

## Watch Movement Specification and Drawing

### SOLAR SERIES

# Cal. VS97A

Movement Size

12'''

Casing Diameter

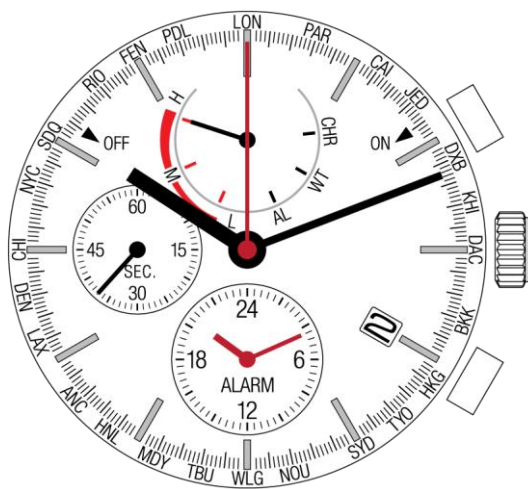
Ø 27.0mm

Height

4.40mm

Running Time

Approx. 6 months



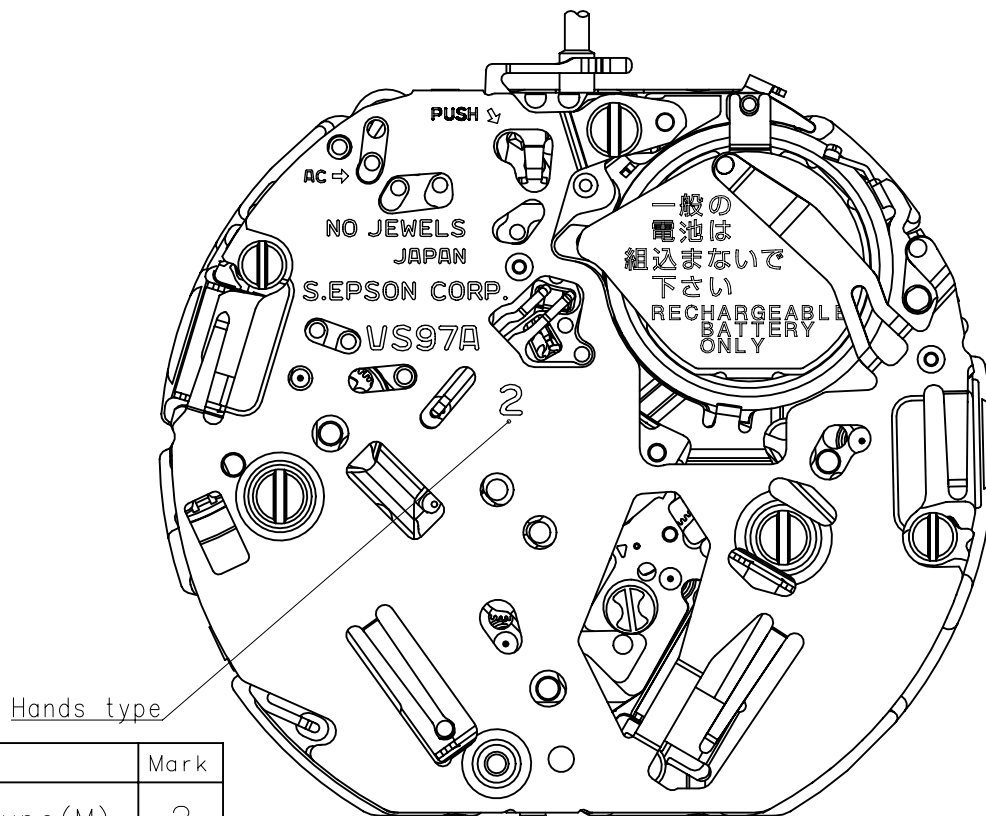
Date: 19/Nov./'24

# Cal. VS97A

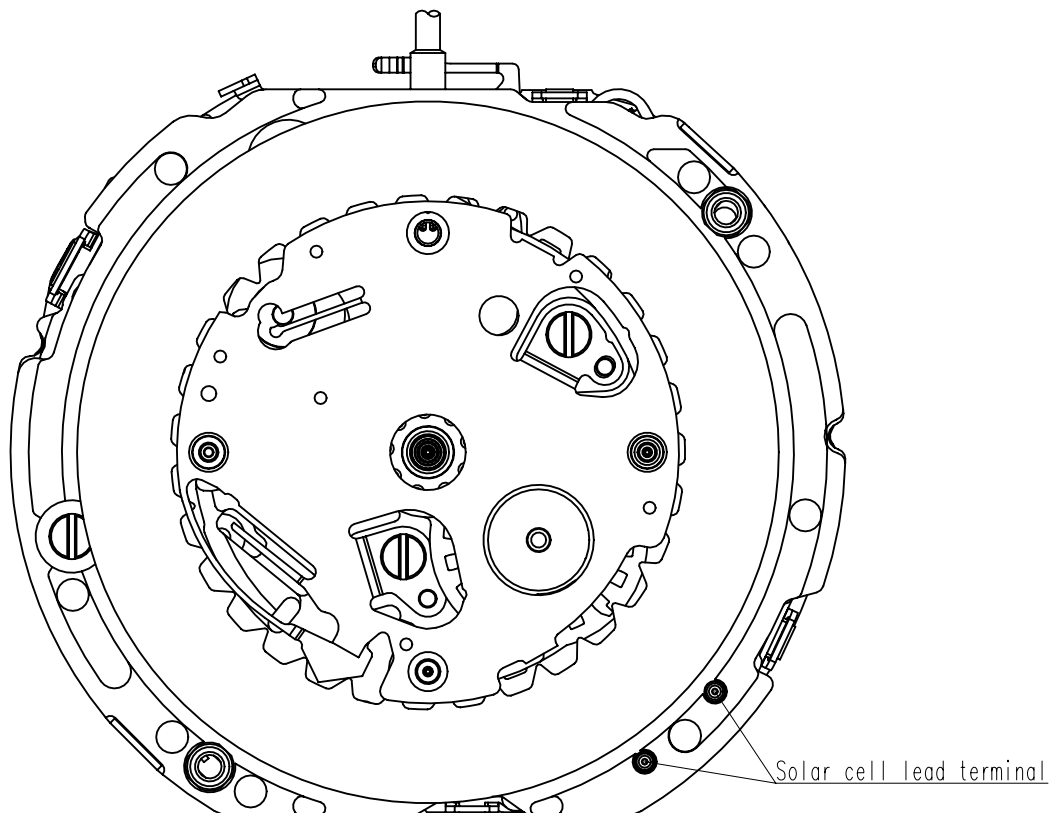
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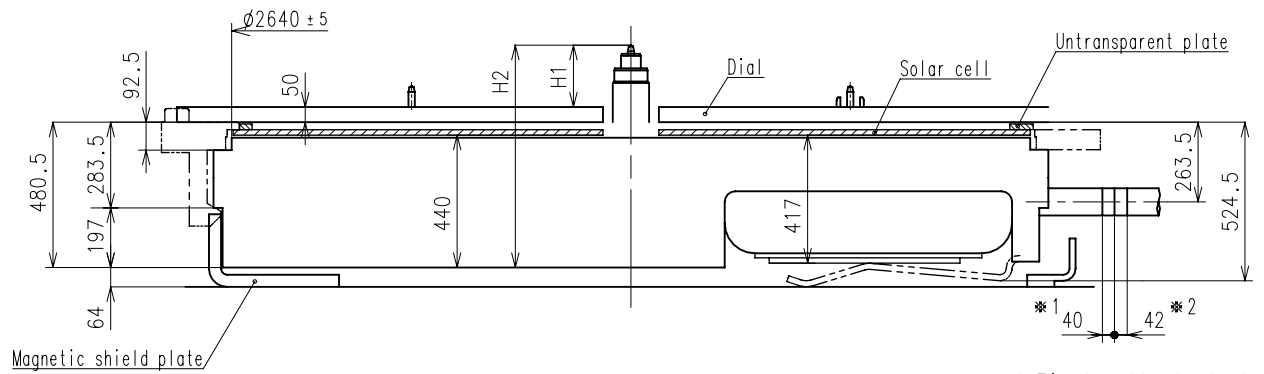
Cal. <b>VS97A</b>	<b>Features</b>	Date : 19/Nov./24 Rev. : 00
<div> <b>1.Solar-powered watch</b> </div> <div>           This watch is a solar-powered watch containing a solar cell underneath the dial to convert any form of light into " electrical energy" and store the power in a secondary battery.         </div> <div> <b>2. Eliminating the need for battery replacement</b> </div> <div>           Unlike conventional quartz watches, this watch does not use a silver oxide battery, thus eliminating the need for battery replacement.         </div> <div> <b>3. You can use the dial which light transmittance is more than 20%</b> </div> <div>           It is possible to assemble the dial which transmits light on the solar cell.            It enabled to cover the solar cell color, and you can design variety colors of dials.         </div> <div> <b>4. Running time</b> </div> <div>           Expected running time from full charge to stoppage will be around 6 months.         </div> <div> <b>5. Power depletion warning function</b> </div> <div>           The two-second intervals movement of the second hand is a signal of energy depletion.            The watch continuous running time after two-second intervals movement is approximately 1 week.         </div> <div> <b>6. Over charge prevent function is equipped</b> </div> <div>           If the secondary battery is charged more than predetermined voltage, over charge prevent function is operated to prevent the secondary battery deterioration and breakage.         </div> <div> <b>7. Structure of the separated parts</b> </div> <div> <div> <div>Untransparent plate</div> <div> <div>Solar cell unit</div> <div>           Solar cell            Dial support ring         </div> </div> <div>Solar cell lead terminal</div> <div>Movement</div> <div>Hand setting stem</div> <div>Secondary battery unit</div> <div>Magnetic shield plate</div> </div> </div>		

