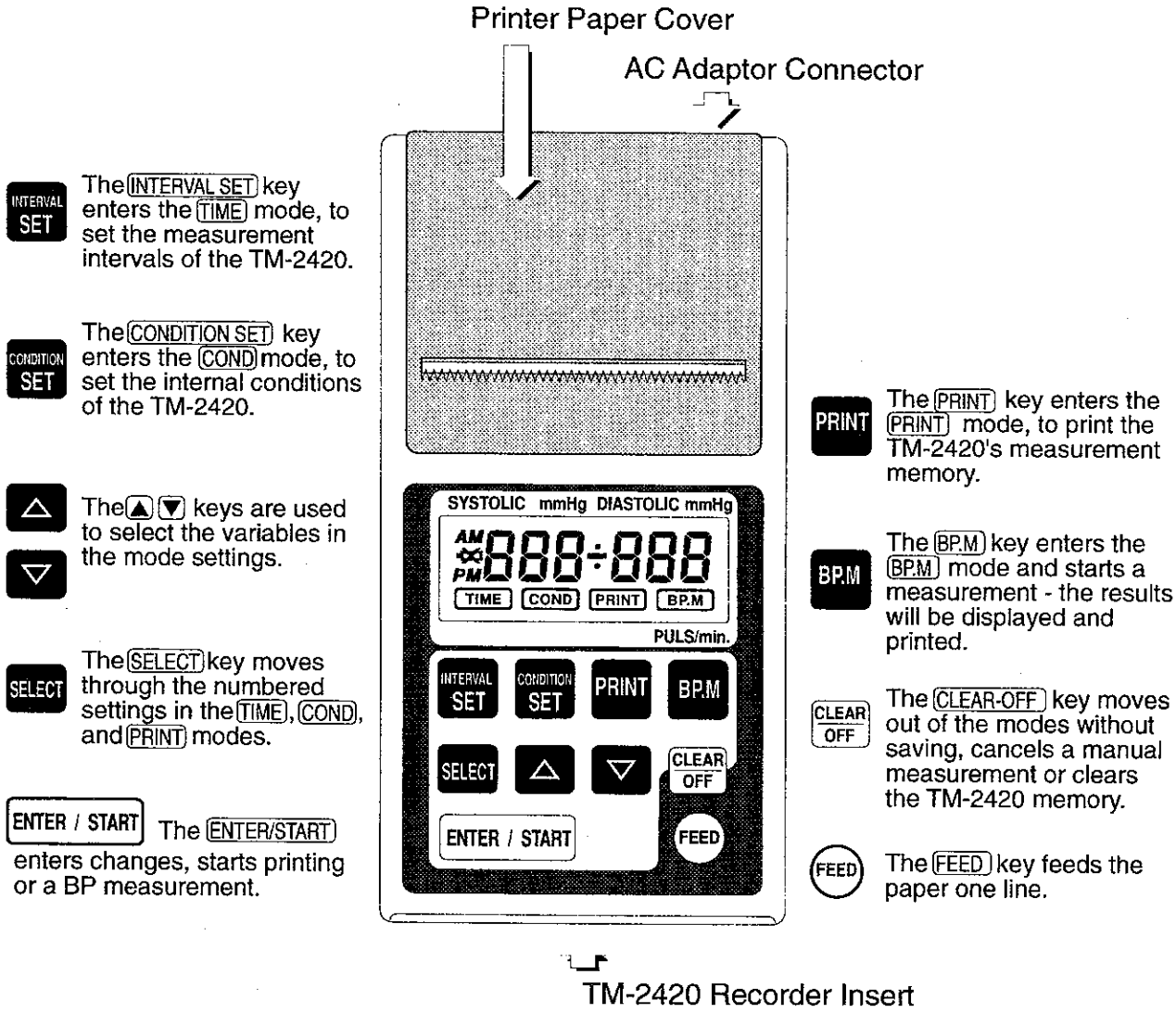
❑ The TM-2021 Processor is inoperative without the TM-2421 Recorder.



TM-2021 Processor Overview

- ❑ The TM-2021 cannot be used independently of the TM-2421 because the TM-2021 is supplied the power form the TM-2421. Connect the TM-2421 Recorder to use .
- ❑ The TM-2021 processor is used:
  1) To set the measurement parameters such as clock setting, interval settings, condition setting and so on.
  2) For the processing and printing of data collected from the TM-2421 recorder.
- ❑ If the low battery figure is seen on the TM-2021 display, remove TM-2021 and TM-2421, then charge the TM-2421.
- ❑ With the optional RS-232C interface, the unit can output measurement data to select computers.

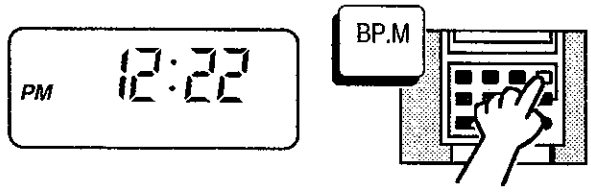
⚠ The power source of TM-2021 is applied from the recorder, TM-2421. When the processor and the recorder are connected each other, battery consumption becomes faster for several hours. In such case, connect the charger to ⎓ ADAPTER on the processor for recorder's power consumption smaller.



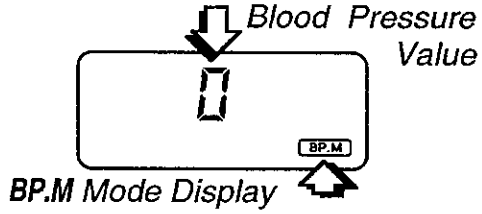
Manual B.P. Measurement

When the TM-2021 Processor is connected to the TM-2421 Recorder, B.P. measurements may be started manually, and the results printed and displayed on the TM-2021 processor.

1



To use the connected TM-2421 & TM-2021 for manual B.P. measurement, connect the placed cuff to the TM-2421. From the clock mode, press the BP.M key.

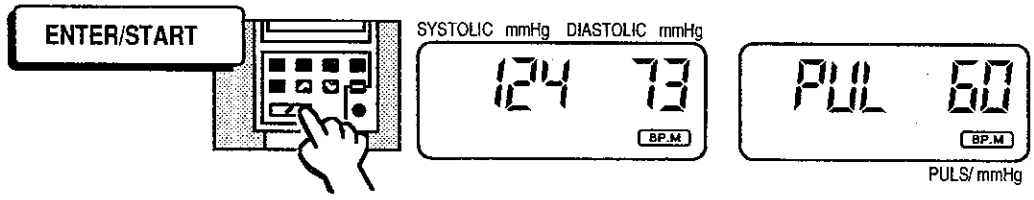


- The Blood Pressure Value indicator is displayed in the center of the display and the BP.M indicator is shown on the lower part of the display.

