TECHNICAL INFORMATION
INFORMACION TECNICA

CITIZEN QUARTZ
Cal. No. 78※※

CITIZEN

ENGLISH

Contents

ESPAÑOL

Índice

§1. OUTLINE

This watch is an analog solar power watch which has solar cell on its dial to convert optical energy into electric energy to drive itself.

Composition of caliber

Caliber No.	Secondary battery block	Capacitor	Appearance structure			Remarks, other items
			Solar cell display frame is large	One-piece structure	Case back fitting structure	
7810		○			○	
7811		○			○	
7812		○			○	Diver's, 200m water-resistance
7815		○		○		
7817		○		○		Diver's, 200m water-resistance
7820	○		○		○	
7822	○		○		○	Diver's, 200m water-resistance
7825	○		○	○		
7827	○		○	○		Diver's, 200m water-resistance
7860		○			○	
7861		○			○	
7862		○			○	
7865		○		○		
7867		○		○		
7870	○				○	
7872	○				○	Diver's, 200m water-resistance
7875	○			○		
7877	○			○		Diver's, 200m water-resistance

§2. SPECIFICATIONS

Caliber No.		**781※**	**782※**	**786※**	**787※**
Type		Analog solar cell watch (Three hands)			
Module size		ø28.4 x 3.4 (t)			
Accuracy (At normal temperature)		±20 sec/month			
Oscillation		32768Hz			
IC		1 unit of C/MOS-LSI			
Operation temperature		–10°C ~ +60°C (14°F ~ 140°F)			
Converter		Bipolar step motor			
Time adjustment		D.F.C (No adjustment terminal for use in market)			
Measurement gate		10 sec			
Additional functions	Date (Quick setting device)	Installed			
	Device to stop second hand at any point	Installed			
	Quick start feature	Installed			
	Insufficient recharging warning feature	Installed			
	Time setting indication feature	Installed			
	Overcharging prevention feature	Installed			
Secondary battery used	Part No.	298-177	295-34	298-226	295-34
	Capacitor symbol	GC920	MT920	GC920	MT920
	Remarks	Capacitor unit	Secondary battery block	Capacitor block (With welded lead plate)	Secondary battery block

§3. FEATURES

1) Quick start feature

If light is applied to this watch while the watch has stopped, the watch starts irregular 2-second operation of the second hand within several seconds. The time to start depends on the intensity of the given light. It is about 10 seconds maximum, however, when the watch is placed in an ordinary room (Illumination intensity: Approx. 500 lux).

2) Time setting indication feature

Once this watch stops, its second hand moves irregularly to notify that the indicated time is incorrect when it starts again. At this time, if the crown is pulled to the second click position and the watch is set to the correct time and pushed in the normal position, the second hand starts the normal operation (1-second or 2-second operation). (The irregular 2-second operation continues until the time correcting operation is performed.)

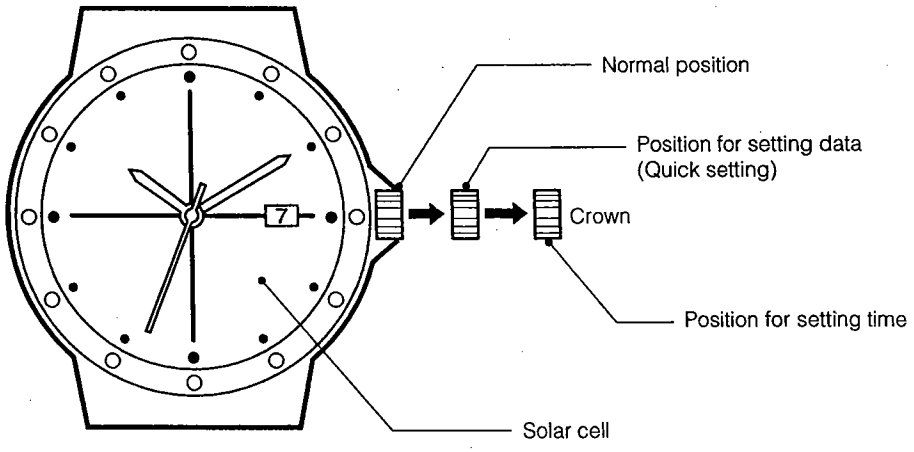
3) Insufficient recharging warning feature (Cal.781※ and 786※ used capacitors. Cal.782※ and 787※ use secondary batteries.)

