

***TECHNICAL  
INFORMATION***

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**CITIZEN QUARTZ**

**Cal. No. 893❖❖**

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## §1. OUTLINE



This watch has been developed to follow the Cal. No. 892-series watches of multi-function "Ana-Digi" which are precedently marketed with good success. It features a thin-gage structure plus a dressy design. The display screen forms mainly the analog dial with a minimum necessary space secured for the digital display. And the handling is easy and simple with operation of the crown.

## §2. FEATURES

- 1) An electronic quartz crystal watch for gentlemen with LC (liquid crystal) display plus the analog center second.
- 2) A small-size and thin-gage structure has been realized for the movement with a smaller number of component parts and smaller size of each element compared with the Cal. No. 892-series watches.

As shown below, the size of the movement is nearly identical to the Cal. No. 7930E which has the standard thin-gage structure of movement among Citizen's analog watches.

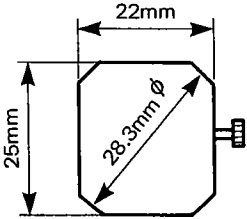
Outer dia. (mm)

Casing dia.: . 28.3  $\phi$  x 22 x 25

Maximum dia.: 29  $\phi$  x 23.2 x 26.2

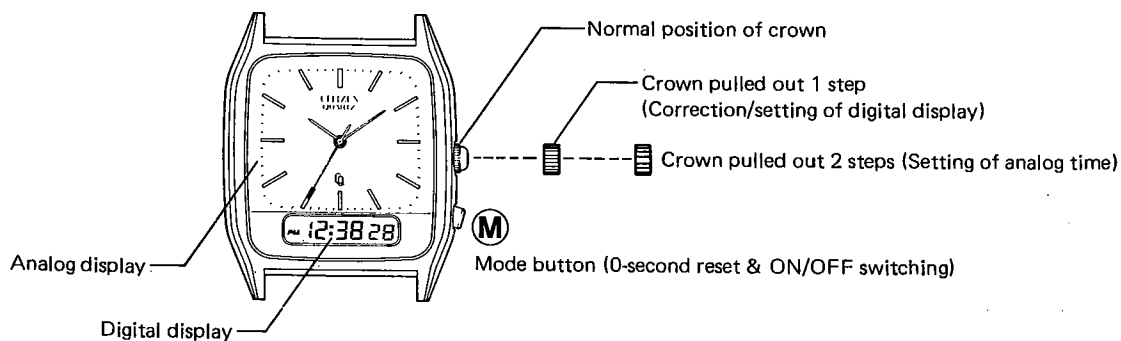
- 3) Easy and simple handling with the crown and a push-button.  
Analog: The time is set by pulling out the crown by 2 steps and then turning it clockwise or counterclockwise.  
Digital: The time is corrected with the addition/subtraction method and by pulling out the crown by 1 step and turning it clockwise or counterclockwise.
- 4) A dressy design is possible with a small-size and thin-gage LC display panel. Owing to such compact structure of the LC display panel, a simultaneous display is possible for both the analog and digital watches on the same dial.

## §3. SPECIFICATIONS

Cal. No.	8930-20	
Movement		Thickness: 2.28mm (Power cell part: 2.7mm)
Accuracy	±15 sec./month at normal temperatures	
Oscillation	32,768 Hz	
Display system	Analog: 3 hands with 1-second step movement Digital : FE twist-type nematic LC with 2-division multiplex driving	
Digital display		
Time	[AM/PM, hour, minute, second] (12-hour display) [Hour, minute, second] (24-hour display)	
Calendar	[Month, date, day] [month, date, year] . . . . . at correction/setting	
Alarm	[AM/PM, hour, minute, AL] (12-hour display) [Hour, minute, AL] (24-hour display) Alarm ON : Display of "Set time AL" Alarm OFF: Display of "OFF AL"	
Chime	Chime ON : Display of "":00 CH" Chime OFF: Display of "OFF CH"	
Time setting/correction method	Operation of the crown plus push-button	
Converter	Bipolar step motor	
Effective temperature range	±0°C ~ +55°C (32°F ~ 131°F)	
Integrated circuit	C/MOS-LSI (1 unit)	
Additional devices	<ul style="list-style-type: none"> <li>●Power saving switch (Crown pulled out 2 steps)</li> <li>●Power cell life indicator             <ul style="list-style-type: none"> <li>Analog: 2-second step movement of second hand</li> <li>Digital : Flashing of colon on display screen (At the moment of drop of voltage)</li> </ul> </li> <li>●Fully automatic calendar (1980 ~ 2019)</li> <li>●Alarm monitor</li> </ul>	
Power cell (Silver oxide cell)	Parts No. : 280-51 Cell code : SR920W Lifetime : About 2 years (Alarm once and chime 24 times a day) Capacity : 39mAH Nominal voltage: 1.55V Size : 9.5 φ x 2.1 mm	

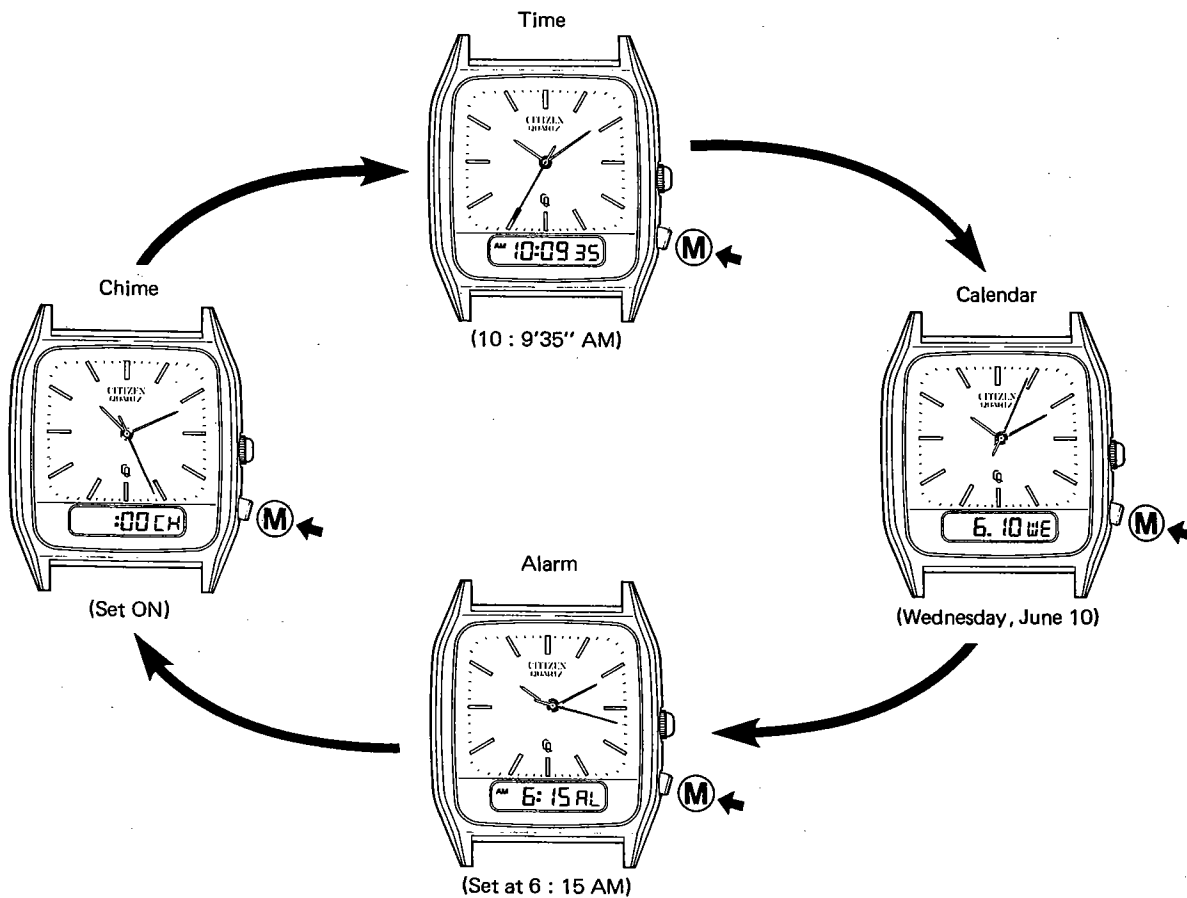
## §4. HANDLING INSTRUCTIONS (The areas of flashing are indicated by ○.)

