

***TECHNICAL
INFORMATION***

CITIZEN QUARTZ

Cal. No. 961※

 **CITIZEN**

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■1. OUTLINE



This is an LCD analog/digital display watch provided with a segmented luminous indicator through the light sensor technique.

It is our leading product heightening the image of Citizen-digital as a genuine multi-functional digital watch with which one can enjoy sound plays by controlling input light of the watch.

■2. FEATURES

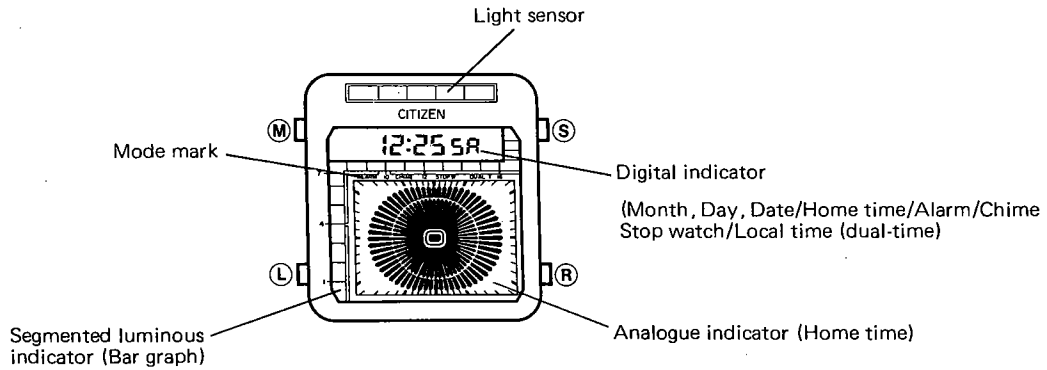
- 1) The segmented luminous indicator is colorfully designed in such way that the illumination is indicated by a bar-graph divided a range of 0 to 100,000 Lx (lux) into 20 steps and the luminous condition is displayed by three colors of green, red and blue.
- 2) The musical scale (do, re, mi, fa . . .) can be enjoyed by controlling the input light onto the light sensor.
- 3) Power cell lifetime is about four years in spite of multi-functional digital watch with light sensor, alarm, light and so forth.

■3. SPECIFICATIONS

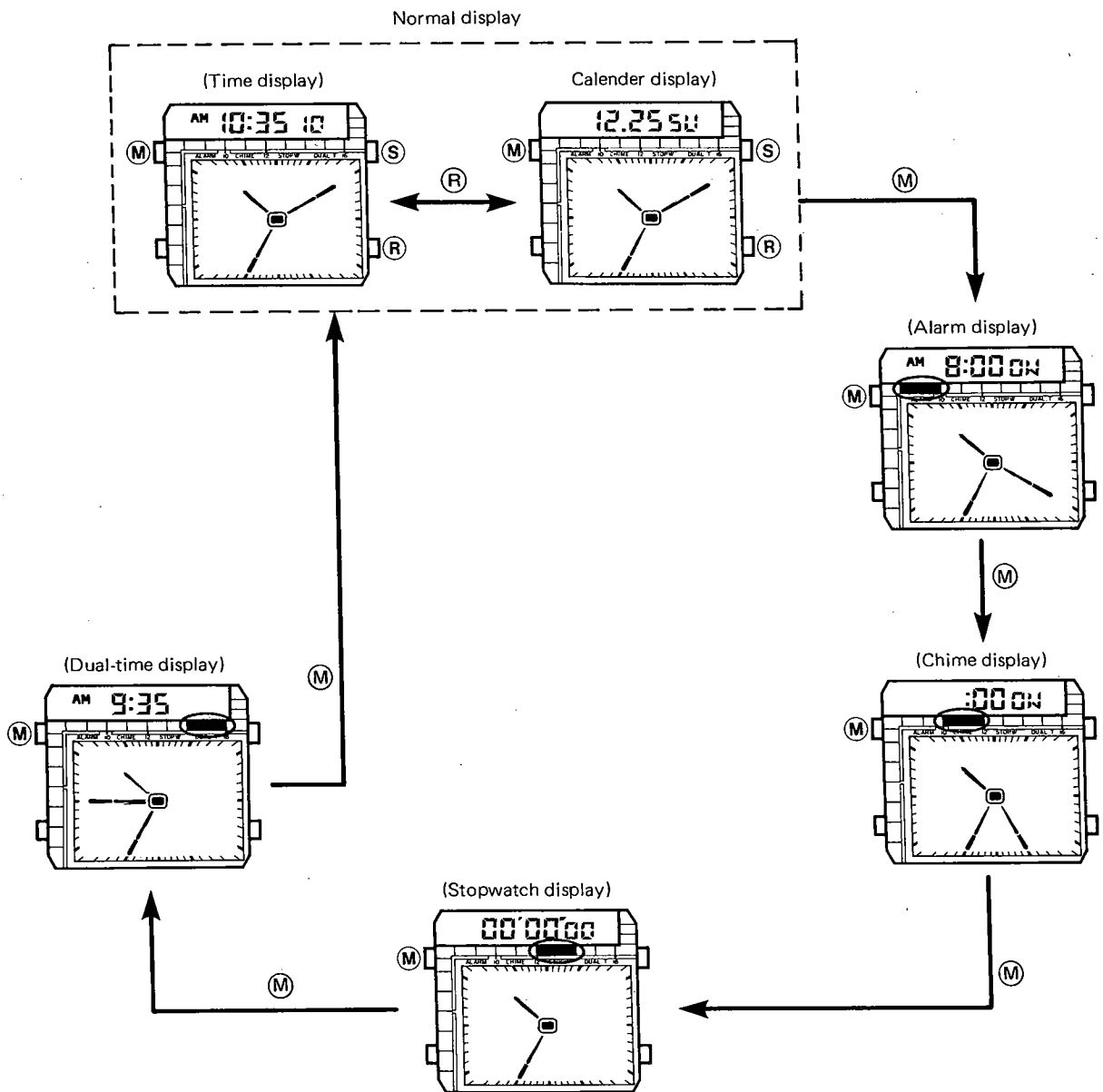
Caliber number	9610	
Type	Digital type quartz crystal watch	
Module size	Size : 27.0mm (12H-6H) x 25.0mm (9H-3H) Thickness : 4.41mm	
Accuracy	±15 sec/month at normal temperatures	
Oscillation	32,768 Hz	
Display method	FE type nematic LC (liquid crystal) multiplex driving Analogue part : Three hands type, 60 x 2 = 120 segments 5-split Digital part : Six digits + mark, 3-split driving Bar graph part : Three color indication, 20 segments, 3-split driving	
Integrated circuit	C/MOS-LSI 1 unit (for watch) and C/MOS-MSI 1 unit (for segmented luminous indicator)	
Effective temperature range	0°C ~ +55°C (32°F ~ 131°F)	
Adjustment of time rate	By trimmer condenser	
Display functions	Normal display	Digital part : "Month, Day, Date" . . . Calender "A/P. Hour, Min., Sec." . . . Home time Analogue part : "Hour, Min., Sec." . . . Home time Bar graph part : "Data indication"
	Alarm	Digital part : "A/P. Hour, Min., Sec., ON/OFF" Analogue part : "Hour, Min., Sec." . . . Home time Bar graph part : On and Off.
	Chime	Digital part : "00, ON/OFF" Analogue part : Condition of "ON" . . . all light Condition of "OFF" . . . all light out
	Stopwatch	Digital part : "Min., Sec., 1/100 sec." (60-minute count) Analogue part : "Hour, Min., Sec." . . . Home time Bar graph part : Flickering
	Dual-time	Digital part : "Hour, Min." . . . Dual-time Analogue part : "Hour, Min., Sec." . . . Home time Bar graph part : Flickering
Addition functions	Sound play : 12H/24H system change, light (Alarm monitor) Instant manual return Fully automatic calendar (A.D. 1980 to 2019) Segmented luminous indicator	
Power cell (Lithium cell)	Parts No. : 280-202 (1 unit) Cell code : BR2016 (Li/(CF)n) Size : 20.0mmφ x 1.6mm Nominal voltage : 3.0V Capacity : 65mAH Lifetime : About four years (20 sec. sound play, 20 sec. alarm ring, 3 sec. lamp lighting & 24 hourly chimes per day)	

