

## Watch Movement Specification and Drawing

### SOLAR SERIES

# Cal. VS98A

Movement Size

12'''

Casing Diameter

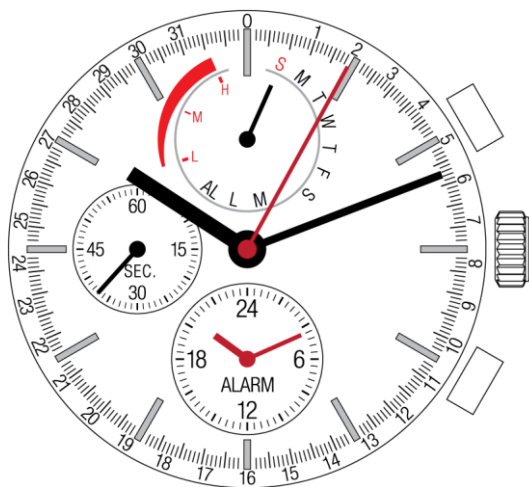
Ø 27.0mm

Height

4.40mm

Running Time

Approx. 6 months



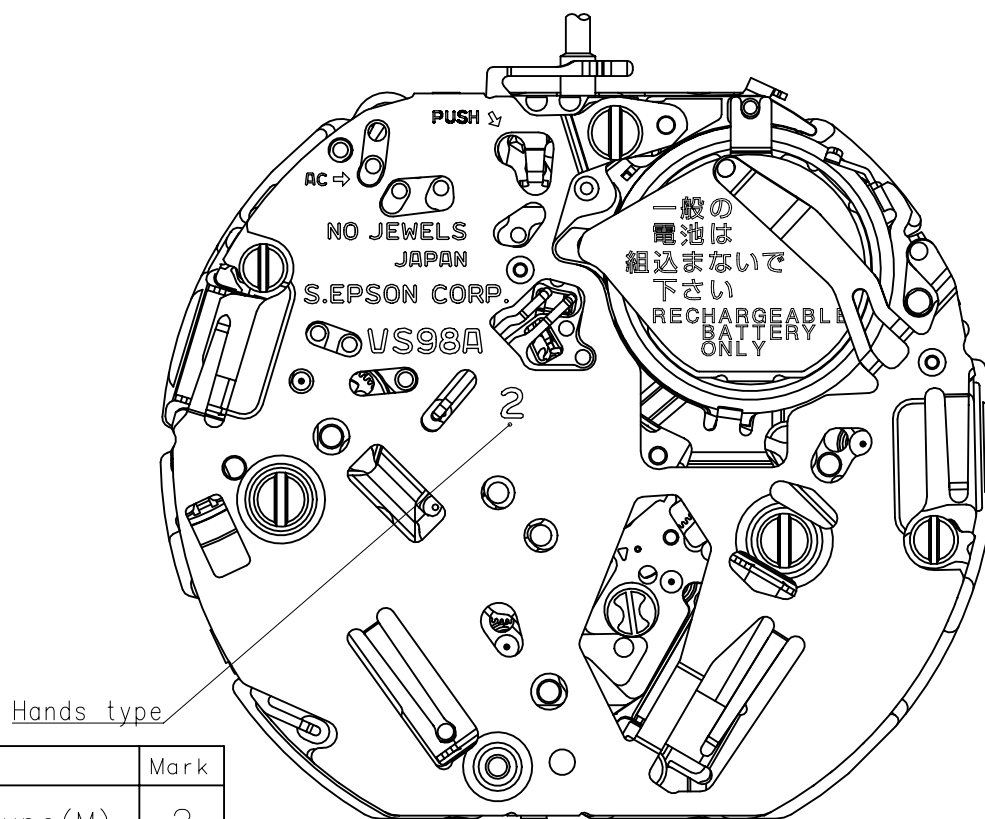
Date: 19/Nov./'24

# Cal. VS98A

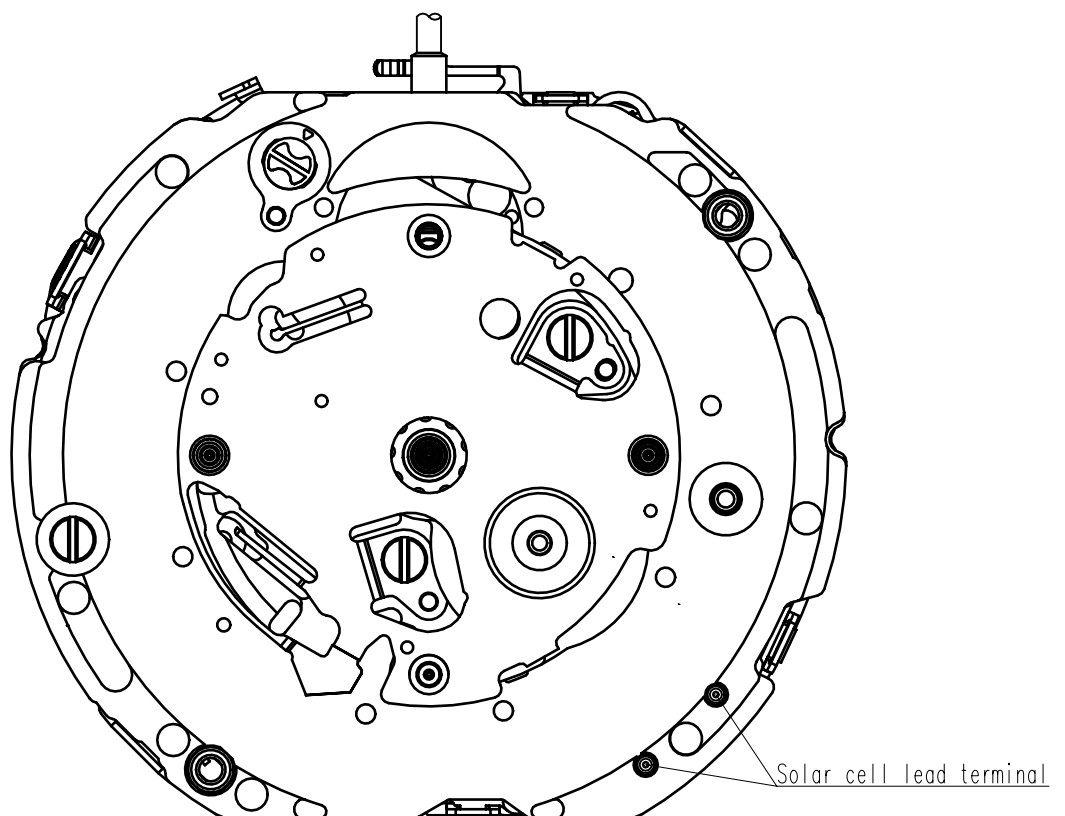
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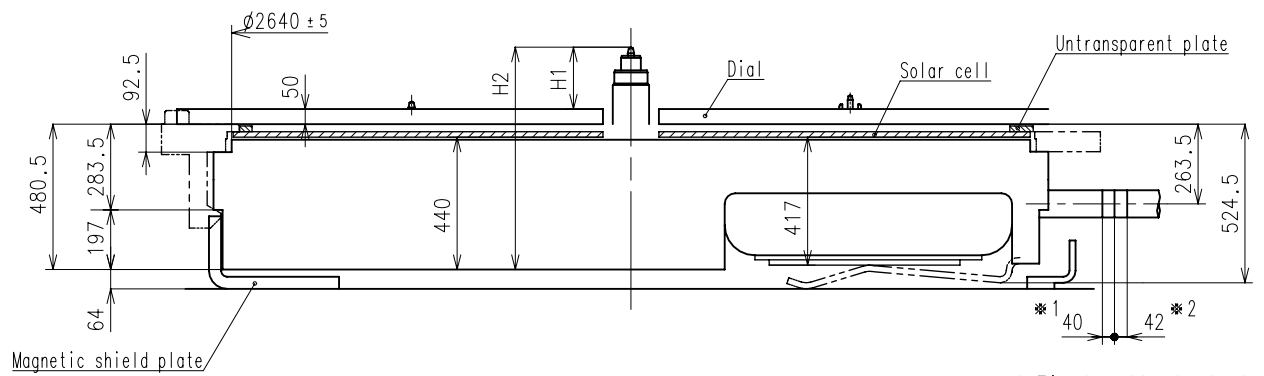
Cal. <b>VS98A</b>	<b>Features</b>	Date : 19/Nov./24 Rev. : 00
<div> <p><b>1.Solar-powered watch</b></p> </div> <div> <p>This watch is a solar-powered watch containing a solar cell underneath the dial to convert any form of light into " electrical energy" and store the power in a secondary battery.</p> </div> <div> <p><b>2. Eliminating the need for battery replacement</b></p> </div> <div> <p>Unlike conventional quartz watches, this watch does not use a silver oxide battery, thus eliminating the need for battery replacement.</p> </div> <div> <p><b>3. You can use the dial which light transmittance is more than 20%</b></p> </div> <div> <p>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.