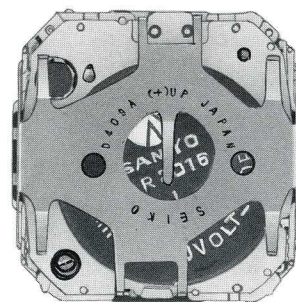


# TECHNICAL GUIDE

## SEIKO

## DIGITAL QUARTZ

CAL. D409A



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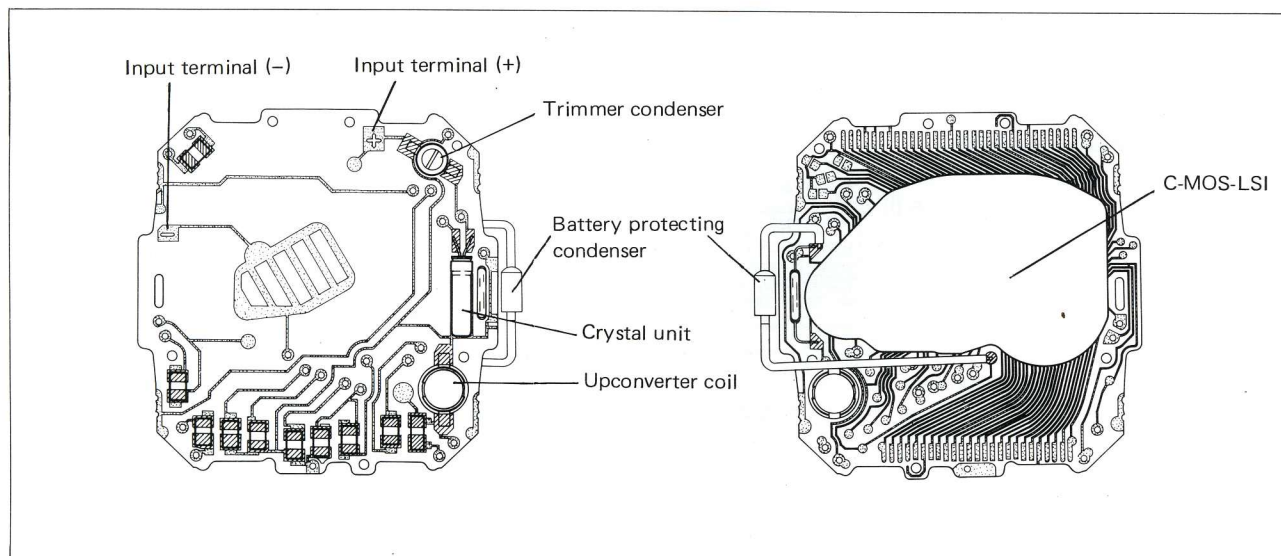
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## I. SPECIFICATIONS

Item		Cal. No.	D409A
Display medium		Nematic Liquid Crystal, FEM (Field Effect Mode)	
Liquid crystal driving system		Multiplex driving system	
Display system		<ul style="list-style-type: none"> <li>• Time and calendar function (12- or 24-hour indication)</li> <li>• Alarm function</li> <li>• Stopwatch function</li> <li>• Multi-channel memory function (7 channel memory display up to 16 digits or letters in one channel)</li> </ul>	
Additional mechanism		<ul style="list-style-type: none"> <li>• Hourly time signal</li> <li>• Alarm test system</li> <li>• Multi-channel memory automatic recalling system</li> <li>• Automatic calendar display system</li> <li>• Illuminating light</li> </ul>	
Loss/gain		Monthly rate at normal temperature range: less than 15 seconds	
Module size	Outside diameter	$\phi 30.8\text{mm}$ (26.0mm between 6 o'clock and 12 o'clock sides) (26.0mm between 3 o'clock and 9 o'clock sides)	
	Height	4.9mm without battery	
Regulation system		Trimmer condenser	
Measuring gate by quartz tester		Any gate is available.	
Battery		Lithium battery Sanyo CR2016, Maxell CR2016, Matsushita BR2016 Battery life is approximately 1.5 years. Voltage: 3.0V for Sanyo CR2016, Maxell CR2016 2.8V for Matsushita BR2016	