■4. HANDLING INSTRUCTIONS (Marks "○" show flashing.)

1) Nomenclature and functions

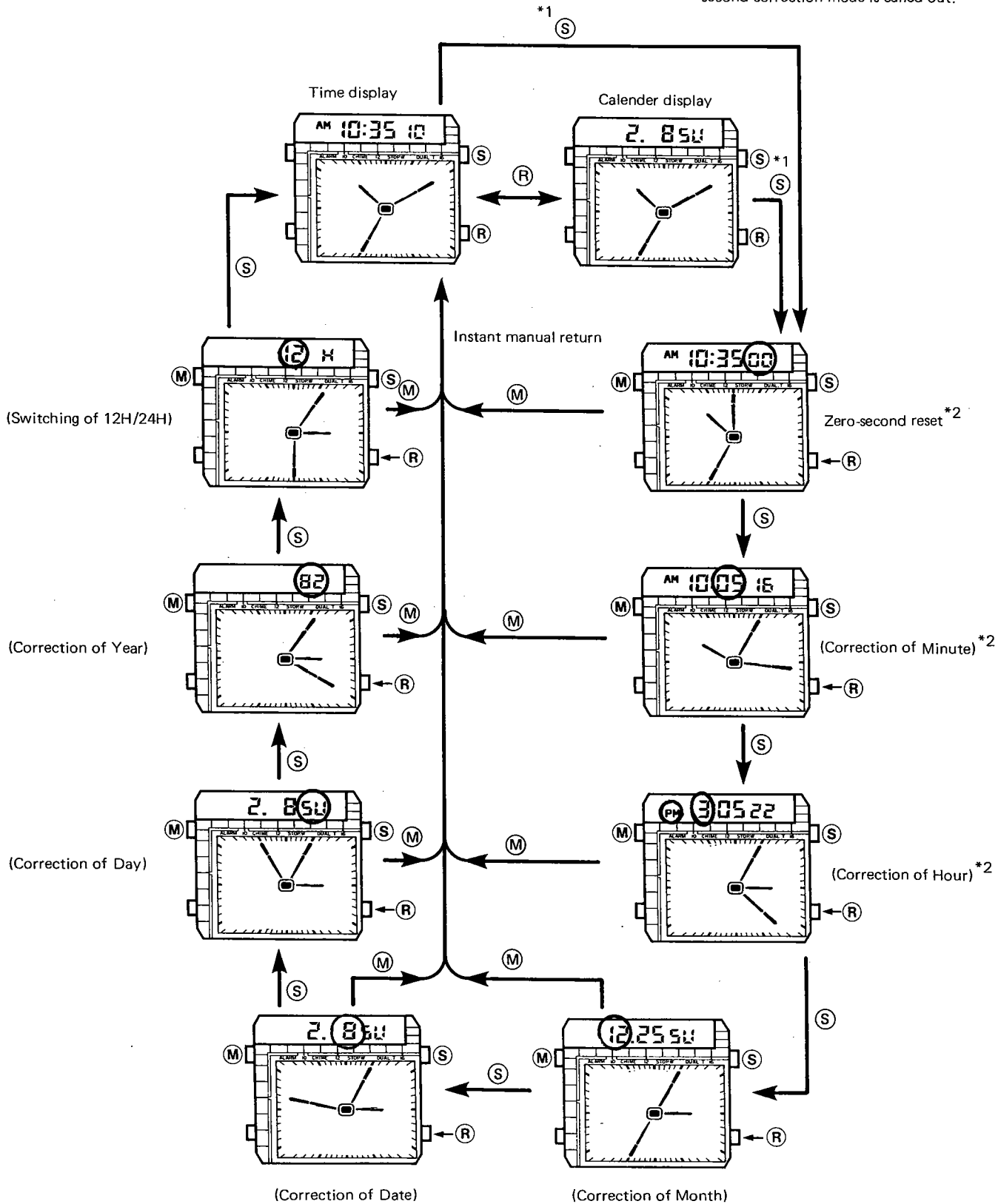


2) Switching of display



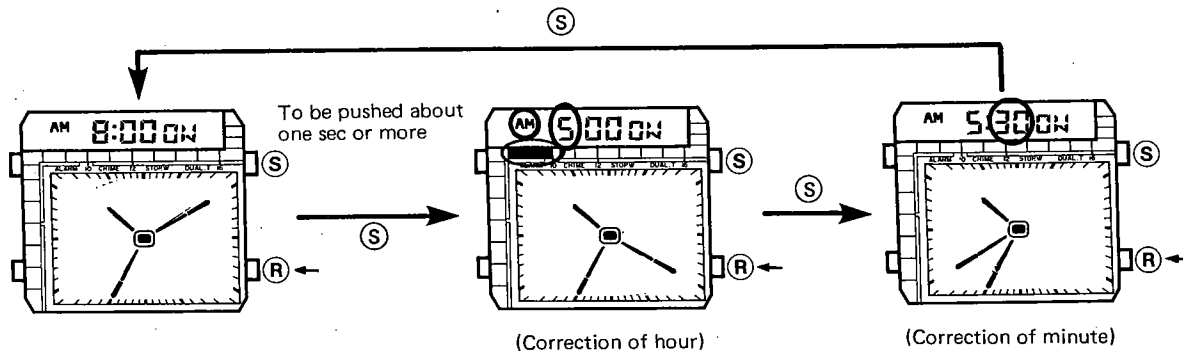
3) Correction of time and calendar

*1. The (S) button is pushed consecutively for one second or more only when the second correction mode is called out.



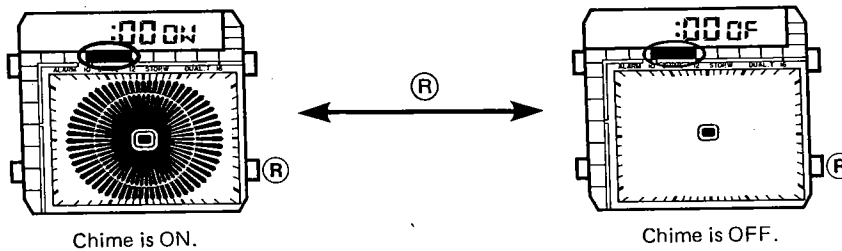
*2 The digital part and the analogue part are linked each other regarding hour, minute and second.

4) Operation of alarm

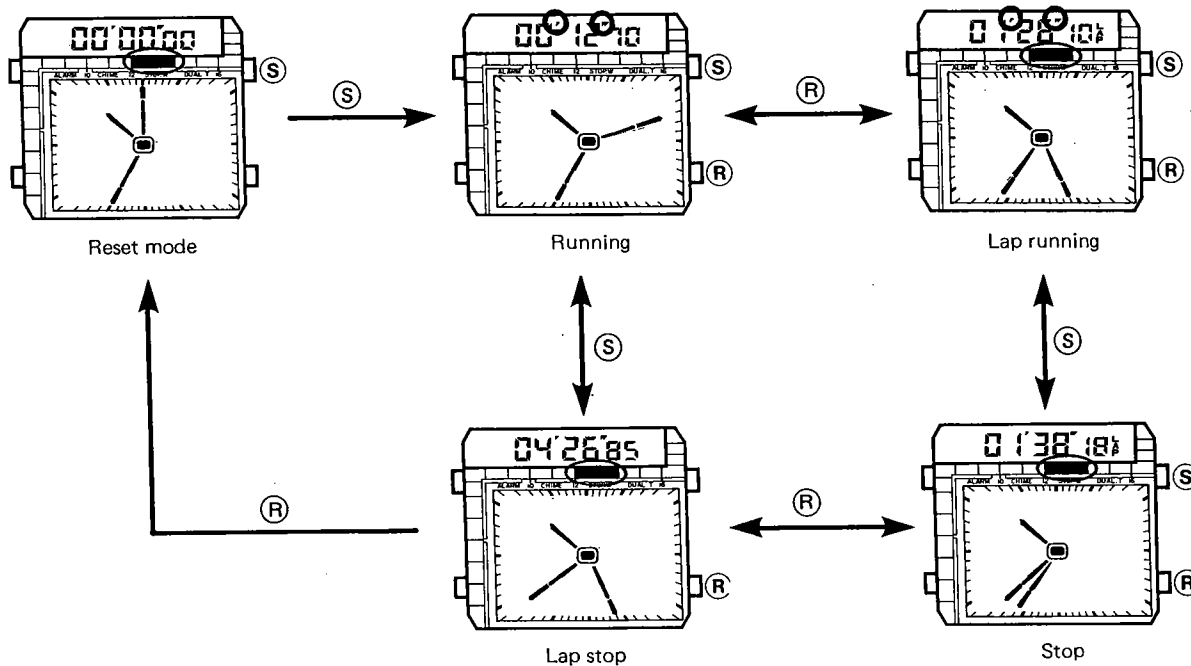


- *1 Switching of ON and OFF of the alarm can be done by the button (R).
