

***TECHNICAL
INFORMATION***

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**CITIZEN QUARTZ
Cal. No. 895✳**

 **CITIZEN**

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§1. OUTLINE



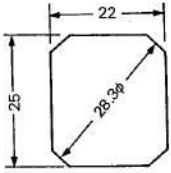
This is a "combination" (Ana-Digi) quartz crystal watch developed for gentlemen with multiple functions coordinated in a thin and small structure. In general a combination watch, featuring a multi-function structure, has disadvantage in the whole thickness of structure since the available space is rather limited for design of a watch. The Citizen technical group, however, has succeeded with the new combination watch to realize a very small thickness of the whole structure — smaller than the Cal. No. 892***-series watches by 1mm or more with appearance parts. In addition to its multiple functions, some type of this new caliber is available with an alarm function with special water resistance in the appearance structure. Owing to a small and thin structure, the Cal. No. 8950 watch can better fit the user's arm. Thus this new watch will be a new leader among the Citizen's combination watches.

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§2. FEATURES

- 1) Combination quartz watch with multiple functions:
In addition to the functions of time, calendar, alarm I, alarm II, chime, stopwatch and timer, the digital section includes such additional functions as an illumination lamp, an alarm monitor and others. On the other hand, the analog section has a center second in addition to the hour and minute hands. And a power cell life indicator tells the user the end of life of the power cell by a different way of second hand's movement from usual way.
- 2) Simple and easy correction of time by crown:
A simple and easy correction is possible for both the digital and analog times.
 - Digital section
The crown is pulled out one step and turned right or left to perform an addition or subtraction of time. (Ineffective with display of calendar).
 - Analog section
The crown is pulled out two steps and turned right or left to perform a correction of time.
- 3) Simplified disassembly and assembly of module:
In comparison with Cal. No. 892***, the number of component parts is cut by about 25% to simplify the disassembly and assembly of module. The Cal. No. 8950 has many parts that can be used in common to Cal. No. 8930.

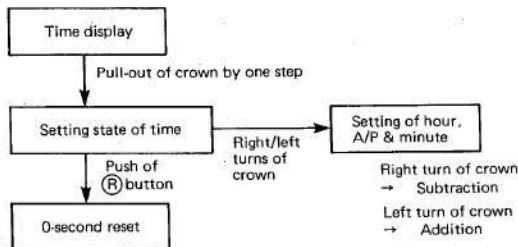
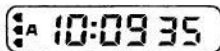
§3. SPECIFICATIONS

Caliber No.	8950-02	
Type	Combination quartz crystal watch (with center second)	
Size of module (mm)	28.3 ϕ x 22 x 25 Thickness : 2.38 ^t Thickness at power cell part : 3.1 ^t Thickness at LC display panel part : 3.58 ^t 	
Accuracy	±15 sec./month (at normal temperatures)	
Oscillation	32,768Hz	
Effective temperature range	0°C ~ 55°C (32°F ~ 131°F)	
Method of digital display	FE twist nematic LC (liquid crystal) with 2-split multiplex driving	
Digital functions	Time	Hour, minute, second & A/P
	Calendar	Month, date & day
	Alarm I	Hour, minute & ON/OFF (12-/24-hour display coupling to time display)
	Alarm II	Hour, minute & ON/OFF (12-/24-hour display coupling to time display)
	Chime	Every hour on the hour
	Stopwatch	Minute, second & 1/10 sec. (10 min. mode)
	Timer	Minute & second (60 min. count with 1 min. of setting unit)
Analog section	Hour & minute hands plus center second	
Converter	Bipolar step motor (Load compensating circuit)	
Additional functions	<ul style="list-style-type: none"> ●Automatic calendar ●Power cell life indicator ●Illumination lamp ●Alarm monitor ●12-/24-hour switching function 	
Power cell (Silver oxide cell)	Parts No. : 280-44 Code : SR927W (Ag ₂ O/KOH) Nominal voltage : 1.55V Capacity : 55mAH Size : 9.5 ϕ x 2.6mm Lifetime : About 2 years (3 sec. lighting of lamp, 42 sec. ring of alarm plus 24 hourly chimes per day)	

3) Setting of time

① Digital time

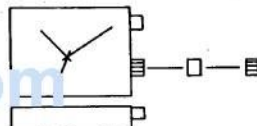
The crown is pulled out one step in the time display mode, and thus a flashing is given to indicate a setting state of time.



② Analog time

When the crown is pulled out two steps in the time display mode, the movement of second hand stops for setting of an analog time.

In this instance, the time display is given a the digital portion. And this digital time display is not affected by turning of the crown.

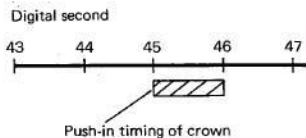


Crown pulled out two steps for setting of analog time

③ Synchronization between digital and analog seconds

Analog time (8:20'45'') to be synchronized with digital time (10:09'30'' AM)

- The crown is pulled two steps to set the analog time to 10:09''. (The second hand stops at 45 sec.)
- The crown is pushed into the normal position after making sure the digital second of 45 sec.



④ Correction of ± 30 sec.

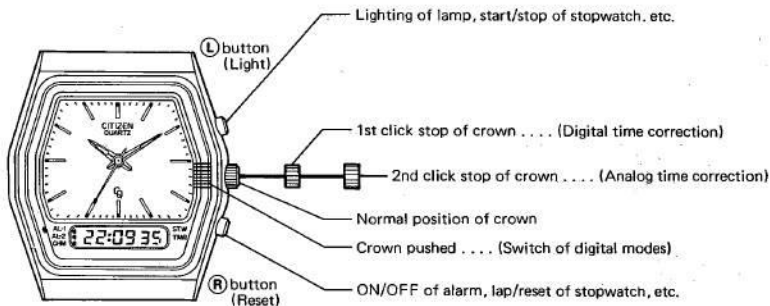
- The crown is pulled one step in the time display mode to secure a setting state of digital time.
- The (R) button is pushed synchronizing with a time signal, and thus the digital second is reset to 0. While the analog second hand is also reset to 0.

Change of analog/digital displays in 0-reset at N seconds.

