



GKM3 MEMS Digital Vibration sensor

Product manual

V1.1-20260514



Technical Highlights

- ❖ RS232/485/TTL signal output selectable;
- ❖ Vibration: 10~2000Hz, 10g;
- ❖ Shock: 100g@11ms, triaxial (half-sine wave);
- ❖ Excellent mechanical strength and long-term stability.

Product Introduction

The GKM392 triaxial Vibration sensor is an independently developed Vibration sensor series by RUICOM Technology, suitable for applications such as vibration testing and impact testing. This product supports digital interface output (RS232/485/TTL optional) and can achieve long-distance series connection of multiple sensors via address code settings, facilitating multi-point synchronous measurement and centralized data analysis.

The GKM392 adopts single-crystal silicon capacitive sensing technology. Its core components include: a micromachined silicon chip, a low-power ASIC signal conditioning circuit, a microprocessor for storing compensation data, and an integrated temperature sensor.

The product has undergone precise calibration and features low power consumption, high structural strength, and stable output. Its electronic system adopts a solid-state power supply reset design and is equipped with overcurrent protection to ensure safe and reliable operation.

The sensor exhibits long-term stability of the scaling factor and a typical deviation value better than 0.1% across the entire measurement range, meeting the requirements for high-precision measurement.

Application Scope

- ❖ Flight data recording and analysis
- ❖ Bridge structural health monitoring
- ❖ Vehicle vibration testing and monitoring
- ❖ Wind turbine generator vibration monitoring
- ❖ Vibration fault early warning for large machinery
- ❖ Monitoring of heavy equipment such as road rollers
- ❖ Structural fatigue monitoring and life prediction
- ❖ Track vibration and roadbed stability monitoring
- ❖ High-speed train operation status monitoring





Performance Parameters

GKM392	Parameter						Unit
Measurement Range	±2	±4	±8	±10	±20	±40	g
Bias Calibration	<1	<1	<1	<1	<1	<1	mg
Measurement Axis	X, Y, Z	X, Y, Z	X, Y, Z	X, Y, Z	X, Y, Z	X, Y, Z	axis
Upward/Power-Off Repeatability	<2	<2	<2	<2	<2	<2	mg(max)
Bias Temp Coefficient	0.01	0.01	0.01	0.01	0.01	0.01	%/°C (typical)
Resolution/Threshold (@ 1Hz)	< 1	< 1	< 1	< 1	< 1	< 1	mg(max)
Nonlinearity	<1	<1	<1	<1	<1	<1	% FS(max)
Bandwidth (3dB)	500	500	500	500	500	500	Hz
Cross-Axis Sensitivity	1	1	1	2	2	2	%
Lateral Vibration Sensitivity Ratio	1	1	2	5	5	5	%
Noise Density	21	21	21	86.6	86.6	86.6	µg/√Hz
Resonant Frequency	2.4	2.4	2.4	5.5	5.5	5.5	kHz
Automatic output rate of serial port protocol	5Hz / 10Hz / 25Hz / 50Hz / 100Hz / 200Hz / 500Hz / 1000Hz						
MODBUS Auto Output Rate	10Hz / 25Hz / 50Hz						
Output Interface	RS232 / TTL / RS485						
Communication Protocol	Serial communication protocol and MODBUS RTU protocol						
Input (VDD_VSS)	9-36 VDC						
Operating Current Consumption	<60mA @ 12 VDC						
Protection Class	IP67						
Connector	MI2*1.0 / 5-pin aviation plug connector						
cable	2-meter black PVC shielded cable, weight: 131g						
Product Material	Product: Aluminum alloy magnetic bottom plate: Carbon steel+magnet						
Product Weight	Net Weight: ≤68g, Magnetic Base: ≤50g						
Product size	Shell size: L36×W32×H24mm Magnetic Base Size: L36×W32×H8.1mm						
Note: Do not use beyond the specified range for extended periods							

