

- Accéléromètre MEMS 3 axes
- Etendue de mesure : ± 2 , ± 4 , $\pm 8g$, $\pm 10g$, $\pm 20g$ ou $\pm 40g$
- Classe de précision : 2-3 %
- Bande passante : 0-500 Hz
- Interface : Modbus RTU RS-485
- Sorties: accélérations, vitesses, déplacements, 1ère harmonique
- Installation : vissée ou magnétique
- Dimensions : 34,3 x 34,3 x 38,5 mm
- Connectique : connecteur M12 + 5 cable de 5m
- Matériau : aluminium IP67 - Poids : 80 g



Caractéristiques

Le capteur de vibration **AKG** est un accéléromètre triaxial numérique de nouvelle génération, conçu pour la mesure précise des vibrations dans les environnements industriels, transports et les structures. Ce capteur intelligent intègre un traitement FFT interne, permettant d'extraire directement les fréquences de vibration, vitesses maximales et amplitudes de déplacement, sans traitement externe.

Avec son interface Modbus RTU RS-485 qui permet de faire très facilement de la mesure multipoints, des étendues de mesure disponibles à partir de $\pm 2g$ jusqu'à $\pm 40g$ et une excellente stabilité thermique, l'AKG392 est une solution idéale pour la surveillance de vibration et la maintenance prédictive, surtout si complétée avec un enregistreur ou une passerelle IOT Modbus.

Applications

- Surveillance de pompes, compresseurs
- Génie civil
- monitoring d'éoliennes
- Monitoring d'infrastructures
- Engins de chantiers
- machines outils

Spécifications

Mécanique

Nombre d'axes	3
Direction	X, Y, Z
étendue de mesure	± 2 , ± 4 , $\pm 8g$, $\pm 10g$, $\pm 20g$ ou $\pm 40g$
Installation	vissée ou magnétique
Protection à la surcharge	150%
Matériau	Inox
Dimensions	34,3 x 34,3 x 38,5 mm

Précision

Classe de précision	2-3 %
Sensibilité transverse	1 à 5% selon étendue de mesure
Résolution	< 1 mg
Dispersion du zéro	< 1 mg
Non-linéarité	0.5% à 1% de la pleine échelle
Bande passante	0-500 Hz
Densité de bruit	21 à 86 $\mu G/\sqrt{\text{Hz}}$

Electrique et communication

Tension d'alimentation	1 - 10V
Consommation	60 mA @ 12 VDC
Interface de sortie	RS-485
Baudrate	5Hz, 10Hz, 25Hz, 50Hz, 100Hz, 200Hz, 500Hz, 1000Hz
Connectique	M12 + câble blindé
Longueur	5 m
Protocole	ASCII ou Modbus RTU

Environnemental

Température de fonctionnement	-40 à 85 °C
Etanchéité	IP67

Firmware - Calculs embarqués - Communication

Indicateurs calculés

INDEX	VALUE	UNIT
Acceleration	2,4,8,10,20,40	g
Speed	Vibration speed	m/s
Amplitude	Vibration amplitude value	m
Frequency	0~500	Hz
Frequency resolution	4	Hz

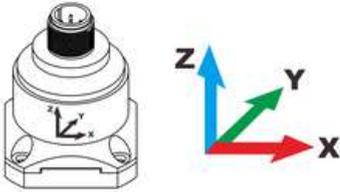
La fréquence de vibration, la vitesse et le déplacement du produit sont obtenus par l'analyse des signaux bruts acquis sur une fenêtre temporelle. La fréquence correspond à la fréquence principale de la vibration actuelle de l'objet (1ère harmonique), la vitesse représente la vitesse maximale de vibration et le déplacement correspond à la valeur maximale de l'amplitude de la vibration de l'objet. En raison de l'irrégularité de la vibration de l'objet, les données ne sont utilisées qu'à titre de référence.