Before 0-reset	After 0-reset	
	Digital	Analog
$0 \leq N < 30$	00 sec. with no change in minute	Waiting for N-sec. count
$30 \leq N < 60$	00 sec. with carry of one minute	Quick advance (32Hz) of (60-N) seconds

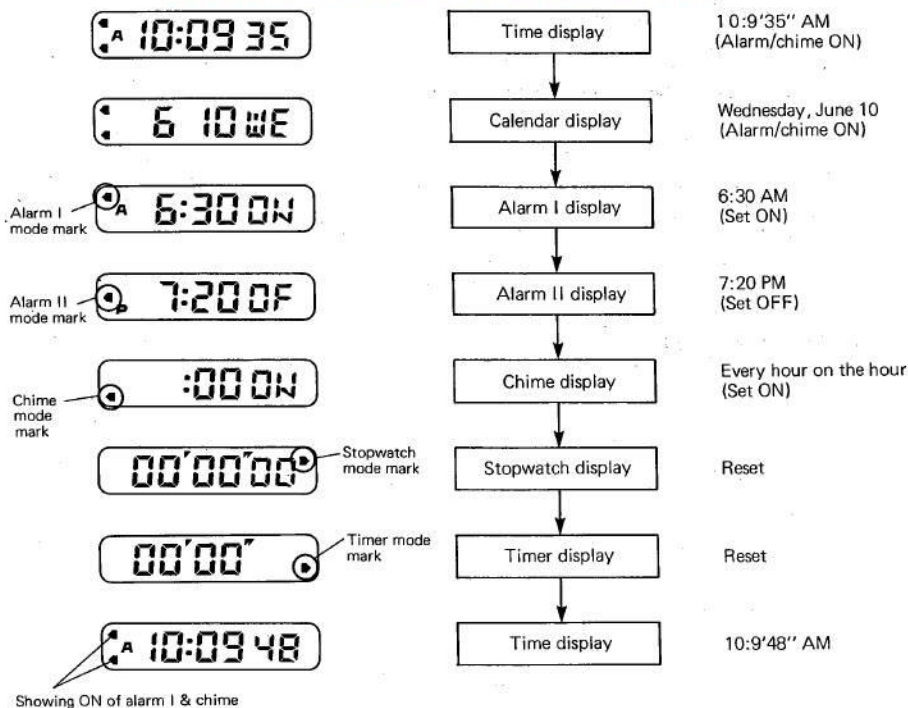
§4. HANDLING INSTRUCTIONS

1) Functions of push-buttons and crown



2) Switch of digital modes

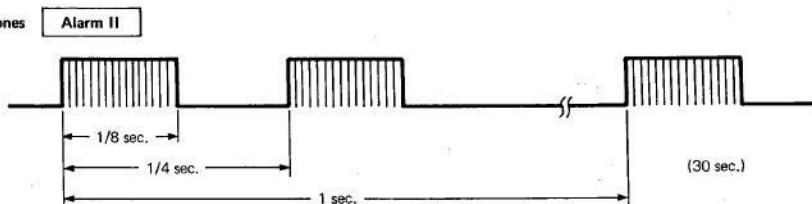
A switch is given among the digital modes with every push of the crown. (The flashing is shown by O.)



6) Function of alarm II

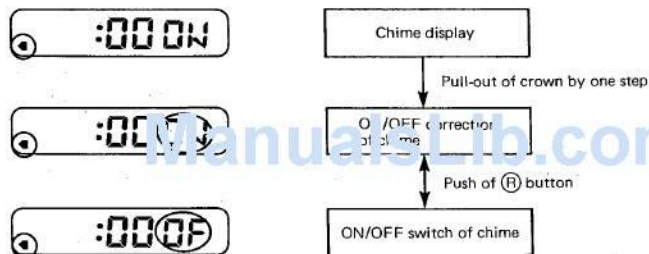
An alarm II display is obtained by pushing once the crown in the mode of alarm I display. Handling of alarm II is identical with alarm I excepting mode marks.

Ring of tones



7) Function of chime

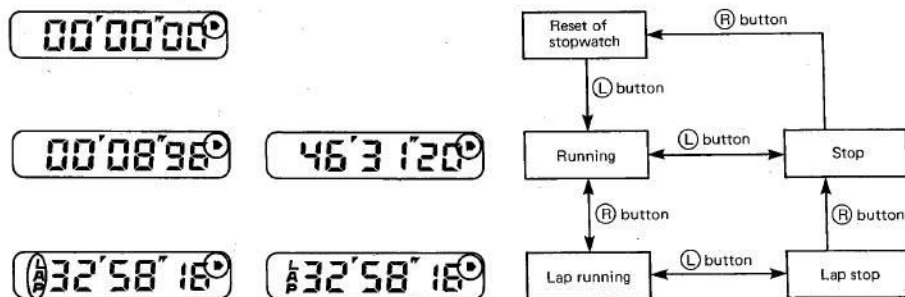
A chime display is obtained by pushing once the crown in the mode of alarm II display. The ON and OFF are switched alternately with every push of (R) button after pulling out the crown one step.



The chime sounds twice (beep, beep) every hour on the hour after setting the chime.

8) Function of stopwatch

A stopwatch display is obtained by pushing once the crown in the mode of chime display.



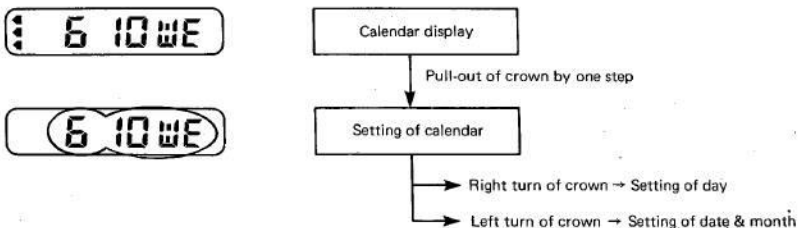
- The stopwatch counts up to one hour, and the counting repeats in a cycle of 59'59'99 → 00'00'00.
- An alarm tone is produced with push of start/stop (L) button.
- The lamp does not go on in the stopwatch mode even with push of (L) button.

Note 1) The digital time must be set prior to the analog time. This is due to the fact that the analog second is regulated by a digital 0-reset. And thus an agreement, if once obtained, is maintained between the digital second and the analog second hand.

Note 2) When a 0-reset is given while the digital second reads 30~59, the minute is carried toward the minute, hour, A/P and then date in that order.

