

Wireless EMG sensor

user manual

Thank you for purchasing Wireless EMG sensor. Model: RR-ES-V01.

The product's manufacture date can be found on the label, and the shelf life is 3 years. Before using Wireless EMG sensor, please carefully read the user manual for proper use. Please keep this user manual properly after reading, so that it can be consulted at any time when needed.

Revision date of manual: 2025.06.02, Revision A,

Wireless EMG sensor firmware: EMGSENSOR-FIRMWARE-1-V1

If you have any questions regarding the product, please contact:

After-sales service unit: Vincent Medical (Dongguan) Technology Co., Ltd.

Address: Rm101 & 201, Block 10, 1 Taoyuan Road, Songshan Lake Zone, Dongguan City, Guangdong Province, P.R.C.

Postal code: 523808

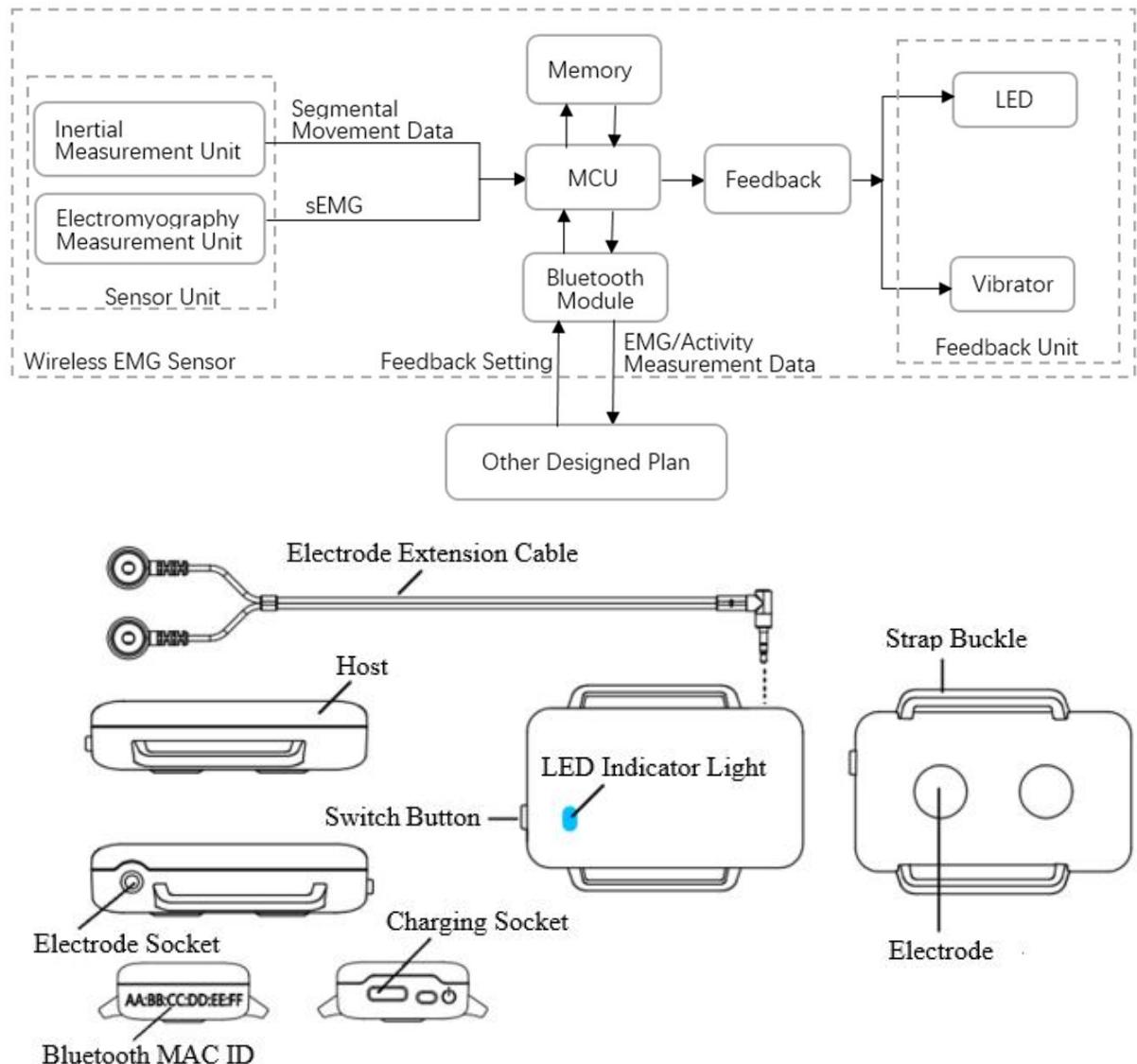
Telephone: 0769-21667506

1. Introduction

Wireless EMG sensor is a device that controls equipment by detecting muscle electrical signals. In terms of control, different voltage signals emitted by muscle contraction are used to control the equipment. Through secondary development, EMG signal control can be achieved, such as toys, home appliances, etc. When purchasing, a testing app will be provided.

Component	Describe
MCU	Built in microcontroller, driving the main functions of the Wireless EMG sensor instrument: data acquisition, processing, storage, and transmission, analyzing the collected data, and controlling the output of the feedback unit according to the set feedback scheme.