</p> </div> <div> <p><b>4. Running time</b></p> </div> <div> <p>Expected running time from full charge to stoppage will be around 6 months.</p> </div> <div> <p><b>5. Power depletion warning function</b></p> </div> <div> <p>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.</p> </div> <div> <p><b>6. Over charge prevent function is equipped</b></p> </div> <div> <p>If the secondary battery is charged more than predetermined voltage, over charge prevent function is operated to prevent the secondary battery deterioration and breakage.</p> </div> <div> <p><b>7. Structure of the separated parts</b></p> </div> <div> </div>		

Cal.	VS98A	Specifications	Date : 19/Nov./24
			Rev. : 00
Solar Analog Quartz 12''' 1/5second Chronograph and Alarm with Perpetual Calendar 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 indicate hour/minute chronograph.		
	Center hand indicate calendar (date) and 1/5 second chronograph.		
Calendar	Perpetual 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 hour 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.			



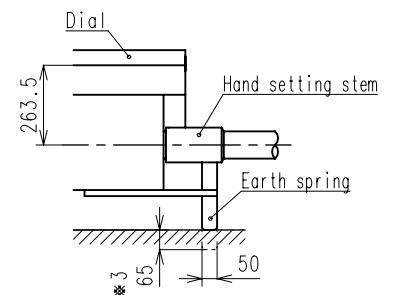
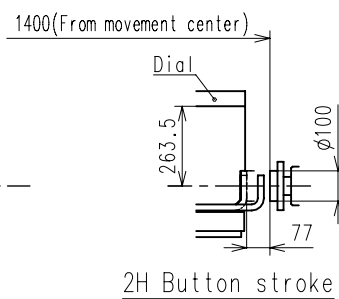
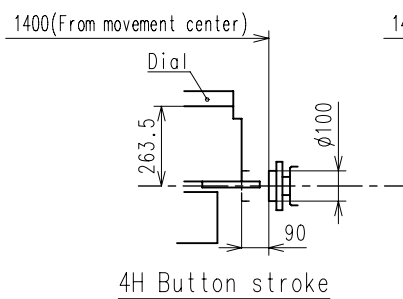
	Mark
Type(M)	2