If the secondary battery (capacitor) is not charged sufficiently, the second hand moves by 2 seconds to notify that the secondary battery (capacitor) needs to be charged. The watch still operates accurately at this time, but will stop about three days (one day in case of Cal. 781※ and 786※) after the 2-second operation starts. Accordingly, apply light to the watch to charge the capacitor until the one-second operation starts.

4) Overcharging prevention feature

If the secondary battery (capacitor) is fully charged, the IC stops charging it. Accordingly, the secondary battery (capacitor) is not over-charged even if the watch is exposed to light for long hours.

§4. HANDLING

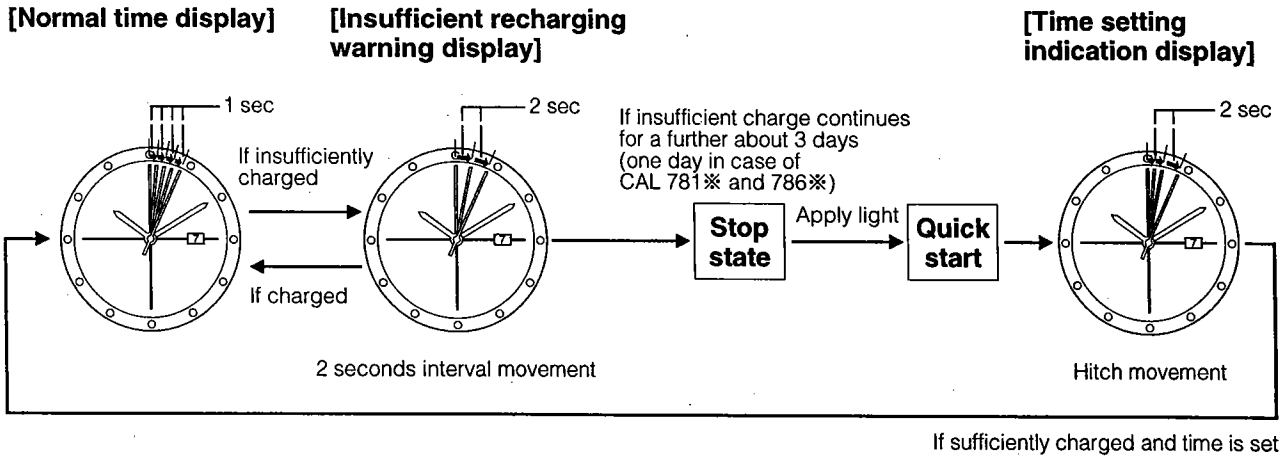


The handling method of this watch is the same as that of a common analog watch. Give light to it as much as possible so that it operates in the one-second operation mode, however, since its energy source is light.

Second hand operation modes

These functions are only found in the solar power watch.

If this watch becomes insufficiently charged, a warning function comes into operation and the display changes, as below.



When the second hand movement is abnormal

Two-second interval movement

Insufficient recharging warning feature is working.
Recharge the watch immediately by exposing it to light until it has returned to one-second interval movement.
During two-second interval movement, the watch continues to keep the correct time.

Hitch movement

Time setting indication feature is working.
Immediately expose the solar cell to light in order to recharge it, then reset to the correct time.

Time required for charge

Illuminance (lux)	Environment	CAL. 781※, 786※ Time required			CAL. 782※, 787※ Time required		
		One day usage	From the stop state to the one second movement	Empty to full	One day usage	From the stop state to the one second movement	Empty to full
500	Inside an ordinary office	1 hour 30 minutes	14 hours	34 hours	1 hour	30 hours	250 hours
1,000	60–70cm under a fluorescent light	40 minutes	7 hours	17 hours	35 minutes	15 hours	125 hours
3,000	20cm under a fluorescent light	15 minutes	3 hours	4 hours 30 minutes	10 minutes	5 hours	40 hours
10,000	Exterior, cloudy	5 minutes	45 minutes	1 hour 30 minutes	3 minutes	1 hour 30 minutes	12 hours
100,000	Exterior, summer, sunny	1 minutes	5 minutes	15 minutes	1 minutes	25 minutes	3 hours 30 minutes

- Since the necessary charging time depends on the type (Color and area of the dial) and environment (Intensity of light), use the above table for only reference.
- 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 characteristics and parts may be deteriorated or deformed by the heat. Accordingly, take care when applying light to it.

