

TECHNICAL INFORMATION

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CITIZEN QUARTZ

Cal. No. 5810*



 **CITIZEN**

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CONVERSION TABLE

0.30480 m	1.0 ft (12 in)
1.0 m	3.28090 feet

10	cm	3.94 inches	21	m	68 ft 11 in
30	cm	11.76 inches	30	m	98 ft 5 in
1	m	3 ft 3 in	40	m	131 ft 3 in
1.5	m	4 ft 11 in	48.8	m	160 ft 1 in
5	m	16 ft 5 in	50	m	164 ft 1 in
10	m	32 ft 10 in	55	m	180 ft 5 in
15	m	49 ft 3 in	200	m	656 ft 2 in
20	m	65 ft 7 in	4000	m	13,123 ft 7 in

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§1. FEATURES

This is a practical diver's watch equipped with an electronic analog (hand) depth meter which was developed first in the world.

The diver can read the present depth, maximum depth, at the same time. As if he reads time, in particular, he can easily see "how many more meters he can dive" with a unique feature of the analog (hand) meter.

- This watch is as reliable as a 200-m water resistance watch based on the ISO Diver's Watch Standard.
- The depth measuring function measures and indicates the depth every second.
- This watch indicates the present time, depth and maximum depth at the same time, which are essential to diving.
- Warning functions for safer diving
 - Surfacing speed warning function
 - Over depth indication warning function
- The depth alarm which automatically sounds when the diver exceeds the preset depth.
- The luminous hand indicators divided by colors for respective functions.

Time (Hour hand, minute hand, second hand)	Green luminous part
Depth (Depth hand, maximum depth hand)	Orange luminous part
(Sub depth hand)	Orange color paint part
- Power cell life-time forecast function which notifies the diver when the power cell is almost dead.

(ISO diver's watch standard is the diver's watch standard (ISO/6425, Ver. May 15, 1984) set by the International Organization for Standardization.)

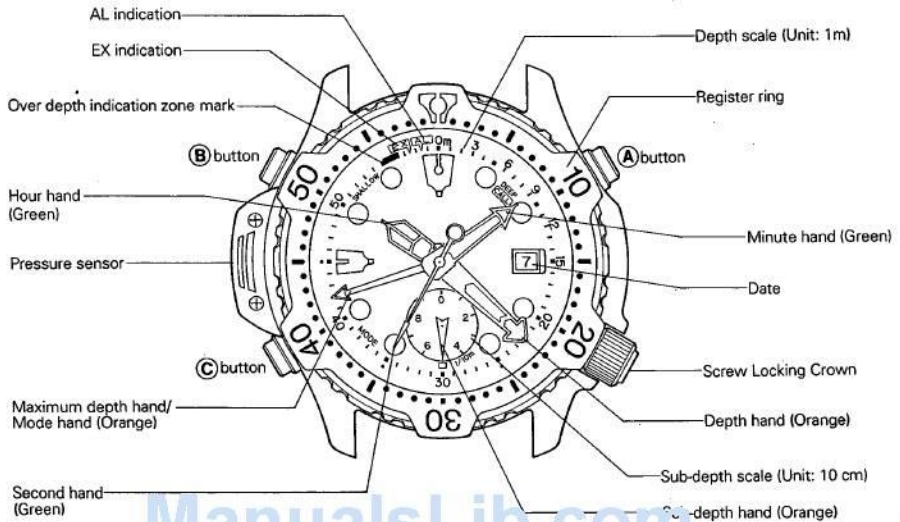
52. SPECIFICATIONS

Type	Analog diver's watch with water depth meter
Caliber No.	Cal. 5810M
Oscillation	32,768Hz (Hz = Vibration/sec.)
Accuracy (at normal temperature):	±15 sec./month
Accuracy of depth meter at constant temperature:	±(3% of indicated value + 0.3 m) • Temperature range: 10°C to 40°C (50°F to 104°F) If temperature changes during diving, accuracy of depth meter is changed. Error made when temperature changes by 30°C (54°F): 1 m max.
Indication method	Analog hand indication Time display system: Hour hand, minute hand, second hand and Date Depth measurement display system: Depth hand, sub-depth hand, maximum depth hand (mode hand)
Effective temperature range	-10°C to 60°C (14°F ~ 140°F)
Indicating functions	Time (Hour, minute, second) Date Present depth: 1.0 to 55.0 m (Unit: 0.1 m) 0 m is indicated when less than 1.0 m Maximum depth: 1.0 to 55.0 m Over depth indication: When depth exceeds 55.0 m Maximum depth memo call: 1 to 55 m (Unit: 1 m) Depth memo call: 1 to 55 m (Unit: 1 m)
Installed functions	Depth measuring function (every second) Depth alarm function Maximum depth memo function Surfacing speed warning function Over depth indication warning function Depth indication error warning function Function to prevent operation in abnormal state
Additional functions	Power cell life-time forecast function Sound monitor function Second hand stopping function Power saving function Date rapid setting function
Outside parts functions	Water resistance case for 200-m diving Function to prevent register ring from reversing
Integrated circuit	C/MOS-LSI, 1 unit
Power cell	Lithium power cell, 1 pieces
Power cell life-time	Approx. 2 years after new one is installed under the following conditions. Standard using conditions: Diving frequency: 50 times/year Length of each diving: 1 hour/diving Average diving depth: 15 m Operations in each diving: Change of mode: 2 times Depth alarm: 15 sec x 5 times Over depth indication warning: 1 min Surfacing speed warning: 1 min Sound monitor: 2 times * The life-time of the power cell largely depends on the using frequency of various functions.
Current consumption	Within 2.0 µA

<The specifications are subject to change.>

§3. OPERATING METHOD

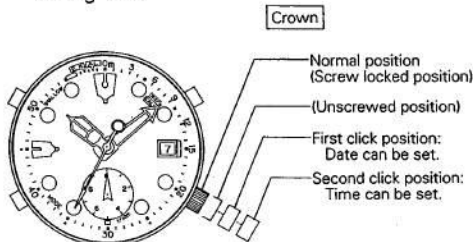
1. NAME OF EACH PART



- * EX: The maximum depth hand (Mode hand) indicates this point during the normal indication.
- * AL: The maximum depth hand (Mode hand) indicates this point during the depth alarm set indication.
- * Over depth indication zone mark: If the diver exceeds the depth of 55.0 m, the depth hand and maximum depth hand indicate this point.

2. HOW TO SET TIME AND CALENDAR

- * Be sure to set the time and date in the normal mode.
- * Do not operate the crown when it is wet.
- * Do not operate any button while the crown is pulled out to the first or second click.
- * Be sure to keep the crown at the normal position (Screw lock) unless the time or date is not being set.



Setting procedure

1. Confirm that the watch indicates normally in the normal mode.
If it does not, set it to the correct state, referring to item §3-3-② "Section of how to change mode and indication."
2. Turn the crown counterclockwise to loosen it.
3. When the second hand comes to the 0 second point, pull the crown to the second click position.

4. Turn the crown to set the hour and minute hands.
 - * Be careful to adjust the AM/PM correctly while watching the date display.
 - * Move the minute hand over the present time by 4 – 5 minutes, then return it to the correct position.
5. Push in the crown to the standard time signal.
The second hand starts moving.
6. Set the crown to the first click position and turn it counterclockwise to set the date.
 - * Avoid setting the date during the period from 8:30 PM to 1:00 AM. If it is set in this period, it may not change correctly.
7. After the time and date have been set, be sure to push in the crown and lock it by screwing (to the normal position).

The time and date are indicated in any indication mode.

3. MEASUREMENT OF DEPTH

① Various warning functions

Function	Condition for operation	Warning method
Surfacing speed warning	<ul style="list-style-type: none"> • Surfacing speed is high. Depth difference of 1.5 m or more is detected in 5 sec. 	<ul style="list-style-type: none"> • Warning sound continues (Peep, peep) while high surfacing speed is detected. • Warning sound continues at least 5 sec.
Over depth indication warning	<ul style="list-style-type: none"> • Measured depth exceeds 55.0 m. 	<ul style="list-style-type: none"> • The depth hand and maximum depth hand move to the over depth indication zone mark. • The warning sound continues (Pip-pip, pip-pip) while the depth exceeds 55.0 m.
Depth indication error warning	<ul style="list-style-type: none"> • An error is detected in depth indication. 	<ul style="list-style-type: none"> • The second hand moves by 4 sec. increments.
Prevention of operation in abnormal state	<ul style="list-style-type: none"> • Depth measuring system has a trouble. • The watch is changed to diving mode at the depth of 5 m or deeper. 	<ul style="list-style-type: none"> • The watch is not changed to diving mode.
Power cell life-time forecast	<ul style="list-style-type: none"> • Power cell is almost dead. 	<ul style="list-style-type: none"> • The second hand moves by 2 sec. increments. • The watch is not changed to diving mode.
Target depth alarm	<ul style="list-style-type: none"> • Measured depth exceeds value set to the depth alarm. 	<ul style="list-style-type: none"> • The alarm sounds (Pip-pip, pip-pip) for 15 sec. every time depth exceeds the preset value. • The alarm sounds for 15 sec. at interval of 1 min. as long as depth is deeper than the preset value.

