ZiFiSense

ZETA®Low-Power Wide Area Networks

Edge-AI Vibration Sensor

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1. Product Description

Edge-AI vibration intelligent terminal is a plug-and-play, wirelessly deployed vibration monitoring product for general rotating equipment. It has high-performance of vibration performance testing and fault diagnosis functions, and is especially suitable for replacing equipment inspection work and equipment status measurement , Recording and tracking, providing basic data support and insightful decision support for equipment condition monitoring and intelligent operation and maintenance.

- Covering general rotating equipment application scenarios: motors, bearings, pumps, fans, air compressors, gear boxes...
- Supports multiple installation methods, plug and play, and rapid deployment
- ZETA network wireless transmission and deployment, low cost, wide coverage, stable connection, and localized deployment
- Low-power design, battery life of about 3 years (default configuration)
- Integrated high-frequency response single-axis MEMS acceleration sensor, 3 to 6 months in advance to find fault signs
- Built-in signal processing algorithms such as FFT and envelope analysis, and return a variety of time and frequency domain vibration characteristic parameters
- Built-in Near-Sensor Computing (near sensor computing) AI algorithm, end-side directly output diagnosis conclusions, without the need for edge gateways and background manual analysis
- Web platform and mobile client APP support, view data and track device status anytime, anywhere

2. Product Specification

Hardware Specification	
Frequency response	Single axis 0Hz-10kHz (1dB point)
Sampling frequency	25.6kHz (configurable)
Frequency resolution	1/1.28 Hz
Measuring range	±33 g
Working temperature	-30~85℃
Ingress level	IP66
Mounting	Magnetic, adhesive, M5 stud
Size	50*50*87mm
Weight	~400g (With battery)
Battery capacity	9600mAh (Replaceable)
Battery life	~3 years (default setting)
Wireless Specification	
Wireless Protocol	ZETA P
Frequency band	920~925MHz
Gateway coverage	2~15km
Antenna type	PCB Antenna
Functional Specification	
Index value report	Operating status, vibration velocity rms (10Hz~1kHz), vibration acceleration rms (10Hz~10kHz), low frequency rms (10Hz~500Hz), high frequency rms (500Hz~5kHz), maximum acceleration, minimum acceleration, peak-to-peak, effective, Kurtosis, skewness, crest factor, pulse factor, margin factor, form factor, surface temperature
Initialization	Acquire the waveform and spectrum characteristics of the device during normal operation, and activate the fault diagnosis function after initialization
Fault diagnosis	Imbalance, misalignment, looseness, bearing failure (inner ring, outer ring, ball damage), gear failure (pitting, wear, broken teeth, gear bearing failure)