4) Setting of calendar

A calendar display is obtained by giving a push to the crown in the time display mode.



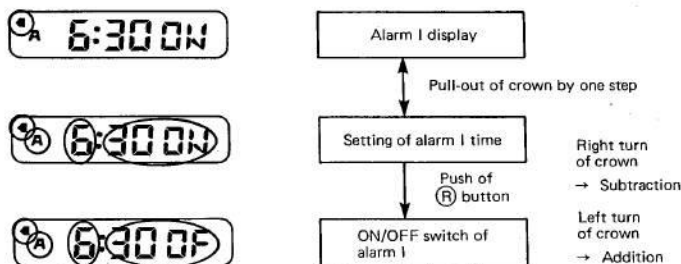
Note 1) In a setting of calendar, the 1st and 2nd signals have no reaction since they function to just a h the rotating direction of crown. The setting action starts with the 3rd signal.

Note 2) An error condition is given between the 31 day and 30 day months with no display of a non-existing date.

In a leap year February 29 can be set although a 28-day display is given to the February of ordinary years.

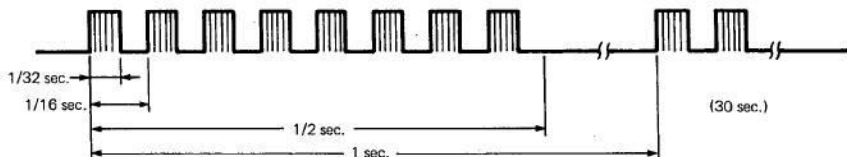
5) Function of alarm 1

An alarm 1 display is obtained by pushing once the crown in the calendar display mode. The alarm time is set by pulling out the crown one step and turning it right or left.



Ring of tones **Alarm 1**

The alarm rings 30 seconds and can be stopped any moment with push of either push-button.



11) All-reset function

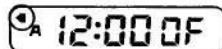
The all-reset function works with a simultaneous push of (L) and (R) buttons after pulling out the crown two steps.



Time display



Calendar display



Alarm I display



Alarm II display



Chime display



Stopwatch display



Timer display

12) Decision of correcting direction

Each digital function is corrected by pulling out the crown one step and then turning it. In this case, the flashing showing an under-correction state ceases with the 1st signal. Then a correction starts with the next signal. The flashing starts again in case the following signal is not given in about 2 seconds after the first ceasing of flashing. Thus the next signal is used for a decision of direction, and a correction starts with the following second signal. A turn of the crown gives 30 signals.

13) Full-segment glow

All display segments glow at a time with a simultaneous push of (L) and (R) button plus the crown each.

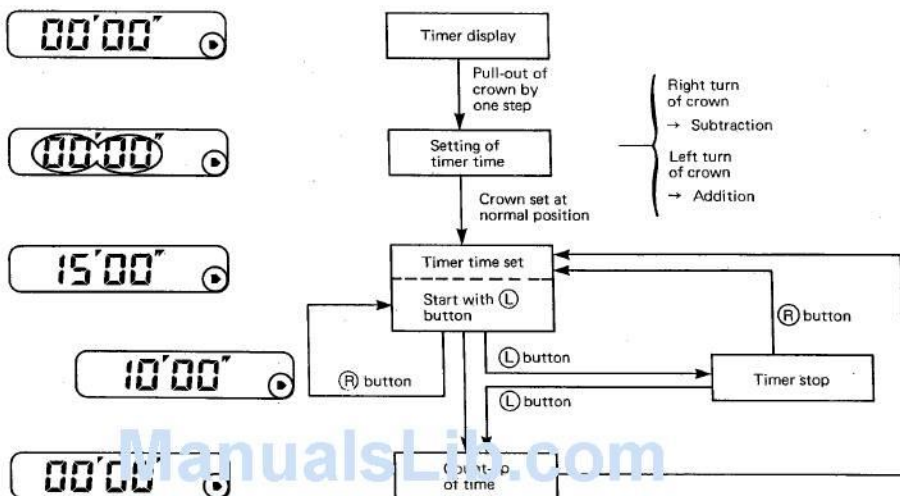


This full-segment glow can be used conveniently for a check of the segment break, etc.

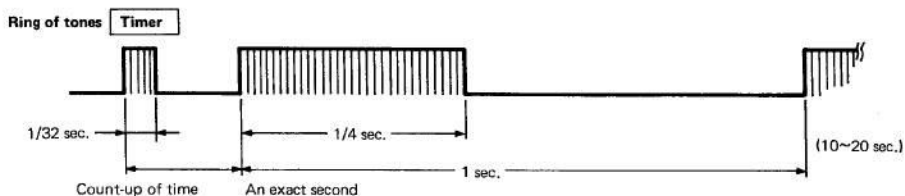
In such case, a time display is given regardless of the precedent mode of display. (The 12-/24-hour switching function may sometimes work.)

9) Function of timer

A timer display is obtained by pushing once the crown in the mode of stopwatch display.



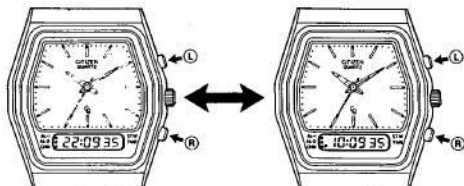
- The timer time from a count-up to an exact second differs by the start timing of the timer.
- The timer counts in a range of 1~59 minutes.
- The lamp does not go on in the timer mode even with push of (L) button.
- An alarm tone is produced for 10~20 seconds when the timer counts up the set time.
- A ring identical with Stopwatch is obtained with push of (L) button in the working mode of timer.



- The ring can be stopped any moment with push of either one of the crown, (L) and (R) buttons for the timer.

10) Alarm monitor and 12-/24-hour switch function

A sound of alarm monitor is produced with a simultaneous push of (L) and (R) buttons in each display mode (excepting the mode of correction).



The 12- and 24-hour displays are switched alternately with every actuation of the switching function in the working mode of time display.

- The ring of an alarm monitor is identical with Alarm I.