### 1) Nomenclature (with functions)



### 2) Switching of display

The mode of display changes with every push of (M) button as follows.



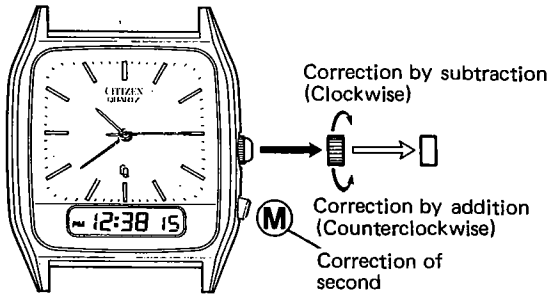
#### \*Alarm monitor

With a continuous push of (M) button about 2 seconds the time display is secured with the function of alarm monitor actuated. And a switching is given between the 12- and 24-hour displays in the time display mode.

**3) Setting/correction**

The digital correction must be done first, and then the analog setting is carried out. The analog second hand is regulated by the digital zero-resetting action. Thus a synchronization is always secured for the display of second between the analog and digital watches after once a coincidence is given between the digital "second display" and the analog "second hand".

**Digital correction**



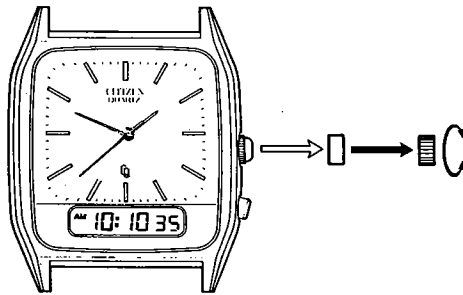
The digital correction mode is secured with a flashing given at the area to be corrected by pulling out the crown 1 step. With turning the crown, the "minute" is corrected. And at the same time, both the "hour" and "AM/PM" can be corrected in coupling. The flashing discontinues while the correction is given.

**\*Correction of second**

A correction is given to the analog time in coupling to the digital 0-second reset with push of (M) button.

(In case no coincidence is secured between the analog and digital time displays, i.e., with an error of N seconds, the analog second hand always receives a coupled correction with the error of N seconds.)

**Analog setting**

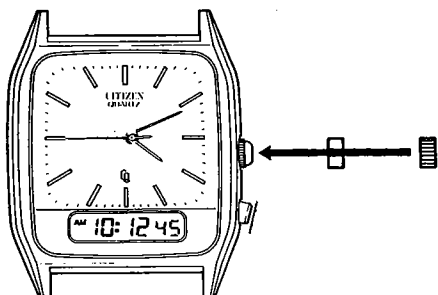


The setting method is identical to other conventional analog watches with center second. The time can be set with the crown pulled out 2 steps. In this moment, the second hand stops its movement to secure the power saving mode. The digital part of switched automatically to the time display.

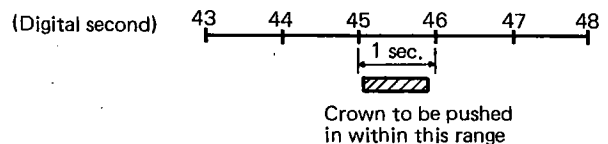
**① Setting of analog time**

The analog second hand is synchronized with the digital second time after the analog watch is set at the desired time (with the hour and minute hands).

**• Setting of analog second hand**



For instance, the second hand stops at 45 seconds when the crown is pulled out 2 steps. In that case, the crown is pushed again into the normal position after confirming that the digital time shows 45 seconds.



Never fail to push in the crown within the range of (45 ~ 46 sec.).

② Correction of normal gains/losses

For correction of the normal gains/losses ( $\pm 30$  sec.), the analog time is regulated to 0 second in coupling to the digital 0-second reset.

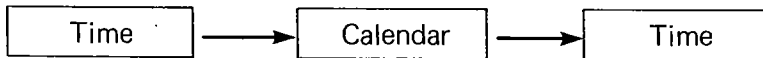
(A coincidence must be secured previously between the analog second hand and the digital second time.)

The change occurs to the analog time and the digital time each as shown in the chart below, when the 0-second reset is given at N seconds.

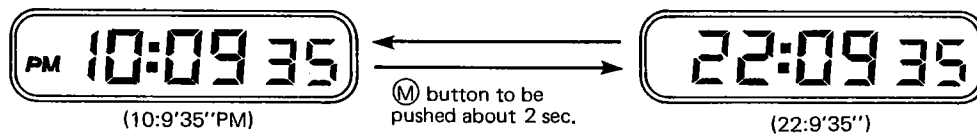
Before 0-reset	After 0-reset	
	Digital	Analog
$0 \leq N \leq 29$	"00" sec. with no change of minute	Waiting for N-sec. count
$30 \leq N \leq 59$	"00" sec. with carry of 1 minute	(60 - N) sec. quick setting (32 Hz)

③ Switching between 12-/24-hour displays

The following switch is given among the displays when the (M) button is pushed for about 2 seconds in the time display mode.

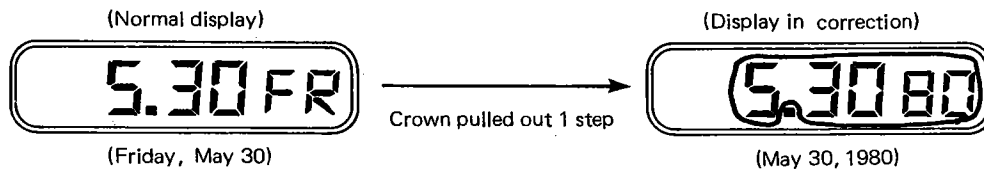


And the switching is carried out between the 12 and 24-hour displays as follows.



4) Correction of calendar

The (M) button is pushed to secure the calendar display mode, and the calendar can be corrected by pulling out the crown by 1 step. And the display switches as follows.



The "day" is corrected by turning the crown clockwise and counterclockwise in the correction mode. At the same time, both the "month" and "year" are corrected in coupling. After correction, the crown is pushed into its normal position.

An automatic setting is secured for the "day of the week" displayed at that moment.

(Note) Setting of "day of the week"

It sometimes occurs that the "day of the week" displayed when the power cell is set does not show the correct day. In such case, the calendar correction mode is set, and the crown is turned in either direction regardless of the addition or subtraction to once switch the "year". After this, the "month", "day" and "year" are set again. Thus the correct "day of the week" is displayed in the normal display mode.

## 5) Operation of alarm

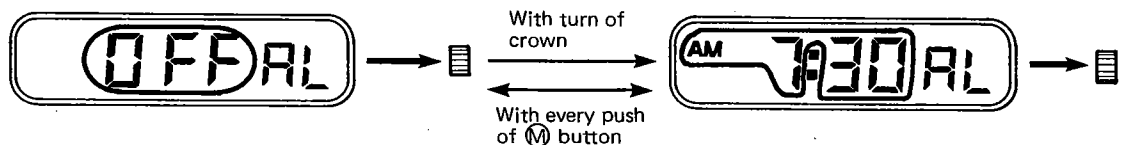
The (M) button is pushed to secure the alarm display mode. In this case, either one of the following two displays is given.