Protocoles, paramètres par défaut

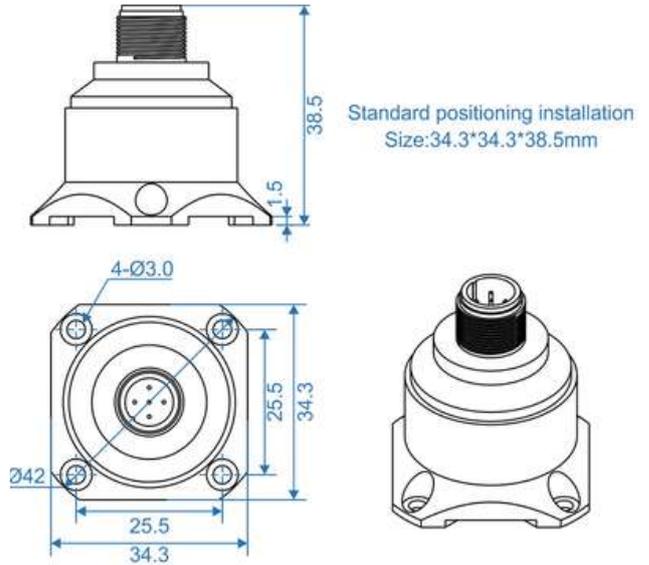
Les données calculées sont collectées via une interface série. 2 protocoles sont supportés : protocole ASCII (RION 68) ou Modbus RTU. Les paramètres par défaut sont listés ci-dessous

PROTOCOL	ASCII PROTOCOL	MODBUS-RTU
Address code	0	1
Broadcast address	255	0
Serial port baud rate	9600	9600
Parity bit	No parity	Even parity
Serial port start bit	1 bit	1 bit
Serial port data length	8 bits	8 bits
Serial port stop bit	1 bit	1 bit
Output mode	Question and answer	Question and answer
Data Format	Data format	Data format
Data check method	Checksum	CRC16

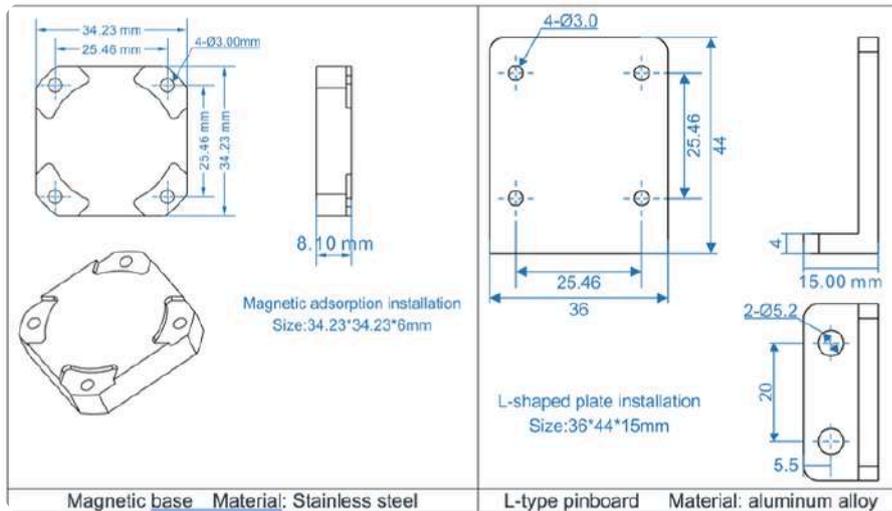
Mesure 3 axes



Dimensions

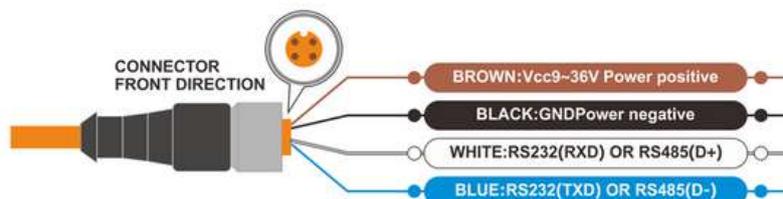


Accessoires de montage



Connectique

THREAD COLOR FUNCTION	BLACK	WHITE	BLUE	BROWN
	GND	RS232(RXD)/ RS485(D+)	RS232(TXD)/ RS485(D-)	Vcc 9~36V



► **AUTOMATICALLY OUTPUT DATA**

This output is related to the automatic output mode command. When the corresponding BIT bit is set, it will be output. The lower the BIT, the higher the data content. That is, all content output is sorted from left to right as: acceleration|frequency|speed|amplitude|temperature. for example:

68 protocol: the automatic output item is 1011H, then the automatic output data is: acceleration|frequency|amplitude;

Modbus protocol: the automatic output item is 9001H, then the automatic output data is: acceleration|amplitude|temperature.

BIT0	BIT1	BIT2	BIT3
Accelerometer	-	-	-
BIT4	BIT5	BIT6	BIT7
frequency	-	-	-
BIT8	BIT9	BIT10	BIT11
Speed	-	-	-
BIT12	BIT13	BIT14	BIT15
Amplitude	-	-	Temperature

The following table describes the relationship between output rate, data content and baud rate, please calculate and set reasonably according to the parameters.

