TECHNICAL GUIDE

AND

PARTS LIST

CAL. Y709A

DIGITAL QUARTZ

CONTENTS

I. SPECIFICATIONS

Item / Cal.No.	Y709A
Display medium	Nematic Liquid Crystal, FEM (Field Effect Mode)
Display system	Four-function changeover system with time, stopwatch, alarm setting and time/calendar setting functions. ● Time function: Digital display system showing hour, minute, second and day of the week. In the time function, calendar and time set for the alarm are displayed by depressing a button. Calendar: Digital display showing month, date, day of the week and "A" for AM /"P" (for PM). Time set for the alarm: Digital display showing hour, minute and "A" (for AM)/"P" (for PM). ● Stopwatch function: 12-hour digital display system showing hour, minute, second and 1/10 second. (The 1/10 second measurement is possible up to 20 minutes.) ● Alarm setting function: Alarm time can be set to operate at the desired minute and 12-hour (with "A" (for AM)/"P" (for PM) indication). ● Time/calendar setting function: Setting of the second, minute, hour ("A" (for AM)/"P" (for PM)), date, month and day of the week.
Additional mechanism	● Alarm test system ● Time signal starts sounding every hour on the hour (When the minute digits and the second digits indicate "00".) ● Sounding device for confirmation of stopwatch operation ● Illuminating light ● Pattern segment light-up system
Crystal oscillator	32,768 Hz (Hz = Hertz..... Cycle per second)
Loss/gain	Loss/gain at normal temperature range Mean monthly rate: less than 20 seconds (Annual rate: less than 4 minutes)
Casing diameter	ϕ30.1 mm
Height	5.9 mm without battery
Operational temperature range	$-10°C \sim +60°C$ (14°F $\sim$ 140°F)
Regulation system	Trimmer condenser
Battery power	Silver oxide battery Maxell SR1120W, U.C.C. 391 Battery life: Approx. 1 year. Voltage: 1.55V
IC (Integrated Circuit)	C-MOS-LSI..... 1 unit

II. DISASSEMBLING, REASSEMBLING AND LUBRICATING

1. Disassembling and reassembling of the case

Disassembling procedures Figs.:
① ～ ④
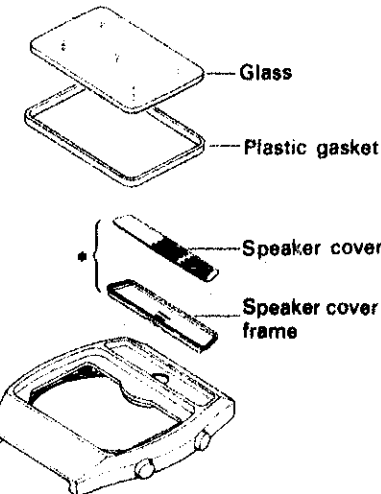Reassembling procedures Figs.:
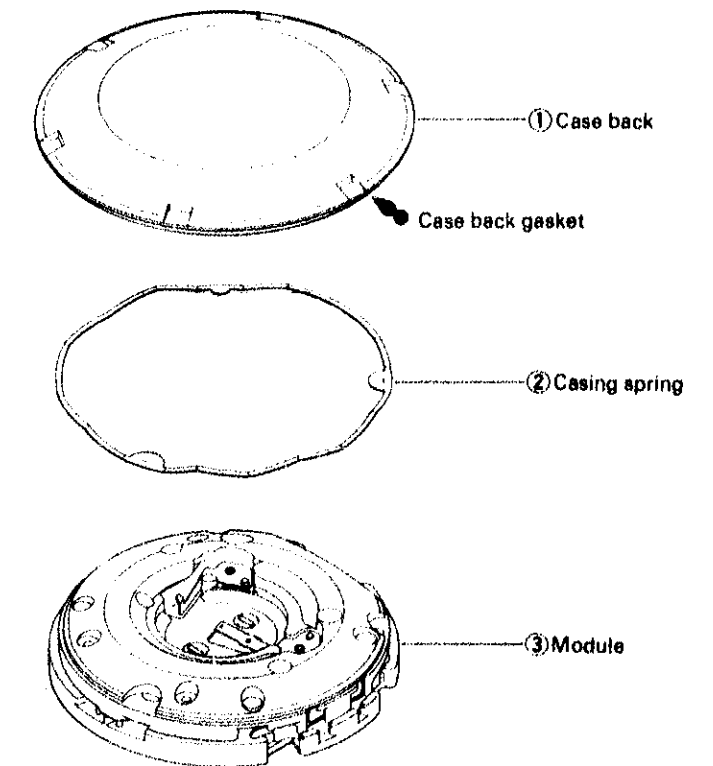④ ～ ①
Lubricating:
Silicone grease (500,000 c.s.)
Normal quantity ●➤

Glass and speaker portions

It is not necessary to disassemble the glass and the speaker cover except when they are required to be replaced. (Refer to pages 4, 5 for handling them.)

— Glass

— Plastic gasket

— Speaker cover

— Speaker cover frame

* Some are one piece with casebezel and cannot be separated.

①Case back

Case back gasket

②Casing spring

③Module

(Speaker block)

(Time adjusting button)
It is not necessary to disassemble the time adjusting buttons (4 assemblies) except when they are required to be replaced.
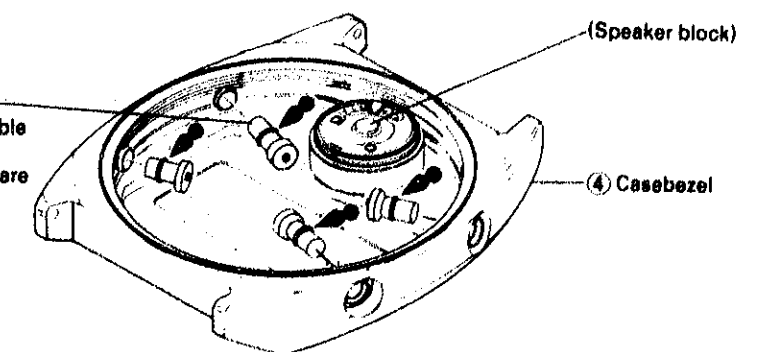
④Casebezel

Remarks for disassembling

'5) Module
- The liquid crystal panel frame is fixed firmly to the casebezel. Pry up the module with tweezers to take out.
  (Do not pry up at the speaker portion; the terminals of the speaker coil may be broken.)
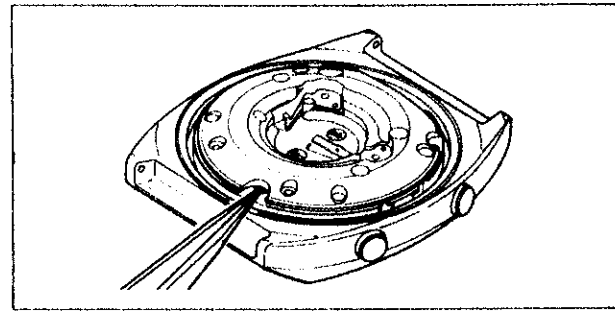
(6) Casebezel
- The speaker block is set in the casebezel. (Refer to page 7 for disassembling procedures.)
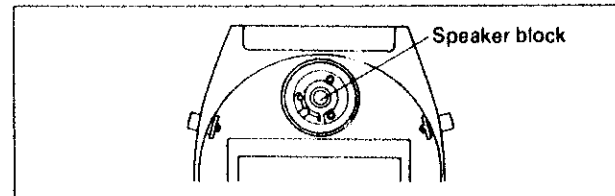
Remarks for reassembling