## II. STRUCTURE OF THE CIRCUIT BLOCK

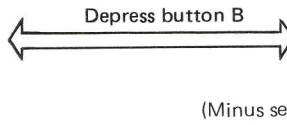


### III. DISPLAY FUNCTION

#### Time and calendar display




#### Time and calendar setting



Set (Minus setting)

Select

Set (Plus setting)

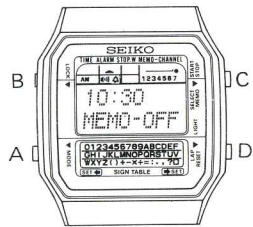
- Depressing buttons C and D at the same time  
The alarm can be heard while depressing.  
This also engages and disengages the hourly time signal alternately with each depression and displays and erases the mark (  ) respectively.  
Besides above, the multi-channel memory is recalled automatically.  
Depress button C to show the time and calendar display.

Second digits are reset to "00" by depressing button A or D.

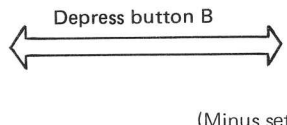
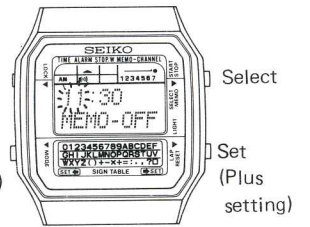


C

#### Alarm display




#### Alarm setting



Set (Minus setting)

Select

Set (Plus setting)

- Depressing button C  
The alarm mark (  ) appears and disappears alternately with each depression, and the alarm is engaged and disengaged respectively.



#### Stopwatch display



Start/Stop

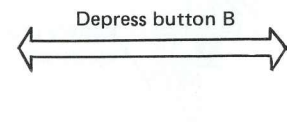
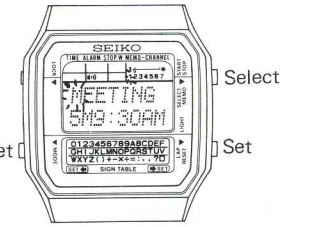
Lap/Lap release/Reset

- Depressing button A  
The display returns to the time and calendar display.

#### Memory display



#### Memory setting



Set

Select

Set

- Depressing button C  
The display changes from Memory 1 through Memory 7 one by one by each depression.
- Depressing button A  
The display will return from any memory channel to the time and calendar display.

- Depressing buttons A and D at the same time for 4 to 5 seconds.  
This clears the memory which is already registered.