§5. PRECAUTIONS FOR DISASSEMBLY AND ASSEMBLY

1) Handling of solar cell

- The amorphous film and electrode are installed on the top of the solar cell. Take care not to damage them when installing and removing the hands and solar cell itself.
- If the solar cell is partly damaged, the quick start function, charging function, etc. may be lowered. In this case, replace the solar cell.
- If the electrode is stained or removed, the electric continuity is lowered. Since it is difficult to clean the electrode surface, take care not to touch it by bare fingers.
- Since the solar cell may be deteriorated by static electricity and moisture, take care when storing it.

2) Replacing secondary battery (CAL. 782※, 787※)

(1) Never use another battery apart from the secondary battery (Titanium lithium ion battery) used in this watch.

(2) The watch structure is so designed that a different kind of battery other than the specified cannot be used to operate it. However, in case a different kind of battery such as a silver battery is used by some chance, there is a danger that the watch will be overcharged to burst, causing damage to the watch and even to the human body.

(3) When you replace the secondary battery, be sure to use a designated secondary battery. (Titanium lithium ion battery/component number 295-34)

(4) Because the secondary battery repeatedly charges and discharges, it is not necessary to replace regularly like a nomal battery.

3) Handling of capacitor (CAL 781※, 786※)

- As explained on the case back and capacitor strap, if a battery is installed, it may explode because of over-charging. Accordingly, never install a battery.

4) Removal and installation of setting stem

Structure with openable case back:
Pushing the point indicated with "PUSH" on the secondary battery strap or capacitor strap with tweezers, etc., remove the setting stem (With the setting stem at the normal position).

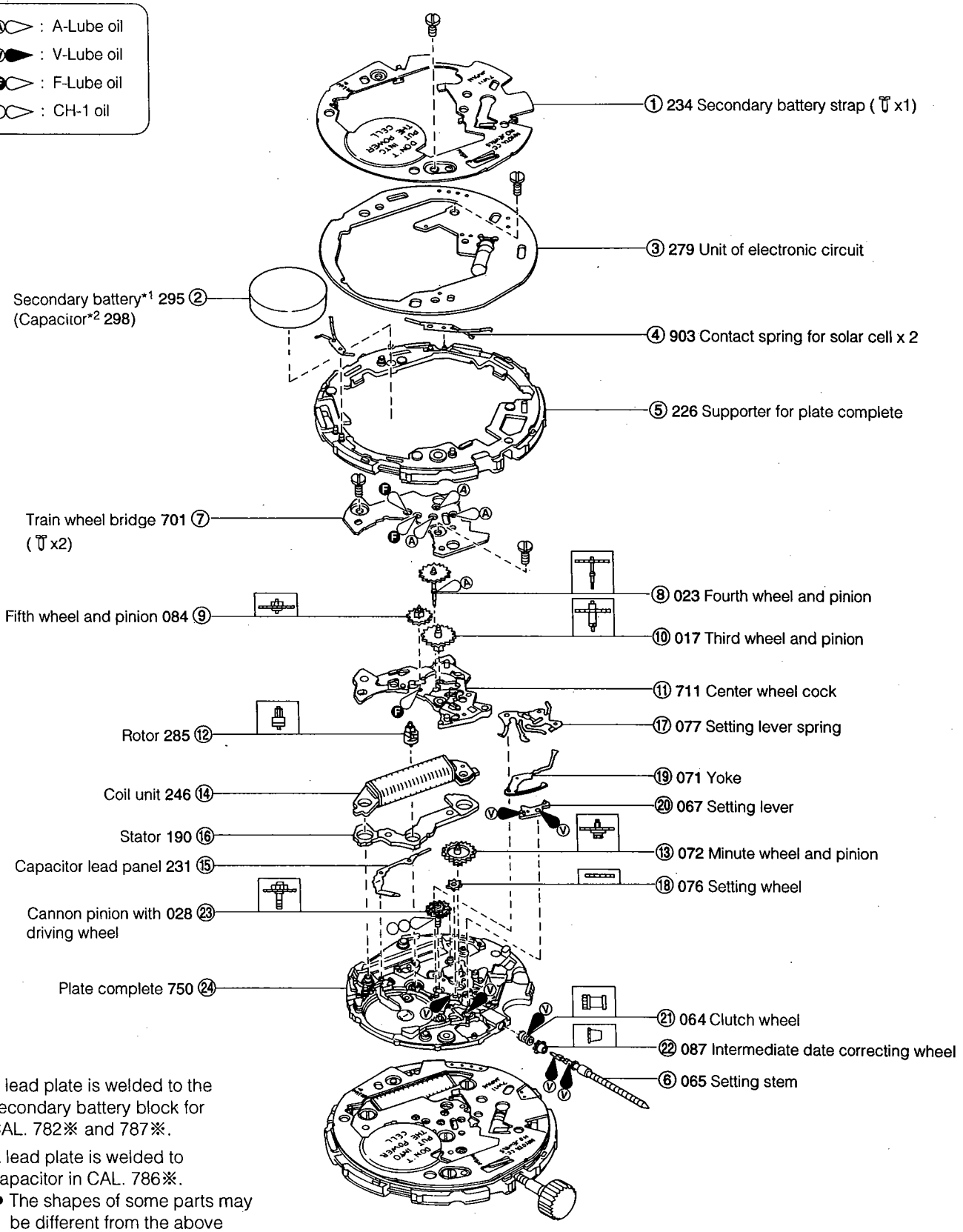
One-piece structure:
Pushing the unlocking lever for setting stem on the side of the dial (near the crown) with tweezers, etc., remove the setting stem.