2

- Make sure that there is no excess environmental noise, the patient is resting comfortably, and his/her arm is relaxed.

  Press the ENTER/START key. The buzzer sounds, measurement starts.

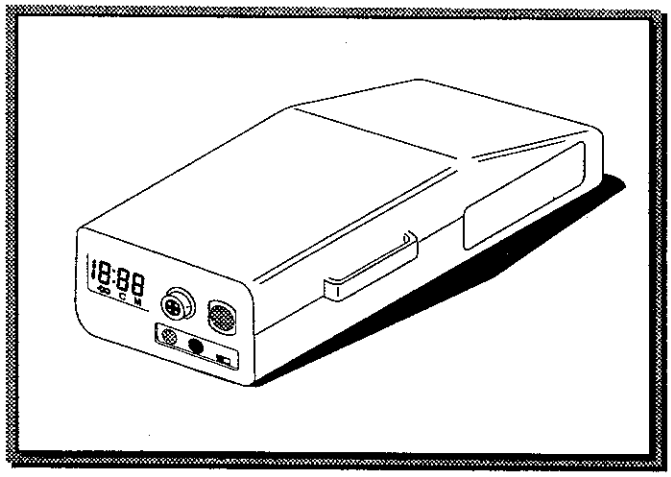


- To stop the measurement press the CLEAR•OFF key ("E 7" displayed).
- After measurement is completed, every two seconds the display will alternate between the systolic & diastolic values, and the pulse rate.
- The measurements results are usually values by Oscillometric method. (If the Oscillometric measurement can't be taken, the measurements result by Korotkoff are displayed instead.)
- The year, month, day, and ID of the first measurement results taken in the blood pressure measurement mode will be printed. Subsequent measurements will be sequentially numbered.

Notes

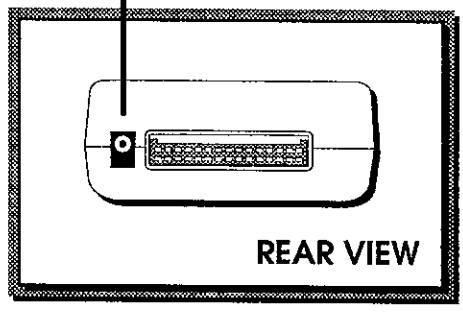
- The clock display will return if the CLEAR•OFF key is pressed at any time, such as during measurement or when the results are displayed.
- If the e or CLEAR•OFF keys are not pressed for two minutes, and the clock display will return.

TM-2421 Recorder Overview



AC Adaptor

- ❑ To recharge the TM-2421 Recorder.
- Remember that the TM-2421 Recorder will not work while the AC Adaptor is connected to it.



REAR VIEW

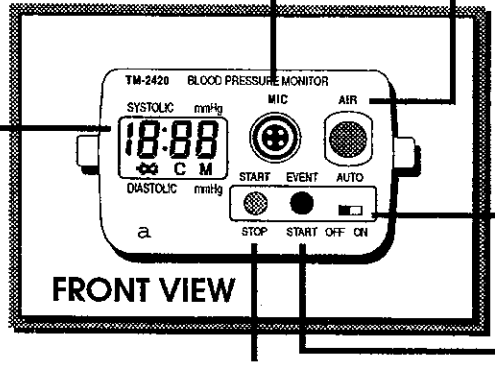
AIR - Air Hose Coupler

- ❑ This is a screw type connection to the Cuff Air Hose. Keep foreign objects out of the Air Hose Coupler.

MIC - Microphone Socket

- ❑ Couple the Cuff Mike Cord connector to the Microphone by gently turning until they click and connect.

See next page for display info.



FRONT VIEW

AUTO OFF/ON Slide Switch

- ❑ Sliding this switch OFF⇒ will discontinue measurement until turned ON again, and the clock will be displayed. For use when changing clothes, or other inconvenient times. Slide this switch ON⇐ to continue the next automatic measurement.
- ❑ When "OFF" is displayed, it could mean: 1) There are no measurements set for present measurement interval, or 2) There are no remaining automatic measurements.

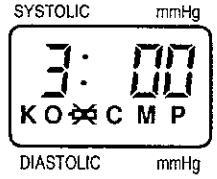
STOP/START Push Switch

- ❑ Pushing the switch as a Stop will cancel any measurement.
- ❑ Pushing this switch as a Start will begin a Manual reading (a "beep" is heard first). It can be used to reStart an interrupted measurement, or to obtain a reading between the automatic intervals. No special note is made in the printout to identify a Manual reading.

EVENT START Push Switch

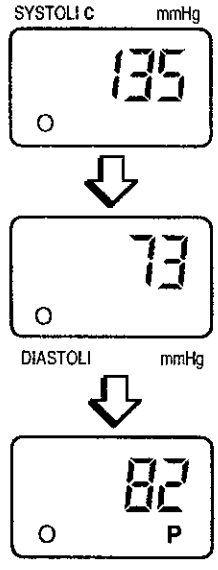
- ❑ This switch is used to take measurements at times other than those set on the timer, such as: a nap, waking up, after medication or meals. The Event indication mark "*" will be printed on printouts when using the Event Start switch.
- ❑ Pushing this switch will start the cuff pressurizing, and a "beep" will be heard. Pushing the Stop/Start switch will cancel the measurement.

LCD Display

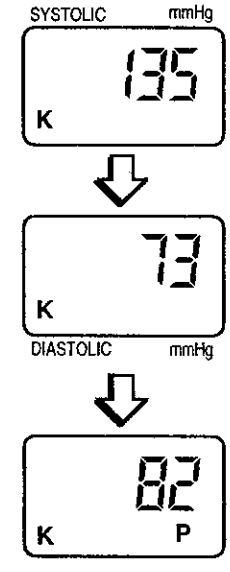


- ❑ "🔋" "This is a low battery symbol. Please recharge the TM-2421 unit when it is lit.
- ❑ "**C**" is displayed during recharging. It will disappear when charging is complete.
- ❑ When "**M**" is displayed, it means that all available memory has been taken (896 readings). No further measurements can be carried out in AUTO mode.
- ❑ In the AUTO switch ON setting, the present time and the remainder time will be alternately displayed.
- ❑ In the AUTO switch OFF setting, then the display on the TM-2421 recorder is in the clock mode.
- ❑ If it is set to display blood pressure measurement results, the results will be displayed for approximately 30 seconds after a reading - alternating between Oscillometric method indication and Korotkoff method indication.
- ❑ When "O" is displayed, it means that the measuring method is Oscillometric.
- ❑ When "K" is displayed, it means that the measuring method is Korotkoff.
- ❑ When "P" is displayed, it means pulse rate.