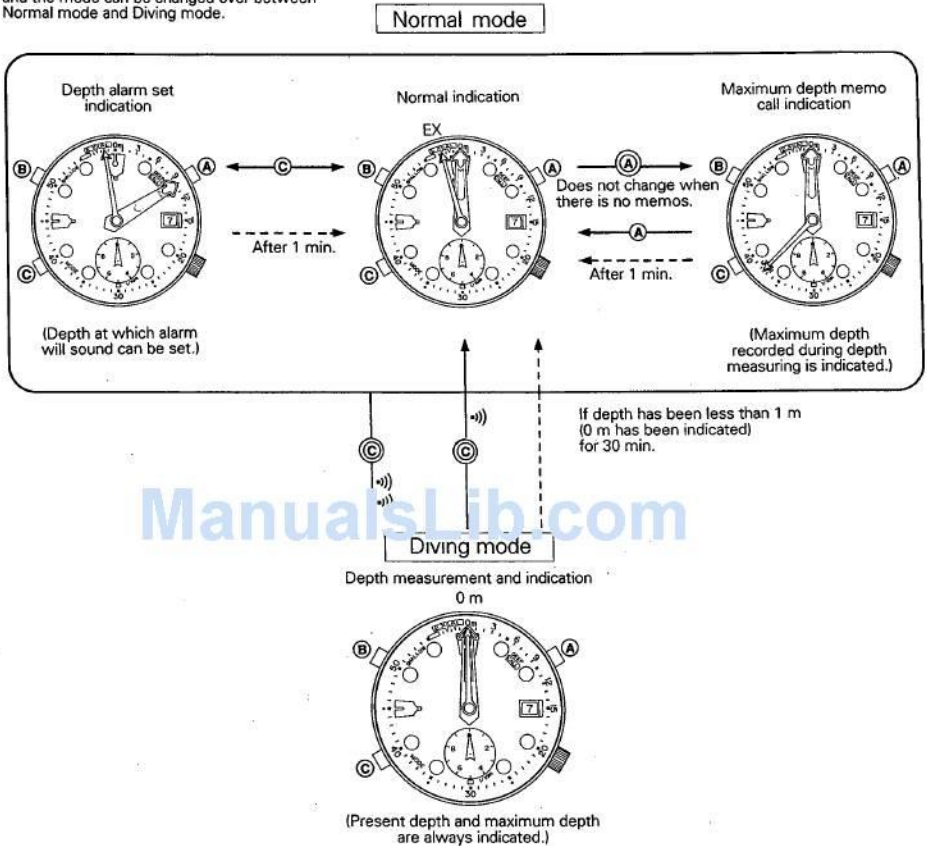
* Since the danger level depends on the condition of diver's body and diving condition, safety is not always secured while the warning function does not operate.

* Use these functions for only reference for diving.

② How to change mode and indication

* Since the time and date are indicated in any indication mode, they are omitted in the following explanation and illustration.

Keep pressing **ⓐ** button approximately for 2 sec., and the mode can be changed over between Normal mode and Diving mode.



- ⓐ : Depress button for 2 sec or more.
- : Depress button one time.
- ∽ : Change confirmation sound (Peep) comes out.
- ∽∽ : Change confirmation sound (Peep) and change finish sound (pip-pip) come out.
- - - -> : Auto return

* In some cases of button operation, the watch may reach the selected indication mode via another indication mode.

(NOTICE FOR USER)

- * Do not change the mode under water.
- * When changing to the diving mode, observe the following points for higher accuracy.
 - Change the mode just before diving.
 - When the atmospheric temperature and water temperature are very different from each other, soak the watch in water for 2 – 3 minutes, then change the mode.

③ Functions in normal mode

a. Setting of Depth alarm

If a target or critical diving depth is set in the depth alarm set indication mode, the alarm automatically sounds when the diver exceeds the set depth with the watch in the diving mode (Depth measurement and indication).

Setting method of depth alarm

- (1) Depress the **(C)** button one time in the normal indication mode to set the watch to the depth alarm set indication mode.

The maximum depth hand (mode hand) indicates AL.

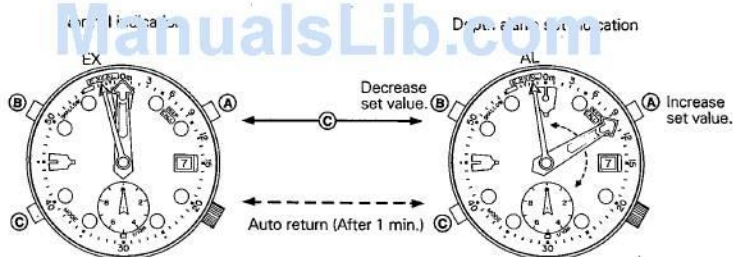
The depth hand and sub-depth hand indicate the previous set value of the depth alarm.

- (2) Set the target depth.

(A) button: Increase the set value. (Deeper)

(B) button: Decrease the set value. (Shallower)

- (3) Depress the **(C)** button to return to the normal indication mode. If the watch is untouched for 1 minute, the watch is automatically returned to the normal indication mode (Auto return).



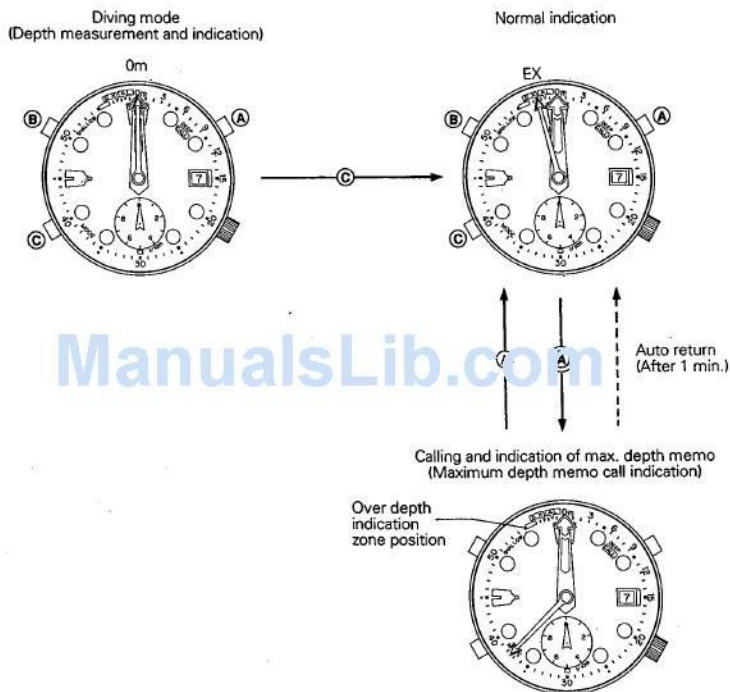
- The setting unit is 1 m.
- The setting range is from 1 m to 55 m.
- If set to 0 m, the depth alarm does not sound in the diving mode (Depth measuring and indication). Be sure to set the depth alarm to 0 m when the depth alarm function is not used.
- Since the depth alarm setting cannot be changed while in the water. Be sure to confirm it before diving.

b. Calling the maximum depth memo

In the normal indication mode, the maximum data recorded automatically in the diving mode (Depth measurement and indication) can be called by this function.

Calling method of maximum depth memo

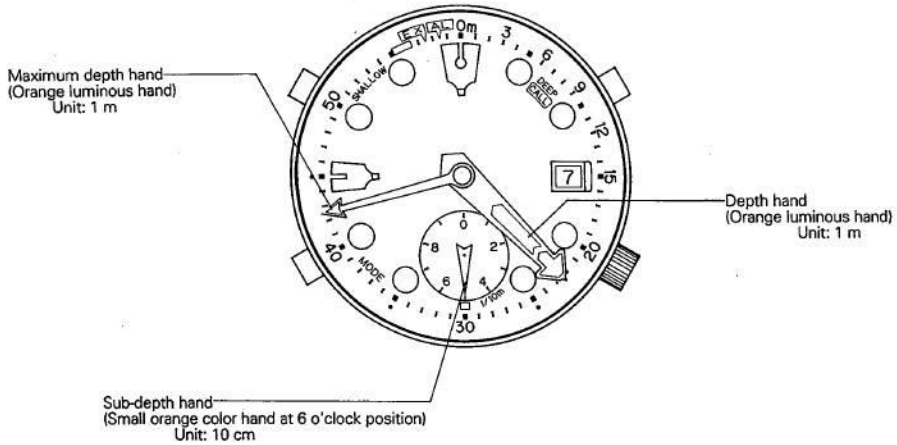
1. After diving is finished, change the watch to the normal indication mode.
2. If the **(A)** button is depressed in the normal indication mode for 2 seconds more, the maximum depth memo is called and indicated.



- The stored depth memo is indicated by the maximum depth hand.
- This memo is stored until a depth of 1 m or deeper is measured in the diving mode (Depth measurement and indication) of the next diving.
- The maximum depth can be indicated from 1 m up to 55 m. If it exceeds 55 m, the hand indicates the over depth indication zone mark.
- Since a diving depth less than 1 m is not recorded, the watch is not changed to the maximum depth memo indication mode.
- If the watch is left untouched in the maximum depth memo indication mode for about 1 minute, it automatically returns to the normal indication mode (Auto return).
- If the power cell is dead, the maximum depth memo is lost. Accordingly, record any important data in a log-book etc. after surfacing by the next diving.

