



## **INSTRUCTION MANUAL**

**No. 8313-50 Heat Stress Monitor**

**Model SK-181GT**

R.12

**SATO KEIRYOKI MFG.CO.,LTD.**

## Introduction

Thank you for purchasing the Heat Stress Monitor Model SK-181GT.

This product is for measuring temperature, globe temperature, humidity and WBGT Index\*. Do not use it for other purposes.

- \* The heat index (WBGT) is an abbreviation for Wet Bulb Globe temperature, and is an index used to evaluate the heat stress (thermal environment) of workers defined in "ISO7243 / JIS Z8504". Please use as a guide to prevent the heat stress.

Read this manual thoroughly before using the instrument and keep it in a safe place for your future reference.



### PRECAUTION

Make sure you fully understand the following facts about this instrument before use for proper usage.

- This instrument *does not* prevent a heat stress.
- This instrument indicates WBGT index which can be used as guidelines for general heat stress.
- Heat stress is caused not only by high temperature ambient, but also by one's health condition, one's adaptability to hot environment, etc.



### WARNING

Never use this instrument in an atmosphere exposed to inflammable gases as it may explode.



- \* If there is anything you are not clear about this instrument, please contact us or the dealer from which the unit was purchased.



### CAUTION

Please keep to the following cautions for proper use of the instrument.

- Use this instrument in a normal atmosphere only.
- This instrument is not waterproof. Never let the instrument to get wet.
- If the instrument gets condensed with moisture, turn the power off immediately and let it dry naturally before using it again.
- This is a precision instrument. Be careful not to drop or give shocks to it.
- When storing or transporting the instrument, use the tray supplied. Do not use foam cushioning materials (air packing, etc.), polyethylene bags (poly bags, etc.) or non-charged polyethylene bags (generally colored bags such as light blue). Otherwise, the temperature and humidity sensors will be deteriorated
- Never disassemble or alter the instrument to avoid any malfunctions and damages.
- Never directly touch the temperature and humidity sensors.

- Do not use the instrument in dusty environment. Otherwise, the coat of temperature and humidity sensors will deteriorate.
- If the instrument is used in an electrically noisy environment, the instrument could show unstable values and errors in accuracy.
- Using the instrument out of its measuring range can cause malfunctions and damages to both the main unit and sensors. Use within the measuring range.
- Do not leave the instrument in a car, etc. It may become extremely hot in the car in summer and it causes the instrument to malfunction.
- Do not wash or wipe this instrument with alcohol, thinner, or any other solvents. If the instrument gets dirty, wipe it with a tightly wrung towel that has been dipped in warm detergent water.
- If the instrument is not in use for a long period of time, always remove the battery. Otherwise, the battery power may be wasted and the battery fluid may leak, resulting malfunctions.
- Be careful when using the strap. It may cause an unexpected accident such as accidental suffocation around the neck.
- Do not swing the instrument with the neck strap, key ring, or carabiner attached. There is a risk of unexpected accidents or damage.

\* For repairs or calibrations, contact us or the shop that you purchased.

## Overview

The SK-181GT is a handy type heat stress monitor which can measure globe temperature, air temperature and relative humidity.

Compact body, but it has a globe and enables highly reliable measurement.

## Features

- JIS B7922:2023 class 2 compliant  
Compliant with JIS B7922:2023 class 2 (electronic Wet Bulb Globe Temperature (WBGT) index meter). It can be used as a guideline for preventing heat stress in sports activities, daily life, and labor.
- Globe is equipped  
The radiation heat (globe temperature) from direct sunlight can be measured.
- Potable design  
Compact size to be portable
- Supports two types of heat stress prevention guidelines  
Display is switchable between the “Heat stress prevention guidelines for exercise (\* 1)” and the “Heat stress prevention guidelines for daily life (\* 2)”.

(\*1) The “Heat stress prevention guidelines for exercise” compiled by the Japan Sport Association

(\*2) The “Heat stress prevention guidelines for daily life” complied by Japanese Society of biometeorology

- **WBGT measurement environment settings**

The formula for calculating the heat index (WBGT) differs between outdoor measurements and indoor measurements. The instrument can switch between outdoor and indoor measurements.