Fre (HZ)	0	5	10	25	50	100	200	500	1000	300	400
Remark	Auto output is valid						Auto output is invalid, only the acceleration data is output, high baud 115200/230400 is recommended to use				

► **RION 68 COMMUNICATION PROTOCOL (DEFAULT PROTOCOL)**

Note: Please read the following items carefully before use:

1) All setting operations will not be saved after power off, and the setting of the command issued will be effective immediately. If it needs to be saved, a save command needs to be issued. The operation is: send the setting command -> return successfully, the setting takes effect -> send the save command -> return successfully, the setting is saved.

2) Please note that the auto output rate of the product is affected by the data length and baud rate, please calculate and set a reasonable baud rate by yourself.

3) The 68 protocol specifies the broadcast address----255. The sensor can also accept the content of the broadcast address, but will never reply. Therefore, the broadcast address 255 can be used for the following purposes, for reference only.

1. Set the addresses of all the acceleration sensors of this model mounted on the bus to a certain address.

2. Set all the acceleration sensors of this model mounted on the bus to relative/absolute zero point.

3. Test the sensor of this type on the entire bus, that is, the host sends a 0 address to the bus to inquire about the acceleration command, and the communication indicator can flash, that is, the communication is normal.

4) Flashes once every 1 second when normal communication.

1.DATA FRAME FORMAT: (8 bits date , 1 bit stop , No check , Default baud rate 9600)

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word(1byte)	Date domain	Check sum (1byte)
0x68					

Default communication parameters: address 0, baud rate 9600, 1 start bit, 8 data, no parity, 1 stop bit;

Effective setting address: 0~254;

Identifier: fixed as 0x68;

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

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

Checksum: The sum of data length, address code, command word and data field, regardless of carry, that is, Sum&0xFF.

2.command word analysis

Command	Meaning/Example	Description
0X01	Read X axis acceleration command. E.g.: 68 04 00 01 05	Data field (0byte) No data field command
0X02	Read Y axis acceleration command. E.g.: 68 04 00 02 06	Data field (0byte) No data field command
0X03	Read Z axis acceleration command. E.g.: 68 04 00 03 07	Data field (0byte) No data field command
0X04	Read all 3 axes acceleration command. E.g.: 68 04 00 04 08	Data field (0byte) No data field command
0X84	Sensor reply E.g.: 68 0D 00 84 00 20 10 10 40 00 05 05 00 1B	Data field (9byte) 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. Acceleration format is the same analytical method as X/Y/Z axis. 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 red three bytes are the X-axis return acceleration value, which is the compressed BCD code. The high bit 0 of the first byte is the sign bit (0 is positive, 1 is negative) 02 is a two-digit integer value, and 10 is a three-digit decimal value. The analysis method for other axis data is the same, and the acceleration is analyzed as +02.010g. 10 40 00 The three blue bytes are the return angle value of Y axis, and the analysis method is the same as that of X axis. 05 05 00 The three green bytes are the Z-axis acceleration, and the analysis method is the same as the X-axis acceleration. 1B: Checksum, the hexadecimal sum of all data, without prefix 68.
0X15	Read 3 axes vibration frequency data E.g.: 68 04 00 15 19	Data field (0byte) No data field command