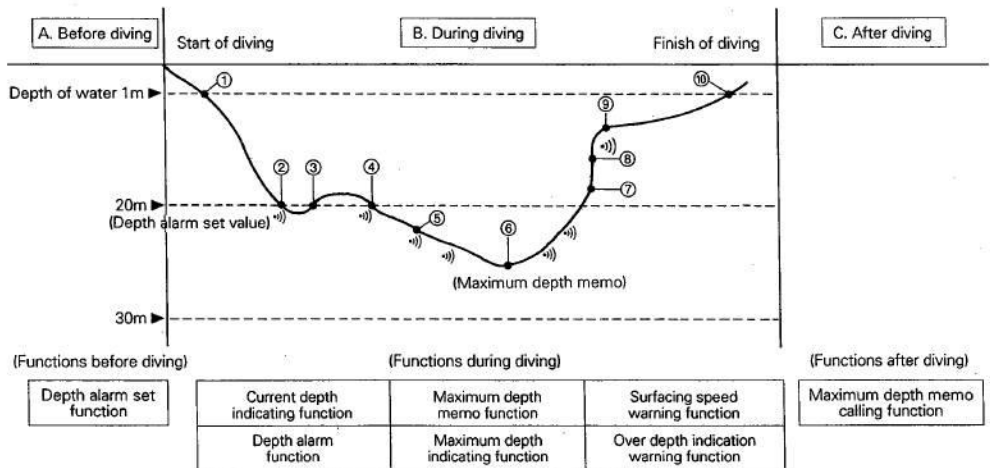
④ Various functions in diving mode

- How to read hands in diving mode



- Concrete example of use

Examples of use of diving functions: Set the depth alarm to 20 m, then start diving.



- * If the depth alarm and surfacing speed warning sound are turned on at the same time during diving, the priority is given to the surfacing speed warning sound for the safety sake.
- * Diving shown above is scheduled only for the explanation.

A. Before diving

- Check the watch
- Confirmation and setting of depth alarm.
- Setting of register ring.
- Depress and hold the **(C)** button in the normal mode for about 2 seconds to change the watch to the diving mode (Depth measurement and Indication), then start diving.

B. During diving

- ① After diving is started, if the watch measures the depth of 1 m, the measured depth is indicated (0 m is indicated when the depth is less than 1 m). The maximum depth hand moves, too.
 - * At this time, the maximum depth memo of the previous diving is cleared.
- ② Since the depth has reached the set value of the depth alarm (20 m), the alarm sounds for 15 seconds.
- ③ Since the diver has heard the alarm and returned to a place shallower than the set depth alarm, the alarm stops. At this time, the maximum depth hand is left.
- ④ Since the depth has exceeded the set value of the depth alarm, again, the alarm sounds.
- ⑤ Since the diver stays deeper than the set depth, the alarm sounds. The alarm sounds every 1 minute while the diver is trying deeper than its set depth. The maximum depth hand moves again, together with the depth hand when the diver goes deeper (this action is repeatable).
- ⑥ The diver starts surfacing since the scheduled diving time has come near its end.
- ⑦ The diver has started quick surfacing without knowing it.
- ⑧ Since surfacing at the rate of 1.5 m for 5 seconds is detected, the surfacing speed warning sound starts (for at least 5 seconds). The warning sound continues while the diver continues quick surfacing.
- ⑨ Since the diver has stopped quick surfacing, the warning sound stops.
- ⑩ Since the diver returns to a place shallower than 1 m, the watch indicates 0 m.

C. After diving

Depress and hold the **(C)** button for 2 seconds to change the watch to the normal indication mode.

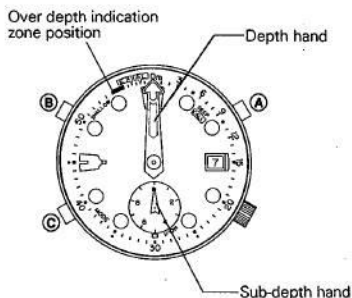
If the watch is kept at 0 m for about 30 minutes, even in the diving mode, it returns automatically to the normal indication mode. Change it to the normal indication mode, however, immediately after finishing diving to save the battery.

- If the **(A)** button is depressed and held for 2 seconds in the normal indication mode, the maximum depth memo during diving of this time is indicated. This data is kept until the depth of 1 m is detected in the next diving (Use this function to record the maximum depth in a log-book, etc.)
 - Clean the watch.
-

- **Main functions in depth measurement mode**

- a. **Current depth indicating function**

The present depth (on the basis of sea water) is indicated during diving.



Indicator hands: The depth hand indicates depth by 1m and sub-depth hand by 10 cm.

Indication range: 1.0 m – 55.0 m

Depth less than 1.0 m is indicated as 0 m.

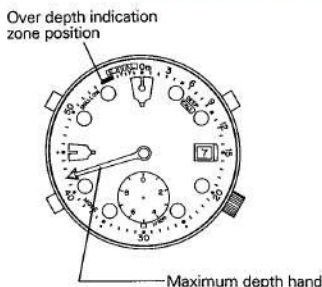
If depth exceeds 55.0 m the hands move to the over depth indication zone.

They indicate depth again if the diver returns to a depth shallower than 55.0 m.

Measuring period: Watch measures and renews indication every 1 sec.

- b. **Maximum depth indication function**

The maximum depth made during diving is indicated by the remaining maximum depth hand.



Indicator range: 1 m – 55 m

Depth less than 1.0 m is indicated as 0 m.

If depth exceeds 55.0 m, the hand moves to the over depth indication zone and is fixed there.

- c. **Maximum depth memo function**

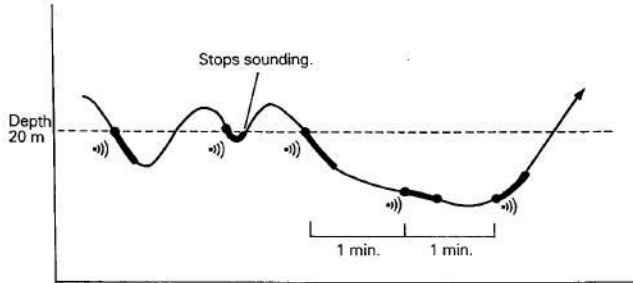
The maximum depth during diving is recorded.

A depth less than 1 m (0 m is indicated) is not recorded. If the depth has exceeded 55 m, "over depth indication" is recorded. This memo is kept until the watch is returned to the normal indication mode and set to the diving mode (depth measurement and indication) again, then submerged exceeding 1 m.

d. Depth alarm function

- The alarm sounds for 15 seconds every time the diving depth exceeds the set value of the depth alarm.
- If the diver returns to a depth shallower than the set depth while the alarm is sounding, the alarm stops sounding.
- If the diver keeps deeper than the set depth after the depth alarm sound, the alarm sounds for 15 seconds at the interval of 1 minute.

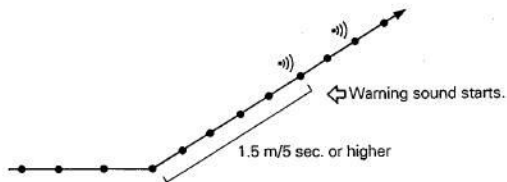
(Example) The depth alarm is set to 20 m.



e. Surfacing speed warning function

If surfacing at 1.5 m in 5 seconds (Equivalent to surfacing speed of 18 m/min.) is detected, the warning sound comes out for at least 5 seconds.

The warning sound continues as long as this surfacing speed is continued.

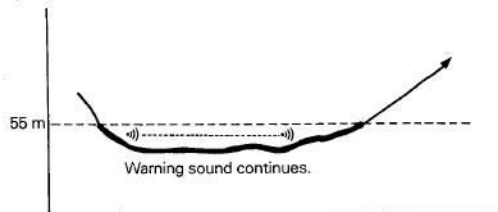
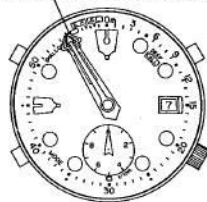


f. Over depth indication warning function

If the depth exceeds 55.0 m during diving, the warning sound continues.

This sound stops if the diver returns to a depth shallower than 55.0 m.

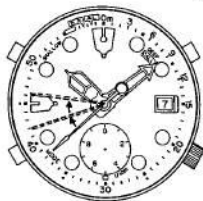
Over depth indication zone position



g. Depth indication error warning function

If an error is made in indication by hitting the watch against a rock etc. during diving, the second hand moves by 4 seconds for warning.

This error warning will continue until the mode is switched to the normal mode.



- * If this watch is kept at a place shallower than 1 m (Indicated depth: 0 m) for about 30 minutes, it is automatically returned to the normal mode.

<Priority of alarm sounds>

The alarm sounds are executed in the following priority order when they are turned on at the same time.

- First: Surfacing speed alarm sound
- Second: Over depth indication alarm sound
- Third: Depth alarm sound

<Priority of warning functions>

The warning functions work in the following priority order when they are turned on at the same time.

- First: Depth indication error warning (Hand moves by 4 seconds increments)
- Second: Power cell life-time forecast (Hand moves by 2 seconds increments)

4. VARIOUS INFORMATIONS FOR DIVERS

The basic precautions for diving are shown below.

• Precautions for safe diving

Precautions for safe diving

This new product is an analog water-resistant watch having a depth meter for diving to 200 m under water. Before using this watch, fully understand the precaution and handling method.

- When using this watch for diving, be sure to take the formal course of safe diving and observe the rules.
 - * When diving, be sure to observe the **BUDDY system**.
- This watch is not a measuring instrument qualified by a public agency. Accordingly, use its measuring functions as only auxiliary measures.
- This watch measures depth of water on the basis of sea water (Specific gravity: 1.025). When it is used in a lake (fresh water), the indicated result must be converted. Accordingly, before using this watch for diving in fresh water, take the special training for that purpose.

(Example) The depth indication at a depth of 50 meters

	Sea water	Fresh water
Indicated depth	50 m	Approx. 48.8 m
(Specific gravity)	(1.025)	(1.0)

What is buddy system

Diving by two men to avoid troubles and dangerous states and save each other.

Inhibited uses

- Do not use this watch out of the use (accuracy) assurance temperature range. The accuracy assurance temperature of this watch is as follows. The reliability of the data indicated at a temperature out of this range is not assured.