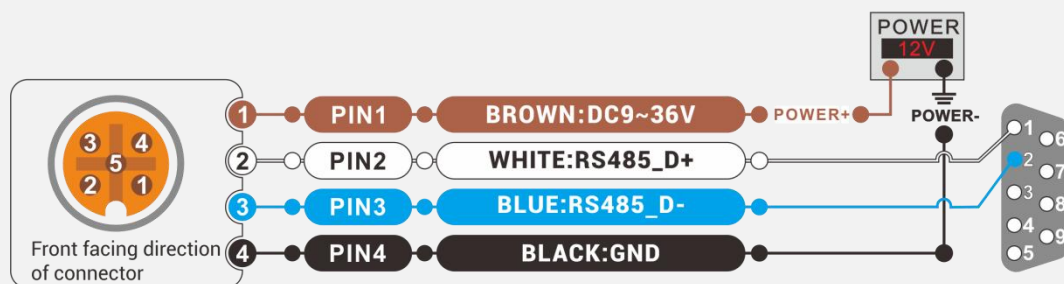
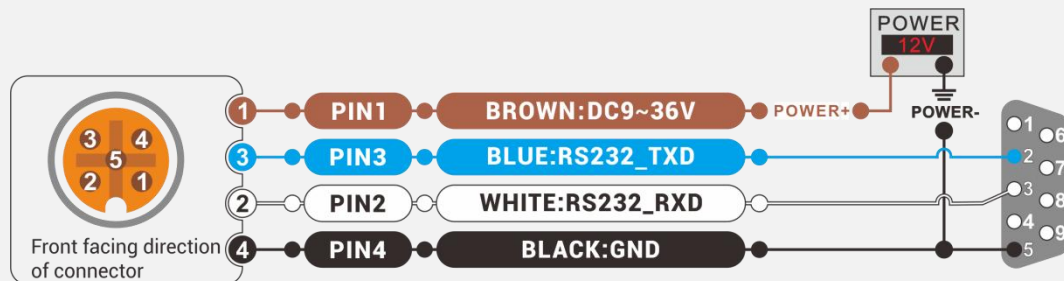
Ordering and Selecting

Model	Range	Signal Output	Protocol	Installation method
GKM3	02: $\pm 2g$	2: RS232	SP: Serial communication protocol	T: Standard
	04: $\pm 4g$	3: TTL	MB: MODBUS Protocol	A: Magnetic Adsorption Base
	08: $\pm 8g$	4: RS485		
	10: $\pm 10g$			
	20: $\pm 20g$			
	40: $\pm 40g$			

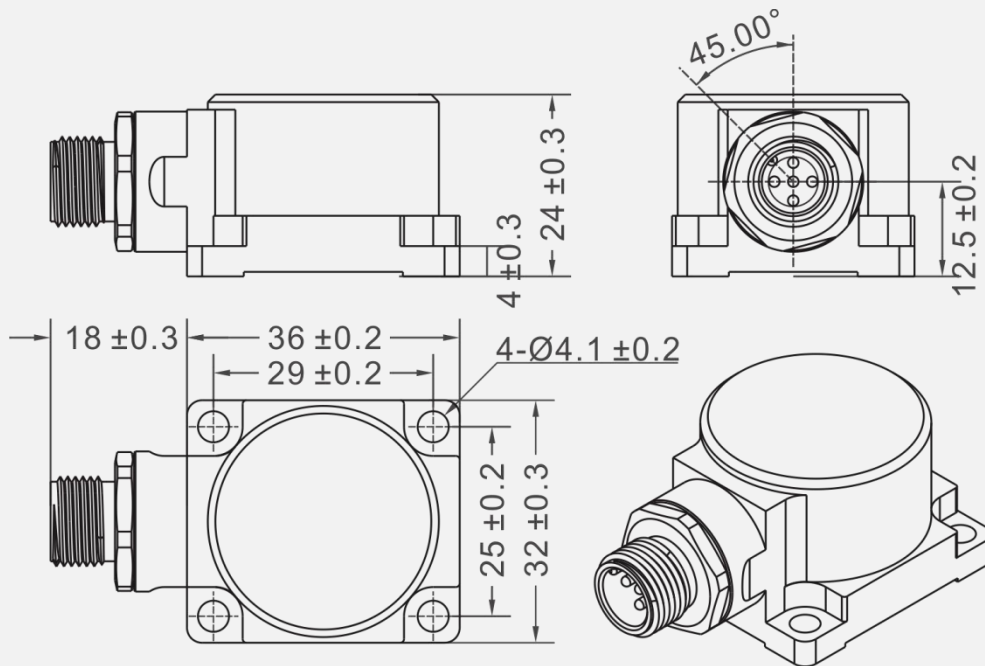
E.g: GKM302-2SP-T: $\pm 2g$ measurement range/RS232 signal output/serial communication protocol/standard installation method.