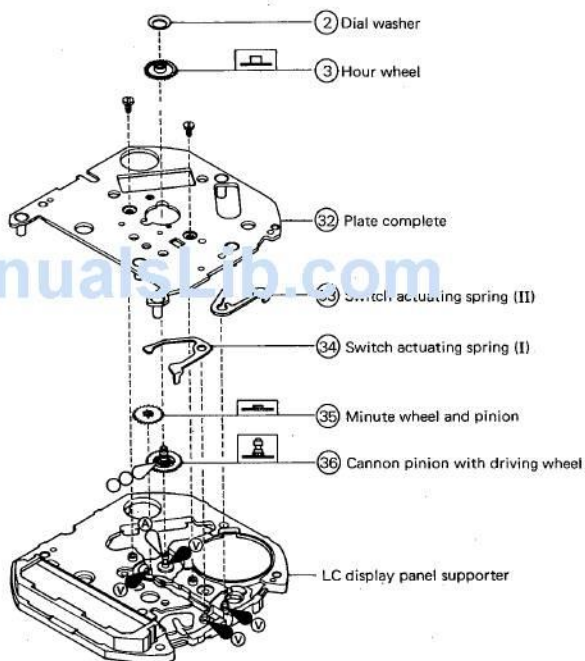
§ 6. DISASSEMBLY/ASSEMBLY OF MODULE

Disassembling procedure: ① → ③⑥
 Assembling procedure: ③⑥ → ①

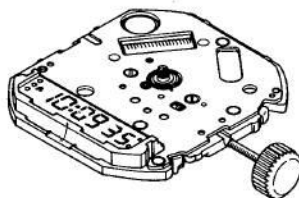
1) LC display panel side

Marks of lubrication:

④ Synt-A-Lube oil
 ⑤ Synta-V-Lube oil
 ⑥ CITIZEN watch oil (CH-1)

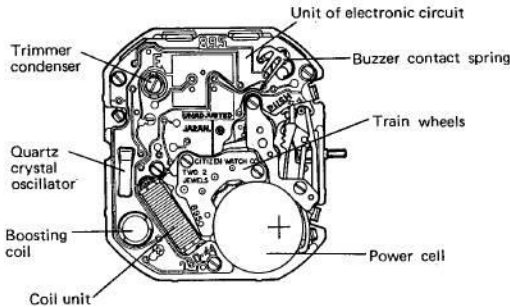
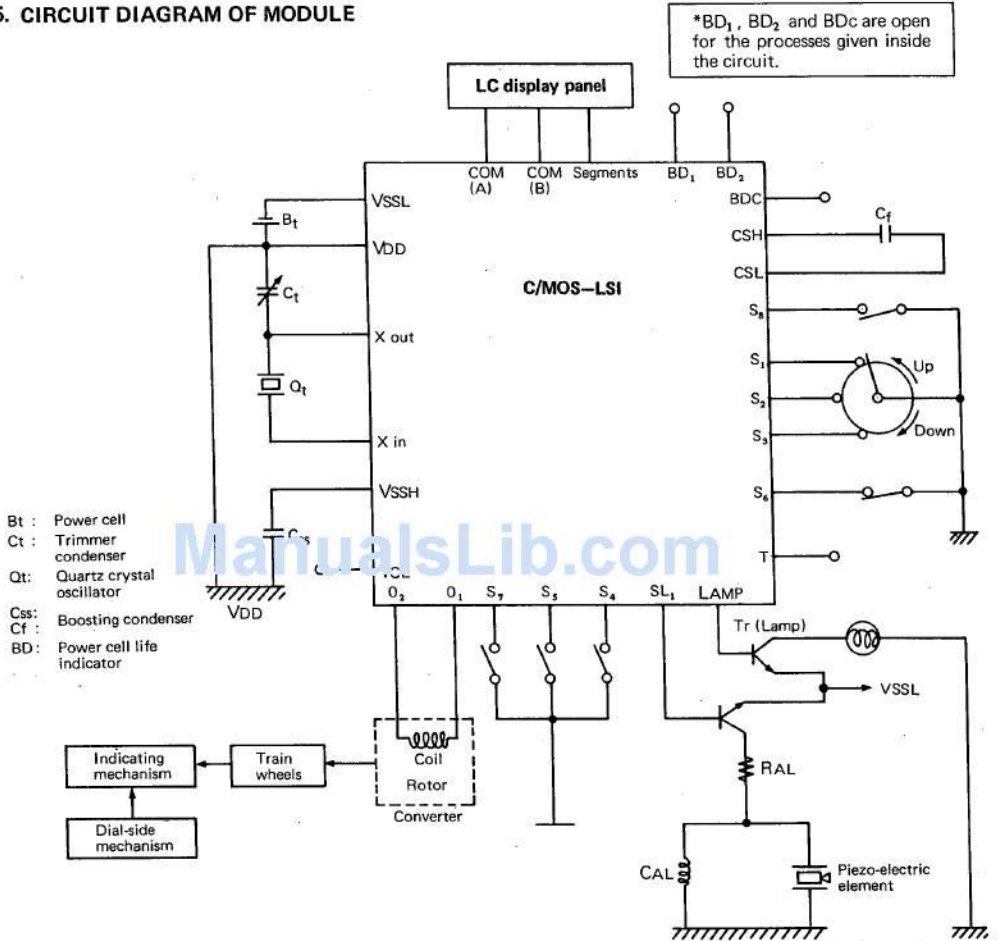


The setting wheel is calked at the back of the plate complete. The V-Lube oil is supplied to the sliding part.

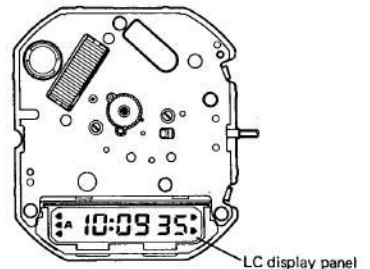


Both disassembly and assembly are carried out based on the LC display panel supporter.

§ 5. CIRCUIT DIAGRAM OF MODULE



Power cell side



LC display panel side

3) Notes on disassembly/assembly

① Setting of buzzer contact spring

The form of the buzzer contact spring is changed from a coil spring type used in the conventional watch with alarm to that shown in Fig. 1.

The three feet of the buzzer contact spring must be set exactly into the holes of the unit of electronic circuit.