Cal.	VS97A	Specifications	Date : 19/Nov./24
			Rev. : 00
Solar Analog Quarts 12''' 1/5 second chronograph and world time alarm Movement			
1. MOVEMENT DIMENSIONS			
Outside diameter	φ 27.60mm(12H-6H) × 24.00mm(3H-9H)		
Casing diameter	φ 27.00mm(12H-6H)		
Total height	4.4mm		
2. TIME STANDARD			
Type of quartz oscillator	Tuning fork		
Frequency of quartz oscillator	32,768 Hz		
Accuracy	±20 seconds per month (on wrist)		
Operating temperature range	-5°C to +50°C		
Regulation device	Nil (Pre-adjusted)		
3. INDICATOR / FUNCTIONS			
3 Hands	Hour / Minute / 1/5 second chronograph (Center)		
Small hands	Battery indicator / Mode(12H)		
	Small second (9H) / Alarm hour and minute (6H)		
	*Alarm watch hands indicates hour/minute chronograph.		
	Center hand indicate city and 1/5 second chronograph.		
Calendar	Instant setting device for date calendar		
Reset switch			
Power depletion warning function (BLD)	(Second hand moves at 2-second intervals when voltage is 1.2V)		
Chronograph	The chronograph can measure up to 24 hours in 1/5 second increments.		
Running time	Approx. 6 months (After fully charged)		
4. FEATURES			
Jewels	0 Jewels		
Anti-magnetism	Over 1600A/m (Direct current magnetic field)		
Driving current consumption	Approx. 0.65 μ A (1.35V , Chronograph non-operates)		
Operation stopping voltage	1.0V		
Solar cell type	Amorphous silicon solar cell		
Maximum unbalance of hands	Small second hand	: 0.03 μ N·m	
	Mode hand	: 0.03 μ N·m	
	Alarm hour hand	: 0.025 μ N·m	
	Alarm minute hand	: 0.03 μ N·m	
	1/5 second chronograph hand	: 0.09 μ N·m	
	Minute hand	: 0.70 μ N·m	
Moment of inertia	1/5 second chronograph hand	: less than 0.12 μ g·m²	
5. SECONDARY BATTERY			
Type	Lithium metal batteries		
Size	φ 9.5 × t 2.05 mm		
Capacity	5.0mAh		
Nominal voltage	1.5V		
6. SEPARATED PARTS (Parts code)			
Hand setting stem	0351587		
Secondary battery unit	302324D		
Solar cell unit	4020559		
Solar cell lead terminal (2 pcs)	4281516		
Untransparent plate	4453500		
Magnetic shield plate	4259519		
Piezoelectric element	4589801		
7. TEST OF ACCURACY			
Equipment to be used	SEIKO quartz tester QT-99		
	Greiner quartz timer-C , Witschi Q-tester 4000		
Duration of measurement	10 seconds		
Microphone to be used	Electromagnetic detection type		
All specifications are subject to change without notice.			



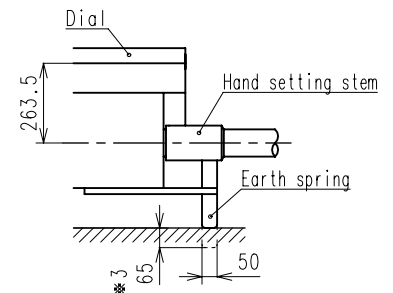
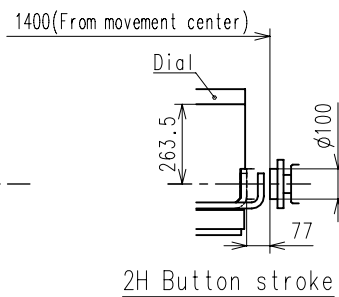
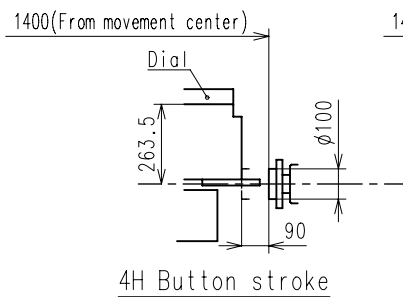
	Mark
Type(M)	2