- The switch between the 12-/24-hour displays of the alarm mode is carried out in coupling to the 12-/24-hour periods of the time display mode. (An independent switch is impossible in the alarm display mode between the 12- and 24-hour displays.)
- The alarm rings 30 seconds at the moment when a coincidence is obtained between the time of watch and an "exact minute" of the set time. The way of ringing differs between the first 20 seconds and the rest 10 seconds respectively. And the ring of alarm is stopped with push of (M) button.

### ① ON/OFF switching

The crown is pulled out 1 step to secure the correction mode.



### ② Setting of alarm time

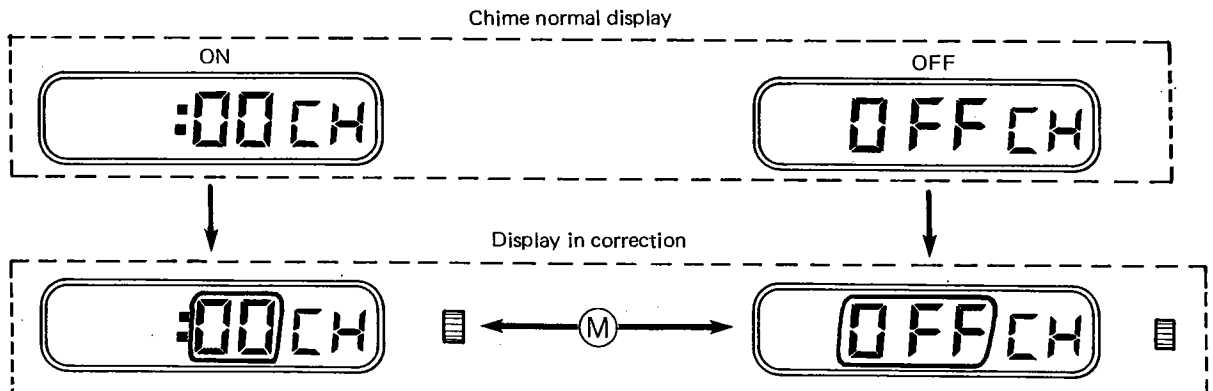
The crown is pulled out 1 step to secure the correction mode.

Then the crown is turned clockwise or counterclockwise to set the "minute", and at the same time both the "hour" and "AM/PM" can be set in coupling.

In this case, the setting is possible with either of the "set time" and "OFF" which is displayed first.

## 6) Setting of chime

The (M) button is pushed to secure the chime display mode, and the crown is pulled out 1 step to set the chime. The ON and OFF are switched alternately with every push of (M) button.



In the ON state, the chime rings twice at every hour on the hour.

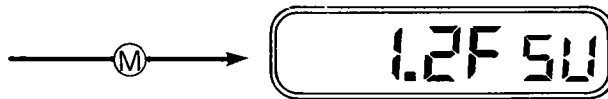
## 7) Notes on handling of watch

## ① Display when setting power cell

Phenomenon:

A phenomenon like the break of segment occurs rarely in the calendar display mode and when the power cell is set into the movement.

(Ex.)



Treatment:

The crown is pulled out 1 step (correction mode) and then turned. Thus the normal state of display can be obtained again. This must always be done in the calendar mode. The normal state is never obtained in other display modes than the calendar.

## ② Actuation of power cell life indicator when setting power cell

Phenomenon:

It rarely occurs that the power cell life indicator is actuated when the power cell is set into the movement.

(Actuation of power cell life indicator)

Analog: 2-second step movement of second hand

Digital: Flashing of colon on display screen

Treatment:

The normal state is secured again for the power cell life indicator when the digital "second" passes "00". After this, the power cell life indicator has the normal actuation with no deterioration at all.

## ③ Skip of second hand when turning hands

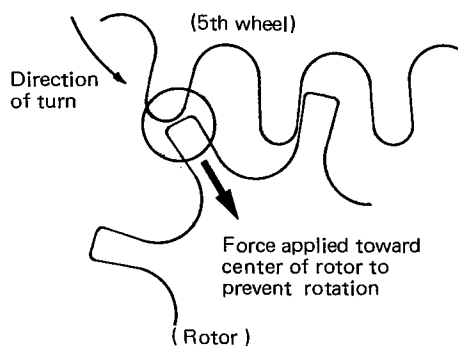
Phenomenon:

It rarely occurs that the second hand skips about 2 ~ 10 seconds when the hands are turned (quickly in particular) after pulling out the crown by 2 steps.

In this caliber, the conventional brake lever or the like is not used to prevent the rotation of the 4th wheel and pinion which is caused when the hands are turned. And thus the rotation of the 4th wheel is prevented in this caliber by securing an engagement between the rotor and the 5th wheel and pinion (See the diagram below).

In this connection, the second hand stops at the moment when the crown is pulled out 2 steps to make it impossible to move forcibly the second hand.

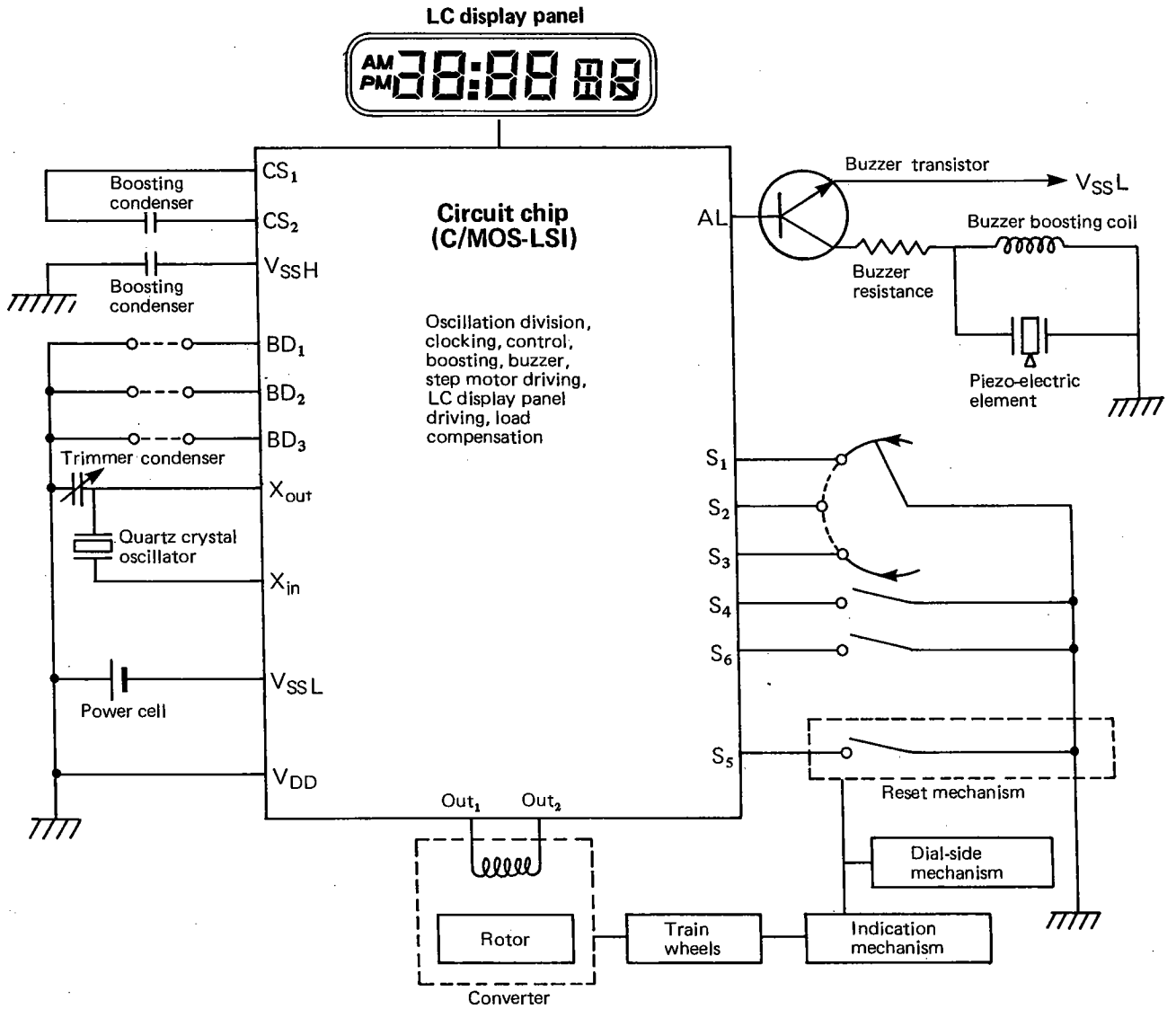
Thus the above-mentioned skip of the second hand is caused due to the timing between the hand turning speed and the engagement of gears. Accordingly, this phenomenon never arises when the hands are turned in a low speed.