PIN Definition

Connector PIN/line color	PIN Definition
PIN1/Brown	DC9 ~ 36V
PIN2/White	TTL/RS232_RXD RS485_D+
PIN3/Blue	TTL/RS232_TXD RS485_D-
PIN4/Black	GND
PIN5/--	NC

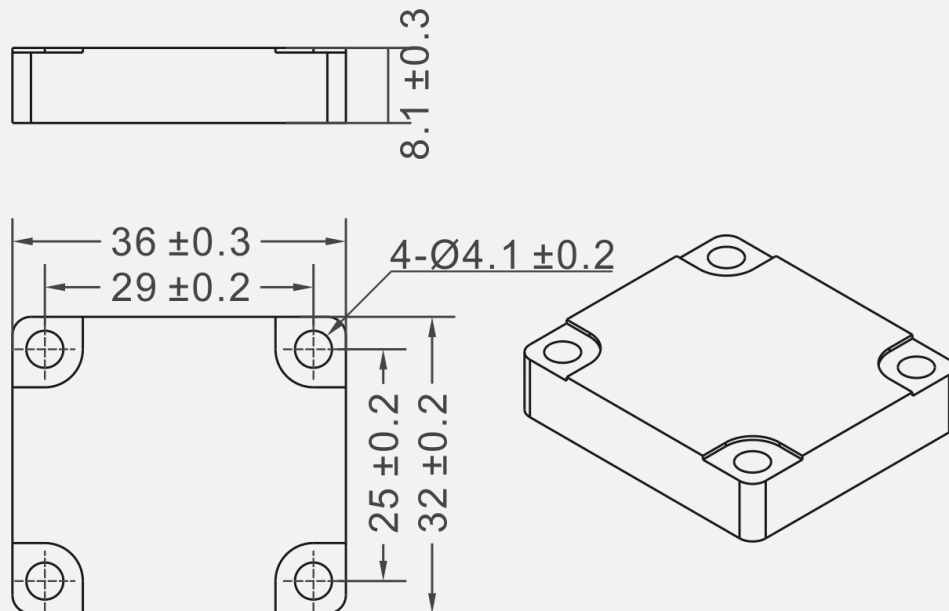


✓ Product Size



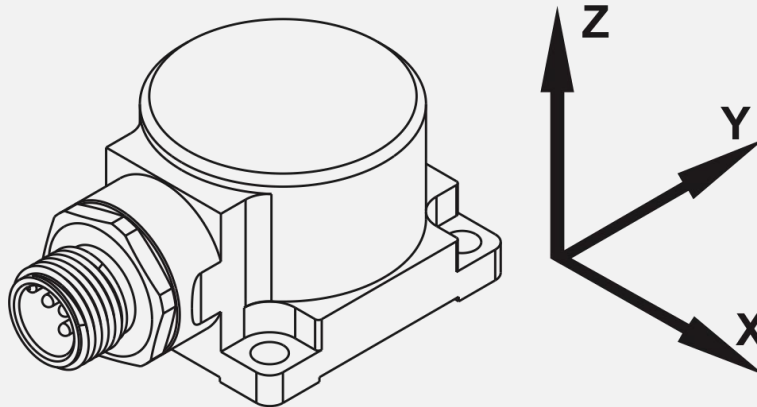
Shell size: L36×W32×H24mm
Installation size: L29×W25×H4mm
Mounting screws: 4 M4 screws

✓ Installation accessory Size



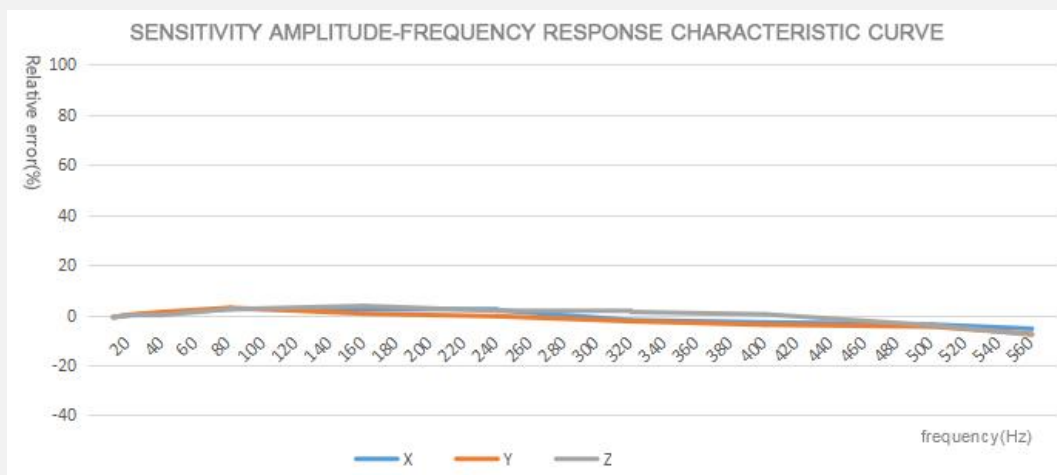
Magnetic base plate size: L36×W32×H8.1mm
Installation size: L29×W25×H11.6mm
Installation method: Magnetic adsorption base installation