- *2 AM/PM of the alarm time is linked with 12H/24H of the normal time display.
- *3 Keep pressing the button (S) till the time adjustment condition is reached, only in the case of changeover to the time adjusted indication. (Pressing period is about 1 to 2 seconds.)

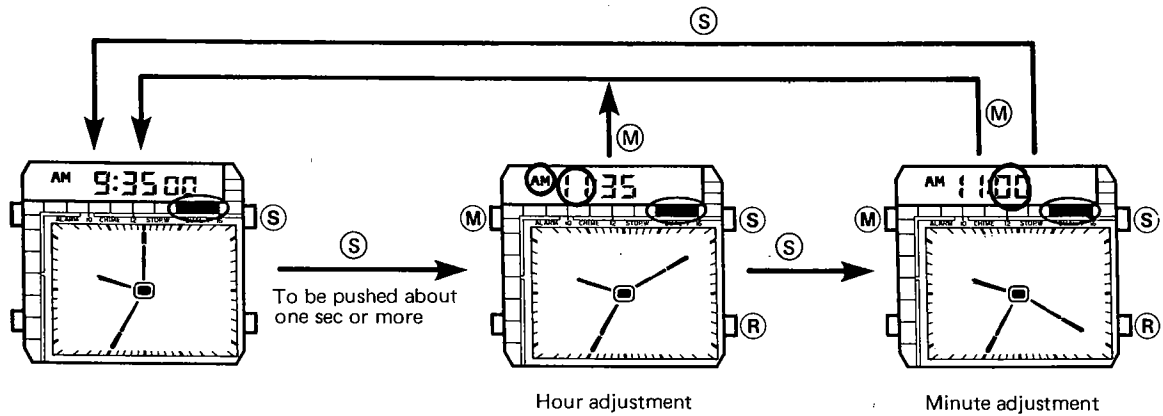
5) Operation of chime



6) Operation of stopwatch



7) Dual time



8) Sound play (Sound monitor)

The sound play (sound monitor) can be achieved with simultaneous push of both **(R)** and **(S)** buttons in the normal display mode (time indication or calendar indication).

