SEIKO

QUARTZ *LC*

Cal.M159A

PARTS LIST

Calibre No.

M159A

Style Name

QUARTZ LC CHRONOGRAPH

Characteristics

Casing diameter : ⌀ 27.0 mm
Maximum height : 6.1 mm
Frequency of quartz crystal oscillator : 32,768 Hz
(Hz ... Hertz ..... Cycle per second)
Time and calendar functions :
Digital Display System showing hour, minute, second, date and day
Stopwatch functions :
20-hour Digital Display System showing hour, minute, second, 1/10 second and LAP-STOP indication
Time micro-adjustor : Trimmer condenser system
Illumination light for digital display panel :
Illuminated in coordination with the touch-button depressing

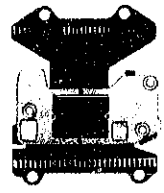
354 940

354 941

383 940

389 940

4009 940



4007 941

4032 940

4050 941

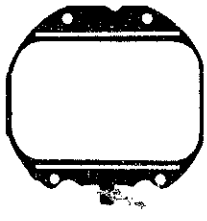
4219 940

4242 941

4256 940

4270 940

4313 940



4398 940

4510 940

4521 940

4540 940

4540 941

SEIKO SB-BU

022 256	023 061	023 067	2/1

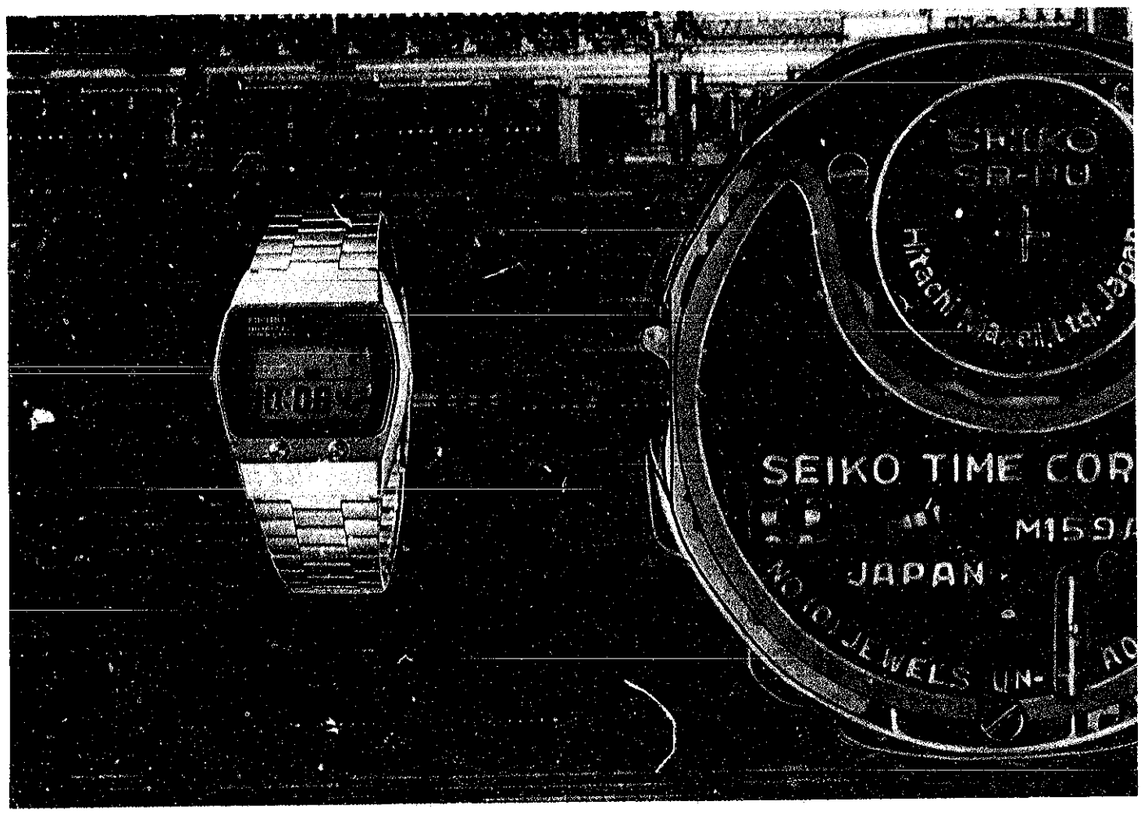
Calibre No.		Style Name	
M159A		QUARTZ LC CHRONOGRAPH	

PART NO.	PART NAME	PART NO.	PART NAME
354 940	Stem (Short)		
354 941	Stem (Long)		
383 940	Setting lever		
389 940	Setting lever axle spring		
4009 940	Crystal oscillator block		
4007 941	LSI block		
4032 940	Bulb		
4050 941	Circuit bridge plate		
4219 940	Insulator for battery connection		
4242 941	Plus terminal of battery connection		
4256 940	Crystal holding spring		
4270 940	Battery connection		
4313 940	Connector		
4398 940	Liquid crystal panel guard		
4510 940	Liquid crystal panel		
4521 940	Reflecting mirror		
4540 940	Spring for liquid crystal panel A		
4540 941	Spring for liquid crystal panel B		
022 256	LSI block screw		
022 256	Bulb holding screw		
022 256	Liquid crystal panel holder screw		
022 256	Circuit bridge plate screw		
022 256	Setting lever axle spring screw		
022 256	Circuit block screw		
023 061	Battery connection pin		
023 067	Pin for plus terminal of battery connection		
SEIKO SB-BU	Silver oxide battery		

TECHNICAL GUIDE

SEIKO
DIGITAL QUARTZ

CAL. M159A

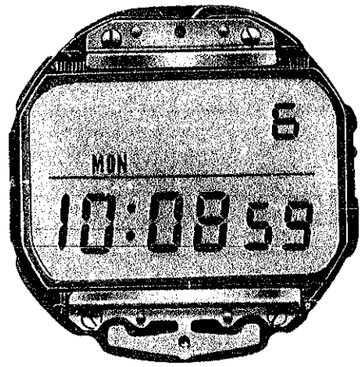


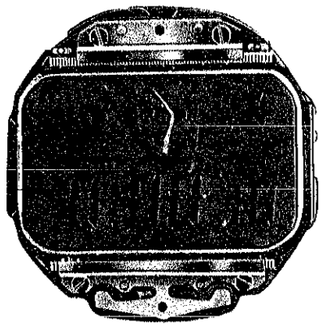
CONTENTS

Calibre M159A

Movement

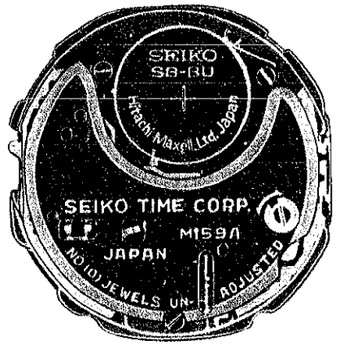
Display panel side





Time and Calendar Function

Stopwatch Function



Case back side

I. SPECIFICATIONS AND FEATURES

1. Specifications

Item \ Calibre No.	M159A
Display medium	Nematic Liquid Crystal, FEM (Field Effect Mode)
Display system	Two function changeover system • Time display: Continuous digital read-out in days, dates, hours, minutes and seconds using FEM (Field Effect Mode) of liquid crystal. • Stopwatch display: Hours, minutes, seconds, 1/10 second and LAP time up to 20 hours using FEM (Field Effect Mode) of liquid crystal. (After 20 hours, measurement starts again from "0" second automatically.)
Additional mechanism	• Illuminating light
Crystal oscillator	32,768 Hz (Hz = Hertz—Cycle per second)
Loss/gain	Loss/gain at normal temperature range Mean monthly rate: less than 10 seconds Annual rate: less than 2 minutes Temperature compensation device
Casing diameter	ϕ 27.0 mm
Height	6.1 mm
Operational temperature range	$-10^{\circ}C \sim +60^{\circ}C$ ($14^{\circ}F \sim 140^{\circ}F$)
Regulation system	Trimmer condenser
Battery power	SEIKO SB-BU silver oxide battery Battery life is approximately two years.
IC (Integrated Circuit)	C-MOS-LSI . . . 1 piece

2. Features

(1) Simultaneous display of the time and calendar.
Since the hour, minute, second, date and day are frequently referred to in daily use, all of these indications are displayed at the same time, so that the time and calendar can be read simultaneously.

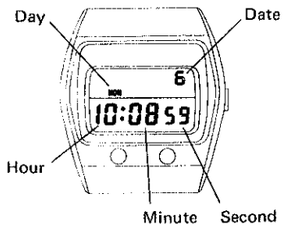
(2) Stopwatch accumulating up to 20 hours
A stopwatch that can accumulate as long as 20 hours and as accurately as up to 1/10 second, has enabled the range of measurable events to be expanded. Measurement of not only a short distance race requiring an accurate time record but such events covering a long time span as marathon and driving races also have become possible.

(3) Thin watch
Despite the watch containing all the necessary chronograph functions, it has been successfully made thinner (the waterproof outer case being 9.0 mm in thickness) with the introduction of a thinner panel and a newly developed module.

II. HOW TO USE

1. Display

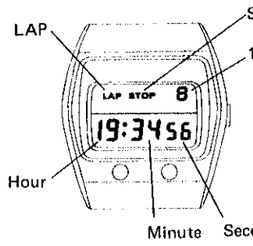
Time and Calendar function



(In the months, April, June, September and November, the date is automatically changed from the 30th to the 1st of the next month, and in February the date is automatically changed from the 28th to the 1st of March.)

