TECHNICAL INFORMATION

CITIZEN QUARTZ

Cal. No. C690

CITIZEN

Contents

§1. FEATURES

This is a combination solar-powered watch that is equipped with a solar cell incorporated in its face to convert light energy into electric energy for powering the hands, Alarm, Chronograph, and other functions.

This watch provides separete analog and digital sections and a larger solar cell for better recharging performance.

Once fully recharged, the watch will continue to run for about 7 months without additional recharging.

This watch uses a secondary battery for storing electric energy. This secondary battery is a "clean energy battery" that contains no hazardous substances. This secondary battery is designed to allow repeated recharging and discharging, and therefore does not have to be replaced like conventional batteries.

§2. SPECIFICATIONS

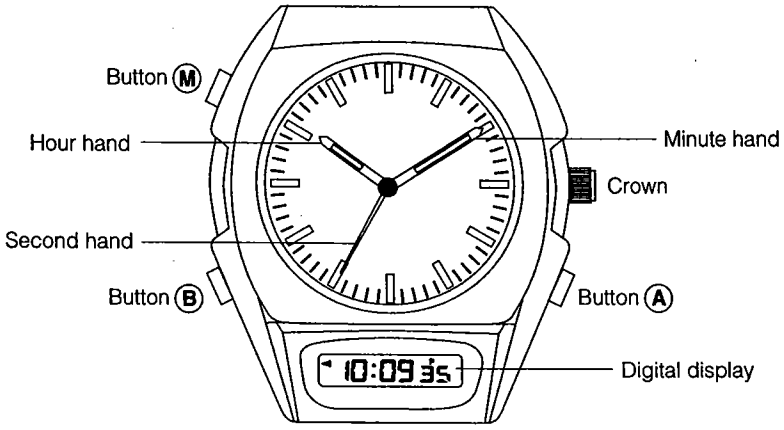
<table>
<tr><th colspan="3">Caliber NO.</th><th>C690</th></tr>
<tr><td colspan="3">Type</td><td>Combination Solar-Powered Watch</td></tr>
<tr><td colspan="3">Movement size (mm)</td><td>ø30.8 x 38.0 x 5.4t</td></tr>
<tr><td colspan="3">Accuracy</td><td>Within ±15 seconds per month on average (when worn at normal temperatures of +5°C to +35°C/41°F to 95°F)</td></tr>
<tr><td colspan="3">IC</td><td>1 unit of C/MOS-LSI</td></tr>
<tr><td colspan="3">Operating temperature range</td><td>0°C to +55°C (32°F to 131°F)</td></tr>
<tr><td colspan="3">Time adjustment</td><td>No ajustment terminal for in the market</td></tr>
<tr><td colspan="3">Measurement gate</td><td>10 sec.</td></tr>
<tr><td rowspan="7">Display function</td><td colspan="2">Analog display</td><td>Time: Hours, Minutes, Seconds</td></tr>
<tr><td rowspan="6">Digital display</td><td>Time</td><td>Hours, Minutes, Seconds, A (Morning)/P (Afternoon)</td></tr>
<tr><td>Calender</td><td>Month, Date, Day, (Year)</td></tr>
<tr><td>Alarm</td><td>Hours, Minutes, A (Morning)/P (Afternoon), ON/OFF,
Alarm monitor</td></tr>
<tr><td>Chronograph</td><td>24-hour Measurement (1/100 seconds units),
Split time measurement</td></tr>
<tr><td>Timer</td><td>60-minute countdown (in 1 minute)</td></tr>
<tr><td>Dual time</td><td>Hours, Minutes, Seconds, A (Morning)/P (Afternoon)</td></tr>
<tr><td colspan="3">Additional function</td><td>• Insufficient recharging warning feature
• Quick start feature
• Time setting warning feature</td></tr>
<tr><td colspan="3">Continuous operating time</td><td>Fully charged to stopping: Approx. 7 months
2-second interval movement to stopping: Approx. 3 days</td></tr>
<tr><td colspan="3">Secondary battery used</td><td>Secondary battery, 1 pc.</td></tr>
</table>

* Specifications are subject to change without notice.

§3. HOW TO USE THIS SOLAR-POWERED WATCH PROPERLY

To use this watch comfortably, including its Alarm of Chronograph functions, be sure to keep the watch charged.
Please note that if you wear long sleeves, this may block light from recharging the watch and cause it to become insufficiently charged. When you take off the watch, try to place it in as bright a location as possible. This will ensure that it will continue to run properly.
Since this watch is provided with an overcharging prevention feature, so there is no risk of over-charging, it is recommended to recharge the watch every day.
For how long to recharge the watch, refer to "Charging Time".

§4. NAME OF PARTS



§5. CHARGING TIME

The time required for charging varies according to the model of watch (color of the watch face, etc.). The following table provides a general reference for determining charging time.

* The recharging time is the period during which the watch is continuously exposed to light.

Illuminance (lux)	Environment	Charging Time (Approximate time)		
		For one day's use	After stopping until one-second movement	For full charge
500	Interior lamp	2 hours	35.5 hours	476 hours
1,000	60–70cm (24-28in.) away from fluorescent desk lamp (30W)	1 hour	16.5 hours	228 hours
3,000	20cm (8in.) away from fluorescent desk lamp (30W)	20 min.	5.5 hours	74 hours
10,000	Outside, cloudy conditions	6 min.	1 hour	14 hours
100,000	Outside, sunny conditions	3 min.	45 min.	12 hours

Full recharging time .....Time required for recharging fully from stopped state.
Recharging time for one day's use .....Recharging time required for the watch to run for one day.

§6. CAUTION ON HANDLING SOLAR-POWERED WATCH

Caution

- The watch will be damaged during recharging if it becomes excessively hot (60°C/140°F and above). Avoid recharging when the watch is hot.

  Example: Recharging when the watch is in close proximity to an incandescent lamp, halogen lamp or other light source that generates considerable heat.

  Recharging while placed on the dashboard of an automobile or other locations subject to excessively high temperatures.

- When you charge the watch by an incandescent lamp, take a distance about 50cm (20 in.) from the light source to prevent extremely high temperature.
- The watch may not get recharged fully in lowly lit locations.