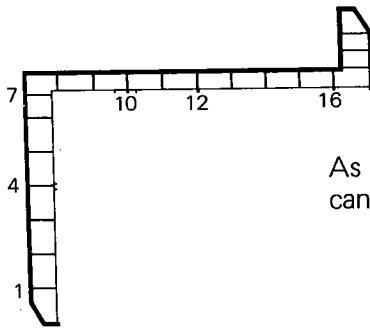
In this mode, one can enjoy sound of a musical scale corresponding to the ambient brightness for 15 to 20 seconds.

In this mode, the normal time displaying mode is kept.

9) Note on segmented luminous indicator

For the segmented luminous indicator used in this watch, some error may sometimes be produced on the bar graph display part due to the variance of the light source, the temperature, the luminous sensor itself, etc.

In this connection, this indicator should be used just for a standard of brightness.



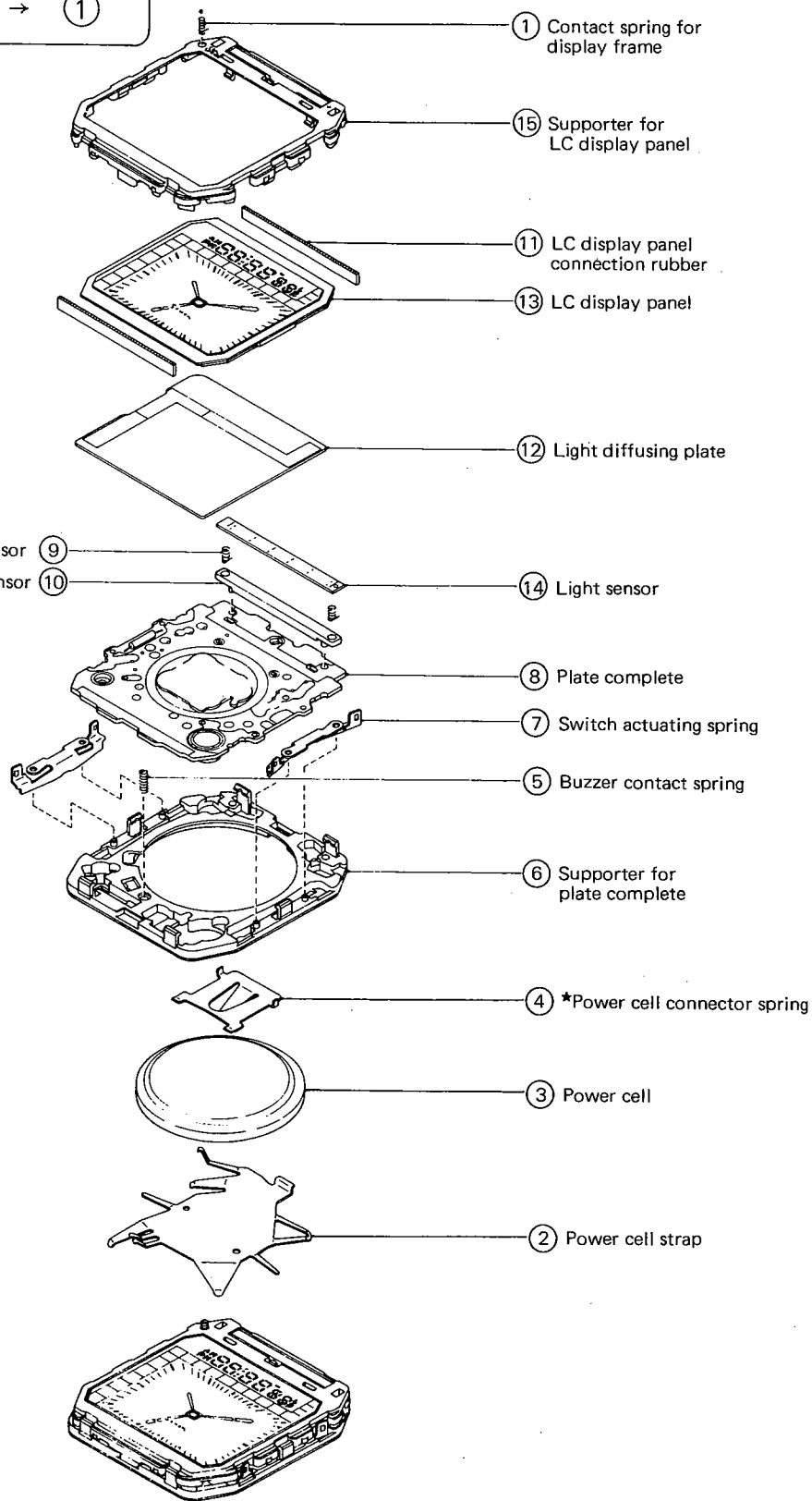
As illustrated, the bar graph display is scored by some figures, which can be used as a guide of illuminance as shown below.

<Reference>

NO	Color	Illuminance range		
		Locations	Works	Sports
16	Blue			
12				
10				
7	Red	<ul style="list-style-type: none"> ● Office ● Drafting room 	<ul style="list-style-type: none"> ● Office ● Typewriting ● Drafting ● Calculation 	General match <ul style="list-style-type: none"> ● Tennis ● Ping-pong
4		<ul style="list-style-type: none"> ● Office ● Meeting room ● School room ● Dining room 		
1	Green			Recreation <ul style="list-style-type: none"> ● Tennis ● Ping-pong General match <ul style="list-style-type: none"> ● Soccer

■5. DISASSEMBLY/ASSEMBLY OF MODULE

Disassembly : ① → ⑮
 Assembly : ⑮ → ①

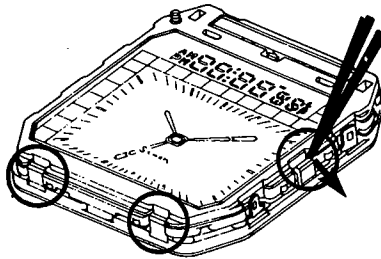


★Power cell connector spring, contact spring for light sensor, and supporter for light sensor are not required to be removed, except in the case of replacement of plate complete.