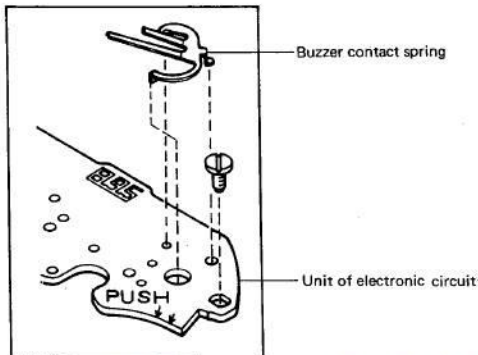


Fig. 1 Setting of buzzer contact spring

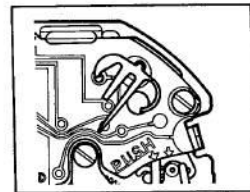


Fig. 2 Position of buzzer contact spring

- ② The disassembly/assembly of this caliber is carried out based on the LC display panel supporter. The movement holder of Cal. No. 8930 can be used in common to this caliber. When driving screws, the good care must be given not to apply an excessive force to the LC display panel supporter (or with plate complete) since the module of this caliber is very small in thickness.

③ Rotation preventing mechanism

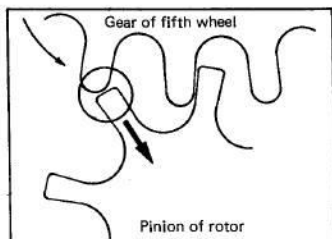
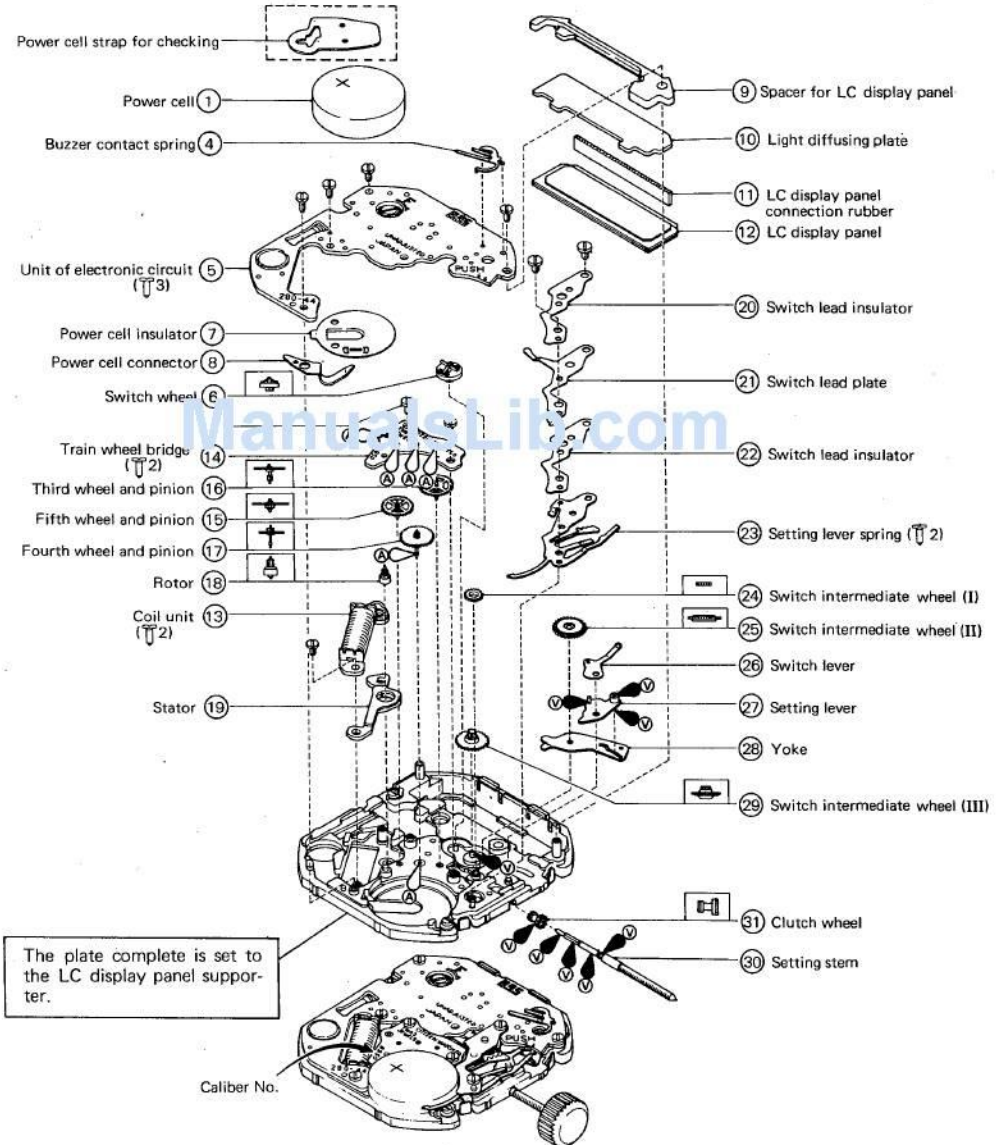


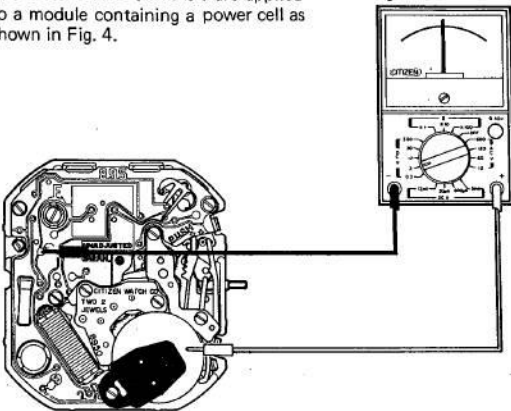
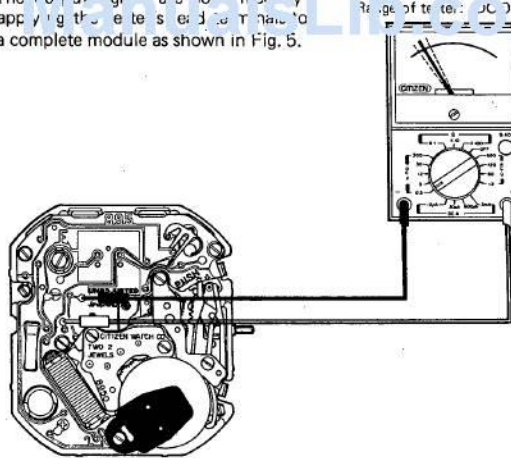

Fig. 3 Bite between fifth wheel & rotor

In the conventional calibers, the reset lever functions to give a forcible stop to the rotations of train wheels when turning the hands.