✓ Spatial coordinate system



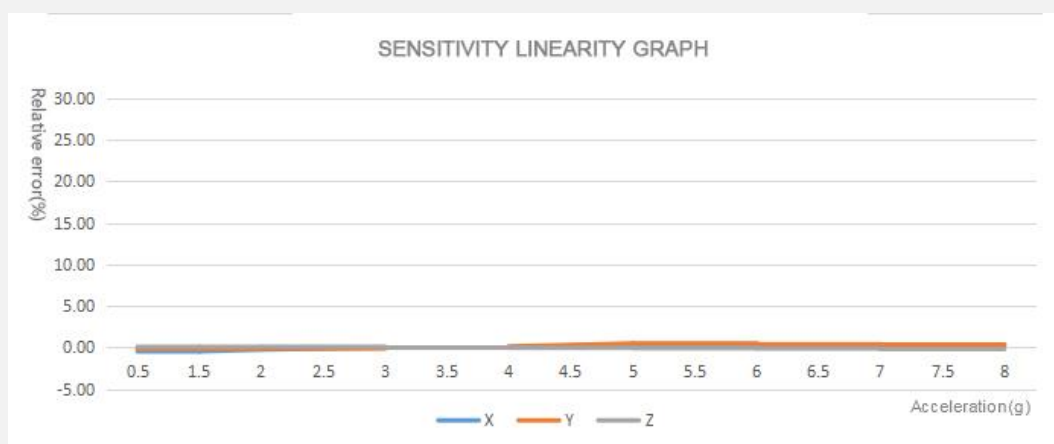
✓ Sensitivity amplitude-frequency response characteristic curve

Reference conditions: $f = 20.000 \text{ Hz}$, $a = 2.000 \text{ G}$



Reference chart for range $\pm 8\text{G}$

✓ Sensitivity linearity curve





Serial communication protocol (this protocol is the factory default)

1.Data frame format: (8 data bits, 1 stop bit, no parity, default rate 9600)

Identifier (1byte)	Data Length (1byte)	Address Code (1byte)	Command Word (1byte)	Data Field	Checksum (1byte)
68					

Data format: Hexadecimal;

Identifier: Fixed at 68;

Data length: Length from the data length to the checksum (including the checksum);

Address code: Address of the acquisition module, default is 00;

Data field: Varies according to the different content and length of the command word;

Checksum: The sum of the data length, address code, command word, and data field, without considering carry.

2.Command word parsing

Command word	Meaning/Example	Description
0X04	Simultaneously read acceleration commands Example: 68 04 00 04 08	Data Field (0 bytes) No Data Field Command
0X84	Sensor response Example: 68 0D 00 84 00 20 10 10 40 00 05 05 00 1B	Data Field (9 bytes) AA AB BB CC CD DD EE EF FF AA AB BB:3 characters represent the X-axis; CC CD DD:3 characters represent the Y-axis; EE EF FF:3 characters represent the Z-axis; The acceleration format is parsed using the same method as the X/Y/Z axes; In the example on the left, the acceleration is: X-axis 02.010g, Y-axis -04.000g, Z-axis: +50.500g; 00 20 10 The three red bytes are the X-axis acceleration value, which is compressed BCD code. The high bit of the first byte is 0 for the sign bit (0 for positive, 1 for negative). 02 represents a two-digit integer value, and 10 represents a three-digit decimal value. The data parsing method for other axes is the same; this acceleration is parsed as +02.010g; 10 40 00 The three blue bytes represent the Y-axis angle value, parsed using the same method as the X-axis; 05 05 00 The three green bytes represent the product's Z-axis acceleration, parsed using the same method as the X-axis acceleration; 1B : Checksum, the hexadecimal sum of all data, excluding the prefix 68.
0X0B	Set Communication Rate Example: 68 05 00 0B 03 13	Data Field (1 byte) Baud Rate: 00 represents 2400 01 represents 4800 02 represents 9600(default) 03 represents 19200 04 represents 38400 05 represents 115200 06 represents 230400
0X8B	Sensor Response Command	Data Field (1 byte) The number in the data field represents the