Oscillometric method indication



Korotkoff method indication



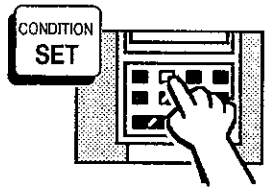
Clearing the TM-2421 Recorder Memory

- ❑ This procedure clears the TM-2421 Recorder's memory of stored B.P. *measurement* data. It does not erase the CONDITION or INTERVAL settings, their information must be changed through their respective mode settings.
- ❑ Press the CLEAR•OFF key for approximately five seconds in the clock display mode to completely clear the memory in the recorder.
- ❑ When the buzzer stops sounding, the stored measurement data has been erased.

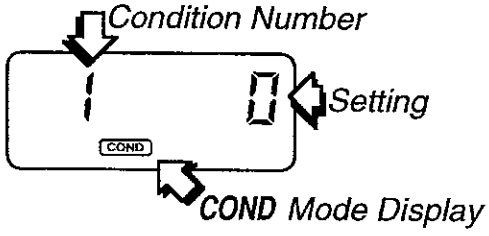
Setting the Conditions

Through the TM-2021 processor, you set the conditions for the TM-2421 recorder to operate. Before setting the conditions, please connect the TM-2021 processor to the TM-2421.

step 1



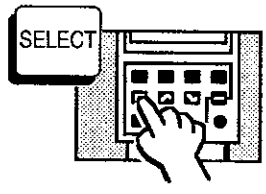
To set the conditions: from the clock display, press the CONDITION SET key.



- At the left, the Condition Number will be shown. In the middle, the C mode display (shown as long as you are in the condition mode), and the present condition setting will be displayed on the right.

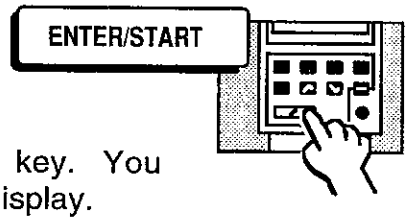
step 2

- To raise or lower the setting, press the ▲ and ▼ keys.
- Use the SELECT key to move to the next setting.

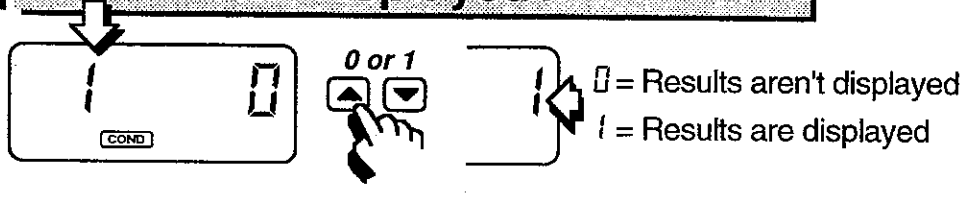


step 3

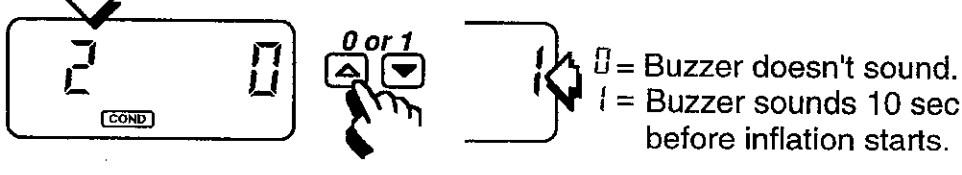
When the conditions have been changed to their correct settings, press the ENTER/START key. You will return to the time display.



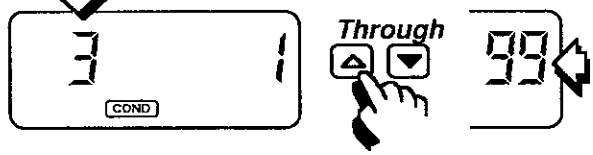
BP Results Displayed?



Buzzer for Cuff Inflation?

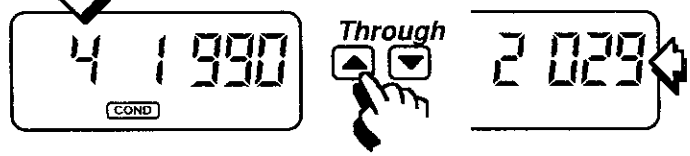


TM-2421 Recorder I.D. Number



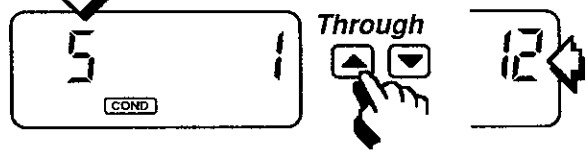
The TM-2421 recorder can have an I.D. number from 1 through 99.

Year



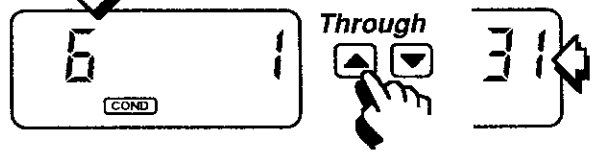
Years from 1990 through 2029.

Month



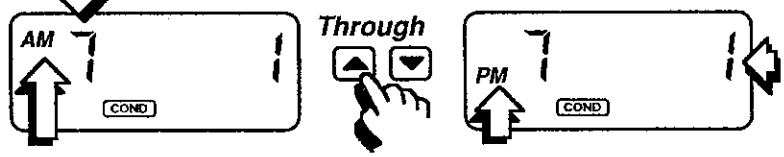
Months January = 1, through December = 12.

Day



Days from the 1st, through the 31st.

Hour



Hours from 1A.M to 1A.M.

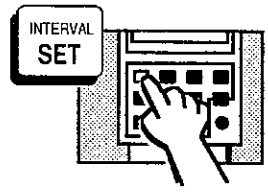
Minutes

Minutes: 00 through 59

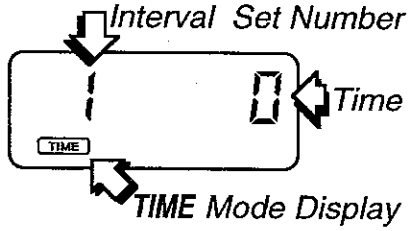
Setting the Measurement Interval

Through the TM-2021 processor, you set the measurement intervals for the TM-2421 recorder to operate. There are four intervals which can be set. Before setting the intervals, please connect the TM-2021 processor to the TM-2421.

step 1



To set Measurement Intervals: from the clock display, press the INTERVAL key.

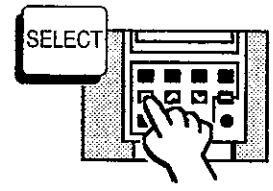


- The first number in the Interval Set, *1* (FIRST INTERVAL START TIME), will appear on the left. In the middle, the T mode display will be shown as long as you are in the Interval Set mode, and the present start time setting will be displayed on the right.

step 2

Set the Start Time

- Set the 1ST INTERVAL START TIME, by using the < and > keys to move through the hours (0→23) until the one desired is displayed.
- Use the s key to move to the next setting.



step 3

Time between Measurements?