In this caliber, however, the force is transmitted toward the center of the rotor (Fig. 3) owing to the tooth forms of the fifth wheel (gear) and the rotor (pinion). Thus the rotation is prevented for the fifth wheel.

2) Power cell side



Checking items	How to check	Results and treatment
<p>1 Measurement of power cell voltage</p>	<p>The tester's lead terminals are applied to a module containing a power cell as shown in Fig. 4.</p> <p>Range of tester: DC 3V</p>  <p>Fig. 4 Measurement of power cell voltage</p>	<p>Over 1.5V → Nondefective</p> <p>Under 1.5V → Replacement of power cell</p> <p>A power cell strap for checking is available conveniently for the working of troubleshooting and adjustment.</p>
<p>2 Confirmation of output signals</p>	<p>The output signals are confirmed by applying the tester's lead terminals to a complete module as shown in Fig. 5.</p> <p>Range of tester: DC 0.1V</p>  <p>Fig. 5 Confirmation of output signals</p>	<p>Tester pointer deflecting right and left every second and centering on 0V → Nondefective unit of electronic circuit</p> <p>No output signal confirmed → Replacement of unit of electronic circuit</p>
<p>3 Check of connection part of LC display panel</p>	<p>(Full-segment glow test) With a simultaneous push of (L) and (R) buttons plus the crown, all segments glow on the LC display panel. A break of segment can be checked quickly through this test.</p> <ol style="list-style-type: none"> 1) Check of LC display panel connection rubber <ul style="list-style-type: none"> ● Make sure that the LC display panel connection rubber is free from a bend, fall, twist or wear as well as an attachment of dust or stains. 2) Check of LC display panel <ul style="list-style-type: none"> ● Make sure that the electrode part of LC display panel is free from a crack or break as well as an attachment of dust or stains. 	<p>Bend, fall, twist of connection rubber → Replacement of connection rubber</p> <p>Crack or break of display panel → Replacement of display panel</p>

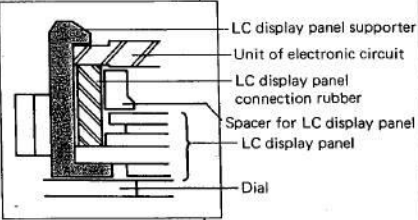
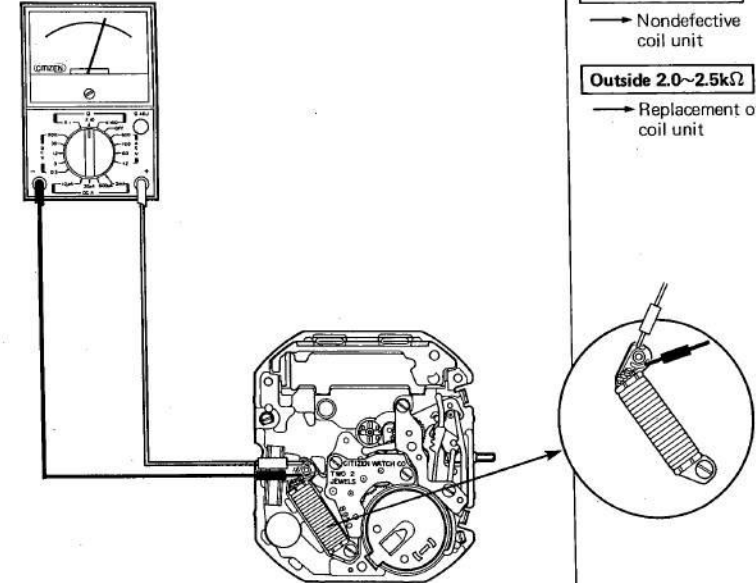
Checking items	How to check	Results and treatment
	<p>3) Check of unit of electronic circuit</p> <ul style="list-style-type: none"> ● Make sure that the electrode part of the unit of electronic circuit is free from any dust or stains. ● The unit of electronic circuit is hooked to the LC display panel supporter to ensure a complete contact (among the electrode of LC display panel, the LC display panel connection rubber and the electrode pattern of unit of electronic circuit each).  <p style="text-align: center;">Fig. 6 Cross section of hook part of LC display panel supporter</p>	
<p>4 Check of connection part</p>	<ul style="list-style-type: none"> ● If the dust or stains attach between the patterns (Out 1 and Out 2) of the unit of electronic circuit and the coil terminal, the contact becomes defective between them. Accordingly the output signal, if delivered, is not transmitted to the coil unit and other subsequent parts. ● Make sure that the sawdust of unit of electronic circuit is removed completely. 	<p>Dust or stains → To be cleared away</p>
<p>5 Measurement of coil resistance</p>	<p>As shown in Fig. 7, the coil resistance is measured with the unit of electronic circuit removed.</p> <p>Range of tester: $\times 10\Omega$</p> 	<p>Within 2.0~2.5kΩ → Nondefective coil unit</p> <p>Outside 2.0~2.5kΩ → Replacement of coil unit</p>