§6. DISASSEMBLY AND ASSEMBLY OF MODULE

Disassembly procedure: ① → ㉝
Assembly procedure: ㉝ → ①

● Lubrication mark

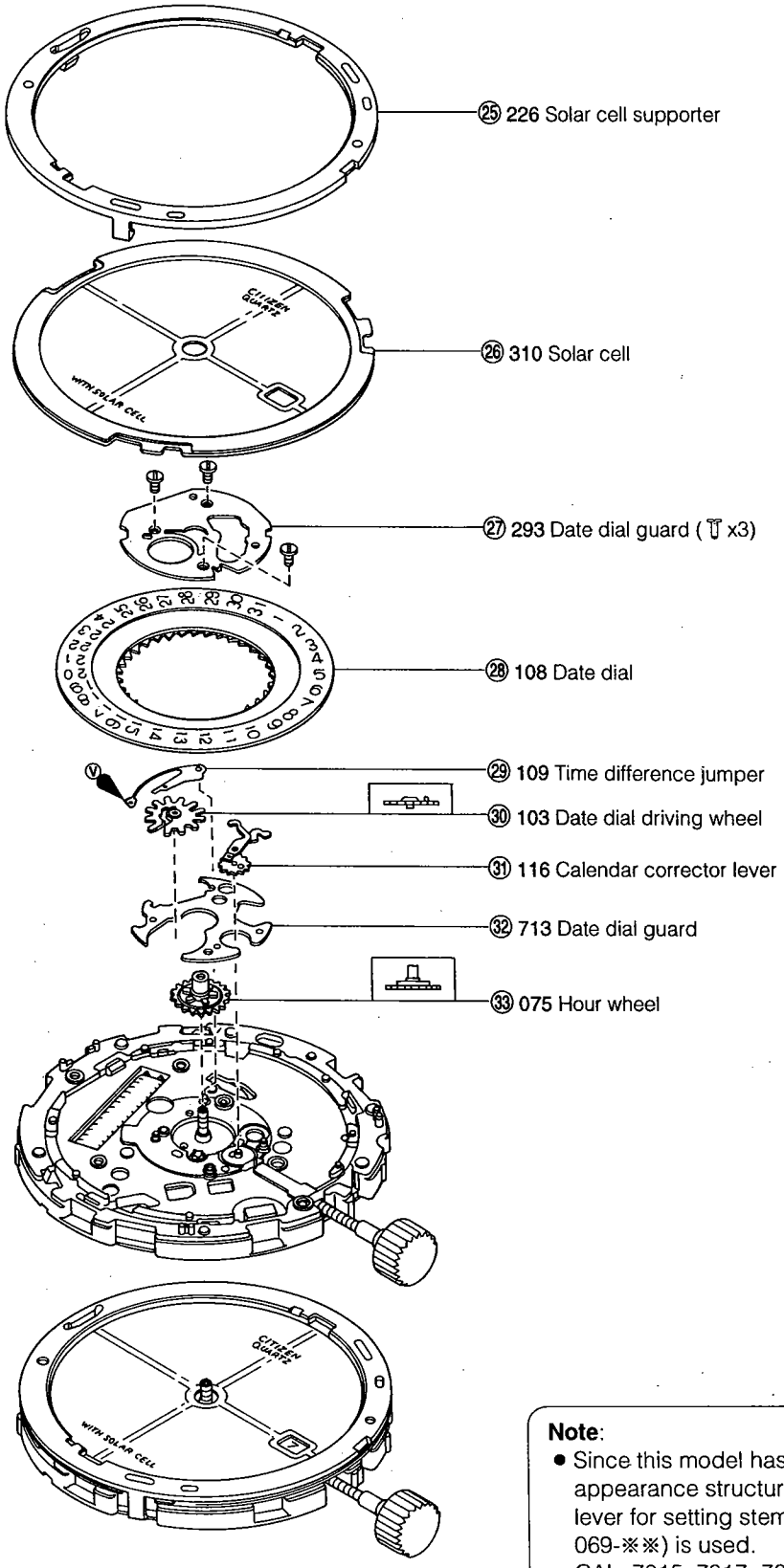
Ⓐ : A-Lube oil
Ⓥ : V-Lube oil
Ⓕ : F-Lube oil
CH-1 oil