	Example: 68 05 00 8B 00 90	sensor's response result: 00 Success FF Failure
0X0C	Set Sensor Output Mode Response Mode: The sensor responds with a relative acceleration only after the host computer sends an acceleration read command. Automatic Output Mode: The sensor automatically outputs X and Y accelerations after power-on, with the output frequency based on the set value. For high-frequency output, please set the baud rate to 115200. Example: 68 05 00 0C 00 11	Data Field (1 byte) 00 Response Mode (default) 01 5Hz Auto Output Mode 02 10Hz Auto Output Mode 03 25Hz Auto Output Mode 04 50Hz Auto Output Mode 05 100Hz Auto Output Mode 06 200Hz Auto Output Mode 07 500Hz Auto Output Mode (Baud rates used are 115200, 230400) 08 1000Hz Automatic Output Mode (Baud rate: 230400) 09 300Hz Automatic Output Mode (Baud rate: 115200, 230400) 10 400Hz Automatic Output Mode (Baud rate: 115200, 230400)
0X8C	Sensor Response Command Example: 68 05 00 8C 00 91	Data Field (1 byte) The number in the data field represents the sensor's response result: 00 Success FF Failure
0X0F	Set Module Address Command The sensor's default address is 00. 1. If multiple sensors are connected to a single bus, such as RS485, each sensor needs to be set to a different address to achieve separate control and acceleration response. 2. After successfully changing the address, all subsequent commands and response data packets must use the new address code to be effective; otherwise, the sensor will not respond to commands. Example: 68 05 00 0F 01 15 Sets the address to 01.	Data Field (1 byte) XX Module Address, address range from 00 to EF; Note: All products share a common address: FF , If you forget the set address during operation, you can use the FF address to operate the product, and it will still respond normally.

	68 05 FF 0F 00 13 Resets the address to 00 using a general address.	
0X8F	Sensor Response Command Example: 68 05 00 8F 00 94	Data Field (1 byte) The number in the data field represents the sensor's response result: 00 Success FF Failure
0X53	Saves the setting command 68 04 00 53 57	
0XD3	Replies to the save setting command 68 05 00 D3 00 57	Data Field (0 bytes) The number in the data field represents the sensor's response result: 00 Success FF Failure

Setup Instructions and Procedures

1. Set relevant parameters (baud rate, address code, automatic output frequency). At this stage, the settings are only effective but not saved to FLASH. Power loss will also erase the settings;

A Set address code B Set baud rate C Set calibration parameters

D Automatic or query mode

Note: Setting the address code and baud rate takes effect immediately (but is not saved to FLASH). Subsequent operations require changing the corresponding address code and baud rate to succeed.

2. Save parameters. Write all parameters to FLASH.



MODBUS Communication Protocol

1. Data Frame Format:

RTU Mode

Communication Parameters: Baud Rate 9600 bps (Default);

Data frame: 1 start bit, 8 data bits, even parity, 1 stop bit.

Please note that you should carefully read the following items before use:

1) The MODBUS protocol stipulates that there should be at least 3.5 bytes of time between two data frames (e.g., at a baud rate of 9600, this time is $3.5 \times (1/9600) \times 11 = 0.004s$). However, to leave sufficient margin, this sensor increases this time to 10ms, so please leave at least a 10ms time interval between each data frame.

Master sends command -- 10ms idle -- Slave replies command -- 10ms idle -- Master sends command...

2) The MODBUS protocol specifies the content related to broadcast address 0. This sensor can also receive broadcast address content, but it will not respond. Therefore, broadcast address 0 can be used for the following purposes, for reference only.

1. Set the address of all Vibration sensors of this model connected to the bus to a specific address.

2. Set all Vibration sensors of this model connected to the bus to a relative/absolute zero point.

3. Test all sensors of this model on the entire bus. The host sends an acceleration query command to the bus at address 0. If the communication indicator light flashes, communication is normal.

