WTVB01-BT50 Vibration sensor instruction manual

Product specification:

Type number: WTVB01-BT50

Description: Bluetooth 5.0 vibration sensor

1. Product overview

1, module internal voltage stability circuit, internal equipped with lithium battery, 3.7V power supply, easy connection.
2, the use of advanced digital filtering technology, can effectively reduce the measurement noise, improve the measurement accuracy.
3. At the same time, provide various kinds of upper computer, use instructions, development manuals required by users, so that the research and development time for various needs is reduced to the minimum.
4, Support Type-C interface, convenient for users to choose the best connection mode. Serial port rate 115200bps.
5. The cut-off frequency is adjustable from 0 to 100Hz, and the detection cycle is adjustable from 1 to 100Hz.
6, three axis displacement, three axis speed, three axis Angle, three axis frequency output, to meet the user's vibration and impact comprehensive measurement, judge whether the measured object (motor water pump) is damaged. If there is a machine fault caused by bearing wear, bearing cracking, poor dynamic balance and moderate factors, vibration sensor can detect the fault in advance and put forward an early warning, to prevent the machine from continuing to work in bad condition and causing damage, thus bringing economic losses.
7, application field: can be widely used in submersible pump, fan, turbine unit, coal mill, system. The bearing vibration measurement and real-time monitoring of oxygen machine, generator, centrifuge, compressor, water pump, motor and other rotating machinery.

2. Parameter indicators

Basic parameter

parameter	condition	Minimum value	default	Maximum value
Communication interfac	UART	115200bps	115200bps	115200bps

Output content		3 axis vibration velocity, 3 axis vibration Angle, 3 axis vibration displacement, 3 axis vibration frequency, temperature		
range		Vibration speed: 0~50mm/s		
		Vibration Angle: 0~180°		
		Vibration displacement: 0~30000um		
Detection cycle		1Hz	100Hz	100Hz
Cut-off frequency		1Hz	10Hz	100Hz
Startup time				1000ms
Cascade quantity	Bluetooth multi-link adapter			4 个
Bluetooth transmission distance	Bluetooth 5.0 (open environment)			50m
Operating temperature		-20℃		60℃
Storage temperature		-40℃		85℃

3. Electrical parameter

parameter	condition	Minimum value	default	Maximum value
Charging voltage			5V	
Battery voltage			3.7V	
Working current			15mA(3.7V)	
Standby current			10uA(3.7V)	
Battery capacity			260mAH	

Battery capacity		6 hours		8 hours
Charging time		2 hours		3 hours

4. Software usage method

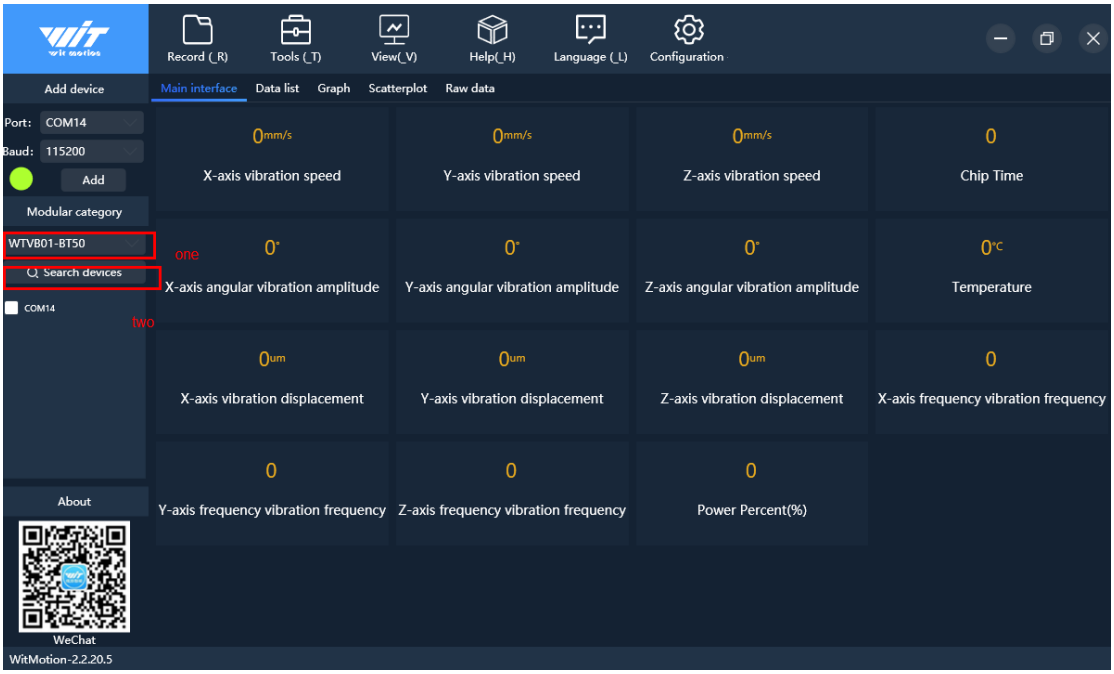
3.1 Connecting to an App

https://drive.google.com/drive/folders/1jNwHD47YgpuH7_M4SjjO08izGwTUzQ4L?usp=drive_link