Accuracy assurance temperature range of water depth measurement:

10°C to 40°C (50°F to 104°F)

- Do not use this watch in helium gas. If this watch is used in helium gas, it may have a trouble and may be broken. Never use it in helium gas. Accordingly, do not use this watch for saturated diving.
- Do not use this watch as a pressure measuring instrument.
- Do not use this watch to prevent troubles at sea or to judge actions and conditions which may cause dangers.
- Do not use this watch at a place higher than 4,000 m above sea level.

Stop using this watch immediately in the following cases.

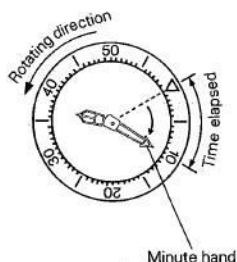
- When an additional function of this watch for safety operates.
 - When the depth indication error warning system operates.
The second hand moves by 4 seconds to indicate this error.
 - When the function of preventing operation under trouble operates.
This watch cannot be switched to the diving mode.
 - When the power cell life time forecast function operates.
The second hand moves by 2 seconds increments to indicate the power cell is almost dead.
- When an abnormality is felt while this watch is used.
 - When this watch stops or it is wrong.
When the data indicated by this watch is very different from those indicated by another measuring instrument.

Precautions

- This watch indicates the depth up to 55.0 m.
 - Although this watch resists water pressure at the depth of 200 m, it cannot indicate the depth more than 55.0 m. It is recommended to limit the diving depth to about 30 m with no decompression for the safety sake.
- Avoid quick submerging (descent rate)
 - If the submerging speed exceeds about 1 m/sec., each depth hands cannot follow it. Decelerate or stop submerging to read the correct depth.
- Avoid quick surfacing (ascent rate)
 - If the surfacing speed exceeds 1.5 m/5 sec. (Equivalent to 18 m/min: Extracted from USA Navy Diving Manual), the surfacing speed alarm turns on the alarm sound.
Keep the safe surfacing speed (below 18 m/min.).
Quick surfacing is dangerous to human body and the depth hands cannot follow the surfacing speed. Positively avoid quick surfacing.
- Avoid using this watch in a place where atmospheric pressure or temperature changes largely.
 - This watch indicates the depth as "0 m" when it is changed from the normal mode to the diving mode.
If the atmospheric pressure or temperature changes largely after this watch is changed to the diving mode, it may indicates 1 m or deeper even on the ground.
* In this case, the watch cannot be changed to the normal mode. See §6-1 All-reset Operation and Zero Setting.
- When diving at a high altitude, take the special training for diving at high altitudes.
- Replace the power cell a little earlier than the expected period.
 - The power cell life of this watch is about 2 years (For the using conditions, see §6-3 Power Cell).
Since this period largely depends on the using frequency of each function, it is recommended to replace the power cell when taking a travel, etc. even if it is a little earlier than the expected replacing period.

§4. OTHER FUNCTIONS FOR DIVING

1. HOW TO USE REGISTER RING



- Measurement of time elapsed
When starting diving, turn the register ring counterclockwise to match the ▽ mark to the minute hand. Then, the minute hand indicates the time elapsed by the scale of the register ring.

(Example) The figure at left shows that 10 minutes (Division of register ring pointed by the minute hand) have passed after the diver started diving (▽ mark).

- * The register ring can be turned counterclockwise only (because of the reverse preventive function). Do not turn it forcedly clockwise.

2. HOW TO READ NO DECOMPRESSION LIMITS

- The no decompression limits based on the US Navy Diving Manual are printed on the band of some models.
- The no decompression limits are the standard limit time after which the diver may surface without decompression.

No decompression limits

Depth: m

No decompression time: min.

No Decompression Limits	
Depth	N.D. Time
12m.	200 min.
15m.	100 min.
18m.	60 min.
21m.	50 min.
24m.	40 min.
27m.	30 min.
30m.	25 min.
33m.	20 min.
36m.	15 min.
39m.	10 min.
42m.	10 min.
45m.	5 min.

12	200
15	100
18	60
21	50
24	40
27	30
30	25
33	20
36	15
39	10
42	10
45	5

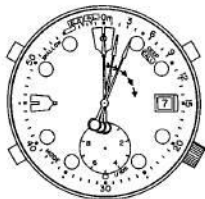
Example: If a diver dives to the depth of 21 m for 50 minutes or less, he may surface without decompression.
This table based on US Navy Diving Manual.

- * This table is only for reference to the diver.
- * This table is not printed on some types of bands.

§5. ADDITIONAL FUNCTIONS

The diver should know these convenient functions.

1. POWER CELL LIFE-TIME FORECAST FUNCTION

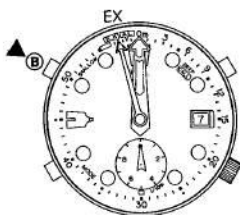


- This watch has power cell forecast function which notifies the diver of the replacement time of the power cell.
- If the power cell is almost dead, the second hand moves by 2 seconds.

If the power cell life-time forecast function operates in the normal indication mode, the watch cannot be changed to the diving mode. When the watch is returned to the normal indication mode after this function operates in the diving mode, the second hand may move normally (by 1 second). In this case also, the power cell will be dead soon.

2. SOUND MONITOR

Normal indication



- If the **B** button is depressed in the normal indication mode, the depth alarm sound and surfacing speed warning sound can be monitored.

The depth alarm sound comes out twice first (Pip-pip, pip-pip), then the surfacing speed warning sound comes out twice (Peep, peep). While the power cell life time forecast function is operating, however, sound monitor does not work.

56. POINTS OF REPAIR

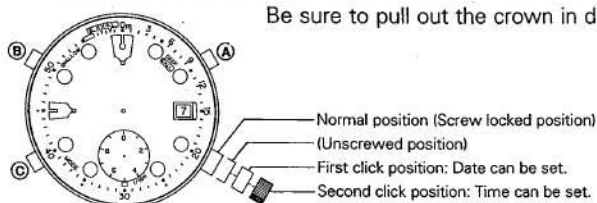
1. ALL-RESET OPERATION AND ZERO SETTING

- This watch cannot indicate a correct depth and cannot be changed to another mode in the following cases. In the following cases, reset the watch according to the procedure explained below.
 - a. In the normal indication mode
 - The depth hand and sub-depth hand do not indicate 0 m.
 - The maximum depth hand (mode hand) does not indicate EX position.
 - b. When the watch is changed to diving mode
 - Each depth hand does not indicate 0 m.
 - c. When the diver surfaces and changes the watch to the normal indication mode since the second hand has moved by 4 seconds during diving in the diving mode
 - The depth hand and sub-depth hand do not indicate 0 m.
 - The maximum depth hand (mode hand) does not indicate EX position.
 - d. When the watch is changed from the diving mode to the normal mode on the ground
 - The depth hand indicates 1 m or deeper and the indication cannot be changed.
 - e. When another abnormal indication appears

After the power cell is installed, also be sure to perform the all-reset operation and zero setting.

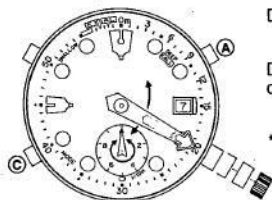
Operating procedure

1. Pull the crown to the second click position (a c t i v a t e s t e p).

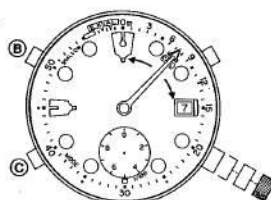


2. Depress the (A), (B), and (C) buttons at the same time, then release them, and the confirmation sound comes out. If the sound does not come out, repeat the same operation securely. If this operation is executed, the set value of the depth alarm and maximum depth memo are cleared.
3. Adjust each depth hand to 0 m.

<How to adjust depth hand and sub-depth hand>



<How to adjust the maximum depth hand>



3. POWER CELL

This watch is a water-resistant watch for diving matched to ISO standard. Accordingly, after the power cell is replaced, be sure to perform the water resistance test.

a. Life-time of power cell

The power cell of this watch has the following life-time.

Life-time of power cell:	Approx. 2 year after new one is installed.		
Standard using conditions:	Diving frequency:	50 times/year	
	Length of each diving:	1 hour/diving	
	Average diving depth:	15 m	
	Operations in each diving:		
	Change of mode:	2 times	
	Depth alarm:	15 sec. x 5 times	
	Over depth indication warning:	1 min.	
	Surfacing speed warning:	1 min.	
	Sound monitor:	2 times	

- * The life-time of the power cell largely depends on the using frequency of various functions. Use the watch in the normal indication mode while you are not diving.
- * The life-time of the power cell changes roughly according to the number of diving times as follows.

Number of diving times	Estimated power cell life-time when the conditions are the same
1 hr x 100 times/year	Approx. 1.7 years
1 hr x 200 times/year	Approx. 1.0 year

b. First power cell

The power cell installed in the watch when it is purchased is a monitor power cell to confirm its functions and performance. Accordingly, it may run out before 2 years.

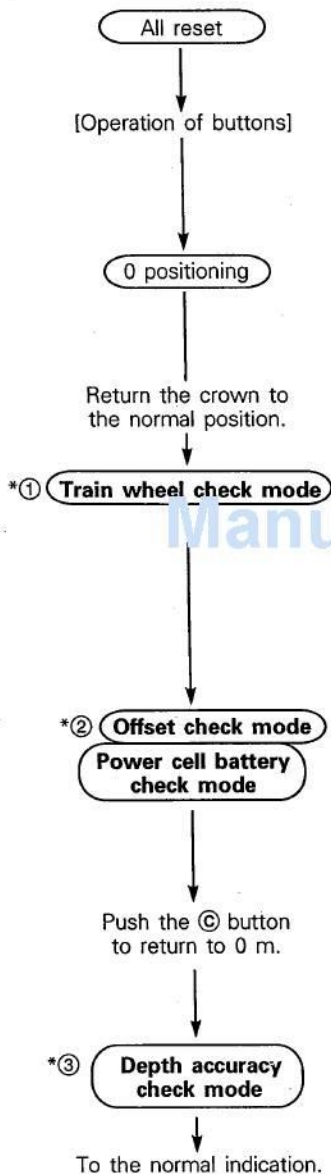
c. Power cell life-time forecast function

If the power cell is almost dead, the second hand move by 2 seconds and the watch cannot be changed to the diving mode.