3) To improve system reliability, both the address setting command and the baud rate setting command must be sent twice consecutively to be effective. "Sent twice consecutively" means that both transmissions are successful (the slave device responds each time), and the two responses must be consecutive; that is, the master device cannot insert other data frames in between the two responses. Otherwise, the command will be locked until power is cut off. The setting process is as follows:

Send the setting address command -- wait for the slave device to send a success command -- (no other commands should appear) Send the setting address command

again -- wait for the slave device to send a success command -- Modification successful

4) After power-on, each of the above two setting commands can only be set once. To set them again, power-on must be performed.

5) The communication indicator light will flash once only after a certain number of normal communications have been completed.

2. Read holding register to retrieve acceleration data.

MODBUS function code 03H, this is format one output.

Host query command:		Slave response:		
Sensor Address	01H	Sensor Address	01H	
Function Code	03H	Function Code	03H	
Access Register Start Address	00H	Data length 9 bytes	09H	
	02H	Data word 1 high 8 bits	50H	X-axis data
Data Length 4 words	00H	Data word 1 low 8 bits	46H	
	04H	Data word 2 high 8 bits	00H	
CRC	E5C9H	Data word 2 low 8 bits	23H	Y-axis data
		Data word 3 high 8 bits	20H	
		Data word 3 low 8 bits	00H	
		Data word 4 high 8 bits	00H	Z-axis data
		Data word 4 low 8 bits	00H	
		Data word 5 high 8 bits	00H	
		CRC	B827H	

Example of using the command to read acceleration data from holding register:

Host sends				01 H	03 H	00 H	02 H	00 H	04 H	E5H	C9H	
Slave Response												
01H	03H	09H	50H	46H	00H	23H	20H	00H	00H	00H	B8H	27H

Note: The data field of the slave response frame is 50H, 46H, 00H, 00H, 23H, 20H, 00H, 00H, 00H.

The X-axis represents bytes 1-3 of the data field, the Y-axis represents bytes 4-6, and the Z-axis represents bytes 7-9, with the least significant byte first. Acceleration is represented using a point-based notation, where one point corresponds to 0.001°. 0.001 × (number of points - offset) is the acceleration, with an offset of 90000.

Taking the above data frame as an example: the acceleration conversion process is as follows:

1) Obtain the current acceleration point count. Note that the least significant byte comes first. The X-axis is 004650H, the Y-axis is 002023H, and the Z-axis is 0.

Converting to decimal: X-axis: 4650H → 18000, Y-axis: 2023H → 8227, Z-axis: 0.

2) Subtract the offset of 90000 (note: this is a fixed value). X-axis: 18000 - 90000 = -72000, Y-axis: 8227 - 90000 = -81773, Z-axis: 0 - 90000 = -90000.

3) The final Vibration sensor readings are: X-axis: -72000 × 0.001 = -72.000g, Y-axis: -81773 × 0.001 = -81.773g, Z-axis: -90000 × 0.001 = -90g.

3. Reading acceleration data from the input register.

MODBUS function code 04H indicates format two output. Users can adjust register addresses and lengths to access data for different axes as needed. The registers are as follows:

Register address	data content	data type	unit	remarks
30003	X-axis acceleration	UINT32 (R)	g	The data analysis is as follows:
30005	Y-axis acceleration	UINT32 (R)	g	The data analysis is as follows:
30007	Z-axis acceleration	UINT32 (R)	g	The data analysis is as follows:

Example of using the command to read measurement data1:

Host query command:		Slave Response:	
Sensor Address	01H	Sensor Address	01H
Function Code	04H	Function Code	03H
Access Register Start Address	00H	Data Length (12 bytes)	0CH
	02H	Data Field	94H
Data Length (6 words)	00H		5FH
CRC	06H		01H
	D1 C8 H		00H
			65H
			63H
			01H
			00H
			47H
			60H
			01H
			00H
		CRC	1BE4H

In the table above, the X-axis represents data bytes 1-4, the Y-axis represents data bytes 5-8, and the Z-axis represents data bytes 9-12. The least significant byte comes first. Acceleration is represented using a point-based notation, where one point corresponds to 0.001°. $0.001 \times (\text{number of points} - \text{offset})$ is the acceleration, with an offset of 90000. Using the data in the table above as an example, the acceleration conversion process is as follows:

Obtain the current acceleration point count. Note that the least significant byte comes first: X-axis: 00015F94H, Y-axis: 00016365H, Z-axis: 00016047H.