0x95	68 0A 00 95 00 04 00 00 00 02 A5	Data field(6byte) Signed 16-bit integer , big endian , coefficient 0.1 E.g.:X axis:0004H = 4*0.1= 0.4HZ
0X16	Read 3 axes vibration speed data E.g.: 68 04 00 16 1A	Data field (0byte) No data field command
0x96	68 10 00 96 00 06 3F 85 00 05 5C F8 00 00 00 00 C9	Data field(6byte) Signed 32-bit integer , big endian , coefficient 0.000001 E.g :X axis :00063F85H = 409,477*0. 000001 = 0.409,477m/s
0X17	Read triaxial vibration amplitude data E.g.: 68 04 00 17 1B	Data field (0byte) No data field command
0x97	68 10 00 97 00 02 CF 1A 00 01 CC 67 00 2E 04 32 2A	Data field(6byte) Signed 32-bit integer,big endian,coefficient 0.0000001 E.g.:X axis:0002CF1A H = 184,090*0.0000001 = 0. 0184,090m
0X18	Read acceleration, vibration frequency, vibration speed, Vibration amplitude, temperature data E.g.: 68 04 00 18 1C	Data field (0byte) No data field command
0X98	Sensor reply E.g.: 68 2D 00 98 10 00 83 00 00 17 00 09 04 00 29 00 24 00 29 00 09 3A 8C 00 03 AD A7 00 04 99 6E 00 03 89 F7 00 01 99 3D 00 01 C3 82 0D BC 8C	Data field (39byte) Blue is X, Y, Z acceleration data in sequence, the unit is g, the data analysis is consistent with the 04H command analysis method Green is X, Y, Z frequency data in sequence, the unit is Hz, the data analysis method is consistent with the 15H command analysis method Orange is X, Y, Z speed data in sequence, the unit is m/s, the data analysis method is consistent with the 16H command analysis method Red is X, Y, Z amplitude data in sequence, the unit is m, the data analysis method is consistent with the 17H command analysis method Purple is the temperature data, the unit is °C, and the coefficient is 0.01. The data analysis method is consistent with the 15H command analysis method.
0X0B	Set communication rate E.g.: 68 05 00 0B 03 13	Data field(1byte) Baud rate: 00 means 2400 01 means 4800 02 means 9600 (Default) 03 means 19200 04 means 38400 05 means 115200 06 means 230400
0X8B	Sensor reply command E.g.: 68 05 00 8B 00 90	Data field(1byte) The number in the data field indicates the result of the sensor response: 00 Success FF Failure
0X0C	Set sensor output mode. Q&A mode:The host computer needs to send a read acceleration command	Data field(1byte)factory default value: 00 00 response system 01 5Hz automatic output mode

	Automatic output mode:After the sensor is powered on, it will automatically output X, Y, Z acceleration, and the output frequency is based on the set value. If high frequency output is required, please set the baud rate to 115200. (This function can be memory when power off) E.g.: 68 05 00 0C 00 11	04 50Hz automatic output mode 05 100Hz automatic output mode 06 200Hz automatic output mode 07 500Hz automatic output mode (the baud rate is 115200, 230400) 08 1000Hz automatic output mode (230400 baud rate) 09 300Hz automatic output mode 10 400Hz automatic output mode
0X8C	Sensor reply command E.g.: 68 05 00 8C 00 91	Data field(1byte) The number in the data field indicates the result of the sensor response: 00 Success FF Failure
0X1B	Set the bandwidth E.g.: 68 06 00 1B 00 01 12	Data field(1byte) 00 Low pass 500HZ (default) 01 Low pass 500HZ 02 Low pass 250HZ 03 Low pass 125HZ 04 Low pass 64HZ 05 Low pass 32HZ
0X0B	Sensor reply command E.g.: 68 05 00 8B 00 90	The number in the data field indicates the result of the sensor response: 00 Success FF Failure
0X0F	Set address command The default address of the sensor is 00, 1. If multiple sensors are connected to a group of buses at the same time, for example RS485: each sensor needs to be set to a different address to achieve separate control and response acceleration. 2. If the new address is successfully changed, the address code in all subsequent commands and response packets must be changed to the new address code after the change to be effective, or the sensor will not respond to the command. E.g.: 68 05 00 0F 01 15 Set the address as 01. 68 05 FF 0F 00 13 Use the general address to reset the address to 00	Data field(1byte) XX address, the address ranges from 00 to EF; Note: All products have a common address: FF
0X8F	Sensor reply command E.g.: 68 05 00 8F 00 94	Data field(1byte), The number in the data field indicates the result of the sensor response: 00 Success FF Failure
0X53	Set save instruction 68 04 00 53 57	
0XD3	Set save command reply 68 05 00 D3 00 57	Data field (0 BYTE) The number in the data field indicates the result of the sensor response 00 Success FF Failure
0X1F	Read software version number instruction 68 04 00 1F 03	

00 14 00 31 41 4B 47 55 59 52 04 01
56 32 31 30 37 30 38 41 A0

The number in the data field indicates the result of the sensor response
AKG392T_V210708A

Setting instructions and procedures

All setting operations are not saved when the power is turned off. The setting is effective immediately once command sent. If you need to save setting command after power off, you need to issue a save command. The operation is: Issue the setting command -> return success, the setting takes effect -> issue the save command -> return success, the setting is saved.

► MODBUS PROTOCOL

MODBUS uses RTU mode, 'big-Endian' represents addresses and data items, adopts CRC16 check data, standard error code. Support 0x03 to read holding registers and 0x06 to write single registers.