6. NOTES ON DISASSEMBLY AND ASSEMBLY

6-1. Notes on disassembly

- a) After removing the power cell, placing the watch so as to face its LC display panel upward, the six hook points shown in the figure below by Marks O (the figure shows only three points on the view side) by means of tweezers. In this case, the care should be paid not to press strongly the light sensor part.



- b) For removing the plate complete, placing the watch so as to face its LC display panel downward, the supporter for plate complete at the above-mentioned six hooks as pressing softly the center of the plate complete with finger.

6-2. Notes on assembly

- a) For handling of the light sensor with tweezers, much care should be paid so as not to break the sensor, because the sensor is a fragile small-size rectangular glass plate.

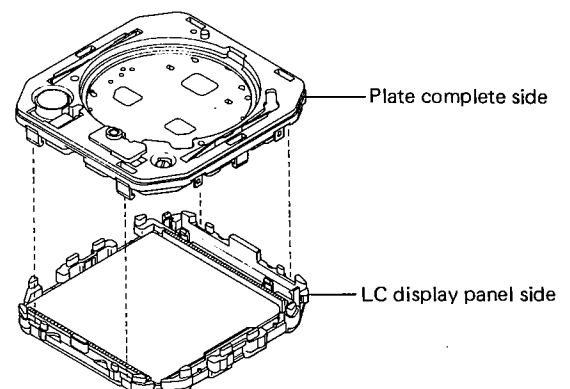
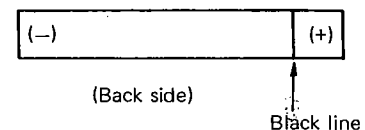
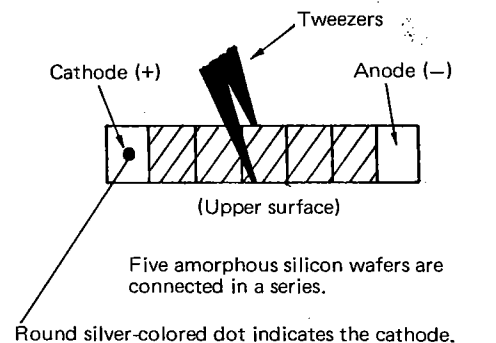
The light sensor is provided with terminals on its both side as shown in the right drawing. These parts should not be touched directly with a finger. In the case of cleaning, wipe dust and stain with very soft cloth or like Rodico.

The sensor should be fitted so that the black line side (+) on the back of the sensor is on the left side in the condition of completed module (LC display panel facing upward).

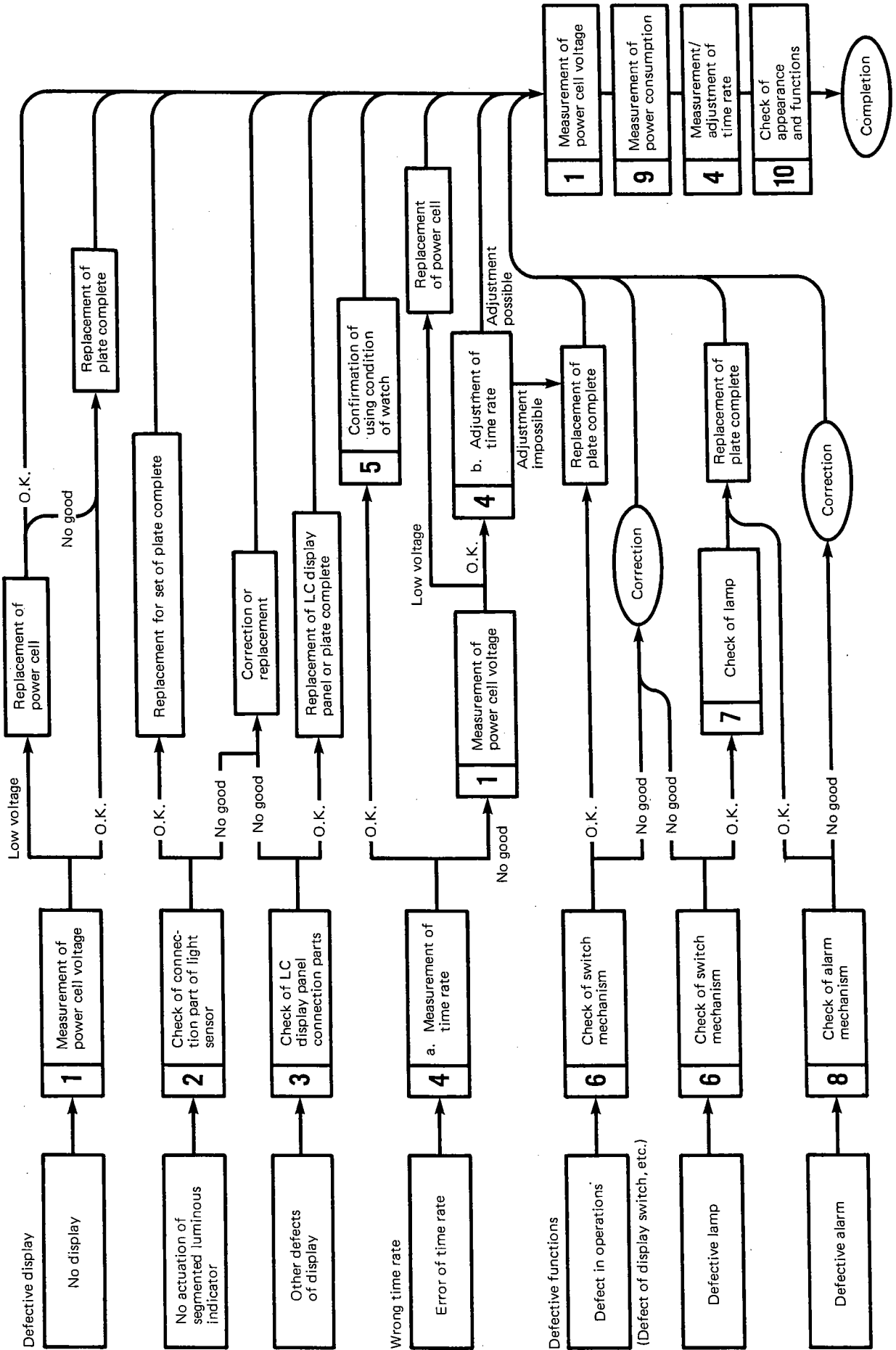
The light sensor fitting recess to the LC display panel supporter has a mark + indicating cathode (+) side of the light sensor.