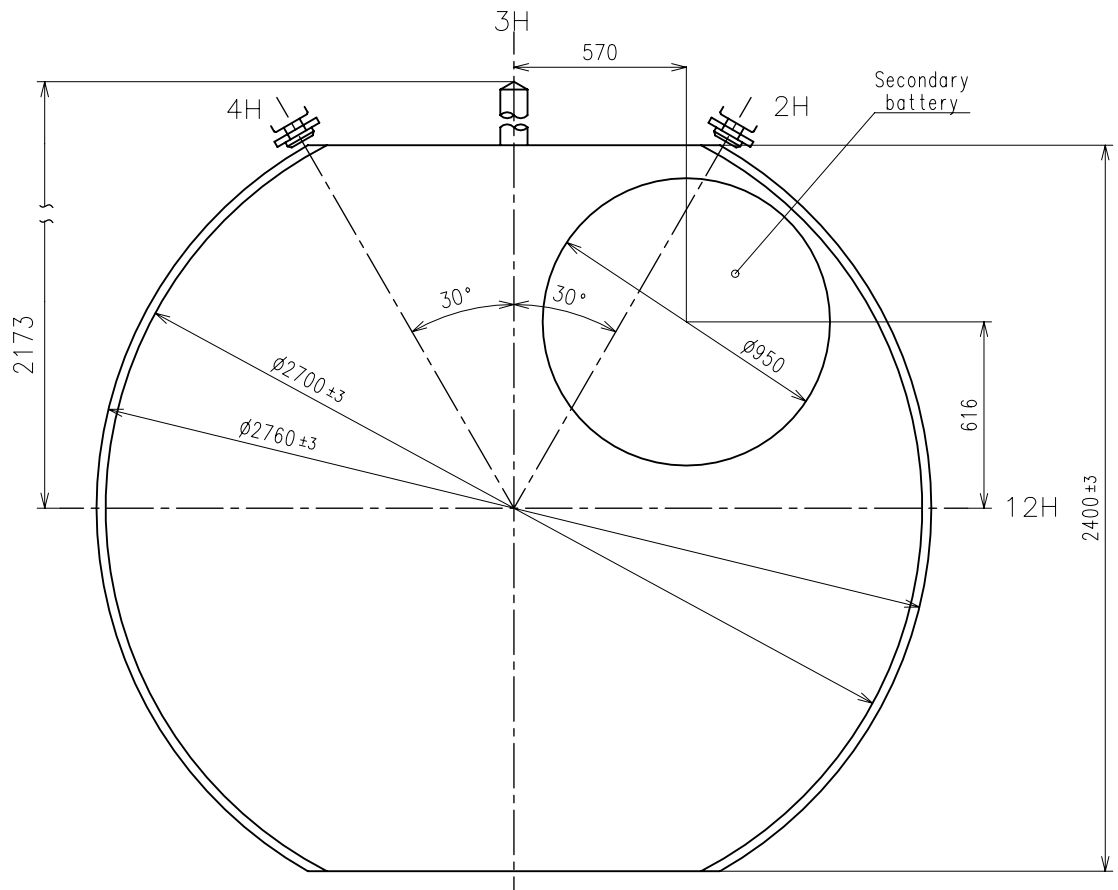


Center post		Type M (2) VS98A*
Maximum height from dial	H1	195.5
Total height including movement	H2	726

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



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

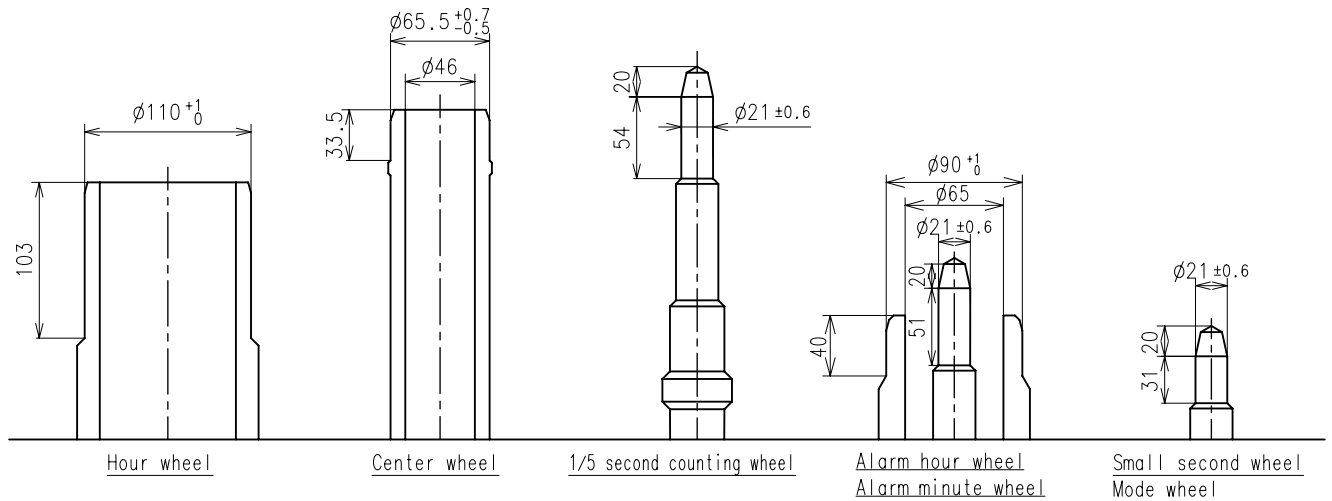


## ※ Unbalance

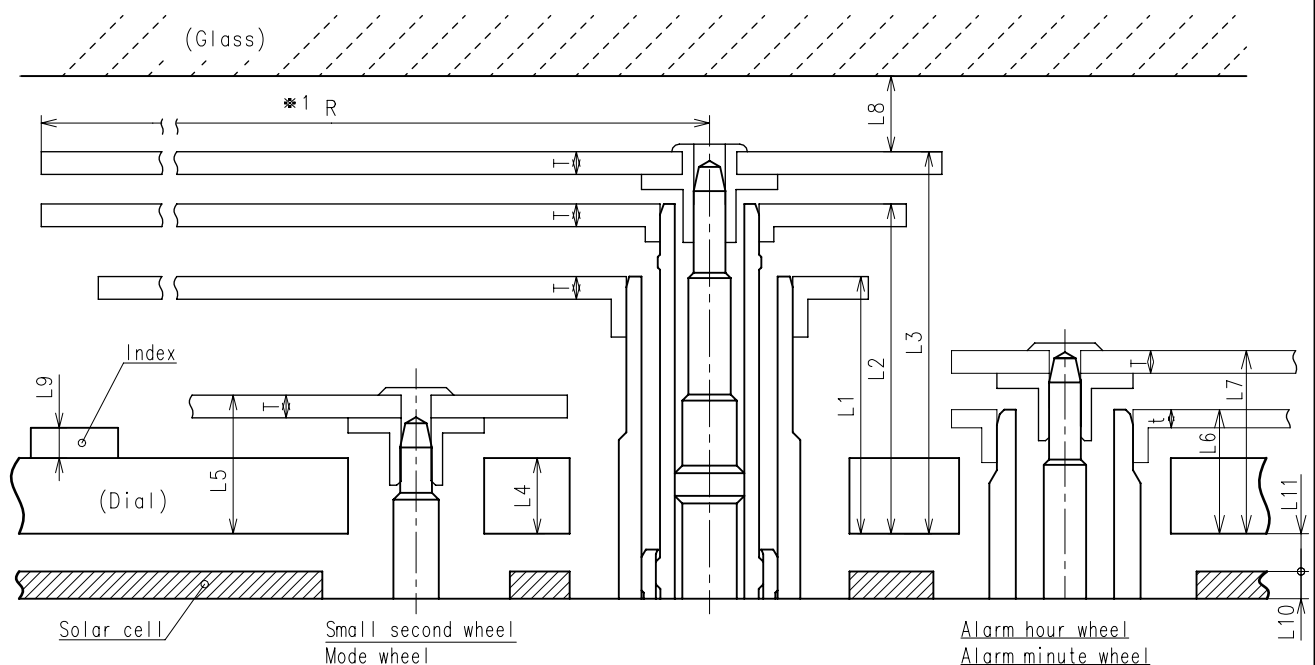
· Small second hand	$\leq 0.03\mu \text{ N} \cdot \text{m}$	$\left( 3\mu \text{ g} \cdot \text{m} \right)$
· Mode hand	$\leq 0.03\mu \text{ N} \cdot \text{m}$	$\left( 3\mu \text{ g} \cdot \text{m} \right)$
· Alarm hour hand	$\leq 0.025\mu \text{ N} \cdot \text{m}$	$\left( 3\mu \text{ g} \cdot \text{m} \right)$
· 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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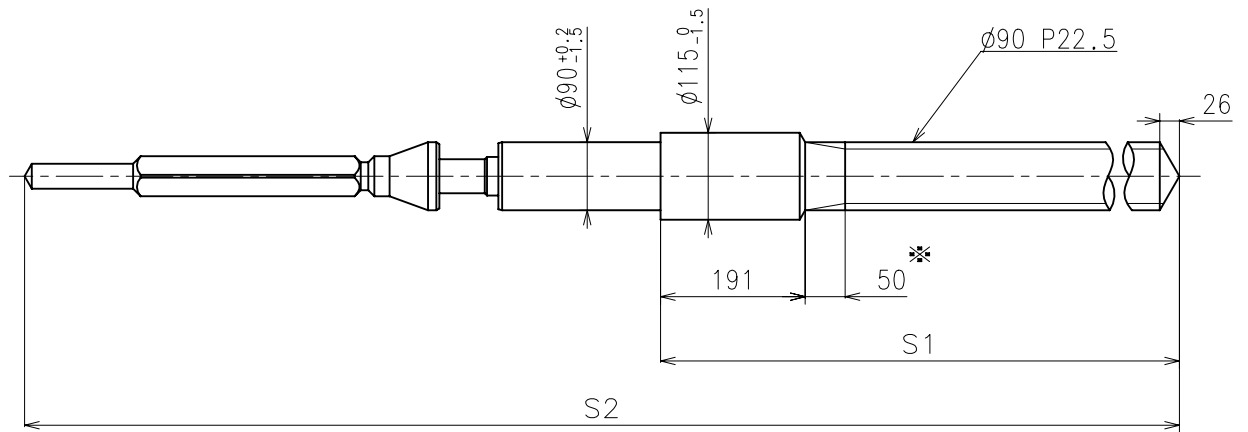