Warning Use Only the Specified Battery

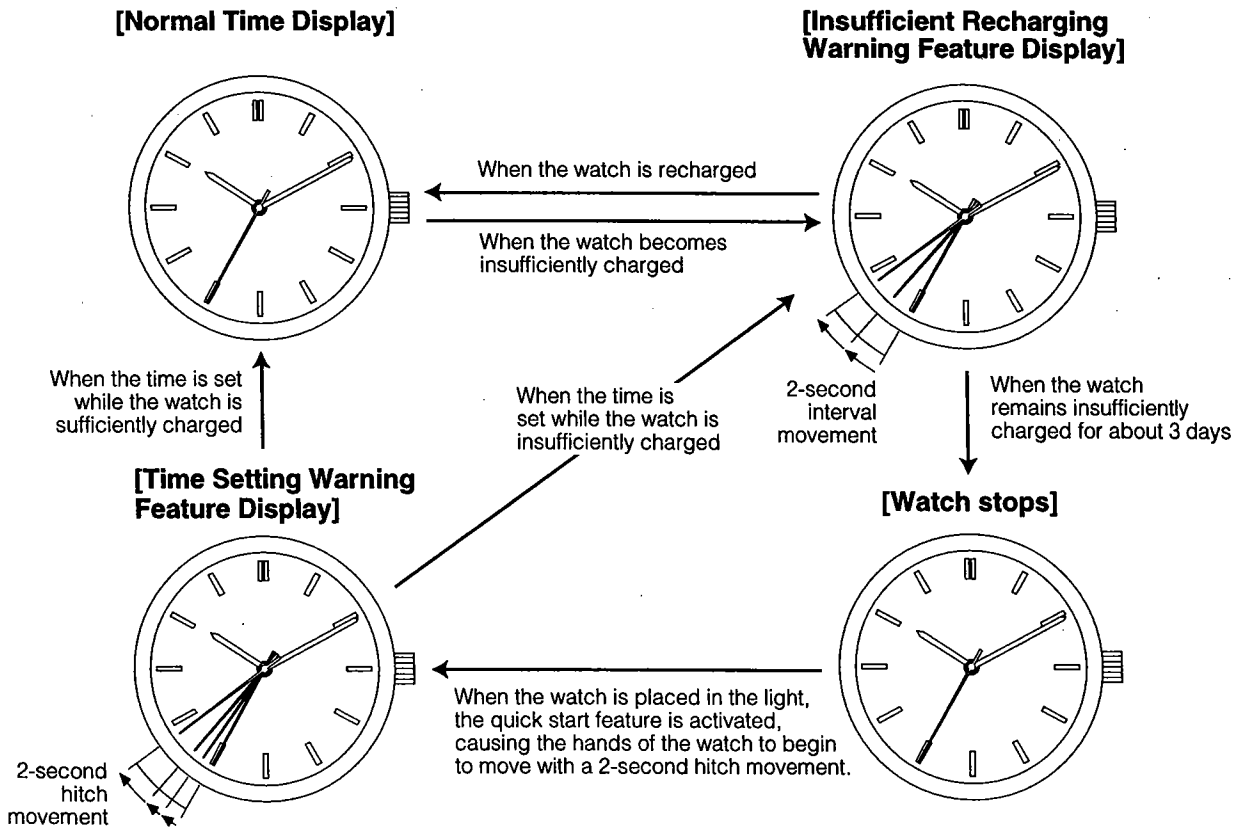
Never use a battery other than the secondary battery specified for use in this watch. Although the watch structure is designed so that it will not operate when another type of battery is installed, if a silver battery or other type of battery is installed in the watch and the watch is recharged, there is a risk of overcharging which may cause the battery to rupture. This can cause damage to the watch and injury to the wearer.
When replacing the secondary battery, always make sure to use the specified secondary battery.

§7. SPECIAL FUNCTIONS OF SOLAR-POWERED WATCH

This watch is provided with a function that warns the user about insufficient charge by altering the display (by causing the hands to move in a particular way).

Analog Display (second hand moves)

Analog Display (second hand moves)



Digital Display

[When the watch becomes insufficiently charged and the insufficient recharging warning feature is activated]

1. Only Time, Calendar, and Dual TIme mode can be switched.
2. If the Alarm, Chronograph, or Timer were displayed, the display switches automatically to the time display.
3. If the Chronograph or Timer were being used, measurement is automatically stopped and the display switches to the time display.
4. The Alarm does not sound even when the set Alarm time is reached.

[When the watch is sufficiently charged and the low charge Alarm function is canceled]

1. Any mode can be switched. Newly perform settings for each mode before use.

<Insufficient Recharging Warning Feature>

When the watch becomes insufficiently charged, the second hand starts moving in 2-seconds intervals to indicate that the watch needs charging. Although the watch will keep the correct time when this happens, the watch will stop after the 2-seconds interval movement goes on for about 3 days.

<Overcharging Prevention Feature>

When the secondary battery is fully charged, the overcharging prevention feature is activated to prevent further recharging. This enables the user to recharge without risk of damage to the watch.

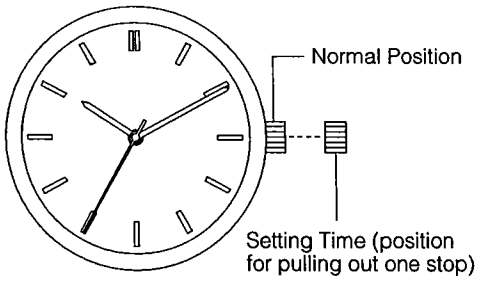
<Quick Start Feature>

The watch will stop when it is completely discharged. When placed in the light for about 10 seconds (the length depends on the brightness of the light), the second hand will begin to move with a 2-second hitch movement (time setting warning feature).
After becoming entirely lit up for about 2 seconds, the digital display will start indicating the time from 0:00 a.m. Please note that if the light is blocked, the watch may stop again as it becomes insuficiently charged, thus be sure to charge it sufficiently.

<Time Setting Warning Feature Display>

After it has stopped, the watch will start running again thanks to the quick start feature when it is exposed to light, the second hand will begin in 2-second hitch movement to indicate that the time is incorrect. The digital display, after becomeing entirely lit, will also start indicating the time from 0:00 a.m.
When this happens, fully recharge the watch and reset the time. The second hand will continue to move in 2-second hitch movement intervals until the time is reset.
If the time is reset while the watch is insufficiently charged, the insufficient recharging warning feature (2-second movement) will be activated.
Following All-Reset, newly perform settings for the digital time display, calendar, and other modes before using them.

§8. SETTING ANALOG TIME



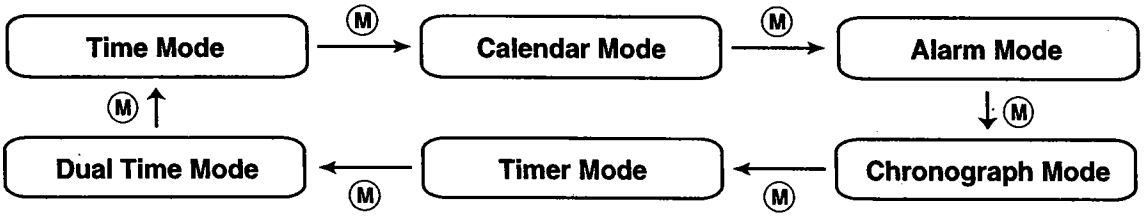
1. Pull out the crown one stop. The second hand will stop.
2. Turn the crown to adjust the time.
3. After adjusting the time, return the crown to its normal position. The watch will start running.

Point for Accurately Setting the Time

After adjusting the time for the digital section, stop the second hand to the 0 second position, then set the minute hand several minutes in advance. Next, set the correct time going backward, and when the digital display reaches 0 seconds, press the crown to start keeping the correct time.

§9. SWITCHING DIGITAL MODES (FUNCTIONS)

In addition to Time mode, this watch has 5 other functions (modes); Calendar, Alarm, Chronograph, Dual Time and Timer. The modes is switched each time you press the button Ⓜ.



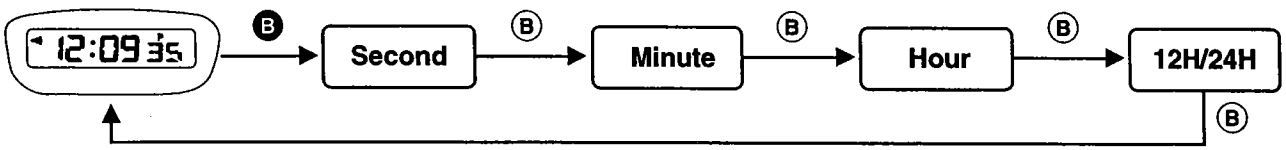
Mode Auto-Return

- The Alarm mode switches automatically to the Time mode if nothing is done for about 2 minutes.