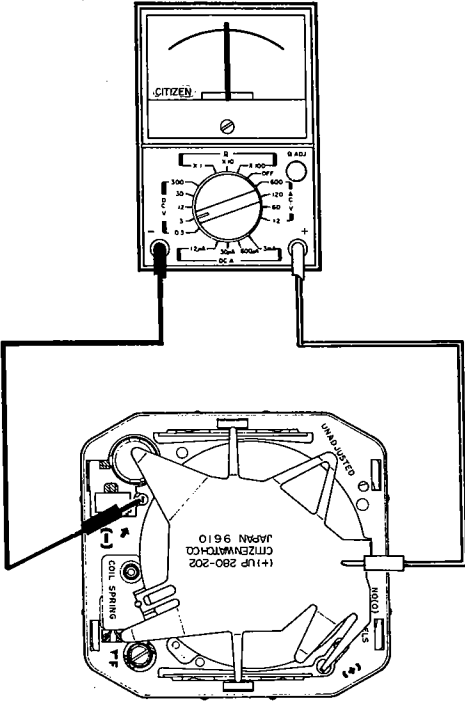
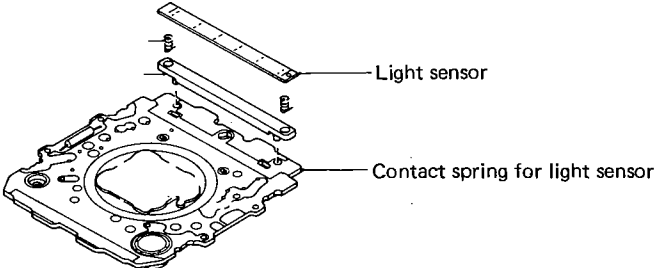
- b) The supporter for plate complete is assembled, after the plate complete has been assembled with the LC display panel supporter, so as not to be displaced by means of previous subassembly of the supporter for plate complete by fitting two switch actuating springs.

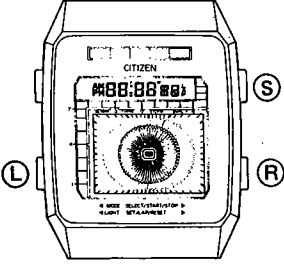
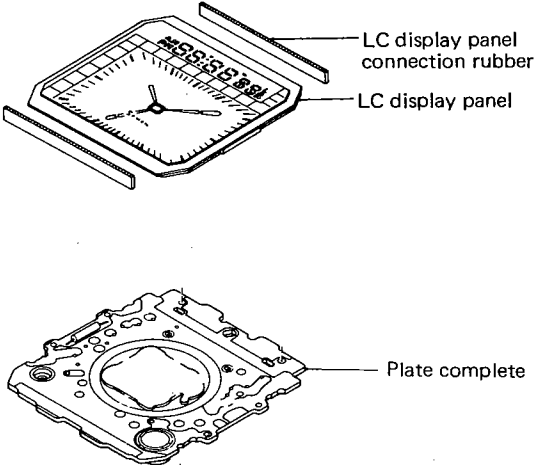
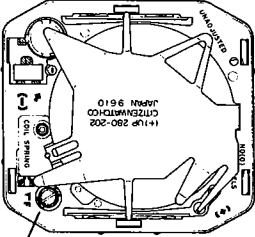
After this assembly, make sure the six points of hooks for clasp tightly.

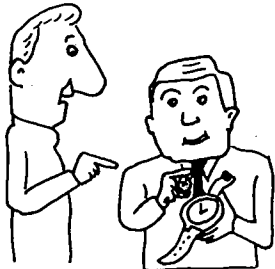
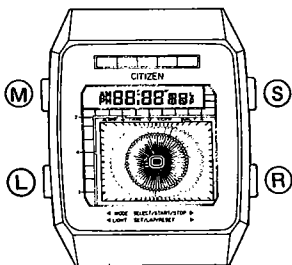
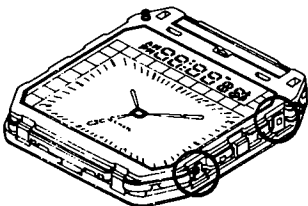