- **Alarm function**

If the measured value reaches the set limit value of the heat stress index, a buzzer sounds and the LED lamp flashes to alert.

- **Screw hole for a tripod is equipped**

Useful to mount the tripod at measurement

- **Accessories**

Carabiner, belt attachment parts, and neck strap are attached.

## **Cautions before Use**

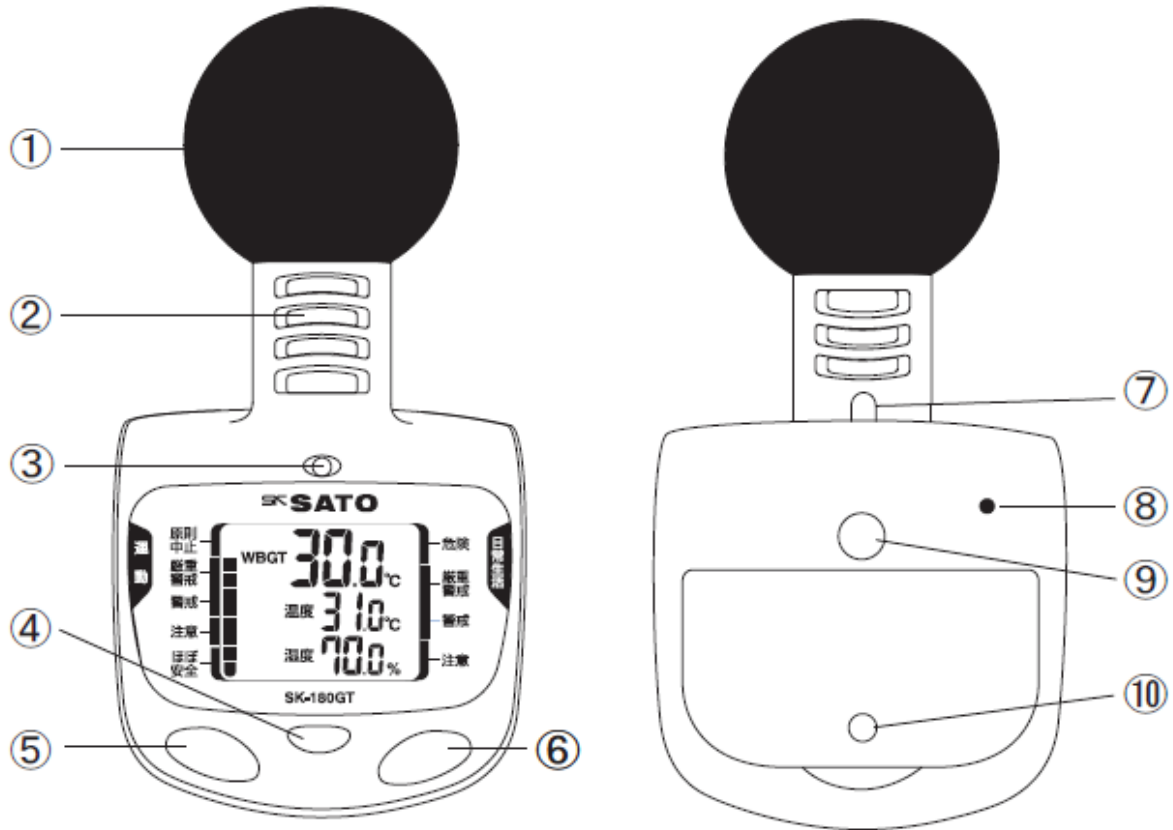
Check that the unit was not damaged during transport. Also, check if any accessories are missing before use.

If any damage or missing items are found, contact us or the dealer from where you bought the unit.

