TECHNICAL INFORMATION

CITIZEN QUARTZ

Cal. No. 959※

CITIZEN

CONTENTS

■1. OUTLINE

This is a full-scale sport-type digital watch with multiple functions and developed from Cal.No.944※※which is precedently marketed as one of the leaders among Citizen sport-type digital watches.

■2. FEATURES

1) A full-scale sport watch with multiple functions:
   - A pacemaker, a stopwatch and a LAP counter are incorporated in addition to the functions of the time display and alarm.
   - Setting of desired time (with previous alarm)
     A desired time is previously set, and thus the previous alarm is produced with each second and for 9 seconds before the set time.
   - Call-out of LAP time record
     The call-out is possible for the maximum 6 different types of lap time and stop time.

2) Lifetime of about 5 years for power cell:
   A long lifetime is assured for the power cell thanks to the use of a lithium cell.

3) No adjustment of time rate carried out on the market:
   Owing to adaption of the DFC (digital frequency control), a perfect adjustment is already carried out for the time rate at the factory side. Accordingly no adjustment of time rate is carried out on the market.

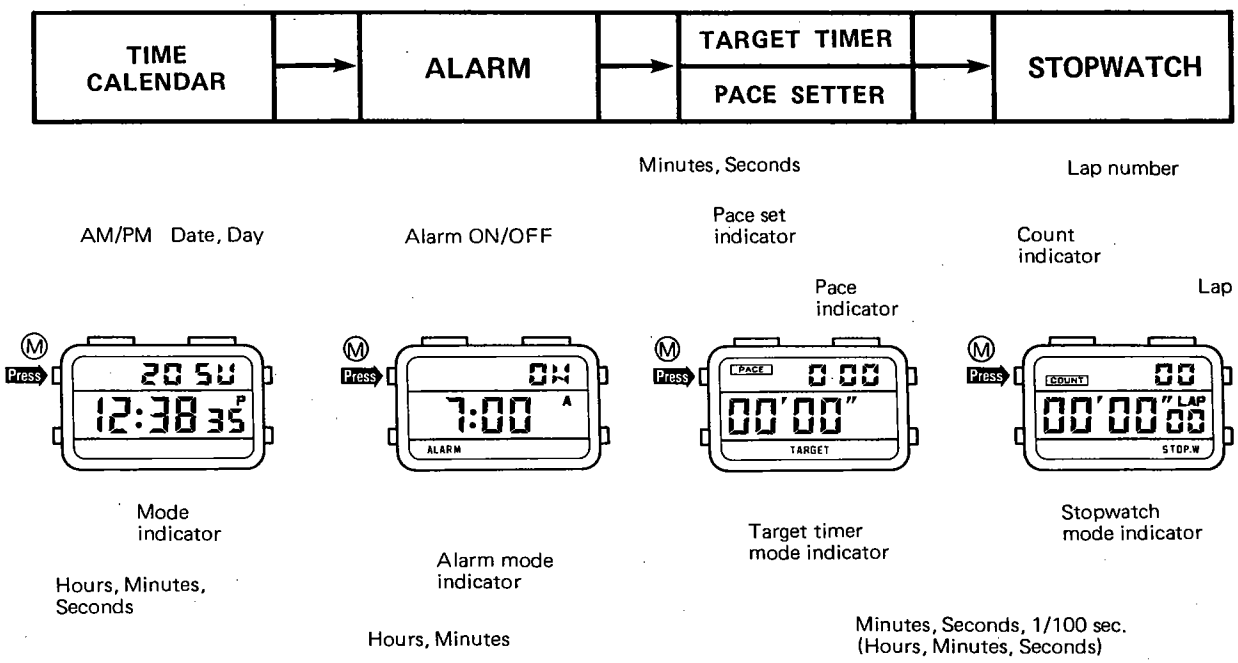
■3. SPECIFICATIONS

Caliber No.	9590
Type	C/MOS-LSI (1 unit)
Module Size	Outer dia.: 27.00φmm Thickness: 4.98^{t}mm (Inc. power cell part)
Accuracy	±20 sec./month at normal temperatures
Oscillation	32,768Hz