§10. SETTING DIGITAL TIME

1. Press button Ⓜ to set the Time mode.
2. Press button Ⓑ for 2 seconds or longer until the "Seconds" flash and can be set.
3. Press button Ⓐ to reset the second to "00" and start the time.
   - When the second display indicates 30 to 59 seconds, the "Minutes" are raised one minute up.
4. Each time button Ⓑ is pressed, the location to be adjusted, "Minutes", "Hours", "12H/24H", is switched. Make the location to be adjusted flash.
5. Press button Ⓐ to make the location to be adjusted flash.
   - Fast adjustment can be done by continuously pressing button Ⓐ.
6. Press button Ⓑ or Ⓜ to return to normal Time display.

Normal Time Display



Switching 12H/24H Display

- 12H/24H display is switched each time button Ⓐ is pressed. In 12H display, be careful to set the time correctly for a.m. (A) or p.m. (P).

Auto-Return

- If nothing is done for 2 minutes while the watch is in the Time adjustment mode, it automatically returns to the normal display mode.

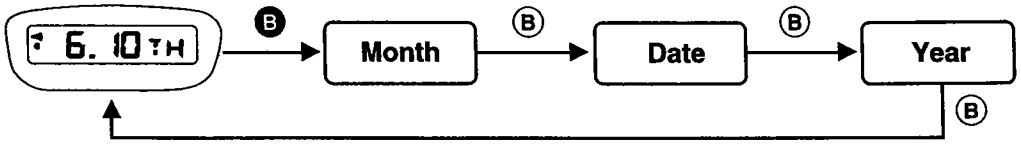
Instant Manual Return

- Pressing button Ⓜ while the watch is in the time adjustment mode causes it to be returned to the normal display mode.

§11. SETTING CALENDAR

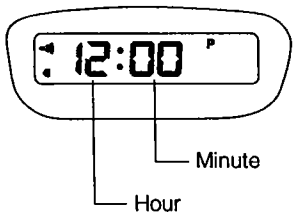
1. Press button Ⓜ to switch to Calendar mode.
2. Press button Ⓑ for more than 2 second. "Month" starts flashing and becomes an adjustment position.
3. Press button Ⓐ to adjust Month.
   - Press and hold button Ⓐ for rapid advancement.
4. Each time you press button Ⓑ, adjustment section changes as shown below. Make flashing where adjustment is needed.
5. Press button Ⓐ to adjust flashing section.
6. Press button Ⓑ or Ⓜ to return to normal Calendar display.

Normal Calendar Display



- Year Setting
  Year is in display only when making adjustments, Calendar can be set from 1998 to 2099. (The watch displays repeatedly from January 1, 1998 to December 31, 2099.)
- Day of the week is automatically set with adjustment of Year, Month and Date.
- Auto-Calendar Function
  Month-end adjustments are not necessary as Calendar is programmed to be set automatically. When Calendar is set to a non-existent date (e.g., February 30), display will show automatically first day of next month when returned to normal mode.
- Auto-Return Function
  Auto-Return to normal Calendar display will activate when the watch is left in adjustment mode for about 2 minutes.
- Instant Manual Return
  Instant Manual Return to normal Calendar display can be made by pressing button Ⓜ in Calendar adjustment mode.

§12. HOW TO USE ALARM



<To Set Alarm>

1. Press button Ⓜ to switch the watch to Alarm mode.
2. Press and hold button Ⓑ for more than 2 seconds.
   "Hour" starts flashing and becomes an adjustment position.
3. Press button Ⓐ and adjust "Hour".
4. Press button Ⓑ. The "Minutes" starts flashing and becomes an ajustment position.
5. Press button Ⓐ and adjust "Minute".
   - Press and hold button Ⓐ for rapid advancement.
6. Press button Ⓑ or Ⓜ to return to normal Alarm display.

<To Switch Alarm ON/OFF>

- Press button Ⓐ in normal Alarm mode to switch the Alarm between ON and OFF.

<Sounding Length of Alarm and How to Stop the Alarm Sound>

- Alarm will sound for 10 seconds.
- Press any button to stop Alarm buzzer.

<Alarm Sound Monitor>

- Press button Ⓐ and hold to make an Alarm monitor sound.

12H/24H-Hour Display

- If the watch is set to 12H display in Time mode, Alarm will also be set to 12H display. Make sure that AM (A)/PM (P) is correct when setting Alarm.

Auto-Return

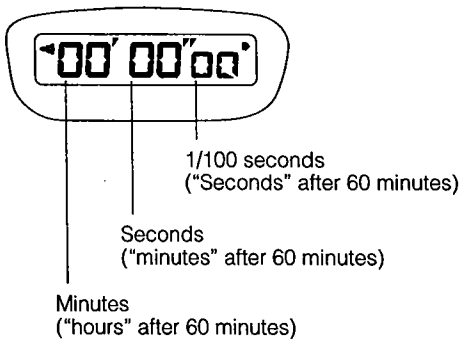
- Auto-Return to normal Alarm display"ON" will activate when the watch is left in Alarm adjustment mode for more than 2 minutes.
- Auto-Return to normal Time display will activate when the watch is left in normal Alarm mode for about 2 minutes.

Instant Manual Return

- Press button Ⓜ in Alarm adjustment mode to return to normal Alarm display.

§13. HOW TO USE CHRONOGRAPH

This Chronograph measures up to 23 hours 59 minutes 59 seconds in units of 1/100 seconds. On reaching 24 hours of elapsed time, if resets to "00 minutes 00 seconds 00" and stops. It can also measure split time (intermediate elapsed time).



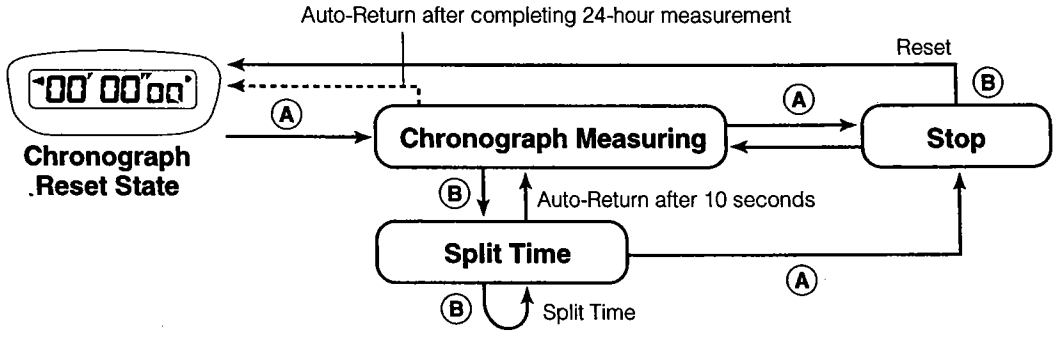
<Accumulative Time Measurement>

1. Press button Ⓐ to start/stop Chronograph.
2. If button Ⓑ is pressed when Chronograph is stopped, it will return to reset state.