	Parts No.						
	Hour wheel	Center wheel	1/5 second counting wheel	Small second wheel	Alarm hour wheel	Alarm minute wheel	Mode wheel
Type M (2) VS98A**	0271636	0221604	0888501	0240511	0278503	0902502	0902500



	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	T	t	*1 R
Type M (2) VS98A**	178	226	261	50	90	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

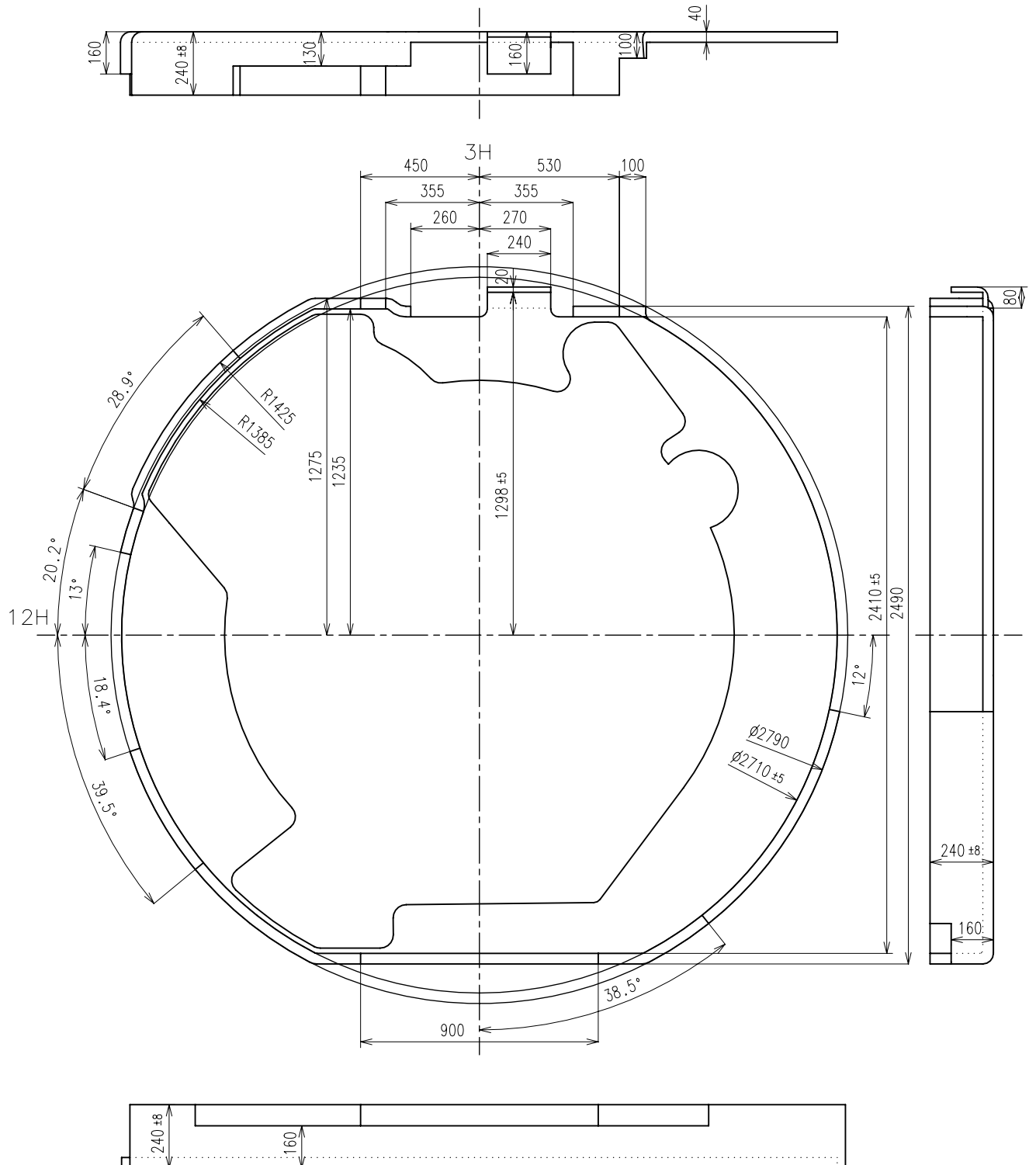
	Part No.	S1	S2
Standard	0351587	1367	2208