Method of display	FE (Field Effect) type nematic LC plus split multiplex driving
Integrated circuit	C/MOS-LSI (1 unit)
Effective temperature range	±0°C ~ +55°C (32°F ~ 131°F)
Adjustment of time rate	DFC method (Unit time of measurement 10 sec. with no terminal for adjustment)
Display functions: Time (Calendar) Alarm Pace setter Target timer Stopwatch	Push-button operated change-over display Hours, Minutes, Seconds, AM/PM, Day, Date, (Under adjustment) Year, Month, 12/24-hour switching Hours, Minutes, AM/PM, Alarm, ON/OFF 0 – 239/minute Minutes, Seconds (up to 79'59") Measurement of Minutes, Seconds, 1/100 second — Stopwatch (up to 59'59"99) 12 hours ····· Hours, Minutes, Seconds — Stopwatch (up to 11:59'59")
Additional functions	●Alarm monitor ●12/24-hour switching ●Illumination lamp ●Auto return system ●Instant manual return ●Fully automatic calendar (up to the year 2019) ●Warning buzzer (9 secs. before the target time) ●Lap time marker (up to 99 laps) ●Lap time memory unit (up to 6 LAP records)
Power cell (Lithium)	Parts No. : 280–204 (1 unit)/280–202 Maker code : CR2016 (Li/MnO_2)/BR2016 (Li/(CF)n) Size : 20.0φmm x 1.6^{t}mm Nominal voltage : 3V Capacity : 65mAH Lifetime : Approx. 5 years based on the assumed daily use of the Alarm 30 secs; Illumination 3 secs; and Pace Setter 15 sec/week

■4. HANDLING INSTRUCTIONS

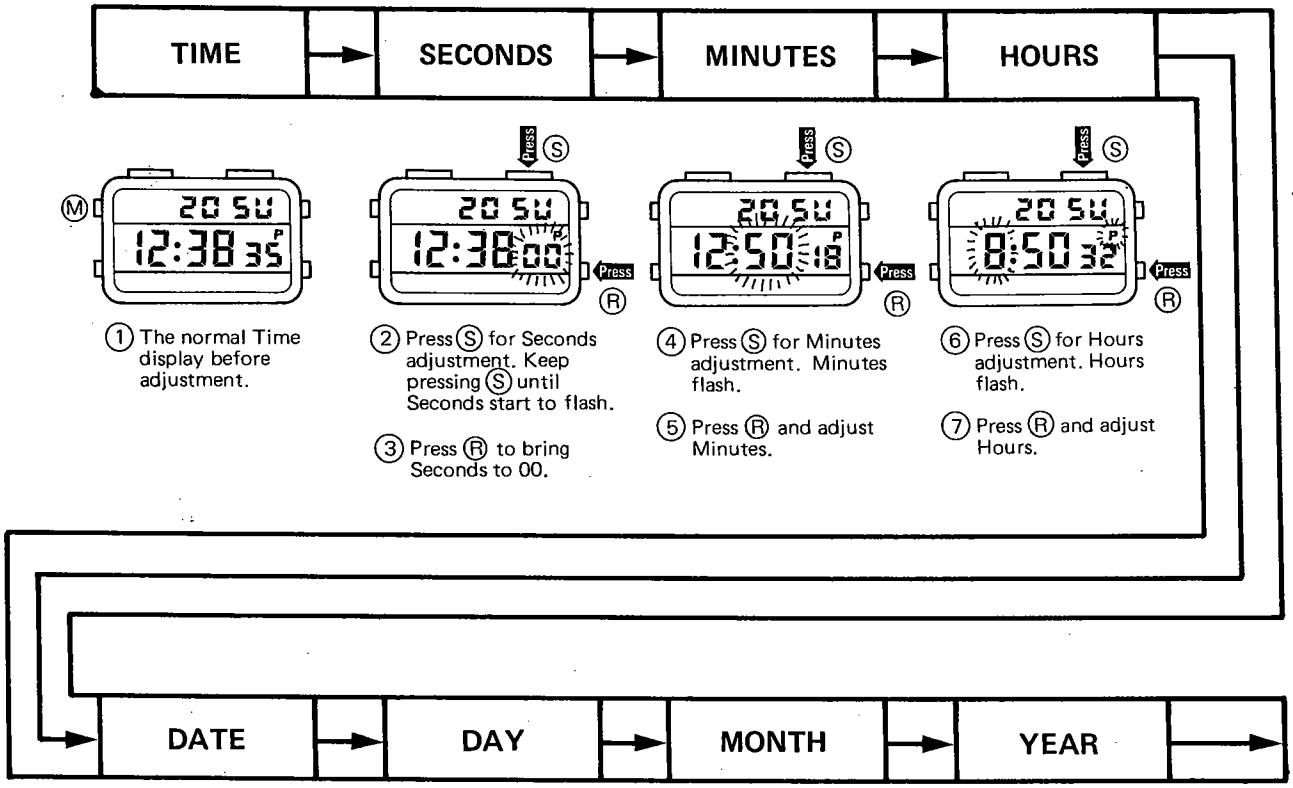
4-1. Selecting basic functions

- Press Ⓜ button to select functions.