(Month digits are displayed only while adjustments are being made.)

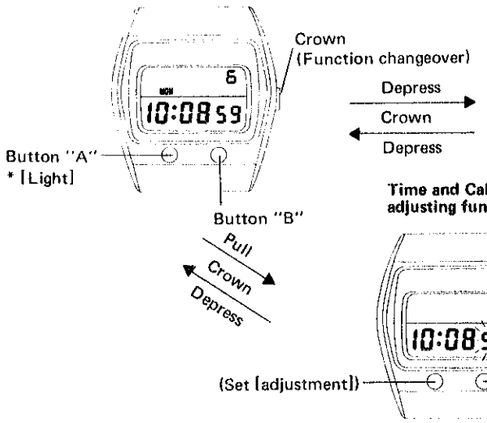
Stopwatch function



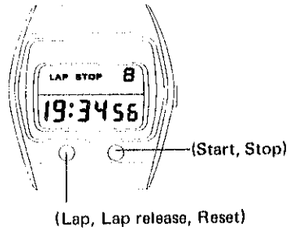
(If accumulated time exceeds 20 hours, the digits will automatically be reset to "0000000" and will start measurement again from "0" second.

2. Button operation

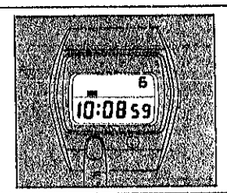
Time and Calendar function



Stopwatch function

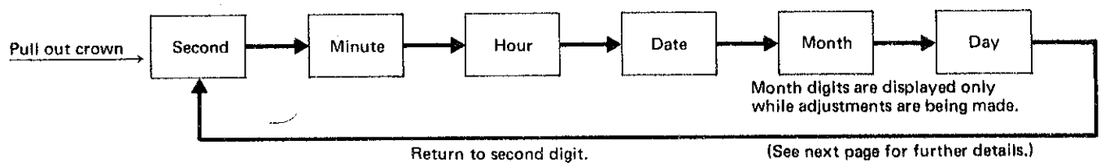


* **How to use the light (for the time and calendar function)**
Depress button "A" to activate the illumination light, and the entire display can be read in the dark.



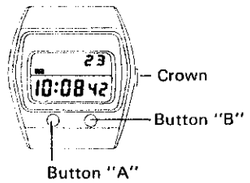
3. How to set the time and calendar

- Pull out crown, and the time and calendar digits are ready to be adjusted. This can be done during any function, time and calendar function or stopwatch function, the watch may be performing.
- With crown still in the pulled out position, depress button "B" and the digits (flashing) to be adjusted are displayed cyclically in the order listed below every time it is depressed.
- With crown still in the pulled out position, depress button "A", and the digits to be adjusted (flashing) advance by one digit every time button "A" is depressed. (With crown in the pulled out position, depress button "A", and the second is reset to "00" second.)
- Push in crown and the watch function is set to the time and calendar function no matter which digit is being adjusted.



[EXAMPLE]

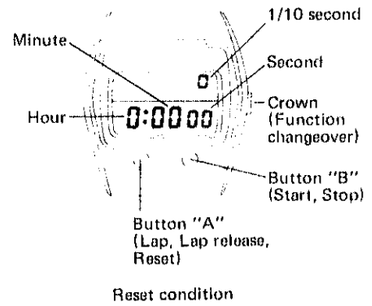
How to change the indication of 10:08:42 AM of May 23 (Sunday) into 7:00:00 PM of June 10 (Friday).



Button operation (Select and set) / Digits to be adjusted (in the numerical order)	SELECT (Select the digits to be adjusted)	SET (Digit adjustment)
	Depress button "B", and the digits start flashing.	Depress button "A", and the flashing digits advance by one digit every time button "A" is depressed. (When the second digits are to be adjusted, depress button "A" and the second will reset to "00".)
① Second	"A" (AM) or "P" (PM) is displayed ("A" or "P" is displayed only while the adjustment is being made.) Pull out crown	Depress button "A" in accordance with the "00" second of a time signal and the seconds are then reset to "00". (When the second counts any numbers from "00" to "29", the seconds are automatically reset to "00". If however, the second counts any numbers from "30" to "59" when button "A" is depressed, one minute is added and the seconds return to "00".
② Minute	Depress button "B" after adjusting the second digits, and the minute digits start flashing.	Adjust the minute digits.
③ Hour		Be careful not to mistake "A" (AM) for "P" (PM) or vice versa. Always take into account the AM or PM period when setting the watch so that the date can change properly at midnight.
④ Date	Day / Date (Month digits are displayed only while an adjustment is being made.) / Month (For date adjustment only)	The display is changed to date, month and day.
⑤ Month		
⑥ Day		Depress button "B" again, and the second digits are ready to be adjusted. After all the adjustments are completed, push in crown.

Return to second digit

4. How to use as a stopwatch



Reset condition

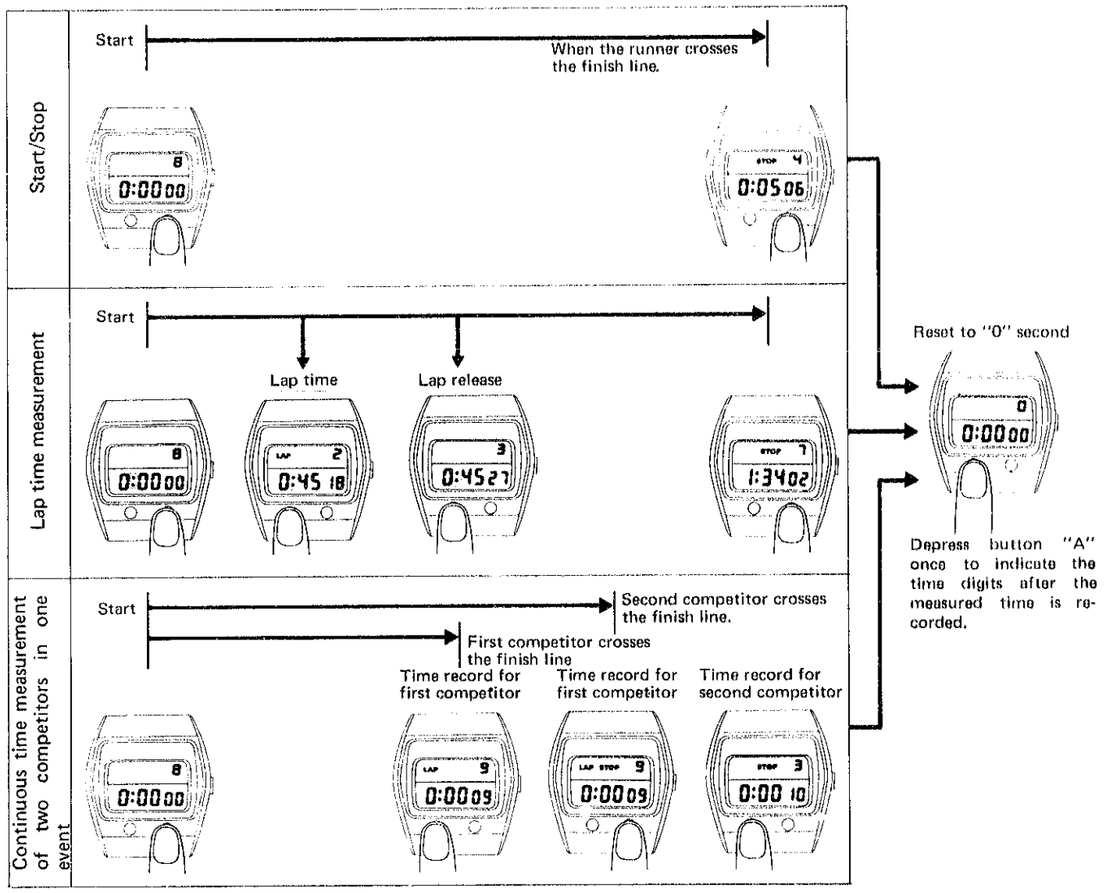
(1) Preparation for measurement

Be sure to start the stopwatch from its reset condition. (All digits must indicate "0" as shown in the illustration on the right.)

How to reset

Depress button "B", and "STOP" is indicated. Then, depress button "A" once or twice.

(2) How to measure



- The stopwatch device and the time and calendar device function independently. When the stopwatch device is used for a long continuous period, it is recommended that crown is depressed to indicate the time and calendar and should be depressed again when the time measurement is required. That prevents the button "A" or "B" from being depressed by mistake and upsetting the stopwatch measurement.

5. Remarks for battery replacement

Incomplete digital figures may be indicated on the display panel after battery is replaced. However, this is not a malfunction. Adjust the time and calendar digits.

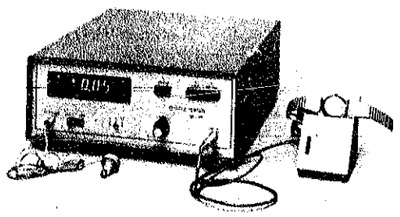
[Example]

1. After-sale servicing instruments and materials

For after-sale servicing of SEIKO Quartz Digital Cal. M159A, the following instructions and materials are necessary.