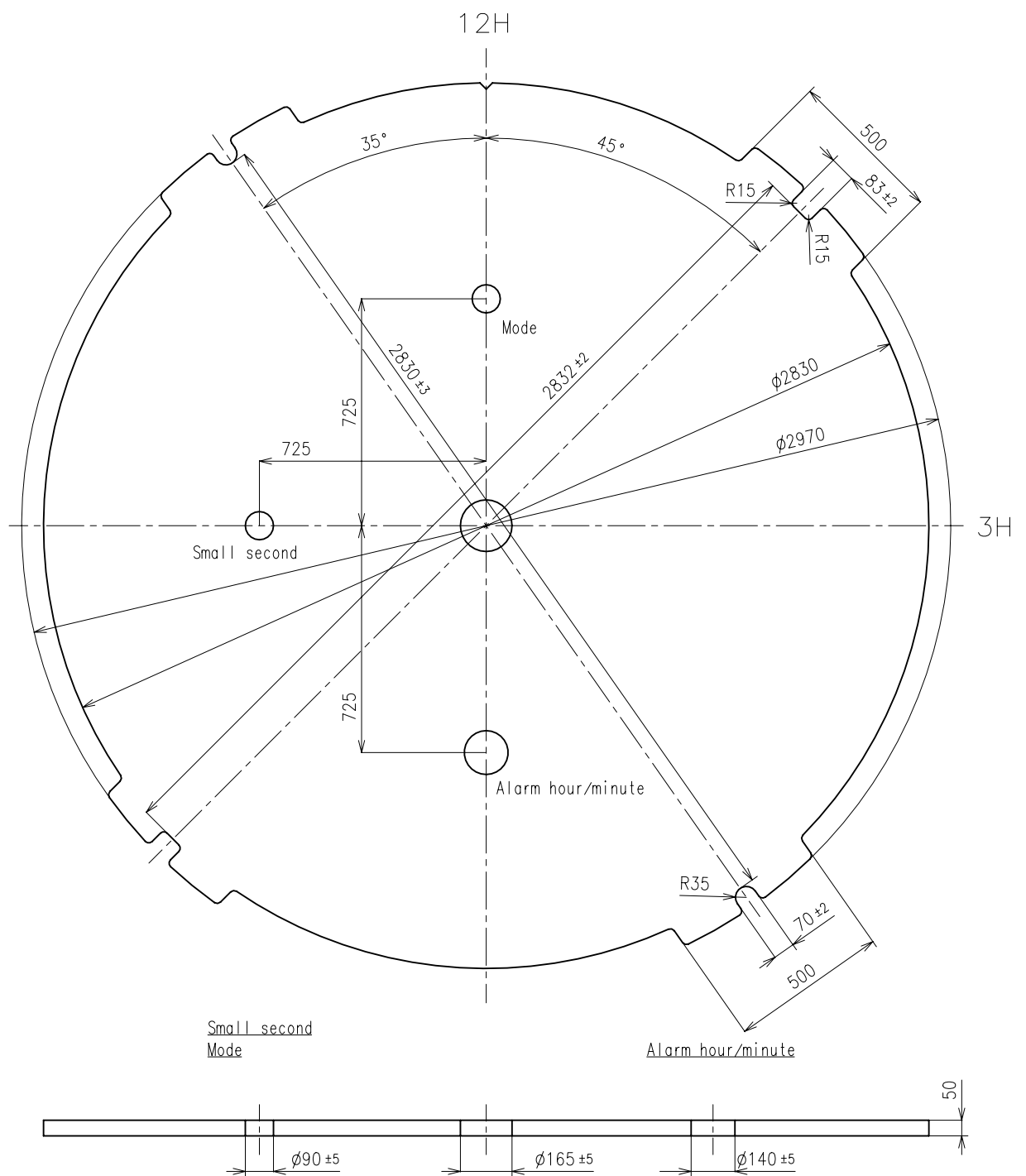
Material : Steel

Hardness : Vickers 600±50



Part No. : 4259519





## [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.

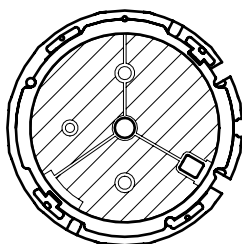
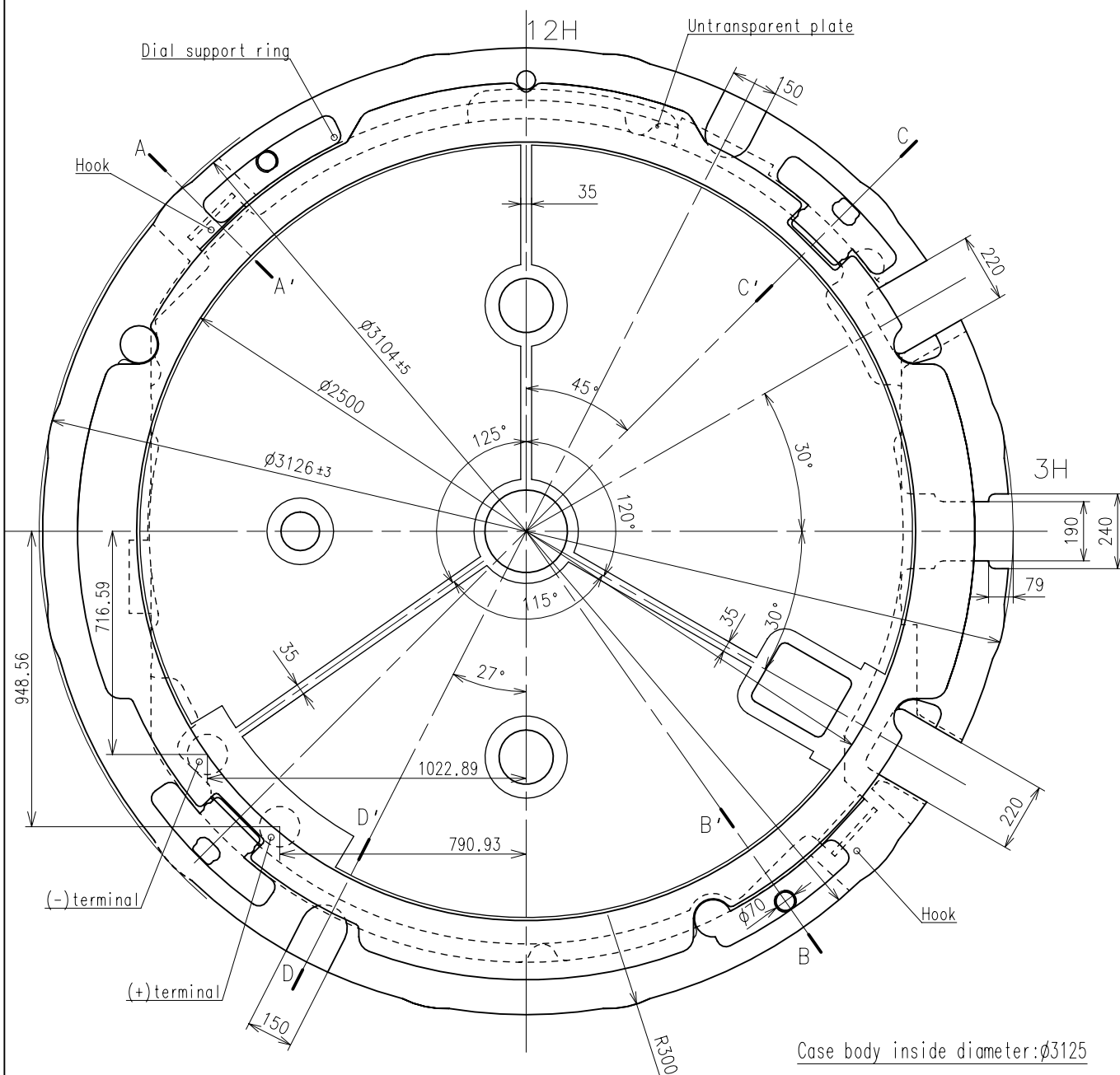