(6) Casebezel
- Before reassembling the module pull out all buttons so that the switch springs do not prevent the module from being inserted. (Push the buttons from inside with tweezers.)
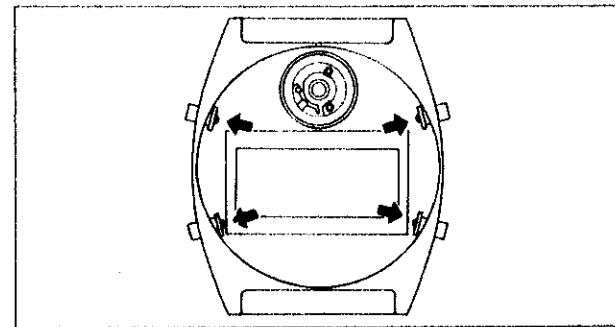
(5) Module
- The liquid crystal panel frame is fixed firmly to the casebezel. Push in the module with fingers.
- Push it in so that it does not catch the buttons.
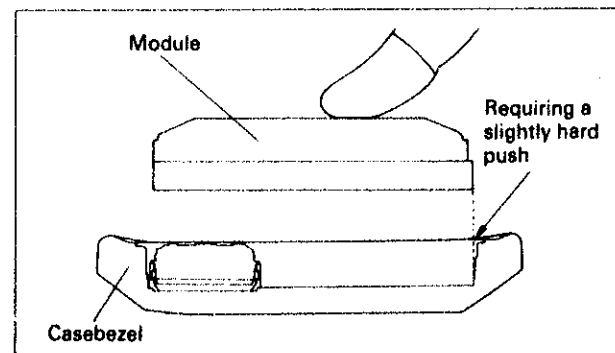
(4) Casing spring
- Set the casing spring
  Be careful not to mistake front for back.
  (The casing spring has three protrusions, two of which are larger and one is smaller. Be sure to fit each of them to the corresponding notches of the module.)

Speaker block

Module

Requiring a slightly hard push

Casebezel

Fit the protrusions of the casing spring.
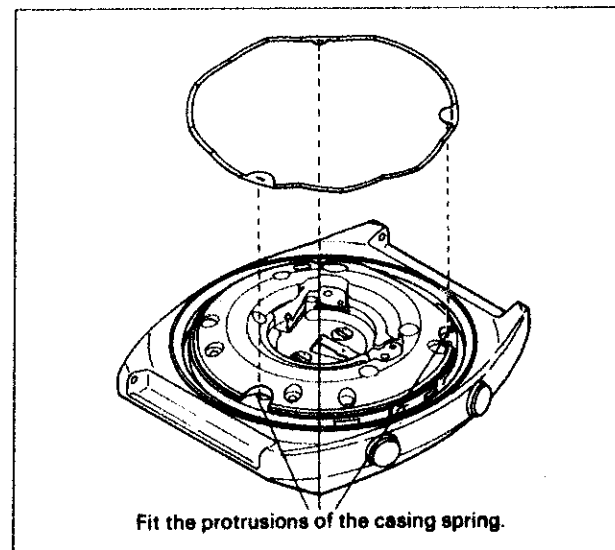
How to replace the glass

It is not necessary to disassemble the glass except when it is replaced.

How to disassemble the glass

- Use the tightening tool if the glass cannot be removed with fingers.
  Inserting disk
  Supporting disk: $\phi33.0 \sim \phi35.0$ mm
- Place a vinyl sheet between the glass and the supporting disk as shown in the illustration on the right.

Inserting disk

Inserting disk

Vinyl sheet

Supporting disk
($\phi33.0 \sim \phi35.0$ mm)
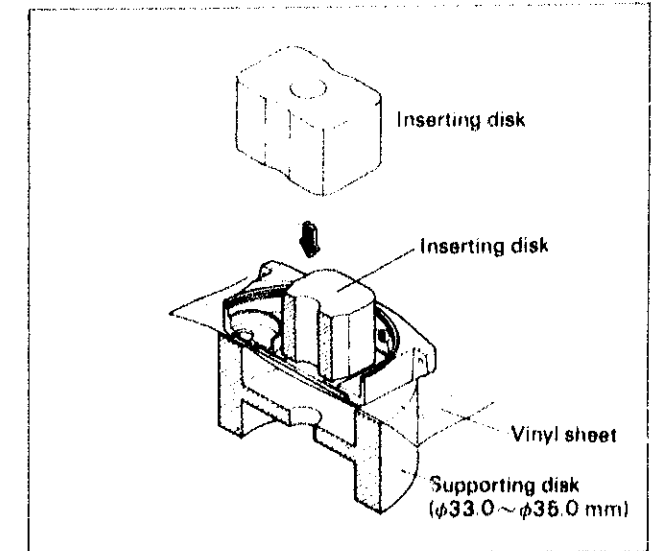
How to reassemble the glass

1) Set the plastic gasket.
- Be sure to replace the plastic gasket with a new one.
- Be careful not to mistake the upper side for the lower side.
2) Place the glass.
- Be careful not to mistake the upper side for the lower side.
  Place the round side down.
3) Push in the glass.
  Inserting disk: Plastic inserting disk
  Supporting disk: $\phi28.0$ or $\phi28.5$ mm

Plastic gasket

Place the side with the beveled corner down.

Narrow bevel

Glass

Wide bevel (rounded corner)
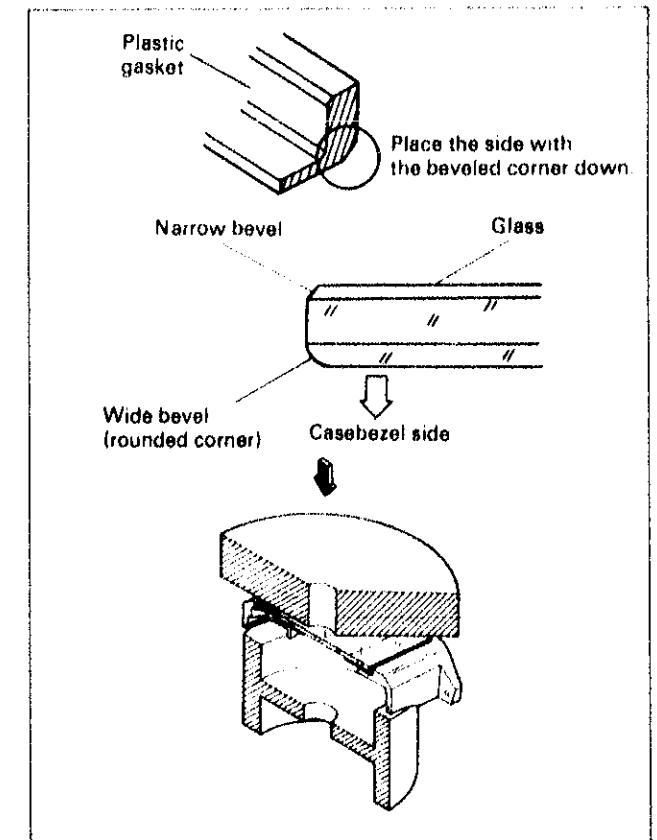
Casebezel side

