TECHNICAL INFORMATION

CITIZEN QUARTZ
Cal. No. C2✳·✳

⏱ CITIZEN

Contents

§1. FEATURES OF THIS WATCH

CAL. C20※
This watch is a standard combination quartz watch which follows CAL. C48※, C170, and C180. Its main features are that the hour, minute, and second hands are installed to the center of the module and the digital display is arranged in an arc, and its handling method is almost the same as the above calibers.

CAL. C21※
This watch is a combination quartz watch for outdoor use which has a yacht timer, chronograph function, etc.

§2. SPECIFICATIONS

Caliber No.			C20※	C21※
Type			Combination quartz watch (Analog quartz + Digital quartz) quartz watch	
Module size			⌀28.4 x 27.8 x 25.0 (Thickness: 3.1 mm)	⌀30.8 x 26.0 x 27.4 (Thickness: 4.9 mm)
Accuracy (At normal temperature)			±30 sec./month	±20 sec./month
Oscillation frequency			32,768 Hz	
Display method			(Digital) FE nematic liquid crystal display (Analog) 3-hand analog indication	
IC			C/MOS-LSI 1 unit	
Effective temperature range			0°C ~ 55°C (32°F ~ 131°F)	
Converter			Bipolar step motor	
Adjustment of time rate			DF Adjustment (Without adjustment terminal)	
Measuring gate			10 seconds	
Display functions	Analog section		Hour, minute, second hands	
	Digital section	• Calendar	Month, date, day	Hour, minute, second (A/P) month, date, day
		• Time	Hour, minute, second (A/P), 12/24-hour switching system	
		• Alarm	A/P, alarm hour, minute	
		• Chronograph	60 minutes meter (maximum measuring range: 59 min, 59 sec, 99)	12-hour meter (maximum measuring range: 11 hour, 59 min, 59 sec)
		• Timer	—	60-minute timer
		• Yacht timer	—	Timer of 10 min, 5 min, and start time measurement with auto chronograph function
	Additional functions		• Chime • Lamp	—
Power cell	Part No.		280-44 (SR927W)	
	Size		⌀9.5 x 2.7 (mm)	
	Nominal voltage		1.55 V	
	Nominal capacity		60 mAH	
	Lifetime		Approx. 3 years	Approx. 2 years
			(Depends on using hours of alarm, chime, lamp, and chronograph.)	

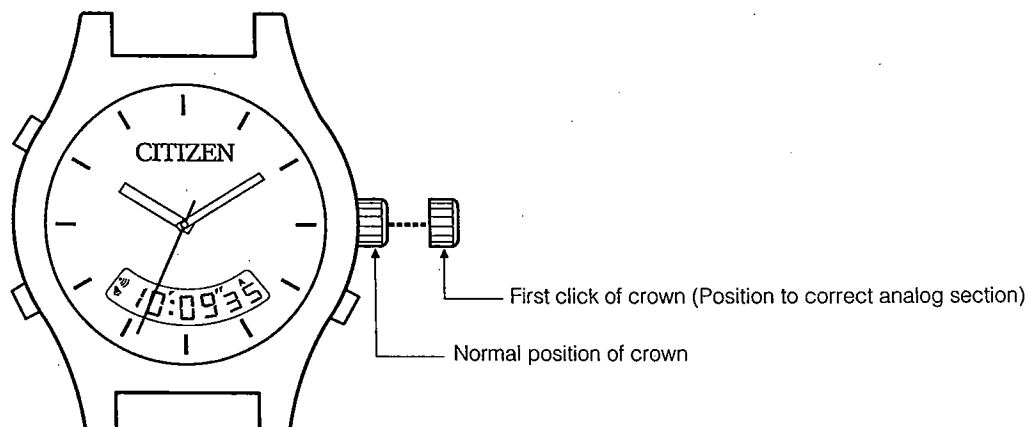<The above specifications are subject to change without notice.>

§3. OUTLINE AND NAME OF EACH PART OF THIS WATCH

This manual mainly explains the technical informations of CAL. C20

- This is an analog/digital combination quartz watch having the functions of calendar, time indication, alarm, and chronograph.

- **Marks of digital section**
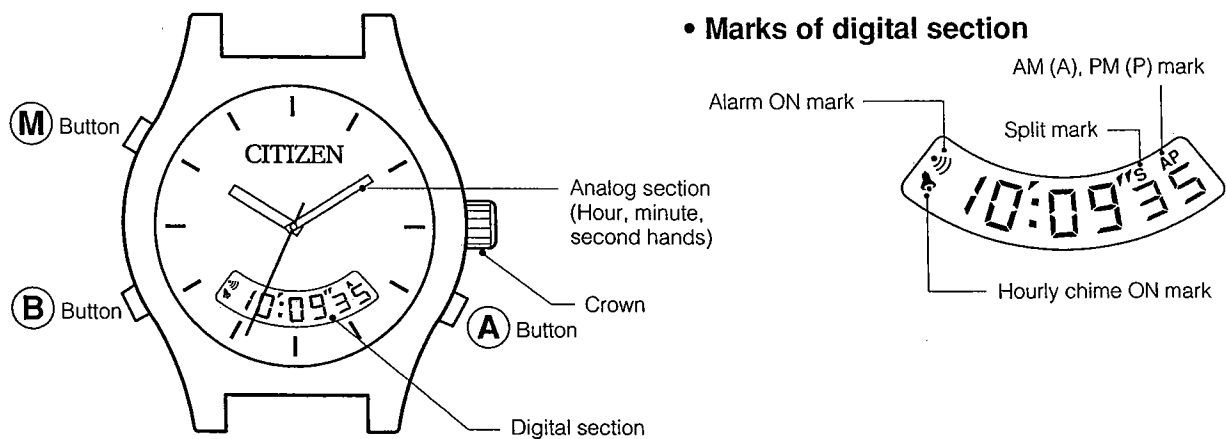
§4. SETTING METHOD OF ANALOG SECTION (Hour, minute, second hands)

(1) Pull out the crown and adjust the time.