## Names of Components

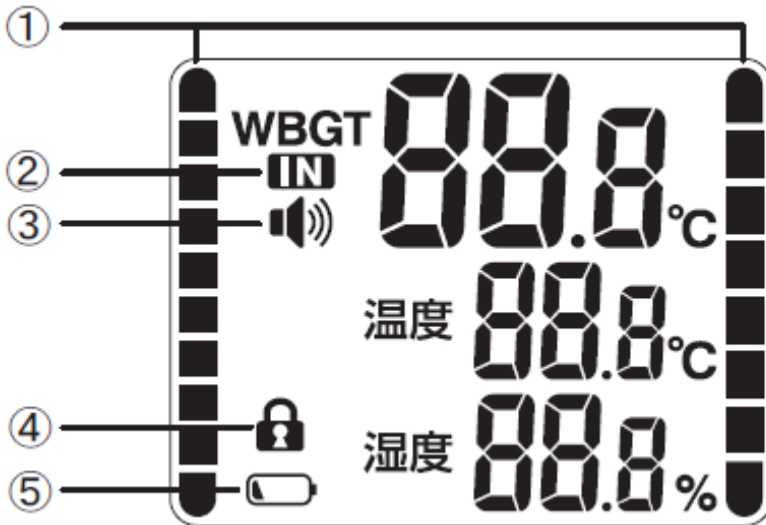
Front view

Rear view



- |   |                       |  |
|---|-----------------------|--|
| ① | Globe                 | Inside the globe, there is a sensor to measure the radiation heat.   |
| ② | Sensing Section       | Temperature and humidity sensors are inside of this section  |
| ③ | LED lamp              | The LED lamp blinks to alert   |
| ④ | POWER key             | On/Off key<br>Press this key to turn the main unit on. Press it again to turn off.   |
| ⑤ | MENU key              | Press this key to enter the setting mode.  |
| ⑥ | SELECT key            | In measuring mode, press this key to switch WBGT setting between outdoor and indoor.<br><br>In setting mode, press this key to change the setting value. |
| ⑦ | Hook for key ring     | Install the key ring through this hook   |
| ⑧ | Buzzer speaker        |  |
| ⑨ | Scerw hole for Tripod |  |
| ⑩ | Battery compartment   | Battery compartment and cover with screw.  |

## LCD Display



- |                     |  |
|---------------------|--|
| ① Heat stress index | Left: Display 5 stages of the “Heat stress prevention guidelines for exercise” in 10 levels.<br>Right: Display 4 stages of the “Heat stress prevention guidelines for daily life” in 8 levels. |
| ② Indoor Mark       | Indication for indoor values in WBGT mode  |
| ③ Buzzer Mark       | Indication of buzzer setting   |
| ④ Keylock Mark      | Indication of keylock.   |
| ⑤ Low Battery Mark  | Indication of low battery. Replace immediately when it is displayed.   |

## How to use

### Loading and Replacing Battery

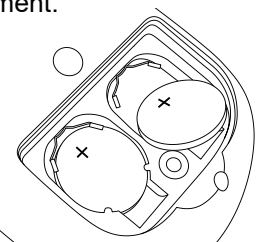
Before using the instrument for the first time, install a new battery.

When low battery mark appears on the display, replace the battery to new one.

- ① Use a “+” screwdriver to loosen the screw counterclockwise on the battery compartment.

NOTE: The screw is attached to the battery cover so that the screw cannot be removed from the battery cover. If the screw is forcibly removed, the battery cover will be damaged.

- ② Remove the old battery if replacing the battery.
- ③ Set a new lithium coin battery (CR2032) with correct polarity that “+” is facing up.
- ④ Close the battery cover and secure it with the screw.





## CAUTION

- Once the “Low Battery Mark” starts to light, replace with new batteries immediately.
- Even if the unused battery if it has been stored very long time may cause a malfunction (such as a buzzer sounding without being displayed). If this happens, replace with a new battery.
- Both batteries must be the same type, and use all new ones. Different types or mixing with old batteries may cause rupture or leakage.
- Do not dispose of the used battery in a fire. Doing so may cause an explosion which may lead to an injury.
- For the environment conservation, dispose the used batteries in compliance with local rules and regulations.
- Keep batteries out of reach of children. If swallowed, contact a medical assistance immediately.