Note: please read the following items carefully before use:

1) Because the MODBUS protocol stipulates that the time between two data frames should be at least 3.5 bytes (for example, at a baud rate of 9600, the time is $3.5 \times (1/9600) \times 11 = 0.004s$). But in order to leave enough margin, this sensor increases the time to 10ms, so please leave at least 10ms time interval between each data frame. Please note that the automatic output of the product does not consider the T3.5 time.

The host sends a command-10ms idle-the slave responds to the command-10ms idle-the host sends a command...

2) The MODBUS protocol stipulates the relevant content of the broadcast address ---- 0. This sensor can also accept the content of the broadcast address, but it will not reply. So broadcast address 0 can be used for the following purposes, for reference only.

1. Set the addresses of all accelerometers of this model mounted on the bus to a certain address.

2. Set all the accelerometers of this model mounted on the bus to relative/absolute zero.

3. Test the sensor of this model on the entire bus, that is, the host sends a 0 address query acceleration command to the bus, and the communication indicator can flash if the communication is normal.

3) In order to improve the reliability of the system, setting the address command and setting the baud rate, these two commands must be sent twice in a row to be effective. "Send twice in a row" means that the two transmissions are successful (the slave responds every time), and the two questions and answers must be consecutive before and after. The setting process is as follows:

Send the setting address command-Waiting for the successful setting command sent by the slave-(No other commands can appear) Send the setting address command again-Waiting for the successful setting command sent by the slave-Successful modification

4) After power on, the command can only be set once, if you need to set again, you need to power on again.

5) When communicating normally, it flashes once per second.

1.Data frame format:

Default communication parameters: address 1, baud rate 9600, 1 start bit, 8 data, even parity, 1 stop bit;

Effective setting address: 1~247;

CRC check: The range is the check of all bytes before the CRC field, using 16-bit CRC check.

2.Data types:

Type	Description
short	Unsigned 16-bit integer
ushort	Unsigned 32-bit integer
int	Signed 16-bit integer
uint	Signed 32-bit integer
R	Read only

3.Register address table:

Register address	Data content	Data type	Accuracy	Unit
40002	Temperature	short (R)	0.001	°C
40003	X acceleration	int (R)	0.001	g
40005	Y acceleration	int (R)	0.001	g
40007	Z acceleration	int (R)	0.001	g
40010	X vibration frequency	short (R)	0.1	hz
40011	Y vibration frequency	short (R)	0.1	hz
40012	Z vibration frequency	short (R)	0.1	hz
40013	X vibration speed	int (R)	0.000001	m/s
40015	Y vibration speed	int (R)	0.000001	m/s
40017	Z vibration speed	int (R)	0.000001	m/s
40019	X vibration amplitude	int (R)	0.0000001	m
40021	Y vibration amplitude	int (R)	0.0000001	m
40023	Z vibration amplitude	int (R)	0.0000001	m

Data analysis method: data value = register data * coefficient.

4.Example : Read X axis data, Modbus function code 03H

Host query command		Slave response		
Sensor address	01H	Sensor address	01H	
Function code	03H	Function code	03H	
Register address	00H	Data length	0CH	
Register length	02H	Data word 1-4 bytes	00H	X acceleration
	00H		00H	
	06H		00H	
CRC	6408H		24H	
		Data word 5-8 bytes	FFH	Y vibration speed
			FFH	
			FFH	
		Data word 9-12 bytes	F0H	Z vibration speed
			00H	
			00H	

			E8H
		CRC_L	2CH
		CRC_H	DEH

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

1) Get the current data, X-axis acceleration is 00000002H, Y-axis acceleration is FFFFFFF0 H, Z-axis acceleration is 000003E8H. Then convert the above data to decimal. The y-axis acceleration is -16 and the z-axis acceleration is 1000.

2) Multiply by the accuracy to get the data X-axis acceleration is $2 \times 0.001 = 0.002g$, Y-axis acceleration is $-16 \times 0.001 = -0.016g$, Z-axis acceleration is $1000 \times 0.001 = 1g$.

5. Set Sensor address:

Set sensor address code command		Slave response	
Sensor address	01H	Sensor address	01H
Function code	06H	Function code	06H
Address	00H	Register address	00H
	11H		11H
Sensor new address	00H	Sensor new address	00H
	04H		04H
CRC	D80C	CRC	D80C

Commands must be sent twice consecutively to be effective.