4. SPECIAL FUNCTION FOR MODULE CHECK

This function is effective in check after a repair.

Special functions for module check



- Pull out the crown two steps and push the (A), (B), and (C) buttons at the same time, then release all of them.

- Keep the crown pulled out two steps.
- Push the (A), (B), and (C) buttons, then release the (C) and (B) buttons in order (Keep pushing the (A) button).
- Push the (C) button again more than 2 seconds.
- Release the (A) and (C) buttons.

- Keep the crown pulled out two steps.
- Adjust the depth hand and sub depth hand to 0 with the (A) button. (If the (A) button is pushed with the (C) button pushed, the depth hand sub depth hand are turned in reverse.)
- Adjust the maximum depth hand with the (B) button. (If the (B) button is pushed with the (C) button pushed, the maximum depth hand is turned in reverse.)

- Push the crown the normal position.
- Push the (A) button, and the depth hands starts moving forward in return.
- Push the (B) button, and the hands starts moving in reverse (They do not return).

If the train wheel is normal, the hands stop at 0 position.

- Push the (C) button.

If the standard value in IC is larger than the measured value → Maximum depth hand indicates 5 m.
If the former is less than the latter → Indicates 55 m.
If the difference is 7 m or larger, the hands do not move.

- Push the (C) button.
The confirmation sound comes out and the watch is ready for accuracy check.

If the watch is put in a water resistance tester chamber and pressure is applied, the maximum depth hand and depth/sub depth hands are left at the maximum depth position after the pressure is lowered, thus the accuracy can be checked.

In the above mode:

Push the (A) and (B) buttons at the same time and release these buttons to go to the EX mode. (Normal mode)

Pull out the crown two steps and push the (A), (B), and (C) buttons at the same time then push crown to normal position to go to the EX mode. (Normal mode)

① Train wheel check

In this special mode, the operation of the train wheel is checked after it is repaired.

(Procedure)

- 1) Pull the crown to the second click and press the (A), (B), and (C) buttons at the same time to perform the all-reset operation.
- 2) Press the (A), (B), and (C) buttons, then release the (C) button and (B) button in order. Then, press the (C) button in 2 seconds, then release the (A) button and (C) button.
- 3) Set the depth hand and maximum depth hand to the zero position.
- 4) If the crown is pressed in the watch is set to the train wheel check mode.
- * 5) If the (A) button is pressed, the depth hand, sub-depth hand, and maximum depth hand start turning.

Confirm the following;

- Do all the hand turn smoothly?
- Do the maximum depth hand, depth hand and sub depth hand move forward and backward by one turn then return to the zero position?
If a train wheel tooth is broken or dirt is among the teeth, the train wheel does not move correctly, thus this check is effective if performed before and after a repair.

(Note) If the (A) button is pressed in (5), the hands move forward and backward by one turn, then stop to the zero position.

If the (B) button is pressed, the hands move only backward, then stop to the zero position.

While the train wheel is turning, all push buttons are ineffective. If the crown is pulled to the second click, the watch is returned to the zero position correction mode. If the crown is pressed again, the watch is set to the train wheel check mode.

② Offset check and power cell voltage check

- In this mode, the 0 m standard value in the IC is compared with the 0 m measured with the sensor to check the difference between them.
 - At the same time, the power cell voltage level (About 2.8 V minimum) can be checked.
- 1) Offset check: Difference between measured value with sensor and standard value in IC.

Press the (C) button when train check mode.

- If plus, the maximum depth hand indicates 5 m.
- If minus, the maximum depth hand indicates 55 m.

In these cases, the depth hand and the sub depth hand indicate the difference value.

- * If the maximum depth hand indicates 5 m or 55 m, the difference between the indications by the sensor and the IC is little, and they are normal.
- * If the standard value is shifted very much (7 m or above), the hand does not move.

In this case, the difference between the indications by the sensor and IC is large, thus replace the sensor and circuit unit as a set.

2) Power cell voltage check

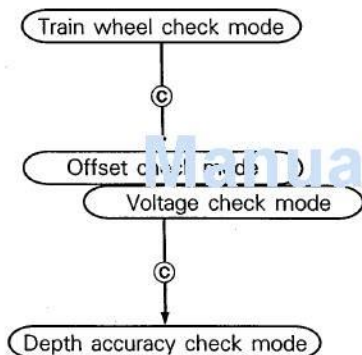
When the offset is checked, the power cell voltage is checked, too.

The power cell voltage drops and the second hand moves by 2 seconds.

- * If the above checks 1) and 2) are finished, a beep sounds comes out for confirmation.

- If the offset is far from the correct value, the maximum depth hand does not move.
In this case, the circuit and sensor must be replaced as a set.
- If the power cell voltage is low (while the power cell life-time forecast function works), the offset cannot be checked correctly.

③ Depth accuracy check



If depth is measured in the depth accuracy check mode for water resistance test etc., both depth hand and maximum depth hand are left at the maximum measured position. This position is the depth measured by the sensor.

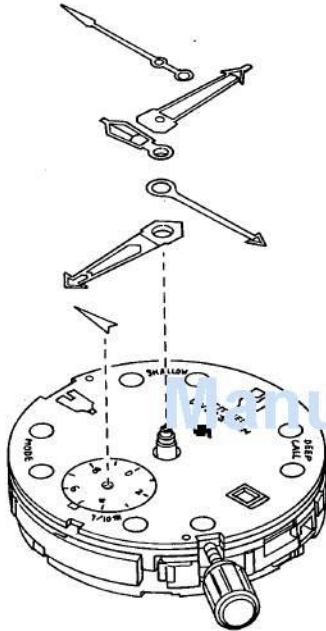
After the depth accuracy is checked, return the watch to the normal indication mode according to the following procedure.

- Press the **(A)** and **(B)** buttons at the same time.
→ The watch returns to the EX (Normal) mode.
- Pull the crown to the second click.
→ 0 position correction mode
In this mode, press the **(A)**, **(B)**, and **(C)** buttons at the same time. Then push the crown to the normal position.
→ The watch returns to the normal indication of EX mode.

5. HOW TO INSTALL AND REMOVE HANDS

(How to remove hands)

1. Open the case back. --- Use a special end piece.
2. Remove the power cell strap screw.
3. Pull out the setting stem.
4. Remove the sensor sheet strap. --- Loosen the sensor sheet strap screw.
5. Take out the module.
6. Remove each hand.



(How to fit hands)

1. Insert the power cell.
2. Install the power cell strap screw.
3. Install the dial.
4. Insert the setting stem.
5. Perform the all-reset operation. --- Pull the crown to the second click and depress the three buttons at the same time.
6. Fit the depth hand and sub-depth hand to the 12 o'clock position. --- If the depth hand is not at the 12 o'clock position, correct it with the push buttons, then install the sub-depth hand (See the section of all-reset).
7. Fit the maximum depth hand at any position.
8. Adjust the maximum depth hand to 12 o'clock position by push button (B) or (C). --- See section §6-1.
9. Fit the hour, minute, and second hands. (Set the hands to the 12 o'clock position when the date changes.)
10. Loosen the power cell strap screw and remove the power cell.
11. Pull out the setting stem.
12. Set the module in the case.
13. Insert the setting stem.
14. Match the sensor seat to the module and tighten the screw.
15. Insert the power cell and tighten the power cell strap screw.
16. Install the insulator sheet.
17. Tighten the case back.
18. Perform the all-reset operation again, to set the hands to the zero position.

6. DIVING ACCURACY

$\pm(3\%$ of indicated value ± 0.3 m) maximum.

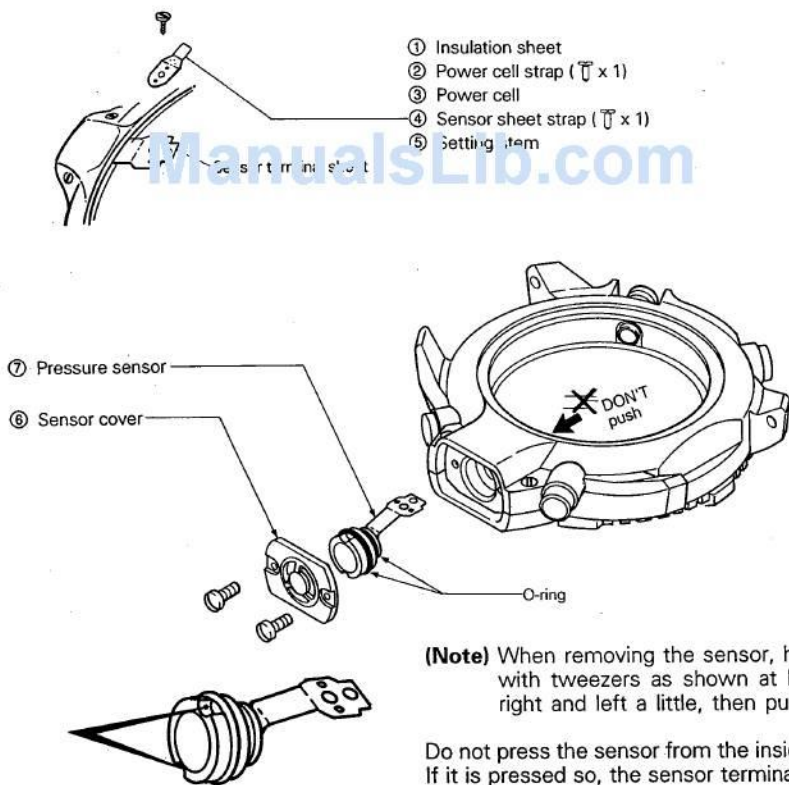
(See 6-4)

As the result of the check in the offset check mode and depth accuracy check mode, if the accuracy is very low, **replace the sensor and circuit as a set** (See §6-4-②).