(2) After adjusting the time, push in the crown perfectly, and the watch starts.

* For accurate setting, stop the second hand at 0 second in advance. Move the minute hand 4 – 5 minutes ahead of the correct time, then return it to the correct time. Push in the crown to a standard time signal.
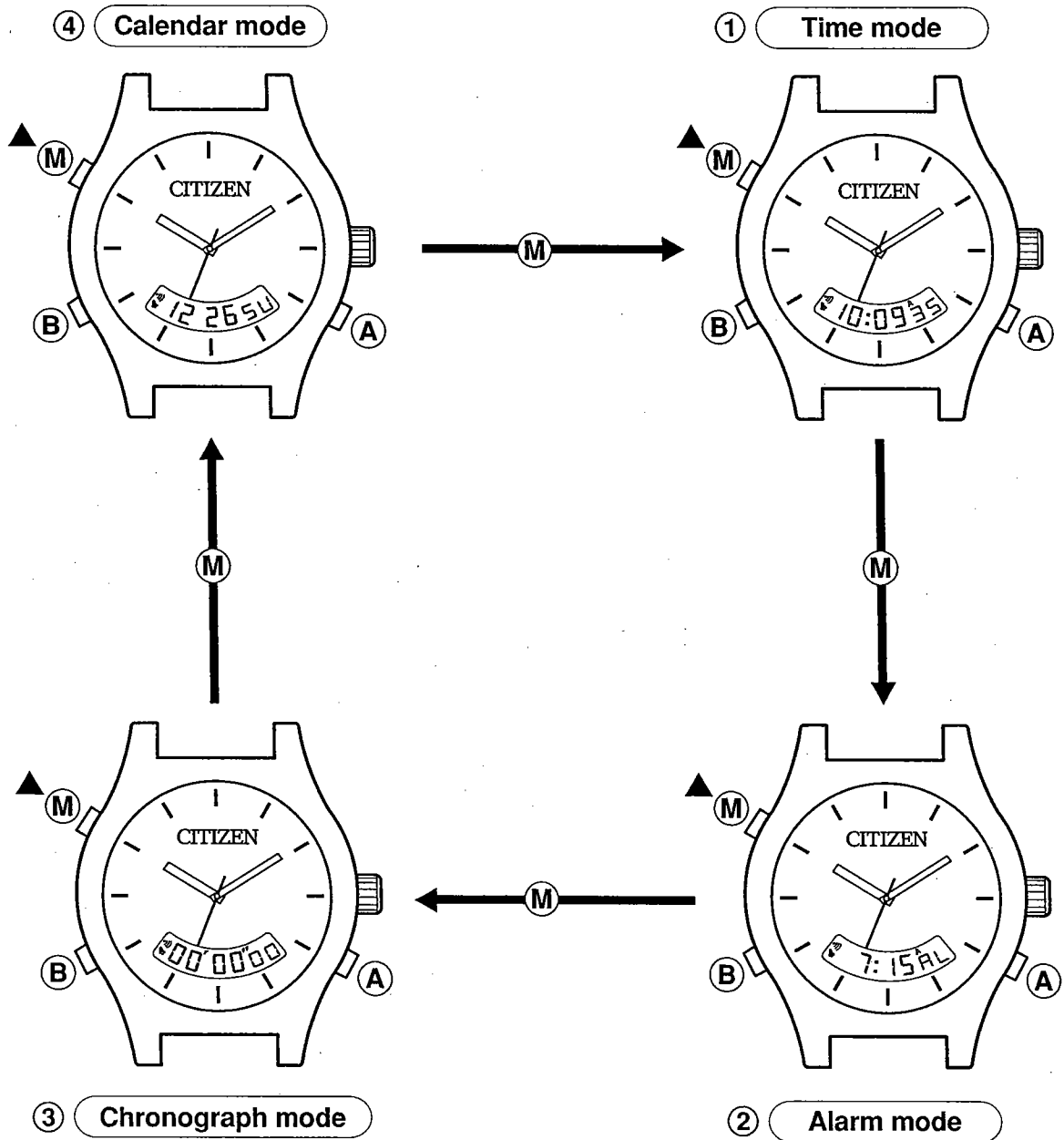
* The analog section (hands) is not synchronized with the digital section. Accordingly, the analog section and digital section can be set to different times and used as a dual time system.

§5. HANDLING METHOD OF DIGITAL SECTION

This watch has four modes (Indicating functions).
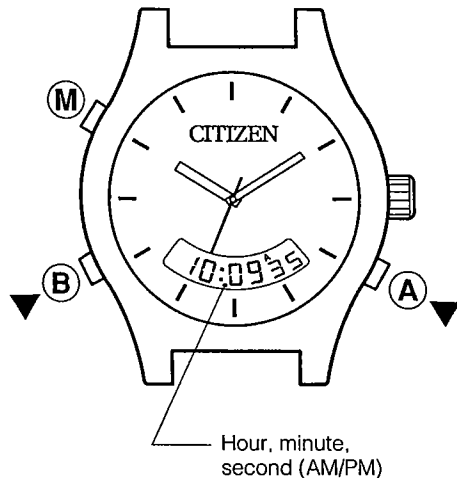
The normal indication in each mode is shown below.

The mode is change every time the Ⓜ button is pushed in the following order.