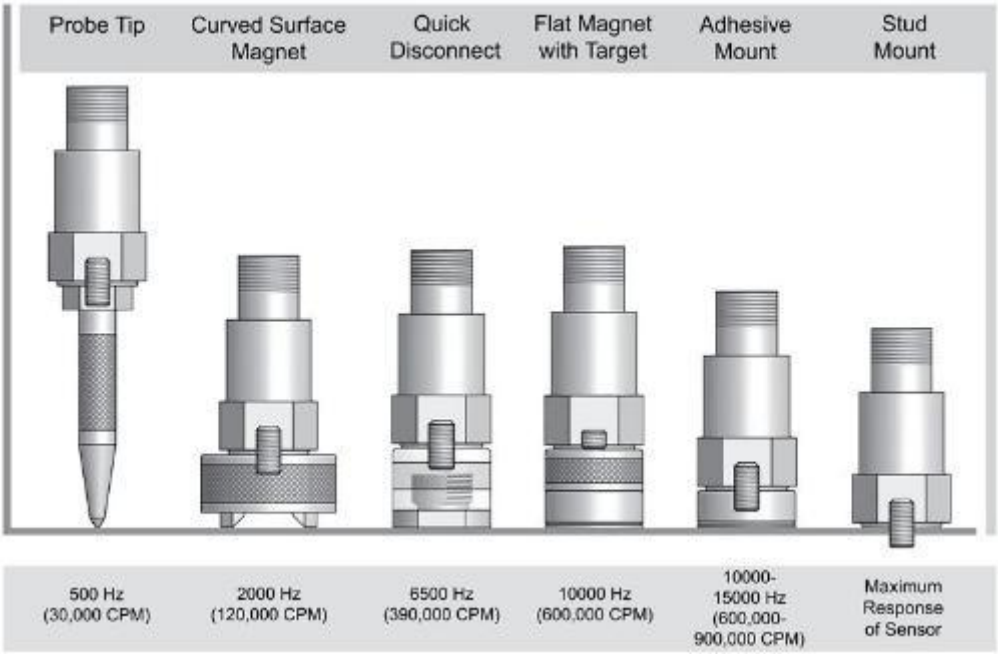
3. Installation

The sensor supports three installation methods: magnet, glue, M8 stud

Installation Precautions:

1. The sensor should be installed as close to the bearing as possible, or other location that can effectively reflect the vibration of the equipment.

2. Different sensor installation methods have different effects on the frequency response curve. See the figure below for details:



(The picture is taken from the Internet, if there is any infringement, please contact us)

Note: Mechanical equipment is usually well insulated. If the mechanical equipment is poorly insulated, it will affect the signal detected by the sensor. At this point, the sensor can be insulated from the mechanical equipment by pasting insulating tape or insulating glue before installing the sensor.

4. Sensor function

4.1. Machine operating status detection

- Start & Stop detection
- Bearing failure: inner ring, outer ring, rolling element
- Rotor failure: misalignment, unbalance
- Gear failure
- Looseness

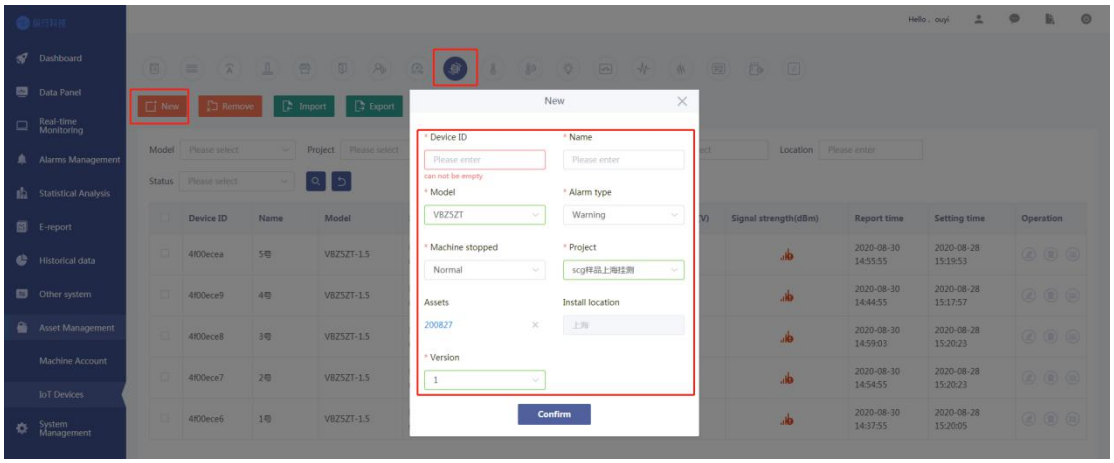
4.2. Characteristic value reporting

- Velocity RMS (10Hz~1kHz), unit mm/s
- Acceleration RMS (10Hz~10kHz), unit m/s2
- Low frequency rms (10Hz~500Hz), unit m/s2
- High frequency rms (500Hz~5kHz), unit m/s2
- Maximum value, unit m/s2
- Minimum value, unit m/s2
- Peak-to-peak value, unit m/s2
- Effective value, unit m/s2
- Kurtosis, unit 1
- Skewness, unit 1
- Crest factor, unit 1
- Pulse factor, unit 1
- Margin factor, unit 1
- Form factor, unit 1
- Surface temperature of measuring point, unit ℃