* Buzzer sounds in confirmation each time you press button to start/stop or reset Chronograph

<Split Time Measurement>

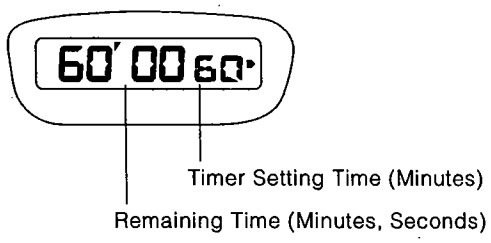
1. Press button Ⓐ to start/stop Chronograph.
2. Press button Ⓑ while Chronograph is running. Split Time will appear for 10 seconds.
   - "SPL" will flash while Split Time is in display.
3. Press button Ⓑ when counting is stopped to reset Chronograph.
   - Buzzer sounds in confirmation each time you press button to start/stop or reset Chronograrph.



* If the watch is switched to another mode while Chronograph is in operation (Chronograph Measuring or Stop) and then switched to Chronograph again, the watch will return to the initial state of use (if Chronograph was showing Split Time, it will return to measuring state). If measuring has exceeded 24 hours, Chronograph stops and returns to reset state.

§14. HOW TO USE TIMER

- Timer can be set in units of 1 minute up to 60 minutes. When Timer countdown is finished (displaying 00 minutes 00 seconds), buzzer will sound for about 5 seconds and Timer will return to the initially set time.

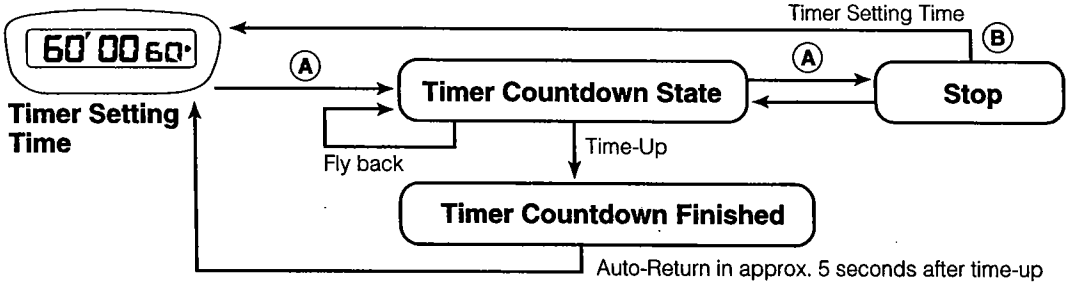


<To Set Timer>

1. Press button Ⓜ and switch to Timer mode.
2. Press button Ⓑ, the set time will be reduced by one minute for each time you press the button. Continue until you reach the set time you want.
   - Press and hold button Ⓑ for rapid advancement.

<To Use Timer>

1. Press button Ⓐ to start Timer.
2. Press button Ⓐ to stop Timer while in the countdown. Press button Ⓐ to start in again.
3. If you press button Ⓑ while Timer is stopped, Timer will return to the set time.
   - Buzzer sounds in confirmation each time you press button to start/stop or reset.
4. Press button Ⓑ while in the countdown. Timer will return to initially set time and restart countdown.
5. When Timer countdown is finished (displaying 00 minutes 00 seconds), watch will sound for about 5 seconds, indicating time-up.
6. After time-up sound is finished, Timer will automatically return to the initially set time.

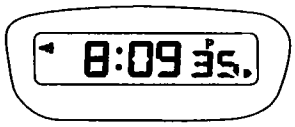


* If the watch is switched to another mode while Timer is in operation (Timer Countdown State or Stop) and then switched to Timer again, the watch will return to initial state of use. If countdown has been completed, the watch will return to the initially set time.

§15. HOW TO USE DUAL TIME

You can set another time (local time), different from Time mode by this Dual Time mode.

Normal Dual Time Display



<To Set Local Time>

1. Press button Ⓜ to switch the watch to Dual Time mode.
2. Press and hold button Ⓑ for more than 2 seconds. "Hour" starts flashing and becomes an adjustment position.
3. Press button Ⓐ and adjust Hour.
4. Press button Ⓑ and the adjustment position switches to "Minute".
5. Press button Ⓐ and adjust Minute.
   - Press and hold button Ⓐ for rapid advancement.
6. Press button Ⓑ or Ⓜ to return to normal display
   - The second cannot be adjusted in the Dual Time mode. It can be adjusted only in the Time mode.

12H/24H-Hour Display

- If the watch is set to 12H display in Time mode, Local Time will also be set to 12H display. Make sure that AM (A)/PM (P) is correct when setting Local Time.

Auto-Return

- Auto-Return to normal display will activate when the watch is left in adjustment mode for more than 2 minutes.

Instant manual Return

- Press button Ⓜ in adjustment mode to return to normal display.

§16. ALL-RESET FUNCTION

Use All-Reset Function to reset the watch after replacing the secondary battery or if the watch is showing abnormal display or operation due to a strong shock (no display, alarm keeps on sounding etc.) All-Reset Function can be performed as follows.