- The mode indicator will flash when the watch is set to a desired function.
- If the watch is left in the ALARM or TARGET TIMER mode for 1–2 minutes, the AUTO RETURN SYSTEM will activate and the watch will return to the normal TIME display.
- The TIME display can be changed from 12-HOUR to 24-HOUR DISPLAY or vice versa (see p.5). The 12/24-HOUR display of the ALARM will coincide with that of the TIME.
- The static mode indicators which will appear when the watch is set to the normal TIME display shown the functions set in operation.
- The CALENDAR function is programmed up to the year 2019, including the leap years.

4-2. Adjusting the time & calendar



① The normal Time display before adjustment.

② Press Ⓢ for Seconds adjustment. Keep pressing Ⓢ until Seconds start to flash.

③ Press Ⓡ to bring Seconds to 00.

④ Press Ⓢ for Minutes adjustment. Minutes flash.

⑤ Press Ⓡ and adjust Minutes.

⑥ Press Ⓢ for Hours adjustment. Hours flash.

⑦ Press Ⓡ and adjust Hours.

⑧ Press Ⓢ for Date adjustment. Date flashes.

⑨ Press Ⓡ and adjust Date.

⑩ Press Ⓢ for Day adjustment. Day flashes.

⑪ Press Ⓡ and adjust Day.

⑫ Press Ⓢ for Month adjustment. Month flashes.

⑬ Press Ⓡ and adjust Month.

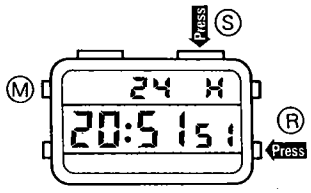
⑭ Press Ⓢ for Year adjustment. Year flashes.

⑮ Press Ⓡ and adjust Year.

4-3. Setting the alarm

- The ALARM can be set by following the same procedure as that for TIME & CALENDAR adjustment. The ALARM can be set only to HOURS and MINUTES.
- The ALARM can be set ON/OFF by pressing A button when the watch is set on the normal ALARM display.
- The ALARM buzzer will sound for 30 seconds at the set time.
- The ALARM buzzer can be stopped by pressing any button.
- The static ALARM mode indicator in the normal TIME display shows that the ALARM is being set "ON".

4-4. 12-hour/24-hour



⑯ Press Ⓢ for 12/24-hour display adjustment. The Hour display flashes.

⑰ Press Ⓡ and select the 12-hour or 24-hour display.

⑱ Press Ⓢ or Ⓜ to finalize adjustment.

- INSTANT MANUAL RETURN to the normal TIME display can be made at any stage of adjustment by pressing Ⓜ button.
- RAPID ADVANCEMENT of any of the digits can be made by pressing Ⓡ button. For digit-by-digit advancement, press Ⓡ button on and off.
- If the watch is left in the adjustment mode for 1–2 minutes without operating any buttons, the AUTO RETURN SYSTEM will activate and the watch will be set to the normal TIME display.
- When adjustment is not needed for any digits, press continuously Ⓢ button to move to the next stage of adjustment.
- If a non-existent date is set during adjustment, the CALENDAR will show the 1st day of the next month when the watch is reset to the normal TIME display.

4-5. Using the pace setter

1) Buttons:

Ⓛ (ON/OFF): The beep goes ON/OFF each time this button is pressed.

Ⓡ (Pace Up): Press this button to increase the pace indicator digits (0 — 239). Keep pressing for rapid digital advancement.

Ⓟ (Pace Down): Press this button to decrease the pace indicator digits (239 — 0). Keep pressing for rapid digital subtraction.

2) The Beep

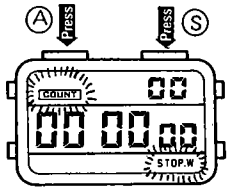
- The beep will sound at the pace set when Ⓛ button is pressed to start.
- The PACE SETTER can be set at a desired number (0 — 239) of pace per minute.
- The PACE SETTER can be operated both in the TARGET TIMER and STOPWATCH modes. The beep will continue even if the watch is set to the TIME or ALARM mode, but it cannot be started when the watch is in these modes. To stop the beep, press Ⓛ button in any mode.

4-6. Setting the timer

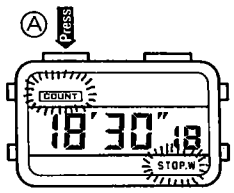
- The TIMER can be set by following the same procedure as that for TIME & CALENDAR adjustment.
- TIMER can be set to MINUTES and SECONDS up to 79'59".
- To start or stop the TIMER, press Ⓐ button after setting the watch to the TIMER mode. See the drawing.
- The buzzer will sound in confirmation each time Ⓐ button is pressed.
- The warning buzzer will be heard every second starting from 9 seconds before the TIMER set time.
- The countdown will continue repeating itself unless Ⓐ button is pressed to stop the TIMER.
- The TIMER cannot be set when the STOPWATCH is in use.