#### IV. DISASSEMBLING, REASSEMBLING AND LUBRICATING OF THE CASE

Disassembling procedures Figs.: ① → ⑥

Reassembling procedures Figs.: ⑥ → ①

##### Lubricating

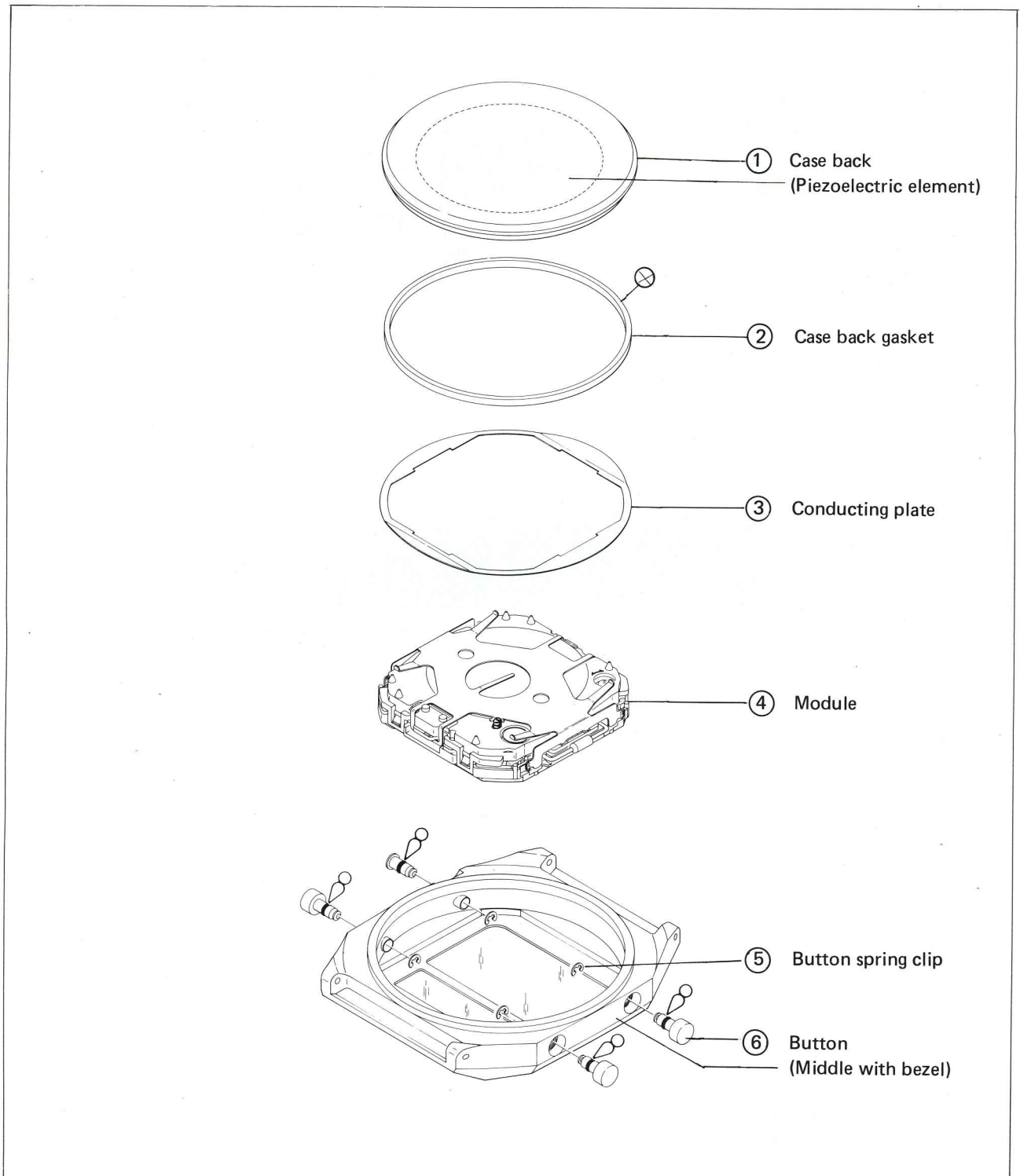
###### Type of oil

Silicon grease 500,000 c.s.

⊗ No lubricating

###### Oil quantity

∞ Normal quantity



## DISASSEMBLING AND REASSEMBLING OF THE MODULE

Disassembling procedures Figs.: ① → ⑪

Reassembling procedures Figs.: ⑪ → ①

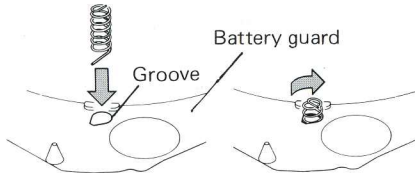
### ① Speaker lead terminal

#### Removing

Turn the speaker lead terminal to release the straight portion of its end from the groove of the battery guard and remove it.

#### Installing

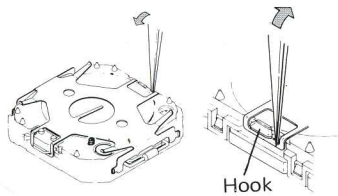
Hook the straight portion at the end of the speaker lead terminal to the groove of the battery guard, and then turn it to set it in position.



### ② Battery clamp

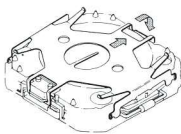
#### Removing

First, put the tips of tweezers into the clearance between the battery clamp and the battery guard at the 12 o'clock position, then release the battery clamp from the hook of the battery guard, and finally remove it.