④ (**Calendar mode**)

① (**Time mode**)

③ (**Chronograph mode**)

② (**Alarm mode**)

① Setting of time

**<Normal indication in time mode>**

Hour, minute,
second (AM/PM)

(1) Push the Ⓜ button to set the watch in the time mode.
(The mode mark does not light up.)

(2) Push and hold the Ⓑ button for about 2 sec, then release it, and "SECOND" flashes. If the Ⓐ button is pushed at this time, the second starts from 0.

(3) Push and release the Ⓑ button, and "MINUTE" flashes. Push the Ⓐ button to correct the minute.

(4) Push and release the Ⓑ button, and "HOUR" flashes. Push the Ⓐ button to correct the hour.

(5) Push and release the Ⓑ button, and 12H or 24H flashes. Push the Ⓐ button to select either 12H system or 24H system. "A" or "P" is indicated above the second display only when the 12H system is selected.

(6) Push the Ⓑ button to return to the normal indication of the time. The time is corrected by the above operation.

Note: If the watch is left untouched in the correction mode, it automatically returns to the normal indication of the time.
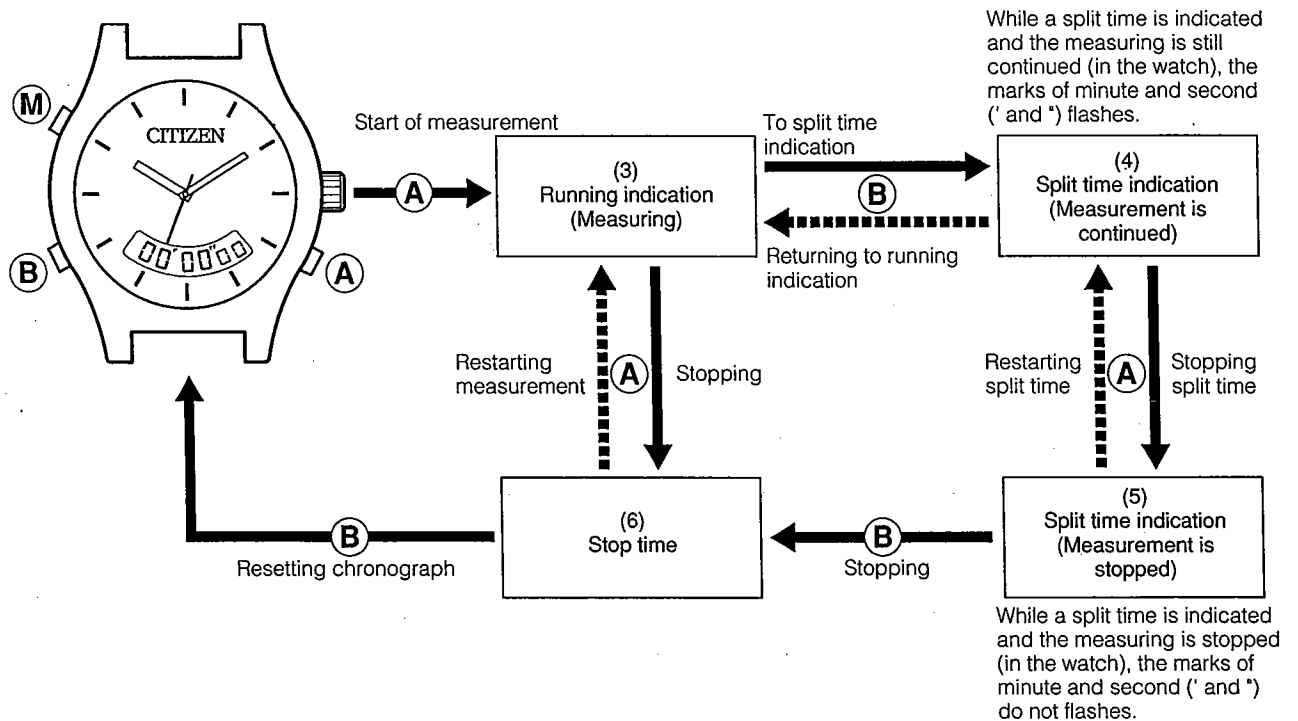
② Setting of alarm time

Alarm set mark

Alarm set time:
Hour, minute (AM/PM)
Alarm mode mark: AL
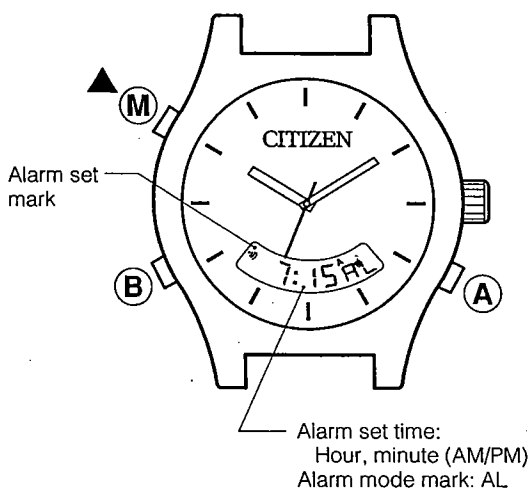
(1) Push the Ⓜ button to set the watch in the alarm mode.

(2) If the Ⓑ button is pushed and released, "HOUR" of the alarm flashes. Push the Ⓐ button to set the alarm time. In the 12H system, take care not to mistake AM and PM for each other.

(3) Push and release the Ⓜ button, and "MINUTE" of the alarm flashes. Push the Ⓐ button to set the MINUTE of the alarm.

(4) Push the Ⓑ button to return to the normal indication of the alarm time. The alarm is set by the above operation.

* The 12H system and 24H system of in alarm mode are conformed to those in the time mode.

* Turn on and off the alarm by pushing the Ⓐ button in the normal indication mode of the alarm time. The former is turned on and off every time the latter is pushed. While the alarm is turned on, the •𝅘 mark lights up.