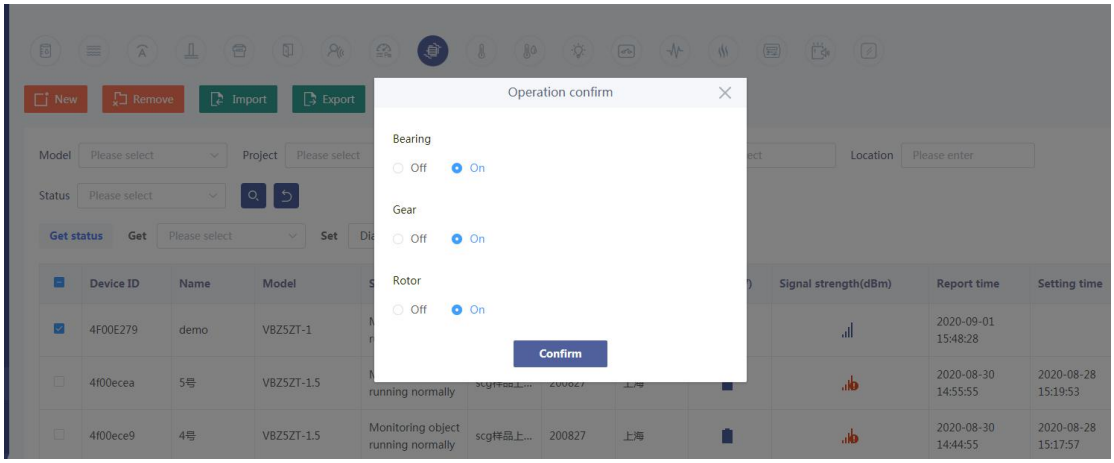
5. Use of Device

5.1. Steps for usage

1) The installation environment is well covered by ZETA network in advance, so that the equipment can enter the network smoothly afterwards;
2) Before powering on the device, first add the device to the FM Platform, as shown in the figure:

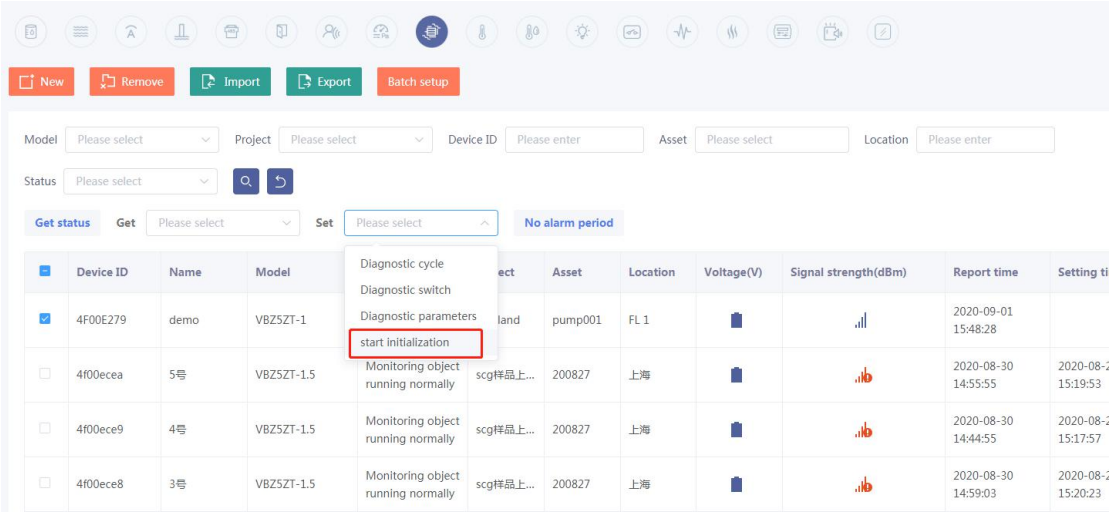


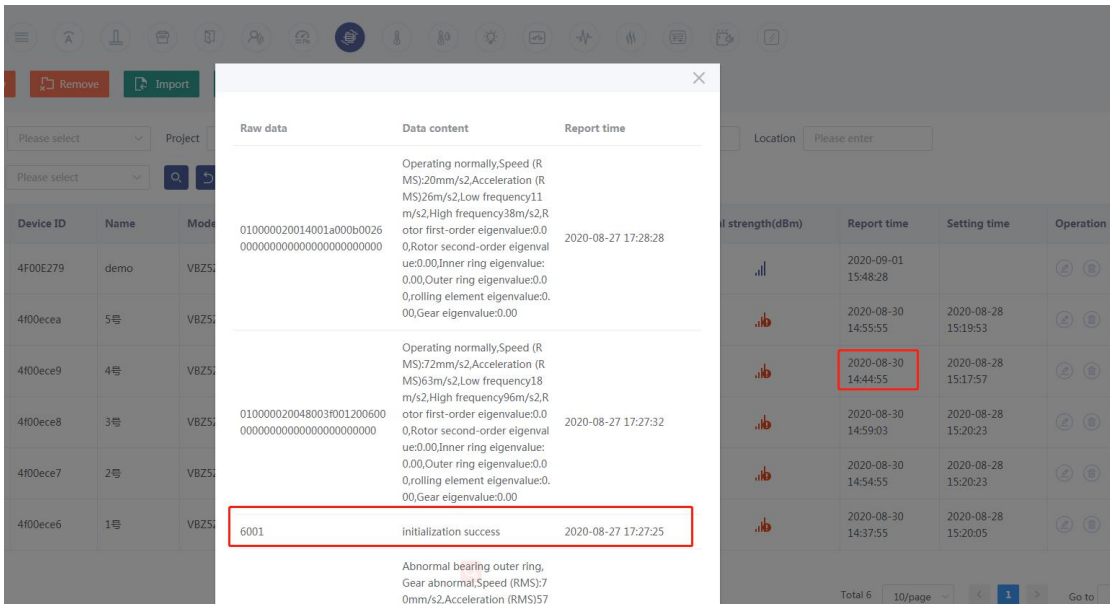
3) Power on the equipment and wait for the equipment to go online, and at the same time install the equipment to the selected installation point of the rotating machinery to be tested;
4) After the device is online, you need to enable the required functions (default is off), such as bearing, rotor, gear fault detection, etc.;



5) Diagnostic parameter settings. For different mechanical equipment, different parameter information needs to be set according to the conditions of the mechanical equipment. For the setting guidelines, please refer to Chapter 3.3.

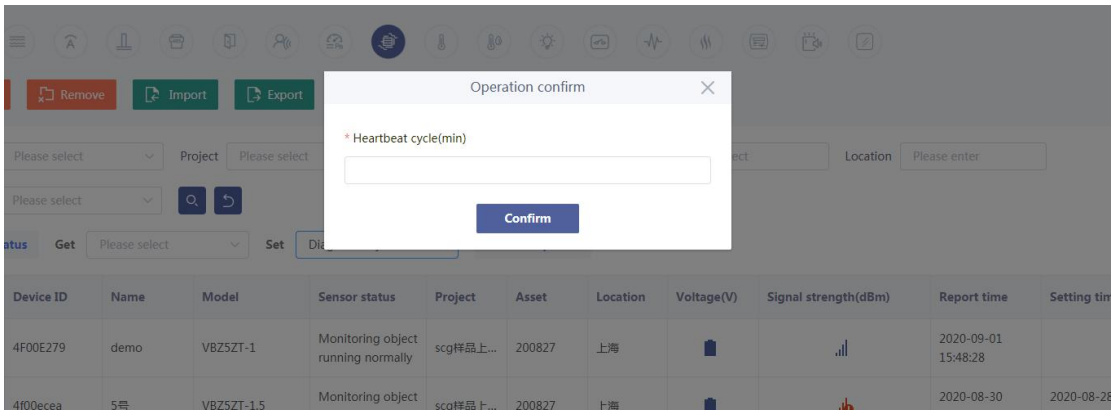
6) The sensor needs to be initialized the first time it is used. Please turn on the mechanical equipment and wait for it to warm up. After confirming that the machine is running in a stable state, issue the "start initialization" command through the platform command. The initialization process usually takes 1-3 minutes. After the initialization is successful, you can view it from the uplink data return status





5.2. Setting detection cycle

Through the FM platform, the sensor detection cycle can be set, as shown below:



Note: The detection cycle is related to the battery life. The more frequent the detection cycle, the faster the battery consumption and the shorter the service life.