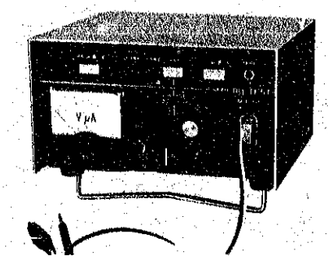
(1) Quartz Tester QT-77

Used to check time accuracy (daily rate).



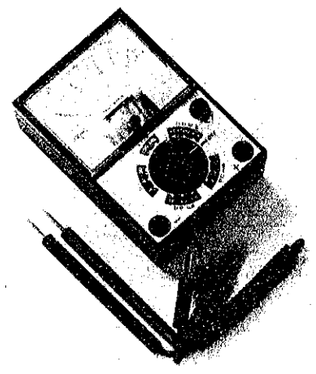
(2) Micro Test MT-10 II

Used to check current consumption and to supply voltage power constantly.



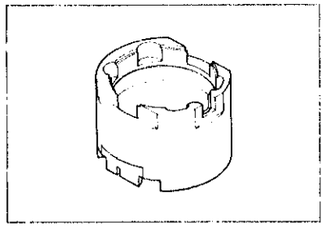
(3) Volt-ohm-meter

Used to check battery voltage and measure current consumption, etc.



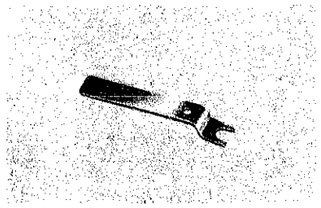
(4) Movement holder (S-644)

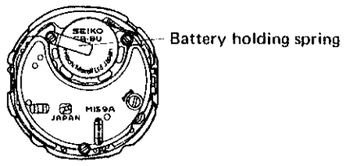
Used for disassembling and reassembling of the movement.



(5) Battery holding spring (S-815)

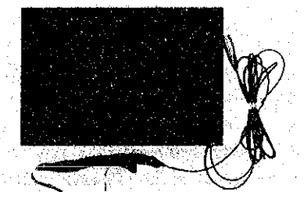
Used for securing battery and flowing current when the movement is removed from the case.





(6) Static electricity protector S-830

Used to protect the C-MOS-LSI of Digital Quartz from being damaged by static electricity.

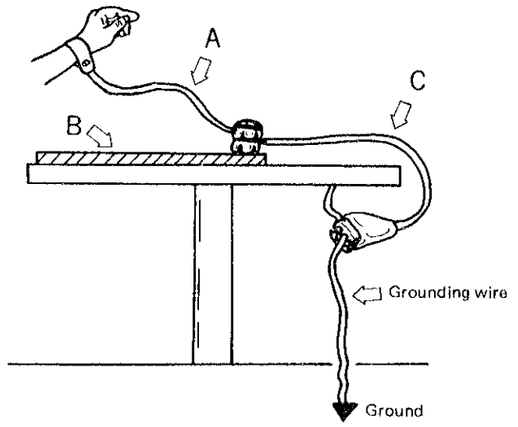


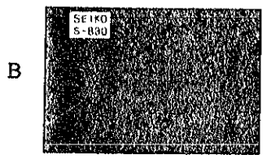
The reason of necessity:

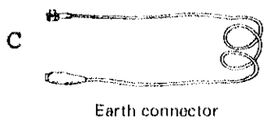
When repairing the movement of the SEIKO Digital Quartz, be sure to use the Static Electricity Protector, S-830, in order to protect its circuit block from being damaged by static electricity.

The human body and clothes are often charged with static electricity of several thousands to several tens of thousands of volts, depending on environmental conditions. If this high voltage static electricity flows directly through the circuit block, the C-MOS-LSI will be damaged. The Static Electricity Protector, S-830, shunts the static electricity to ground, protecting the circuit block when it is repaired.

How to use

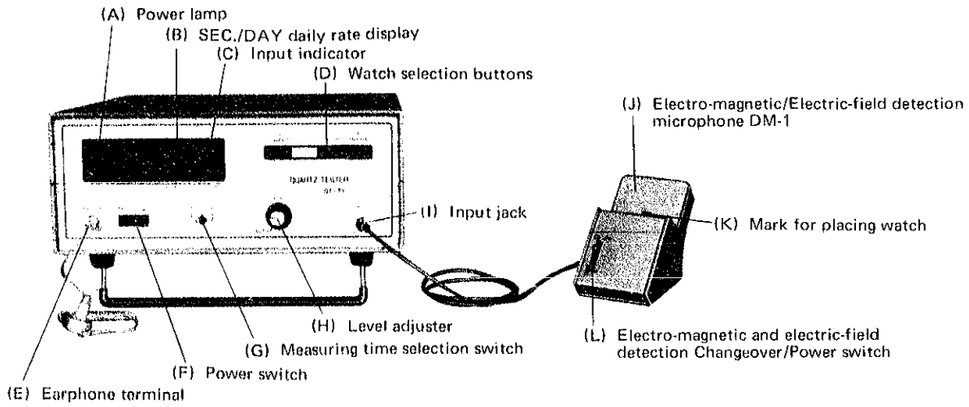






- Set up the Static Electricity Protector as illustrated above, and place the movement of the Digital Quartz Watch on the conductive rubber sheet (B) for repair. This rubber sheet is specially processed to have a conductivity for discharging static electricity.
- Put the wrist strap (A) direct around the naked skin, and not over clothing.
- Be sure to connect the earth connector (C) to the grounding wire directly connected to the ground, or connect the earth connector (C) to the grounding wire which is connected to the earth terminal at the outlet or a metallic water service pipe for the same effect.

K. Hattori & Co., Ltd. has put on sale its new Quartz Tester QT-77. When measuring the watch accuracy by the new Quartz Tester QT-77, be sure to follow the instructions below.



Preparations before measurement

- Make sure that the voltage indicated by the supply voltage setting switch is the same as the voltage rating of your household power supply. If it isn't, turn the fuse holder counterclockwise (arrow-marked direction) and remove the fuse. Pull out the supply voltage setting switch and adjust it to the voltage rating of your power supply, and set the fuse in position.

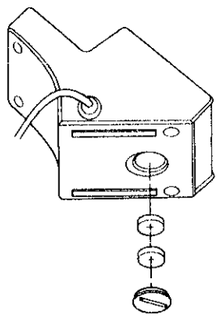
Fuse holder

Supply voltage setting switch (ex. 220V)

The fuse holder is located in the center of the rear panel of QT-77.

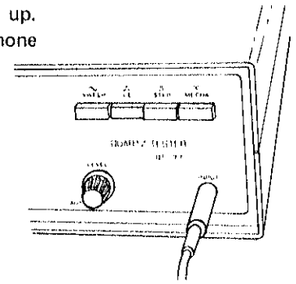
- **Battery for Electro-magnetic/electric-field detection microphone DM-1**

If the microphone is to be used for the first time, insert the battery (supplied along with the microphone) into the microphone. It is recommended to check the battery voltage periodically. When the microphone is not used turn the electro-magnetic and electric-field detection Changeover/Power switch to "STEP, SWEEP, LE" side, to preserve the battery life.

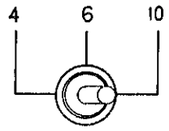


Measurement of time accuracy (daily rate)

(1) With the power switch (F) off, insert the power supply cord plug into the electric power outlet. Leave the Quartz Tester (QT-77) to stand for some 20 minutes.
(2) Turn on the power switch (F). The power lamp (A) will light up.
(3) Put the plug of the electro-magnetic/electric-field detection microphone DM-1 (J) all the way into the input jack (1).
(4) Depress white button (LC) of the watch selection button.

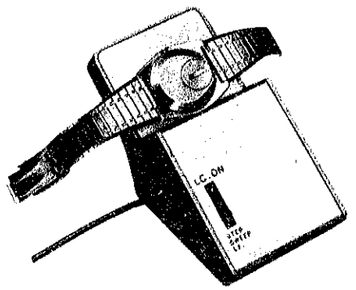


(5) Set the measuring time selection switch (G) at "4 sec.", "6 sec." or "10 sec.".
The daily rate can be measured at any position 4 sec., 6 sec. or 10 sec.
It is generally accepted, however, that the longer the measuring time is the more accurate will be the measurement.



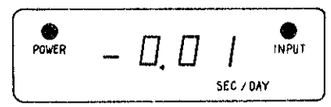
(6) Insert the earphone cord plug into earphone terminal (E).
(7) Turn the level adjuster (H) to AUTO position (turn it counterclockwise until a click is heard).
(8) Push the switch (L) of the microphone (J) to the LC·ON position (electric-field detection function).
(9) Place the watch on the microphone.
Place the watch with its liquid crystal display facing the mark ▣ (K) in the center of the microphone.
Put on the earphone, and move the watch on the microphone in various ways, and by changing its position and angle, the volume will change. Determine the watch position and direction where the earphone sound becomes loudest. At this time, the input indicator (C) will remain lit.

Note:
In almost all cases, all the above procedures will be sufficient for measuring the daily rate. If the input indicator flashes or does not light up at all, turn the level adjuster to keep the input indicator lit during measurement.



(10) Read the daily rate on the display panel (B). If the daily rate of the watch exceeds the measurable range, it is not displayed on the panel.