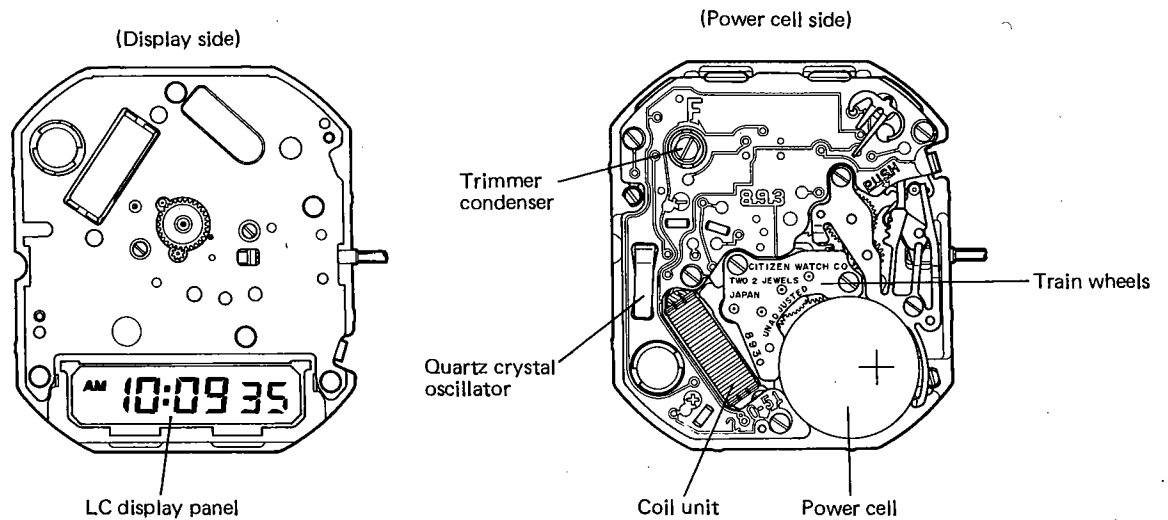


§5. STRUCTURE OF MOVEMENT

1) Circuit diagram



2) Movement

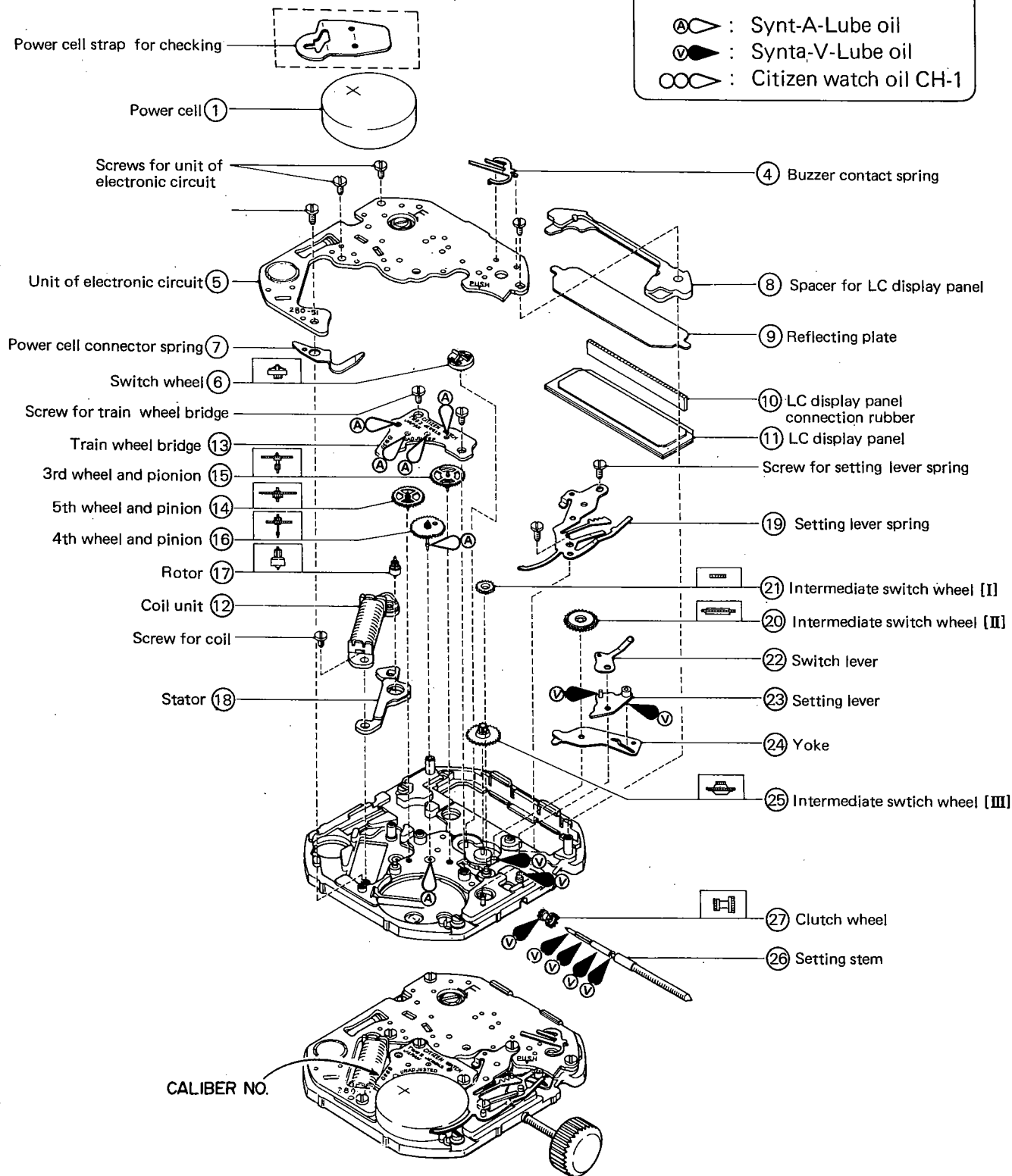


§ 6. DISASSEMBLY/ASSEMBLY WITH LUBRICATION

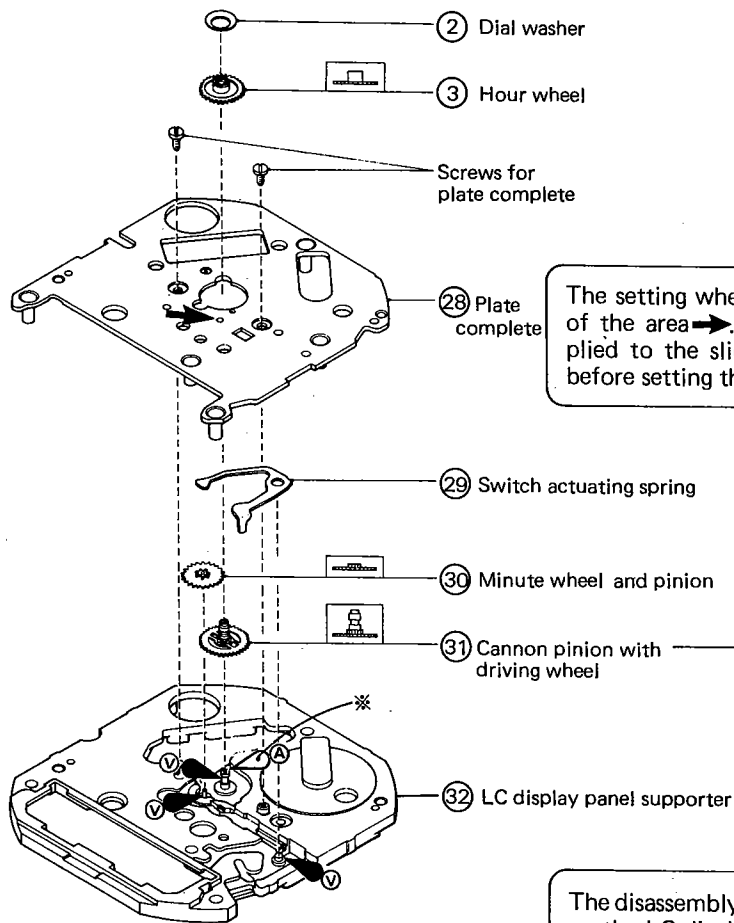
1) Power cell side

Disassembling procedure: ① → ③②  
 Assembling procedure: ③② → ①

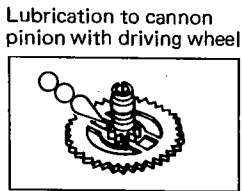
Marks of lubrication  
 Ⓐ : Synt-A-Lube oil  
 ▼ : Synta-V-Lube oil  
 ∞ : Citizen watch oil CH-1



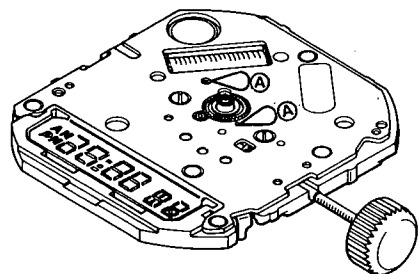