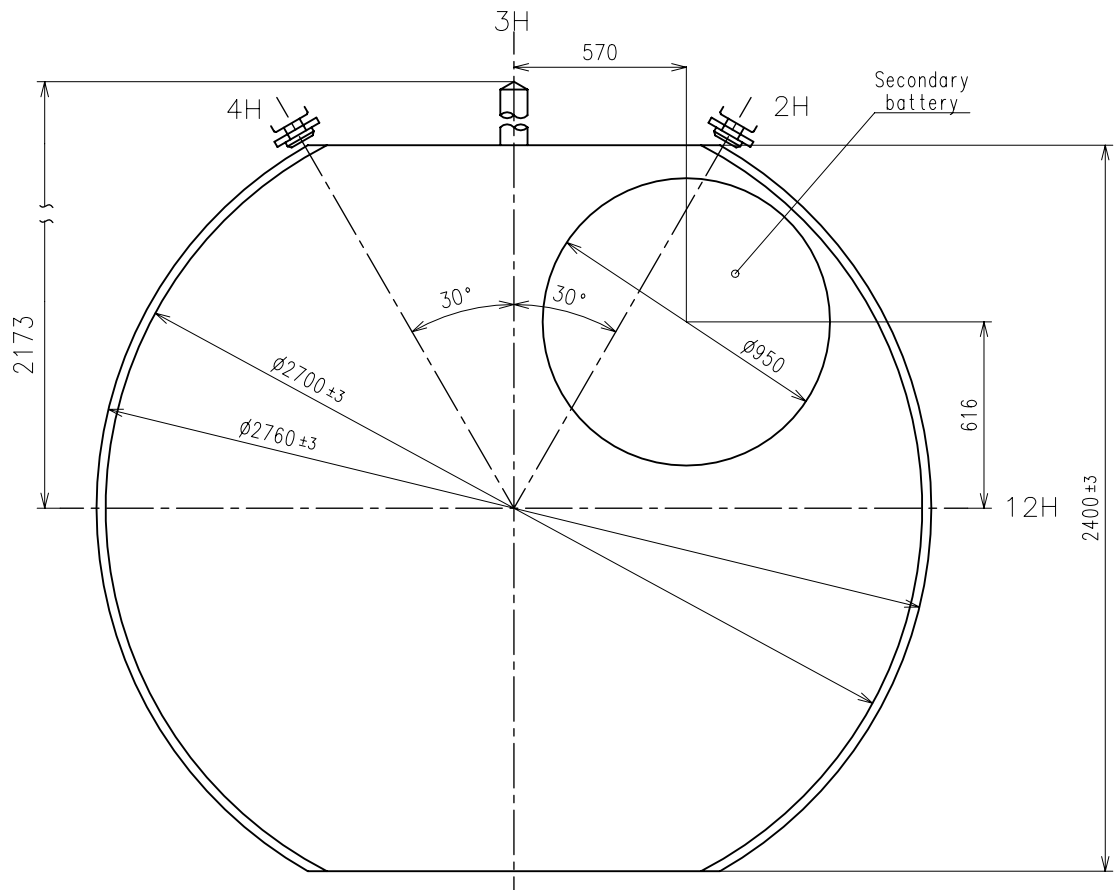


Center post		Type M (2) VS97A*
Maximum height from dial	H1	195.5
Total height including movement	H2	726

\*1: First pullout stroke  
\*2: Second pullout stroke



\*3: The earth spring is absolutely placed in contact with the case back.