How to replace the speaker cover

(Some are in a body with frame and should not be removed.)
(The speaker cover and the speaker cover frame are set to the casebezel. It is not necessary to disassemble the speaker cover and the speaker cover frame except when they are required to be replaced.)
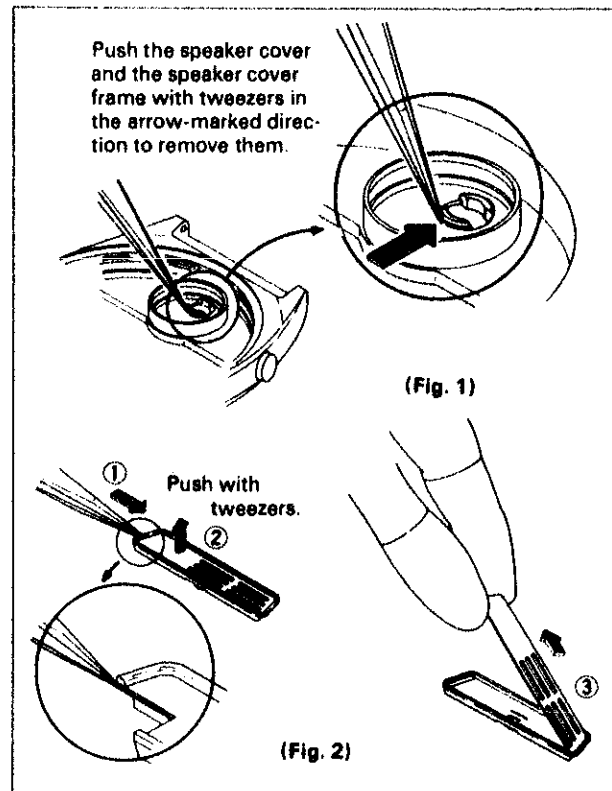
How to disassemble the speaker cover

1) Disassemble the speaker.
   (Refer to page 7 for the disassembling procedures of the speaker.)
2) Disassemble the speaker cover by pushing it through the speaker hole inside the casebezel. The speaker cover and the speaker cover frame are removed together. (Fig. 1)
3) Remove the speaker cover as shown in Fig. 2. Remove the speaker cover in the order of ①, ② and ③ as shown in Fig. 2.

Push the speaker cover and the speaker cover frame with tweezers in the arrow-marked direction to remove them.

(Fig. 1)

① Push with tweezers.
②
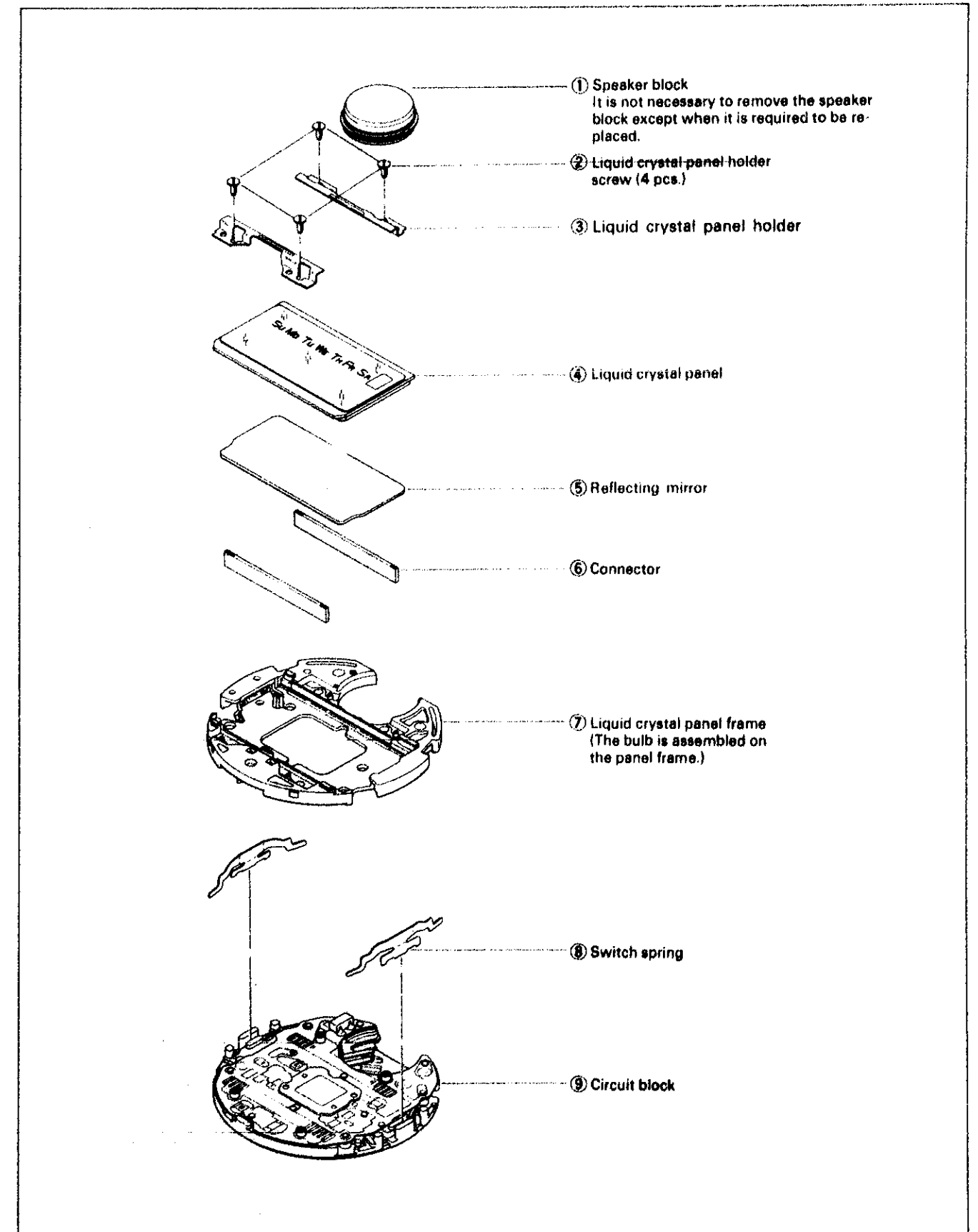③

(Fig. 2)

How to reassemble the speaker cover

1) Set the speaker cover to the speaker cover frame.
   Reassemble the speaker cover and the speaker cover frame in reverse order to the disassembling procedures. (Fig. 3)
   The speaker cover frame can be reused, if not damaged.
2) Set the speaker cover and the speaker cover frame together to the casebezel.
   Fit the leg portion of the speaker cover to the speaker hole portion of the casebezel and push it in. (Fig. 4)
   If the speaker cover cannot be pushed in with fingers, place a vinyl sheet on it so as not to scratch and push it hard with the flat part of the end of the tweezers. (Fig. 4)

Put the finger-cots on your fingers when handling the speaker cover.

①
②
③

(Fig. 3)

(Fig. 4)
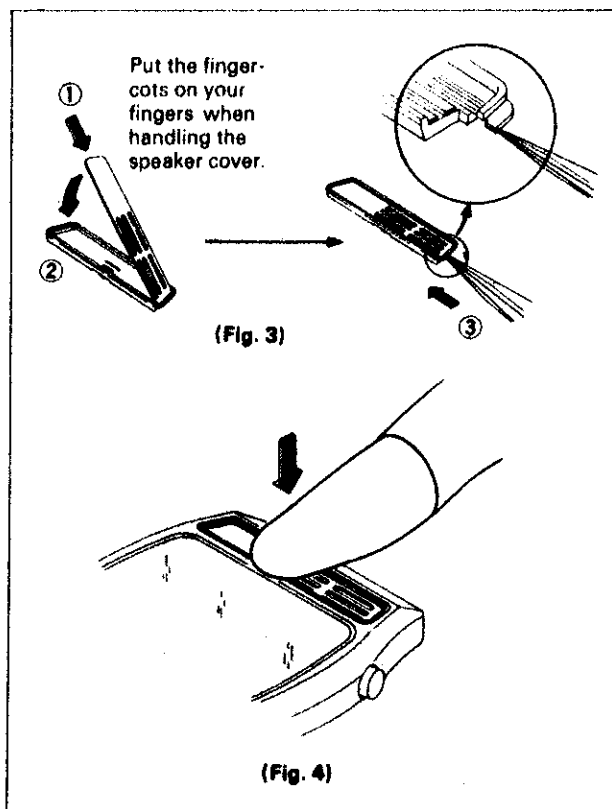
2. Disassembling and reassembling of the module

Disassembling procedures Figs.: ① ~ ⑨
Reassembling procedures Figs.: ⑨ ~ ①

① Speaker block
It is not necessary to remove the speaker block except when it is required to be replaced.