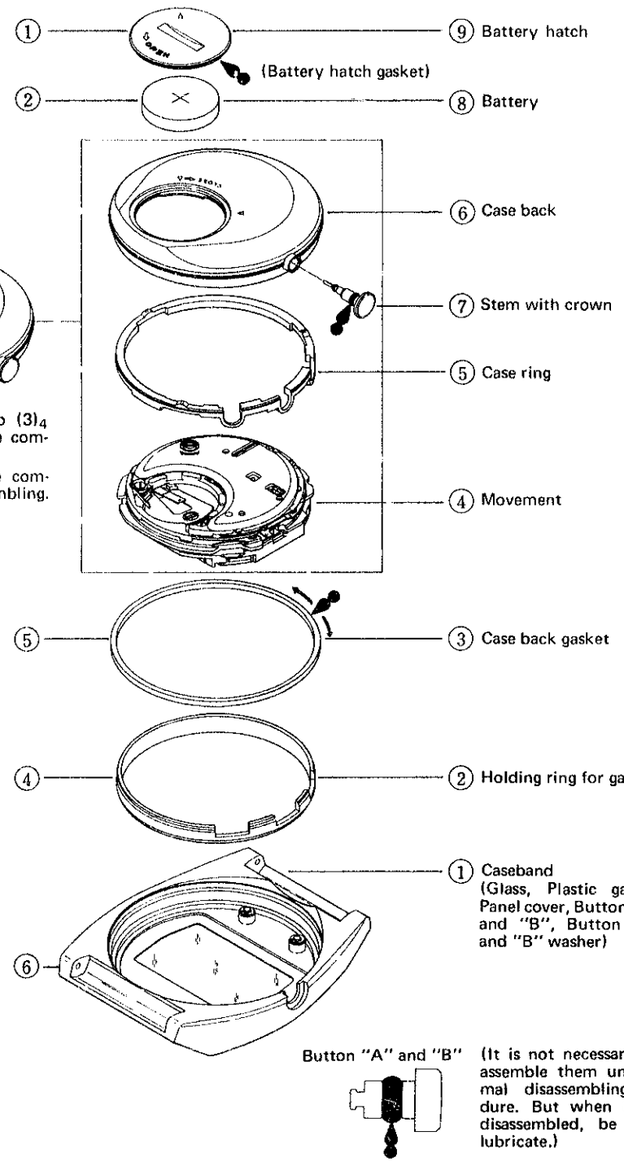
Note:
If the glass of the watch has perspiration or oil on it, the Quartz Tester QT-77 does not pick up the signal.
Be sure not to put the watch in a vinyl bag while it is being measured.



2. Disassembling and reassembling of the case

Lubricating ●►: Silicone grease (500,000 c.s.)
Normal quantity
(lubricate gaskets)

< Disassembling procedures > **<Reassembling procedures>**

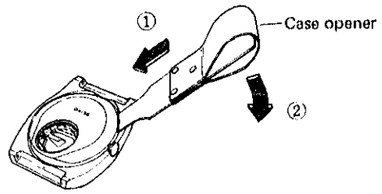


The parts from $(3)_1$ to $(3)_4$ are disassembled as one combined unit.
Turn upside down the combined unit for disassembling.

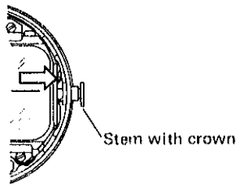
Button "A" and "B" (It is not necessary to disassemble them under normal disassembling procedure. But when they are disassembled, be sure to lubricate.)

REMARKS FOR DISASSEMBLING

③ The case back can be disassembled by pushing the case opener into the opening notch. (The parts from $(3)_1$ to $(3)_4$ are disassembled as one combined unit.)



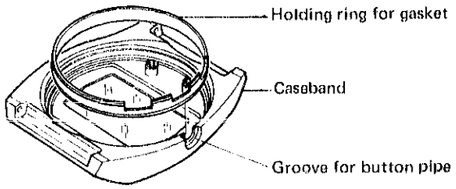
$(3)_1$ Stem with crown
While pushing the arrow-marked portion with tweezers, pull out the stem with crown.

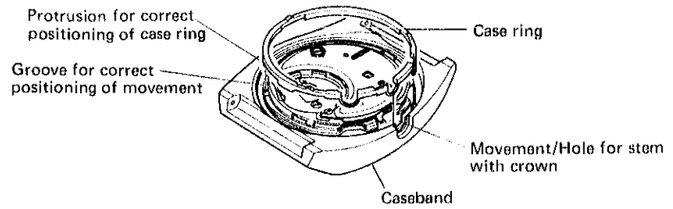


REMARKS FOR REASSEMBLING

② Holding ring for gasket
④ Movement
⑤ Case ring

Reassemble the above three parts as shown in the illustration on the right. Make sure that they are reassembled in the correct position and direction.

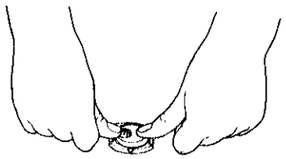


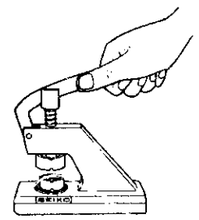


⑥ Case back

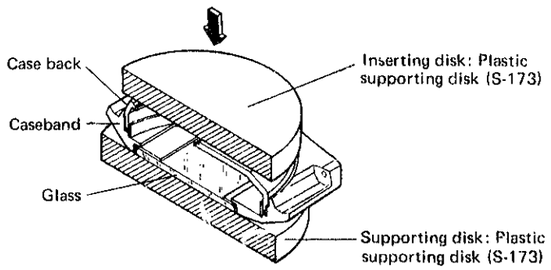
i) Mount the case back evenly on the caseband making sure that the stem with crown is set into the groove.

ii) Push the case back hard with fingers so that the caseband is snapped closed to the case back firmly as shown in the illustration. If it is not snapped closed with fingers, use SEIKO tightening tool.





(S-220)



⑦ Stem with crown
After reassembling, check to see if the stem with crown is pulled out and then pressed in correctly.

REPLACEMENT OF THE GLASS

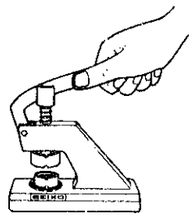
(As the glass is combined with the caseband, disassemble it only when the replacement of parts is necessary. Use the case tightening tool S-220.)

- **How to disassemble the glass**

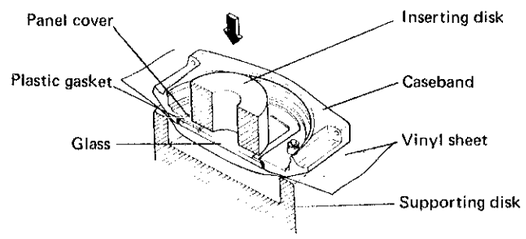
  Use the S-160 Disk unit to disassemble the glass.

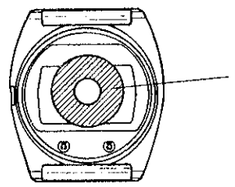
  Inserting disk: ϕ18.5 mm ~ ϕ19.5 mm
  Supporting disk: ϕ33.0 mm ~ ϕ35.0 mm

  - Place a vinyl sheet between the supporting disk and the glass as shown in the illustration.
  - Push the glass together with the panel cover for disassembling.



(S-220)





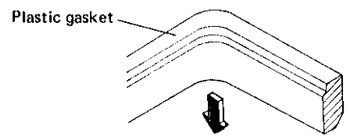
- **How to reassemble the glass**

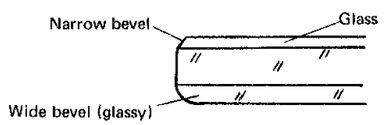
  i) Fix the plastic gasket
  - Be sure to replace it with a new plastic gasket so as to maintain high water-resistance.
  - Do not mistake the upper side of the gasket for the lower side.

  ii) Fix the panel cover
  Be sure to fix the back side of the panel cover firmly to the caseband.

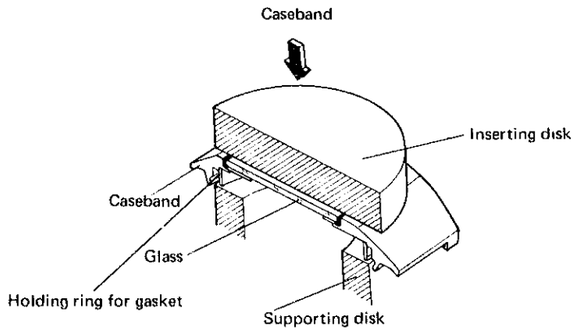
  iii) Set the glass
  Do not mistake the upper side (narrow bevel) of the glass for the lower side (wide bevel) which fits into the caseband.

  iv) Push the glass in
  Inserting disk: Plastic supporting disk (S-173)
  Supporting disk: ϕ26.0 mm ~ ϕ27.0 mm





Inserting disk: Plastic supporting disk (S-173)
Supporting disk: ϕ26.0 mm ~ ϕ27.0 mm