Fig. 7 Measurement of coil resistance

Checking items	How to check	Results and treatment
6 Check of train wheels	<p>For this caliber, a rotation is prevented for the train wheels when turning the hands by the gear of fifth wheel and the pinion of rotor. This makes it impossible to confirm a transmission among the train wheels by giving rotations to the train wheels by means of a forming bar or the like.</p> <p>The following points are confirmed.</p> <ol style="list-style-type: none"> 1) A proper clearance is secured for each gear. 2) The lubrication is proper and enough for each tenon. 3) No dust nor stains attach to the gears. 	
7 Check of dial-side mechanism	<ul style="list-style-type: none"> ●Make sure that the crown is pulled out and pushed in smoothly. ●An inspection is given to the state of lubrication. Make sure in particular that the slip torque of the cannon pinion with driving wheel is not high nor loose extraordinarily. 	
8 Measurement/adjustment of time rate	<p>The time rate is measured by the CQT-101 (Citizen Quarts Tester). A measurement of time rate is possible for both the analog and digital portions. However, the value of measurement may sometimes have some variance with the digital display since the digital portion is positioned at the lower side to the microphone. In this respect, a better result may be obtained by carrying out a measurement based on the analog watch.</p> <p>An adjustment is given to the time rate by turning the trimmer condenser.</p>	
9 Confirmation of using condition of watch	<p>The following points are confirmed with the user of watch after obtaining a normal value through the measurement of time rate.</p> <ol style="list-style-type: none"> 1) Using circumstances of watch <ol style="list-style-type: none"> a) The watch is used in an extremely low or high temperature. (Digital/analog) b) The watch receives the static electricity in a low humidity. (Digital) c) The watch receives an electromagnetic wave (spark produced from an arc welding). (Digital) d) The watch is exposed long in the intensive light of a strobo flash or the like. (Digital/analog) e) The watch is affected by the magnetism of magnetic health appliances, a magnet door and the like. (Analog) 2) How many days have passed since a correct time was set to the watch last? 3) Other factors (temporary error of time rate caused by an impact, state of contact of power cell, mixture of dust into train wheels, etc.) 	

Checking items	How to check	Results and treatment															
10 Check of switch mechanism	<p>1) Switch/correction impossible with operation of crown</p> <p>① The crown is operated with a complete module to confirm a correct working of the switch wheel and the switch lever each.</p> <table border="1" data-bbox="350 341 868 482"> <thead> <tr> <th></th> <th>Switch lever</th> <th>Switch wheel</th> </tr> </thead> <tbody> <tr> <td>Pull-out of crown by one step</td> <td>S₄</td> <td>—</td> </tr> <tr> <td>Pull-out of crown by two steps</td> <td>S₅</td> <td>—</td> </tr> <tr> <td>Push-in of crown</td> <td>S₇</td> <td>—</td> </tr> <tr> <td>Turn of crown</td> <td>—</td> <td>S₁, S₂, S₃</td> </tr> </tbody> </table> <p>A contact between (R) button and the switch lever is secured at S₆; and a contact is secured at S₈ between (L) button and the switch lever respectively.</p> <p>② Check of connection part with unit of electronic circuit removed</p> <ul style="list-style-type: none"> ● Make sure that the spring part of switch lever is set in a correct way with no malformation, break nor stains. ● Make sure that the switch pattern on the back side of the unit of electronic circuit is free from a defective contact and a solder bridge or stains. <p>2) Switch/correction impossible with operation of push-buttons</p> <p>① Check with complete module</p> <ul style="list-style-type: none"> ● Operation possible with complete module → ② Check of push-button ● Operation impossible with complete module → ③ Check of switch spring <p>② Check of push-button</p> <p>The push-button features a double O-ring type as shown in Fig. 9.</p> <ul style="list-style-type: none"> ● The dust or stains attached to the push-button causes an insufficient stroke and then an inaccurate working of the button. ● A shortage of oil to the packing of push-button produces a friction resistance of stroke to cause a heavy working of the button. <div data-bbox="366 1260 671 1486" style="text-align: center;"> <p>Fig. 9 Cross section of push-button</p> </div>		Switch lever	Switch wheel	Pull-out of crown by one step	S ₄	—	Pull-out of crown by two steps	S ₅	—	Push-in of crown	S ₇	—	Turn of crown	—	S ₁ , S ₂ , S ₃	<div data-bbox="900 252 1100 482" style="text-align: center;"> <p>Fig. 8 Pattern diagram of back side of unit of electronic circuit</p> </div> <p>No defect detected through above inspections → Replacement of unit of electronic circuit</p> <p>Dust or stains → To be cleared away</p> <p>Shortage of oil → Lubrication of silicone oil after washing or replacement of packing</p> <p>Bend of push-button → Replacement of push-button</p>
	Switch lever	Switch wheel															
Pull-out of crown by one step	S ₄	—															
Pull-out of crown by two steps	S ₅	—															
Push-in of crown	S ₇	—															
Turn of crown	—	S ₁ , S ₂ , S ₃															

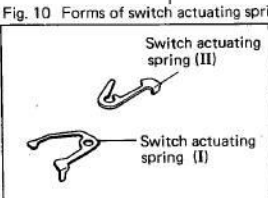
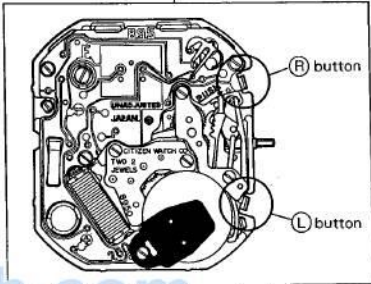
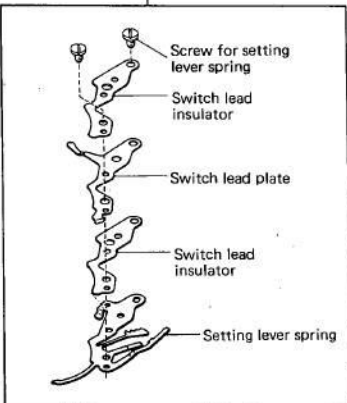
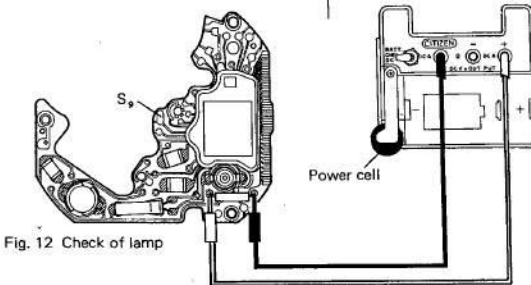
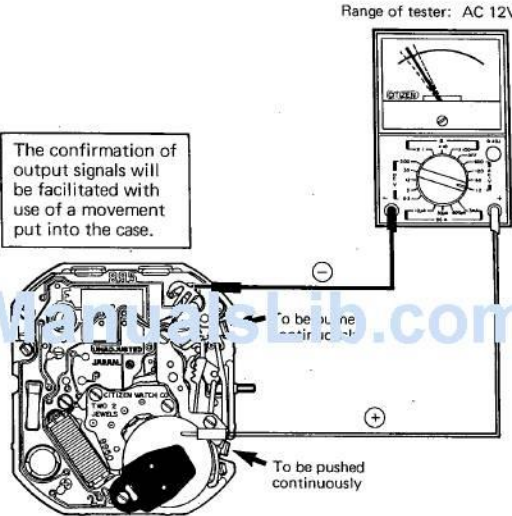
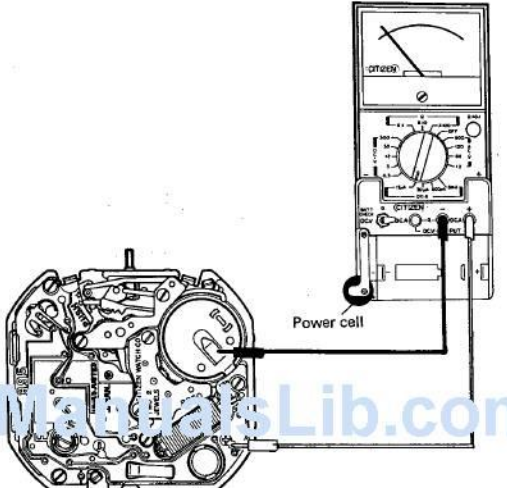