② Liquid crystal panel holder screw (4 pcs.)

③ Liquid crystal panel holder

④ Liquid crystal panel

⑤ Reflecting mirror

⑥ Connector

⑦ Liquid crystal panel frame
(The bulb is assembled on the panel frame.)

⑧ Switch spring

⑨ Circuit block
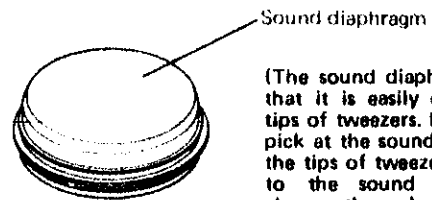
Remarks for disassembling

① Speaker block

- Hold the speaker block at its groove by the tips of tweezers and pull out the speaker block from the casebezel as shown in the illustration.
- Or pry out the speaker block by pushing up on its outer edge evenly with the tip of a screwdriver.

Sound diaphragm

(The sound diaphragm is so thin that it is easily damaged by the tips of tweezers. Be careful not to pick at the sound diaphragm with the tips of tweezers. Any damage to the sound diaphragm will change the volume and tone of the alarm or cause poor water resistance.)

- When the speaker gasket is replaced, be careful not to mistake the upper side for the lower side. (Reassemble the speaker gasket with its round side turned up. Otherwise, the speaker gasket may be twisted.)

⑤ Reflecting mirror

- Be careful not to scratch or contaminate the reflecting mirror.

⑥ Connector

- The connectors may be disassembled together with the liquid crystal panel.
- Be careful not to scratch the connectors with tweezers.
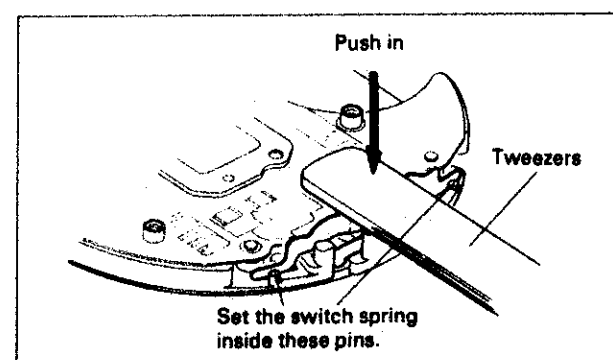- There is no difference between the top and bottom connectors.

⑨ Circuit block

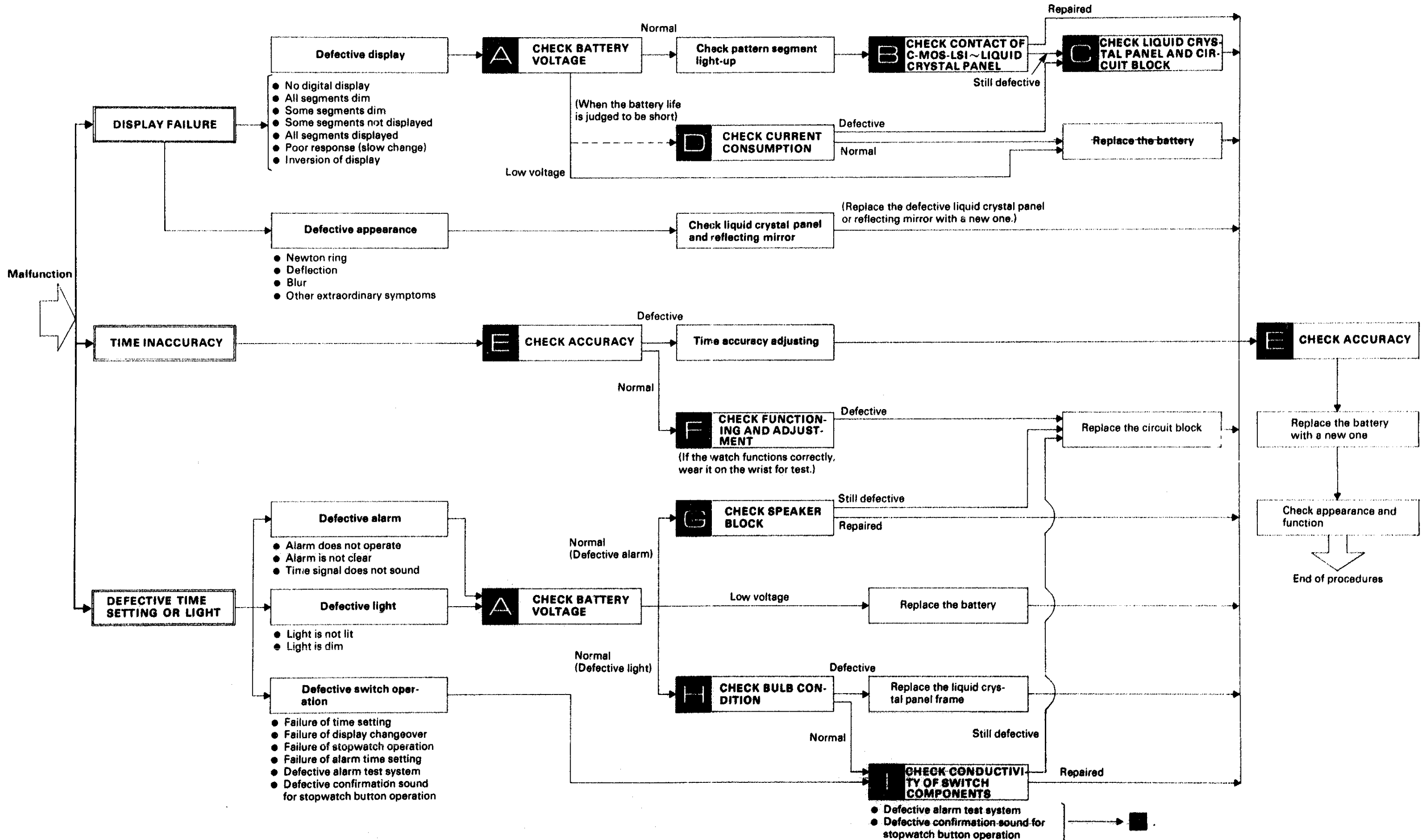- Be careful not to touch the electronic parts except when it is required.

Remarks for reassembling

⑧ Switch spring

- Set the switch spring in position vertically from above.
- Push it in by the flat part of the end of the tweezers.

Groove of the speaker block

Terminals of speaker coil (Be careful not to break the coil wire.)

Silicone grease

Connectors

Push in

Tweezers

Set the switch spring inside these pins.

Be sure to use the Static electricity protector when handling the module.

1. Guide table for checking and adjustment

Malfunction

DISPLAY FAILURE
- No digital display
- All segments dim
- Some segments dim
- Some segments not displayed
- All segments displayed
- Poor response (slow change)
- Inversion of display

Defective display → A **CHECK BATTERY VOLTAGE**

Normal → Check pattern segment light-up → B **CHECK CONTACT OF C-MOS-LSI~LIQUID CRYSTAL PANEL**

Repaired → C **CHECK LIQUID CRYSTAL PANEL AND CIRCUIT BLOCK**

Still defective

(When the battery life is judged to be short)

D **CHECK CURRENT CONSUMPTION**

Defective

Normal → Replace the battery

Low voltage

Defective appearance
- Newton ring
- Deflection
- Blur
- Other extraordinary symptoms

Check liquid crystal panel and reflecting mirror

(Replace the defective liquid crystal panel or reflecting mirror with a new one.)

TIME INACCURACY → E **CHECK ACCURACY**

Defective → Time accuracy adjusting → E **CHECK ACCURACY**

Normal

F **CHECK FUNCTIONING AND ADJUSTMENT**
(If the watch functions correctly, wear it on the wrist for test.)