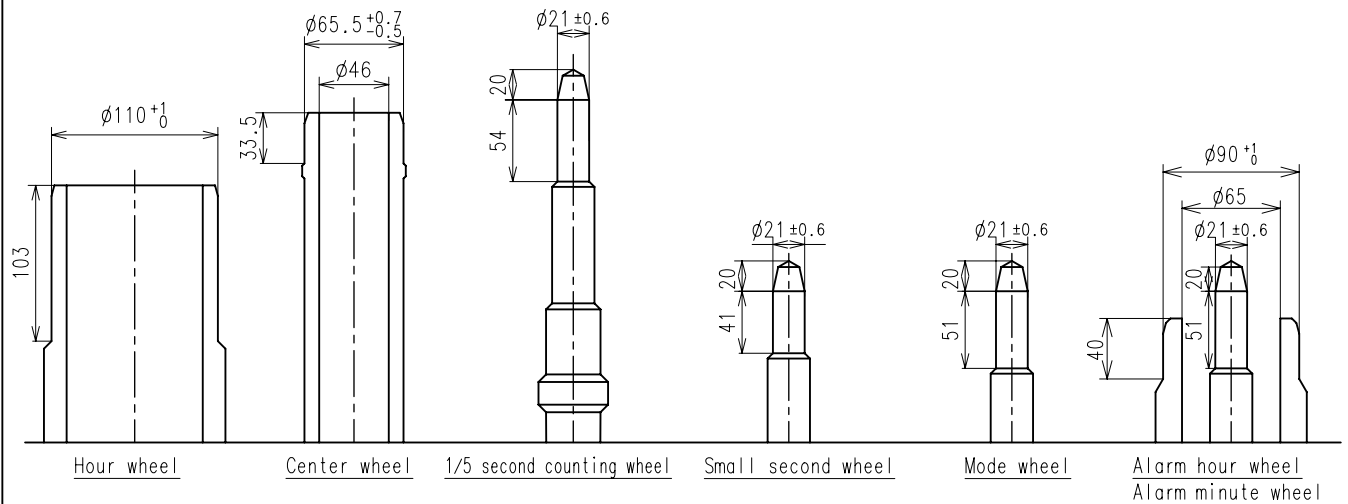


## ※ Unbalance

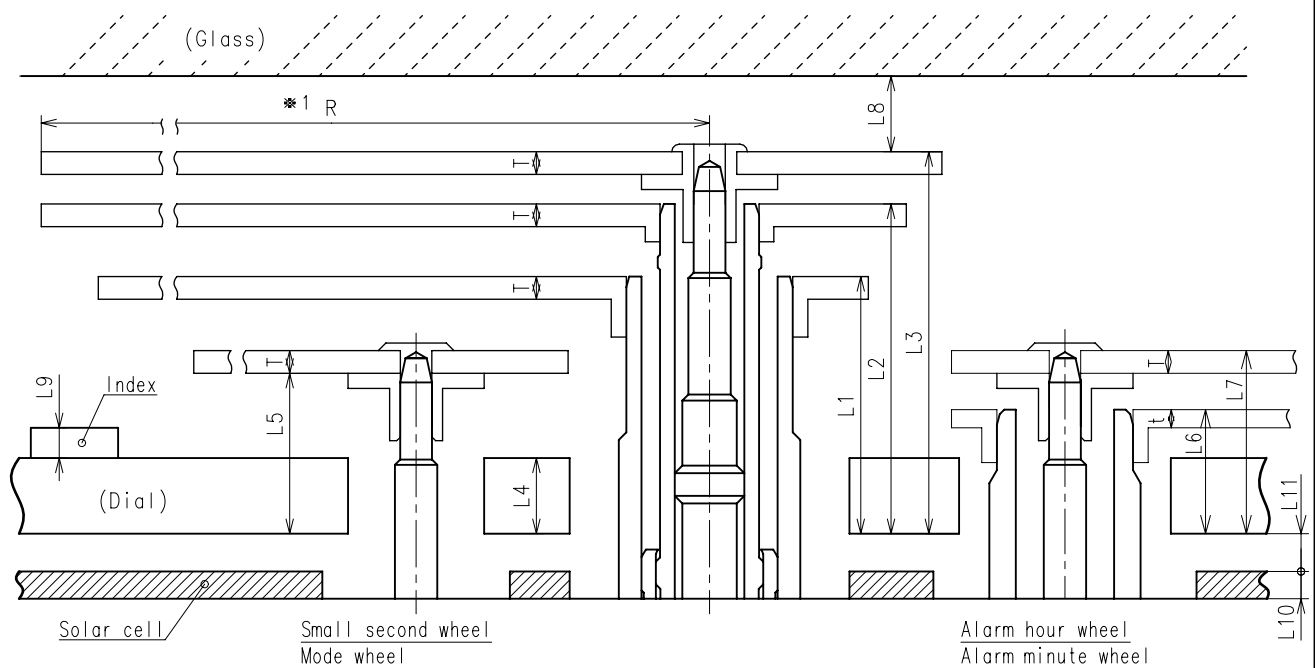
· Small second hand	$\leq 0.03\mu \text{ N} \cdot \text{m}$	$\left( 3\mu \text{ g} \cdot \text{m} \right)$
· Mode hand	$\leq 0.03\mu \text{ N} \cdot \text{m}$	$\left( 3\mu \text{ g} \cdot \text{m} \right)$
· Alarm hour hand	$\leq 0.025\mu \text{ N} \cdot \text{m}$	$\left( 3\mu \text{ g} \cdot \text{m} \right)$
· Alarm minute hand	$\leq 0.03\mu \text{ N} \cdot \text{m}$	$\left( 3\mu \text{ g} \cdot \text{m} \right)$
· 1/5 second chronograph hand	$\leq 0.09\mu \text{ N} \cdot \text{m}$	$\left( 9\mu \text{ g} \cdot \text{m} \right)$
· Minute hand	$\leq 0.70\mu \text{ N} \cdot \text{m}$	$\left( 70\mu \text{ g} \cdot \text{m} \right)$

## ※ Moment of inertia

· 1/5 second chronograph hand	$\leq 0.12\mu \text{ g} \cdot \text{m}^2$
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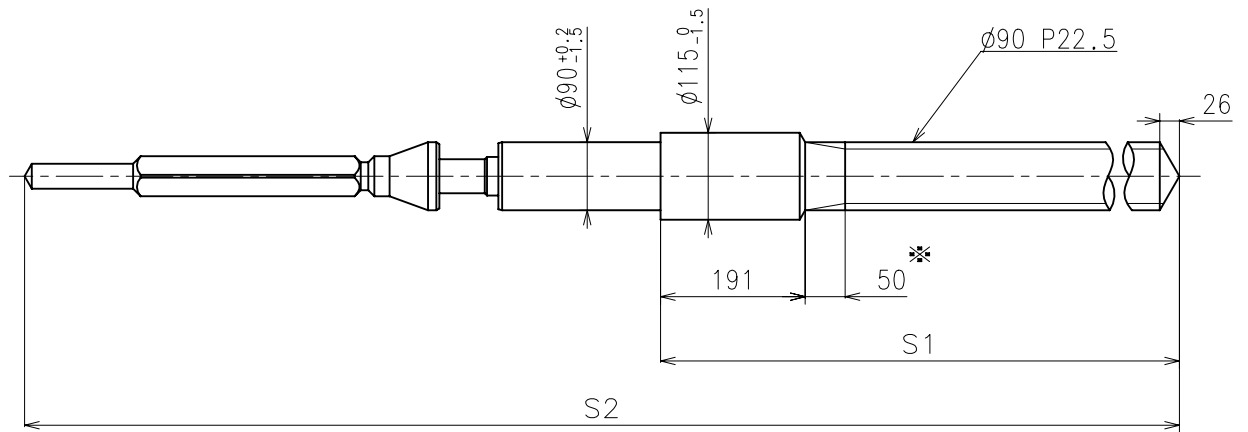


	Parts No.						
	Hour wheel	Center wheel	1/5 second counting wheel	Small second wheel	Mode wheel	Alarm hour wheel	Alarm minute wheel
Type M (2) VS97A**	0271636	0221604	0888501	0240521	0902502	0278503	0902502



	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	T	t	*1 R
Type M (2) VS97A**	178	226	261	50	127	82	116	MIN: 50	MAX: 50	18	20	15	12	MAX: 1250

※ 1: It is the size taken into consideration for hands attachment.  
Please observe some standard value specified in unbalance and moment of inertia  
when using long hands.



※ Not threaded

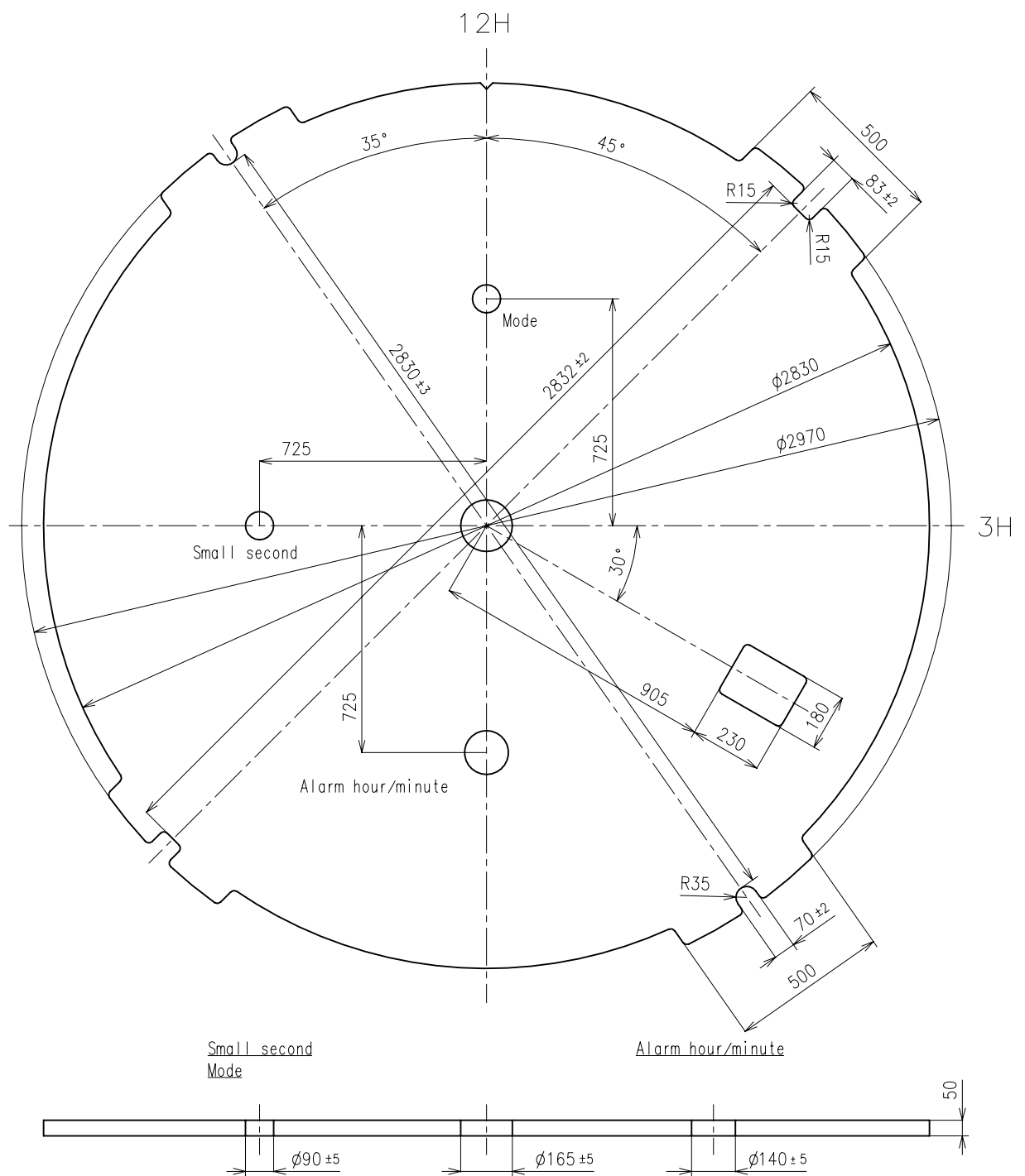
	Part No.	S1	S2
Standard	0351587	1367	2208