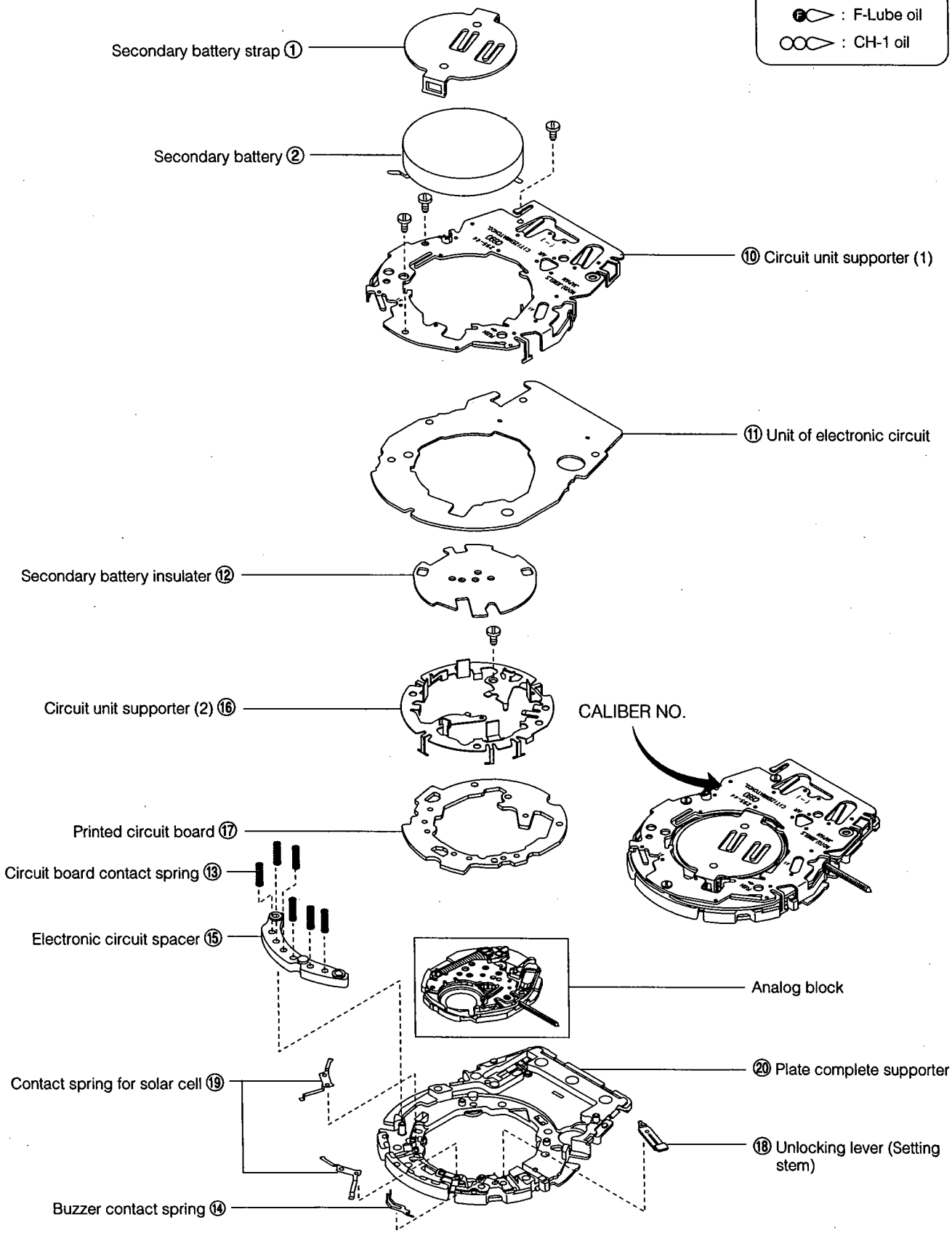
<All-Reset Function>

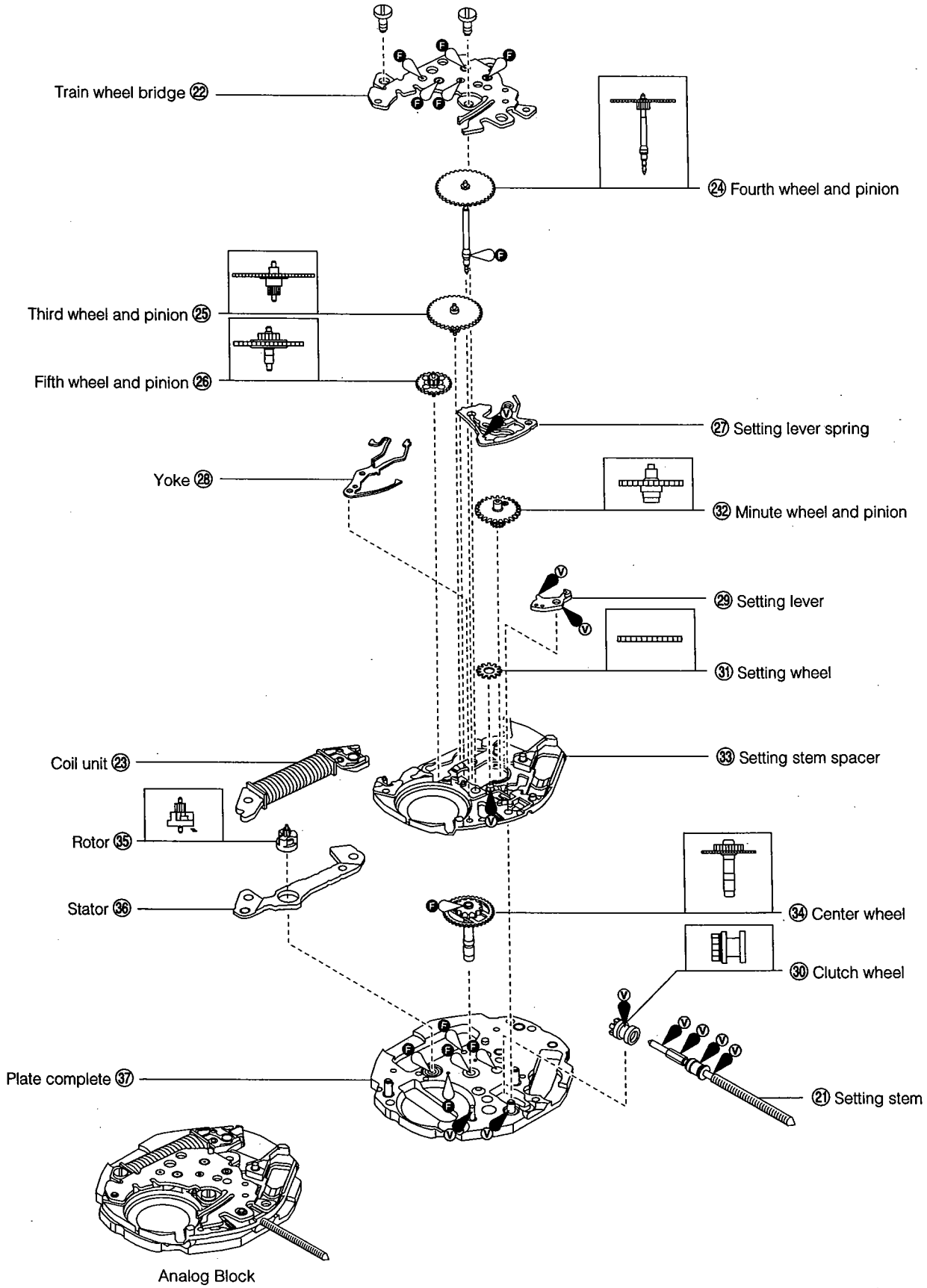
1. Press button Ⓐ, Ⓑ and Ⓜ simultaneously for more than 2 seconds. All digital displays will disappear.
   - If any one of the buttons is released, all displays will reappear.
2. Press one button from Ⓐ, Ⓑ, and Ⓜ. The watch will start from "00 hours 00 minutes 00 seconds" a.m.
3. At this point, buzzer sounds for 2 seconds in confirmation indicating All-Reset is completed.
4. Readjust Time, Calendar and other modes correctly before use.