Defective → Replace the circuit block

Replace the battery with a new one

Check appearance and function

End of procedures

DEFECTIVE TIME SETTING OR LIGHT

Defective alarm
- Alarm does not operate
- Alarm is not clear
- Time signal does not sound

Normal (Defective alarm) → G **CHECK SPEAKER BLOCK**

Still defective

Repaired

Defective light
- Light is not lit
- Light is dim

→ A **CHECK BATTERY VOLTAGE**

Low voltage → Replace the battery

Normal (Defective light)

Defective switch operation
- Failure of time setting
- Failure of display changeover
- Failure of stopwatch operation
- Failure of alarm time setting
- Defective alarm test system
- Defective confirmation sound for stopwatch button operation

H **CHECK BULB CONDITION**

Defective → Replace the liquid crystal panel frame

Normal

Still defective

I **CHECK CONDUCTIVITY OF SWITCH COMPONENTS**

Repaired

- Defective alarm test system
- Defective confirmation sound for stopwatch button operation

2. Relationship between the segment (Liquid Crystal Panel Electrode) and the C-MOS-LSI output terminal

A complete knowledge of how the segment (Liquid Crystal Panel Electrode) works with the C-MOS-LSI output terminal will provide the proper procedures for checking and adjustment.
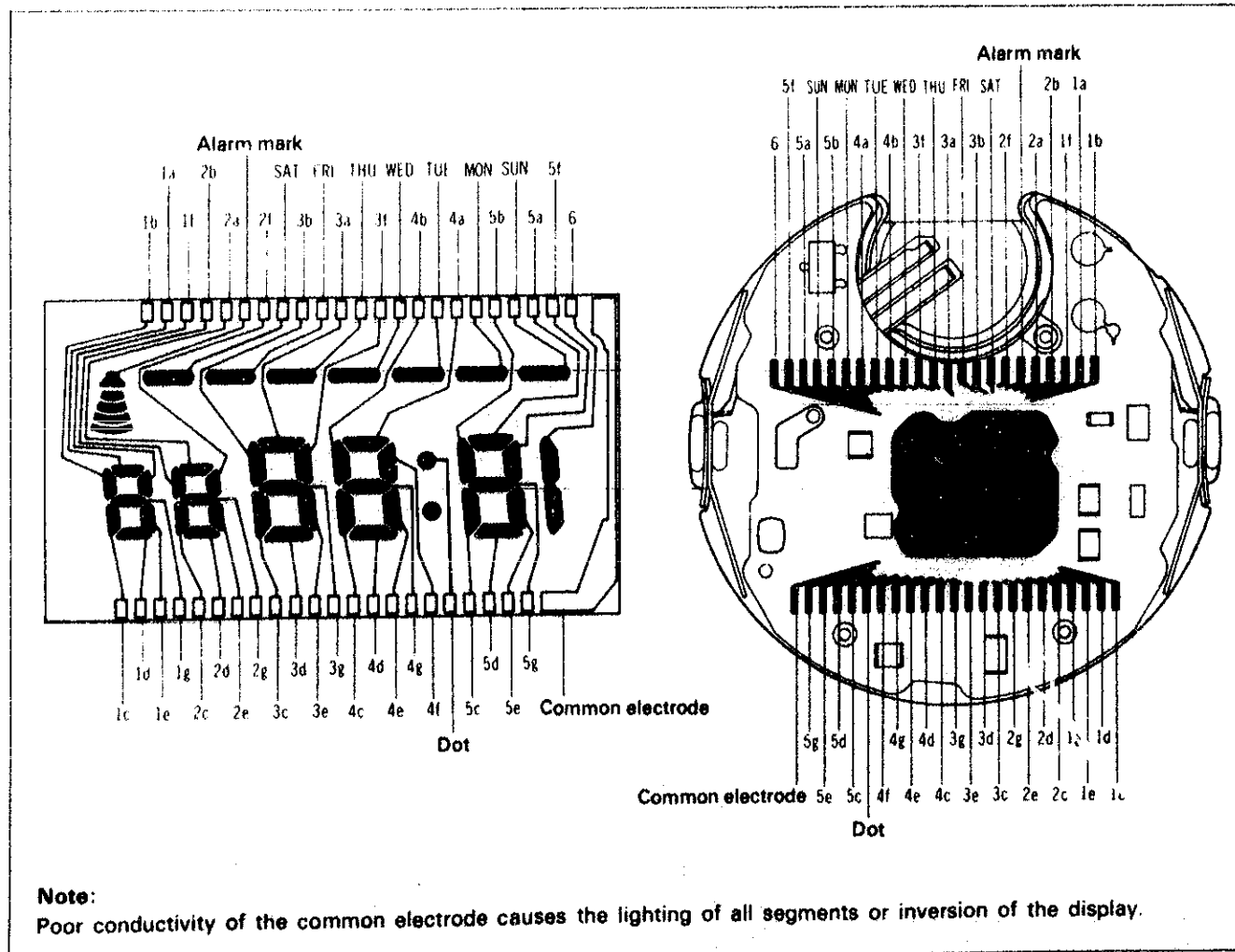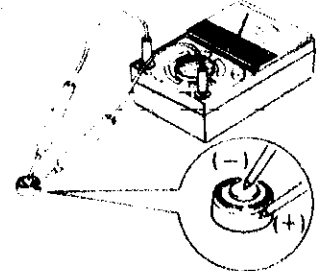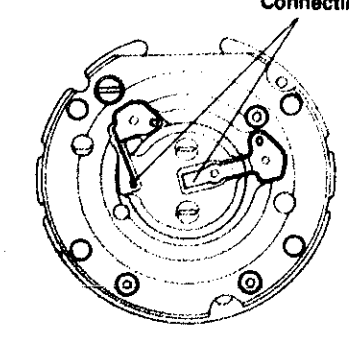
● Designation of segment