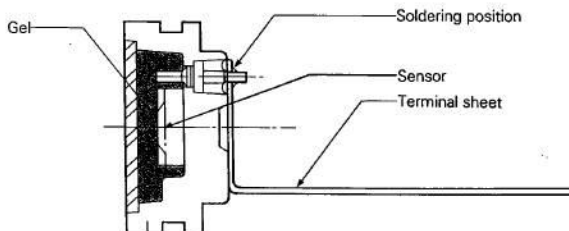
Temperature change has delicate effects on the depth accuracy. (The change of accuracy caused by temperature change is about 1 m in 30°C.)

7. HOW TO REMOVE AND INSTALL SENSOR

- Remove the sensor according to the steps ① to ⑦.
- Install the sensor according to the steps ⑦ to ①.



- **Pressure sensor**



The pressure sensor is filled with gel.

If anything is stuck in the gel, the pressure sensor does not work correctly. Accordingly, take care when handling the sensor.

Do not wash the pressure sensor in volatile liquid such as benzene, alcohol, etc.

If it is washed in such a liquid, the gel will be dissolved in the liquid and the sensor will not work normally.

(Note) Sensor replacement:

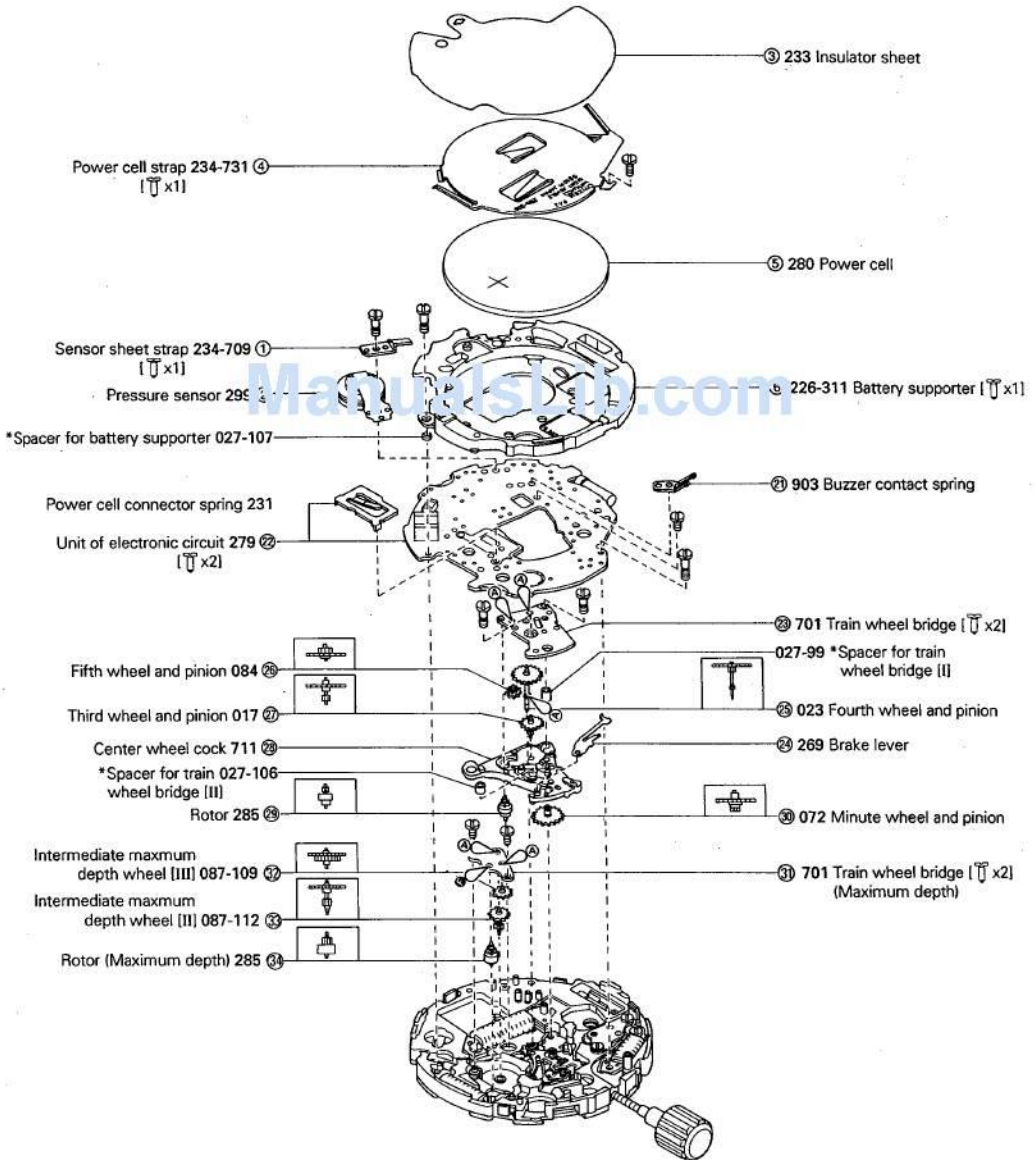
Since the sensor and circuit are matched to each other to secure the accuracy, be sure to replace them as a set when necessary.