#### Installing

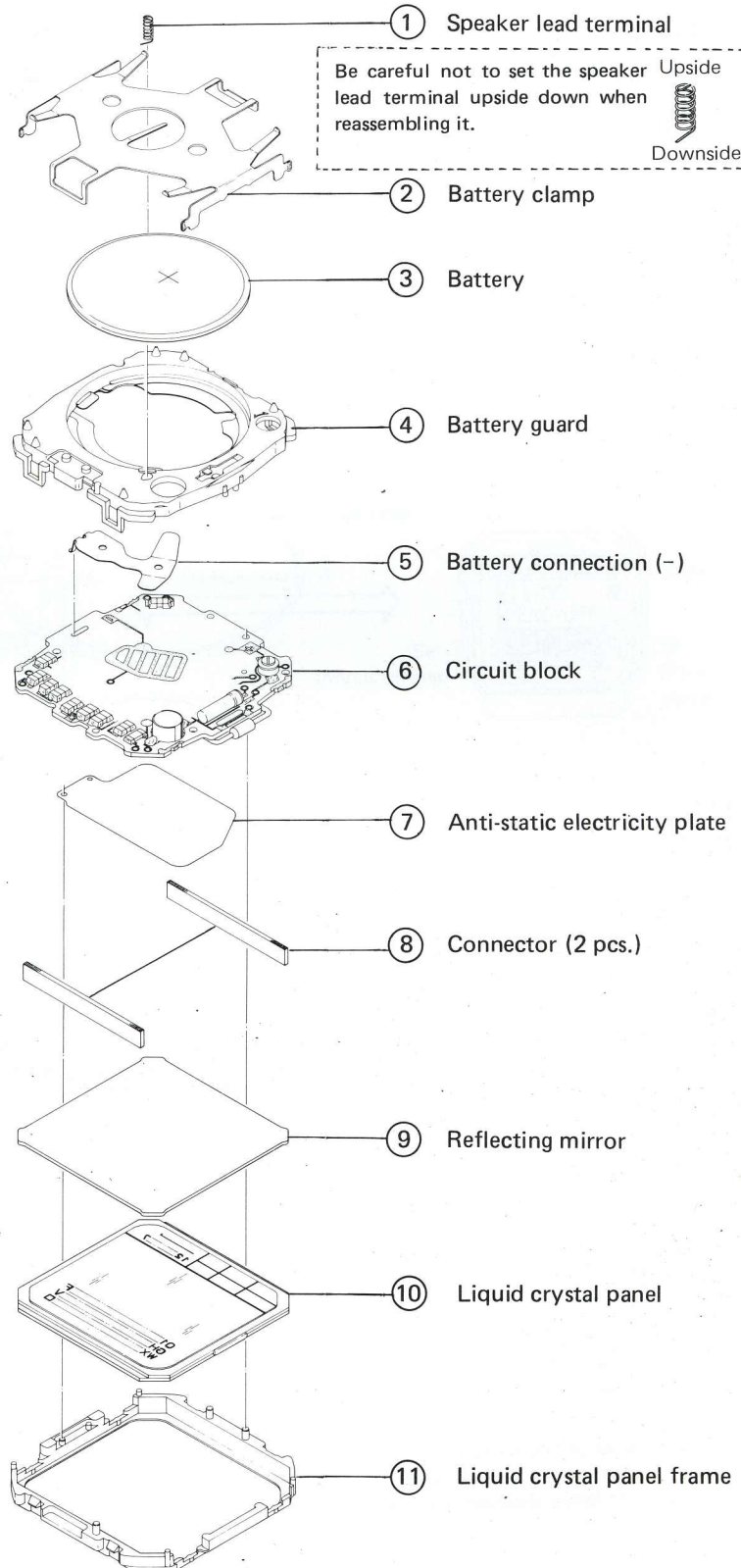
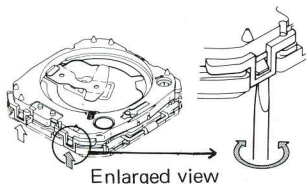
When setting the battery clamp, hook its 6 o'clock position at first and then the 12 o'clock position to the battery guard.