Example of setting sensor address command									
Host send		01H	06H	00H	11H	00H	04H	D8H	0CH
Slave response									
01H	06H	00H	11H	00H	04H	D8 H	0CH		

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

6. Set the baud rate of the sensor: (The factory default is 9600bps)

Set sensor baud rate command		Slave response	
Sensor address	01H	Sensor address	01H
Function code	06H	Function code	06H
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 A4H:230400

Example of sensor baud rate setting:									
Host send		01H	06H	00H	12H	00H	A2H	A8H	76H
Slave response									
01H	06H	00H	12 H	00 H	A2H	A8H	76H		

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

7. Set the parity bit of the sensor serial port: (factory default is even parity)

Set parity bit command		Slave response	
Sensor address	01H	Sensor address	01H
Function code	06H	Function code	06H
Register address	00H	Register address	00H
	09H		09H
Sensor change parity bit	00H	Sensor change parity bit	00H
	01H		01H
CRC	9808	CRC	9808

Application example of setting parity bit command:

Host send	01 H	06 H	00 H	09 H	00 H	01H	98H	08H
Slave response	01 H	06 H	00 H	09 H	00 H	01H	98 H	08H

The above example is to set the byte format to: a start bit + 8 data bits no parity + 1 stop bit
Valid after re-powering on. The factory default is one start bit + 8 data bits even parity + 1 stop bit

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

0000H: a start bit + 8 data bits even parity + 1 stop bit

0001H: A start bit + 8 data bits without parity + 1 stop bit

8 . Set sensor output mode: (factory default 0HZ)

Set sensor output mode command:		Slave response:	
Sensor address	01H	Sensor address	01H
function code	06H	function code	06H
address	00H	register address	00H
	13H		13H
The output rate of the sensor	00H	The output rate of the sensor	00H
	XX		XX
CRC	CRC LH	CRC	CRC LH

The following table shows the valid values of data field XX :

frequency (HZ)	0	5	10	25	50	100	200	500	1000	300	400
XX	00H	01H	02H	03H	04H	05H	06H	07H	08H	09H	0AH

Application example of set Set sensor output mode command:

Host send	01H	06H	00H	13H	00H	A2H	A8H	76H
Slave response	01H	06H	00H	13H	00H	02H	A8H	76H

above example, the output rate of the sensor is set to 10HZ, the last two bytes are the CRC checksum, and the automatic output is three-axis acceleration data.

9. Set sensor auto-output data command :

Set sensor auto-output data command:		Slave response:	
Sensor address	01H	Sensor address	01H
function code	06H	function code	06H
address	00H	register address	00H
	00H		00H
Automatic outputs from sensors	91H	Automatic outputs from sensors	91H
	11H		11H
CRC	CRC LH	CRC	CRC LH

The command must be sent twice in a row to be effective

Application example of Set sensor auto-output data command:								
Host send	01H	06H	00H	00H	91H	11H	D8H	0CH
Slave response	01H	06H	00H	11H	00H	04H	D8H	0CH

Note: 0000H is the register address, which controls the sensor to automatically output data items. In the above example, the output item of the sensor is set to 9111H, and the last two bytes are the CRC checksum.

10. Read sensor automatic output data command:

Read sensor automatic output data command:		Slave response:	
Sensor address	01H	Sensor address	01H
function code	03H	function code	03H
register address	00H	length	02H
	00H		91H
register length	00H	register data	11H
	01H		
CRC	CRC LH	CRC	CRC LH

The command must be sent twice in a row to be effective

Application example of Read sensor automatic output data command:								
Host send	01H	03H	00H	00H	00H	01H	84H	0AH
Slave response	01H	03H	02H	91H	11H	15H	D8	

Note: 0000H is the register address, which controls the sensor to automatically output data items. In the above example, the output item of the read sensor is 9111H, and the last two bytes are the CRC checksum.

11. Set the sensor bandwidth:

Set Sensor bandwidth command: :		Slave response:	
Sensor address	01H	Sensor address	01H

Function code	06H	Function code	06H
address	00H	register address	00H
	14H		14H
Sensor bandwidth	00H	Sensor bandwidth	00H
	XXH		XXH
CRC	CRC LH	CRC	CRC LH

The following table shows the valid values of data field XX :

Low-pass bandwidth (HZ)	500	500	250	125	64	32
XX	0	1	2	3	4	5

The command must be sent twice in a row to be effective

Application Example of the Set Sensor Bandwidth Command:										
Host send			01H	06H	00H	14H	00H	01H	08H	04H
Slave response										
01H	06H	00H	14H	00H	01H	08H	04H			

Note: 0014H is the register address that controls the bandwidth of the sensor. In the above example, set the bandwidth of the sensor to 500 HZ, and the last two bytes are the CRC checksum.