Sensing unit	Built in electromyographic, electrodes/signal, amplifiers/noise, filters and IMU, capable of collecting biological electromyographic, activity data and dynamic motion data during muscle rest or contraction.
Feedback unit	Cooperate with the pre-set feedback, plan to provide feedback on the activity of body muscles and limb movements to the user
Memory	The built-in 128MB, memory can store collected electromyography, exercise data offline.
Bluetooth	Using low-power-Bluetooth (version 5.0), to wirelessly transmit data to third-party developed, adaptive devices via a private data protocol, or to receive modified settings of electromyography sensors from the adaptive devices.
Power	Powered by lithium-batterie. Charging lithium-batterie using USB, Type-C, interface and charging cable.
Electrode extension cable	After connecting the Electrode extension cable, the system will collect electromyographic signals from the extension cord electrode, while disabling the electrode at the bottom of the control box. Both cannot be used simultaneously.
Fixing device	Wireless EMG sensor can be fixed to different, parts of the body with double-

Component	Describe
	sided tape/straps, and the electrodes, at the bottom of the electromyography, sensor can be placed close to the surface of the user's skin.



2. Bluetooth

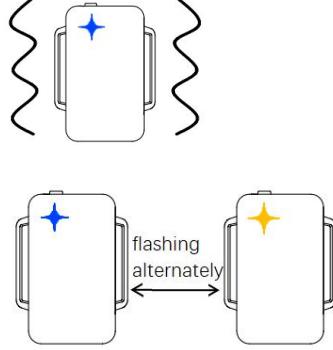
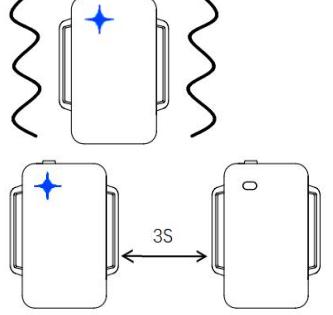
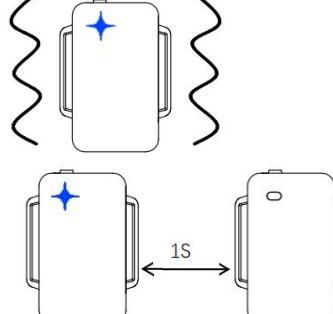
The wireless EMG sensor, connects to paired devices via low-energy Bluetooth to enable data transmission.

The wireless EMG sensor, needs to enter pairing mode before connecting to a new device, in order to pair the low-energy Bluetooth with the device.