## How to Measure

- ① Turn on the power by pressing the POWER key for longer than 2 seconds. After all characters are lit in the display section for one second with the buzzer sound and LED lamp flashes, enter the measuring mode.
- ② Have the instrument fully adapt to measuring ambient before measurement.  
The heat index (WBGT), temperature, humidity, and heat stress level are displayed
- ③ Press the POWER key for longer than 2 seconds to turn off.



## CAUTION

- Abrupt change of ambient temperature can effect on the accuracy of the instrument. Have the instrument fully adapt to measuring ambient before use.
- When the wind speed of the measurement environment is other than 0.3 to 3.0 m/s, an error may occur in the heat index (WBGT).

## How to Install

- ① Installing on a tripod  
Attach the tripod (Cat. No.8310-80 Model M45) to the tripod screw hole on the unit.  
Installation position: 1.2 to 1.5m above the ground.
- ② Wearing the instrument  
Use the attached accessories (carabiner, belt attachment parts, and neck strap) to wear the instrument.



## CAUTION

- Install so that the globe is on top.

- Do not block the vent of the temperature / humidity detector.
- When wearing the instrument, do not cover the instrument with clothing.
- When measuring in a sunny place, make sure that the entire globe is exposed to direct sunlight. Do not let obstacles or clothing block the direct sunlight.

## Switching WBGT measurement environment

The formula for calculating the heat index (WBGT) differs between outdoor and indoor measurement environments. Switch the instrument's outdoor / indoor settings according to the measurement environment.

\* The factory default setting is "Outdoor".

## How to set the WBGT measurement environment

Press the SELECT key in the measurement mode to choose the WBGT measurement environment setting.

Measurement environment	Environment Mark	Usage
Outdoor	<b>IN</b> mark is not displayed	When used outdoor (place in the sun)
Indoor	<b>IN</b> mark is displayed	When used indoor or outdoor at the place not in the sun

## Keylock function

To prevent the incorrect operation, the keylock function is equipped.

### . How to activate the keylock function

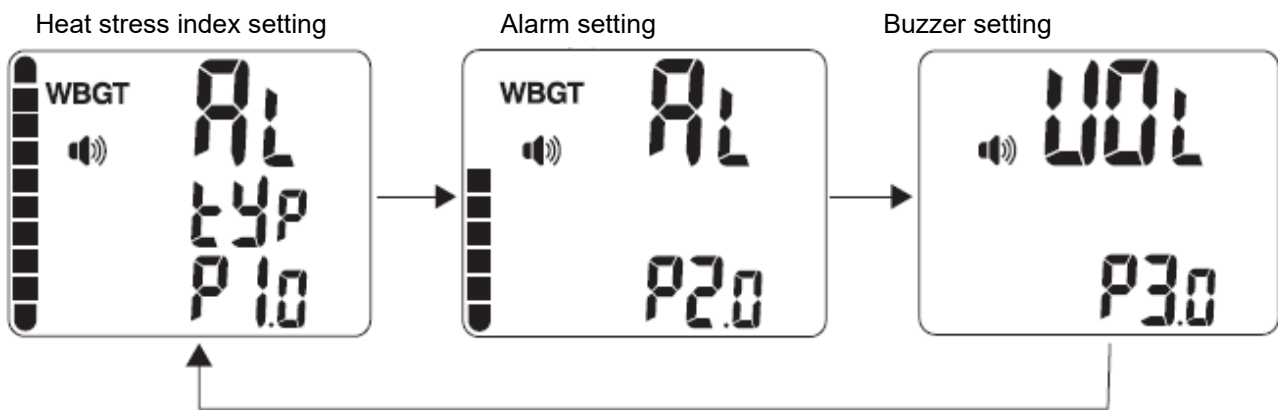
- ① Press the MENU and SELECT key simultaneously in the measurement mode for longer than 2 seconds. The keylock mark lights up and the key is locked.
- ② To cancel the keylock function, repeat ①. The keylock mark turns off and the keylock function is canceled.

## Various functions settings

### How to set the "Heat stress index" and alarm

- ① Turn on the power. Press the MENU and SELECT key simultaneously for longer than 2 seconds to enter the setting mode.
- ② Press the MENU key to switch the setting mode as shown below.