3.2 Connecting with PC software

Download from upper computer:
https://drive.google.com/drive/folders/1TLutidDBd_tDg5aTXgjvkz63OVt5_8ZZ?usp=drive_link
First, automatic search:

1. Search for the sensor model.
2. Click Search Device and select Bluetooth device WTVB01_BT50.

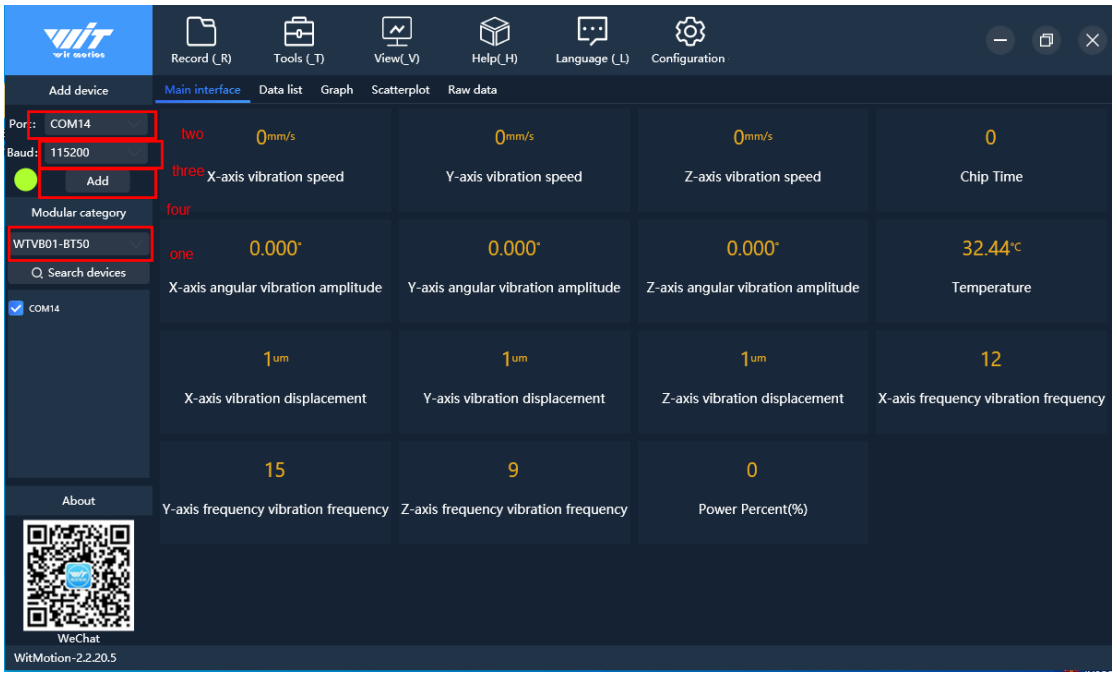


After successful connection, data can be displayed on the software, as shown in the figure below:

Two, manual connection

Type_C data cable to connect computer

1. Select the device name.
2. Select the serial port number.
3. Set baud rate to 115200,
4. Click Add.

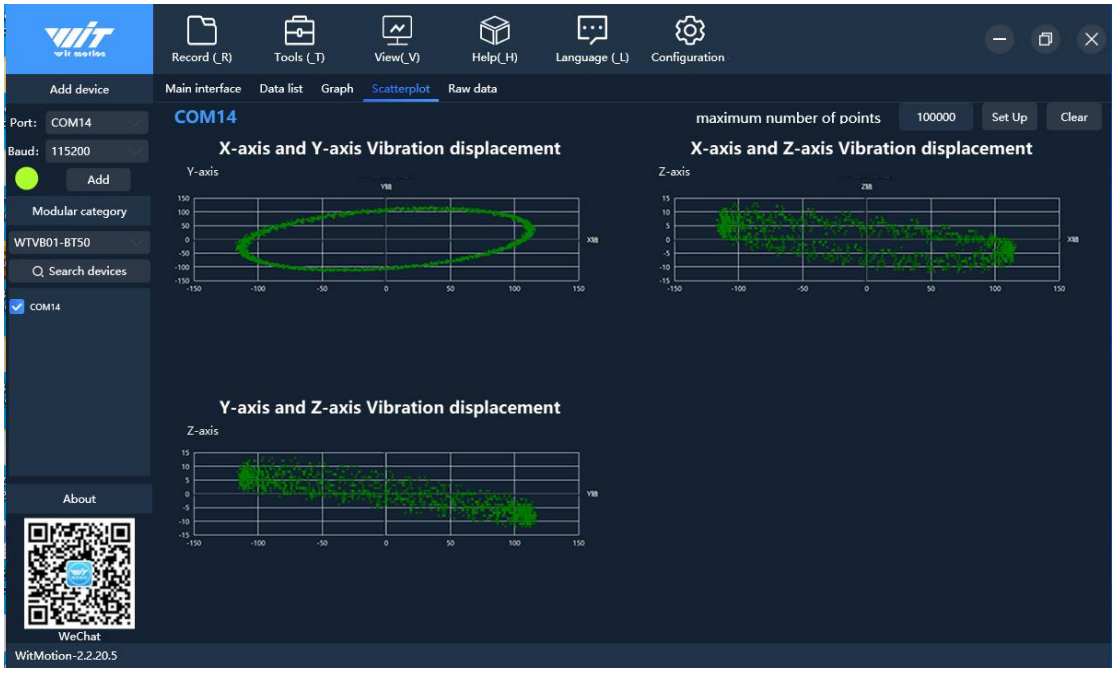


3.3 Curve Chart

Click on the graph, there are curves of vibration velocity, vibration Angle, vibration displacement and temperature (normal mode); In high-speed mode, only the vibration displacement curve has data, as shown in the figure below:

3.4 Scatter diagram

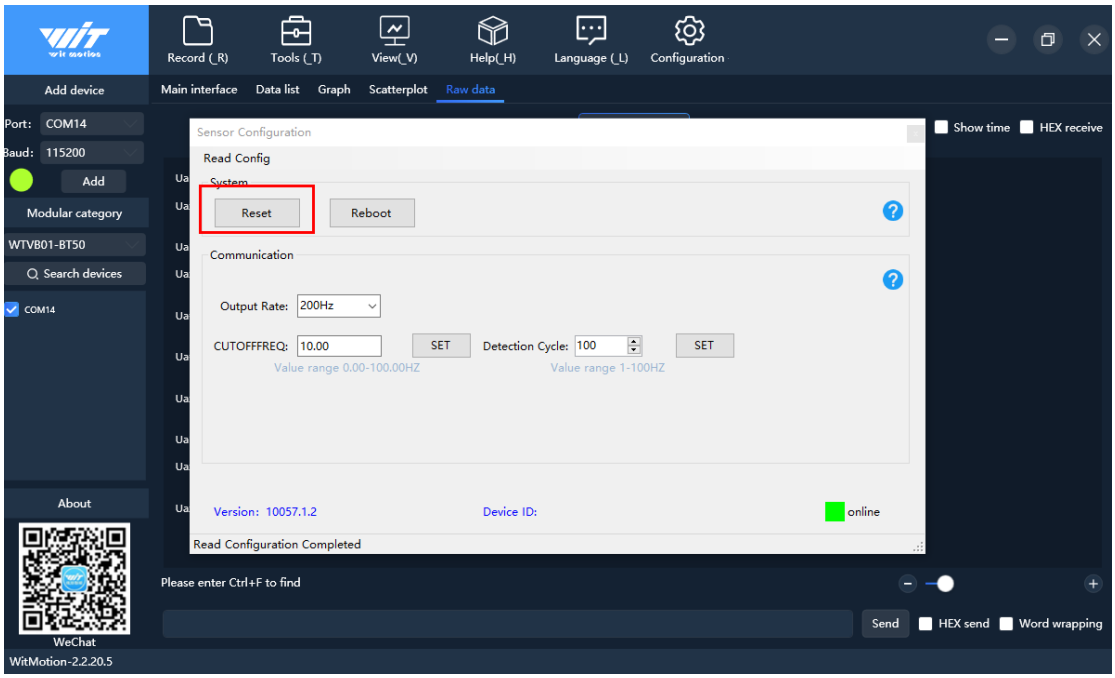
In order to obtain the complete vibration displacement scatter diagram, it is recommended to use the high-speed mode to view