4-7. Using the stopwatch

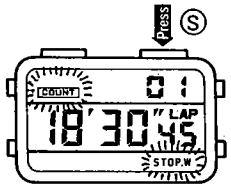
STOPWATCH RESET	→	STOPWATCH COUNTER	→	LAP TIME	→	STOPWATCH STOP



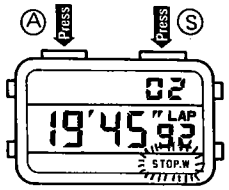
① Press Ⓐ and Ⓢ simultaneously to reset the Stopwatch display at 00'00"00.



② Press Ⓐ to start the Stopwatch Counter.



③ Press Ⓢ to take the LAP time. The LAP number is indicated on the upper right corner.



④ Press Ⓐ to stop the Stopwatch Counter.

⑤ Press Ⓢ to retrieve the lap time records stored in the Memory unit.

- The STOPWATCH will count up to 11:59'59" and the display will change automatically from MINUTES/SECONDS/1/100 SECOND to HOURS/MINUTES/SECONDS at 80 minutes.
- Each time the buttons are pressed, the buzzer will sound a short signal in confirmation.
- When Ⓢ button is pressed, the display will change to show the LAP time for approx. 5 seconds. The LAP time can be taken up to 99 times.
- The first five and last LAPs, and the finish time are stored in the memory unit. To retrieve these seven records, press Ⓢ button after finalizing the STOPWATCH COUNTER. Repeated memory retrievals are possible.
  The LAPs are indicated with the LAP number, the finish time by FIN.
- The TARGET TIMER and the STOPWATCH COUNTER can be used simultaneously if the TIMER has been set in advance. Thus, you can keep track of the target time and lap time at the same time. The TIMER will start from the original setting each time Ⓢ button is pressed.
- When the stopwatch is used after the replacement of power cell, both Ⓐ and Ⓢ buttons must be simultaneously pushed for one or more seconds (resetting operation) before the use of the stopwatch although the stopwatch is in the reset mode (00'00"00).

4-8. Alarm monitor

ALARM MONITORING can be conducted to check the sounding of the buzzer by pressing Ⓡ and (PD) buttons at the same time when the watch is set to the normal Time/Calendar display.

4-9. Display illumination

The display will be illuminated when the Ⓛ button is pressed.