Segment

Example: 3a
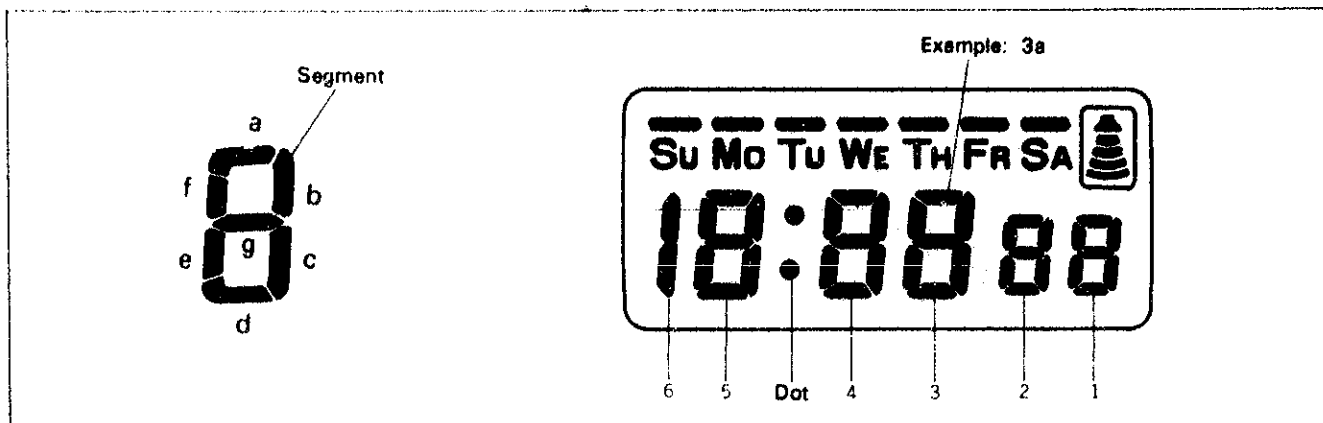
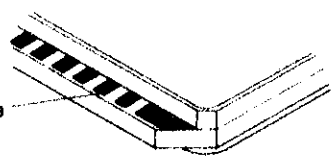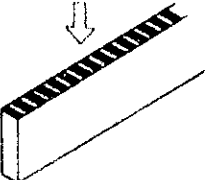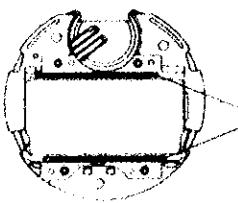● Relationship between the segment and the C-MOS-LSI output terminal
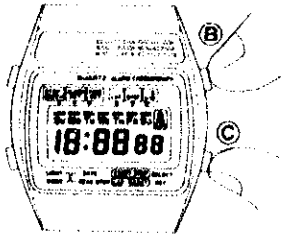
The liquid crystal panel electrode is connected electrically with each segment which forms a digital figure as shown in the illustration of the panel pattern below. (The panel pattern can be seen if the panel is slightly tilted and looked at in an angular position.)
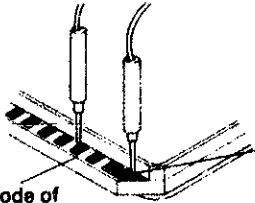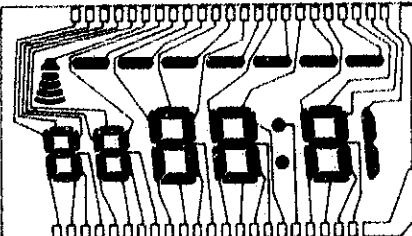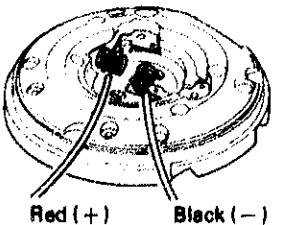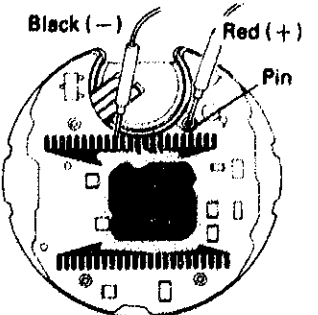
Also, the liquid crystal panel electrode is connected electrically with the C-MOS-LSI output terminal by the connector.

Note:
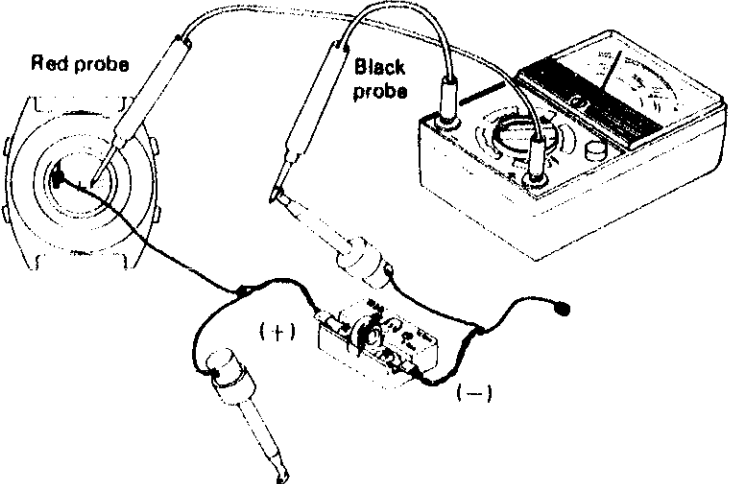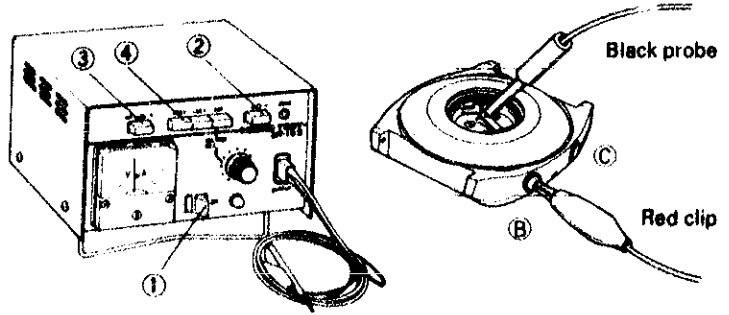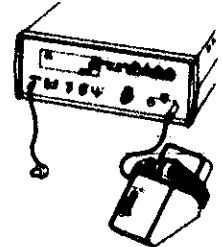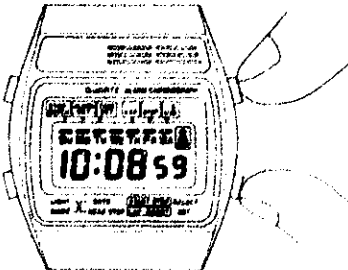Poor conductivity of the common electrode causes the lighting of all segments or inversion of the display.

3. Procedures for checking and adjustment

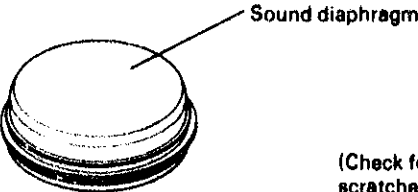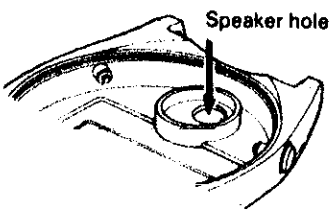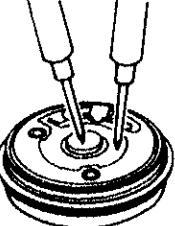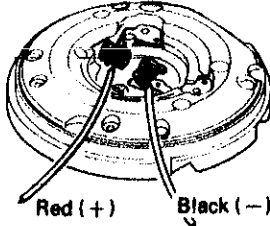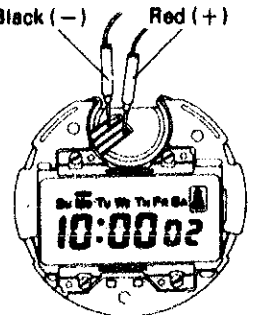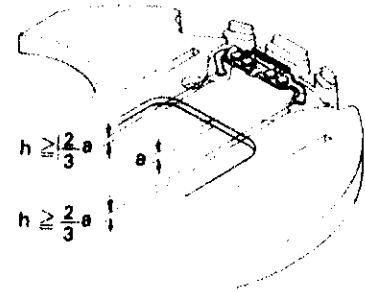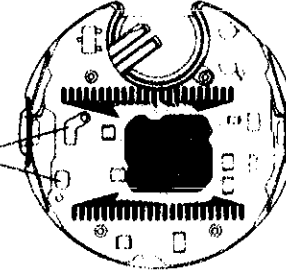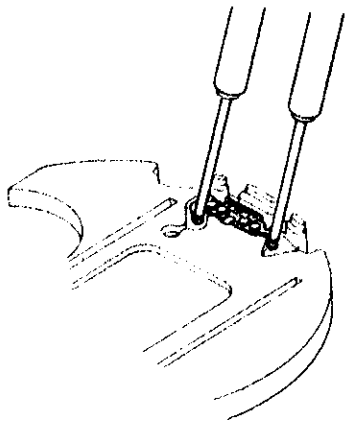| Procedure	Result and repair
A — CHECK BATTERY VOLTAGE Use the following procedures to check battery voltage. (1) Set up the Volt-ohm-meter. 　　Range to be used:　DC 3V (2) Measuring 　　Probe Red　　(+) 　　... Battery surface (+) 　　Probe Black　(−) 　　... Battery surface (−) When there is battery electrolyte leakage, refer to "HOW TO CHECK BATTERY ELECTROLYTE LEAKAGE AND REPAIR" below for repairing.	More than 1.5V:　Normal Less than 1.5V:　Defective
HOW TO CHECK BATTERY ELECTROLYTE LEAKAGE AND REPAIR (1) Remove the module from the case. (2) Disassemble the module. (3) Wipe off battery electrolyte on the circuit block. 　1. Wipe off battery electrolyte with a cloth moistened with distilled water. If distilled water is not available, use tap water. **Note:** ● Do not expose the trimmer condenser to water or alcohol, and if it is exposed, there may be a change in its capacity and eventually in the time accuracy. ● Do not use a cloth which gives off lint such as gauze, flannel, etc. ● When the circuit block is cleaned, be sure to clean the connecting portions. Connecting portions 　2. Rinse with alcohol. 　　(If the cleaned portions remain wet with water, they will corrode with rust.) 　3. Dry with cool air by using a dryer.	If the circuit block is badly contaminated with battery electrolyte, replace the circuit block with a new one. Ex. ● When the circuit block is rusted. ● When even the liquid crystal panel side is contaminated with battery electrolyte.