- Use the ▲ and ▼ keys to select OFF, 1, 3, 5, 10, 15, 20, 30, 60 or 120 minutes for the 1ST INTERVAL MEASUREMENT REPEAT.
- Use the SELECT key to move to the next setting.

step 4

Set the Stop Time

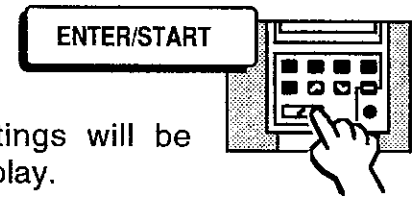
- Set the 1ST INTERVAL STOP TIME, by using the ▲ and ▼ keys to move through the hours (0→23) until the one desired is displayed. Make sure that the stop time is after the start time or you will go into a 24 hour mode.

5 step 5 Set More Intervals or ENTER

- ❑ If you wish to set more intervals, the stop time of the first interval is also the start of the second. Use the table below for INTERVAL SET number definitions, and follow the same procedure as earlier (The hour select setting will automatically come up with one hour added the previous setting - to aid hour selection).
- ❑ If you do not want continuous readings, just turn the time between measurements to OFF during the time period you do not want readings.

  For example: If you want readings from 3P.M. to 4P.M., and then from 6P.M. to 7P.M., but not between - you would set Interval 2 (4P.M. to 6P.M.) measurement repeat to OFF.

- ❑ If only one measurement interval is required, or you have finished interval setting, then:



- ❑ Press the [ENTER/START] key. The settings will be saved, and you will return to the time display.
- ❑ This is a good time to check the INTERVAL SETTINGS and CONDITIONS by getting a printout. Please see the TM-2021 PRINTING section for more information (Press the [PRINT] key, the [SELECT] key 9 times, and the [ENTER/START] key).

---

6 step 6 Ready to Use

- ❑ If the CONDITIONS have also been set and the recorder is fully charged, then: 1) Detach the TM-2421 recorder, 2) Slide the recorder's **AUTO OFF/ON** switch to ON, 3) Connect to an attached cuff, and 4) Do a test measurement using the **START/STOP** key.

1	**1st Interval Start Time.** Input the time you wish 1st measurement interval to start.
2	**1st Interval Measurement Repeat** Select OFF,1,3,5,10,15,20,30 60 or 120 min. repeat.
3	**1st Interval Stop, or 2nd Start Time.** Input time 1st interval to stop or 2nd to start.

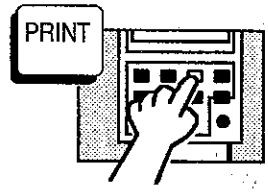
12	= 12 P.M. Noon	**18**	= 6 P.M.
13	= 1 P.M.	**19**	= 7 P.M.
14	= 2 P.M.	**20**	= 8 P.M.
15	= 3 P.M.	**21**	= 9 P.M.
16	= 4 P.M.	**00**	= 12 A.M. Midnight
17	= 5 P.M.	**10**	= 10 A.M.

4	**2nd Interval Measurement Repeat** Select OFF,1,3,5,10,15,20,30,60 or 120 min.
5	**2nd Interval Stop, or 3rd Start Time.** Input time 2nd interval to stop or 3rd to start.
6	**3rd Interval Measurement Repeat** Select OFF,1,3,5,10,15,20,30,60 or 120 min.
7	**3rd Interval Stop, or 4th Start Time.** Input time 3rd interval to stop or 4th to start.
8	**4th Interval Measurement Repeat** Select OFF,1,3,5,10,15,20,30,60 or 120 min.
9	**4th Interval Stop Time.** Select the time for the 4th measurment interval to stop.

TM-2021 Printing

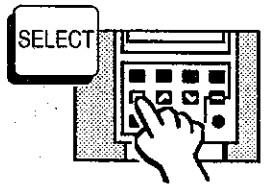
Through the TM-2021 processor, you set the conditions for the TM-2421 recorder to operate. Before setting the conditions, please connect the TM-2021 processor to the TM-2421.

1 step 1

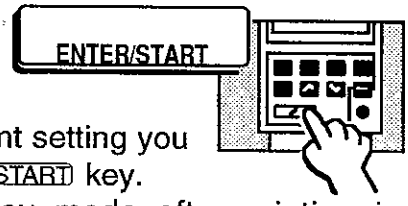


To enter the print mode, press the PRINT key.

2 step 2



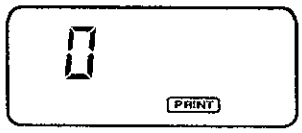
- Use the ENTER/START key to move through the print settings.
- When you have the print setting you want, press the ENTER/START key.



- The unit will return to the clock display mode after printing is completed and when: the CLEAR•OFF key is pressed (until the buzzer sounds), there is no data is in the recorder.

Table form (Sequence Numbers 0,2,4,6)

- In a table printout all the measured data is printed. The TM-2021 prints the date, patient ID number, the pressure measurement number, the time of that measurement, the systolic pressure, the diastolic pressure, the patient's pulse, any applicable error codes for that measurement, and an asterisk if that measurement was initiated by the patient pressing the Event Start Switch.
  At the same time, statistical values processed in the set time slot of the measurement interval and statistical values processed from all data are printed. In the case of data for which an error code (See page30. "Error Displays") between 20 and 24 is generated, however, only printout is performed and statistical or graphic printout doesn't contain the error data.
- The measurement interval time slot should be reset before printing out when the statistical processing time slot is to be changed.
  In this case, any interval times are permissible, but caution is required when taking the next interval measurement.
- When interpolated printout is performed with sequence numbers 0 or 2, an interpolation mark is attached to the data.



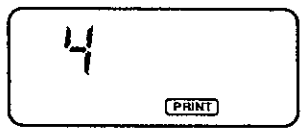
Sequence Number 0:

Printout TM-2421 recorder measurement data by Korotkoff method in table form. (Oscillometric printout in the event of a measurement error)

Sequence Number 2:

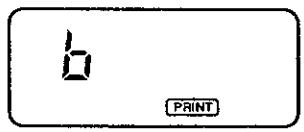
Printout TM-2421 recorder measurement data by Oscillometric method in table form.

(Korotkoff printout in the event of a measurement error)



Sequence Number 4:

Printout TM-2421 recorder measurement data by Korotkoff method in table form.