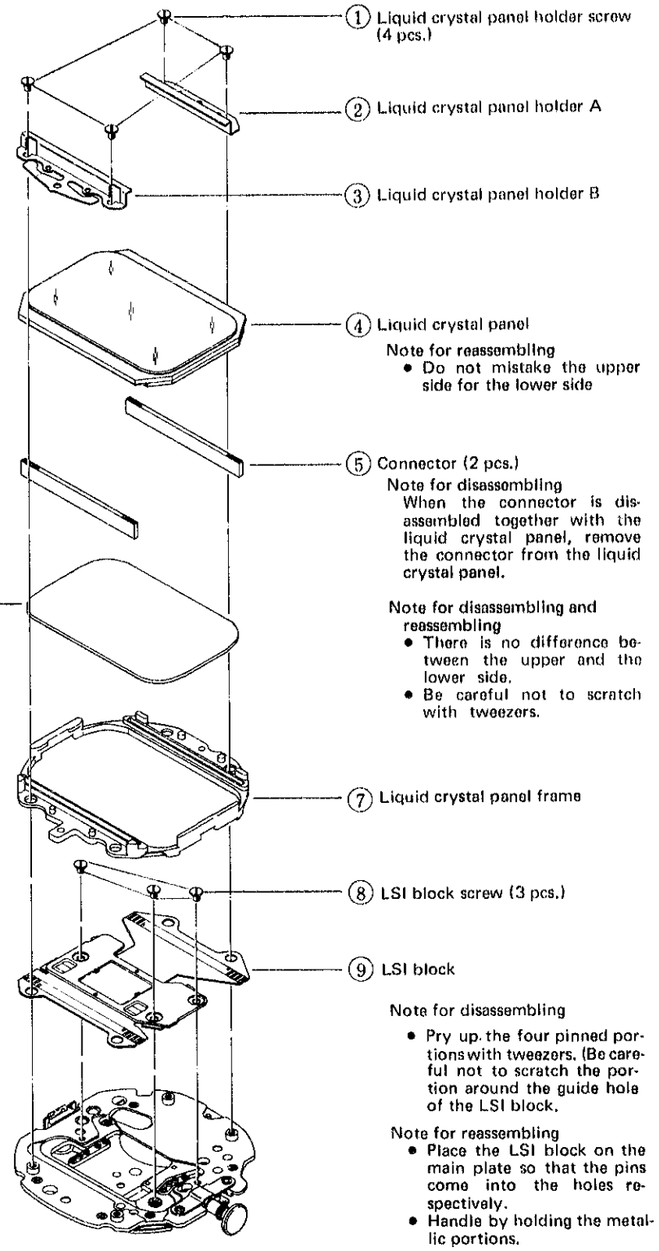
(The holding ring for gasket must be placed on the supporting disk as shown above.)

3. Disassembling and reassembling of the movement and lubricating of the switch components

Disassembling procedures Figs.: ① ~ ⑳
Reassembling procedures Figs.: ⑳ ~ ①
Lubricating: SEIKO Watch Oil, S-6, ⊂⊃
Normal quantity

ALL THE SCREWS USED ARE THE SAME.

NOTE:
After reassembling, hold the battery with the battery holding spring and check the display.
If there are any display failures, the connector might not be placed in the correct position. Move the connectors and reassemble them in the correct position.



④ Liquid crystal panel
Note for reassembling
- Do not mistake the upper side for the lower side

⑤ Connector (2 pcs.)
Note for disassembling
When the connector is disassembled together with the liquid crystal panel, remove the connector from the liquid crystal panel.

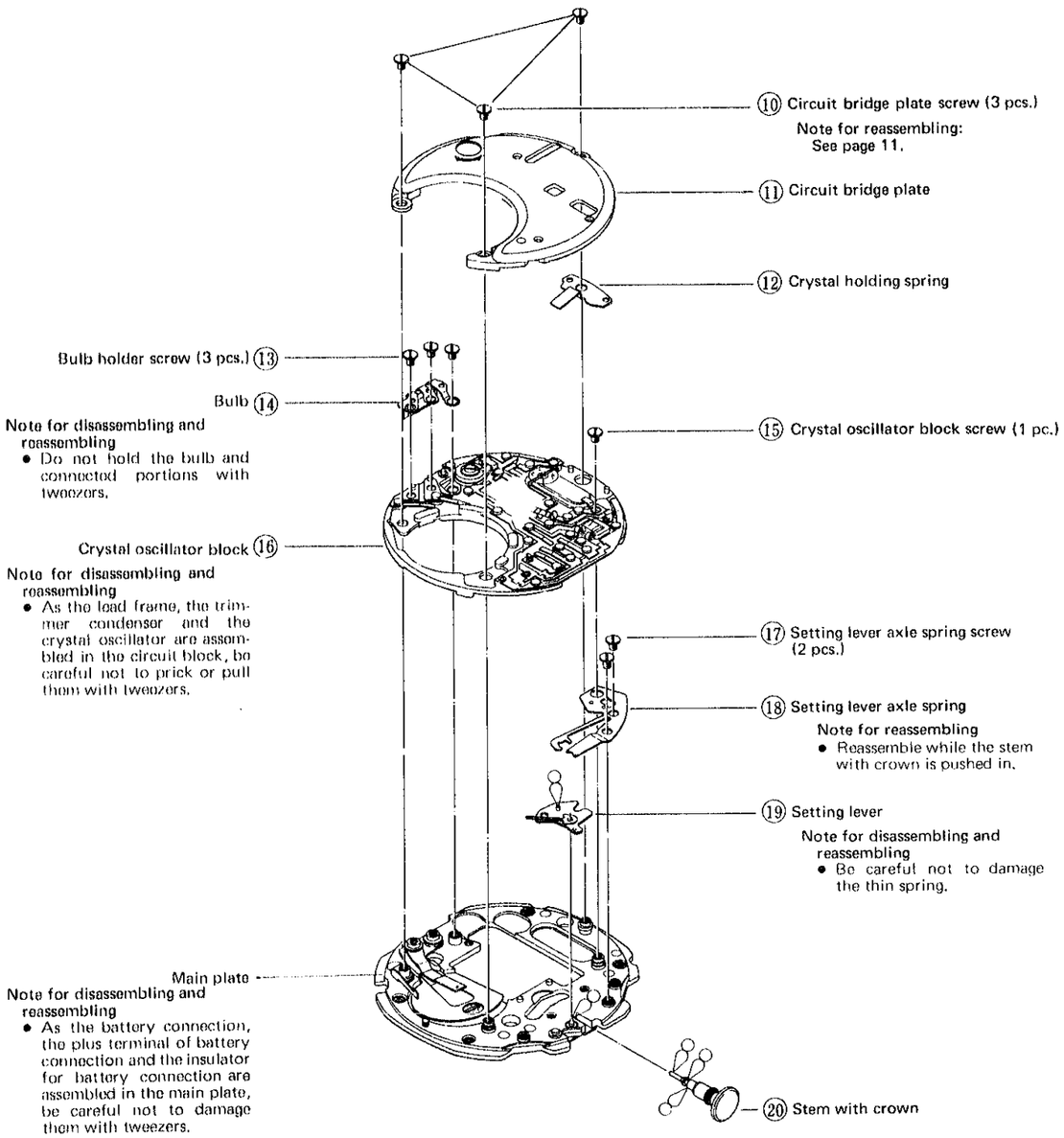
⑥ Reflecting mirror
Note for disassembling and reassembling
- Be careful not to scratch the surface
- Reassemble with the black coated side down.

Note for disassembling and reassembling
- There is no difference between the upper and the lower side.
- Be careful not to scratch with tweezers.

⑨ LSI block

Note for disassembling
- Pry up the four pinned portions with tweezers. (Be careful not to scratch the portion around the guide hole of the LSI block.

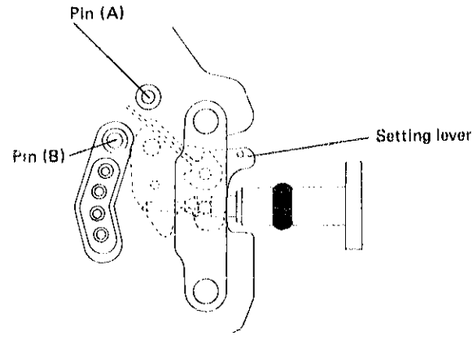
Note for reassembling
- Place the LSI block on the main plate so that the pins come into the holes respectively.
- Handle by holding the metallic portions.



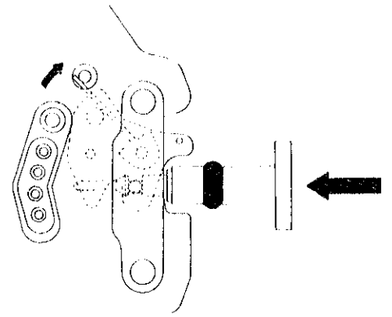
REMARKS FOR REASSEMBLING

With the movement reassembled by following the procedures from ⑳ to the circuit bridge plate screw ⑩ as explained in Page 14, check the movement by the following procedures.

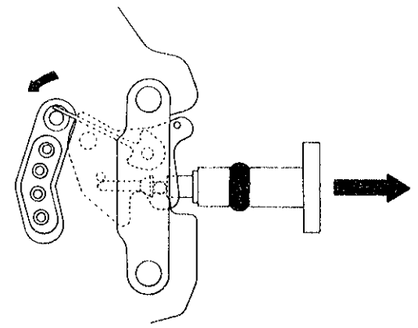
1. When the stem with crown is in the normal position, the spring of the setting lever touches neither pin (A) nor pin (B).



2. When the stem with crown is pushed in, the spring of the setting lever touches pin (A) but it does not touch pin (A) when the stem with crown is released back to the normal position.
This acts as a switch mechanism and enables the watch to change from the time and calendar function to the stopwatch function and vice versa.