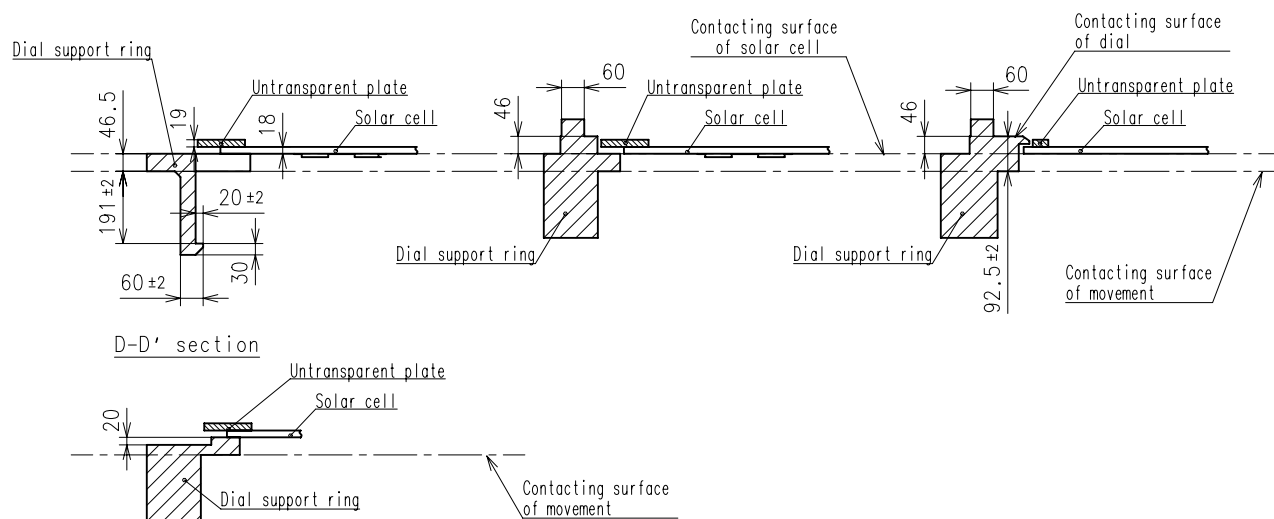
Fig.[1]  elements of solar cell



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

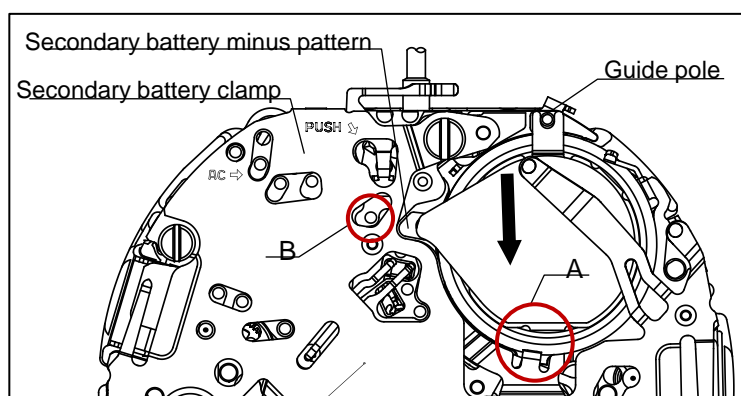


Fig.[1]

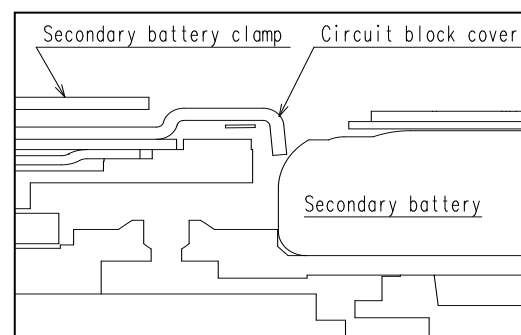


Fig.[2] A section

**⚠ 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.

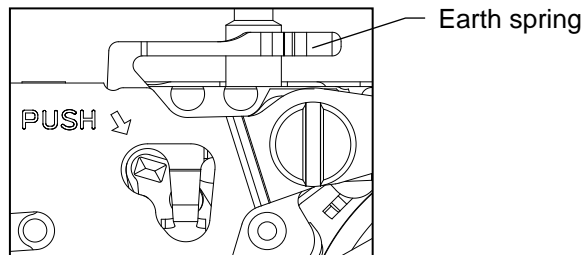


Fig.[3] Crown pulled out at 1st click

## 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.

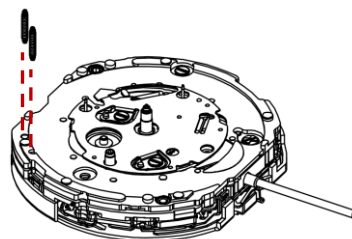
## 10. Caution

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

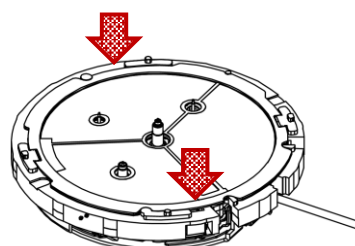
Please set 2pcs of solar cell lead terminals in accordance with this illustration.