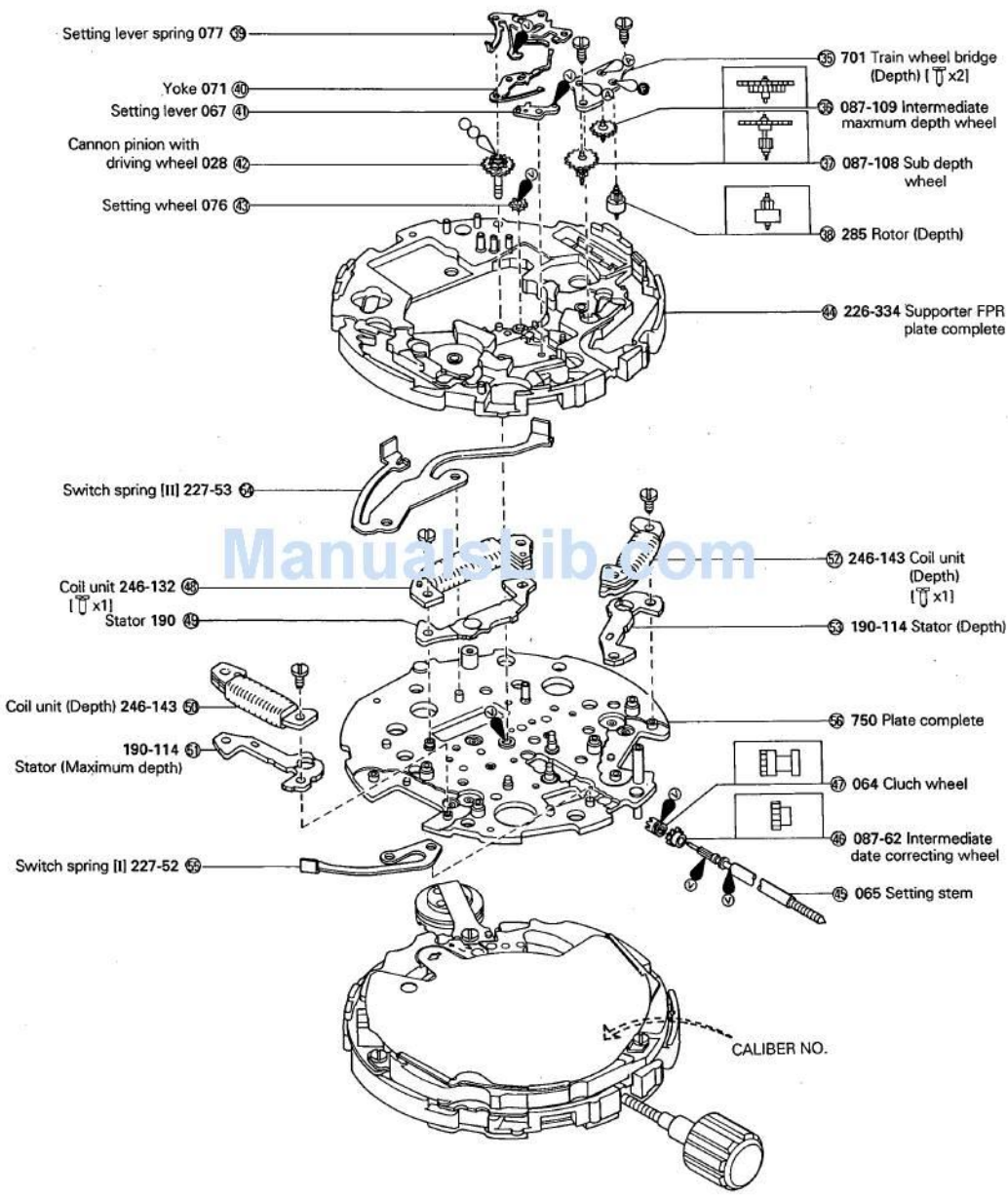
§7. DISASSEMBLING AND ASSEMBLING PROCEDURE

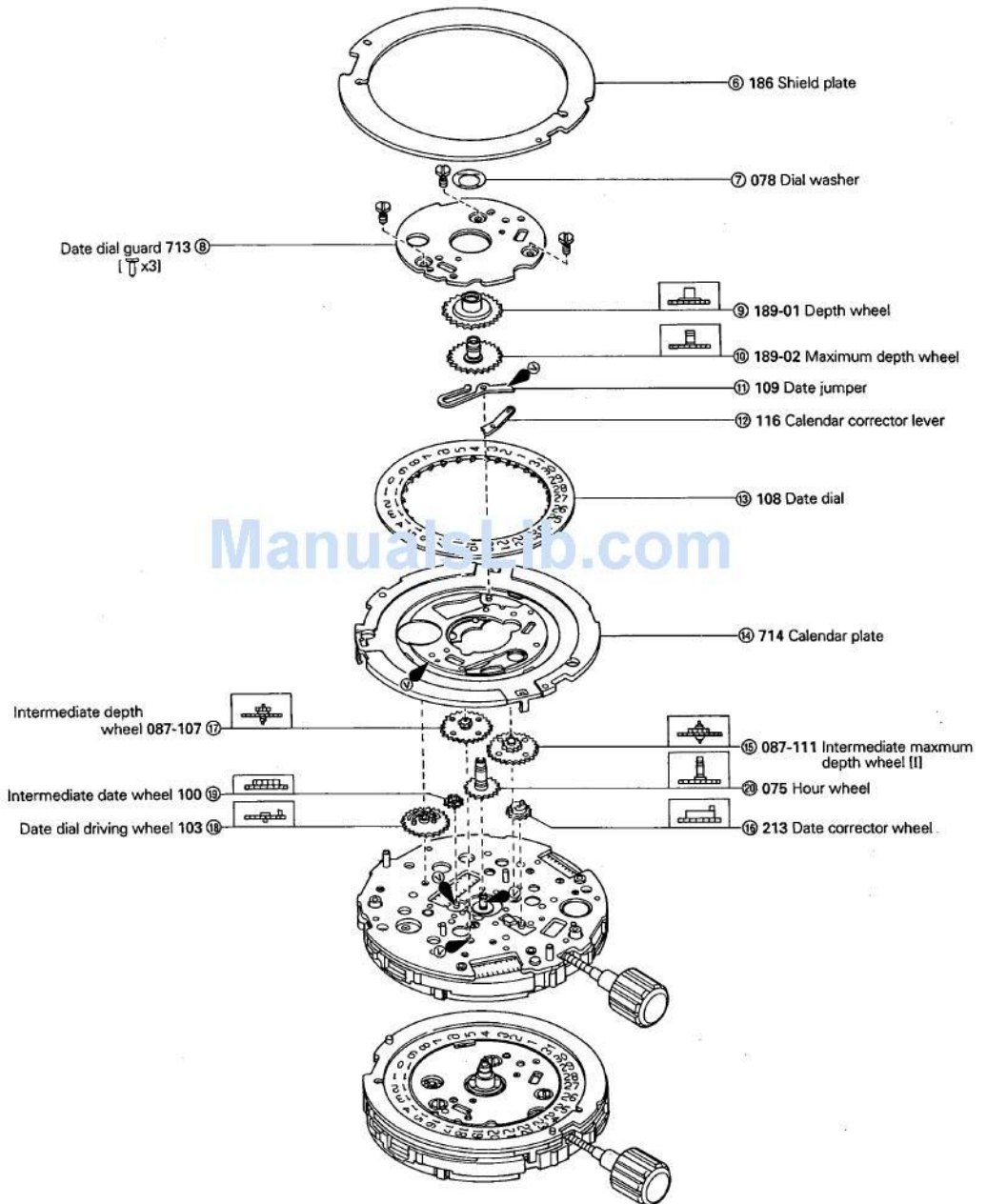
● Lubrication narjubgs

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

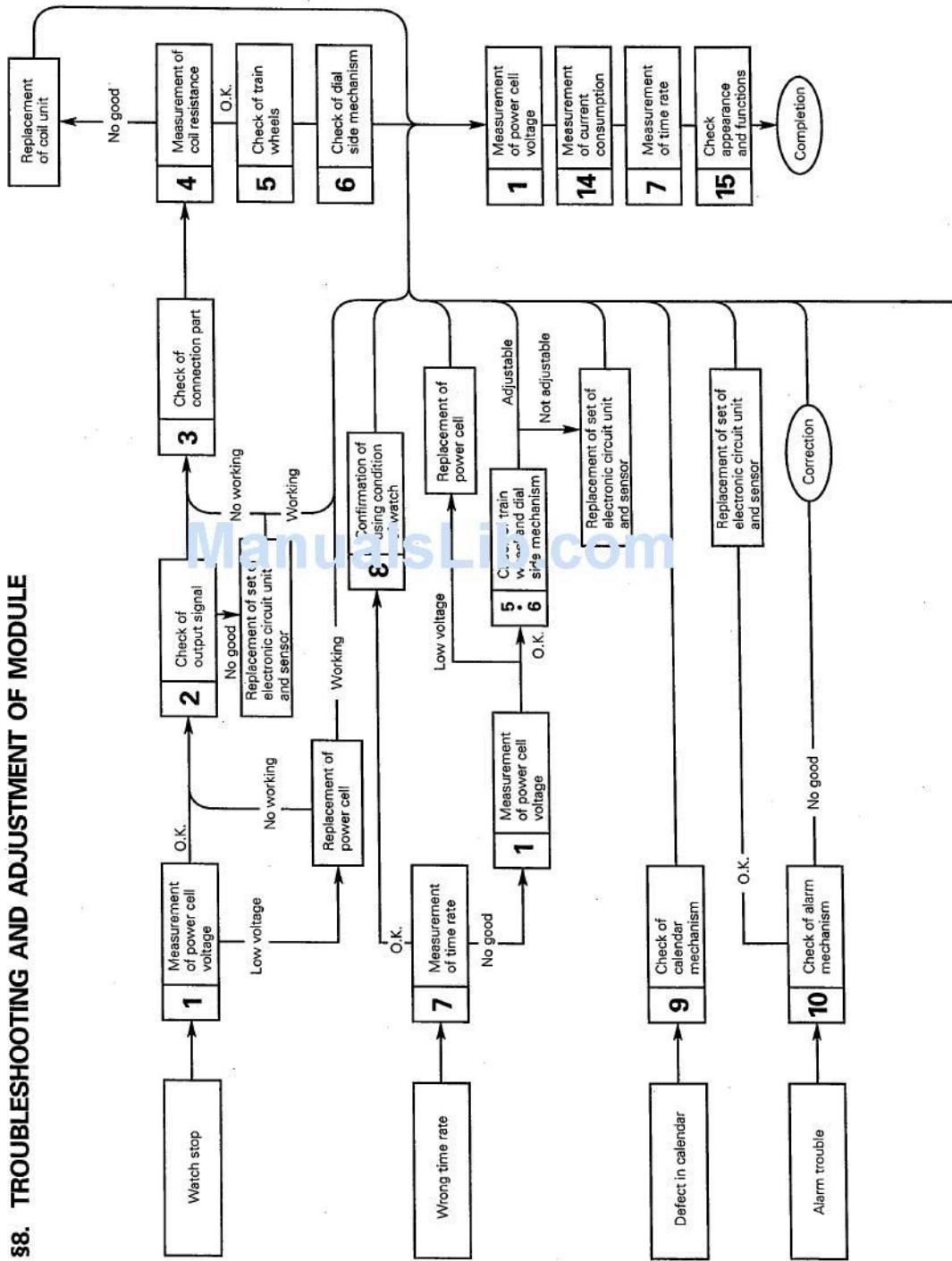
Disassemble procedure ① → ⑤⑥
 Assemble procedure ⑤⑥ → ①

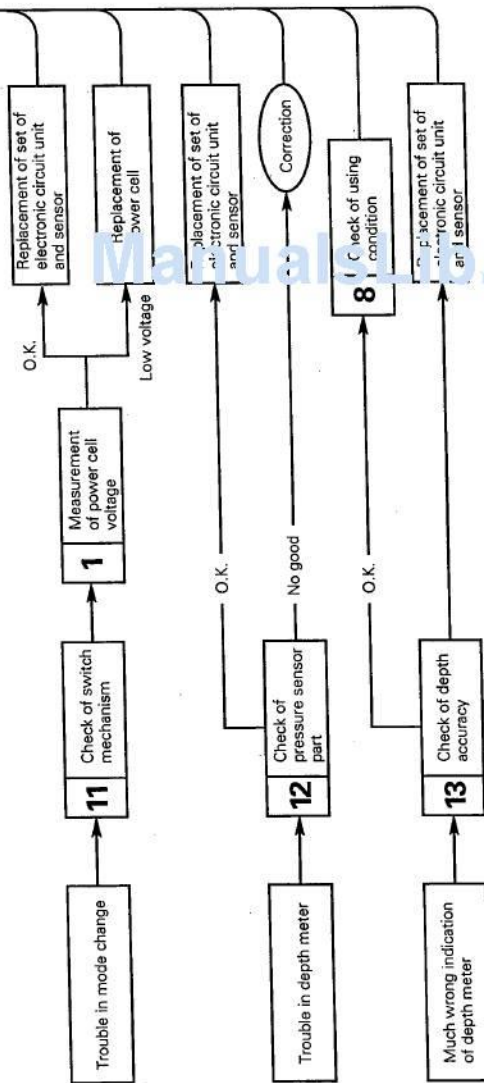


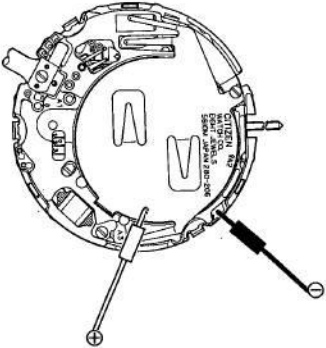
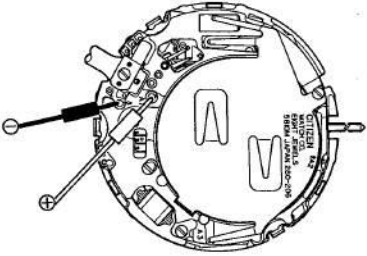