Converting to decimal: X-axis: 00015F94H → 90004, Y-axis: 00016365H → 90981, Z-axis: 00016047H → 90183.

Subtract the offset of 90000 (note: this is a fixed value). X-axis: $90004 - 90000 = 4$, Y-axis: $90981 - 90000 = 981$, Z-axis: $90183 - 90000 = 183$.

The final Vibration sensor reading is: X-axis: $4 \times 0.001 = 0.004\text{g}$, Y-axis: $981 \times 0.001 = 0.981\text{g}$, Z-axis: $183 \times 0.001 = 0.183\text{g}$.

4.Set sensor address

Command to set sensor address code:		Slave Response:	
Sensor Address	01H	Sensor Address	01H
Function Code	06H	Function Code	06H
Address	00H	Register Address	00H
	11H		11H

New Address of Sensor	00H	New Address of Sensor	00H
	04H		04H
CRC	D80C	CRC	D80C

Commands must be sent twice consecutively to be effective.

Example of using the command to set the sensor address:

Host sends	01H	06H	00H	11H	00H	04H	D8H	0CH
Slave Response	01H	06H	00H	11H	00H	04H	D8H	0CH

Note: 0011H is the register address, which controls the sensor address. In the example above, the sensor address has been changed to 0004H, and the last two bytes are the CRC checksum.

5. Set the sensor baud rate (the factory default is 9600bps)

Command to set sensor baud rate:				Slave Response:			
Sensor Address	01H			Sensor Address	01H		
Function Code	06H			Function Code	06H		
Register Address	00H			Register Address	00H		
	12H				12H		
Sensor Baud Rate	00H			Sensor Baud Rate	00H		
	XX				XX		
CRC	CRC LH			CRC	CRC LH		

XX : A0H:4800 A1H:9600 A2H:19200 A3H:38400 A4H:115200

Example of using the command to set the sensor baud rate:

Host sends	01H	06H	00H	12H	00H	A2H	A8H	76H
Slave Response	01H	06H	00H	12H	00H	A2H	A8H	76H

Note: 0012H is the register address, which controls the sensor baud rate. In the example above, the sensor baud rate is set to 19200, and the last two bytes are the CRC checksum.

6. Set the sensor communication character format (the factory default is even parity).

Set sensor communication character format:				Slave Response:			
Sensor Address	01H			Sensor Address	01H		
Function Code	06H			Function Code	06H		
Address	00H			Register Address	00H		
	09H				09H		
Sensor Change	00H			New format of sensors	00H		
	01H				01H		
CRC	9808			CRC	9808		

Example of using the command to set the character format for sensor communication:

Host sends	01H	06H	00H	09H	00H	01H	98H	08H
Slave Response	01H	06H	00H	09H	00H	01H	98H	08H

The above example sets the byte format to one start bit + 8 data bits, no parity, and 1 stop bit. This setting takes effect after a power cycle. The factory default is one start bit + 8 data bits, even parity, and 1 stop bit.

Note: 0009 is the register address; this register controls the sensor communication character format.

0000H: One start bit + 8 data bits, even parity, and 1 stop bit

0001H: One start bit + 8 data bits, no parity, and 1 stop bit

7. Set the sensor to output automatically (factory default 0Hz)

Configure the sensor to automatically output commands.:		Slave Response:	
Sensor Address	01H	Sensor Address	01H
Function Code	06H	Function Code	06H
Address	00H	Register Address	00H
	13H		13H
Sensor Output Frequency	00H	Sensor Output Frequency	00H
	XX		XX
CRC	CRC LH	CRC	CRC LH

The table below shows the valid values for data field XX.:

Frequency	0HZ	10HZ	25HZ	50HZ
Format 1 Output Settings Command	00H	01H	02H	03H
Format 2 Output Settings Command	00H	A1H	A2H	A3H

Example of setting up automatic command output for sensors:

Host sends	01H	06H	00H	13H	00H	A2H	A8H	76H
Slave Response	01H	06H	00H	13H	00 H	A2H	A8H	76H

Note: 0013H is the register address, which controls the sensor output frequency. In the example above, the sensor is set to output data in format two at 25Hz, and the last two bytes are the CRC checksum.

Note: Method for switching between serial communication protocol and MODBUS communication protocol: Upon power-up, the host computer continuously sends 0xAA. When the Vibration sensor replies with 0XAA, 0XAA, 0XBB, 0XBB, it indicates that the change was successful.