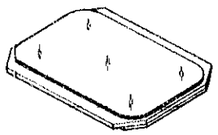
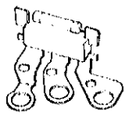
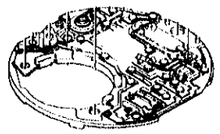
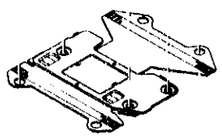
3. When the stem with crown is pulled out, the spring of the setting lever touches pin (B), and this makes the time and calendar display ready to be adjusted.



4. Cleaning

Since several parts of M159 differ from conventional mechanical watches, use the following method when cleaning.

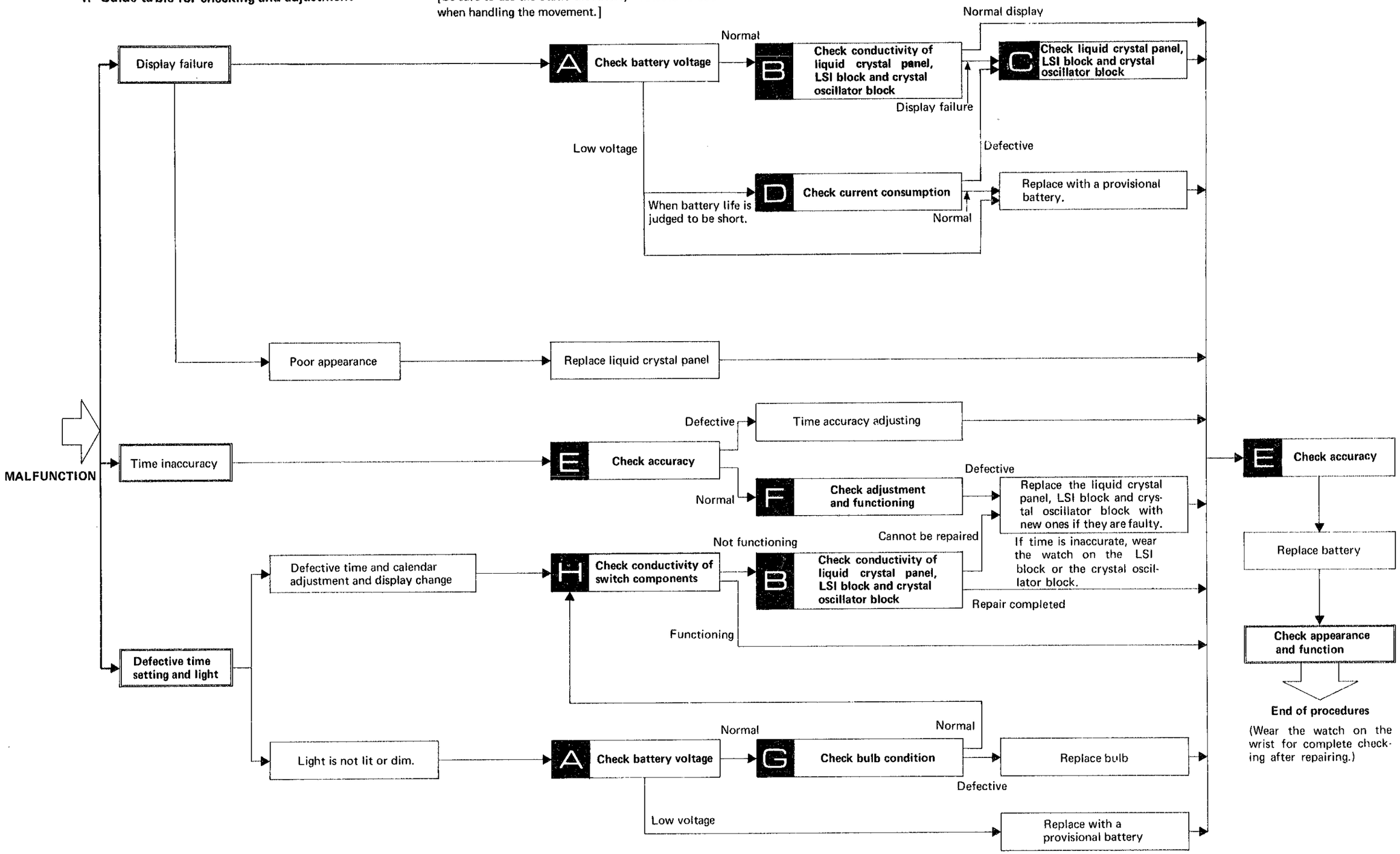
HOW TO CLEAN

Name of parts	Cleaning	Drying	Solution	Remarks
Liquid crystal panel 	DO NOT CLEAN			• Wipe dust and lint off with a soft brush.
Reflecting mirror 				• Wipe the electrodes of the liquid crystal panel and the LSI block ONLY with a cloth moistened with benzine or alcohol.
Bulb 				
Crystal oscillator block 				
LSI block 				
Connector 	Rinse or wash with a soft brush	Cool air	Alcohol	• Do not use benzine and trichloroethylene.
Main plate Liquid crystal panel frame Circuit bridge plate	Rinse or wash with a soft brush	Cool air	Benzine or alcohol	
Parts other than above	Clean with cleaner, rinse or wash with a soft brush.	Cool or hot air	Trichloro-ethylene, benzine or alcohol	

IV. CHECKING AND ADJUSTMENT

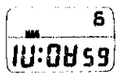
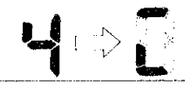
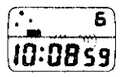
1. Guide table for checking and adjustment

[Be sure to use the Static Electricity Protector S-830 when handling the movement.]



2. Malfunction and checking points

- Check in the numerical order.
- Refer to "Guide table for checking and adjustment"on page 17.

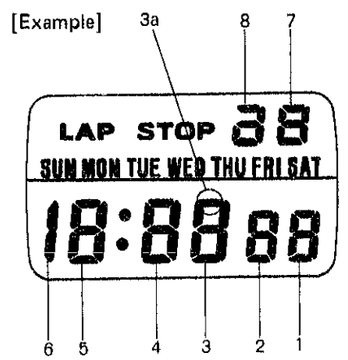
	FAULTY SYMPTOMS	CHECKING POINTS A: Battery voltage	B: Conductivity of liquid crystal panel, LSI block and crystal oscillator block	C: Liquid crystal panel	C: LSI block Crystal oscillator block	Time accuracy adjusting	F: Adjustment and functioning	G: Bulb	H: Switch components
DISPLAY FAILURE	No digital display, all segments are dim or poor response.	①	②	③	④				
DISPLAY FAILURE	Some segments of the digital figures are not lighted.  All segments are displayed or the segment which should be on and off is reversed as shown in the illustration.  		①	②	③				
DISPLAY FAILURE	(Deflection) Some or all of one segment show different contrast depending on the direction of view. Example:  (Poor appearance) Some portions of the liquid crystal panel will have air bubbles or iridescent view. Example: 			①					
TIME INACCURACY	Gain or loss tested by Quartz Tester.					①			
TIME INACCURACY	Though Quartz tester indicates the normal figures, a watch gains or loses when it is worn on the wrist.		②		③		①		
DEFECTIVE TIME AND CALENDAR SETTING, DISPLAY CHANGEOVER OR LIGHT	Defective time and calendar setting or failure of changeover of time and calendar display		②		③				①
DEFECTIVE TIME AND CALENDAR SETTING, DISPLAY CHANGEOVER OR LIGHT	Light is not lit or light is lit but dims soon.	①	④		⑤			②	③

3. Relation between segment (Liquid Crystal Panel Electrode) and 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 correct procedures for checking and adjustment.

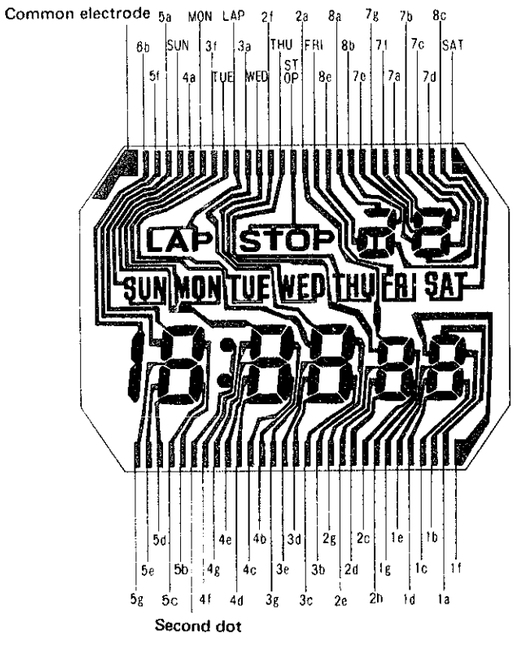
Note: All segments are displayed or the segment which should be on and off is reversed when the common electrode causes defective conductivity.