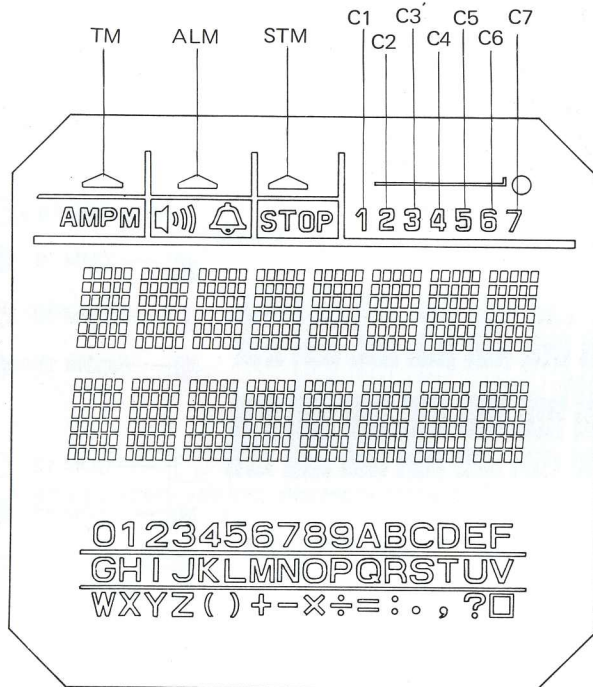
### ④ Battery guard

#### Removing

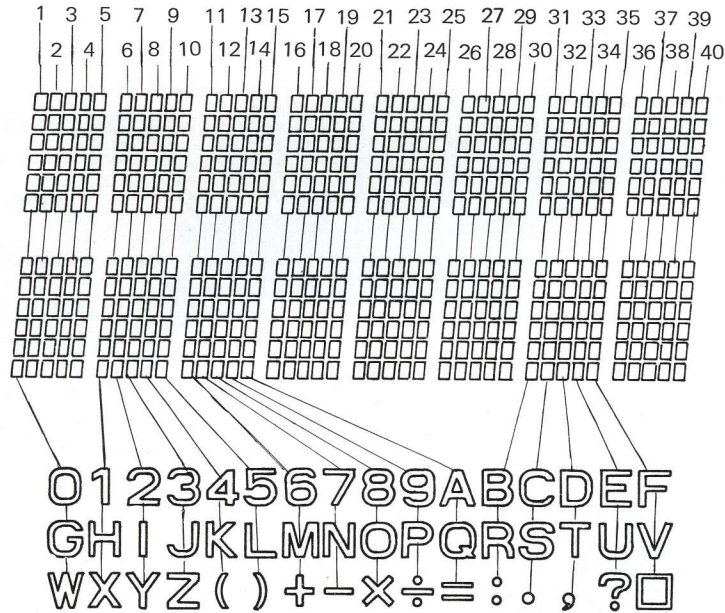
Pry up the battery guard lightly at the four hooking places by using the tips of tweezers.