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



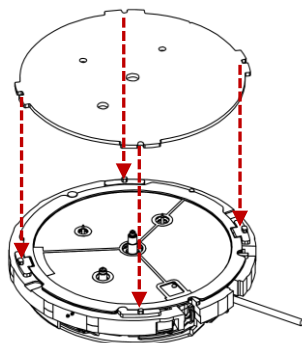
## 12. How to set the solar cell unit

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



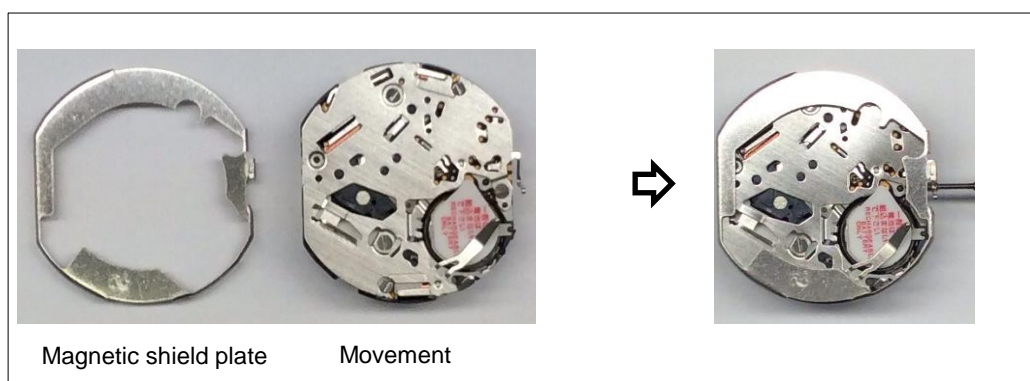
### 13.How to set the dial

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



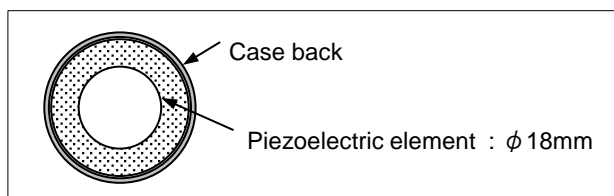
### 14.Magnetic shield plate

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.

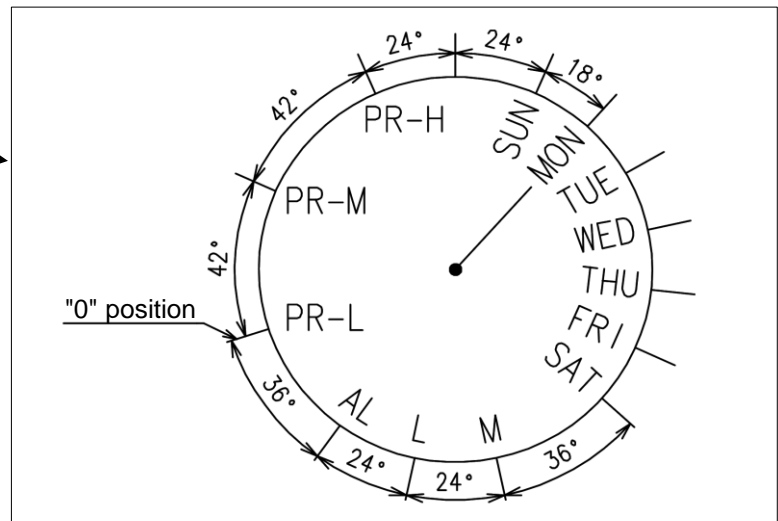
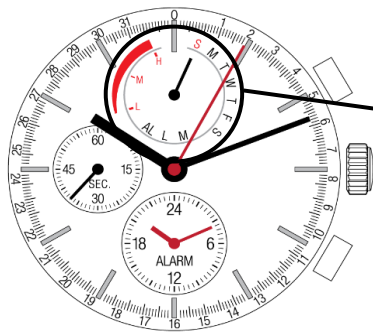
### 16.System reset as complete watch

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

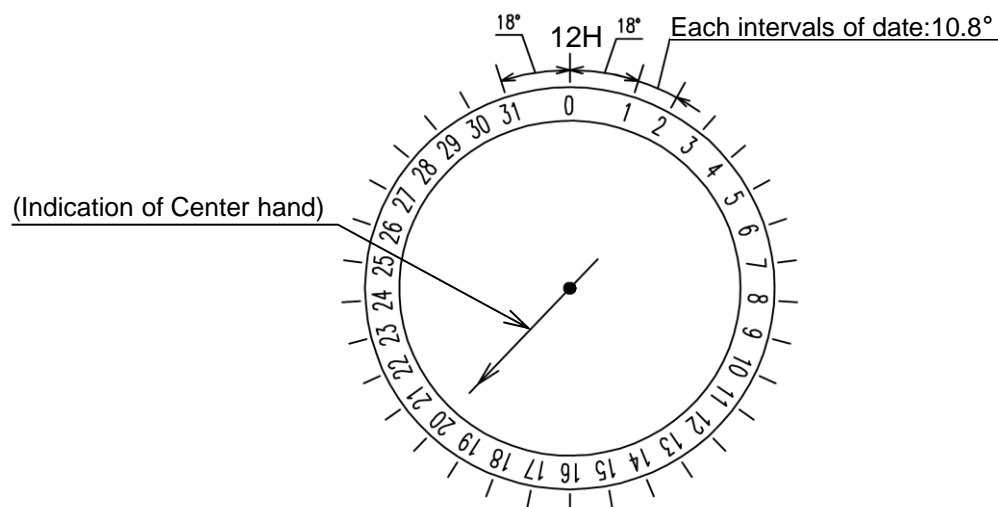


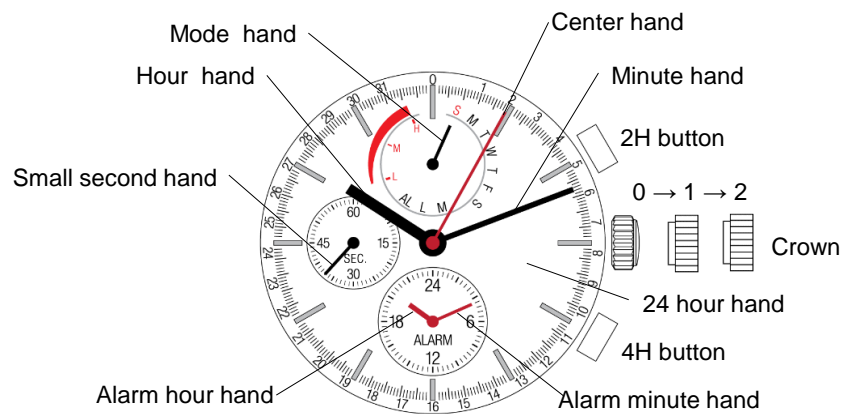
### 2.The start position of mode hand

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

### 3.The design instruction of calendar indicator (Center hand)

Center hand indicate calendar (date) and 1/5 second chronograph.