* The alarm sounds for 20 seconds. It can be stopped by pushing any one of the Ⓐ, Ⓑ, and Ⓜ buttons.

③ How to use the chronograph (stopwatch)

While a split time is indicated and the measuring is still continued (in the watch), the marks of minute and second (' and ") flashes.

Start of measurement

To split time indication

(3) Running indication (Measuring)

Returning to running indication

(4) Split time indication (Measurement is continued)

Restarting measurement — (A) — Stopping

Restarting split time — (A) — Stopping split time

Resetting chronograph

(6) Stop time

Stopping

(5) Split time indication (Measurement is stopped)

While a split time is indicated and the measuring is stopped (in the watch), the marks of minute and second (' and ") do not flashes.

(1) Push the Ⓜ button to set the watch in the chronograph mode.

(2) Push the Ⓐ button while the chronograph is reset state (00'00"00), to start the chronograph (measurement). → (3)

(3) While the chronograph (measurement) is running (3);
- If the Ⓐ button is pushed, the stop time of the chronograph from the starting point is indicated. → (6)
- If the Ⓑ button is pushed, the split time is indicated. → (4)
  (In this case, the watch is still measuring the time from the starting point with the chronograph.)

(4) While the split time is indicated (Chronograph is still measuring) (4);
- If the Ⓐ button is pushed, the split time is kept indicated, but the chronograph, which has measured the time from the starting point, stops the measurement. → (5)
- If the Ⓑ button is pushed, the watch returns to the measurement with the chronograph. → (3)

(5) While the split time is indicated (Chronograph has stopped measuring) (5);
- If the Ⓐ button is pushed, the split time is kept indicated, but the chronograph in the watch starts the measurement, adding the former stop time. → (4)
- If the Ⓑ button is pushed, the stop time of the chronograph is indicated. → (6)

(6) While the stop time is indicated (6);
- If the Ⓐ button is pushed, the chronograph starts the measurement again at the stop time. → (3)
- If the Ⓑ button is pushed, the chronograph is reset. → (2)
- * The maximum length of measured time is 59 minutes, 59 seconds, 99/100. After this time, the measurement is repeated from 00'00"00.
- * A sound comes out for confirmation every time the Ⓐ or Ⓑ button is pushed.
- * If the mode is changed while a split time is indicated (Chronograph is measuring the time) (4) or (Chronograph has stopped measuring the time (5)), and if the watch is returned to the chronograph mode
  - The chronograph starts running (measurement) (3) in the former case.
  - The chronograph indicates the stop time (6) in the latter case.
- * The split time means the time after the starting point. While the split time is indicated, the "S" mark is indicated at the right upper part.

④ Setting of calendar
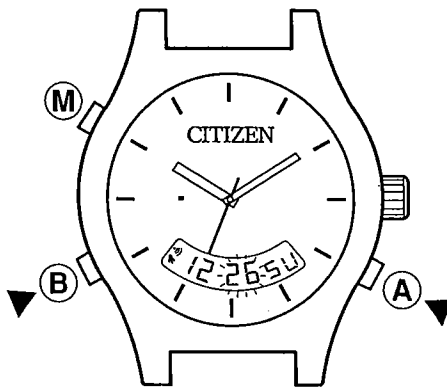
(1) Push the Ⓜ button to set the watch in the calendar mode.

(2) Push and hold the Ⓑ button for about 2 seconds, then release it, and "DATE" flashes. Set the date with the Ⓐ button.

(3) Push and release the Ⓑ button, and "MONTH" flashes. Set the month with the Ⓐ button.

(4) Push and release the Ⓑ button, and "DAY" flashes. Set the day by pushing the Ⓐ button.

(5) Push the Ⓑ button, and the watch returns to the normal calendar indication. The calendar is set by the above operation.

- Once the calendar is set, the month, date, and day are changed automatically. (They do not need to be corrected at the end of each month.)They need to be corrected, however, at the end of February in each leap year, since the end of February is set to 28.