Material : Steel

Hardness : Vickers 600±50

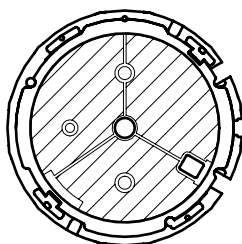


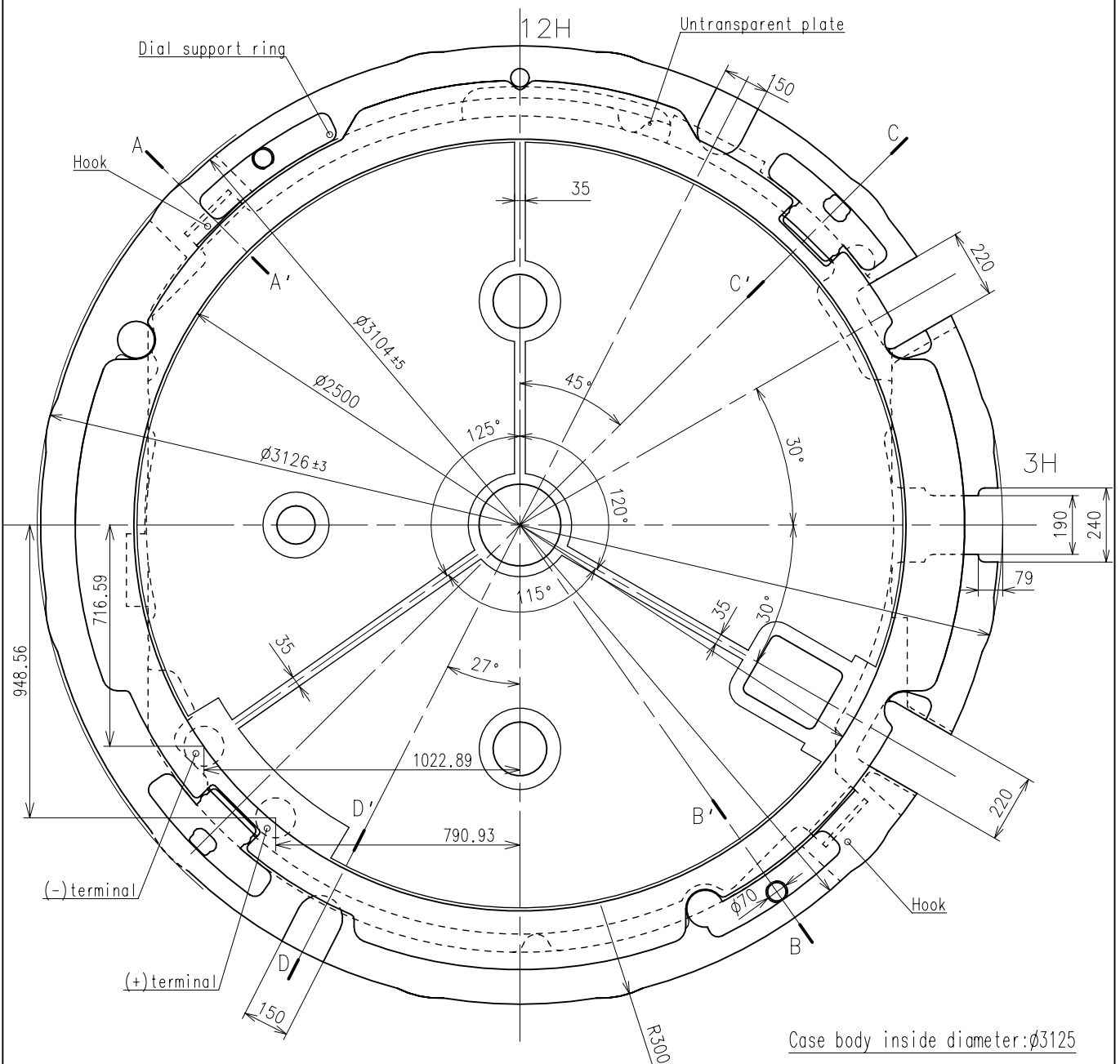




## [Attention]

Each elements of solar cell must be kept the transparency rate of the dial more than 20%.  
Refer to the Fig.[1] or [Solar cell unit] page instruction as to the shape of solar cell.

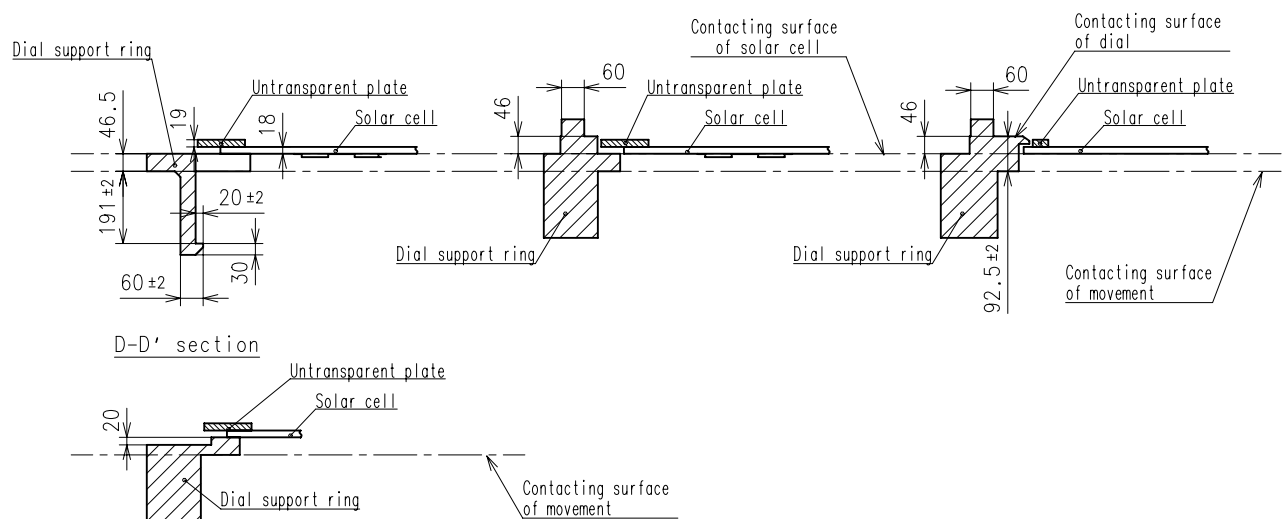
Fig.[1]  elements of solar cell



A-A' section

B-B' section

C-C' section



**1. Attention for solar cell unit**

Pay attention not to touch and scratch the surface of the solar cell.