2) Dial side



The setting wheel is caulked at the back side of the area →. The Synta-V-Lube oil is supplied to the sliding part from the back side before setting the plate complete.



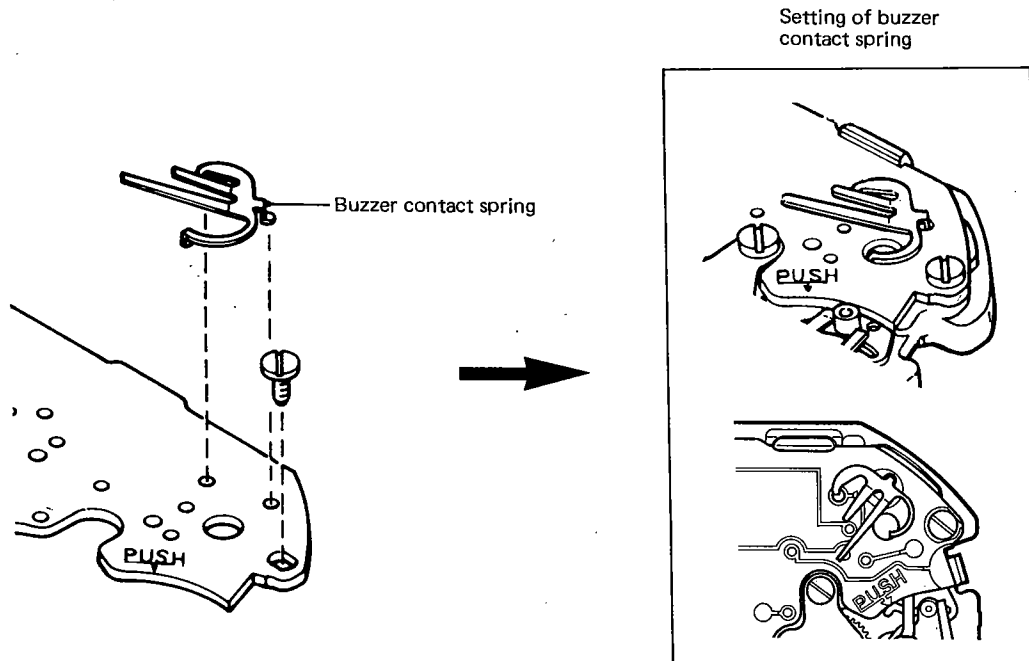
The disassembly/assembly is carried out based on the LC display panel supporter.



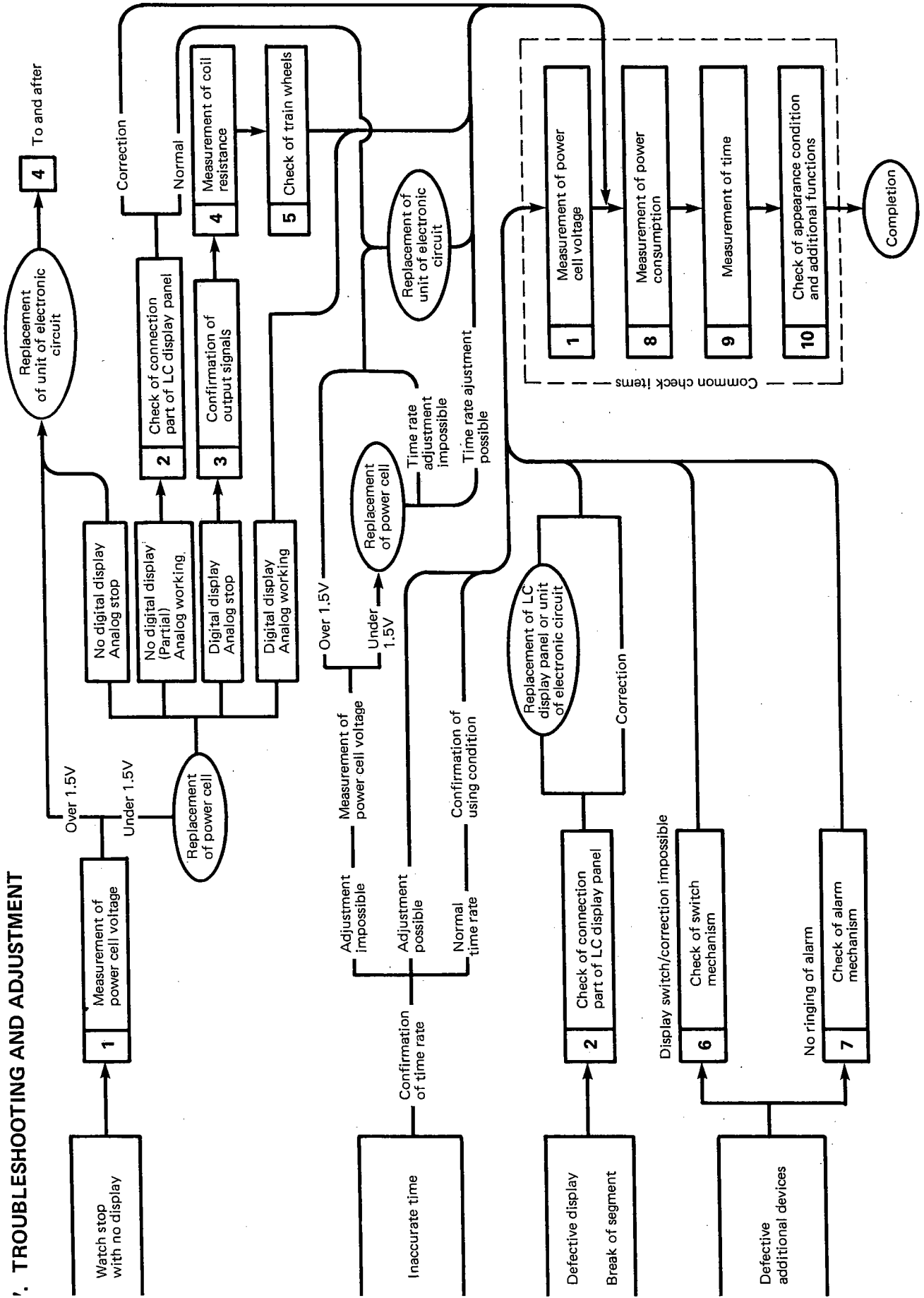
\* Lubrication to lower tenon of 5th wheel and pinion  
The Synta-V-Lube oil is supplied to the lower tenon of the 5th wheel before setting of the plate complete.