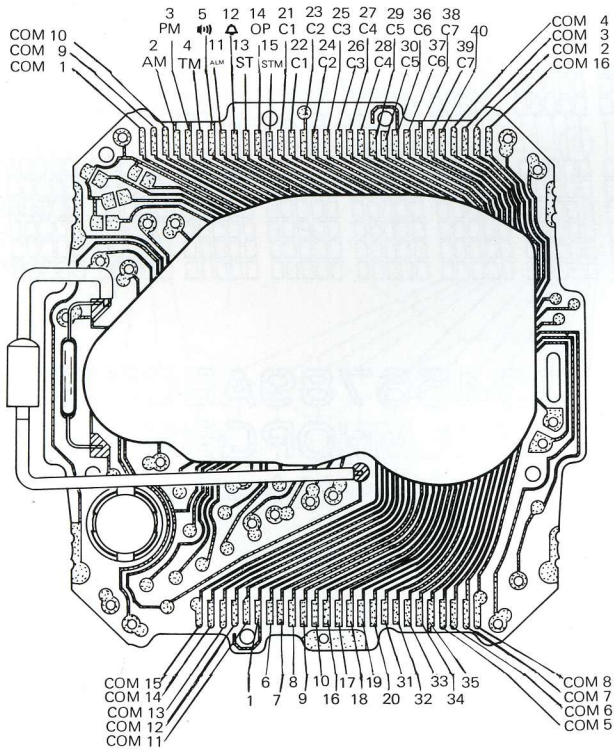
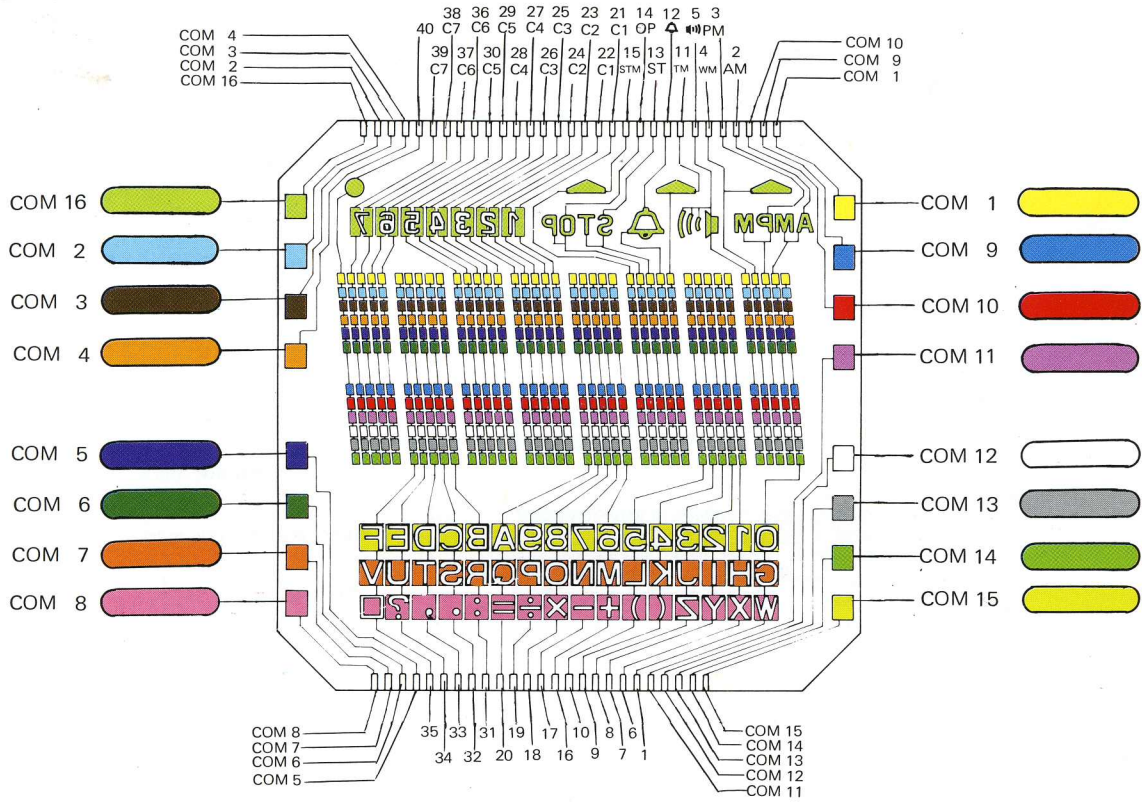
# VI. RELATIONSHIP BETWEEN THE SEGMENT (LIQUID CRYSTAL PANEL ELECTRODE) AND THE C-MOS-LSI OUTPUT TERMINAL



TM: Time mode mark  
 ALM: Alarm mode mark  
 STM: Stopwatch mode mark



\*COM: COM stands for common electrode.



## VII. CHECKING AND ADJUSTMENT

- The explanation here is particularly for the points of Cal. D409A.  
Refer to the "TECHNICAL GUIDE, GENERAL INSTRUCTION" for SEIKO Digital Quartz for ordinary checking and adjustment.

### Procedure

#### ● Remarks on replacing battery

In this watch, after replacing the battery, depress buttons A, B, C and D simultaneously to reset the circuit. Follow the same procedure when checking battery voltage.

#### CHECK BATTERY VOLTAGE

Set up the volt-ohm-meter.

Range to be used: DC 6V

#### Result:

When either Sanyo or Maxell CR2016 is used:

Normal: More than 3.0V

Defective: Less than 3.0V

When Matsushita BR2016 is used:

Normal: More than 2.8V

Defective: Less than 2.8V

**Note:** After checking battery voltage, depress buttons A, B, C and D simultaneously.

#### CHECK BATTERY CONDUCTIVITY

#### CHECK ALL SEGMENTS LIT UP

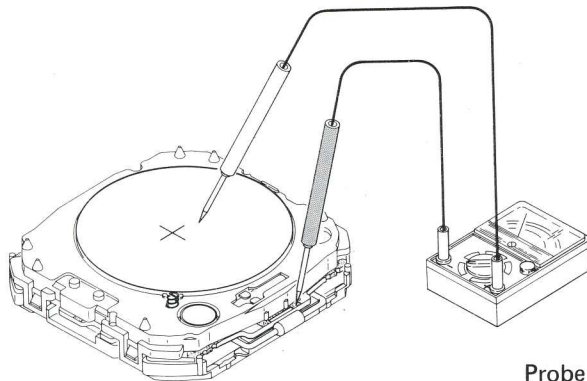
In the time and calendar setting function, check to see if all the segments light up by depressing buttons C and D at the same time. That can be released by depressing any one of buttons A, B, C, and D.