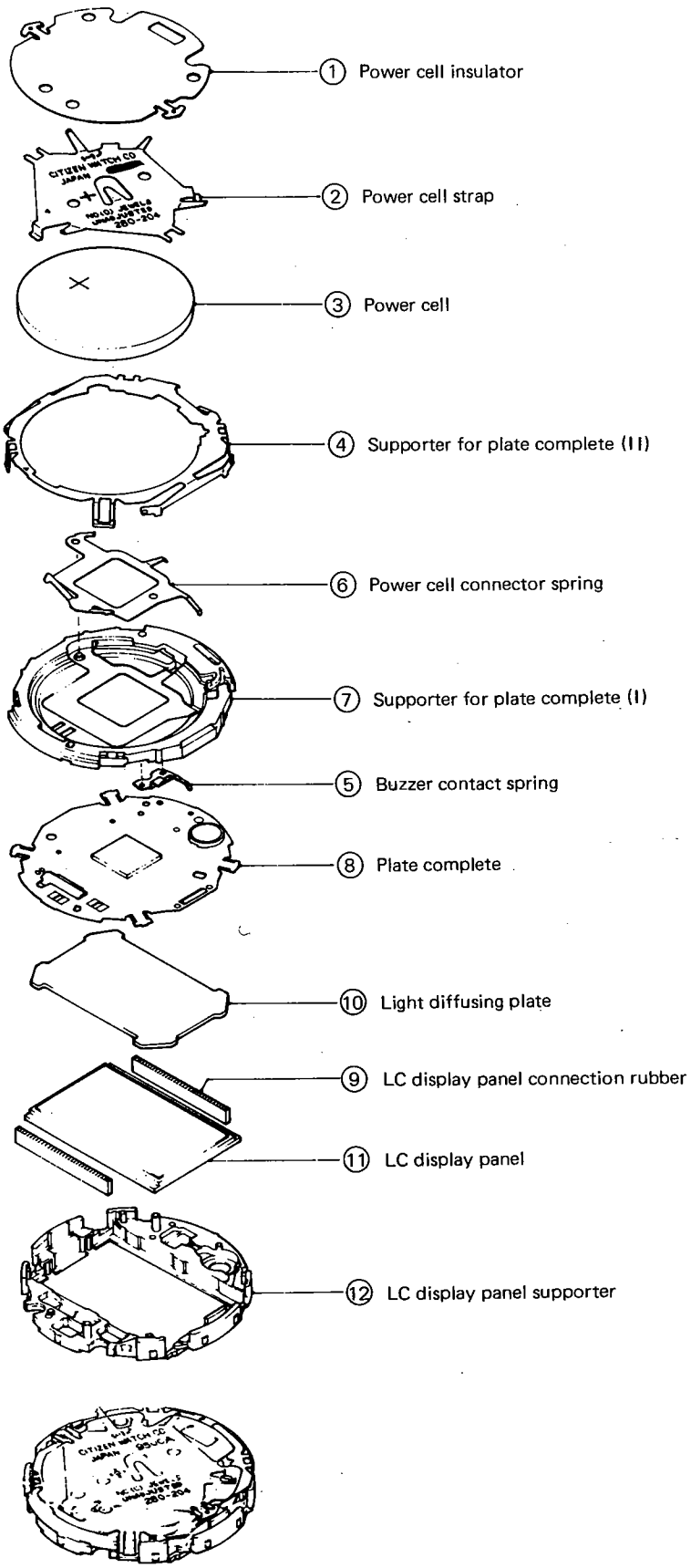
■5. DISASSEMBLY/ASSEMBLY OF MODULE

Disassembling procedure

① → ⑫

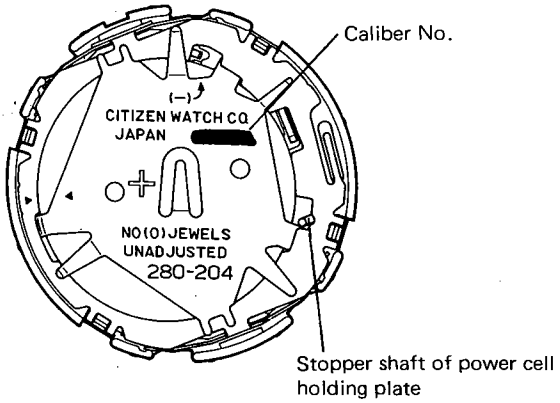
Assembling procedure

⑫ → ①



■6. NOTES ON DISASSEMBLY/ASSEMBLY

1) Follow the procedure described below for an attachment and detachment of the power cell holding plate.

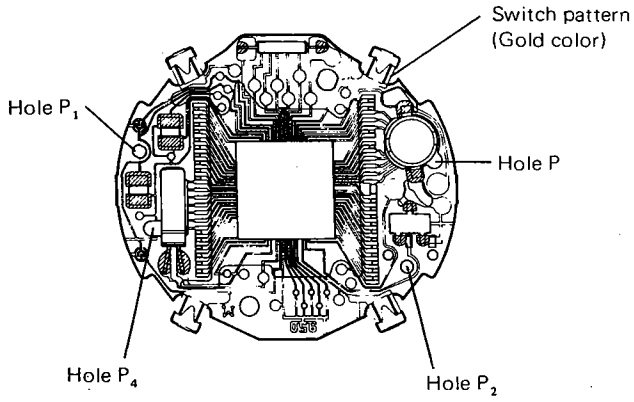


The power cell holding plate is slided left for detachment while the stopper shaft (shown by an arrow in the left diagram) is pushed up light with a tweezers or the like.

In this case, a good care must be given not to damage the stopper shaft.

When attaching the power cell holding plate, the holding plate is slided right while the tip of the holding plate is pressed down from above the stopper shaft.

2) Note the following points for an attachment and detachment of the plate complete.



1) The plate complete is positioned by holes P_1 and P_2.