In pairing mode, the wireless EMG sensor's low-energy Bluetooth continuously broadcasts signals,

Waiting for new paired devices, to detect the signals and then initiate pairing and subscription. The same group of Bluetooth devices only needs to be paired once. The optimal number of device pairings is up to 4, which ensures the most stable signal transmission. The more pairings there are, the more delayed the data transmission becomes

Methods for Pairing and Connecting Bluetooth for Wireless EMG Sensor

Status	Status indicator light
Pairing mode	<p>When the device is turned off, press and hold the button for about 7 seconds. Release the button when the device vibrates for the second time. The device will enter pairing mode, during which the blue and orange lights will flash alternately.</p> <p>After successfully pairing, the device will automatically switch to standby mode.</p> <p>If the device fails to complete pairing, the pairing mode will automatically end and shut down after 2 minutes.</p> 
Standby mode	<p>In the off state of the device, press and hold the button for about three seconds. When the device vibrates once, release the button to turn on the device.</p> <p>In standby mode without a Bluetooth connection, the blue indicator light will flash once every 3 seconds.</p> 
Streaming mode	<p>In standby mode, when the equipped device connects to a Bluetooth device, it will vibrate continuously for 1 second.</p> <p>The blue indicator light flashes once every second, indicating that the device is in streaming mode after being connected via Bluetooth.</p> 



: Indicator light is flashing.



: Indicator light stays continuously lit.

3. Installation and Wearing

When using the wireless EMG sensor, the two electrodes need to make direct contact with the skin surface, and be secured above the muscle to be tested. We usually need to use double-sided tape to attach the sensor to the skin surface, or use straps to secure the sensor to the user's limb.

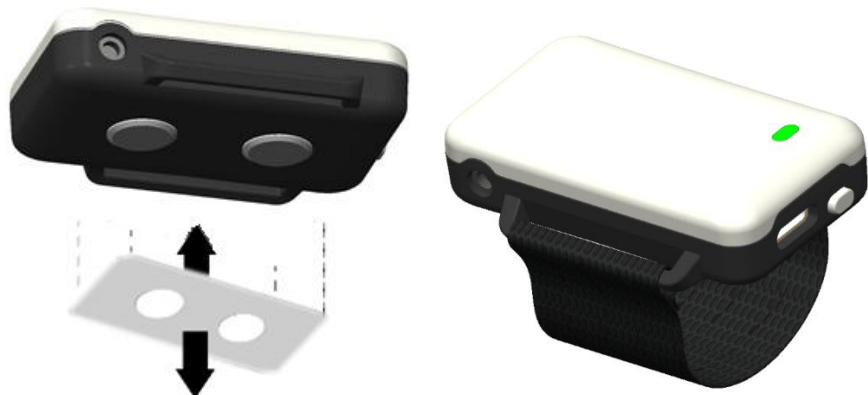


Figure 1 L : Fix the Sensor Using Double-sided Tape / R : Use Strap to Secure the Sensor

Use Scenario 1 :

When the space around the target muscle is limited and it is not possible to directly attach the wireless EMG sensor to the skin, you can use an electrode extension cable to secure the wireless sensor at a closer position. To minimize the impact on hand gripping activities, thinner and smaller electrodes can be applied to the palm.

Use Scenario 2 :

You can also mount the wireless EMG sensor on the dorsum of the shoe and secure it with the shoelaces.

Subsequently, an electrode extension cable can be used to extend the electrode to the skin surface over the tibia in the anterior lower leg, allowing for the measurement of the tibialis anterior muscle that controls dorsiflexion of the foot .

Precautions :

When the electrode extension line is connected to the sensor, the electrodes at the bottom of the sensor will become inactive, so these two types of electrodes cannot be used simultaneously. Only the electrodes on the connected extension line can collect surface electromyography signals.

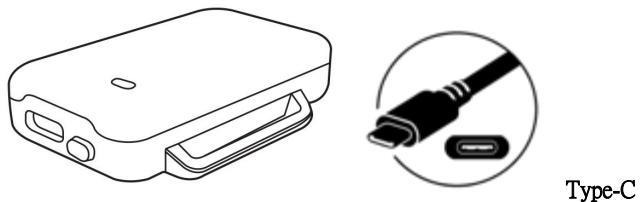
Figure 2	Figure 3
<p>By using electrode extension lines, the sensor can be placed on the limb, thereby reducing interference and restriction on limb movement.</p>	<p>You can secure the sensor to the shoe using shoelaces, and then use electrode extension wires to measure the muscle electrical activity in other parts of the body.</p>

Note: The electrode extension wires require two additional disposable electrode pads, which can be secured to the electrode port at the end of the extension wire using a button form. Disposable electrode pads are consumables and can be purchased separately from the distributor if needed.