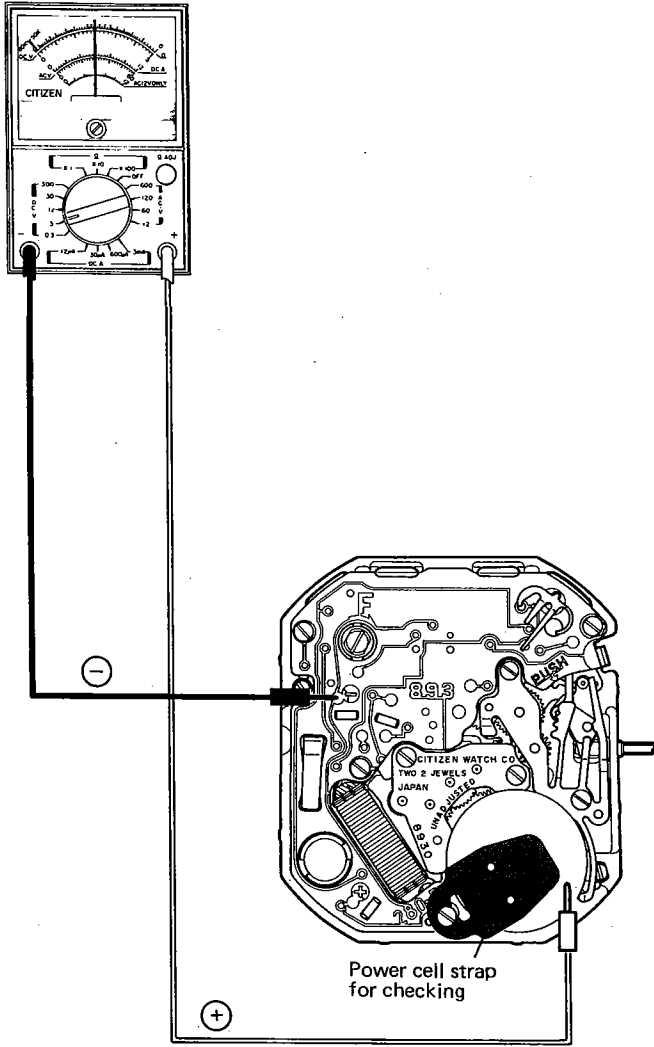
### 3) Notes on disassembly/assembly

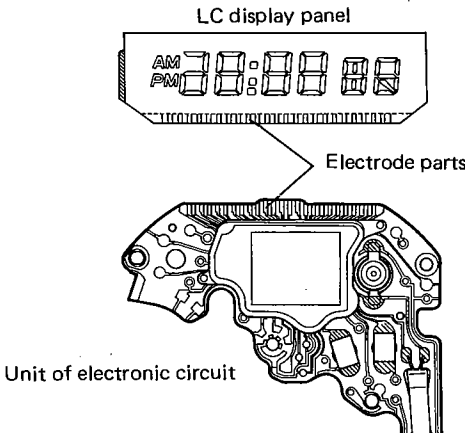
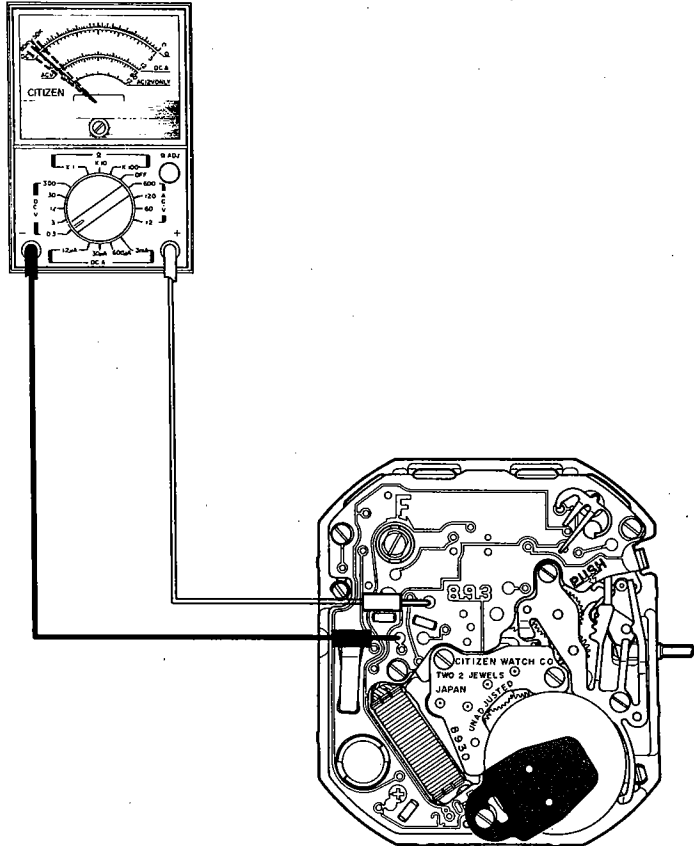
- ① Owing to a thin-gage movement of this caliber, the load may be applied to the plate complete or the LC display panel supporter to cause a malfunction to them if the assembly of the unit of electronic circuit, the attachment of hands and the like are carried out without using the movement holder.  
In this connection, the movement holder must always be used when carrying out the disassembly/assembly.
- ② Assembly of unit of electronic circuit  
The unit of electronic circuit is fixed with four pieces of screws and then hooked at two areas to the LC display panel supporter at the joint to the LC display panel.  
When assembling, the four screw parts of the unit of electronic circuit are set first and then the hook part is set.  
The hook part is set as if the unit of electronic circuit were pressed to the LC display connection rubber. In this case, no play is required for the hook part of the LC display panel supporter. This is to avoid the malfunction or flaws.  
And the setting of the unit of electronic circuit is impossible if the LC display panel is set adversely. And thus if you try to press forcibly the unit of electronic circuit, the LC display panel may be cracked.  
In this respect, the LC display panel must be set in the correct direction.
- ③ Setting of buzzer contact spring  
The buzzer contact spring has been changed to the type as shown in the diagrams below from the conventional spring-type one. This is due to the fact that the gap between the unit of electronic circuit and the piezoelectric element is small in this watch.  
The three feet of the buzzer contact spring must be set assuredly into the holes of the unit of electronic circuit.