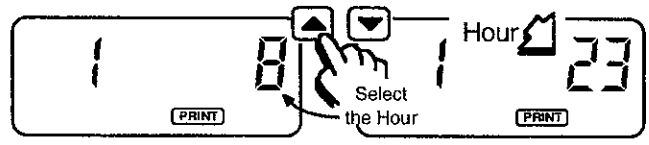
Sequence Number 6:

Printout TM-2421 recorder measurement data by Oscillometric method in table form.

Graphic form (Sequence Numbers 1,3,5,7)

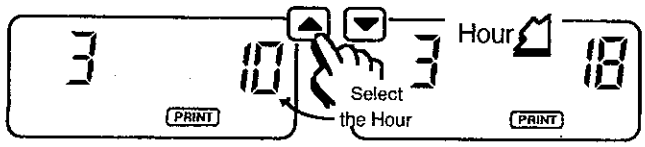
- Measurement data is printed in 24-hour units in graph form.
- The time at which printing is started is the time set first in the measurement interval setting.

  When the printout time is to be changed, refer to the next page on print start setting.
- In graphic printout, graphic data is printed in every 15 minutes. That is, one hour is divided into 4 blocks: 0 to 14 minutes, 15 to 29 minutes, 30 to 44 minutes, and 45 to 59 minutes, and if there is more than one graphic data in each block the first data in each block is printed.
  When EVENT measurement is performed, that data is printed.
- When interpolated printout is performed with sequence numbers 1 or 3, the data is plotted using a dotted line.



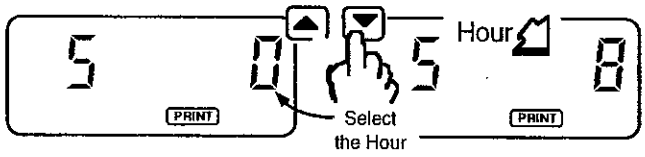
Sequence Number 1:

Printout TM-2421 recorder measurement data by Korotkoff method in graph form after you have selected the desired beginning time (24 hour). (Oscillometric printout in the event of a measurement error)



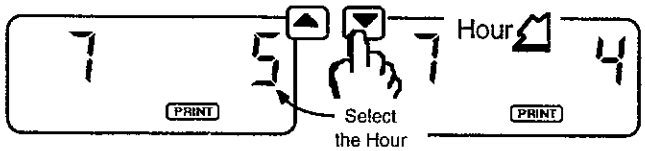
Sequence Number 3:

Printout TM-2421 recorder measurement data by Oscillometric method in graph form after you have selected the desired beginning time (24 hour). (Korotkoff printout in the event of a measurement error)



Sequence Number 5:

Printout TM-2421 recorder measurement data by Korotkoff method in graph form after you have selected desired beginning time (24 hour).



Sequence Number 7:

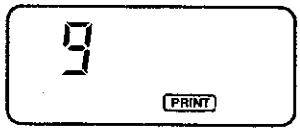
Printout T-M2421 recorder measurement data by Oscillometric method in graph form after you have selected desired beginning time.

Table & Graphic Printout (Sequence Number 8)

Sequence Number 8:

The contents of sequence numbers 0 to 7 are printed consecutively.

Printout of internal settings (Sequence Number 9)



Sequence Number 9:

Printout the present CONDITIONS and INTERVAL SETTINGS entered into the TM-2421 recorder

Notes

- In the "PRINT TABLE" mode, the unit will print measurement time, ID, blood pressure and other measurement conditions line by line for each measurement it has stored in its memory.
- The EVENT indication mark * will be printed when measurement has been taken using the EVENT switch on the TM-2421 recorder.
- An "**M**" will be printed in the place of the event indication when the recorder's memory is full. In this case, automatic measurement cannot be done without erasing the oldest memory. However continuous measurement is possible.

Print Examples (Korotkoff method)

(Actual Size)

❑ Sequence Number 0

Korotkoff Table Form

(an error reading will not be printed if remeasurement is successful)

```
5/ 9'91  ID.  1  K-S(OSC)
              mmHg  /min
  TIME   SYS DIA PUL ERR EV
1 13:00  148 104  75
2 13:15  142  97  72
3 13:30  138  88  71
4 13:45  139  98  74
5 14:00  134 111  78
6 14:15  135  81  84
7 14:30  131  98  75
8 14:45  138  95  90
9 15:00  141  92  81
10 15:15 142 102  84
11 15:30 136 104  76
12 15:45 148 111  73
13 16:00 173 113  76
14 16:15 154 112  83
15 16:30 156 107  78
16 16:45 150  95  76
17 17:00 137 102  77
18 17:01 140 103  66
19 17:15 138 110  65
20 17:30 137 104  67
21 17:45 143 102  68
22 18:00 152 109  67
23 18:15 146  85  86
24 18:30 148  96  77
25 18:45 148 106  61
26 19:00 144  99  62
27 19:15 151 112  65
28 19:30 143 115  64
29 19:45 144 107  62
30 20:00 145 117  65
31 20:15 143 115  65
32 20:30 152 118  72
33 20:45 163  95  76
34 21:00   .   .   .   7

INTERVAL 1     13 TO 13 HOUR
  SYS  AVE= 128  S.D.= 20.6
  DIA  AVE=  88  S.D.= 18.4
  PUL  AVE=  68  S.D.= 14.0

TOTAL
  SYS  AVE= 128  S.D.= 20.6
  DIA  AVE=  88  S.D.= 18.4
  PUL  AVE=  68  S.D.= 14.0
```

Interpolation Mark (Oscillometric)

0

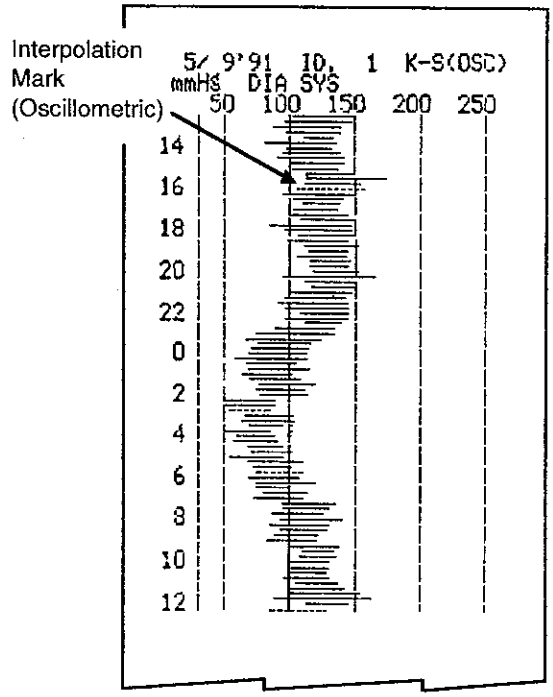
※

Event Mark

Error Code

❑ Sequence Number 1

Korotkoff Graph Form



○ One set of measurement data from every 15 minute period is printed as a single graph line.