5.3. Setting diagnostic parameters

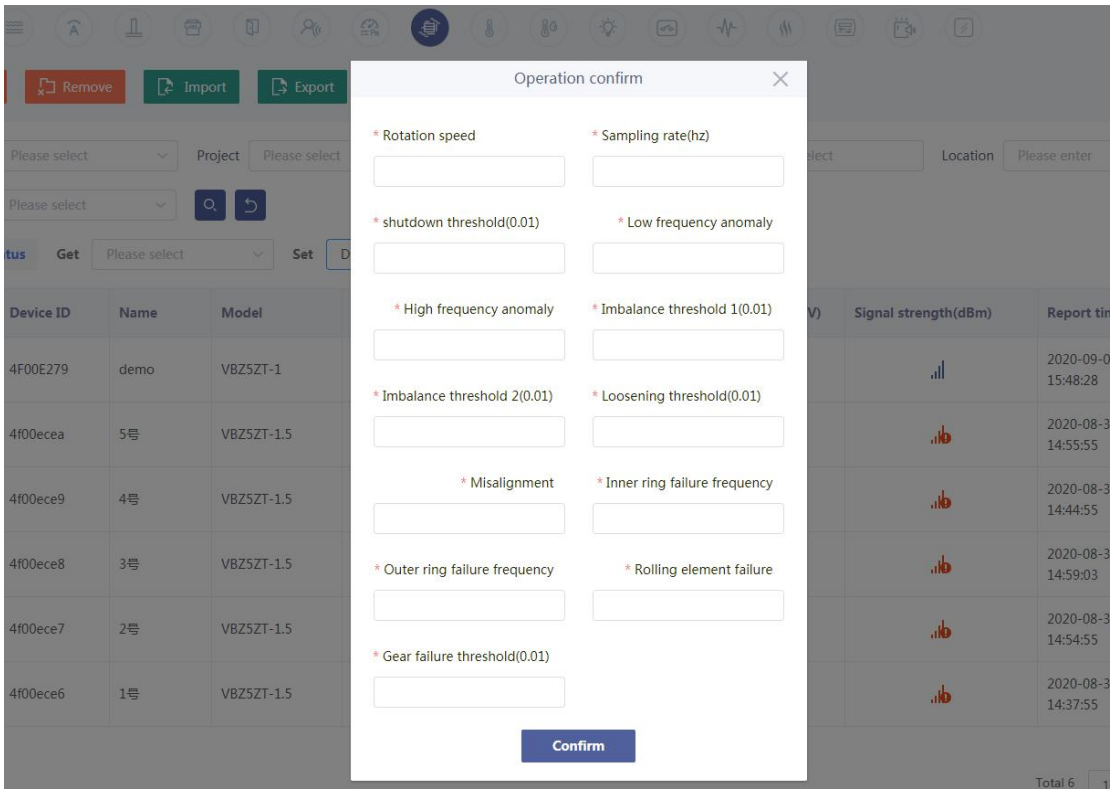
Among them, the following parameters need to be set according to the models of different rotating machinery and equipment[1]:

- Rotation speed: fill in according to the actual parameters of the mechanical equipment installed, range: 1-6000 rpm
- Inner ring failure frequency coefficient: Query according to the bearing model of mechanical equipment, and fill in the corresponding coefficient value
- Outer ring failure frequency coefficient: Query according to the mechanical equipment bearing model, and fill in the corresponding coefficient value
- Frequency coefficient of rolling element failure: Query according to the bearing model of mechanical equipment, and fill in the corresponding coefficient value

[1] The failure coefficient of the inner ring, outer ring and rolling bar can be queried in the database through the bearing model. If you need help with database query, please contact us

Other parameter settings have been set to default values:

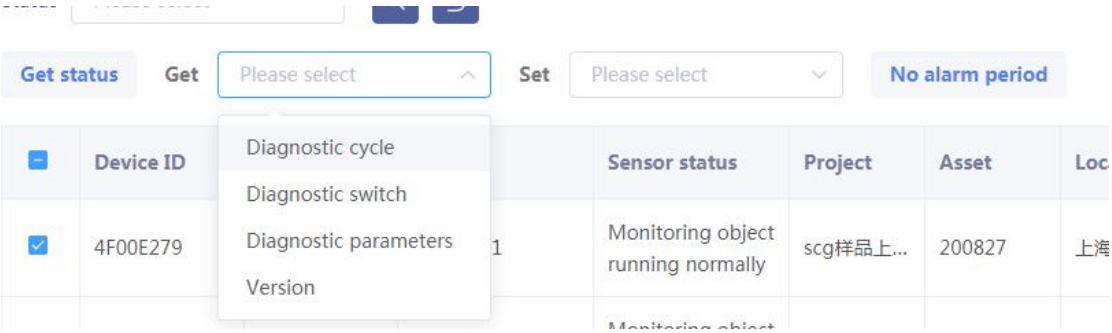
- Sampling rate: default value: 25600, unit hz
- Shutdown threshold: default value: 30, unit 0.01
- Low frequency anomaly threshold: Default value: 130, unit 0.01
- High frequency anomaly threshold: Default value: 120, unit 0.01
- Unbalance threshold 1: Default value: 162, unit 0.01
- Unbalance threshold 2: Default value: 190, unit 0.01
- Looseness threshold: Default value: 400, unit 0.01
- Misalignment fault threshold: default value: 140, unit 0.01
- Gear failure threshold: Default value: 150, unit 0.01



5.4. Query function

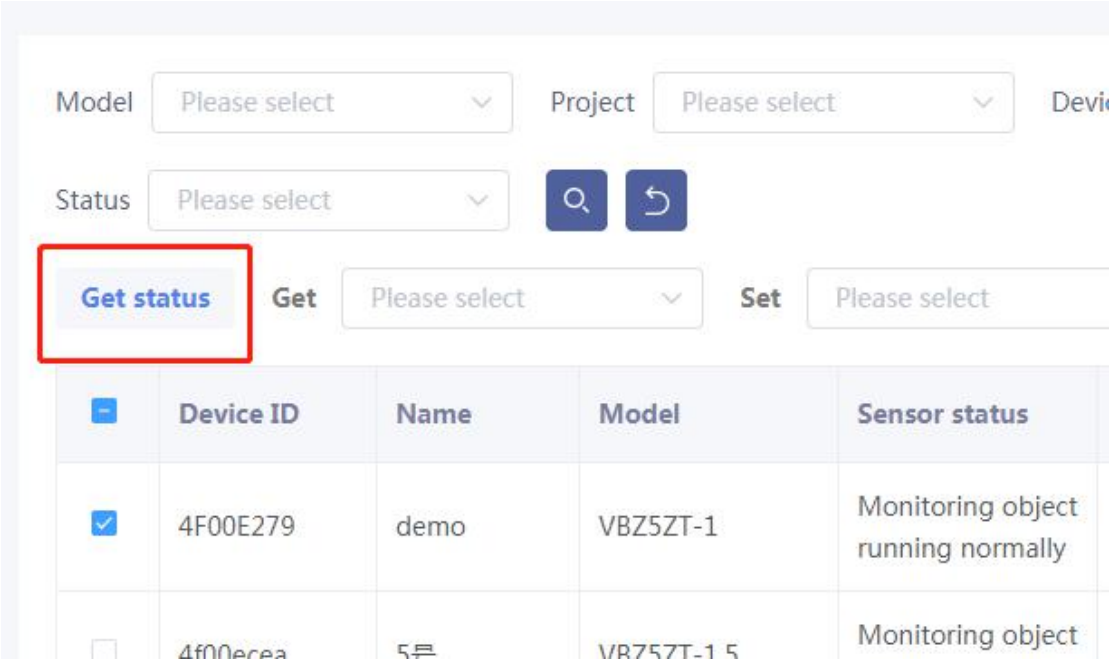
Through platform commands, the device parameter setting information can be queried:

- Query detection cycle
- Query enable switch
- Query detection parameter
- Query software version



5.5. Query device status

Proactively initiate a diagnosis of mechanical equipment through platform instructions without waiting for the diagnosis cycle.[2]



[2] The query delay is related to the ZETA protocol. If it is in real-time downlink mode, it can be inquired in real time. If it is in ACK downlink mode, it needs to wait for the uplink cycle.