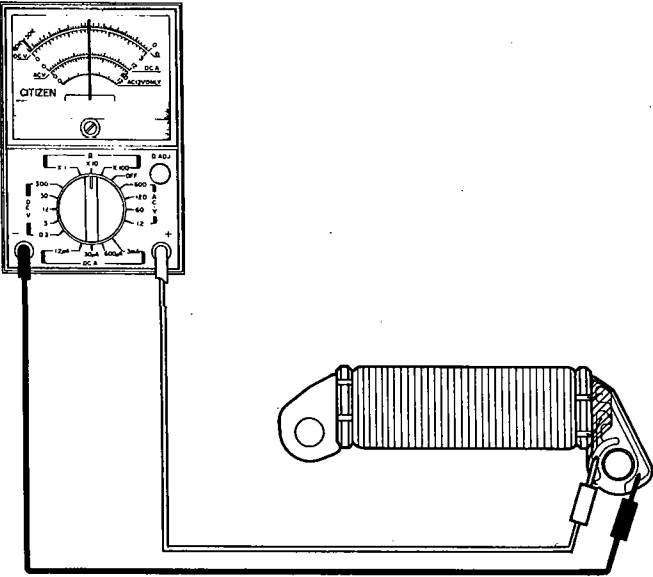
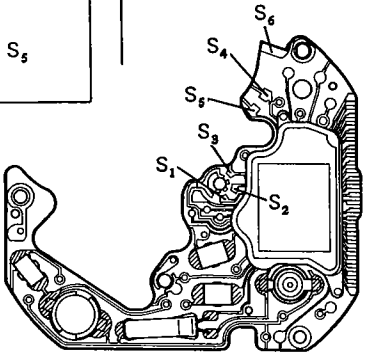


7. TROUBLESHOOTING AND ADJUSTMENT



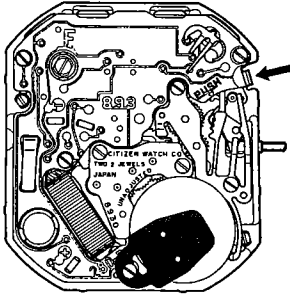
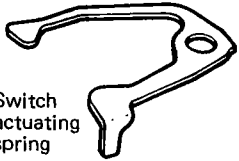


Checking items	How to check	Result and treatment
<p>1 Measurement of power cell voltage</p>	<p>[DC 3V Range]</p>  <p>Power cell strap for checking</p>	<p><b>Over 1.5V</b> → Normal</p> <p><b>Under 1.5V</b> → Replacement of power cell</p>
<p>2 Check of connection part of LC display panel</p>	<p>(Full-segment glowing test) With push of <b>M</b> button after pulling out the crown 2 steps, all segments glows. This can be used for a check of the "break of segment".</p> <p>1) Check of LC display panel connection rubber</p> <p>① Check of setting state of connection rubber</p> <ul style="list-style-type: none"> <li>• Make sure that the LC display panel connection rubber is set in a correct way without any bend or fall-down.</li> <li>• Make sure that the LC display panel supporter and the unit of electronic circuit are hooked completely to each other at two areas.</li> </ul> <p>② Check of LC display panel connection rubber itself</p> <ul style="list-style-type: none"> <li>• Make sure that the connection rubber has no twist nor wear.</li> <li>• Make sure that the connection rubber is free from any dust or stains.</li> </ul>	<p>Incomplete setting → To be set again</p> <p>Rubber twisted or worn out → Replacement of connection rubber</p> <p>Dust or stains → To be cleared away</p>

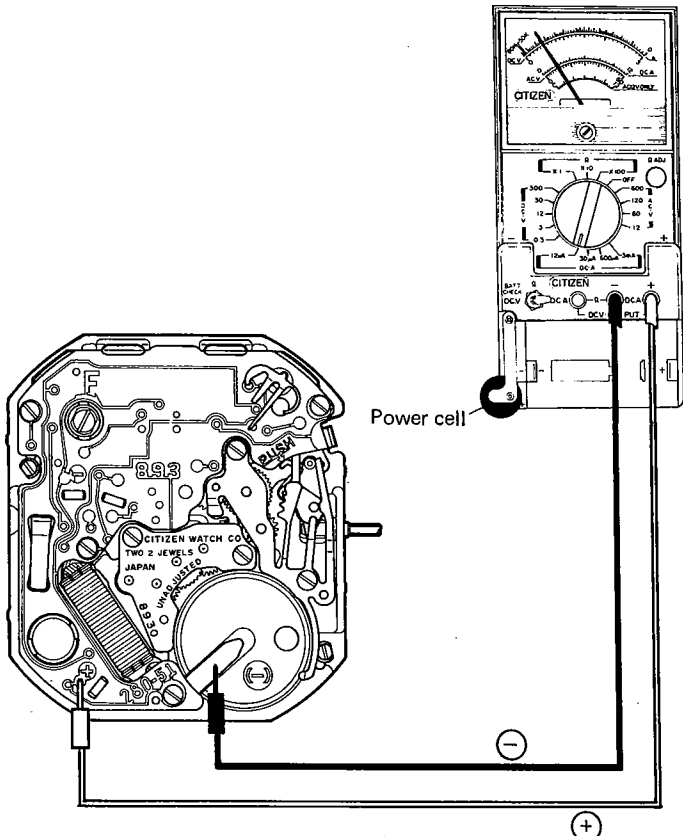
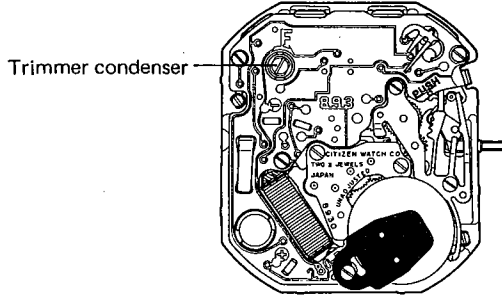
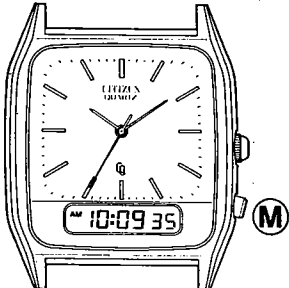
Checking items	How to check	Result and treatment
	<p>2) Check of LC display panel</p> <ul style="list-style-type: none"> <li>• Make sure that the electrode part of the LC display panel has no crack nor break and also free from any dust or stains.</li> </ul> <p>3) Check of unit of electronic circuit</p> <ul style="list-style-type: none"> <li>• Check whether some dust or stains are stuck to the electrode part of the unit of electronic circuit.</li> </ul> 	<p>Crack or break</p> <p>→ Replacement of LC display panel</p> <p>Dust or stains</p> <p>→ To be cleared away</p> <p>Dust or stains</p> <p>→ To be cleared away</p> <p>No display secured yet even after above checks</p> <p>→ Replacement of LC display panel</p> <p>No correct display secured even after replacement of LC display panel</p> <p>→ Replacement of unit of electronic circuit</p>
<p><b>3</b> Confirmation of output signals</p>	<p>[DC 0.3V Range]</p> 	<p>If the tester's pointer is deflected right and left with every second and centering on 0V, the transmission of the output signals are normal.</p> <p>Transmission of output signals</p> <p>→ No fault with unit of electronic circuit</p> <p>No transmission of output signals</p> <p>→ Replacement of unit of electronic circuit</p>