§17. DISASSEMBLY AND ASSEMBLY OF THE MOVEMENT

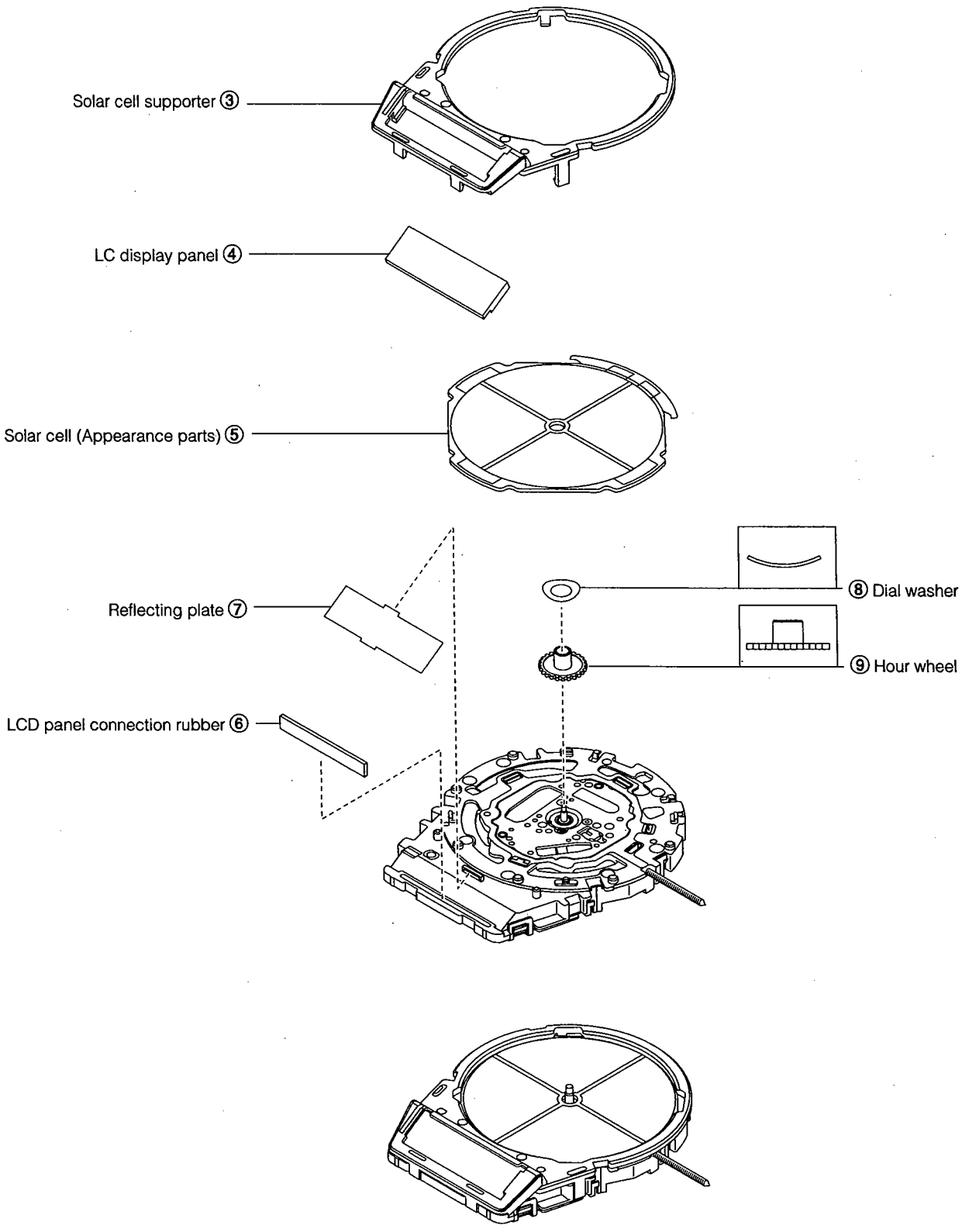
Disassembly procedure: ① → ㊲
Assembly procedure: ㊲ → ①

● Lubrication mark
Ⓐ : A-Lube oil
Ⓥ : V-Lube oil
Ⓕ : F-Lube oil
○○ : CH-1 oil

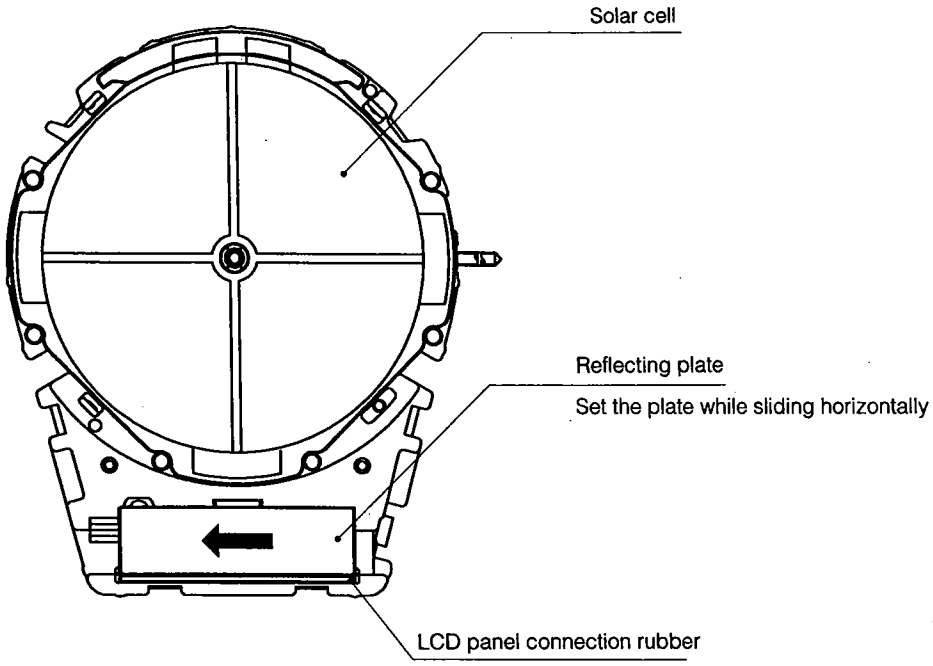




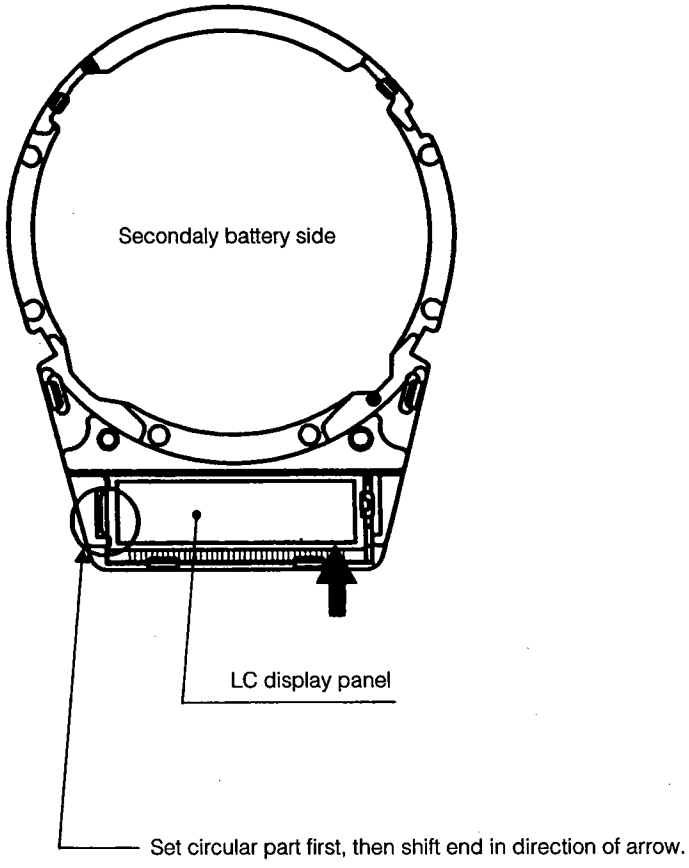
Analog Block


Solar cell supporter ③
LC display panel ④
Solar cell (Appearance parts) ⑤
Reflecting plate ⑦
⑧ Dial washer
⑨ Hour wheel
LCD panel connection rubber ⑥