4. Configure the software

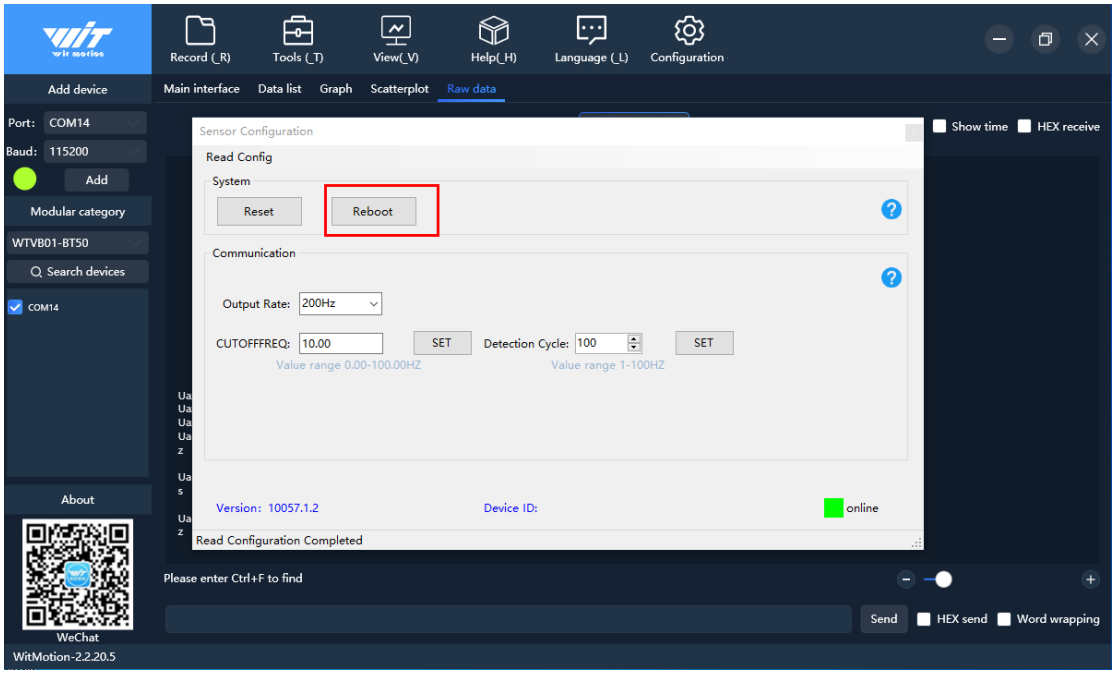
4.1 Restoring Settings

Click "Configuration", and click "Restore Settings" in the sensor configuration interface to restore factory Settings, as shown in the picture below:



4.2 Restart

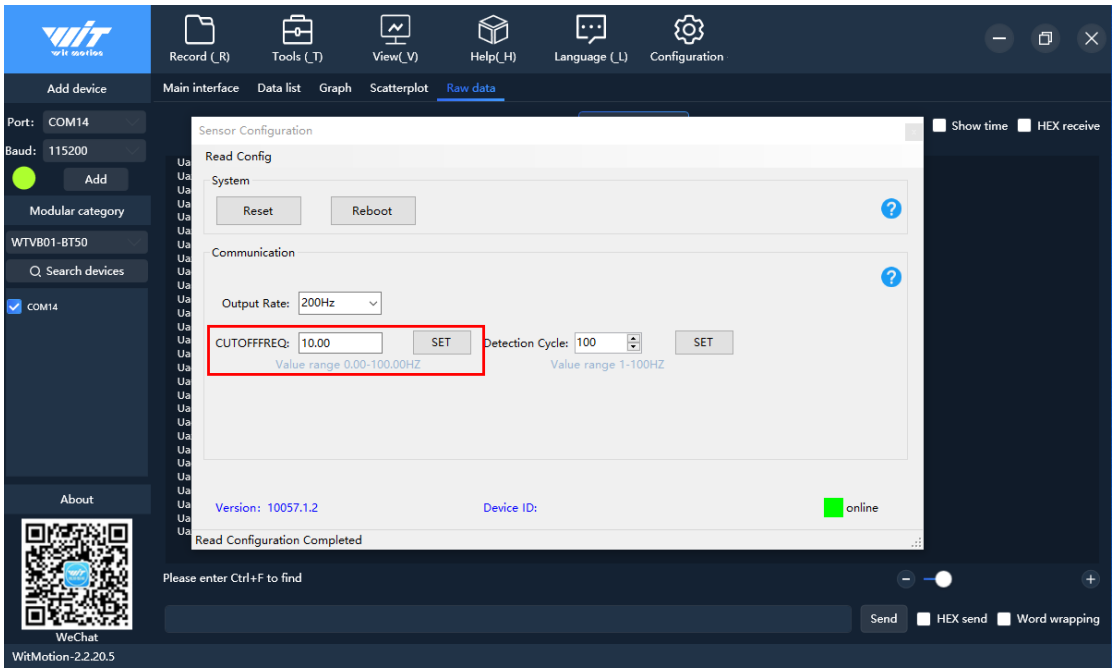
Click "Configure", and click "Restart" in the sensor configuration interface to restart the sensor, as shown in the figure below:



4.3 Cut-off frequency

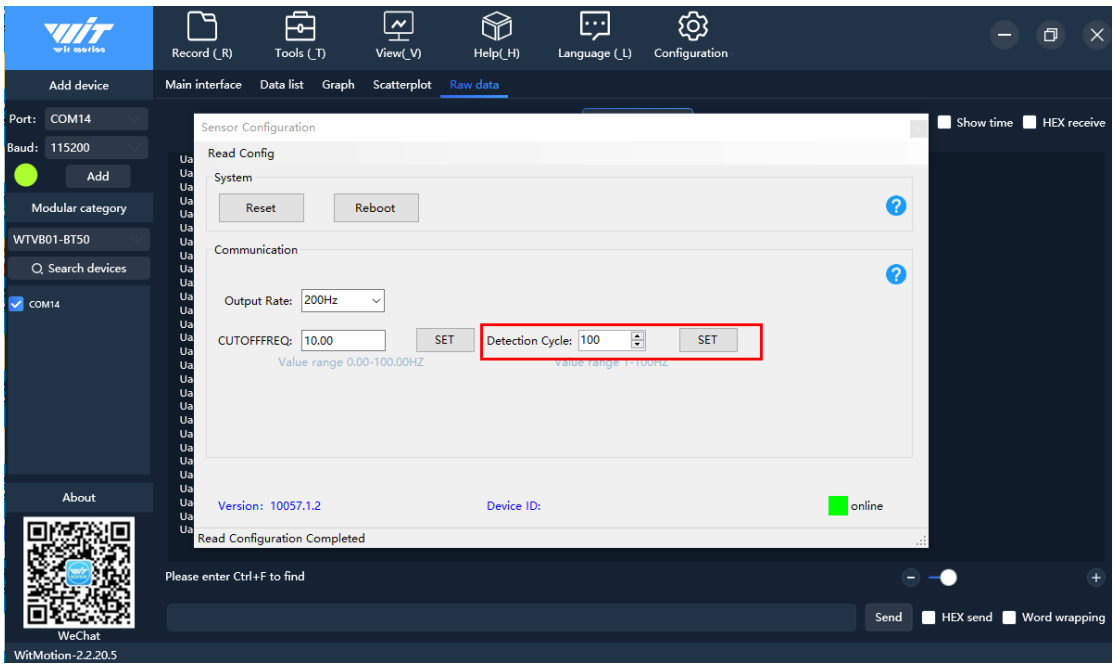
Open "Configuration", click the drop-down menu of "Cutoff frequency" in the sensor configuration interface, and select the corresponding cutoff frequency to set the cutoff frequency (the default cutoff frequency is 10.0Hz). Our cutoff frequency is

used in this way (excitation with amplitude sinusoidal signal, constantly changing the frequency, the corresponding frequency when the output amplitude decreases to 0.707 times of the input is the cutoff frequency. The output amplitude is greater than or equal to 0.707 times the frequency range of the input amplitude, that is, the working frequency range. We can change the cut-off frequency to filter out clutter of other frequencies. For example, the frequency of other clutter is 30Hz, and the sensor works at 50Hz, so we may as well set the cut-off frequency to 40.0 and 50.0Hz.



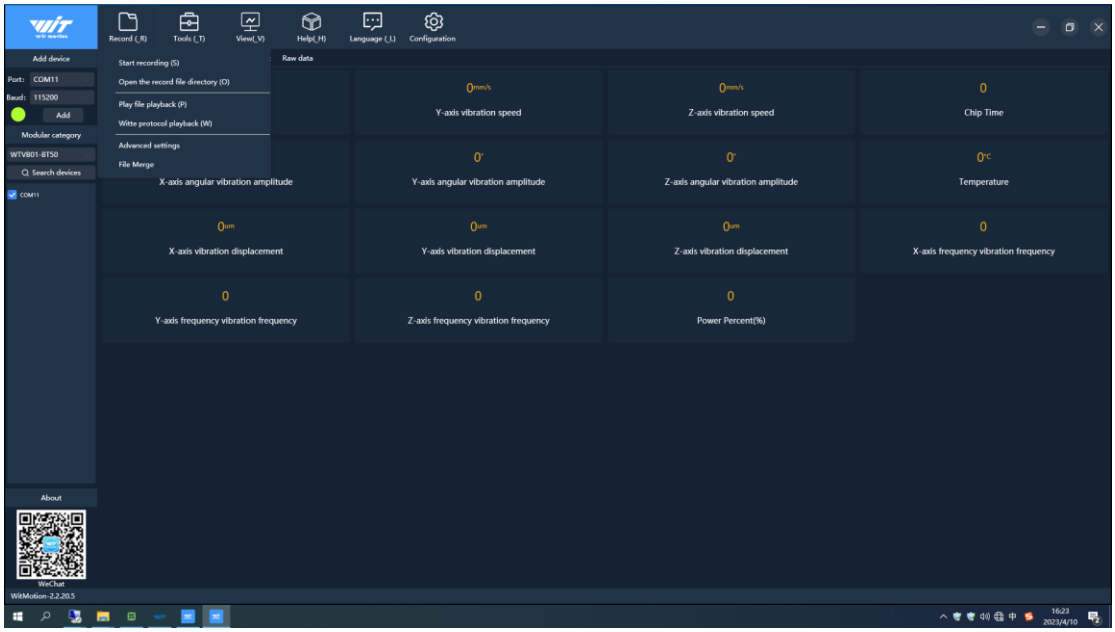
4.4 Detection Cycle

Open "Configuration", click the drop-down menu of "Detection cycle" in the sensor configuration interface, and select the corresponding detection cycle to set the detection cycle (the default detection cycle is 100Hz, and the detection cycle can be considered as the number of output packets per second), as shown in the figure:



4.5 Recording Data

Open "Record" and click "Start Record" to record the output data of the sensor.