4. Charging

The wireless EMG sensor is equipped with a USB Type-C charging port. Please use USB

Type-C cable to charge the device. This product only includes the wireless EMG sensor. Please prepare a suitable USB Type-C charger and charging cable on your own. The lithium battery specification for the wireless EMG sensor is 300mAh and 3.7V. The working duration with a new battery under different operating conditions is detailed in Table 8.21a.



5. Battery

The performance of the device's indicator lights under different battery level states :

Status	Status indicator light
Shutdown	Press and hold the button for about 3 seconds, and the device will vibrate briefly while the blue indicator light flashes.
The battery is depleted	After holding the button for about 3 seconds, the device showed no response and did not vibrate
The battery is too low	When the device is powered on, the indicator light flashes orange once every second.
During charging	During battery charging, the orange indicator light stays continuously lit.
The battery charging is complete	When the battery charging is complete, the purple indicator light stays continuously lit.
The device is in standby mode	After powering on, the blue indicator light flashes every 3 seconds, indicating that the device is in Bluetooth pairing mode. If the device remains in standby mode without a Bluetooth connection for 2 minutes, it will automatically power off.



6. Data collection mode

After successfully connecting the Bluetooth device, you can press "Next" to enter the EMG measurement page. On this page, the mobile software will continuously monitor and display the changes in the target EMG, signal in real time, as well as display the current root mean square (RMS), value of the EMG, signal in real time.

You can press a button to toggle, the display of the surface electromyography (sEMG), signals. In the signal chart, the sEMG will be represented by a blue line.

You can press a button to toggle, the display of the root mean square (RMS), of the surface electromyography (sEMG), signals. In the signal chart, the RMS, will be represented by a red line. The root mean square (RMS), of surface EMG signals is defined as calculating the average of the squared values, of a set of surface EMG signals, and then taking the square root of that average.

The root mean square (RMS), results in a smooth linear envelope used to estimate the average amplitude of signals composed of positive and negative oscillations. As shown in Figure 4, the red root mean

square curve illustrates the variation of the measured, surface electromyography signal's effective value.

The following is the calculation formula for the root mean square (RMS) of electromyography signals.