Checking items	How to check	Results and treatment
	<p>③ Check of switch springs</p> <p>The switch actuating spring corresponds to (R) button part and has a contact with the side face pattern of the unit of electronic circuit.</p> <ul style="list-style-type: none"> ● Make sure that the switch actuating spring is set in a correct way. ● Make sure that the spring is free from dust or stains. ● Make sure that no stains nor exfoliation of pattern exist at the side of S₆ pattern. <p>Defective working even with no fault detected through above confirmation</p> <p>→ Replacement of unit of electronic circuit</p> <p>The switch actuating spring (II) corresponds to (L) button and has a contact with the switch lead plate. And a same inspection as (R) button is given to the spring (II).</p>	<p>Fig. 10 Forms of switch actuating springs</p>  <p>Switch actuating spring (II)</p> <p>Switch actuating spring (I)</p>  <p>(R) button</p> <p>(L) button</p>
<p>11 Check of lamp</p>	<p>The voltage of 1.5V is applied to both terminals of a lamp by means of the tester's adaptor in order to confirm the lighting of lamp.</p> <p>No lighting of lamp secured when set into unit of electronic circuit although lighting confirmed with lamp itself</p> <p>→ Replacement of unit of electronic circuit</p> 	<p>Fig. 12 Check of lamp</p>  <p>S₆</p> <p>Power cell</p> <p>Check of assembly of parts: One side of the switch lead plate is connected to the pattern S₆ on the back side of the unit of electronic circuit. This lead plate is usually open and then connected to VDD with push of (L) button to switch on the lamp.</p> <p>Accordingly, the lighting of lamp may sometimes continue with no push of (L) button if a wrong assembly is given to the relative parts.</p> <p>The lamp may sometimes not go on when set into the unit of electronic circuit although the lamp itself is nondefective. This is due to the fact that the current is supplied to the lamp via a transistor.</p>

Fig. 13 Assembly parts of switch lead plate

Checking items	How to check	Results and treatment
<p>12 Check of alarm mechanism</p>	<p>1) The alarm output signals are confirmed by a tester.</p> <p>The plus and minus lead terminals of a tester are applied to the power cell and the buzzer contact spring respectively. Then the switch actuating springs corresponding to L and R buttons are pushed at a time (alarm monitor state) to confirm the output signals.</p> <div style="text-align: center;"> <p>Range of tester: AC 12V*</p>  </div> <p>The confirmation of output signals will be facilitated with use of a movement put into the case.</p> <p>Fig. 14 Confirmation of alarm output signals</p> <p>2) The following points are confirmed in case no defect is detected with the unit of electronic circuit.</p> <ol style="list-style-type: none"> Make sure that the buzzer contact spring is set is a correct way with no malformation. Make sure that the pattern of the unit of electronic circuit where the buzzer contact spring is set is free completely from dust or stains. Make sure that the vibrating plate (piezoelectric element) has no crack nor break and is connected completely to the buzzer contact spring. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>*Two tester ranges AC 12V and DC 0.3V are available for confirmation of the alarm ouput signals. A better result will be obtained with AC since the alarm output itself is an AC signal. However, the AC 12V is the minimum scale in the AC range. And a larger deflection is secured for the tester's pointer with DC 0.3V.</p> </div>	<p>Tester's pointer swinging → Nondefective unit of electronic circuit</p> <p>No swinging of tester's pointer → Replacement of unit of electronic circuit</p>

Checking items	How to check	Results and treatment
<p>13 Measurement of power consumption</p>	<p>As illustrated in Fig. 15, the plus and minus lead terminals of a tester are applied to the plus (+) pattern of the unit of electronic circuit and the power cell connector respectively.</p> <p>Range of tester: DC 12μA</p>  <p>Fig. 15. Measurement of power consumption</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <ul style="list-style-type: none"> ● It rarely occurs that the alarm function is ON when measuring the power consumption. As a result, the amount of power consumption increases to give a full swing to the tester's pointer. Such phenomenon, however, lasts 30 seconds at the most, and then the measurement will be carried out in a good condition. ● The load compensating circuit rarely works when replacing the power cells. This increases the power consumption by 0.2~0.3μA (for maximum one minute). </div>	<p>1) Measurement with complete module</p> <p>Under 2.4μA</p> <p>→ Nondefective</p> <p>Over 2.4μA</p> <p>→ Measurement of power consumption with unit of electronic circuit only</p> <p>2) Measurement with unit of electronic circuit</p> <p>Under 1.5μA</p> <p>→ Nondefective unit of electronic circuit; some defect expected at connection part of LC display panel or converter and its subsequent parts (train wheels, etc.)</p> <p>Over 1.5μA</p> <p>→ Replacement of unit of electronic circuit</p>
<p>14 Check of appearance and functions</p>	<p>The following points are confirmed with a complete form of watch.</p> <ol style="list-style-type: none"> 1) Make sure that no defect is detected in all segments of marks, figures and other display elements. (A "full-segment glow test" will be given conveniently by a simultaneous push of (L) and (R) buttons plus the crown). 2) Make sure that the crown and push-buttons are operated in a smooth way with a correct working of each function. 	

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