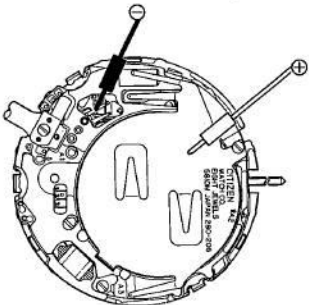
§8. TROUBLESHOOTING AND ADJUSTMENT OF MODULE

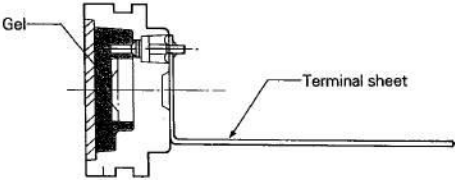


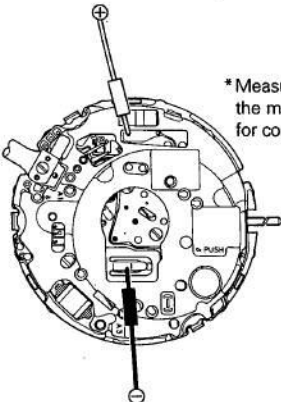



Check items	Check method	Results and Treatment
<p>① Measurement of power cell voltage</p>	<p>* Refer to Technical Manual, Basic Course II-1-a.</p> <p><Tester range: DC 12V></p> 	<ul style="list-style-type: none"> • Above 2.8 V → Normal • Under 2.8 V → Replace the power cell
<p>② Check of output signal</p>	<p>* Refer to Technical Manual, Basic Course II-1-b.</p> <p><Tester range: DC 0.3 V></p>  <p>The probes have no polarity</p>	<ul style="list-style-type: none"> • Pointer of tester swings every second → Normal • Pointer of tester does not switch → Inspect connection parts • No abnormalities in connection parts → Replace electronic circuit unit and sensor
<p>③ Check of connection parts</p>	<p>* Refer to Technical Manual, Basic Course II-2-a "Analog Section".</p>	

Check items	Check method	Results and Treatment
<p>4 Measurement of coil resistance</p>	<p>* Refer to Technical Manual, Basic Course II-1-c.</p> <p style="text-align: right;"><Tester range: R x 10></p> <ul style="list-style-type: none"> • Remove the electronic circuit unit and measure the resistance. • The probes have no polarity. 	<p>(Resistance) Part No.: 246-132: 2.7 ~ 3.2 kΩ</p> <p>Part No.: 246-143: 2.0 ~ 2.4 kΩ</p> <ul style="list-style-type: none"> • Out of range → Replace coil unit
<p>5 Check train wheel</p>	<p>* Refer to Technical Manual, Basic Course II-2-b.</p> <p>The train wheel is divided in to the three blocks of the depth hand/sub-depth system, maximum depth system, and normal time system.</p> <ul style="list-style-type: none"> • Take care of dirt, quantity of oil, and type of oil and clearance of each wheel etc. <p>Be sure to supply F-lube to top and bottom of the rotor.</p>	
<p>6 Check dial side mechanism</p>	<p>* Refer to Technical Manual, Basic Course II-2-c.</p> <ul style="list-style-type: none"> • Confirm all parts are not deformed and are lubricated properly. 	
<p>7 Measurement of time rate</p>	<p>* Refer to Technical Manual, Basic Course II-2-d.</p> <ul style="list-style-type: none"> • Measurement range: Analog, 10 seconds 	<ul style="list-style-type: none"> • Error/month: ±0.5 seconds max. (Error/day: ±0.5 seconds) → Normal • Very large error → Replace set of electronic circuit unit and sensor

Check items	Check method	Results and Treatment
<p>⑧ Confirmation of using condition</p>	<p>* Refer to Technical Manual, Basic Course II-2-e.</p> <ul style="list-style-type: none"> • Wrong time indication, stopping, etc. Check the using temperature range, strong magnetism (magnetic necklace, etc.), power cell replacement time, operation method, etc. with the customer. • In case of functions for diving See if the depth hands are at zero positions. Ask the customer if the (she) has read the operation manual and has used correctly. <p>Refer to 56-4-② Offset check and 56-4-③ Depth accuracy check.</p>	
<p>⑨ Check calendar mechanism</p>	<p>* Refer to Technical Manual, Basic Course II-2-c.</p> <ul style="list-style-type: none"> • Check the lubricating condition of the date dial and date jumper etc . . . 	
<p>⑩ Check alarm mechanism</p>	<p>Refer to Technical Manual, Basic Course II-1-d.</p> <p>A. Remove the case back, and check the alarm output (In normal indication mode).</p> <ol style="list-style-type: none"> ① Set the tester range to DC.V 0.3V. ② Apply the (+) probe to the (+) side of the power cell and the (-) probe to the buzzer contact spring. ③ Press the ⑧ button in the sound monitor mode (See 55-2.) <p>B. If the alarm output is normal, perform the following inspections.</p> <ol style="list-style-type: none"> a. Check the Piezo-electric element of the case back for cracks. b. Check the buzzer contact spring for deformation. c. Check the contact points of the electronic circuit and buzzer contact spring for dirt. 	<ul style="list-style-type: none"> • The pointer of the tester swings every time the ⑧ button is pressed. → Normal • Pointer of tester does not swing. → Replace the electronic circuit unit and sensor as a set.

Check items	Check method	Results and Treatment
<p>⑪ Check switch mechanism</p>	<p>Check to see which one has trouble, push buttons or module. First, check the module and case separately.</p> <p>(Module)</p> <ul style="list-style-type: none"> • Check the power cell voltage. • Check the switch spring for deformation. • Press the switch spring with tweezers etc. to conform the switch function. <p>(Case)</p> <ul style="list-style-type: none"> • Check the push buttons for dirt and deformation. <p>* Remove dirt from push buttons, and be sure to apply silicon oil to the packings.</p>	<ul style="list-style-type: none"> • No power cell voltage → Replace power cell • Switch function is normal → Check push buttons • Switch spring is deformed → Replace switch spring (Part No. 227-52, 227-53) • Push button is dirty → Remove dirt • Push buttons are deformed → Replace push buttons
<p>⑫ Check pressure sensor</p>	<p>* Refer to §6-7) "How to remove and install sensor" in this Technical Information.</p> <ul style="list-style-type: none"> • Check the pressure sensor for sand, dirt, etc. • Check the pressure sensor for abnormal balance. Check the gel for removal. • Check the connection parts of the sensor and module for abnormality.  <p>* The set of the pressure sensor and electron circuit unit is adjusted for depth accuracy, replace both of them when either of them is malfunctioned.</p>	<ul style="list-style-type: none"> • Dirt → Remove dirt • Pressure sensor is abnormal → Replace set of pressure sensor and electronic circuit unit • Soldered part of sensor is removed → Solder again • Sensor sheet strap screw is loosened → Tighten screw • Sensor terminal sheet is broken → Replace set of sensor and electronic circuit unit

Check items	Check method	Results and Treatment
<p>⑫ Check depth accuracy</p>	<p>See §6-4) "Special functions for module check" in this Technical Information.</p> <p>Set the watch to the depth accuracy check mode and check by using the water resistance tester.</p> <p>* Since this watch is designed to measure depth of sea water (Specific gravity: 1.025), it may indicate a little shallower than the true depth in this tester.</p> <p>* Lock the screw of the crown and confirm that the case back is tightened securely.</p> <p>* Since this watch indicates depth to 55m, perform pressure test at about 5 atm.</p>	<ul style="list-style-type: none"> • Depth indication is wrong very much <ul style="list-style-type: none"> → Check pressure sensor, then replace set of sensor and electronic circuit • Depth indication is normal <ul style="list-style-type: none"> → Check using condition
<p>⑬ Measurement of current consumption</p>	<p>* Refer to Technical Manual, Basic Course II-1-f.</p> <p>This watch has microcomputer IC. When measuring current consumption, be sure to perform all-reset operation.</p> <p>① Set the power cell to the tester.</p> <p>② Set the power of tester to the power and pull out the crown with the condition complete of the A, B, and C buttons, and the all functions are reset.</p> <p>③ Press in the crown.</p> <p>④ Under this condition, measure the current consumption.</p> <div style="text-align: center;">  <p>* Measure without removing the module out of the case for convenient.</p> </div>	<p>(Normal mode)</p> <ul style="list-style-type: none"> • Under 2.0 μA <ul style="list-style-type: none"> → Normal • Above 2.0 μA <ul style="list-style-type: none"> → Check train wheel and dial side. → Remove dirt. <p>Module is normal, but current consumption is abnormal.</p> <div style="text-align: center;">  </div> <p>Replace set of electronic circuit unit and sensor.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Effect of light</p> <p>Do not measure the current consumption, under the light of an incandescent lamp or the direct ray of the sun. If the watch is exposed to strong light, much current may be consumed. It is not affected by the light of a fluorescent lamp.</p> </div>

Check items	Check method	Results and Treatment
<p>① Check appearance conditions and functions</p>	<p>* Refer to Technical Manual, Basic Course II-2-f.</p> <ul style="list-style-type: none">• Confirm that the case back is securely tightened and buttons operate normally, and hand the watch to the customer.	
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