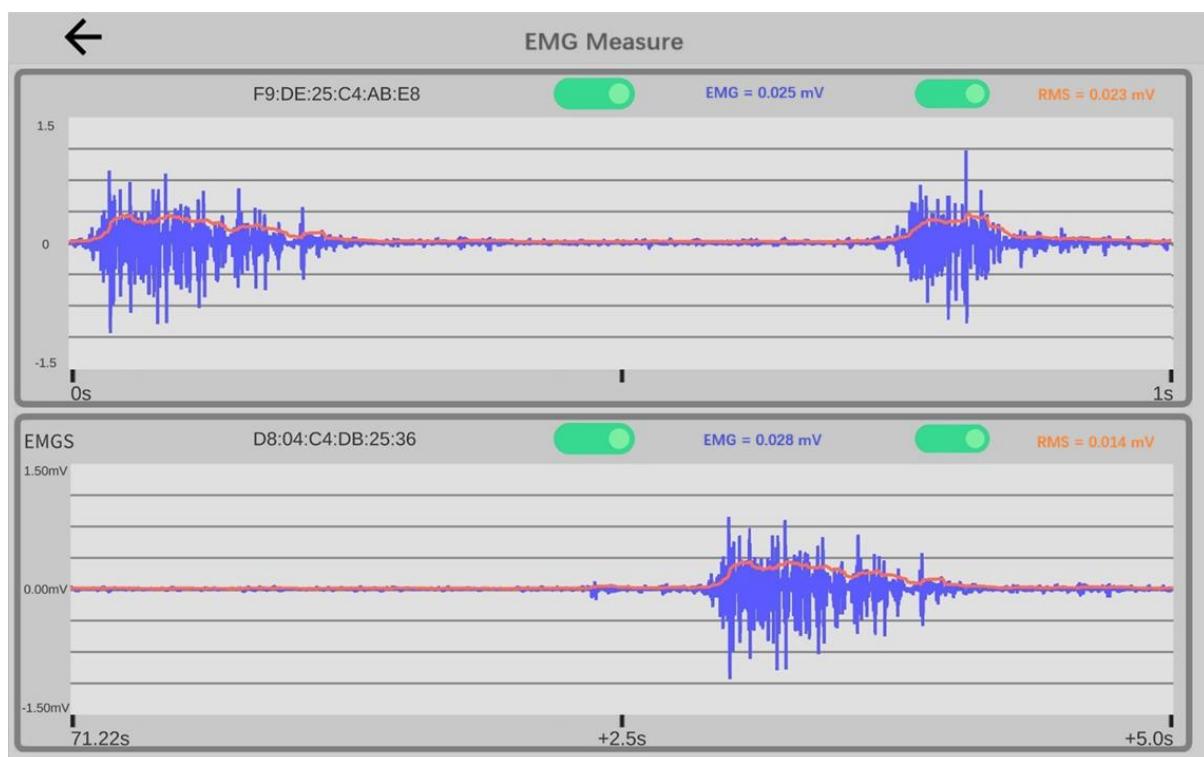


Figure 4 Data display page

7. Data Description

The following are the data contents and applicable settings that can be collected by wireless EMG sensor.

Date	Sensor	Description/Specification
sEMG	EMG electrodes, signal amplifiers, noise filters	sampling frequency : 1000 Hz Sampling bits (resolution) : 16 位 Voltage amplitude of microprocessor : 3V Computable square mean (Root Mean Square , RMS)

		$RMS = \sqrt{\frac{1}{N} \sum_i^N x_i^2}$
Rotational angular velocity (three-axis)*X、Y、Z	gyroscope	Optional sampling frequency : 1-255 Hz Optional total-range : $\pm 250\text{dps}, \pm 500\text{dps}, \pm 1000\text{dps}, \pm 2000\text{dps}$
Mobile acceleration (three-axis) * X、Y、Z	accelerometer	Optional sampling frequency : 1-255 Hz Optional total-range : $2\text{g}, \pm 4\text{g}, \pm 8\text{g}, \pm 16\text{g}$ Optional elimination of gravitational acceleration effects
Magnetic induction intensity (three-axis) * X、Y、Z	magnetometer	Optional sampling frequency : 1-70 Hz
Time Stamp	Real Time Clock	Using Coordinated Universal Time (UTC), adjustable/calibrated.
Does the feedback data exceed the threshold	/	Exceeding/falling below the threshold. Determine whether the monitored data stream value exceeds the threshold based on the pre-set feedback plan.
sEMG monitoring record	/	According to the established monitoring plan, record the user's electromyographic signal activity

* Based on the IMU, the three-dimensional rotation vector can be calculated.

8. Specification

Specification	Value
Model	RR_ES_V01
Size	Length : $52.5\text{ mm} \pm 0.5\text{mm}$ Width : $38.5\text{ mm} \pm 0.5\text{mm}$ Height : $13.8\text{ mm} \pm 0.5\text{mm}$
Sampling rate of surface electromyography signals	1000 Hz
Variable value of sampling rate for rotational angular velocity	1-255 Hz
Variable range of rotational angular velocity across the entire range	$\pm 250\text{dps}, \pm 500\text{dps}, \pm 1000\text{dps}, \pm 2000\text{dps}$
Variable value of mobile acceleration sampling rate	1-255 Hz
Variable range of mobile acceleration over the full range	$\pm 2\text{g}, \pm 4\text{g}, \pm 8\text{g}, \pm 16\text{g}$
Variable sampling rate of magnetic induction intensity	1-70 Hz
Battery	300mAh, 3.7V
Endurance	4 hours
Input	USB Type-C, 5V dc, 500mA

9. Other function/setting

The following list provides all the functions that users can operate.