## Display of Heat stress index

This instrument use bar graph to display the “Heat stress index” based on the “Heat stress prevention guidelines for exercise” or based on the “Heat stress prevention guidelines for daily life”, which are derived from the measured heat index (WBGT). The “Heat stress index” of measurement environment can be easily checked.

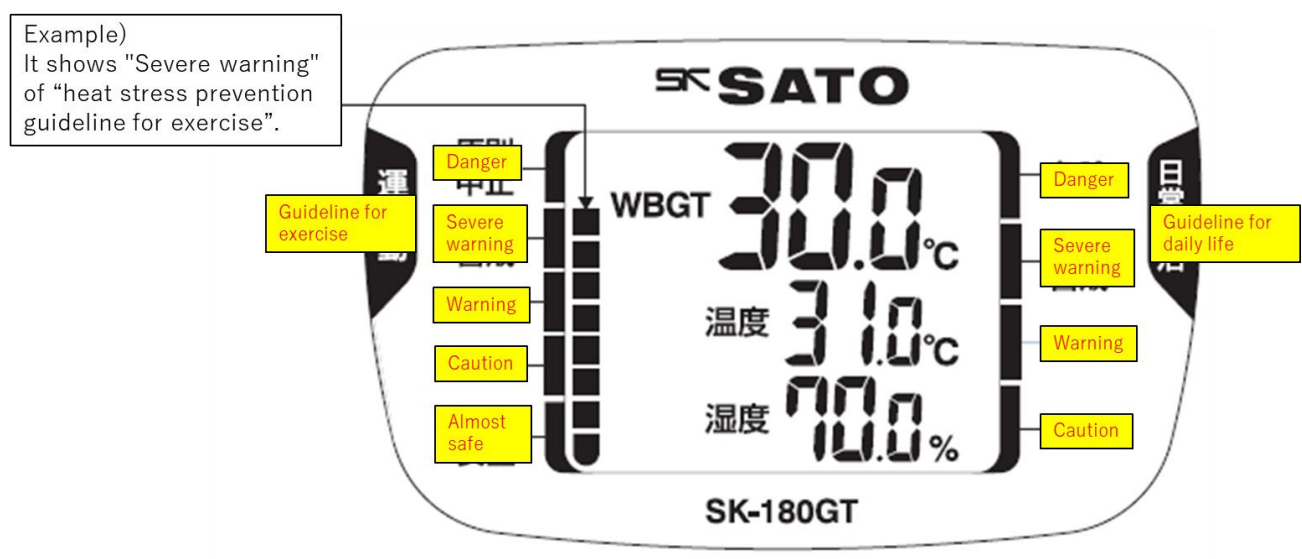
\* The factory setting is set as the “Heat stress prevention guidelines for exercise”.

① The “Heat stress prevention guidelines for exercise”.

5 steps (“Almost safe”, “Caution”, “Warning”, “Severe warning”, “Danger”) are displayed in bar graph of 10 levels.

② The “Heat stress prevention guidelines for daily life”.

4 steps (“Caution”, “Warning”, “Severe warning”, “Danger”) are displayed in bar graph of 8 levels.



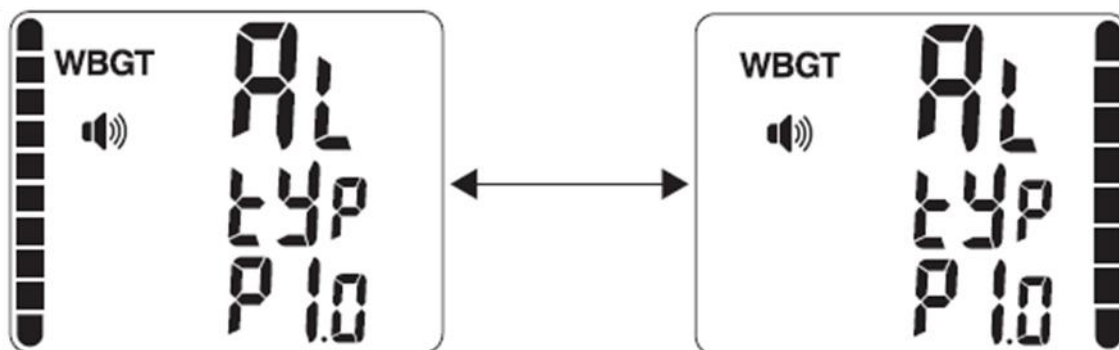
Please refer to the “Reference data” section for more information regarding each guideline for heat stress prevention.