**2. Dial transparency rate**

Keep the transparency rate of the dial more than 20%.

(Effective aperture is  $\phi 27\text{mm}$ )

Each elements of solar cell must be kept the transparency rate.

**3. The guideline of charging time is as in below**

Illumination (Lx)	Source of light	Environment	Dial transparency rate = 20%		
			A (Approx. Hours)	B (Approx. Hours)	C (Approx. Minutes)
700	A fluorescent lamp	Inside the office	—	48	123
3,000		30W 20cm	90	11	28
10,000	Sun light	Cloudy	24.0	2.9	8
100,000		Fine weather	5.0	1.2	3

Condition A : Time required for full charge

Condition B : Time required for steady operation

Condition C : Time to charge 1 day of power

**4. How to set the secondary battery unit**

- Please set the exclusive secondary battery unit.

(The secondary battery is Lithium metal batteries without any environmentally harmful substances.)

- Please install the plus part of the secondary battery towards inside of the watch.
- When installing or changing the secondary battery unit, it is recommended to remove three secondary battery clamp screws first, then remove the secondary battery clamp not to damage the movement parts.

If you install the secondary battery unit without removing the secondary battery clamp, please install the secondary battery unit from [→] direction as illustrated below Fig.[1].

- Secondary battery unit guide must be connected to "Guide pole". (Refer to the Fig.[1] in below.)
- Check whether the secondary battery lead plate is surely connected to the secondary battery minus pattern.
- Install the secondary battery unit under the circuit block cover as illustrated below Fig.[1] and

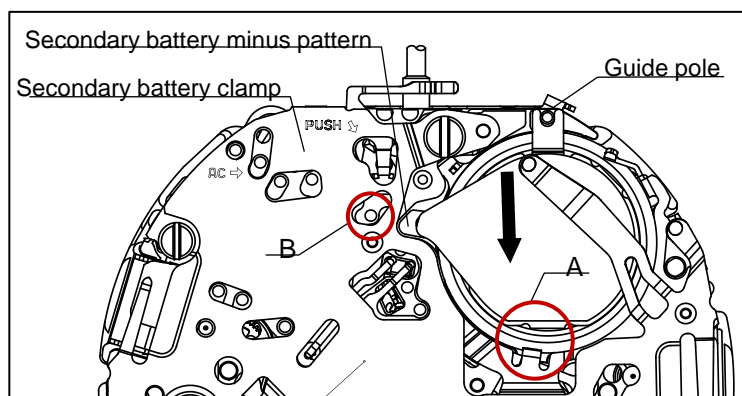


Fig.[1]

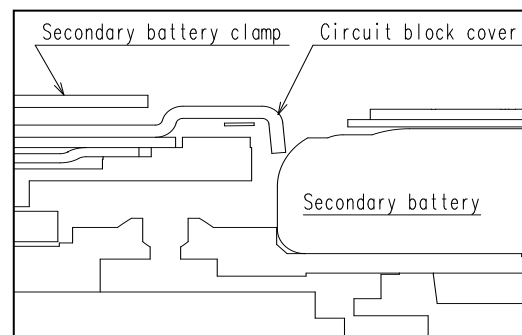


Fig.[2] A section

**⚠ 5. To do system reset**

- System-reset and adjusting the polarity of each step rotors is required as below after installing secondary battery unit.  
Short the circuit pattern "AC" to the secondary battery clamp for more than 2 seconds.  
Short the circuit pattern "B" to the secondary battery clamp for more than 2 seconds at 2nd click.

## 6. How to remove the setting stem

- When removing the setting stem, pull out the crown at 1st click position and then remove the setting stem while pressing the hollow portion of setting lever by tweezers. (Refer to the Fig.[3].)
- Please do not transform the earth spring.

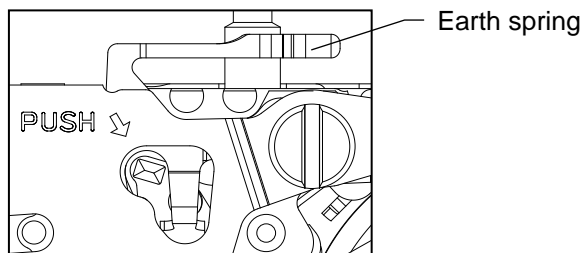


Fig.[3] Crown pulled out at 1st click

## 7. Attention of casing part structure

- Use the specified dial support ring to prevent rotation of the movement inside of the case in order to stabilize the button operation.  
Refer to the [Solar cell unit] page instruction as to the shape and tolerance.
- Use the metal case to prevent from the movement mal-function by static electricity.
- The center wheel have a safety stopper structure to prevent the minute hand from being pressed too much. However pay attention to the contact between hour hand and minute hand.

## 8. How to set the hands

- Each hand moves at step interval. Set the each hand at correct position according to the scale on the dial in order not to make a mistake in reading time.
- Do not turn the hand forcibly.

## 9. How to remove the hands

- When removing the hands, use exclusive fork-shaped tools.
- Do not remove the dial under the condition that any hands are set.

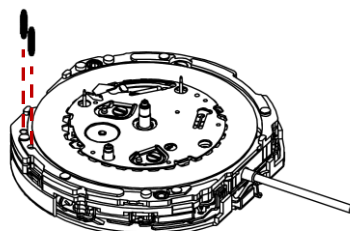
## 10. Caution

When charging the watch, do not place it too close to fluorescent lamp or other light sources as the watch temperature will become extremely high, causing damage to the parts inside the watch.

## 11. How to set the solar cell lead terminal

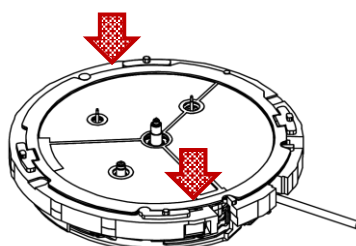
Please set 2pcs of solar cell lead terminals in accordance with this illustration.

As to the solar cell lead terminal shape, there is no distinction between upper and lower.



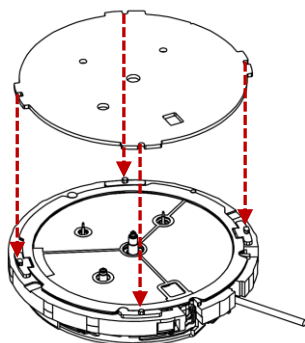
## 12. How to set the solar cell unit

Push above part of each hook on the solar cell unit into main plate certainly.