Checking items	How to check	Result and treatment																	
<p>4 Measurement of coil resistance</p>	<p>[X10Ω Range]</p> 	<p>2.0 ~ 2.5 kΩ → Normal</p> <p>Out of 2.0 ~ 2.5 kΩ → Replacement of coil unit</p>																	
<p>5 Check of train wheels</p>	<p>As mentioned on page 7, the rotation of the 4th wheel caused by the turning of hands is prevented by the engagement between the 5th wheel and the rotor.</p> <p>Accordingly, it is impossible with this caliber to confirm the transmission among gears by giving turns to the train wheels with the forming bar, tweezers and the like.</p> <p>Thus the following points are checked.</p> <ol style="list-style-type: none"> <li>1) Make sure that a proper clearance is secured for each gear.</li> <li>2) Check whether some dust or stains are mixed among the gears and whether the lubrication is proper.</li> </ol>																		
<p>6 Check of switch mechanism</p>	<p>1) The switch/correction of display is impossible with operation of the crown. As shown in the diagram below, the switch patterns are set as S<sub>1</sub> ~ S<sub>6</sub> on the unit of electronic circuit.</p> <p>The relation between the switch patterns and the contact parts is shown in the chart below with each position of the crown.</p> <table border="1" data-bbox="456 1499 1140 1774"> <thead> <tr> <th rowspan="2">Position of crown</th> <th rowspan="2">Function</th> <th colspan="2">Contact to switch pattern</th> </tr> <tr> <th>Contact parts</th> <th>Pattern</th> </tr> </thead> <tbody> <tr> <td rowspan="2">1-step pull-out</td> <td>Correction possible</td> <td>Switch lever</td> <td>S<sub>4</sub></td> </tr> <tr> <td>Correction given (by turn)</td> <td>Switch wheel</td> <td>S<sub>1</sub>, S<sub>2</sub>, S<sub>3</sub></td> </tr> <tr> <td>2-step pull-out</td> <td>Reset to time display Power saving switch</td> <td>Switch lever</td> <td>S<sub>5</sub></td> </tr> </tbody> </table>  <p>S<sub>6</sub> serving as contact to M button</p>	Position of crown	Function	Contact to switch pattern		Contact parts	Pattern	1-step pull-out	Correction possible	Switch lever	S <sub>4</sub>	Correction given (by turn)	Switch wheel	S <sub>1</sub> , S <sub>2</sub> , S <sub>3</sub>	2-step pull-out	Reset to time display Power saving switch	Switch lever	S <sub>5</sub>	
Position of crown	Function			Contact to switch pattern															
		Contact parts	Pattern																
1-step pull-out	Correction possible	Switch lever	S <sub>4</sub>																
	Correction given (by turn)	Switch wheel	S <sub>1</sub> , S <sub>2</sub> , S <sub>3</sub>																
2-step pull-out	Reset to time display Power saving switch	Switch lever	S <sub>5</sub>																



Checking items	How to check	Result and treatment
	<p>① The crown is operated in the state of a complete movement to make sure a smooth and assured working of the switch lever and the switch wheel each.</p> <p>② If no defect is detected through the inspection of ①, the unit of electronic circuit is removed out of the movement to give the following inspections to the contact parts.</p> <ul style="list-style-type: none"> <li>• Make sure that the spring part of the switch lever has no malformation nor break to ensure a correct setting and that the spring part is free from any dust or stains.</li> <li>• Make sure that the switch wheel is free from any malformation or dust and stains.</li> </ul>  <p style="text-align: center;">Spring part Switch lever</p>  <p style="text-align: center;">Switch wheel</p> <p>③ Check whether the patterns on the unit of electronic circuit have some defective conduction due to the dust or stains.</p>	<p>Malformation or break → Replacement of parts</p> <p>Dust or stains → To be cleared away</p> <p>Repair impossible through above inspections → Replacement of unit of electronic circuit</p>
	<p>2) The switch/correction of display is impossible with the push-button.</p> <p>① Check of movement itself The switch spring corresponding to (M) button is pressed to make sure a smooth and correct operation.</p>  <p>② Check of push-button</p> <ul style="list-style-type: none"> <li>• Make sure that the push-button is free from any malformation or dust and stains.</li> <li>• The push-button is set to the case to make sure its smooth working.</li> </ul> <p>③ Check of switch mechanism The (M) button has a contact to the switch pattern S<sub>6</sub> on the unit of electronic circuit via the switch actuating spring.</p> <ul style="list-style-type: none"> <li>• Make sure that the switch actuating spring is set in a correct way with no malformation nor breakage.</li> <li>• Make sure that the contact part between the pattern S<sub>6</sub> and the switch actuating spring is free from any dust or stains.</li> </ul>  <p style="text-align: center;">Switch actuating spring</p>	<p>Operation possible → 2</p> <p>Operation impossible → 3</p> <p>Malformation → Replacement of button</p> <p>Dust or stains → To be cleared away</p> <p>Repair impossible through above inspections → Replacement of unit of electronic circuit</p>

Checking items	How to check	Result and treatment
<p>7 Check of alarm mechanism</p>	<p>1) Confirmation of alarm output by tester</p> <p>The <math>\ominus</math> lead is applied to the buzzer contact spring or the pattern on the unit of electronic circuit after removing the buzzer contact spring.</p> <p>The switch spring is pushed continuously while applying the lead in order to secure the alarm monitor mode.</p> <div data-bbox="430 451 1079 1228" style="text-align: center;"> <p>[DC 0.3V Range]</p> </div> <p>2) The following points are checked when no fault is detected through the inspection of 1).</p> <ol style="list-style-type: none"> <li>① Make sure that the buzzer contact spring is set in a correct way with no bend nor malformation.</li> <li>② Check whether some dust or stains are stuck to the pattern on the unit of electronic circuit to have a contact to the buzzer contact spring to cause a defective conduction.</li> <li>③ This caliber applies the "case back vibrating method" for alarm by adhering the piezoelectric element to the case back.</li> </ol> <p>As a result, the crack or break of the piezoelectric element due to the shock or the slack of the case back can be improved along with the intensity of adhesive in comparison with the conventional "vibrating plate type".</p> <p>Here an inspection is given to an assured contact between the buzzer contact spring and the piezoelectric element.</p>	<p>Deflection of pointer</p> <p>→ No fault in unit of electronic circuit</p> <p>→ 2)</p> <p>No deflection of pointer</p> <p>→ Replacement of unit of electronic circuit</p> <p>Bend or malformation</p> <p>→ Replacement of contact spring</p> <p>Dust or stains</p> <p>→ To be cleared away</p>

Checking items	How to check	Result and treatment
<p>8 Measurement of power consumption</p>	<p>[DC 12<math>\mu</math>A Range]</p>  <p>Power cell</p>	<p>1) Measurement with complete movement</p> <p><b>Under 2.0<math>\mu</math>A</b></p> <p>→ Normal</p> <p><b>Over 2.0<math>\mu</math>A</b></p> <p>→ 2) Measurement with unit of electronic circuit itself</p> <p>2) Measurement with unit of electronic circuit itself</p> <p><b>Under 1.0<math>\mu</math>A</b></p> <p>→ 2) Check of connection part of LC display panel</p> <p><b>Over 1.0<math>\mu</math>A</b></p> <p>→ Replacement of unit of electronic circuit</p>
<p>9 Measurement of time</p>	<p>The measurement of time is possible in both the analog and digital sections of the microphone of quartz tester. And the adjustment of time is performed by the trimmer condenser.</p>  <p>Trimmer condenser</p>	
<p>10 Check of appearance condition and additional functions</p>	<p>The following points are confirmed with a complete watch.</p> <ol style="list-style-type: none"> <li>1) The figures or marks displayed have no defect at all.</li> <li>2) The crown and the push-button can be operated in a smooth and correct way for each function.</li> <li>3) The appearance part of the watch is free from any dust or stains.</li> </ol>	

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