§6. SOUND MONITOR AND SETTING OF HOURLY CHIME

Hourly chime set mark
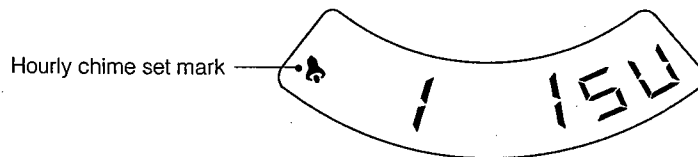
- **Sound monitor**
  The sound monitor means the function to confirm the alarm sound. If the Ⓐ and Ⓑ buttons are pushed at the same time in the normal indication of the calendar mode or the time, the alarm sound comes out while they are pushed.
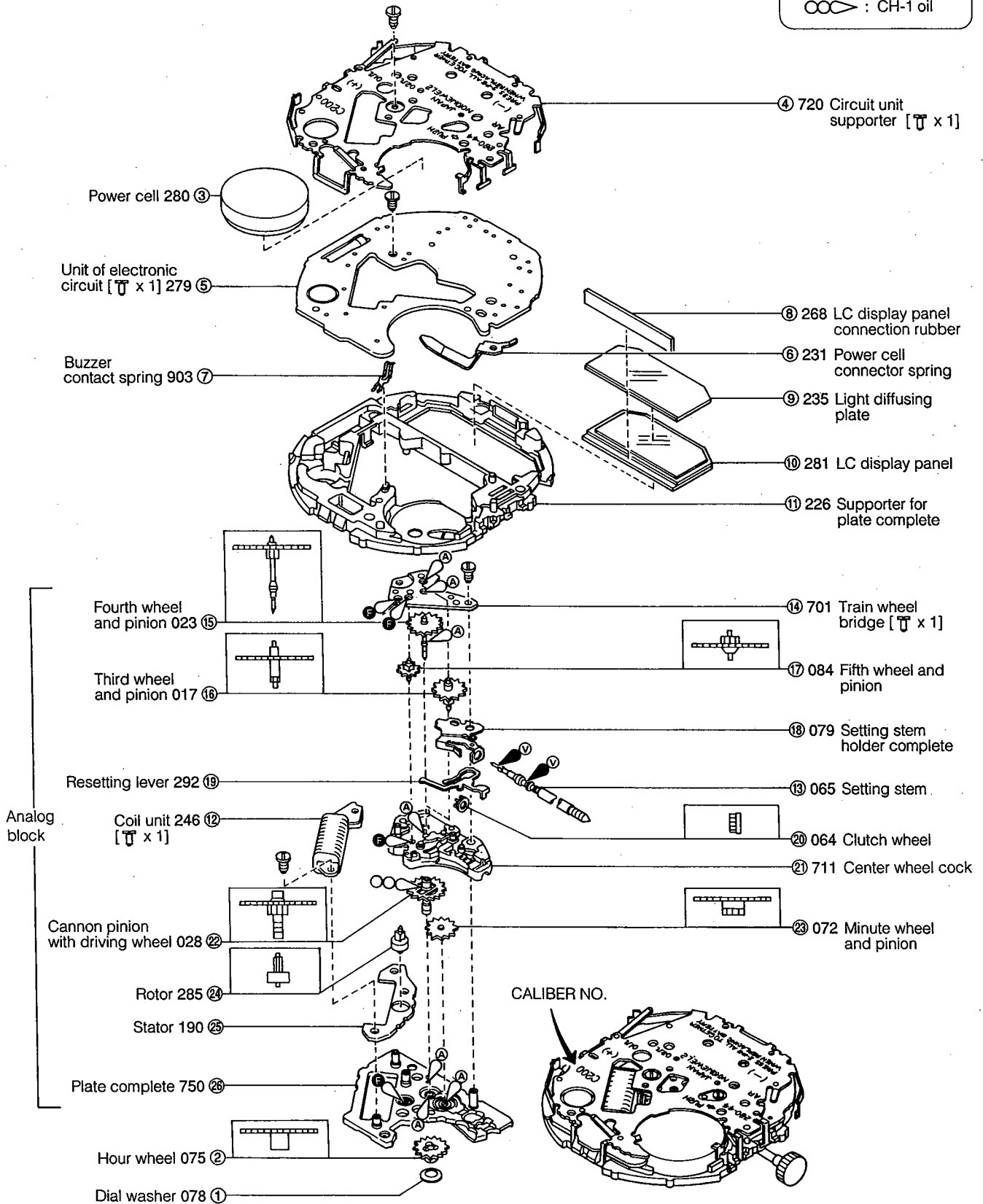
- **Setting of hourly chime**
  The hourly chime can be turned on and off by performing the operation for the sound monitor. If the hourly chime is set, the HOURLY CHIME ON mark is indicated.

§7. DISASSEMBLY AND ASSEMBLY OF MODULE

Disassemble procedure: ① → ㉖
Assemble procedure: ㉖ → ①

● Lubrication marks

⒜⊂▷ : A-Lube oil
⒱●▷ : V-Lube oil
⒡●▷ : F-Lube oil
○○○▷ : CH-1 oil

④ 720 Circuit unit supporter [🔩 x 1]

Power cell 280 ③

Unit of electronic circuit [🔩 x 1] 279 ⑤

⑧ 268 LC display panel connection rubber

⑥ 231 Power cell connector spring

Buzzer contact spring 903 ⑦

⑨ 235 Light diffusing plate

⑩ 281 LC display panel

⑪ 226 Supporter for plate complete

Fourth wheel and pinion 023 ⑮

⑭ 701 Train wheel bridge [🔩 x 1]

⑰ 084 Fifth wheel and pinion

Third wheel and pinion 017 ⑯

⑱ 079 Setting stem holder complete

Resetting lever 292 ⑲

⑬ 065 Setting stem

Analog block

Coil unit 246 ⑫ [🔩 x 1]

⑳ 064 Clutch wheel

㉑ 711 Center wheel cock

Cannon pinion with driving wheel 028 ㉒

㉓ 072 Minute wheel and pinion

Rotor 285 ㉔

CALIBER NO.

Stator 190 ㉕

Plate complete 750 ㉖

Hour wheel 075 ②

Dial washer 078 ①

• Use the movement holder C20.

☆ Notes on disassembly and assemble

1. How to take out the setting stem

- With the crown at the normal position, push the part of the setting stem holder marked with a circle and pull out the setting stem.

  If it does not come out, turn it with the crown at the normal position, then pull it out.

Setting stem

Setting stem holder
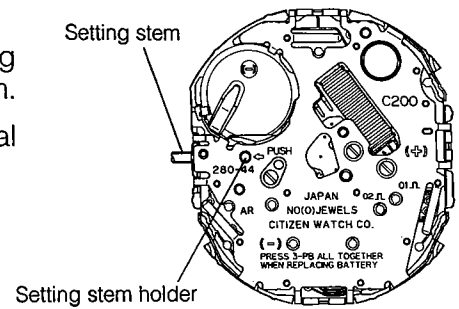
2. How to remove the circuit unit supporter

- Remove the set screw, then disengage the five hooks marked with circles.

  At this time, take care not to bend the hooks and the push-button switching part of the circuit unit supporter.