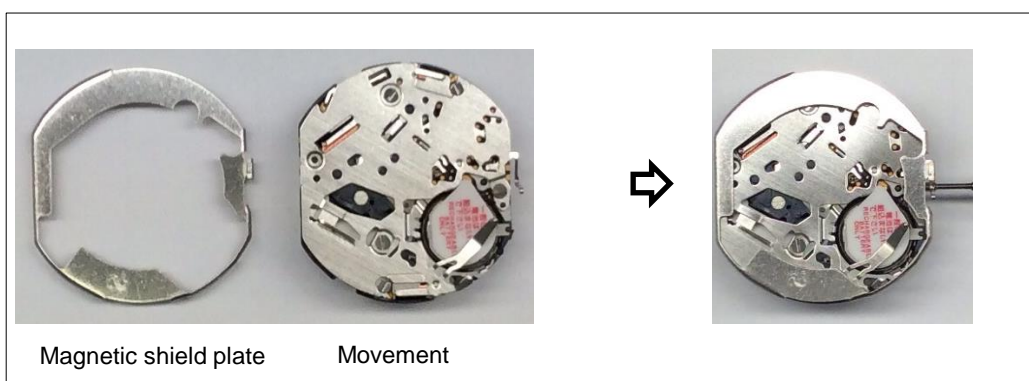
### 13.How to set the dial

The dial is held by the four guide poles on the solar cell unit.



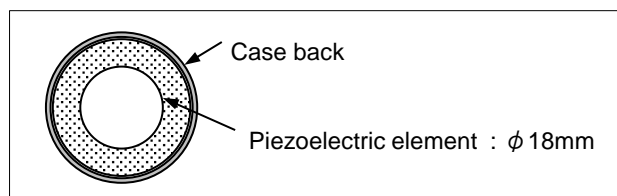
### 14.Magnetic shield plate

Install magnetic shield plate on the movement(on battery clamp) before assembling the case back.  
Refer to the following picture not to install magnetic shield plate incorrect direction.



### 15.Piezoelectric element

Stick piezoelectric element to the center of case back.



- Piezoelectric element must be stuck to case back by thermoplastic adhesive.
- Thermoplastic adhesive is already printed to the surface of piezoelectric element.
- Heating temperature and time to stick piezoelectric element is shown in the following table.

Material of case back	Heating temperature	Heating time
Stainless	250°C	5 seconds
Titanium	250°C	6 seconds

- Check piezoelectric element is definitely stuck to case back after heating.

Sticking position

- The amount of the misalignment between the center of case back and piezoelectric : 0.35mm and less

If the sticking position of piezoelectric element is drastically misaligned or if the electrical continuity is bad, no sound may occur.

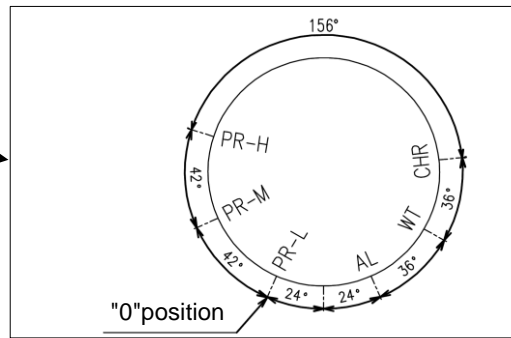
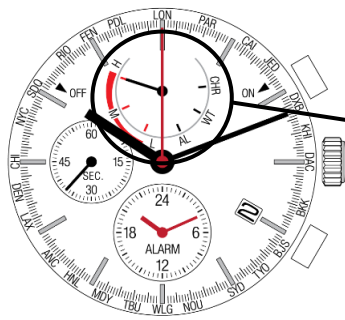
### 16.System reset as complete watch

System-reset(Refer to Operation-01[\*1].) is required in case of below,

- after replacement of secondary battery unit.
- malfunction or abnormal operation when an error occurs

※It is necessary to set the "0" position after system-reset, because "0" position of small hands may slip off.

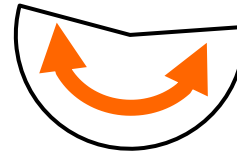
### 1.The design instruction of mode indicator



### 2.The index design instruction of mode hand

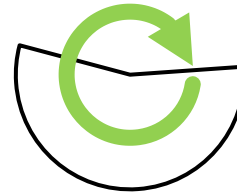
#### (1) Mode indicator

The mode hand moves 204 degrees from the start point.



#### (2) Set to "0" position

When the mode hand is set to "0" position, the mode hand turns a full round.



#### (3) Dial index design

The dial index must be designed on the assumption that the mode hand turns a full round.

### 3.The start position of mode hand

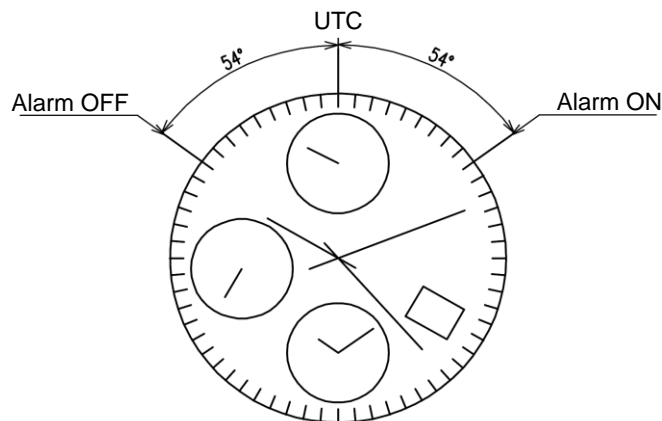
The start position of the mode hand can be set on the arbitrary positions in the range of 360 degrees.

### 4.The design instruction of city indicator (Center hand)

The UTC must be put on the 12H position.

Center hand indicate city and alarm on/off and 1/5 second chronograph.

The city interval refer to [Attention of design].

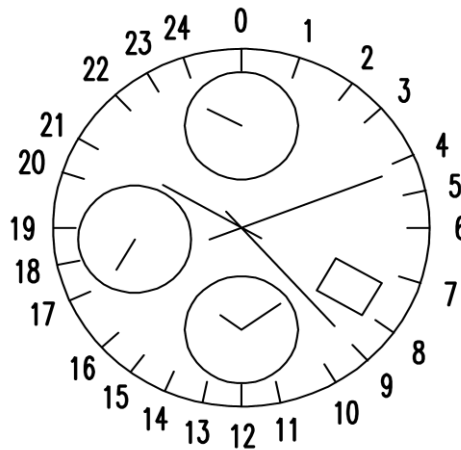


**The design instruction of the city**

The time in 25 cities is displayed.

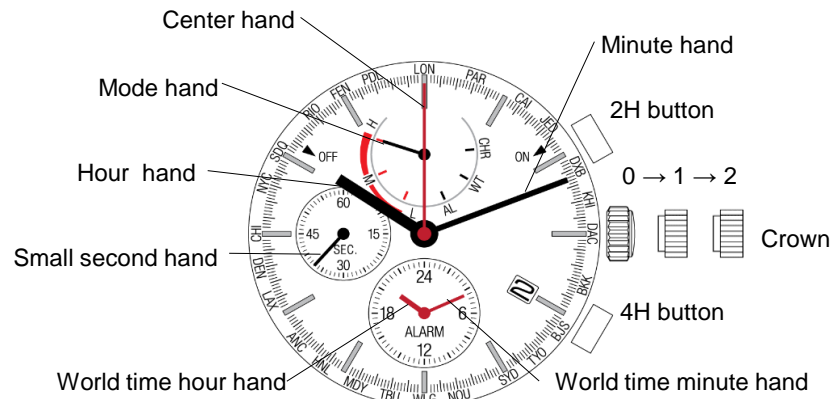
When designing a dial, it has to be checked whether time difference has been changed.