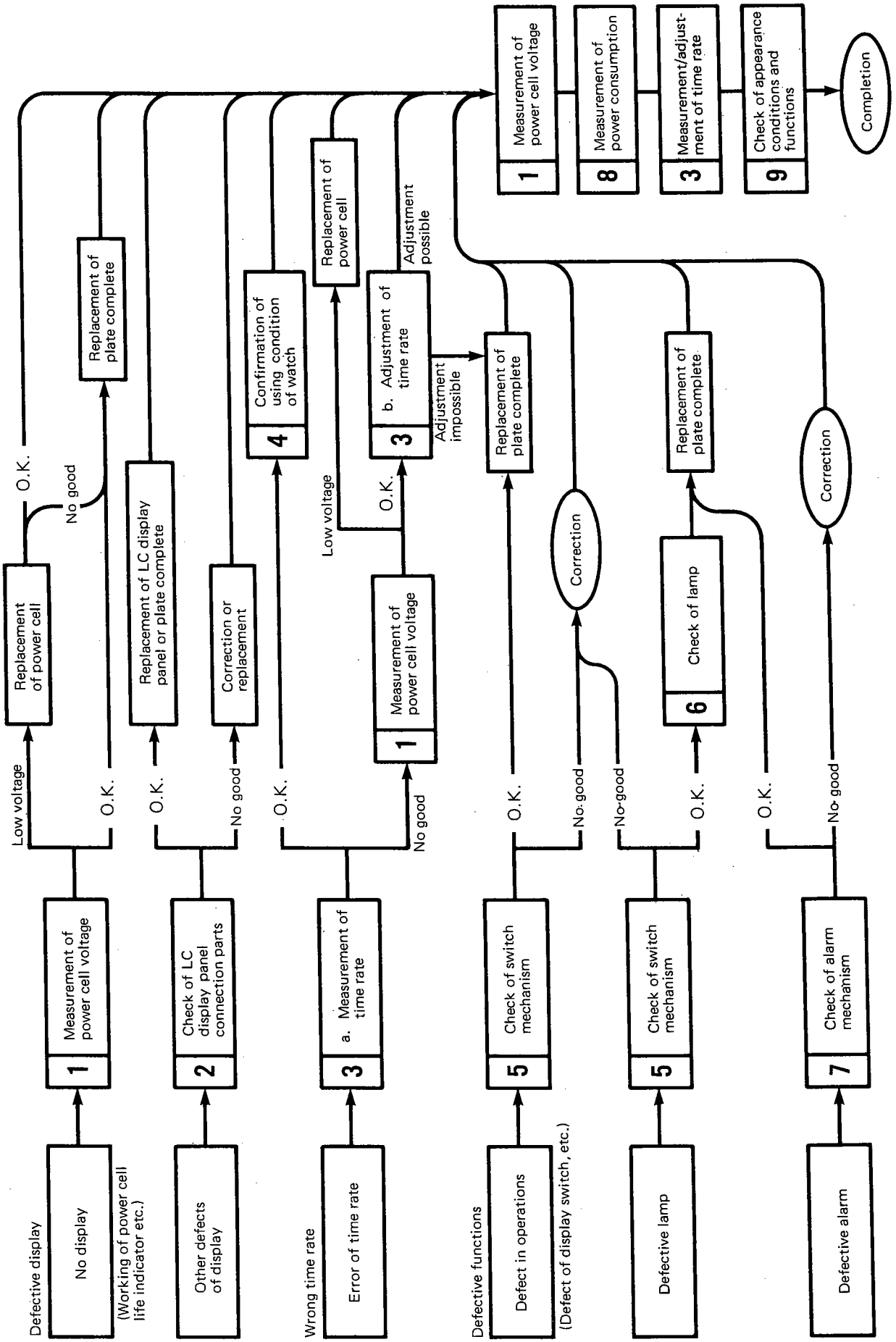
   The holes P_3 and P_4 are provided to secure a correct fixing between the plate complete and the LC display panel supporter.

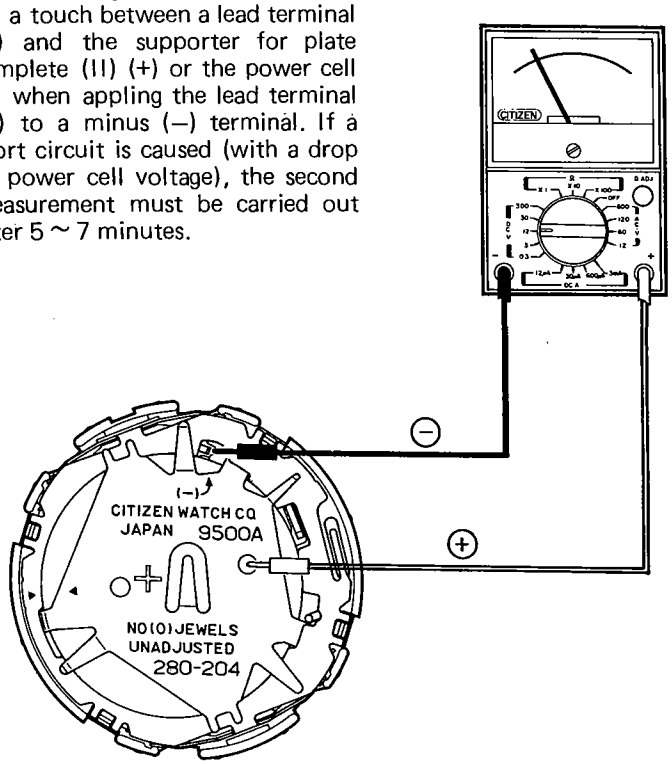
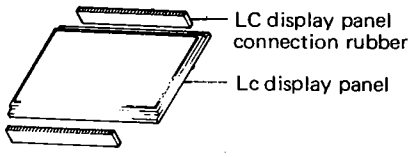
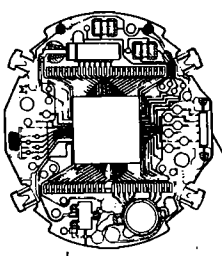
   Avoid applying a large amount of force to the LC and other parts when setting these holes.