*1: A lead plate is welded to the secondary battery block for CAL. 782※ and 787※.

*2: A lead plate is welded to capacitor in CAL. 786※.

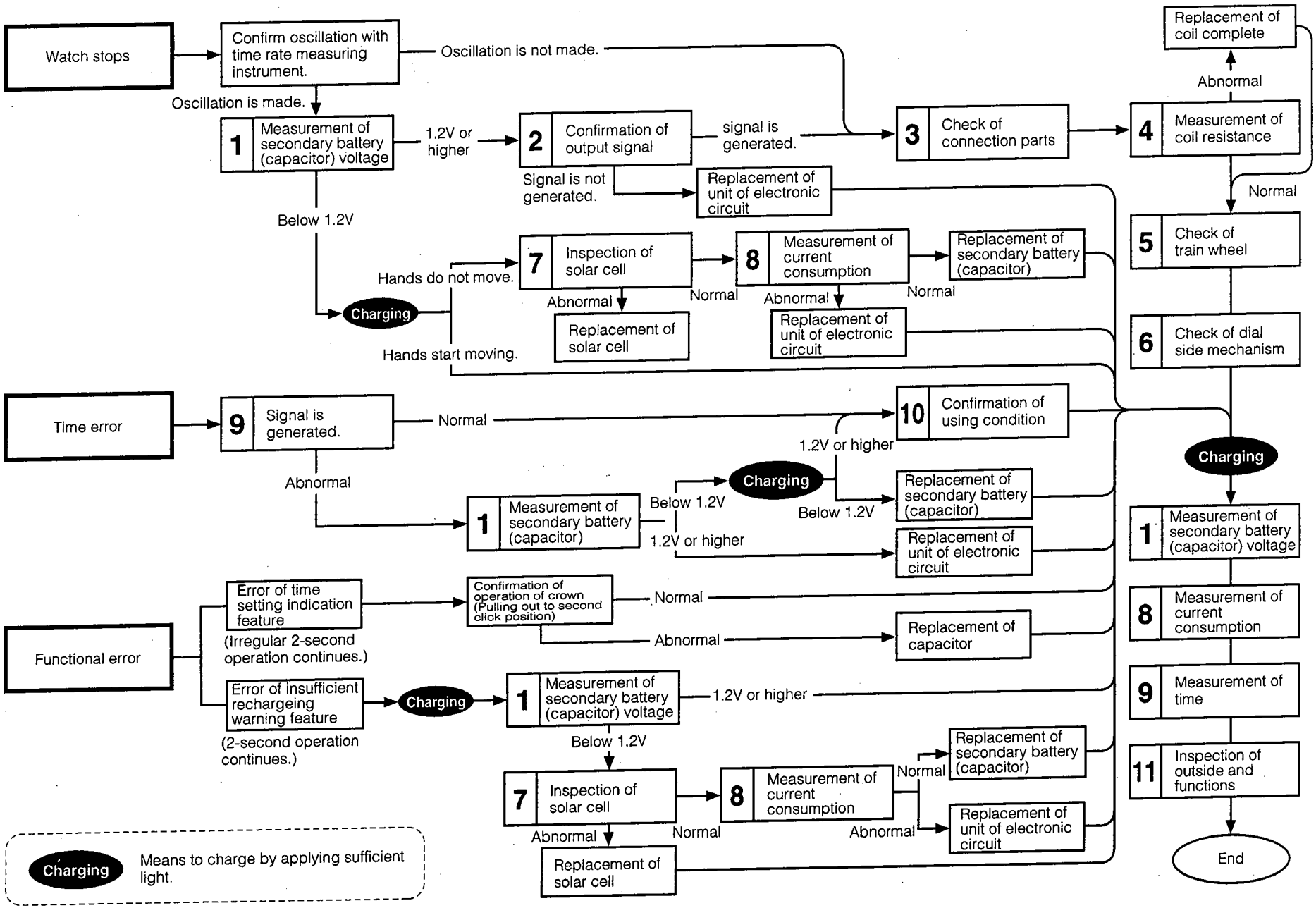
● The shapes of some parts may be different from the above illustration.