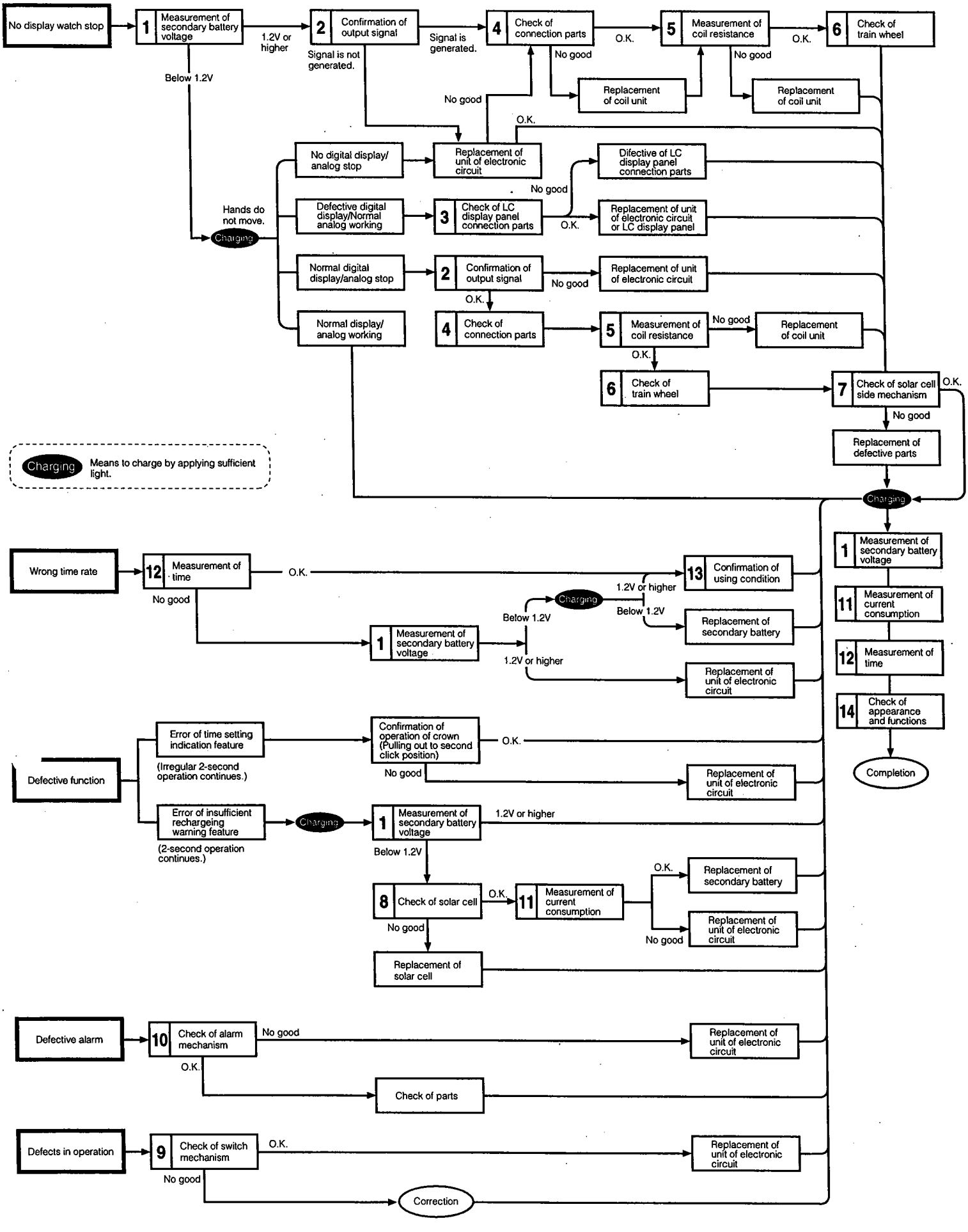
Setting Method of Reflecting Plate

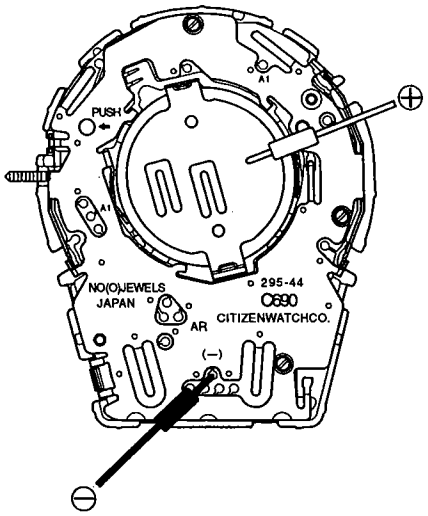


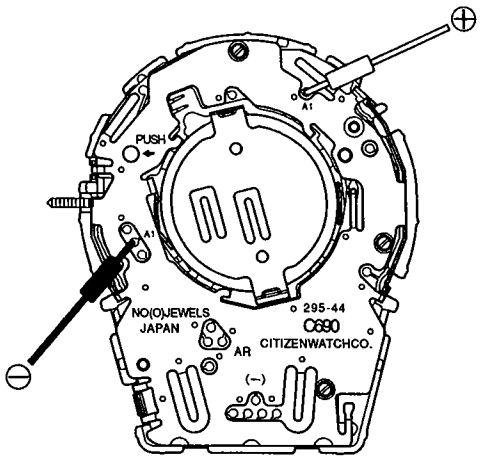
Setting Method of LC Display Panel

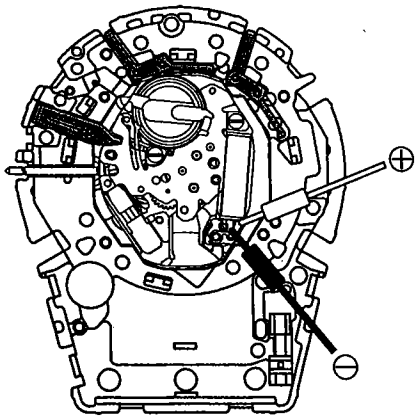


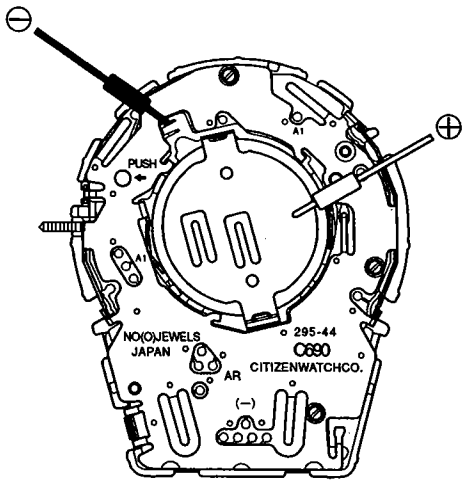
§18. TROUBLESHOOTING AND ADJUSTMENT

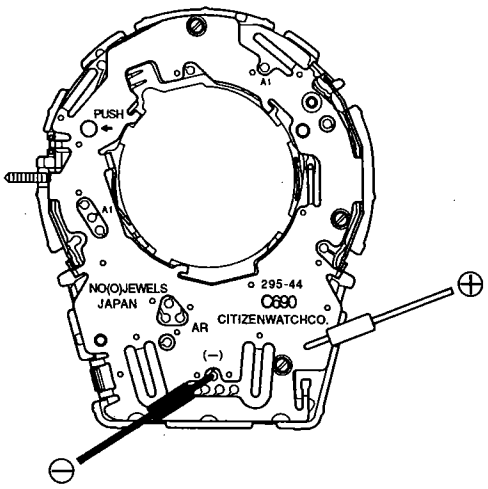


Check Items	How to Check	Result and Treatment
❶ Measurement of secondary battery voltage	<Tester range: DC. 3V>  Reference: • 0.9V ~ 1.2V: Two-second step running mode 1.3V ~ 2.6V: One-second step running mode These voltages may vary slightly from watch to watch. • Irregular two-second step running is a function that signals that the watch has stopped and restarted. This mode will continue until the watch is set to the correct time, irrespective of the voltage. • A quick-start is activated by the small-capacity tantalum capacitor which has been incorporated in the circuit, in addition to the primary capacitor. After the watch is illuminated (right after it begins running), the secondary battery voltage will display an extremely low value because the secondary battery has not been fully charged. **Caution:** When measuring the voltage, be careful not to place the ⊖ tester pin on the secondary battery strap (a short circuit will occur.)	