Some functions can be operated using the device's buttons, while access to other functions requires the use of Bluetooth command sets, in conjunction with third-party developed applications and compatible devices. If software developers need a detailed Bluetooth instruction set, please request the software development manual from the vendor for reference :

Function	Operate	Bluetooth Command Set
Power on	✓	

Power off	✓	
Enter pairing mode	✓	
Adjust feedback threshold		✓
Start/Stop Online Streaming Mode		✓
		✓ Raw data
Initiate data acquisition of sEMG		✓ Calibration data
		✓ Root mean square
Initiate data collection for rotational angular velocity		✓ Raw data
		✓ Calibration data
		✓ Raw data
Initiate data collection for mobile acceleration		✓ Calibration data
		✓ Eliminate the influence of gravity acceleration
Initiate data collection of magnetic induction intensity		✓ Raw data
		✓ Calibration data
Adjust the sampling frequency of the rotational angular velocity		✓
Adjust the sampling frequency of the moving acceleration		✓
Adjust the sampling frequency of magnetic induction intensity		✓
Adjust the total-range of rotational angular velocity		✓
Adjust the total-range of mobile acceleration		✓
Adjust the sampling frequency of the 3D rotation vector		✓
Adjust real-time clock		✓
Obtain real-time clock values		✓
Obtain the percentage value of battery power		✓
Revise feedback plan		✓
Set a timed feedback prompt schedule		✓
Start/Stop LED		✓

Fault Analysis and Troubleshooting

Issue	Reason	Check Device	Solution
The device is not responding	Not powered on	Check 1: Please check the device's indicator lights. If the system is powered on, the signal blue light on the host should be lit or blinking.	Press and hold the button for 3 seconds until the device vibrates briefly, and then the device will turn on.

	He device is completely out of battery	Check 2: Please press and hold the button for more than 3 seconds, then release it. If the device is not powered on, it will vibrate briefly and start up. If the device is already powered on, the indicator light will flash orange 3 times and then turn off. If there is no response, the device may be out of battery.	Insert a USB Type-C power source to charge the device.
	Low battery	Check 3: You can check if the orange indicator light is on and flashing, which indicates that the battery is low.	Insert a USB Type-C power source to charge the device.
Cannot connect to the Bluetooth device	The device to be connected has Bluetooth turned off.	Check 5: Check the Bluetooth settings of the paired device.	Please ensure that the Bluetooth on the compatible device is turned on and functioning properly.
	Unpaired Bluetooth device.	Check 5: Check the Bluetooth settings of the paired device.	Hold down the button for 7 seconds while the device is powered off to enter pairing mode. The Bluetooth settings of the compatible device should be able to search for and pair with the wireless EMG sensor. (See section pairing Bluetooth devices.)
	The adapter has selected the wrong device number.	Check 6: Check the device number on the surface of the wireless EMG sensor and compare it with the Bluetooth settings to ensure that the correct device number is selected on the paired device client.	Please make sure to pair and connect with the correct Bluetooth device and equipment number.
Other Issue	Please consult technical support.		

10. Maintenance

Clean: If the surface of the product is dirty, it can be wiped with 75% alcohol

system maintenance: If there is any abnormal data in the product, please contact Vincent Medical (Dongguan) Technology Co., Ltd. for after-sales service. Please do not disassemble it without authorization.

11. Operational environment

Environmental conditions for use	General environment Equipment used in ventilated indoor environments.
Operating environment	5 °C ~40 °C, humidity≤80%
precaution	Allow for general vibrations and impacts during use to facilitate the movement of the device.

12. Transportation and storage

Transport: Handle with care, Keep dry ,Not cool.

Storage: Stored in -20 °C ~ 55°Ctemperatureand humidity≤80%, Indoor environment with no corrosive gases and good ventilation.

13. Unpacking and checking

Unpacking : Please check if the accessories are complete.

If you encounter packaging damage or water immersion marks, please contact the supplier.