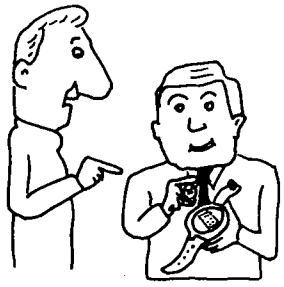
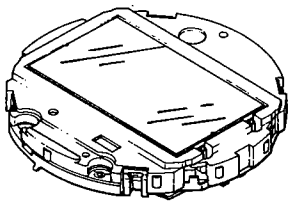
   If a correct and complete fixing is not secured between the plate complete and the LC display panel supporter, the switch pattern may be broken when the supporter for plate complete (I) is attached.

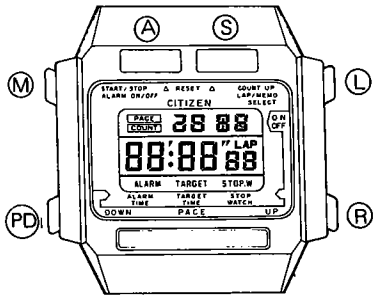
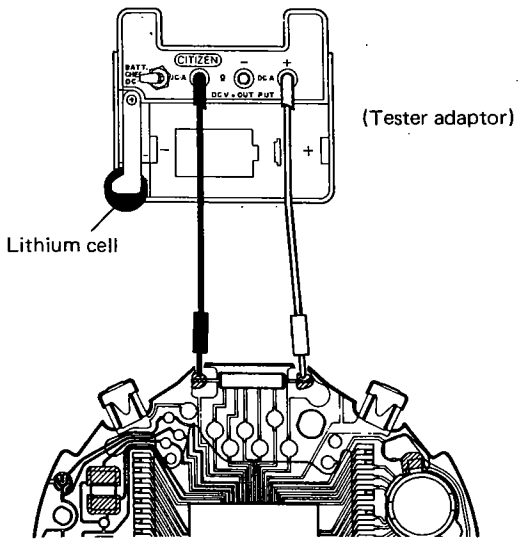
2) Avoid touching the switch pattern part with a tweezers or the like.

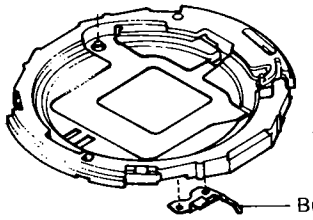
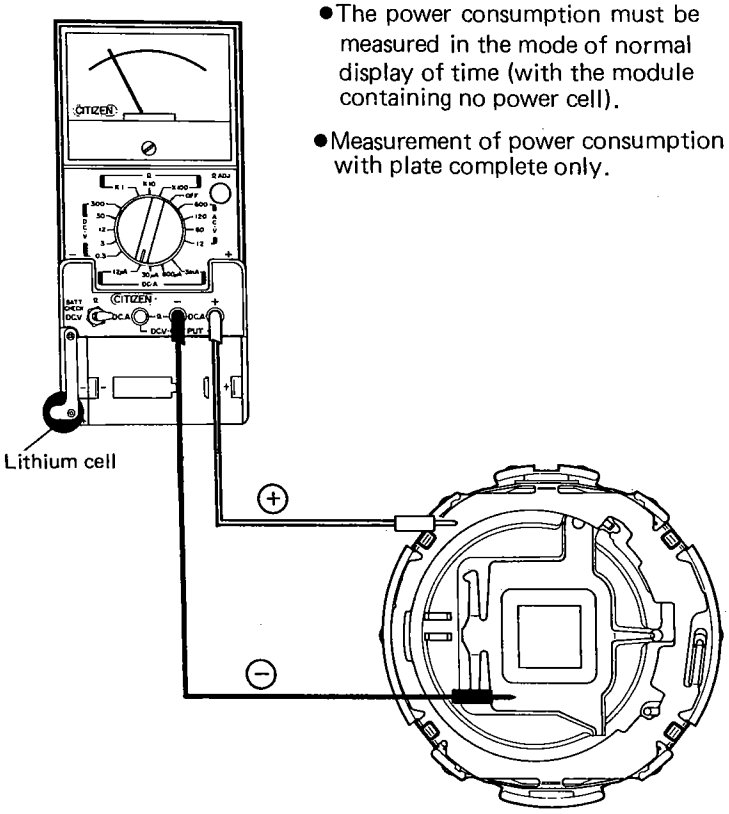
■7. TROUBLESHOOTING AND ADJUSTMENT