5.6. Power button and status indicator

■ Power button

- ✧ Plug in the battery, the default power is on
- ✧ Long press for 5 seconds to turn off the power
- ✧ Long press for 3 seconds to turn on the power

■ Indicator light

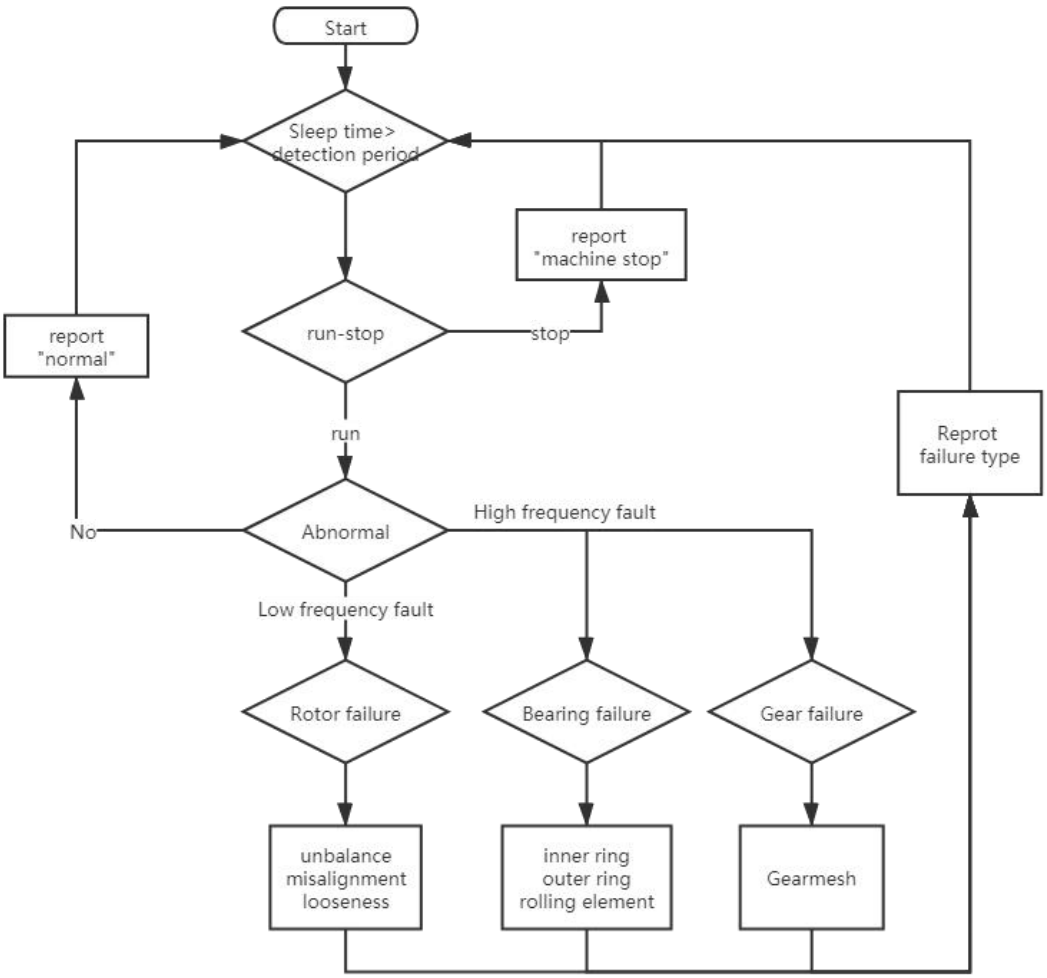
- ✧ Module registration

  It will be on for 2ms every 2s until the registration is successful and the device enters sleep or long sleep, the light is off.
- ✧ When the device is successfully registered

  Every 500ms, it lights for 2ms and lasts for 5s.
- ✧ During normal work

  2ms on every 1 minute

6. Sensor detection flow chart



7. Common faults and handling

- Ensure ZETA signal coverage
- Ensure that the device is powered on, and the ZETA network device management platform can observe that the ZETA module is on line
- Check the battery usage of the device. When the battery is low, replace the battery in time.

FCC Statement

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.

This device complies with FCC PART15 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.

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

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