**How to set “Heat stress index”**

- ① Press the MENU key in the setting mode to enter the “heat stress index” setting.
- ② Press the SELECT key to choose the guideline of heat stress index.

heat stress prevention guidelines for exercise.

heat stress prevention guidelines for daily life



“Heat stress index” setting	Usage
Heat stress prevention guidelines for exercise	Guidelines for preventing heat stress in sports activities.
Heat stress prevention guidelines for daily life	Guideline for preventing heat stress in daily life.

- ③ Press the MENU key to continue to the alarm setting.  
To return to the measurement mode, press the MENU key for longer than 2 seconds.

**Alarm Function**

The alarm is triggered with sound of buzzer and blinking LED light when the “Heat stress index” exceeds the set value.

\* The factory setting is “Severe Warning” in the “Heat stress prevention guidelines for exercise” with buzzer ON.

• **Alarm action**

- If the measured value reached to set “Heat stress index”, an alarm is activated for 10 seconds.
- If measured value continues to exceed the set “Heat stress index”, the alarm will be activated for 2 seconds every 10 minutes.
- If the “Heat stress index” is higher than set limit and if there is an increase or decrease in the “Heat stress index”, an alarm will be activated for 10 seconds to notify the change.

The Buzzer sound: The different buzzers will be activated depending on the “Heat stress index”.

Heat stress prevention guidelines for exercise	Heat stress prevention guidelines for daily life	Buzzer sound
Almost safe / Caution	Caution	Beep, Beep, Beep
Warning	Warning	Beep-Beep, Beep-Beep,
Severe warning	Severe warning	Beep-Beep-Beep, Beep-Beep-Beep
Danger	Danger	Beeep, Beeep (long beep)

The LED lamp flashes: The LED lamp flashes while the alarm is sounding.

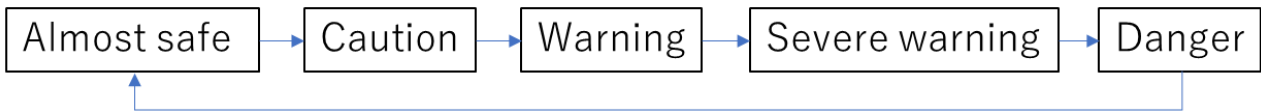
\* If the alarm sounds, take the appropriate actions to prevent the heat stress.

Please refer to the “Reference data” for the actions of the heat stress prevention guidelines.

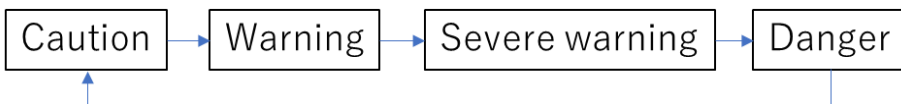
• **How to set alarm function**

- ① Press the MENU key in the setting mode to enter the Alarm Setting.
- ② Press the SELECT key to choose the “Heat stress index”. The bar lights up to the Heat stress index to be set.

The “Heat stress prevention guidelines for exercise”



The “Heat stress prevention guidelines for daily life”



\*The Alarm Setting cannot be canceled.

- ③ To continue to the buzzer setting, press the MENU key.  
To return to the measurement mode, press the MENU key for longer than 2 seconds.

● **How to set Buzzer function**

① Press the SELECT key in the buzzer setting to set buzzer ON/OFF.