Screw for circuit unit supporter
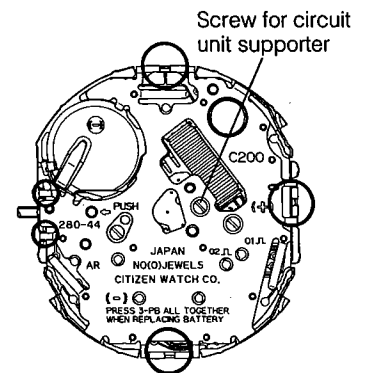
3. How to remove the analog block

- Remove the three hooks of the plate supporter, and the analog block, including the coil, can be removed. The parts of the analog block are No. ⑭ ~ ㉖ in the disassembly drawing.

  (When disassembling and re-assembling the analog block, use the side of the movement holder C20.)

Analog block
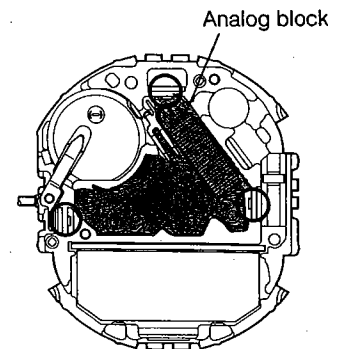
4. Handling of plastic parts

- Plastic parts may be dissolved or deformed in cleaning liquid. They also may be melted or deformed by hot air.

  Accordingly, take every care during and after cleaning them. We recommend to rinse them simply, then immediately dry them by blowing air against them or simply wipe them with a chamois piece.

  Take care, in particular, when using cleaning liquid containing solvent.

☆ All-reset operation

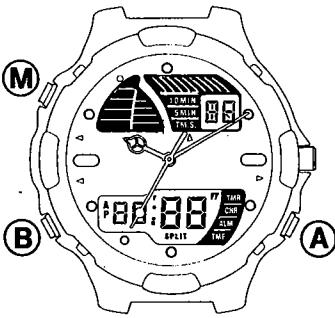● **A microcomputer IC is used in the circuit of this watch.**
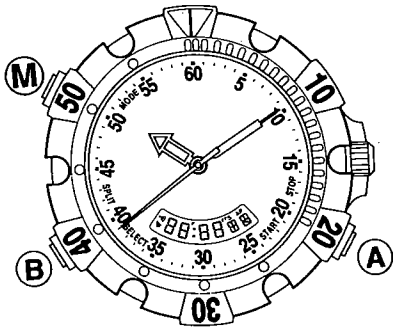
Accordingly, it must undergo all-reset operation to be reset correctly in the following cases.

- When the power cell is replaced.
- When the watch has received a strong shock and it indicates or operates abnormally.

Examples of abnormal indication and operation:

    a) The indication is kept turned off.

    b) A part of indication is lost (Some segments are not turned on).

    c) The digits are not indicated correctly.

    d) The alarm keeps sounding

● **All-reset operation procedure**

C20※	C21※
1) Push the Ⓐ, Ⓑ, and Ⓜ buttons at the same time. → At this time, all the segments of the digital indication unit are turned on. 2) Release the Ⓐ, Ⓑ, and Ⓜ buttons. → At this time, a sound comes out for confirmation and the watch indicates 1. 1. SU (January 1st, Sunday). 3) The all-reset operation is completed. Set each mode correctly.	1) Pull out the crown. 2) Push the Ⓐ, Ⓑ, and Ⓜ buttons at the same time. → At this time, all the indication goes off. 3) Release the Ⓐ, Ⓑ, and Ⓜ buttons. → At this time, all the segments are turned on (All items are indicated). 4) Push in the crown. → At this time, a sound comes our for confirmation, and the watch starts from A12:00.00 in the normal time mode. 5) The all-reset operation is completed. Set each mode correctly.

☆ Measuring method of current consumption

If the lamp, alarm, chronograph, or timer mode is used, more current flows than in the normal time/calendar mode.

Accordingly, the life of the power cell is shortened.

Generally, the life of a new power cell is calculated on the assumption that the alarm is used for 20 seconds, the lamp is turned on for 2 seconds, and the time signal is turned on 24 times every day. The watch must be so handled that its push buttons will not be kept pushed and its lamp and alarm will not be kept turned on and its chronograph (stopwatch) will not keep running.

Accordingly, when the watches are shipped, they must be so packed that their push buttons will not be pushed during transportation. Besides, this point must be explained to the general users.

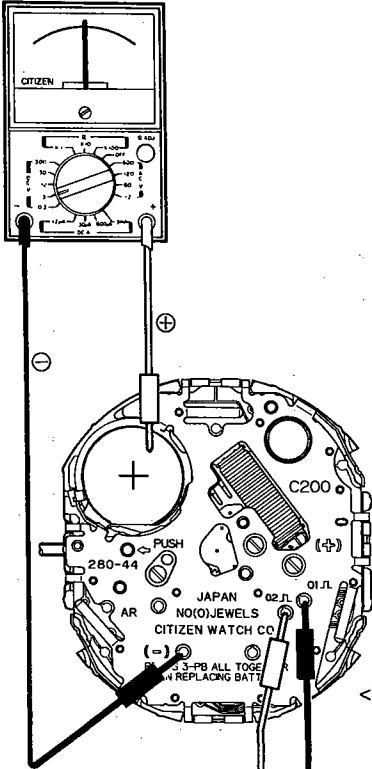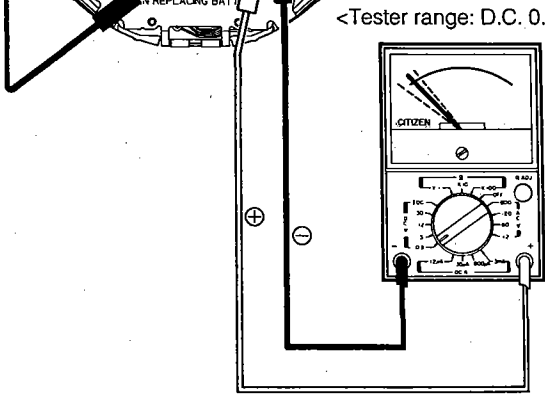## • Main operations of watch which shorten life of power cell in it