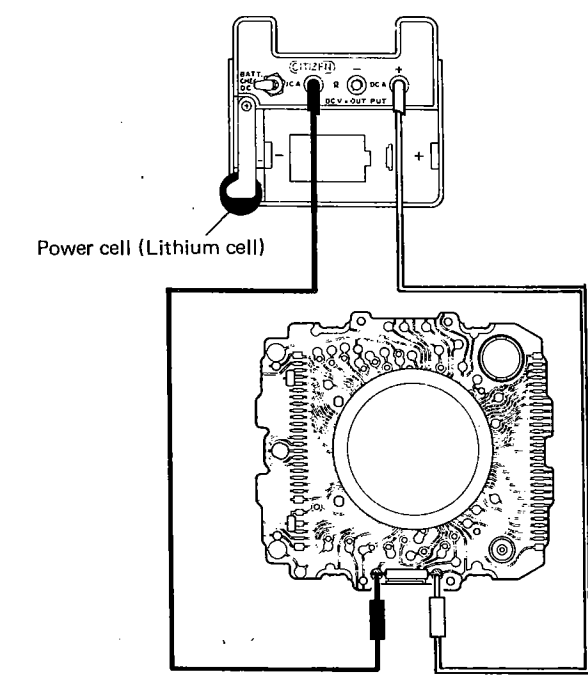
7. TROUBLESHOOTING AND ADJUSTMENT

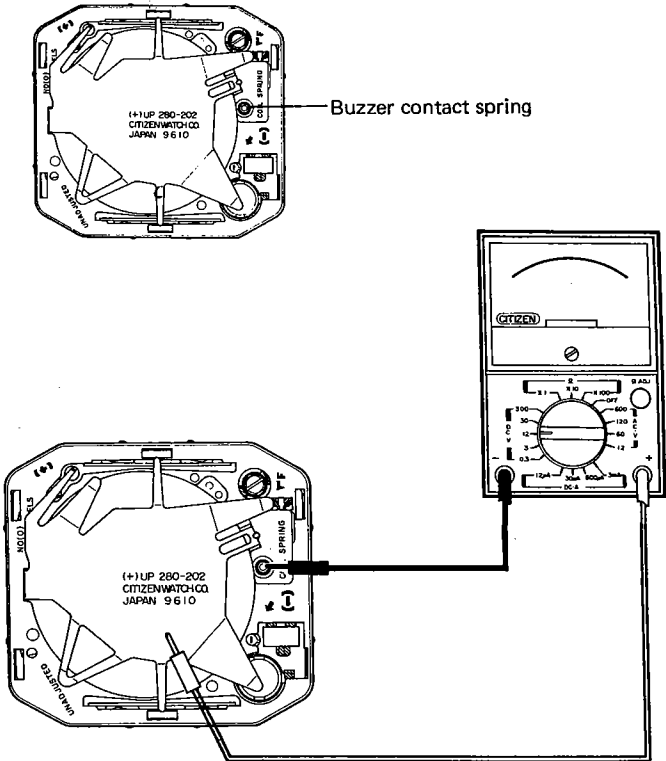


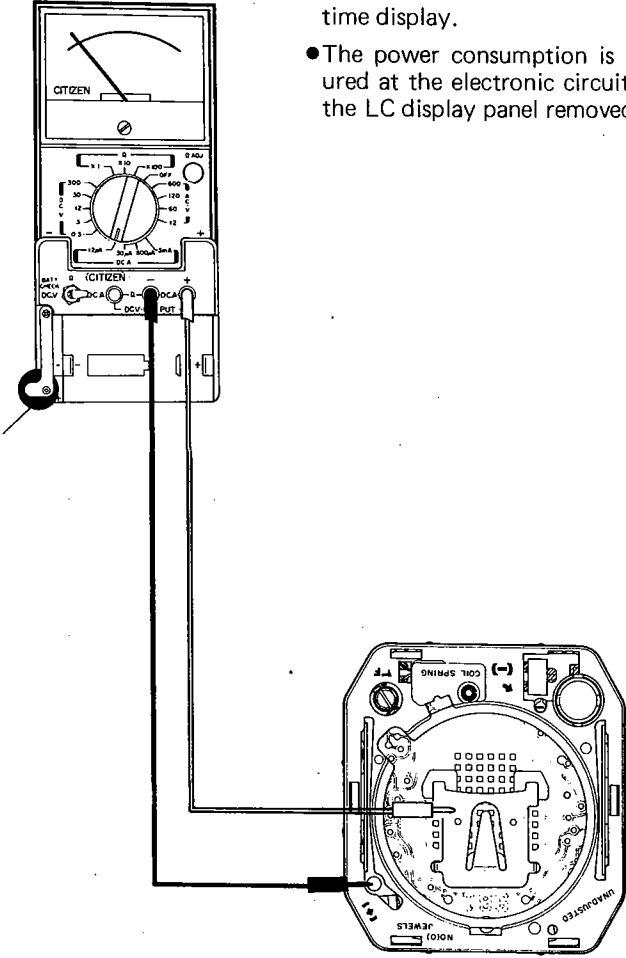
Checking items	How to check	Results and treatment
<p>1 Measurement of power cell voltage</p>	<p>Range of tester: DC-3V</p> 	<p>Over 2.8V → Nothing wrong</p> <p>Under 2.8V → Replacement of power cell</p>
<p>2 Check of connection part of light sensor</p>	<ul style="list-style-type: none"> ● Check the contact spring for light sensor for their fitting condition. No good → To be reassembled ● Check the photosensor for crack and breakage. Cracked or broken → Replacement with new one  <p>Note: When the light sensor is replaced, the plate complete should be replaced together with the sensor, because the accuracy of the segmented luminous indicator depends on combination of the light sensor and the plate complete. Therefore, the light sensor is not supplied as a simple spare part, but is supplied as set with the plate complete.</p>	

Checking items	How to check	Results and treatment
<p>3 Check of connection areas of LC display panel</p>	<p>(Full-segment glow check)</p>  <ul style="list-style-type: none"> ● The all segments of display glow with a simultaneous push of (S), (R) and (L) buttons. ● Check the defective segments by a full-segment glow state. ● The full-segment glow state is changed to the normal display mode with push of either one of the four push-buttons. <p>(Connection check among LC display panel, LC display panel connection rubber and plate complete)</p>  <p>LC display panel connection rubber</p> <p>LC display panel</p> <p>Plate complete</p>	<p>Rubber twisted or worn out → To be replaced</p> <p>Dust or stains → To be cleared off</p> <p>LC display panel cracked → To be replaced</p> <p>No defect detected through above checking → Replacement of LC display panel</p> <p>Correction impossible yet → Replacement of plate complete</p>
<p>4 Measurement/adjustment of time rate</p>	 <p>Trimmer condenser</p> <p>a. Time measurement For measurement of time, "MEASURE TIME" can be measured with two second range.</p> <p>b. Time adjustment If the pace is much out of order, adjust time by turning the trimmer condenser clockwise or counterclockwise.</p>	<p>Big error detected in time rate → Replacement of plate complete</p> <p>Normal time rate → Confirmation of using condition of watch</p> <p>Adjustment impossible → Replacement of plate complete</p>

Checking items	How to check	Results and treatment
<p>5 Confirmation of using condition of watch</p>	<p>The following points must be confirmed in case the time is inaccurate although no fault is detected through checking of the time rate, along with a measurement test.</p> <ol style="list-style-type: none"> Whether some misoperation has been given to the watch. Whether the watch has been used at an extremely high or low temperature. How many days have passed since the time adjustment was given last? 	
<p>6 Check of switch mechanism</p>	<ol style="list-style-type: none"> Make sure whether each function has the correct operation by pressing via the tweezers the switch spring corresponding to each push-button in the state of the module. Check of push-buttons In case no defective operation is detected through the check in the state of the movement, the push-button may have some defect.  <p>(The silicon oil must be applied to the O-ring of the push-button.)</p> <ul style="list-style-type: none"> Whether some dust or stains are sticking to the push-button or the area of the case where the push-button is removed. Whether the push-button has some malformation or breakage. Make sure whether the smooth operation is secured after setting the push-button to the case. Check of switch spring mechanism <ul style="list-style-type: none"> Whether each switch spring has some malformation or breakage.  	<p>Nothing wrong with operation (No trouble in movement) → 2. Check of push-buttons</p> <p>Something wrong with operation → 3. Check of switch spring mechanism</p> <p>No lighting of lamp → Check of lamp</p> <p>Dust or stains → To be removed</p> <p>Push-button deformed or broken → To be replaced with new one</p> <p>Spring deformed or broken → To be replaced with new one</p> <p>No defect detected → Replacement of plate complete</p>