Procedure	Result and repair

HOW TO CHECK BATTERY ELECTROLYTE LEAKAGE AND REPAIR

(4) Clean the other parts. (Switch spring, etc.)
1. Wipe off battery electrolyte on the other parts with a soft brush moistened with distilled water. (If distilled water is not available, use tap water.)
2. Rinse with alcohol.
3. Dry with cool air by using a dryer.
(5) Reassemble the module.
Replace the battery with a new one.
(6) Check to see if the time and calendar function, the stopwatch function, the calendar function and the current consumption are normal.

CHECK PATTERN SEGMENT CHECKING SYSTEM

If some segments are dead or dim, set the mode for the time and calendar setting functions. Then depress buttons Ⓑ and Ⓒ together to find the defective segments. (If there is no defective segment, all segments light up.)

Proceed to 🅑.

Ⓑ CHECK CONTACT OF C-MOS-LSI ~ LIQUID CRYSTAL PANEL

After removing the liquid crystal panel, check for poor conductivity of the liquid crystal panel, connector and C-MOS-LSI output terminal whose segments are found to be defective in "CHECK PATERN SEGMENT CHECKING SYSTEM". (Refer to "Relationship between the segrnent and the C-MOS-LSI output terminal" on Page. 10.) Use a microscope for checking.

(1) Check for dust, lint and other contamination on the liquid crystal panel electrode.

Liquid crystal panel electrode

Uncontaminated: Normal
Proceed to 🅑 (2).
Contaminated: Defective
Wipe off any foreign matter.

(2) Check for any contamination, scratches, cracks and breaks of the connector.

Be sure to check the connecting portion of the liquid crystal panel and the circuit block carefully.

No contamination, scratches, cracks, or breaks: Normal
Proceed to 🅑 (3).
Contaminated: Defective
Clean.
Scratched, cracked or broken: Defective
Replace the connector with a new one.

(3) Check for dust, lint and other contamination on the output terminal of the circuit block.

Output terminal of the circuit block

Uncontaminated: Normal
Proceed to 🅒.
Contaminated: Defective
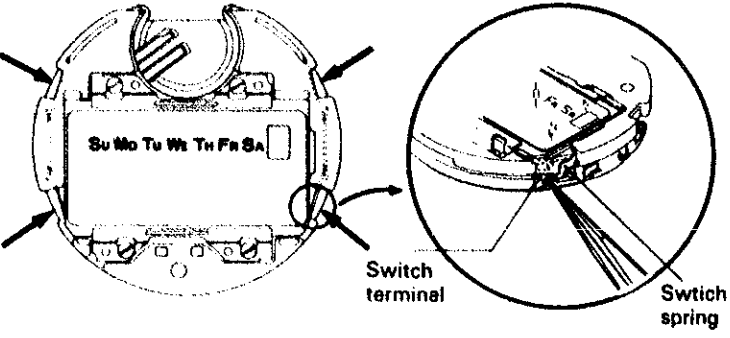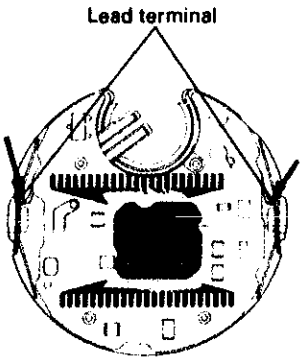Wipe off any foreign matter.

Procedure	Result and repair

Ⓒ CHECK LIQUID CRYSTAL PANEL AND CIRCUIT BLOCK

Check to see if the liquid crystal panel and the circuit block function correctly. (Refer to "Relationship between the segment and the C-MOS-LSI output terminal on page 10.)
(1) Check liquid crystal panel.
1. Set up the Volt-ohm-meter.
Range to be used: OHMS R × 1 ~ R × 1K

Note:
Any range will do if more than 3V is applied to the probes of the volt-ohm-meter. If less than 3V is applied to the probes, all segments may not be lit. Change the range to the one (R × 10K) which is higher in resistance than R × 1K.

2. Remove the liquid crystal panel from the module and turn it upside down.
3. Measuring
(Check to see if the corresponding segment lights up.)

Note:
Either red or black probe will do.

Electrode of defective segment

Common electrode (Either red or black probe must be applied to the common electrode.)

Lights up: Normal
Proceed to 🅒 (2).
Does not light up: Defective
Replace the liquid crystal panel with a new one.

(2) Check the circuit block output voltage.
1. Set up the Volt-ohm-meter.
Range to be used: DC 3V
2. Attach the electricity supplier to the circuit block.
Spring (+): Plus terminal of battery connection
Spring (−): Battery connection
3. Measuring
Probe Red (+):
Pin for the liquid crystal panel holder screw of the circuit block (Shown in the right illustration.)
Probe Black (−):
Each portion of the output terminal of the C-MOS-LSI. (If some displays are defective, apply to the corresponding output terminals of the C-MOS-LSI.)

Red (+)   Black (−)

Black (−)   Red (+)
Pin

More than 0.8V: Normal
(All the terminals must be more than this range of voltage.)
Return to 🅑.
Less than 0.8V: Defective
Replace the circuit block with a new one and check to see if it functions correctly.
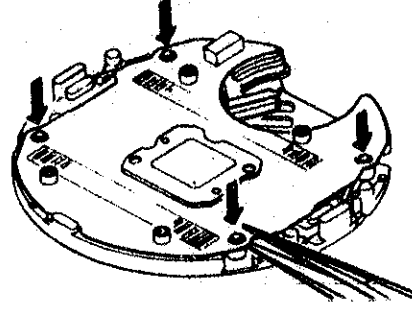
CHECK CURRENT CONSUMPTION

D

Check to see if the current consumption is normal.
(Can be checked no matter which function the watch may be performing.)

● Volt-ohm-meter
Range to be used: DC 12 μA or DC 0.03 mA*
Use the electricity supplier and connect as shown in the illustration below.

Red probe   Black probe

(+)

(−)

*Note:
If the pointer of the Volt-ohm-meter swings over the maximum value when DC 12μA or DC 0.03mA is used, change the range to a greater one where the pointer does not run over the maximum value while applying the probes to the respective portions. Then, after two or three seconds, return the range to DC 12μA or DC 0.03mA again for measuring.

Less than 3.0 μA: Normal
   Replace the battery with a new one.
More than 3.0 μA: Defective
   Proceed to ▣.