Buzzer Mark	Description
🔊 is displayed	Buzzer ON
🔊 is not displayed)	Buzzer OFF

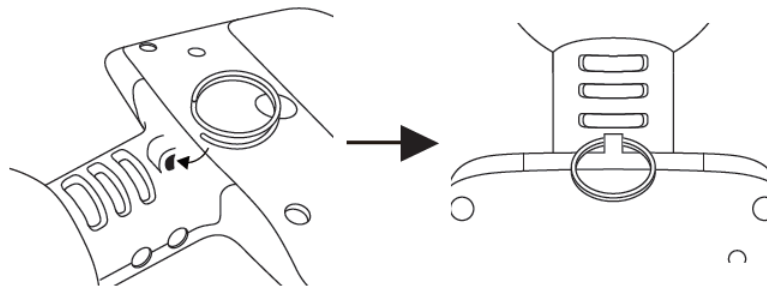
\* When the buzzer is OFF, the alarm action is only LED flashing.

LED flashing cannot be turned off.

② Press the MENU key for longer than 2 seconds to return to the measurement mode.

**How to install the mounting accessories**

The instrument can be worn with the mounting accessories. When attaching the mounting accessories, pass the key ring through the ring hole of the unit as shown below.



• Neck strap

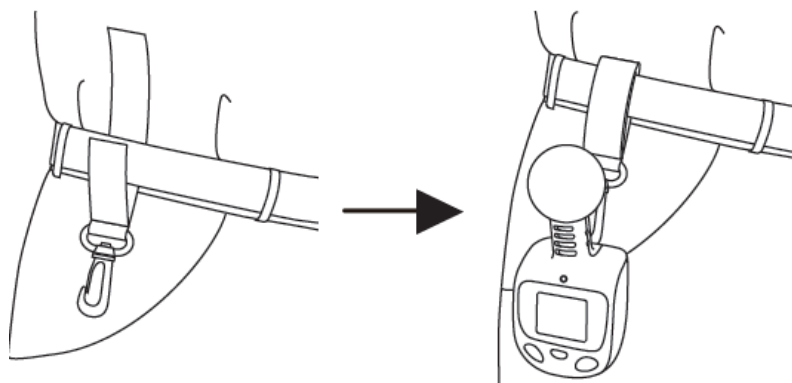
Used when hanging the instrument from the neck

• Carabiner

Used when hooking the instrument.

• Belt attachment parts

Used when fixing the instrument to the belt. Fasten the belt mounting parts to the belt as shown in the figure below and attach the instrument.





## CAUTION

- Be cautious when using the neck strap. It may cause an unexpected accident such as accidental suffocation around the neck.
- Do not swing the instrument with the neck strap, key ring, or carabiner attached. There are the risks of unexpected accidents or damages.

### Reference Data

The followings are a reference material about the heat stress index (WBGT).

The Wet Bulb Globe Temperature (WBGT) is a composite temperature used to estimate the effect of temperature, humidity, and solar radiation (globe temperature) on humans. It is used by industrial hygienist, athletes, and the military to determine appropriate exposure levels to high temperatures. It is derived from the following formulas.

**Outdoors:**  $WBGT = 0.7 \times WB + 0.2 \times TG + 0.1 \times DB$

**Indoors:**  $WBGT = 0.7 \times WB + 0.3 \times TG$

WB = Wet bulb temperature

TG = Globe temperature

DB = Dry bulb temperature

### The “Heat stress prevention guidelines for exercise” compiled by Japan Sports Association

WBGT	Wet bulb temperature	Dry bulb temperature	Warning level	Guides to how much exercise can be safely performed
Above 31°C	Above 27°C	Above 35°C	Danger	Except for special cases, all exercise should be stopped. It should be discontinued especially for children.
28 to 31°C	24 to 27°C	31 to 35°C	Severe Warning	The risk of heat stress is high, so avoid exercises that tend to increase body temperature, such as intense exercise or endurance running
25 to 28°C	21 to 24°C	28 to 31°C	Warning	The risk of heat stress increases, so take a break and replenish water with salt as appropriate. In intense exercise, have a rest every 30 minutes.

21 to 25°C	18 to 21°C	24 to 28°C	Caution	There is a possibility of fatal accidents due to heat stress. Pay attention to signs of heat stress, and actively drink plenty of fluid and take salt to keep sodium balance between exercises.
Below 21°C	Below 18°C	Below 24°C	Almost safe	The risk of heat stress is usually low, but supplementation with water and salt is necessary. Heat stress could occur even under these conditions in events such as marathons, so caution is advised.