Step 5: Register

5.1 Register address table

address	symbol	meaning

0x00	SAVE	Save, restart, or restore to factory defaults
0x03	RRATE	Return rate
0x1A	IICADDR	Device address
0x3A	VX	X axis vibration velocity
0x3B	VY	Y-axis vibration velocity
0x3C	VZ	Z axis vibration velocity
0x3D	ADX	X axis Angle vibration Angle
0x3E	ADY	Y axis Angle vibration Angle
0x3F	ADZ	Z axis Angle vibration Angle
0x40	TEMP	Product temperature
0x41	DX	X axis vibration displacement
0x42	DY	Y-axis vibration displacement
0x43	DZ	Z axis vibration displacement
0x44	HZX	X axis vibration frequency
0x45	HZY	Y-axis vibration frequency
0x46	HZZ	Z axis vibration frequency
0x47	FDNFX	X-axis vibration displacement (high-speed mode)
0x48	FDNFY	Y-axis vibration displacement (high-speed mode)

0x49	FDNFZ	Z axis vibration displacement (high speed mode)
0x5d	CUTOFFFREQI	Cutoff frequency integer
0x5e	CUTOFFFREQF	Cutoff frequency decimal
0x5f	SAMPLEFREQ	Detection cycle
0x64	BatPer	Electric quantity

5.2 Module Uppermost computer

By default, the module will upload the data of Flag=0x61(vibration speed, vibration Angle, temperature, vibration displacement and vibration frequency), totaling 28 bytes.

Packet

Data packet header

Data packet header 1Byte	Flagbit 1Byte	VXL	VXH	.....	YawL	YawH
0x55	Flag	0xNN	0xNN	.....	0xNN	0xNN

Note: 0xNN is the specific value received. The order of data return is vibration velocity XYZ, vibration Angle XYZ, temperature, vibration displacement XYZ, vibration frequency XYZ, low byte first, high byte last.
Flag = 0x61 Data content 26Byte indicates vibration speed, vibration Angle, temperature, vibration displacement, and vibration frequency

0x55	Data packet header
0x61	标志位
VXL	X axis vibration speed is 8 bits lower
VXH	X axis vibration speed is 8 bits higher
VYL	Y-axis vibration velocity is 8 bits lower
VYH	Y-axis vibration velocity is 8 bits higher
VZL	Z-axis vibration speed is 8 bits lower

VZH	Z-axis vibration speed is 8 bits higher
ADXL	The vibration Angle of X axis is 8 digits lower
ADXH	X axis vibration Angle is 8 bits higher
ADYL	Y-axis vibration Angle is 8 bits lower
ADYH	Y-axis vibration Angle is 8 bits higher
ADZL	Z-axis vibration Angle is 8 bits lower
ADZH	Z-axis vibration Angle is 8 bits higher
TEMP	The temperature is 8 bits lower
TEMP	The temperature is 8 bits higher
DXL	X-axis vibration displacement is 8 bits lower
DXH	X axis vibration displacement is 8 bits higher
DYL	X axis vibration displacement is 8 bits higher
DYH	Y-axis vibration displacement is 8 bits higher
DZL	Z-axis vibration displacement is 8 bits lower
DZH	Z axis vibration displacement is 8 bits higher
HZXL	The vibration frequency of X axis is 8 digits lower
HZXH	The vibration frequency of X axis is 8 bits higher
HZYL	Y-axis vibration frequency is 8 digits lower
HZYH	Y-axis vibration frequency is 8 bits higher
HZZL	Z-axis vibration frequency is 8 digits lower
HZZH	Z-axis vibration frequency is 8 bits higher

Calculation method of vibration velocity: Unit (mm/s)

Register name: VX~VZ
Register address: 58~60 (0x3A~0x3C)
Read/write direction: R

Default value:0x0000

Bit	NAME	FUNCTION
15:0	VX[15:0]	Vibration velocity VX（mm/S）=((VXH << 8)| VXL)
15:0	VY[15:0]	Vibration velocity VY（mm/S） =((VYH << 8)| VYL)
15:0	VZ[15:0]	Vibration velocity VZ（mm/S） =((VZH << 8)| VZL)