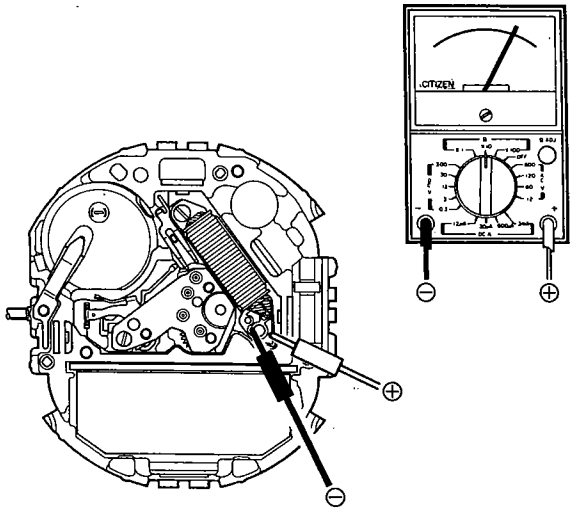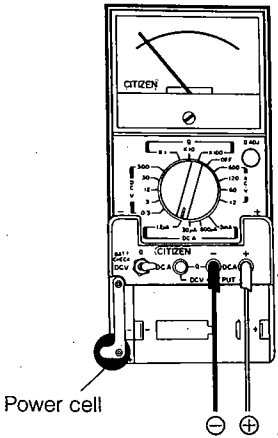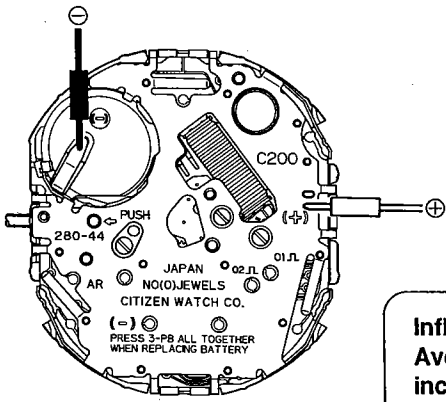|	Operation of watch	Ratio of current consumption to value in normal using state	Current consumption (Reference value)
1	Lamp is turned on	About 5,000 times	About 10 ~ 15 mA
2	Alarm is sounding	About 1,000 times	About 2 mA
3	Chronograph is running	About 2 times	About 3 ~ 4 µA
4	Timer is running	About 2 times	About 3 ~ 4 µA
5	Quick setting	(Forward) About 100 times	About 200 µA
		(Reverse) About 50 times	About 100 µA

(1 mA = 1000 µA)

Note: The above values are shown only for reference. The current consumption depends on the type of watch, AQ/CQ/DQ, and setting speed.
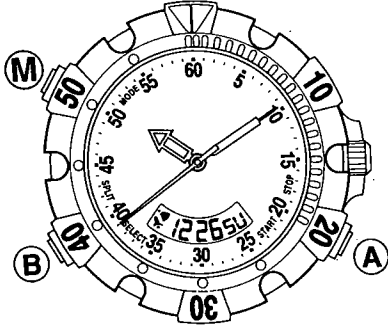
§8. TROUBLESHOOTING AND ADJUSTMENT

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No display                    Measurement of
Watch stop    ──────→    1    power cell voltage

                              Low voltage

                              Replacement
                              of power cell
```

```
No digital display        Replacement of unit
Analog stop               of electronic circuit
                                    ↑ O.K.
Defective digital         3   Check of LC display    No good →  Replacement of unit of electronic
display/Normal                panel connection                  circuit of LC display panel
analog working                parts                             connection part.

Normal digital            2   Confirmation of        No good →  Correction of
display                       output signals                    replacement
Analog stop                         ↓ O.K.                      ↑
                          4   Check of                          No good →  Replacement of unit
Normal display/               connection part                              of electronic circuit
working
```

```
                          5   Measurement of     No good →  Replacement of coil
                              coil resistance
                                    ↓ O.K.
                          6   Check of train
                              wheels
                                    ↓
                          7   Check of dial
                              side mechanism  ──────────────→
```

```
Measurement of         1   Measurement of
power cell voltage         power cell voltage

                           Low voltage

                           Replacement of
                           power cell
                               ↓ O.K.
                           Replacement of unit
                           of electronic circuit
                               O.K. → Correction
                               No good

                           Replacement of unit
                           of electronic circuit
                               O.K. → Correction
                               No good
```

```
Wrong time rate   ──→   8   a. Measurement of
                            time rate
                                ↑ O.K.
                        9   Confirmation of
                            using condition
                                No good
                        1   Measurement of
                            power cell voltage
```

```
Defects in operation        Check of switch
(Incomplete switch of  ──→  10  mechanism
displays, etc.)