(Time difference at 2015/3)



Display position	Difference in hour from UTC	Representative city (sample)	Position (Second)
0	±0	UTC / LONDON	0
1	+1	PARIS / ROME	3
2	+2	CAIRO	6
3	+3	JEDDAH	8
4	+4	DUBAI	11
5	+5	KARACHI	13
6	+6	DHAKA	15
7	+7	BANGKOK	18
8	+8	BEIJING	21
9	+9	TOKYO	23
10	+10	SYDNEY	25
11	+11	NOUMEA	28
12	+12	WELLINGTON	30
13	+13	NUKU'ALOFA(TONGATAPU)	32
14	-11	MIDWAY	34
15	-10	HONOLULU	36
16	-9	ANCHORAGE	38
17	-8	LOS ANGELES	41
18	-7	DENVER	43
19	-6	CHICAGO	45
20	-5	NEW YORK	48
21	-4	SANTO DOMINGO	50
22	-3	RIO DE JANEIRO	53
23	-2	Fernando de Noronha	55
24	-1	AZORES	57





	Crown position		
	0 click	1st click	2nd click
Crown	Free	Turn clockwise for date change	Time setting
2H button	Chronograph Start/Stop Restart	Alarm ON/OFF	[*1]
4H button	Chronograph Reset Split Split release World time city setting (Press for 3 seconds)	Daily Alarm time setting (at 6h small circle)	World time setting (at 6h small circle)

### [\*1] Branching at the 2nd click

Pull crown out to the 2nd click position.

Press 2H button for 3 seconds.

→ [\*2] set the "0" position.

Press 2H button

→ [\*3] How to set the "0" position of the center hand

### [\*2] How to set the "0" position / System-reset (Crown position : 2nd click)

#### How to set the "0" position.

Pull crown out to the 2nd click position.

→ Press 2H button for 3 seconds.

The mode hand and alarm hand display the "0" position.

Press the 4H button repeatedly to set the alarm hand to the "0" position.

Press 2H button.

Center hand turns a full round and can now be set to correct "0" position.

Press 4H button repeatedly to set it to "0" position.

Press 2H button.

Mode hand turns a full round and can now be set to correct "0" position.

Press 4H button repeatedly to set it to "0" position.

Press 2H button here will allow you to resume the procedure again as indicated by the arrow if necessary.

Push crown back to normal position.

#### System-reset

Pull crown out to the 2nd click position.

Press 2H and 4H buttons at the same time for longer than 2 seconds.

It is necessary to set the world time, city and alarm time after system-reset

### [\*3]How to set the "0" position of the center hand

#### ■ How to set the "0" position of the center hand

Pull crown out to the 2nd click position.



→ Press 2H button.

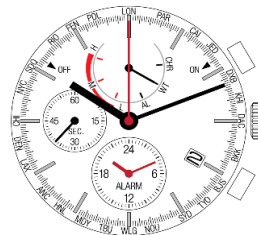
Mode hands indicates "WT"



Press 2H button repeatedly to set the world time hands.

Press 2H button here will allow you to resume the procedure again as indicated by the arrow if necessary.

Push crown back to normal position.



### World time function

- The time in 25 cities is displayed by the 12 hour indication.

#### ■ World time city setting

4H button

Press 4H button for more than 3 seconds.  
The current selected city.

2H / 4H button

Press 2H / 4H button to select the city  
while city hand is indicating the city

After 10 seconds without button press it turns to normal position.

### Alarm function

- The regular alarm can be set to sound at a designated time everyday.
- The alarm time can be set in one minute increments.

#### ■ Set the alarm ON/OFF

Crown

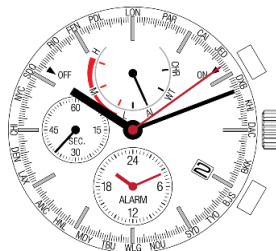
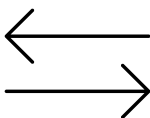
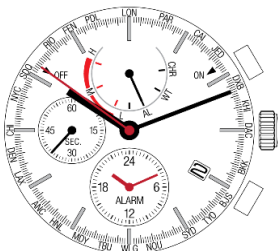
Pull out  
1st. position

2H button

Set the ON/OFF  
with the Center hand.

Crown

Push back  
Normal position



#### ■ Set the alarm time

Crown

Pull out  
1st. position

4H button

Set the alarm time  
[\*4]

Crown

Push back  
Normal position

[\*4]

Press 4H button repeatedly to set the alarm hands to the desired alarm time.  
The alarm hands move quickly when the 4H button is kept pressed.

#### ■ Stop the alarm

- At the designated time the alarm rings for 20 seconds, and it is automatically disengaged as it stops.
- It is possible to stop ringing manually when pressing any button.

#### ■ Alarm sound demonstration

Crown

Pull out  
1st. position

2H button

Alarm sound demonstration  
[\*5]

Crown

Push back  
Normal position




[\*5]

Press and hold 2H button for longer than 3 seconds.  
The alarm sound can be heard while the button is kept pressed.

Battery indicator

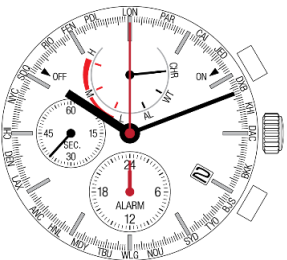
Remaining battery capacity is normally indicated.  
During the chronograph function is activated, battery indicator is invalid.  
After reset chronograph measurement, the battery indicator become valid automatically 60 seconds later or push 4Hbutton.

Battery indicator and duration

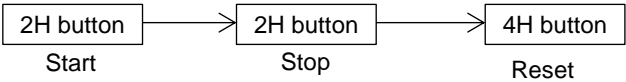
Battery level	Display	Power reserve
High		100 days or more
Middle		2-100 days
Low (BLD)		2 days or less

Chronograph function

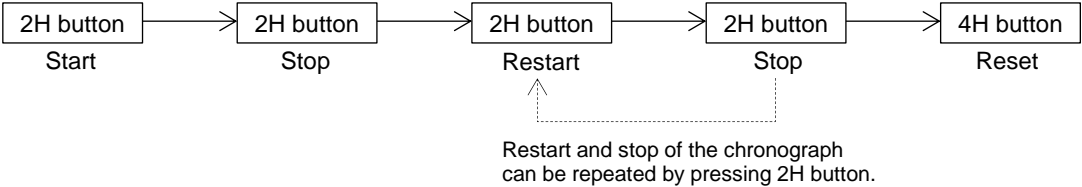
- The chronograph can measure up to 24 hours in 1/5 second increments.
- When the measurement reaches 24 hours, the chronograph automatically stops counting.



■ Standard measurement



■ Accumulated elapsed time measurement



■ Split time measurement