❑ Sequence Number 9

Conditions & Interval Settings

See SETTING THE CONDITIONS & SETTING THE MEASUREMENT INTERVAL Sections

```
5/ 9'91  ID.  1
START  STOP    INT
  13---→13      15

DISPLAY         ON
BEEP            ON
```

Print Examples (Oscillometric method)

(Actual Size)

❑ Sequence Number 2

Oscillometric Table Form

(an error reading will not be printed if remeasurement is successful)

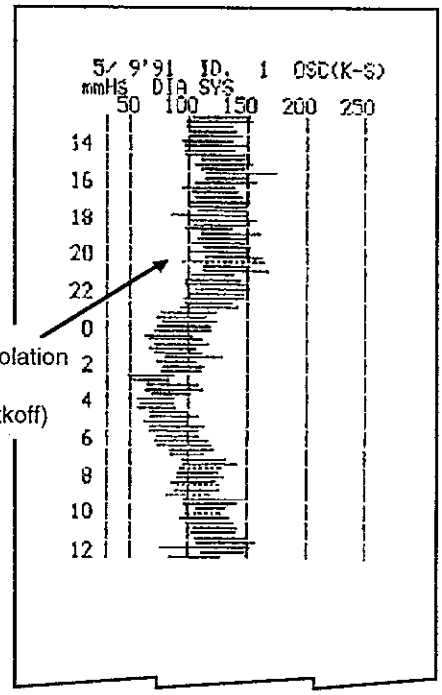
```
5/ 9'91  ID.  1  OSC(K-S)
                mmHg  /min
  TIME  SYS DIA PUL ERR EV
 1 13:00 152 103  78
 2 13:15 154  99  74
 3 13:30 136  99  73
 4 13:45 140 101  74
 5 14:00 145 102  78
 6 14:15 136  95  74
 7 14:30 150  97  78
 8 14:45 139  97  90
 9 15:00 146  98  83
10 15:15 147 112  83
11 15:30 153 106  78
12 15:45 147 111  74
13 16:00 174 115  76
14 16:15 148 115  85
15 16:30 156 107  78
16 16:45 138  95  78
17 17:00 149 102  78
18 17:01 141 103  66   *
19 17:15 145 106  66
20 17:30 152 102  68
21 17:45 150 102  71
22 18:00 150 100  68
23 18:15 149  86  48
24 18:30 157 101  68
25 18:45 151 105  60
26 19:00 136  99  64
27 19:15 160 111  65
28 19:30 150 108  66
29 19:45 146 103  64
30 20:00 152 113  66
31 20:15 149 102  66
32 20:30 161 115  73
33 20:45 163  95  76   K
34 21:00   .   .   .  7

INTERVAL 1    13 TO 13 HOUR
  SYS  AVE= 132  S.D.= 20.2
  DIA  AVE=  90  S.D.= 17.0
  PUL  AVE=  69  S.D.= 14.0

TOTAL
  SYS  AVE= 132  S.D.= 20.2
  DIA  AVE=  90  S.D.= 17.0
  PUL  AVE=  69  S.D.= 14.0
```

Event Mark

Interpolation Mark (Korotkoff)

❑ Sequence Number 3

Oscillometric Graph Form



Interpolation Mark (Korotkoff)

❑ Sequence Number 9

Conditions & Interval Settings

See SETTING THE CONDITIONS & SETTING THE MEASUREMENT INTERVAL Sections

```
5/ 9'91  ID.  1
START  STOP    INT
  13--->13      15

DISPLAY         ON
BEEP            ON
```

Safety Precaution Specifications

Safety Precautions are taken with this device by means of the following operations:

(1) If a 40 mmHg pressure increase has not occurred 25 seconds after the start of pressurization, the measurement is discontinued and rapid exhaust performed, and an "E05" error is displayed.

(2) If pressure has not risen to the target pressure set value within 100 seconds after the start of pressurization, the measurement is discontinued and rapid exhaust performed, and an "E05" error is displayed.

(3) If the pressure reaches 320 mmHg or higher, the measurement is discontinued and rapid exhaust performed, and an "E06" error is displayed.

(4) If 80 seconds have elapsed since the start of pressurization, the measurement is discontinued and rapid exhaust performed, and an "E05" error is displayed.

(5) If measurement takes 30 seconds or longer in a 1-minute interval measurement, the following interval measurement is canceled.

Loading Paper

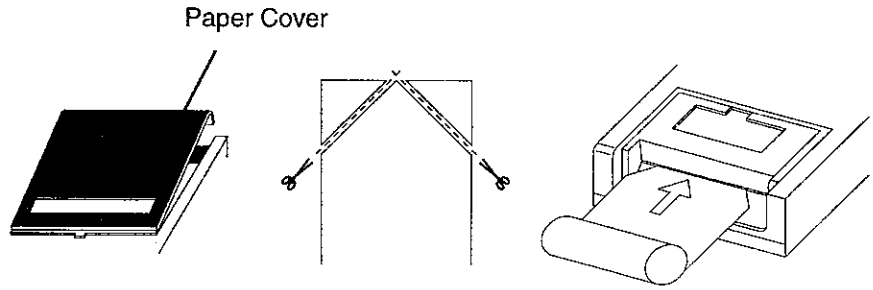
❑ Printer Jams

If the printer becomes jammed, you will hear a beep and the display will return to Clock mode. Clear the paper path and then repeat the steps to print the patient record again.

❑ Printer Out of Paper

If the printer runs out of paper, printing will stop. To load a new roll of paper, refer to the illustration and the instructions below.

1. Lift and remove the paper cover.
2. Remove any remaining paper from the TM-2021 Printer/Processor by lifting it out of the unit
3. Cut the leading end of the new roll. Uneven or jagged edges may cause the unit to jam.



4. Following the natural "curl" of the paper, feed the leading edge of the paper into the TM-2021 paper-guide slot.
5. Press the FEED button to advance the paper.
6. If the paper feeds properly (straight):
   - ❑ Slide the leading edge of the paper through the cover's perforated tear slot.
   - ❑ Place the roll in the TM-2021 paper receptacle.
   - ❑ Place paper cover back on the TM-2021.
7. If the paper doesn't feed properly, remove the paper and repeat steps 4 through 6.

❑ Printer Paper Capacity

- The total length of the printer paper (30 mm diamater) is approx.9m. The last 60cm of the paper carries a red end mark.
- Example of Use

  If blood pressure measurements are taken of 30-minute intervals over a 24-hour period and the table and graphic data of both Oscillometric and Korotkoff method can be printed out respectively for 7 days.