#### CHECK CURRENT CONSUMPTION

Set up the volt-ohm-meter.

Range to be used: DC 12 $\mu$ A

- Be sure to protect the C-MOS-LSI from light with case back or black paper, etc. while measuring.  
Do not check current consumption under an incandescent lamp since strong light causes a watch to consume excess current.



#### Result:

Normal: Less than 6 $\mu$ A

Defective: More than 6 $\mu$ A

\* Replace the circuit block or the liquid crystal panel with a new one.

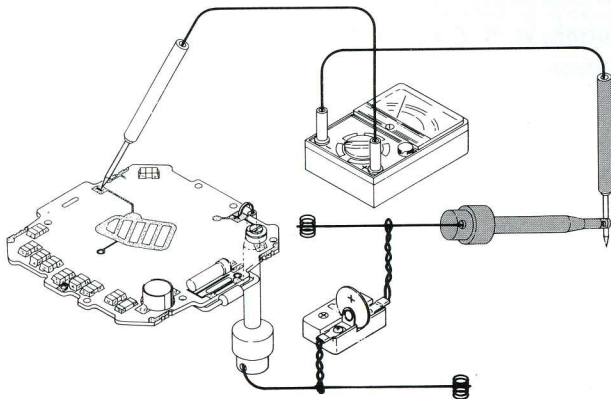
Probe red . . . . . Battery surface (+)

Probe black . . . . . Circuit block (+) terminal

## Procedure

### \*How to find defects when the current consumption is more than $6\mu\text{A}$

Check current consumption for the circuit block alone.



#### Result:

Less than  $3.5\mu\text{A}$ : Replace the liquid crystal panel with a new one.

More than  $3.5\mu\text{A}$ : Replace the circuit block with a new one.

### CHECK WATER RESISTANCE

### CHECK CONTACT BETWEEN C-MOS-LSI AND LIQUID CRYSTAL PANEL

Refer to the "RELATIONSHIP BETWEEN THE SEGMENT (LIQUID CRYSTAL PANEL ELECTRODE) AND THE C-MOS-LSI OUTPUT TERMINAL", and check for poor conductivity of the liquid crystal panel, connector, and C-MOS-LSI output terminal.

### CHECK LIQUID CRYSTAL PANEL AND CIRCUIT BLOCK

- (1) Check to see if there is any broken wire, short circuit, etc. in the liquid crystal panel.  
Set up the volt-ohm-meter.  
Range to be used: OHMS  $\times 1 \sim \times 1\text{K}$

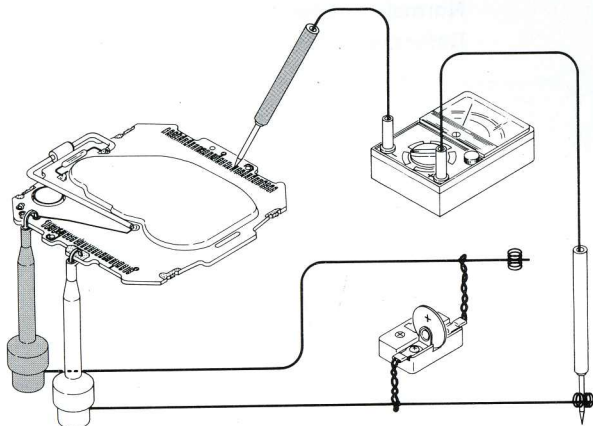
#### Result:

Normal: Lights up.

Defective: Does not light up.

Replace the liquid crystal panel with a new one.

- (2) Check to see if the electric signal is correctly transmitted from the circuit block.  
Set up the volt-ohm-meter.  
Range to be used: DC 3V



#### Result:

Normal: More than 0.8V

Defective: Less than 0.8V

Replace the circuit block with a new one.

## Procedure

### CHECK ACCURACY

- The daily rate can be measured easily when all the segments are lit up.
- Be sure to protect the C-MOS-LSI from light with case back or black paper, etc. while measuring.  
Do not measure accuracy under an incandescent lamp, since strong light adversely affects time accuracy.

**Result:**

Normal: Neither gain nor loss

Defective: Either gain or loss  
Adjust time accuracy.

\* Turn the trimmer condenser.