Defective alarm   ──────→   11  Check of alarm
```

```
1   Measurement of        12  Measurement of    8   Measurement of   13  Check of appearance   →  Completion
    power cell voltage         current                  time rate             and functions
                                consumption
```

Check items	How to check	Result and treatment
❶ Measurement of power cell voltage	[Refer to Technical Manual, Basic Course: II-1-a] <Tester range: D.C. 3V> 	**Over 1.5 V** → Nondefective **Under 1.5 V** → Replace the power cell
❷ Confirmation of output signal	<Tester range: D.C. 0.3V> [Refer to Technical Manual, Basic Course: II-1-b]	If the tester pointer swings back and forth around zero every second, the unit of electronic circuit is nondefective.
❸ Check of LC display panel connection parts	[Refer to Technical Manual, Basic Course: II-2-a] Check the following points; • Whether the LC display panel connection rubber has been properly mounted. • Whether the LC display panel connection rubber has not been damaged. • Whether there is no dust or dirt on the connection parts.	• If mounting was incorrect, mount again. • If it has been damaged, replace it with a new one. • If dust or dirt is found, remove it.
❹ Check of connection part	• Check that there is no dust or dirt on the connection parts. • Check that the screws have been fastened.	• If dust or dirt is found, remove it. • If the screws are loose, fasten them.

Check items	How to check	Result and treatment
❺ Measurement of coil resistance	[Refer to Technical Manual, Basic Course: II-1-c] <Tester range: R x 10Ω> (The tester lead pins have no polarity)	Within a range of 1.9 ~ 2.3 kΩ → Nondefective Beyond the above range → Replace the coil unit.
❻ Check of train wheel	[Refer to Technical Manual, Basic Course: II-2-b] Check the following points; • Whether the transmission goes smoothly with each gear with an appropriate clearance and with no backlash. • Whether no foreign matter gets in the gears. • Whether lubrication is in a good condition. • Whether hole jewels have no cracks or cuts. • Whether plastic parts are deformed or damaged.	• If improper clearance or backlash is found, adjust the gear. • Foreign matter → Remove it. • Bad lubrication → Adjust it. • Cracks or cuts → Replace the hole jewels. • Deformation or damage → Replace the parts.
❼ Check of dial – side mechanism	[Refer to Technical Manual, Basic Course: II-2-c] • Check that the hands go around in a correct way. • Check that the crown is pulled out in a correct way. • Check that each part has been properly mounted.	• There are problems with turning of the hands → Replace the parts or adjust them. • Pulling out the crown cannot be correctly performed → Replace the damaged parts or adjust them. • Bad mounting → Mount again.
❽ Measurement of time rate	[Refer to Technical Manual, Basic Course: II-2-d] • Since this watch has D.F.C. and does not have adjustment terminals, thus the time rate cannot be adjusted in the customer's place. (Measurement is made in a 10 second-range.) • Accuracy Cal C20※ ±30 seconds per month (±1 second per day) Cal. C21※ ±20 seconds per month (± 0.7 second per day)	• The watch loses or gains substantial time → Replace the electronic circuit unit.

Check items	How to check	Result and treatment
❾ Confirmation of using condition	[Refer to Technical Manual, Basic Course: II-2-e] It is thought that accuracy is affected by the environments in which the watch is used. Therefore, confirm the using condition in terms of magnetism, temperature, humidity, shock, etc. In particular, since the analog block can be stopped and its operation can be disordered by magnetism, the using environment must be confirmed.	
❿ Check of switch mechanism Check of illumination lamp	Check each switch spring in the following points, • Whether the switch spring has been damaged. • Whether the switch spring is in a good contact with the push button. • Whether the switch spring is in a good contact with the pattern of the plate. • Whether dust or dirt around the push buttons creates bad operation of the push buttons. Mount the power cell on the adapter of the tester and check the lamp using D.C.V. OUT-PUT as shown in the illustration. (There is no polarity.) Power cell Lamp	• Damaged switch spring → Replace it. • Bad contact → Adjust it. • Bad contact → Adjust it. • Bad operation, damaged push button → Remove dust/dirt or replace damaged part. The lamp lights up. → Nondefective The lamp does not light up. → Replace the plate complete.
⓫ Check of alarm	[Refer to Technical Manual, Basic Course: II-1-d] Confirmation should be done with alarm monitor in operation. <Tester range: D.C. 0.3V>	• The tester pointer swings. → Nondefective • The tester pointer does not swing at all. → Replace the plate complete.

Check items	How to check	Result and treatment
⑫ Measurement of current consumption	[Refer to Technical Manual, Basic Course: II-1-f] <Tester range: D.C. 10 µA, 12 µA or 30 µA> Power cell ⊖ ⊕ 	• Current consumption of the module **Under** **Cal. C20※: 2.2 µA** **Cal. C21※: 3.1 µA** → Nondefective **Over** **Cal. C20※: 2.2 µA** **Cal. C21※: 3.1 µA** → Measure the unit of electronic circuit singly for current. • Measurement of the separate electronic circuit. **Under** **Cal. C20※: 1.0 µA** **Cal. C21※: 2.5 µA** → Nondefective **Over** **Cal. C20※: 1.0 µA** **Cal. C21※: 2.5 µA** → Replace the unit of electronic circuit.

Influence of light;
Avoid measuring current consumption under an incandescent lamp or the direct rays of the sun, because it may cause the current value to increase.

<Measuring procedure>

	Cal. C20※	Cal. C21※
1)	Push in the crown.	Pull out the crown.
2)	Set the tester as shown above.	←
3)	Set the tester to 100µA or 120µA or a higher range.	←
4)	Apply the probes and push the three push buttons at the same time to perform the all-reset operation.	← Then, perform the all-reset operation, then push in the crown.
5)	After the tester needle is stabilized, change the tester to 30µA or a lower range (10µA or 12µA), with the probes kept applied.	←
6)	When the tester needle is stabilized, it indicates the current consumption.	←

Check items	How to check	Result and treatment
⓭ Check of appearance and functions	[Refer to Technical Manual, Basic Course: II-2-f] • Make sure that there is no dust or dirt inside the watch. • Make sure that each button functions correctly. • Make sure that all the segments have been provided. • Make sure that the alarm monitor operates in an expected manner.	→ See the section of all-reset operation.
⓭ Check of appearance and functions	[Refer to Technical Manual, Basic Course: II-2-f]	