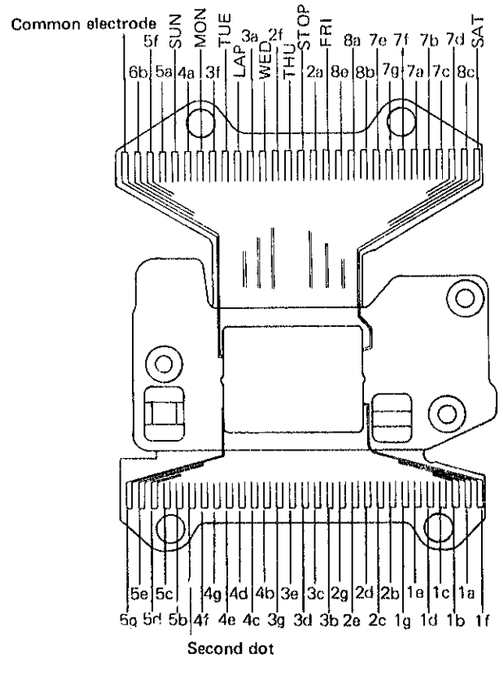
- **Designation of segment**



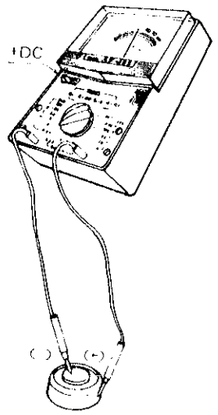
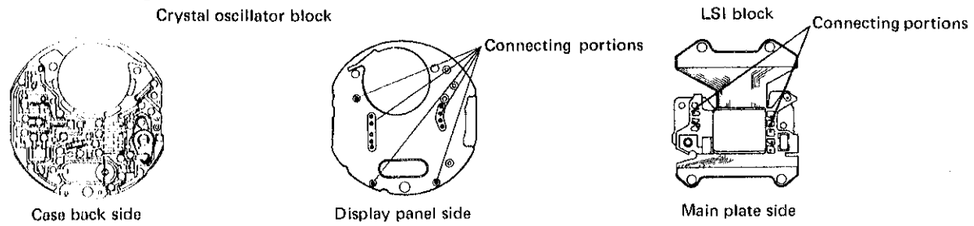
- **Connection with segment and C-MOS- LSI output terminal**

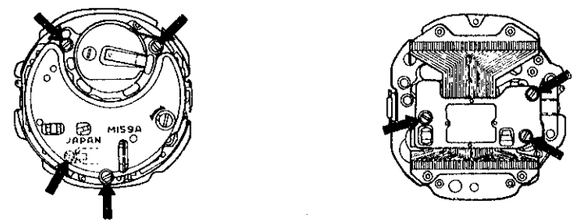
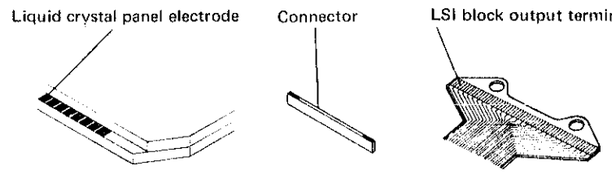
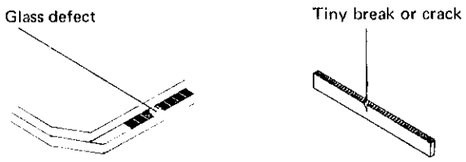
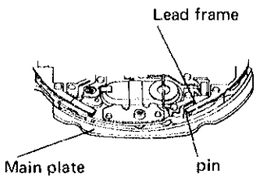
The liquid crystal panel electrode is connected electrically with each segment which forms a digital figure as shown in the illustration of the panel pattern below.
(The panel pattern can be seen if the panel is slightly tilted and looked at in an angular position.)
Also, the liquid crystal panel electrode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



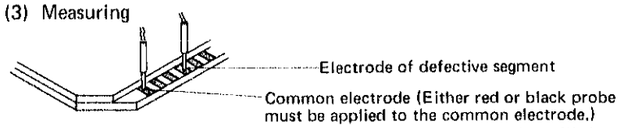
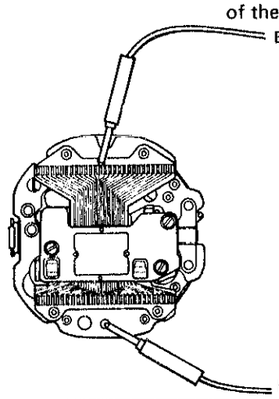


4. Procedures for checking and adjustment

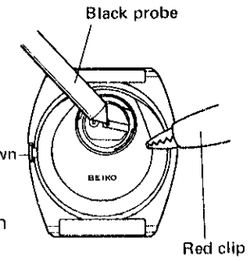
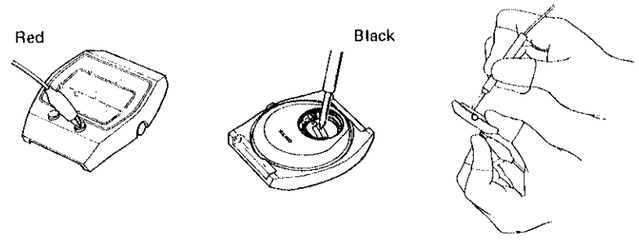
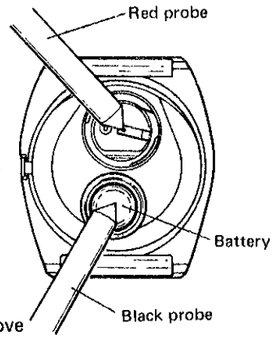
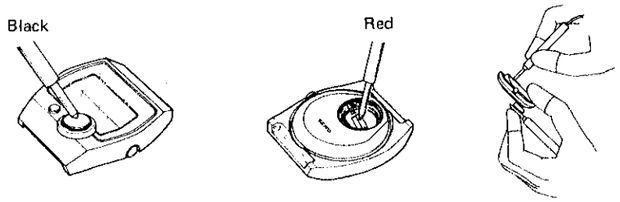
	Procedure	Result and Repair
A CHECK BATTERY VOLTAGE	Use the following procedures to check battery voltage. **1. Set up the volt-ohm-meter** Range to be used: DC 3V **2. Measuring** • Probe Red (+) . . . . Battery surface (+) • Probe Black (–) . . Battery surface (–) When there is battery electrolyte 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 movement from the case** **2. Disassemble the movement** **3. Wipe off battery electrolyte on the crystal oscillator block and the LSI block** (1) Wipe off battery electrolyte on the lead frame, each connecting portion, etc. with a cloth moistened with distilled water. (Do not use such fluffy cloth as gauze, flannel, etc.) When the crystal oscillator block and the LSI block are cleaned, be sure to clean the shaded portions shown below and the connecting portions. **Note:** Do not expose the trimmer condenser to water or alcohol, and if it is exposed, there may be a change in its condenser capacity and eventually in the time accuracy.  (2) Wipe the shaded portions and the connecting portions again with a cloth moistened with alcohol. (If the cleaned portions remain wet with water, they will corrode with rust.) (3) Dry with cool air by using a dryer. **4. Wipe off battery electrolyte on the other parts (main plate, switch components, etc.).** (1) Wipe off battery electrolyte on each portion with a soft brush moistened with distilled water. (If distilled water is not available, use ordinary water.) (2) Rinse with alcohol. (3) Dry with cool air by using a dryer. **5. Reassemble the movement** Replace the battery with a new one. **6. Check if the time setting functions and the current consumption are normal.**	

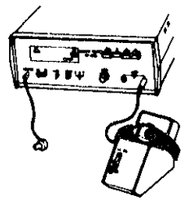
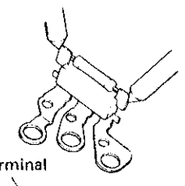
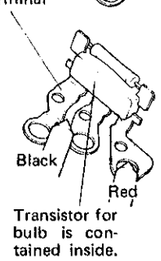
	Procedure	Result and Repair
B CHECK CONDUCTIVITY OF LIQUID CRYSTAL PANEL, LSI BLOCK AND CRYSTAL OSCILLATOR BLOCK	(1) Make sure that the screws are tightened firmly. 1. Crystal oscillator block screw (1 pc.), circuit bridge plate screws (3 pcs.) 2. LSI block screws (3 pcs.)  (2) Check for dust, lint or other contamination on the conductive portions shown in the illustration below.  (3) Check the liquid crystal panel electrode for any glass defect and the connector for any tiny break.  (4) Remove the circuit bridge plate and check the connection of the lead frame of the crystal oscillator block with the pins by using a microphone. 	No loosened screws . . . Normal Proceed to B 2 Loosened screws . . . . . Defective Retighten screws Uncontaminated . . . Normal Proceed to B 3 Contaminated . . . . . Defective Wipe off any foreign matter. No glass defects, break or crack . . . . . Normal Proceed to B 4 Glass defects, break or crack . . . . . Defective Replace with new ones Lead frame, Pin, Main plate . . . . . Normal If time is inaccurate, wear the watch on the wrist for test. . . . . . Defective Bend the lead frame with tweezers so that it touches the pin.