	Crown position		
	0 click	1st click	2nd click
Crown	Free	Free	Time setting
2H button	[*1]	Alarm time setting (clockwise)	[*3]
4H button	[*1] [*2]	Alarm time setting (counterclockwise)	[*3]

**[\*1] Button operation of each mode (Crown position : 0 click)**

Indication (Mode hand)	Display (Center)	2H button	4H button
→ Day	Date display	Mode change (Month)	Mode change (Chronograph) [*2]
M	Month display	Mode change (Year)	
L	Year display	Mode change (Battery)	
— Battery	Date display	Mode change (Day)	

**[\*2] Button operation of chronograph mode (Crown position : 0 click)**

Indication (Mode hand)	Display (Center)	2H button	4H button
Battery	1/5 second count	Start/Stop	Reset Split / Split release
			Mode change (Day) [*1] (When the chronograph is measuring, it is invalid.)



**[\*3]Branching at the 2nd click**

Pull crown out to the 2nd click position.

Press 2H button for 3 seconds.

→ [\*4]set the "0" position.

Press 2H button

→ [\*5]Set the current time(at 6h small circle) / Day /Date / Month / Year

**[\*4] 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 center hand and alarm hands move and can now be set to correct "0" position.

↓  
 Press the 4H button repeatedly to set the alarm hands to the '0' position.

↓  
 Press 2H button  
 Center hand turns a full round and can now be set to correct "0" position.

↓  
 Press the 4H button repeatedly to set the center hands to the '0' position.

↓  
 Press 2H button  
 Mode hand turns a full round and can now be set to correct "0" position.

↓  
 Press the 4H button repeatedly to set the mode hands to the '0' position.

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

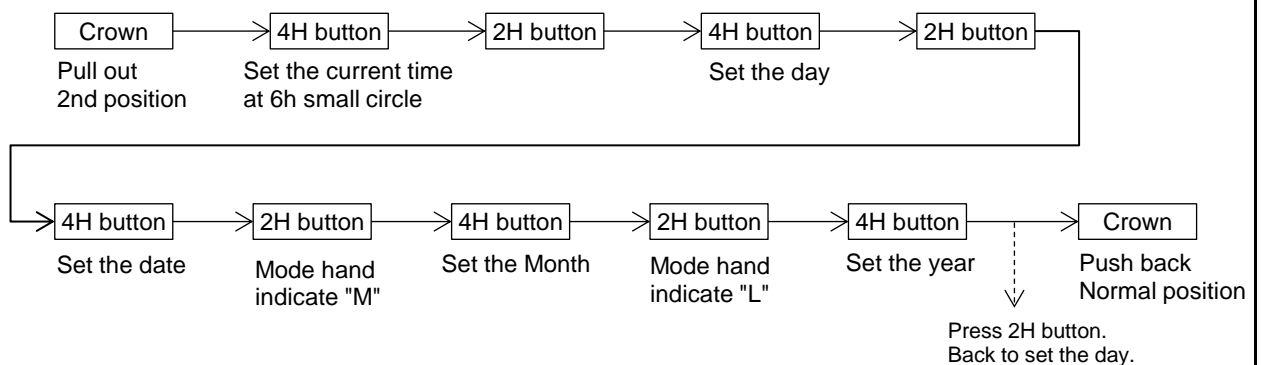
↓  
 Push crown back to normal position.

**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 "0" position after system-reset.

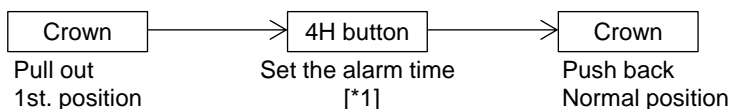
**[\*5] How to set current time (Crown position : 2nd click)****How to set current time.**

- Small watch hands must be set both "0" position and alarm time for the correct indication of alarm and chronograph.
- Center hand must be set the "0" position by the side of chronograph indication.

## Alarm function

- The alarm can be set to ring only once at a designated time within the coming 12 hours.
- The alarm time can be set in one minute increments.
- When the alarm is not set, it displays the current time.

### ■ Set the alarm time



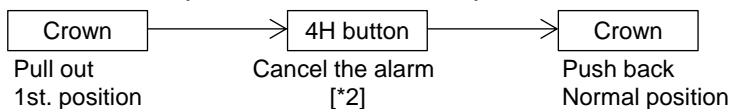
[\*1]

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.  
They stop when the hands reach to the current time.  
Release and press the 4H button, the alarm hands will start moving again.

### ■ 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.
- While the alarm is ringing, no chronograph operation can be made.

### ■ Cancel the alarm (when alarm time is set)



[\*2]

Press and hold 4H button until alarm hands stop and indicate the current time.

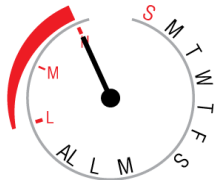
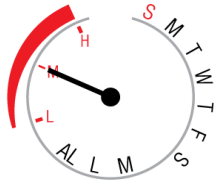
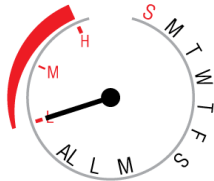
## Perpetual calendar function

- The calendar hand indicate the date, month and year.
- The day hand indicate the day of the week.
- There is no need to adjust the date at the end of the month up to February 28, 2100.

## Battery indicator

In the battery indicator mode, the battery capacity is displayed.  
Even when the chronograph function is activated, the mode hand displays the battery capacity.

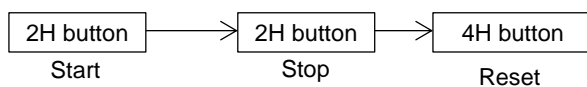
## Battery indicator and duration

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

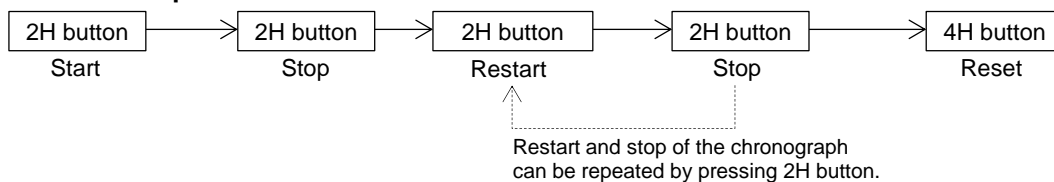
## Chronograph function

- The chronograph can measure up to 60 minutes in 1/5 second increments.
- When the measurement reaches 60 minutes, the chronograph automatically stops counting.

### Standard measurement



### Accumulated elapsed time measurement



### Split time measurement