Example： 55 61 11 00 16 00 02 00 02 00 00 00 01 00 E6 0A 43 00 47 00 0A 00 25 00 25 00 25 00
VXL: 0x11 VXH: 0x00 VYL: 0x16 VYH: 0x00 VZL: 0x02 VZH: 0x00
Vibration velocity VX（mm/s）=(((short)VXH << 8)| VXL) = 0x0011 = 17(mm/s)
Vibration velocity VX（mm/s）=(((short)VXH << 8)| VXL) = 0x0016 = 22(mm/s)
Vibration velocity VX（mm/s）=(((short)VXH << 8)| VXL) = 0x0002 = 2(mm/s)

Vibration Angle calculation method: Unit (°)

Register name: ADX~ADZ
Register address: 61~63(0x3D~0x3F)
Read/write direction: R
Default value: 0x0000

Bit	NAME	FUNCTION
15:0	ADX[15:0]	Vibration Angle ADX(°)=((ADXH << 8)| ADXL)/32768*180
15:0	ADY[15:0]	Vibration Angle ADY(°)=((ADYH << 8)| ADYL)/32768*180
15:0	ADZ[15:0]	Vibration Angle ADZ(°)=((ADZH << 8)| ADZL)/32768*180

Example： 55 61 11 00 16 00 02 00 02 00 00 00 01 00 E6 0A 43 00 47 00 0A 00 25 00 25 00 25 00
ADXL: 0x02 ADXH: 0x00 ADYL: 0x00 ADYH: 0x00 ADZL: 0x01 ADZH: 0x00
Vibration velocity ADX =(((short)ADXH << 8)| ADXL) /32768*180 = 0x0002/32768*180 = 0.011(°)
Vibration velocity ADX =(((short)ADXH << 8)| ADXL) /32768*180 = 0x0000/32768*180 = 0.00(°)
Vibration velocity ADX =(((short)ADXH << 8)| ADXL) /32768*180 = 0x0001/32768*180 = 0.005(°)

Temperature calculation method: Unit (℃)

Register name: TEMP
Register address: 64 (0x40)
Read/write direction: R
Default value: 0x0000

Bit	NAME	FUNCTION
15:0	TEMP[15:0]	Temperature=TEMP[15:0]/100℃
Example:55 61 11 00 16 00 02 00 02 00 00 00 01 00 E6 0A 43 00 47 00 0A 00 25 00 25 00 25 00 TEMPL：0xE6 TEMPH：0x0A TEMP[15:0] =(((short)TEMPH <<8)|TEMPL)/100 = 0x0AE6 /100= 2790/100 = 27.90(℃)		

Vibration displacement calculation method: Unit (um)

Register name: DX~DZ
Register address: 65~67 (0x41~0x43)
Read/write direction: R
Default value: 0x0000

Bit	NAME	FUNCTION
15:0	DX[15:0]	Vibration displacement DX(um)=((DXH << 8)| DXL)
15:0	DY[15:0]	Vibration displacement DY(um)=((DYH << 8)| DYL)
15:0	DZ[15:0]	Vibration displacement DZ(um)=((DZH << 8)| DZL)

Example: 55 61 11 00 16 00 02 00 02 00 00 00 01 00 E6 0A 43 00 47 00 0A 00 25 00 25 00 25 00
DX[15:0]=(((short)DXH <<8)|DXL) = 0x0043 = 67(um)
DY[15:0]=(((short)DYH <<8)|DYL) = 0x0047 = 71(um)
DZ[15:0]=(((short)DZH <<8)|DZL) = 0x000A = 10(um)

Vibration frequency calculation method: Unit (Hz)

Register name: HZX~HZZ
Register address: 68~70 (0x44~0x46)
Read/write direction: R
Default value: 0x0000

Bit	NAME	FUNCTION
15:0	HZX[15:0]	vibration frequency HZX(Hz)=((HZXH << 8)| HZXL)
15:0	HZY[15:0]	vibration frequency HZY(Hz)=((HZYH << 8)| HZYL)
15:0	HZZ[15:0]	vibration frequency HZZ(Hz)=((HZZH << 8)| HZZL)

Example：55 61 11 00 16 00 02 00 02 00 00 00 01 00 E6 0A 43 00 47 00 0A 00 25 00 25 00 25 00
HZX[15:0]=(((short)HZXH <<8)|HZXL) = 0x0025 = 37(Hz)
HZY[15:0]=(((short)HZYH <<8)|HZYL) = 0x0025 = 37(Hz)
HZZ[15:0]=(((short)HZZH <<8)|HZZL) = 0x0025 = 37(Hz)

5.3 Host computer to module

Read register packet

The single return packet needs to send the register reading instruction first. The instruction format is as follows:

FF AA 27 XX 00

XX refers to the number of the corresponding register. The number of the register is referred to. The example of sending instructions is as follows:

function	instruction
Read temperature	FF AA 27 40 00

After sending this instruction, the module will send back a data packet starting with 0x55 0x71, which contains the data corresponding to the start register address, the start register address and the following 7 register data (8 registers are fixed to be uploaded). The format of the return data is as follows:
Start register (2Byte) + Register data (16Byte,8 registers)

baotou	Flag bit	Start register address low	Start register address high	Register 1 data low	The number of register 1 is high	.....	Register 8 data low	Register 8 data high
0x55	0x71	RegL	RegH	0xNN	0xNN	.....	0xNN	0xNN

Note: 0xNN is the specific value received, with the low byte first and the high byte second.