Error Displays

- Error codes displayed during measurement indicate the following problems:

Error code	Meaning	Check Items / Remearement Conditions
01	Microphone is Open.	Is the microphone connected properly ?
02	Air leak	Are the air plug and air hose correctly connected?
04	Measurement not possible due to low battery power	Charged?
05	Pressure does not rise, pressrization time exceeds 100 sec., measurement time exceeds 90 sec., or OFF operation is not performed. operation is not performed.	Are the air plug and air hose correctly connected?
06	Pressurization more than 320 mmHg.	Has air hose broken during measurement?
07	Manual stop (STOP key was pressed).	
08	Korotkoff sounds can't be heard.	Is microphone position correct? May be bad positioning of the lower mike. Remeasurement performed when pulse over
20	Pulse error: pulse less than 35 beats, or over 200 beats/min.	May be bad mike position or noise. 140 beats/min. or less than 35 beats/min-in one measurement
21	DIA greater than 160 mmHg or less than 40mmHg	Remeasurement performed when DIA greater than 120 mmHg or less than 40mmHg in one measurement.
22	SYS less than 60 mmHg or greater than 280 mmHg	Remeasurement performed when SYS less than 80 mmHg or greater than 240 mmHg in one measurement.
23	SYS minus DIA less than 10 mmHg	Remeasurement performed when pulse pressure less than 20 mmHg in one measurement.
24	SYS minus DIA greater than 150 mmHg	Remeasurement performed when pulse pressure greater than 150 mmHg in one measurement.

- If an error 2, 5, 6, 8, 20, 21, 22, 23, or 24 occurs while measurement with oscillometric method, the unit automatically remeasures.
- Re-measurement is started five seconds later, and only if the the remaining time to the next measurement is longer than 8 minutes in the "AUTO" mode.
- In following case, remeasurement cannot be performed; the measurement can be made with oscillometric method and error occurs with Korotkoff sound method.

Specifications

TM-2421 Recorder, Preformance	
Measurement	Riva-Rocci Korotkoff & Oscillometric
Measurement	35-200 pulse/minute (Pulse) Systolic 61-280mmHg, Diastolic 40-159mmHg (Pressure)
Pressure	± 3mmHg or 2% of reading if greater (Pressure) / ± 5%
Minumum Display Division	1mmH
Displays (LCD's)	LCD 10 x 18mm (Digit Size) 0-320mmHg (Pressure Range) Time, time to next measurement, sytolic/diastolic
Pressurizatio	Diaphragm micro-pump, preset at 190mmHg
Depressurizatio	Ceramic valve, constant air release
Measurement	4 measurement periods per 24 hrs. Repeat at: OFF, 1,3,5,10,15,20,30,60,120 minute intervals
Memory	Up to 896 measurements, data protected for approx. 2 weeks after low voltage warning
Power	⎓ 4.8V (for recharging only) Ni-Cd cell provide for 300 measurements per charge, LCD low battery warning.
Type of protection against electric shock	Class II ⧈
The degree of protection against electric shock	type BF

TM-2421 Recorder, Environment specification	
Operating	+10°C (+50°F) to +40°C (+104°F) Less then 85% RH
Transport and Storage	–20°C (-4°F) to 55°C (131°F) Less then 95% RH

TM-2421 Recorder, Physical specification	
Weigh	Approximately 390g (0.86 lb) excluding
Overall	68mm (W) x 144mm (D) x 42mm (H) 2.7 in. (W) x 5.7 in. (D) x 1.7 in. (H)

TM-2021 Processor	
Display	LCD 20 x 52mm (Digit Size)
Printing Method,	Serial thermal, approx.1 line/sec.
Pape	58mm [2.3 in.] (W) x30mm [1.2 in.] (Dia)
Power	Supply to TM-2421
Rating	⎓ 4.8V 500mA

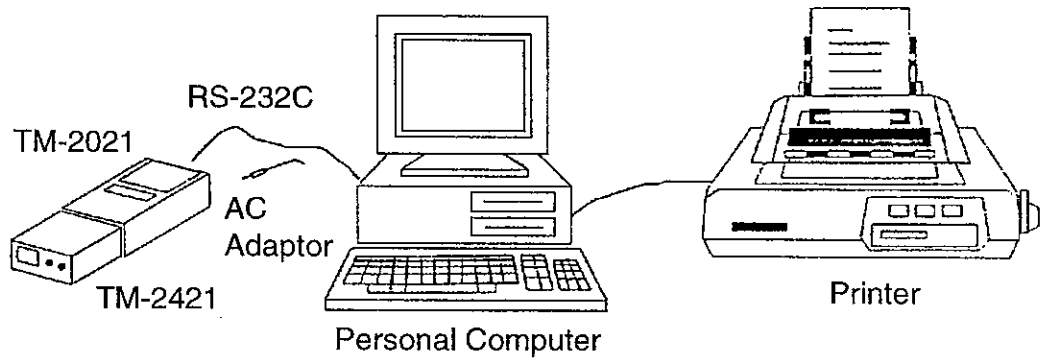
TM-2021 Processor, Environment specification	
Operating	+10°C (+50°F) to +40°C (+104°F) Less then 85% RH
Transport and Storage	–20°C (-4°F) to 55°C (131°F) Less then 95% RH

TM-2021 Processor, Pysical specification	
Weigh	Approximately 250g (0.55 lb) without
Overall	77mm (W) x 149mm (D) x 52mm (H) 3.1 in. (W) x 6.0 in. (D) x 2.1 in. (H)

Data Communication (RS-232C)

❑ The TM-2021 is equiped with RS-232C pins for external interface use. Connecting the device to a personal computer etc. makes it simple to read blood pressure measurement values or set measurement conditions externally. (A special-pressure cable and software should be used.)

(Personal computer analytical software is available from us.)



Communication method

Communication method	Half-duplex
Baud rate	4800 bps
Data bits	8 bits
Parity check	None
Stop bits	2 bits

Connector Specification (TM-2021)

Pin No.	Signal Name	Description
1	GND	GROUND
2	TXD	SEND DATA
3	RXD	RECEIVE DATA
4	NC	
5	NC	
6	DSR	DATA SET READY
7	CONTACT	CONNECTED TO SIGNAL GND
8	NC	
9	DTR	DATA TERMINAL READY

Use of Analysis Software

The personal computer analytical software (available separately) should be used as shown below.

(1) Connect the recorder (TM-2421) to the processor (TM-2021).

(2) Connect the processor (TM-2021) to the personal computer via a special-purpose RS-232C cable.

(Target computers are the IBM PC XT, AT, or PS/2.)

(3) Start up the personal computer with the analytical software.

(4) Operate in accordance with the processor display.

Case 1

In case of [- - - - - -], continue the personal computer operation.

Case 2

In case of [0 - - - - -], press "TOHROKU" key to obtain the display as shown in the case 1, then operate the personal computer.

[0 - - - - -] -> [- - - - - -]

(5) If the personal computer displays a message of "Serial adapter error" while an operation, reconnect the recorder for [- - - - - -] display and continue the operation.