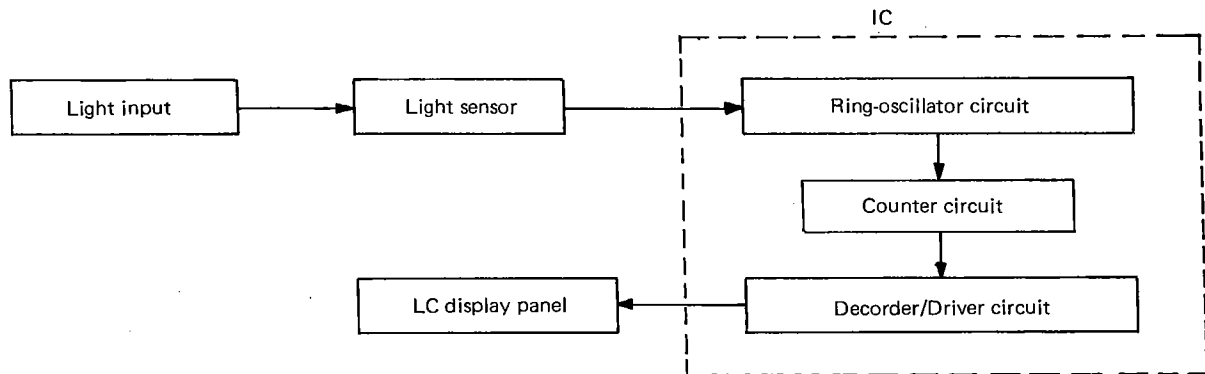
Checking items	How to check	Results and treatment
<p>7 Check of lamp</p>	 <p>Power cell (Lithium cell)</p> <p>As illustrated above, the leads from terminal OUTPUT of the tester's adaptor are applied to both ends of the lamp. In this case, no distinction is required between the plus and minus polarities.</p>	<p>Lighting</p> <p>→ Good</p> <p>No lighting</p> <p>→ Replacement of plate complete</p>

Checking items	How to check	Results and treatment
<p>8 Check of alarm mechanism</p>	<p>a. Check of piezoelectric element The crack and breakage of the piezoelectric element, which is of white color and adhered directly on the back cover, especially at the position hit by the buzzer contact spring cause fault of alarm.</p> <p>b. Check of the buzzer contact spring Check the buzzer contact spring for deformation and droop.</p> <p>c. Check of alarm output signal of the plate complete. (This inspection can be done with the module set into the case.)</p>  <p>The diagram consists of two parts. The top part shows the back cover of a watch module with the text '(+)UP 280-202 CITIZENWATCH CO. JAPAN 9610'. A label 'Buzzer contact spring' points to a specific component on the right side. The bottom part shows the same back cover with a multimeter connected to it. The multimeter is a 'CITIZEN' brand with a dial set to 'AC 12V'. The positive lead is connected to the 'BUZZER STRAP' terminal and the negative lead is connected to the 'BUZZER CONTACT SPRING' terminal.</p> <p>Setting of module:</p> <ul style="list-style-type: none"> ●Set the module in the sound monitor mode with a simultaneous push of S and R buttons in the normal time display mode. ●Set the tester range at AC 12V. ●Put the \oplus lead terminal of the tester on the buzzer strap and the \ominus lead terminal on the buzzer contact spring. <p>(The tester terminals should be put softly on spring to avoid the malformation of these springs.)</p> <p>And then, check the motion of the tester indicator.</p> <p>No motion of indicator → Replacement of plate complete Indicator having motion → Good</p> <p>Note: As the sound monitor stops to ring after 15 to 20 seconds, when the buzzer stops during check, continue the check by pressing again the S and R buttons.</p>	

Checking items	How to check	Results and treatment
<p>9 Measurement of power consumption</p>	<p>[DC: 12μA RANGE]</p>  <ul style="list-style-type: none"> ● The measurement must be carried out in the mode of the normal time display. ● The power consumption is measured at the electronic circuit with the LC display panel removed. 	<p>Under 1.8μA — Good</p> <p>Over 1.8μA → Measurement of power consumption with plate complete only</p> <p>Measurement of power consumption with plate complete only</p> <p>Under 1.2μA → Replace LC display panel</p> <p>Over 1.2μA → Replacement of plate complete</p>
<p>10 Check of appearance and functions</p>	<p>When all above checks are over, the appearance functions are inspected as follows.</p> <ul style="list-style-type: none"> ● The operation is correct and smooth for each function. ● The marks displayed are correct. ● Each function part is free from my dust or stains. ● And other factors. 	

■8. SEGMENTED LUMINOUS INDICATOR

1) Composition of segmented luminous indicator



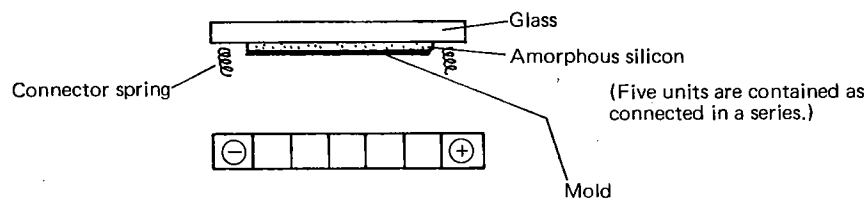
The light input to the watch is converted to the voltage corresponding to the strength of the input light through a light sensor. The ring-oscillator circuit oscillates at a frequency (F) corresponding to the input voltage. This frequency is counted by the counter circuit and the counted number is displayed on the LC display panel divided into 20 levels through the decoder/driver circuit.

2) Light sensor

The light sensor employed to this caliber is a semiconductor called "amorphous silicon" vacuum-evaporated on the lower surface of glass and molded with a light brownish material as a protection coating.

The amorphous silicon (a-Si) has an outstanding performance as a photo-electromotive force element converting photoenergy directly into electric energy.

The photosensor produces the electromotive force according to the illuminance of the light striking against the sensor.



Material for the amorphous silicon:

The main material gas of the amorphous silicon is composed of SiH_4 (silane), SiF_4 (silicon tetrafluoride), B_2H_6 (diborane), PH_3 (phosphine) and so on.

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