Check Items	How to Check	Result and Treatment
❷ Confirmation of output signal	[Refer to Technical Manual, Basic Course: II-1-b.] <Tester range: DCV. 0.3V>  <The tester lead pins have no polarity> • In the 1-second operation mode, the tester pointer should moves to the right left every 1 second. • In the 2-second operation or irregular 2-second operation mode, the test pointer moves in only one direction every 2 seconds.	Tester pointer does not move → Check connection parts. ⬇ Connection parts are normal → Replace of electronic circuit unit.
❸ Check of LC display panel connection parts	[Refer to Digital Section of Technical Manual, Basic Course: II-2-a] Inspection of all segments (1) Press Ⓐ, Ⓑ and Ⓜ buttons simultaneously for more than 2 seconds. All digital displays will disappear. (If button is released, all displays will reappear.) (2) Press any one of Ⓐ, Ⓑ and Ⓜ buttons. The watch will restart from 12:00:00 AM. • Continuity test on LC display panel, cell connection rubber and plate. Check the parts for stain, breakage, etc.	• LC display panel, connection rubber or metal plate is not installed correctly. → Install correctly. • Parts are stained or dirty. → Remove stain and dirt. • Parts are broken or scratched. → Replace parts.
❹ Check of connection parts	[Refer to the Analog Section of Technical Manual, Basic Course: II-2-a.] • Check for looseness of screws, dust, stain, etc. • Check for stain and removal of the solar cell pattern (two places), deformation of connection spring, removal of welded lead plate of the secondary battery stain of the circuit pattern, bad contact of each part.	Stain of solar cell pattern and circuit pattern → Remove stain. Removal of solar cell pattern, removal of circuit pattern, removal of welded lead plate of secondary battery → Replace parts.

Check Items	How to Check	Result and Treatment
❺ Measurement of coil resistance	* For the setting method of the tester, see Basic Course: II-1-c. • Remove the unit of electronic circuit and measure the coil resistance. <Tester range: R x 10Ω>  <The tester lead pins have no polarity>	**1.5 ~ 1.9kΩ** → Normal Out of range of 1.5 ~ 1.9kΩ → Replace coil unit.
❻ Check of train wheel	[Refer to Technical Manual, Basic Course: II-2-b.]	
❼ Check of solar cell side mechanism	[Refer to Technical Manual, Basic Course: II-2-c.]	
❽ Check of solar cell	• Check the solar cell for breakage and stain, and check its electrode for stain and flaking.	Breakage of solar cell → Replace solar cell. Stain → Remove stain. Flaking of electrode → Replace solar cell.

Check Items	How to Check	Result and Treatment
⑨ Check of switch mechanism	1. Inspection of movement. • Press the switch spring of circuit unit supporter with tweezers, etc. to contact it to unit of electronic circuit, and confirm the switching function. • Check for removal of pattern of electronic circuit unit, deformation of switch return spring, etc. 2. Inspection of push button • Check push button for deformation, stain, etc. **Note:** Be sure to apply silicone oil to the packing of push button for waterproofness and smooth operation.	• Switching function is normal. → Inspect push button. • Pattern is removed or deformed. → Replace defective parts. • Push button is stained or deformed. → Remove stain, or replace push button
⑩ Check of alarm mechanism	[Refer to Technical Manual, Basic Course: II-1-d.] *1. Set the module in the case, and check output of alarm signal with the case back removed. (1) Set the watch in alarm mode. (2) Apply ⊕ lead pin to circuit unit supporter and ⊖ lead pin to buzzer contact spring, them press Ⓐ button. <Tester range: DC 0.3V>  *2. If the output of alarm is normal, perform the following inspection. • Check the piezo-electric element of vibrating plate for cracks and breakage. • Check the buzzer contact spring for bend and deformation. • Check the pattern of electronic circuit unit for dust and stain.	• Tester pointer does not swing. → Replace the electronic circuit unit. ⬇ • Tester pointer swings. → Normal ⬇ • Perform inspection in *2. ⬇ Normal indication. → Normal

Check Items	How to Check	Result and Treatment
⓫ Measurement of current consumption	[Refer to Technical Manual, Basic Course: II-1-f.] This watch uses a secondary battery block instead of a battery. Accordingly, prepare a silber battery (1.50V or higher), then measure the current consumption according to the following procedure. (1) Remove the secondary battery block from the movement. (2) Pull out the crown to the first click. (3) Referring to Technical Manual, Basic Course, set the silver battery (1.55V) to the tester adapter. (4) Set the tester. (Apply the test pins ⊕ and ⊖ to the patterns of the electronic circuit unit.) (5) Return the crown to its normal position. (The tester indicates a high value at first. Wait until the tester pointer is stabilized, then start measurement.) <Tester range: DC 12μA>  **Note:** When measuring the current consumption, do not apply any light to the solar cell. If any light is applied, the voltage changes and correct current consumption cannot be measured. ★ If the current consumption is measured without shorting the reset terminal to ⊕, the current consumption in the irregular 2-second operation mode is measured, and about 2mA may be indicated.	Current consumption by module **Below 2.1μA** → Good **2.1μA or higher** → Measure unit of electronic circuit. Measurement of unit of electronic circuit. **Below 1.3μA** → Good **1.3μA or higher** → Replace unit of electronic circuit. Current consumption by module is high but that by electronic circuit unit is low → A part other than circuit seems to have a brouble. Check for stain, bad lubrication, deformation of parts, and remove causes of load.

Check Items	How to Check	Result and Treatment
⑫ Measurement of time	[Refer to Technical Manual, Basic Course: II-2-d.] • Since DF measurement is applied, measure in the 10-second range. The time rate cannot be adjusted, however. The time rate may not be measured accurately in the 2-second operation of irregular 2-second operation. In this case, apply light to the watch until the second hand moves in the 1-second operation mode, the measure the time rate.	This time gains or loses largely. → Replace the electronic circuit unit.
⑬ Confirmation of using condition	[Refer to Technical Manual, Basic Course: II-2-e.] • Since this watch is energized by light, it should receive light as much as possible. If the watch is placed near a light source which generates heat (above 60°C) such as an incandescent lamp, a halogen lamp, etc., its functions and parts may be deteriorated or deformated by the heat. Accordingly, take care when applying light to it. Example: When the watch is hidden under a long sleeve or the customer works in a dark place, it needs to be exposed to light on purpose.	
⑭ Check of appearance and functions	[Refer to Technical Manual, Basic Course: II-2-f.] • Check inside of case for dust and stain. • Check operation of setting switches for normality. • Check segment for normality (See 3 Check of LC display panel and connection part.) • Be sure to apply silicone oil to packing of each push button. It is necessary for water resistance and smooth operation.	