Packing list :

Accessory	Qty.
Wireless EMG sensor	1 PC
Electrode extension cable	2 PCS
EMG strap	4 PCS
Manual	1 PC

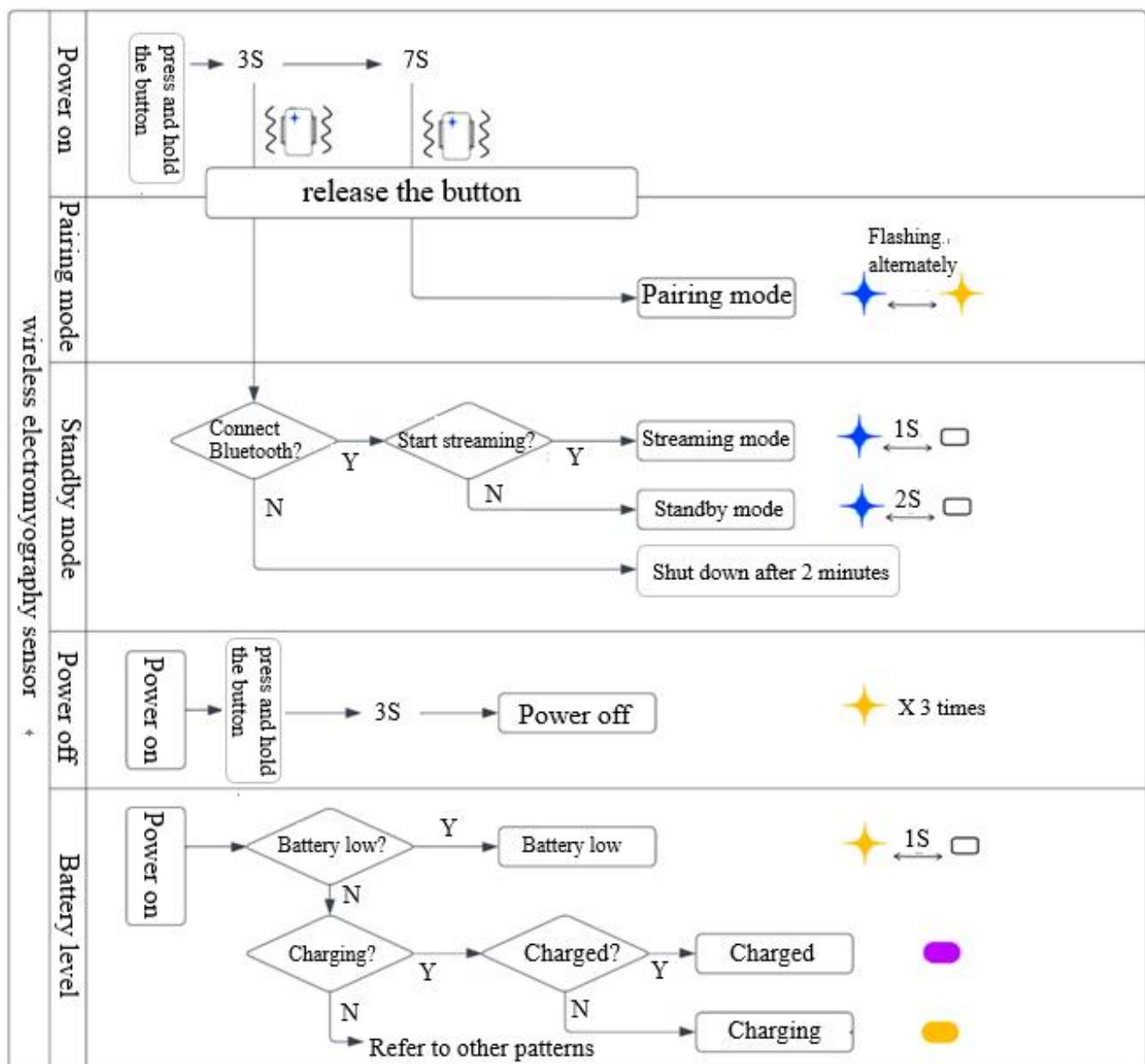
 **Warning and precautions:** Do not disassemble, impact or squeeze, do not put into fire or water, and do not place in high temperature environments

14. Symbol Definition

Symbol	Meaning
	Waste Electrical and Electronic Equipment
	CE Marking
	Recyclable
	Direct Current
	Temperature extremes
	Limit of the atmosphere
	Humidity limit
	Handle with care
	This side up
	Keep out of the direct sun

Symbol	Meaning
	keep dry

Wireless EMG sensor function Table :



Indicator light flashing Indicator light stays continuously lit

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure statement

The device has been evaluatec to mee general RF exposure requirement. The device can be used in portable exposure condition without restriction.