Available Accessories & Options

ITEM	CODE	REMARKS
Cuff Cover	AX-13002018-S	Adult Cuff (10 sheets)
	AX-13A37410-S	Small Cuff (10 sheets)
	AX-13300266-S	Large Cuff (10 sheets)
5 rolls of printing paper	AX-PP132-S	5 rolls – 58mm wide
Mike Holding Tape	AX-00B45654A	50 pcs
Activity Record Sheets	AX:PP135A-S	10 sheets
Software	TM2021-13	for Windows analysis software
Clinical test kit	TM2420-90	
AC adaptor & battery charger	AX-TB214	for 220V
Large Cuff	TM2420-02 (K0001)	Large Cuff: Recomended for use 28~36 cm (11~14 inch)
Adult Cuf	TM2420-06 (K0001)	Adult Cuff: Recomended for use 20~31 cm (8~12 inch)
Small Cuff	TM2420-07 (K0001)	Small Cuff: Recomended for use 15~22 cm (6~8.5 inch)

Maintenance

Checking Accuracy

This method simultaneously measures the TM-2421 internal pressure accuracy and the static cuff pressure being applied to the cuff, and compares values by using the TM-2421 and an external mercury manometer.

Required equipment

- ❑ Accurate office mercury sphygmomanometer or aneroid gauge with inflation system.
- ❑ Clinical test kit (TM-2420-90).
- ❑ A rigid cylinder sized to fit the cuff pressured.

Steps for checking accuracy

Setting the TM-2421 Meter/Recorder

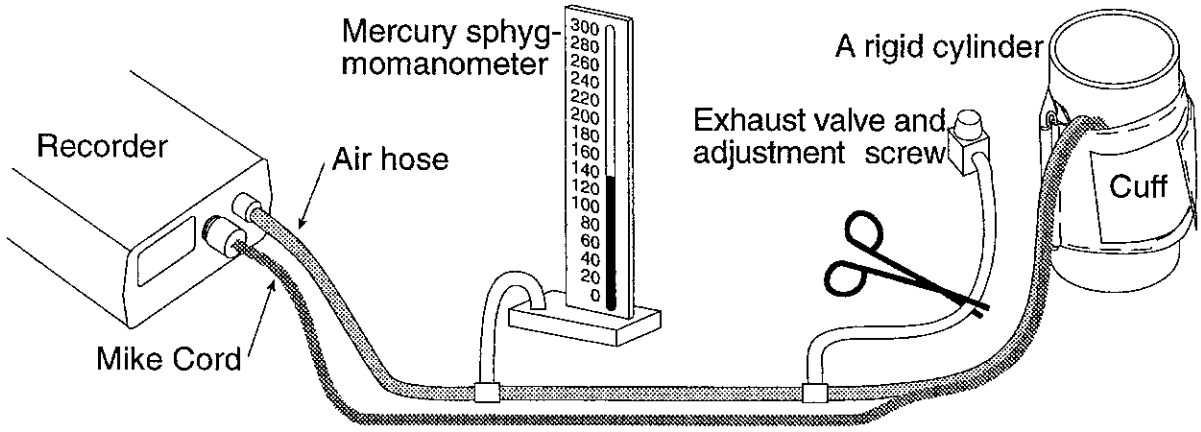
1. Turn on the TM-2421 using power switch.
2. Perform the TM-2421 condition setup by using the TM-2021. Set the display mode of the condition to "I ;" the pressure value will that be indicated on the LCD display of the TM-2421.
3. Turn on the auto-measurement slide switch mounted on the front panel of the TM-2421.
4. Connect the mike connector of the cuff and the connector of the branch air tube of the Test Kit to the TM-2421.

Setting the TM-2421 to the test mode

5. Set the slide switch on the Circuit board TM-2421-T to the reverse side of the test mode, then insert the connector on the connector on the rear panel. (Confirm that the pins of the connector on the PC board are straight. Insert the connector pins while observing the upper and lower directions of the connector.)
6. Make sure there is no remaining pressure inside the cuff, and that the LCD display of the TM-2421 is set to the auto-interval measurement mode. Then set the slide switch on the Circuit board to the test mode side. At this time, the zero pressure of the TM-2421 internal pressure measuring circuit can be automatically set at the external cuff pressure (auto-zero function.) Make sure a click sound is heard inside the TM-2421, and that the LCD display indicates "O."

Connecting the instrument

7 To test the pressure accuracy of the TM-2421, connect devices as shown in the drawing. Connect the cuff supplied with the TM-2421 to the tube of the Test Kit, and to the mercury manometer. Wind the cuff around a cylindrical object. Also clamp the air tube connecting to the constant-speed exhaust valve with forceps to the top the air flow.



Measuring the pressure of the cuff

8 Pressurize the cuff

Hold down the orange-colored start/stop switch on the TM-2421 front panel to pressurize above 180mmHg while observing the pressure on the mercury tube. Make sure the pressure is indicated on the LCD display of the TM-2421. Releasing your finger from the switch stops pressurization.

Note:

In case of insufficient pressurization, error code "E08" or "E02" may be indicated on the LCD display of the TM-2421. In this case, press the orange-colored start/stop switch to pressurize again. If the error code does not return to "O" after de pressurizing to zero, set the pressure of the air connector. Set the switch on the PC board to the side opposite the test mode, then set the switch tot the test mode again.

9 Compare the displayed pressure values of the mercury tube and TM-2421. De pressurize to the point to check and compare the readings on the mercury tube and the value indicated on the LCD display of the TM-2421. Compare the pressure art several points (i.e., near 200, 150, 100 and 50mmHg).

Note: Do not touch the air system (Ex. cuff) while comparing pressure values.

Cleaning the cuff and recorder

- Before cleaning these instruments, turn the power switch off.
- These instruments is not water resistant, do not allow liquids to splash on or get into the case while cleaning.
- After each use, wipe the case of these products with a clean lint free cloth, moistened with water and a mild detergent.
- Do not use antiseptic solutions, Alcohol, etc., to clean these instruments, hose or cuff.
- Clean the cuff cloth and cuff cover by washing in water with a mild detergent. Do not scrub or wring them by hand. If the cuff cloth and cuff cover become contaminated, replace them with new covers.

Periodical inspection

- This blood pressure recorder is a precision instrument. Please inspect the functions (every year) periodically. Contact your nearest A&D office for this inspection.
- When the instrument is inspected, replace these battery to new ones.

Problem solving

Caution

- Do not open the case of the recorder because it uses delicate electrical components and intricate air unit that could be damaged.
- If you can not locate and fix the problem, request service from your supplier, or from the A&D service group.
- A&D service group will support authorized suppliers about technical information, spare parts and units.

MEMO

MEMO

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