Checking items	How to check	Result and treatment
1 Measurement of power cell voltage	(Note) Avoid causing a short circuit by giving a touch between a lead terminal (—) and the supporter for plate complete (II) (+) or the power cell (+) when appling the lead terminal (—) to a minus (—) terminal. If a short circuit is caused (with a drop of power cell voltage), the second measurement must be carried out after 5 ~ 7 minutes. 	**Over 2.8V** →O.K. **Under 2.8V** →Replacement of power cell
2 Check of connection part of LC display panel	1) Full-segment glow test With a simultaneous push of Ⓜ , (PD) and Ⓡ buttons each, all segments of display glow. Under such conditions, the defective segments can be detected conveniently.  2) Check of connection parts among LC display panel, connection rubber and plate complete ●Make sure that each necessary component parts is set in a correct and complete way. ●Make sure that each connection part is completely free from the dust, stains and crack or break, etc.  	Dust or stains →To be cleared away Crack, break or wear →Replacement with nondefective parts

Checking items	How to check	Result and treatment
3 Measurement of time rate	Owing to the DFC method, this caliber has received a complete adjustment of time rate in terms of the circuit at the factory. If the time rate has a big error due to a severe shock or the like, the plate complete must be replaced with nondefective one. When measuring the time rate, set the "MEASURE TIME" at 10 sec. or its integer-fold value.	
4 Confirmation of using condition of watch	When no defect is detected through a measurement of time rate or no big error is detected in the time rate, the following points must be confirmed with the user of a watch. 1) A wrong handling or mioperation of the watch. 2) Use of the watch in an extreme change of temperatures. 3) The time when an adjustment was given last to the time rate. 4) And others. 	
5 Check of switch mechanism	1) Check with complete module ●Make sure that the supporter for plate complete (II) is set in a correct and complete way. ●Make sure that a correct contact is secured between the switch part of the supporter for plate complete (II) and the connection part of the plate complete. Make sure that no dust, stains nor other foreign substances attach the contact part. 	Malformation of switch part ⟶ Repair of switch part Dust or stains ⟶ To be cleared away

Checking items	How to check	Result and treatment
	2) Check of push-buttons ●Make sure that both the case and the push-buttons are free from any malformation or stains.  (Note) Never fail to apply the silicone oil to the push-buttons to maintain a water resistance as well as a smooth operation of buttons.	Malformation of push-button ⟶Replacement with nondefective one Dust or stains ⟶To be cleared away
6 Check of lamp	As illustrated below, the lead led from the OUTPUT terminal of the adaptor is applied across a lamp. (No definition is required for the polarity.)  	No lighting of lamp ⟶Replacement of plate complete

Checking items	How to check	Result and treatment
7 Check of alarm mechanism	A white piezoelectric element is adhered directly to the case back with use of a special adhesive. Owing to this special adhesive, the ringing function of the alarm is not affected virtually except for the contact part with the buzzer contact spring although the piezoelectric element has some crack, break or the like defect. 1) Check of buzzer contact spring  	Crack or break of piezoelectric element at contact part of buzzer contact spring → Replacement of case Malformation or breakdown of buzzer contact spring → Correction or replacement of spring
8 Measurement of power consumption	 ● The power consumption must be measured in the mode of normal display of time (with the module containing no power cell). ● Measurement of power consumption with plate complete only. Note: The power consumption may sometimes increase under the light of a incandescent lamp or by a window (sunlight) by several to several tens times as much as the ordinary value. In such case, the watch must be moved to rather a dark place for measurement of the power consumption. A fluorescent lamp does not virtually affect the measurement of power consumption.	**Under 1.6μA** → Nondefective **Over 1.6μA** → Measurement of power consumption with plate complete only **Over 1.1μA** → Replacement of plate complete **Under 1.1μA** → Replacement of LC display panel

Checking items	How to check	Result and treatment
9 Check of appearance and functions	The following points are checked with a complete watch. 1) Make sure that no defect is detected in the display. 2) Make sure that the operation is correct and smooth for each push-button. 3) Make sure that the display screen of the LC display panel is free from the dust or stains.	

■8. MISCELLANEOUS INFORMATION

As mentioned before, this caliber adapts the DFC method.
And a reproduction of plate complete is not carried out due to the following factors.

Each of the quartz crystal oscillators used in the quartz watches has its own accuracy of production (variance) in terms of frequency.

According to this variance of frequency, a disconnection is given to the pattern for control to vary the frequency and then adjust the time rate (DFC method).

Here if a quartz crystal oscillator having a different frequency is used in replacement with a defective oscillator, some error is naturally caused to the time rate.

In this connection, a replacement must be carried out for the plate complete in case no terminal for adjustment is used owing to the DFC method.

In addition, a consideration must be given also to the illumination lamp and the condenser in terms of an application of the spot welding, the material of the plate (polyimide film) and other factors.

Under such circumstances, the repair of the plate complete is very difficult on the market.
Thus the plate complete must be replaced with a nondefective one if the lamp or condenser is defective.

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