Set instruction description

function	instruction
Unlock (useful for 10 seconds)	FF AA 69 88 B5
set	FF AA register address Register value Low register value high
save	FF AA 00 00 00

Set instruction

FF AA 00 SAVE 00	Save, restart, or restore to factory defaults
FF AA 03 RATE 00	Set the return transmission rate
FF AA 5D CUTOFFFREQI 00	Cut-off frequency integer part (0~100)
FF AA 5E CUTOFFFREQF 00	Cutoff frequency fractional part (0~99)
FF AA 5F SAMPLEFREQ 00	Detection cycle (1~100Hz)

Register description

SAVE (save/restart/restore to factory)

Register name: SAVE
Register address: 0 (0x00)
Read/write direction: R/W
Default value: 0x0000

Bit	NAME	FUNCTION
15:0	SAVE[15:0]	Save: 0x0000 Restart: 0x00FF Restore factory default: 0x0001

Example: FF AA 69 88 B5 (Useful for unlocking within 10S)
FF AA 00 00 00 (Save)

ATE (Save/restart/restore factory defaults)

Register name: RATE
Register address: 3 (0x03)
Read/write direction: R/W
Default value: 0x0006

Bit	NAME	FUNCTION
15:0	RATE[15:0]	0x01：0.1Hz 0x02：0.5Hz 0x03：1Hz 0x04：2Hz 0x05：5Hz 0x06：10Hz (Default) 0x07：20Hz

		0x08：50Hz 0x09：100Hz 0x0A：200Hz
Example: FF AA 69 88 B5 (Useful for unlocking within 10S) FF AA 03 06 00 (Set the return rate to 10Hz) FF AA 00 00 00 (Save)		

CUTOFFFREQI, CUTOFFFREQF (cutoff frequency)

Register name: CUTOFFFREQI (integer 0~100)
Register address: 93(0x5d)
Read/write direction: R/W
Default value: 0x000A

Bit	NAME	FUNCTION
15:2		
1:0	CUTOFFFREQI[1:0]	The cut-off frequency is used to filter out the interference of other clutter to the sensor. The cut-off frequency can be set between 0.00 and 100.00Hz

Example: Set the cut-off frequency to 10.99Hz
Send: FF AA 69 88 B5 (useful for unlocking within 10S)
FF AA 5D 0A 00 (Set the integer part of the cutoff frequency to 10)
FF AA 5E 63 00 (Set cut-off frequency to 99 for decimal part)
FF AA 00 00 00 (Save)CUTOFFFREQI and CUTOFFFREQF registers are required for cutofffreqf cut-off frequency setting
Cutoff frequency decimal part description: Set the small value X100 (set.99, actually need to set the decimal part to 99)

Register name: CUTOFFFREQF (set decimal 0~99 equal to set 0.00~0.99)
Register address: 94(0x5e)
Read/write direction: R/W
Default value: 0x000A

Bit	NAME	FUNCTION
15:2		
1:0	CUTOFFFREQF[1:0]	The cut-off frequency is used to filter out the interference of other clutter to the sensor. The cut-off frequency can be set between 0.00 and 100.00Hz

Example: Set the cut-off frequency to 10.99Hz
Send: FF AA 69 88 B5 (useful for unlocking within 10S)
FF AA 5D 0A 00 (Set the integer part of the cutoff frequency to 10)
FF AA 5E 63 00 (Set cut-off frequency to 99 for decimal part)
FF AA 00 00 00 (Save)CUTOFFFREQI and CUTOFFFREQF registers are required for cutofffreqf cut-off frequency setting
Cutoff frequency decimal part description: Set the small value X100 (set.99, actually need to set the decimal part to 99)

SAMPLEFREQ (Detection cycle)

Register name: SAMPLEFREQ

Register address: 95(0x5f)

Read/write direction: R/W

Default value: 0x0064

Bit	NAME	FUNCTION
15:2		
1:0	SAMPLEFREQ[1:0]	Detection period, whose reciprocal is the number of output data per second, can be set between 1 and 100Hz

Example:

Send: FF AA 69 88 B5 (useful for unlocking within 10S)

FF AA 5F 64 00 (Set detection period to 100Hz)

FF AA 00 00 00 (Save)