### CHECK FUNCTIONING AND ADJUSTING

Refer to the "DISPLAY FUNCTION", and check to see if the time and calendar setting and other functions are correctly activated.

**Result:**

Normal: Operate correctly.

Defective: Do not operate correctly.

Go back or proceed to the procedures CHECK CIRCUIT BLOCK and CHECK CONDUCTIVITY OF SWITCH COMPONENTS.

### CHECK ALARM TEST SYSTEM

In the time and calendar display, check to see if the alarm rings by depressing buttons C and D at the same time.

**Result:**

Normal: The alarm rings.

Defective:

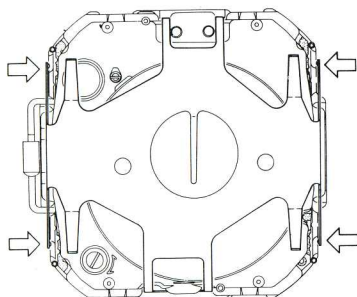
— The display disappears.

Replace the battery with a new one.

— The alarm does not ring.

Proceed to the procedure CHECK ALARM CONDITION.

### CHECK CONDUCTIVITY OF SWITCH COMPONENTS



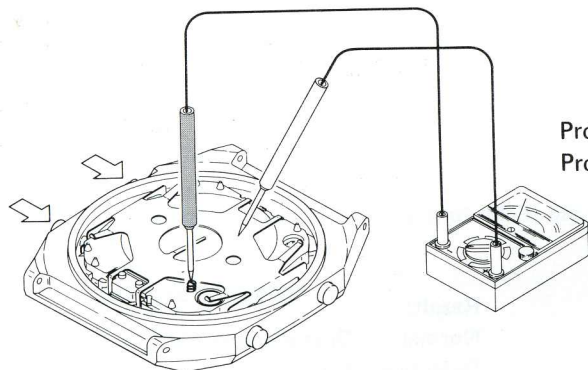
Check to see if the switch components (marked with "↔") operate correctly.

## Procedure

### CHECK ALARM CONDITION

Check the alarm condition if the alarm does not ring.

- (1) Check alarm output voltage from the circuit block. Apply the probes as shown in the illustration below before operating the alarm test system. (Depress buttons C and D at the same time in the time and calendar display.)



Set up the volt-ohm-meter.

Range to be used: DC 12 $\mu$ A

Probe red. . . . . Battery clamp  
Probe black . . . . . Speaker lead terminal

#### Result:

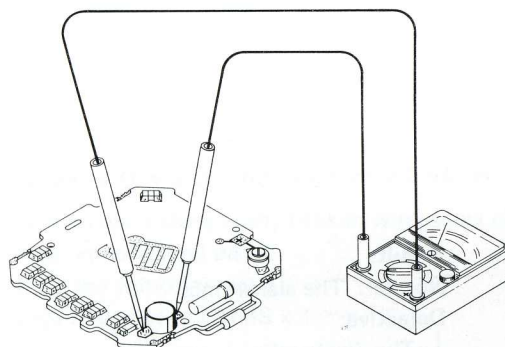
Normal: The pointer swings.

Defective: The pointer does not swing.  
Check the upconverter coil.

- (2) Check the upconverter coil.

Set up the volt-ohm-meter.

Range to be used: OHMS  $\times$  1



#### Result:

Normal: 130 $\Omega$  ~ 170 $\Omega$

Defective:

- Less than 130 $\Omega$   
(Short circuit)
- More than 170 $\Omega$   
(Broken wire)

Replace the circuit block with a new one.

- (3) Check the appearance of the piezoelectric element. When there is no defect to be found through the checking methods above, check the piezoelectric element to see if there is any crack, chip, peeling, or the like on the piezoelectric element.

### CHECK BULB CONDITION

#### OTHERS

##### ● Caution when receiving repair requests

When Cal. D409A is exposed to a high temperature over 80 $^{\circ}$ C, its time display may become disordered, or its memory may change or be cleared. When the watch is requested to be repaired for such a symptom, place it first in the normal temperature (5 $^{\circ}$ C ~ 35 $^{\circ}$ C) and then clear the display by depressing all the four buttons at the same time. After that, set the time and memory again.

If the watch does not return to normal through the operation above, follow the procedures of CHECKING AND ADJUSTMENT.

All procedures of Disassembling, Reassembling, Lubricating, Checking and Adjustment are completed.