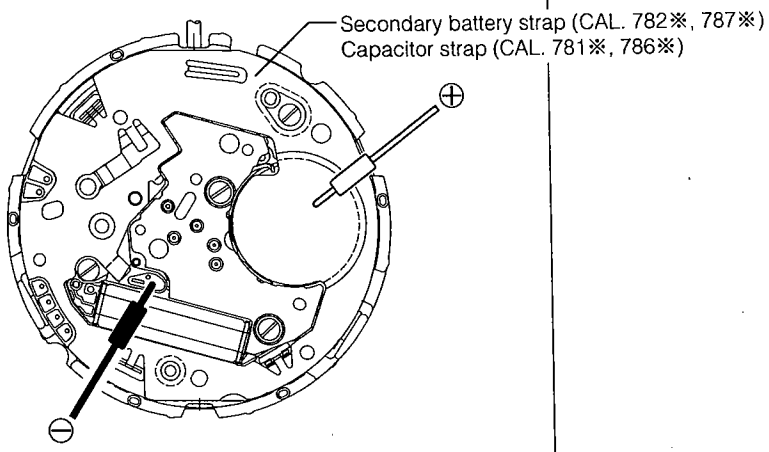


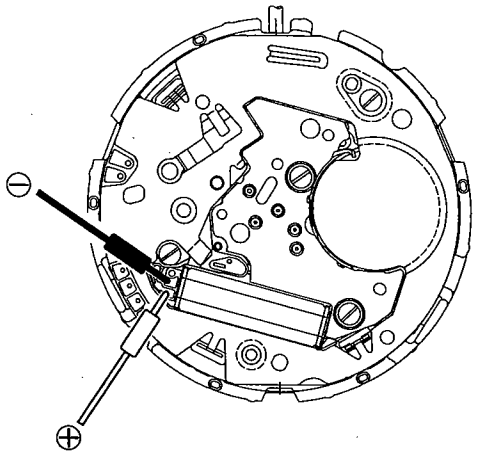
Note:

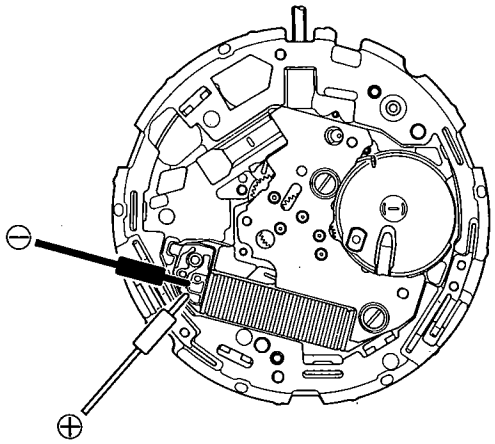
- Since this model has one-piece appearance structure, the unlocking lever for setting stem (Part No. 069-※※) is used.
  CAL. 7815, 7817, 7825, 7827, 7865, 7867, 7875, 7877
- The solar cell (Parts No. 310-※※) is handled as an appearance part.