● Micro Test
Set up the Micro Test*.
1. Power switch: ON
2. Polarity changeover button: +
3. Current consumption/
   Voltage indication button: μA
4. Voltage selection button: 1.55V
   Probe Black (−): Battery connection
   Clip Red (+): Button
      (except the light button)

③ ④ ②

Black probe

①

ⓒ

ⓑ

Red clip

*Note:
If the pointer of the Micro Test swings over the maximum value while the current consumption is measured, depress the Current consumption/Voltage indication button ③ so that it is released to indicate the voltage (▉V) while the black probe and the red clip are applied. Then, after two or three seconds, depress the Current consumption/Voltage indication button again so that it holds in the pushed-in position (μA▄) to indicate the current consumption for measuring.

Apply the red clip (+) to button ⓑ or ⓒ for measuring.

Be careful not to depress the button while measuring.

CHECK ACCURACY

E

Check gain and loss of time.
1. Set up the Quartz Tester.
   As there are several types of Quartz Testers, refer to the respective instruction manual.
2. Measuring

If the watch tends to gain or lose, proceed to |Time accuracy adjusting|
Time accuracy is adjusted by turning the trimmer condenser.

CHECK FUNCTIONING AND ADJUSTMENT

F

1. Check the stopwatch function.
   Check to see if "start", "stop", "lap", "lap release" and "reset" function correctly.
2. Check the alarm time setting function.
   Rotate the hour and minute more than one cycle and check to see if the digits are advancing correctly.
3. Check the time and calendar setting function.
   Rotate the time and calendar digits more than one cycle for each unit and check to see if each digit is advancing correctly.

Functions correctly and can be adjusted: Normal

Wear the watch on the wrist to check time accuracy.
Does not function correctly or cannot be adjusted: Defective

Proceed to |Replace the circuit block.|

CHECK SPEAKER BLOCK

G

(1) Check to see if the speaker sounds the alarm correctly.
   Check to see if the speaker sounds when the watch is in the time function and when the two buttons on the right side are depressed together.

10:08 59

Speaker sounds: Normal

Set the alarm time and if the alarm does not operate at the required time, proceed to |Replace the circuit block.|
Speaker does not sound or it sounds but not clear: Defective

Proceed to ▣ (2).

Procedure	Result and repair

G

(2) Check for any dust and scratches on the sound diaphragm of the speaker block.

— Sound diaphragm

(Check for any dust and scratches on the sound diaphragm.)

Note:
Make sure that the speaker hole isn't clogged with dust.

Speaker hole

No dust or scratches: Normal
  Proceed to G (3).
Dust: Defective
  Wipe off any foreign matter lightly with a cloth moistened with cleaning solution.
Scratched: Defective
  Replace speaker block.

(3) Check for any broken coil wire and short-circuit of the coil of the speaker block.
  1. Set up the Volt-ohm-meter.
    Range to be used: OHMS R × 1
  2. Measuring

Apply the probes of the Volt-ohm-meter to the lead terminal of the speaker block.

Note:
Be careful not to break the coil wire when the probes are applied to the coil terminal.

Resistance:
30Ω ~ 150Ω: Normal
  Proceed to G (4).
Less than 30Ω or more than 150Ω: Defective
  Replace speaker block.

(4) Check to see if the output signal of the circuit block is transmitted to operate the speaker block.
  1. Set up the Volt-ohm-meter.
    Range to be used: DC 3V
  2. Attach the electricity supplier to the module.
  ● Prepare the alarm for sounding by pushing the switch spring.
  3. Measuring
    Apply the probes of the Volt-ohm-meter to the output terminals for speaker of the circuit block as shown in the illustration on the right.
    Check to see if the pointer of the Volt-ohm-meter swings twice every second.

Red (+)   Black (−)
Black (−)   Red (+)

10:00 02

Swings: Normal
  Replace speaker block.
Does not swing: Defective
  Replace circuit block.

Procedure	Result and repair

H

(1) Check to see if the bulb lead terminals touch the lead terminal of the circuit block.
  1. Check to see if the two bulb lead terminals protrude by more than 0.3 mm from the back side of the liquid crystal panel frame. Check for any dust, lint and other contamination of the bulb lead terminal. Protrusion "h" of the bulb lead terminal should be two-thirds or more of the thickness "a" of the liquid crystal panel frame.

$h \geq \frac{2}{3} a$

$h \geq \frac{2}{3} a$

Protrudes by more than 0.3 mm: Normal
Protrudes by less than 0.3 mm: Defective
  Pull out by using tweezers.

  2. Check for any contamination on the bulb lead terminal of the circuit block.

Bulb lead terminal

No dust, lint or uncontaminated: Normal
  Proceed to H (2).
Dust, lint or contaminated: Defective
  Wipe off any foreign matter.

(2) Check to see if there is a broken filament in the bulb and if there is any break in the welded portion of the bulb lead terminal.
  1. Set up the Volt-ohm-meter.
    Range to be used: OHMS R × 1
  2. Measuring
    Apply the two probes of the Volt-ohm-meter to the bulb lead terminal as shown in the illustration.

Bulb lights up: Normal
  Proceed to H.
Bulb does not light up: Defective
  Replace the liquid crystal panel frame.

Note:
Either red or black probe will do.

Procedure	Result and repair
Check to see if the switch spring functions correctly. (1) Check to see if the switch springs (four arrow-marked portions shown in the illustration below) function correctly when they are pushed in. 1. Check to see if the four arrow-marked springs touch the switch terminals of the circuit block when they are pushed in with the tips of tweezers and that they do not touch the switch terminals of the circuit block when released.	Functions correctly: Normal Does not function correctly: Defective If the switch springs do not function correctly after the switch springs are set correctly, replace the switch springs with new ones.

Switch terminal
Swtich spring

| 2. Check for dust, lint and other contamination on the contacting portions. | No dust, lint or uncontaminated: Normal
Proceed to ■ (2).
Dust, lint or contaminated: Defective
Wipe off any foreign matter. |

| (2) Check to see if the switch springs touch the lead terminal of the circuit block.
1. Check to see if the two arrow-marked portions touch correctly when the liquid crystal panel frame is removed. | Touch: Normal
Do not touch: Defective
Adjust by using tweezers so that the lead terminal of the circuit block touches the switch spring. |

Lead terminal

| 2. Check for dust, lint and other contamination on the connecting portions. | No dust, lint or uncontaminated: Normal
Proceed to ■ (3).
Dust, lint or contaminated: Defective
Wipe off any foreign matter. |

Procedure	Result and repair
(3) Check to see if the pins for the switch terminals are fixed firmly in the circuit board. Check to see if the four arrow-marked pins for the switch terminals are fixed firmly in the circuit board by slightly lifting the circuit board with tweezers as shown in the illustration on the right.	Fixed firmly: Normal Replace circuit block. (Defective C-MOS-LSI) Not fixed firmly: Defective Replace circuit block (The pins for the switch terminals are not fixed firmly.) Defective alarm test system or functioning sounds of stopwatch buttons indicate they do not function correctly: Proceed to ⑥

All procedures of Disassembling and Reassembling, and Checking and Adjustment are completed.

IV. PARTS LIST OF MODULE

Cal. Y709A			
PART NO.	**PART NAME**	**PART NO.**	**PART NAME**
4001 987	Circuit block		
4033 860	Liquid crystal panel frame (with bulb)		
4245 860	Switch spring		
4313 860	Connector		
☆ 4510 980	Liquid crystal panel		
4521 550	Reflecting mirror (Silver)		
4540 860	Liquid crystal panel holder		
4580 861	Speaker block		
022 493	Liquid crystal panel holder screw		
☆ Maxell SR1120W ☆ U.C.C. 391	Silver oxide battery		

Remarks:

Liquid crystal panel
☆ 4510 980 .... Be sure that the combination between the color of panel cover and liquid crystal panel should be matched.

Battery
☆ Maxell SR1120W
☆ U.C.C. 391 }............... Additional batteries for this calibre might be added as substitutes in the future.

☆ ▷ Please see remarks.