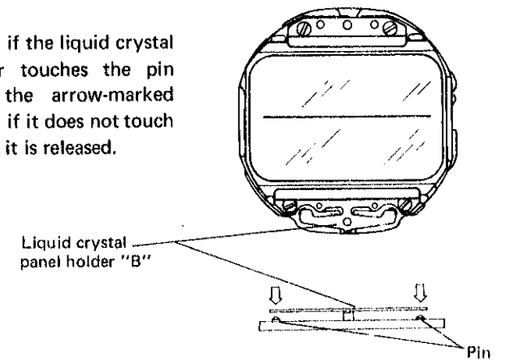
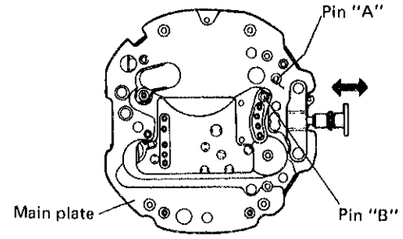
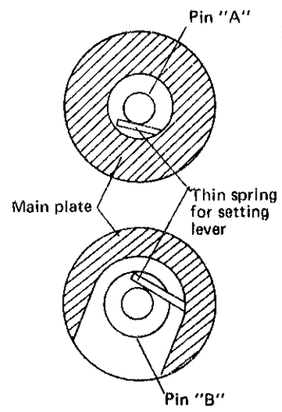
C CHECK LIQUID CRYSTAL PANEL, LSI BLOCK AND CRYSTAL OSCILLATOR BLOCK

Procedure	Result and Repair
Check to see if the liquid crystal panel and the crystal oscillator block function correctly. (Refer to "Relations between the segment and the C-MOS-LSI output terminal" on page 19.)	
1. Check liquid crystal panel	
(1) Set up the volt-ohm-meter Range to be used: OHMS R X 1 ~ R X 1K **Note:** • Any range will do if more than 3V is applied to the terminal of the volt-ohm-meter. • If the output voltage of the volt-ohm-meter is less than 3V in measuring, all segments may not be lit. When no segment is lit, change the range to R X 10K which is higher in resistance than R X 1K.	
(2) Remove the liquid crystal panel from the movement and turn it upside down. Apply the probes.	
(3) Measuring  **Note:** Either red or black probe will do.	Lights up . . . . . Normal Proceed to C 2 Does not light up . . . Defective Replace the liquid crystal panel with a new one.
2. Check the LSI block and crystal oscillator block output voltage.	
(1) Set up the volt-ohm-meter. Range to be used: DC 3 V	
(2) After reassembling the battery and the battery holding spring to the movement, remove the liquid crystal panel holder screw, liquid crystal panel holder, liquid crystal panel, connector, reflecting mirror and the panel frame ⑦ as explained on page 13.	
(3) Measuring Probe Red (+) . . . . Main plate Probe Black (–) . . . One of the output terminals of the C-MOS-LSI  (If some displays are defective, apply to the corresponding output terminals of the C-MOS-LSI.)	More than 0.8 V . . . Normal (All the terminals must be more than 0.8 V.) Return to B Less than 0.8 V . . . . Defective → Replace the crystal oscillator block or the LSI block with a new one and check to see if it functions correctly. (This will tell which block is defective.)

D CHECK CURRENT CONSUMPTION

Procedure	Result and Repair
Check to see if the current consumption is normal. Check under the following three conditions. 1. Time and calendar function 2. Stopwatch function 3. Time and calendar adjusting function **Measuring** **(1) Micro Test** • Probe Red (+) . . . . . Case • Probe Black (–) . . . . Battery connection  If current consumption cannot be measured (if electricity does not flow from the movement to the case), apply the red probe (+) to button "B" (or stem with crown) for measuring.  **Reason:** • Button is connected electrically with (+). • Application of a probe to button "A" activates the light and electricity consumption increases excessively.	*** Note:** If the pointer of the volt-ohm-meter swings over the maximum value when 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 0.03mA again for measuring. Less than 3.5 μA . . . . Normal Replace with a provisional battery More than 3.5 μA . . . Defective Proceed to C
(2) Volt-ohm-meter Place the battery on the case back with its minus surface turned up. Range to be used: DC 0.03 mA* • Probe Red (+) . . . . Battery connection • Probe Black (–) . . . Battery surface (–)  If measurement is impossible by the above procedures, place the battery on button "B" (or stem with crown) and touch it with the probe.  	

	Procedure	Result and Repair
E CHECK ACCURACY	Check gain and loss of time. **1. Set up the Quartz Tester.** As there are several different types of the Quartz Testers, refer to the respective instruction manual. **2. Measuring** 	Neither gain nor loss ... Normal Either gain or loss ..... Defetive Time accuracy adjusting (See page 26 for reference.)
F CHECK ADJUSTMENT AND FUNCTIONING	**1. Check adjustment** Check to see if the digit adjustment can be made correctly by the button operation following the procedures on page 4. • Check adjustment by following all the adjusting procedures. **2. Check functioning** Check to see if the stopwatch device functions correctly by following the procedures on page 5.	Can be adjusted ..... Normal Proceed to B Cannot be adjusted ... Defective Replace the LSI block or crystal oscillator block with new ones.
G CHECK BULB CONDITION	Check to see if the bulb functions correctly. **1. Check to see if there are any loosened bulb holder screws (3 pcs.)** **2. Check by the Volt-ohm-meter.** (1) Remove the bulb from the crystal oscillator block. (2) Set up the Volt-ohm-meter Range to be used: OHMS R X 1 (3) Checking I) Check to see if there is a broken filament in the bulb and if there is any break in the soldered portion of the terminal. Probe Red (+) Probe Black (–) Apply to either side of the bulb  II) Check to see if the transistor for bulb functions correctly.  Probe Red . . . Bulb lead terminal shown in the illustration. Probe Black . . . Two other bulb lead terminals. **Note:** The light might become slightly dim due to the transistor used for the bulb.	No loosened screw . . . Normal Proceed to G 2 Loosened screws .... Defective Retighten screws Lights up ..... Normal Proceed to G (3) II) Does not light up . . . Defective Replace bulb with a new one. Lights up ..... Normal Proceed to H Does not light up . . . Defective Replace bulb with a new one.

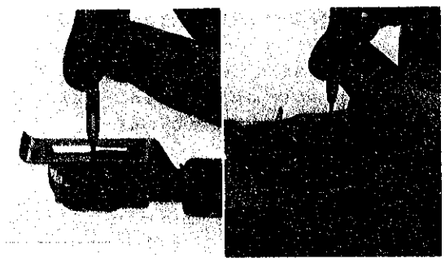
	Procedure	Result and Repair
H CHECK CONDUCTIVITY OF SWITCH COMPONENTS	**1. Remove the movement and check to see if the switch portion of the liquid crystal panel holder "B" functions correctly.** • **Checking** Check to see if the liquid crystal panel holder touches the pin pushed in the arrow-marked direction and if it does not touch the pin when it is released.  **2. Check to see if the thin spring of the setting lever functions correctly.** Check after disassembling procedures have been completed up to (9) LSI block and setting the stem with crown in position as explained on page 13. (Pins "A" and "B" are combined with the crystal oscillator block.)  • **Checking** Check with a microscope. (1) Check to see if the thin spring of the setting lever touches the pin "A" when the stem with crown is pushed in and if it disconnects from pin "A" when the stem with crown is released. (2) Check to see if the thin spring of the setting lever touches the pin "B" when the stem with button is pulled out and if it does not touch the pin "B" when the stem with button is pushed in.  (3) Check for dust, lint or other contamination on the conductive portions of the parts above. When there is battery electrolyte leakage, refer to "HOW TO CHECK BATTERY ELECTROLYTE LEAKAGE AND REPAIR" for repairing.	Functions correctly . . . Normal Proceed to H (2) Does not function correctly ..... Defective Adjust the switch (If adjustment is impossible, replace the liquid crystal panel holder "B" with a new one.) Functions correctly..... Normal Proceed to H (3) Does not function correctly ..... Defective Adjust the thin spring. (If adjustment is impossible, replace the setting lever with a new one.) Uncontaminated . . . Normal Proceed to B Contaminated ..... Defective Wipe off carefully

TIME ACCURACY ADJUSTING

Time accuracy of Cal. M159A is adjusted by turning the trimmer condenser.

- **Adjusting method**

  The watch will gain or lose according to the direction in which the trimmer condenser is turned.
  Adjustment should therefore be made after ascertaining with the Quartz Tester whether the watch tends to gain or lose.

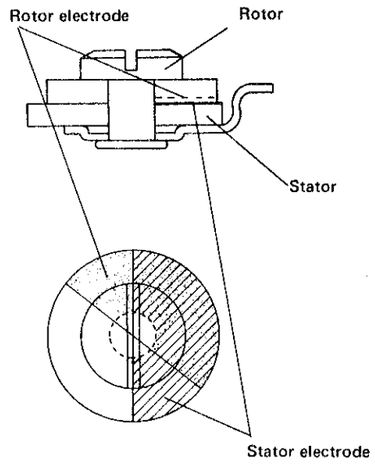


- **Note for handling the trimmer condenser**

  Avoid excessive depressing and turning of the trimmer condenser.

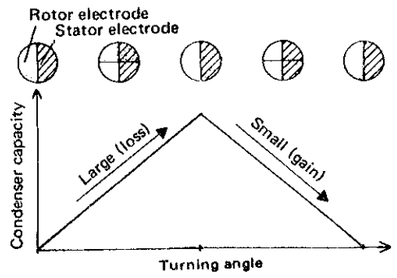
- **Function of the Trimmer Condenser**

  The trimmer condenser consists of a rotor electrode and a stator electrode as shown in the diagram.
  Turning the shaft fixed to the rotor changes the overlapped area between the stator electrode and rotor electrode, which in turn changes the capacity of the trimmer condenser.



- **Change in the capacity of trimmer condenser and the adjusting accuracy rate.**

  Turning the trimmer condenser changes its capacity as shown in the diagram.
  The trimmer condenser has been adjusted at the factory so as to let the watch gain when it is turned clockwise and vice versa. Whenever adjustment is needed, however, turn the trimmer condenser while examining the gain and loss by the Quartz Tester.



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