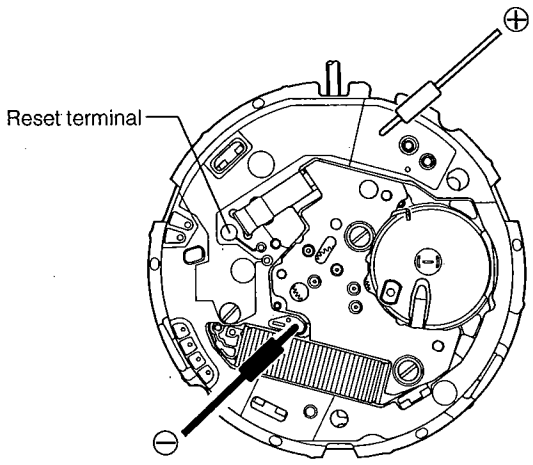
§7. TROUBLESHOOTING AND ADJUSTMENT METHOD

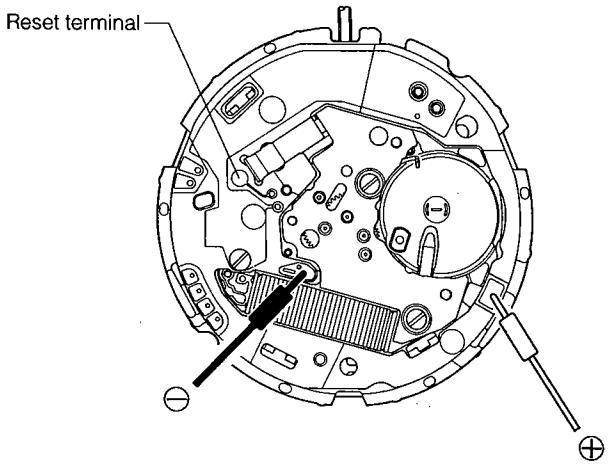


Check Items	How to Check	Result and Treatment
❶ Measurement of secondary battery or capacitor voltage	<Tester range: DC. 3V>  Reference: ● 0.9V~1.2V: Two-second step running mode 1.2V~2.6V: One-second step running mode These voltages may vary slightly from watch to watch. ● Irregular two-second step 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 (capacitor) voltage will display an extremely low value because the secondary battery (capacitor) has not been fully charged. **Caution:** When measuring the voltage, be careful not to place the ⊖ tester pin on the secondary battery strap (capacitor 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>  • 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 electronic circuit unit.
❸ Check of connection parts	* Refer to 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 (capacitor), 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 (capacitor) → Replace parts.

Check Items	How to Check	Result and Treatment
❹ 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>	2.2 ~ 2.7kΩ → Normal Out of range of 2.2 ~ 2.7kΩ → Replace coil complete.
❺ Check of train wheel	* Refer to Basic Course: II-2-b.	
❻ Check of dial side mechanism	* Refer to Basic Course: II-2-c.	
❼ 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
❽ Measurement of current consumption	* Refer to Basic Course: II-1-f. This watch uses a secondary battery block (Capacitors for CAL 781※ & 786※) 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 strap and secondary battery block (the capacitor holder and capacitor in case of CAL. 781※ and 786※). (2) Pull out the crown to the second 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.) **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. <Tester range: DC 10μA> **In case of CAL. 781※, 782※, 787※**  	Current consumption by module **Below 1.4μA** → Good **1.4μA or higher** → Measure unit of electronic circuit. Measurement of unit of electronic circuit. **Below 0.3μA** → Good **0.3μA or higher** → Replace unit of electronic circuit.

Check Items	How to Check	Result and Treatment
	In case of CAL. 786※  ★ 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 is high but that by electronic circuit unit is low → A part other than circuit seems to have a trouble. Check for stain, bad lubrication, deformation of parts, and remove causes of load.
❾ Measurement of time	* Refer to 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 or 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.	
❿ Confirmation of using condition	* Refer to 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 deformed 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.	
⓫ Inspection of outside and functions	* Refer to Basic Course: II-2-f.	

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