Reference: Japan Sports Association, "A Guidebook for the Prevention of Heat Disorder During Sports Activities", 2013.

**The “Heat stress prevention guidelines for daily life” complied by Japanese Society of Biometeorology**

WBGT Index	Risk of occurrence in relation to physical activity	Remarks
Danger (31°C or higher)	Risk during any physical activity	Risk of occurrence is high in the elderly, even in the resting state. Avoid going out and stay in a cool room
Severe warning (28 to 31°C)		Avoid direct sunlight outdoors and watch for any rise in room temperature indoors
Warning (25 to 28°C)	Risk during moderate to vigorous physical activity	Regularly take adequate rest when exercising or doing vigorous work.
Caution (25°C or lower)	Risk during very vigorous physical activity	Basically, low in risk, but high in risk when doing vigorous exercise or heavy labor

## Errors Displays and Safety Instructions

If there is a malfunction detected, one of the following error codes will be displayed.

Type	Code	Description	Solution
WBGT Temperature Humidity	<b>E02</b>	The measured value is under the display range.	Use within the measuring range. If doing so still does not solve the problem, there is a possibility that the sensor could be malfunctioning.
	<b>E03</b>	The measured value is over the display range.	
WBGT	<b>E04</b>	Unable to calculate the heat index WBGT.	Use within the measuring range. If doing so still does not solve the problem, there is a possibility that the sensor could be malfunctioning.

If an error message other than the above is displayed or If the above-mentioned solution doesn't work, please contact us or the dealer from which the unit was purchased for assistance.

## Trouble shooting

Trouble	Possible Cause	Solution
The power cannot be turned on.	The battery is exhausted.	Replace with new batteries.
The displayed value is not stable.	The instrument does not adapt in the ambient temperature	Let the instrument adapt to the ambient before use.
	The electric noises generated from the environment may affect	Do not use the unit in the circumstances where electric noises are generated. Doing so may result in unstable display or large errors.
Abnormal value is displayed.	The electric noises generated from the environment may affect	Do not use the unit in the circumstances where electric noises are generated. Doing so may result in unstable display or large errors.

If the above-mentioned solution doesn't work, please contact us or the dealer from which the unit was purchased for assistance.

## **Specifications**

Cat. No.	: No. 8313-50		
Model	: SK-181GT		
Measuring Range	Temperature	:	0.0 to 50.0°C
	Globe Temperature*	:	0.0 to 60.0°C
	WBGT	:	0.0 to 50.0°C
	Humidity	:	10.0 to 95.0% rh
	Accuracy	Temperature	:
	Globe Temperature*	:	± 0.6°C (20.0 to 40.0°C) : ± 1.0°C for others
	WBGT	:	± 2.0°C (20.0 to 40.0°C) : ± 3.0°C for others
	Humidity	:	± 5.0% rh (30% to 90% at 20 to 30°C) ± 7.0% rh for others
Resolution	: 0.1		
Sampling Time	: Approx. 20 seconds		
Conformity Standards	: Confirming to JIS B7922:2023 Class 2		
Operation Ambient	: 0 to 50°C, less than 95% rh (no condensing), Wind speed 0.3 to 3.0 m/s		
Storage Ambient	: -10 to 50°C (no condensing)		
Power Requirement	: 3VDC (Lithium coin battery (CR2032) × 2 (in parallel connection))		
Battery Life	: Approx. 6 months in continuous use with alarm activated twice a day		
Materials (case, globe)	: ABS resin		
Dimensions	Body	:	(W) 60 × (H) 122 × (D) 25 mm
	Globe	:	∅ 40 mm
Weight	: Approx. 70 g (including battery)		
Standard Accessories	: Instruction manual, Lithium coin battery (CR2032) × 2, neck strap x 1, carabiner x1, belt attachment parts x1, key ring x1		

\*Globe temperature is not displayed.

\*\*All specifications and appearance are subject to change without notice for improvement purpose.

## **Optional Accessories**

No. 8310-90      Tripod for SK-181GT      Model ZF-400WSH

For details, contact us or a retailer from which you have purchased.

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