WIT Standard Communication Protocol

Instructions for Command：

Command

The serial port sending command must be completed within 10S, otherwise it will be automatically locked. To avoid this situation, please do the following steps first.

1. **Enter the unlock command（0XFF 0XAA 0X69 0X88 0XB5，0X means hexadecimal ）**
2. **Enter the command that needs to modify or read the data**
3. **Save command（0XFF 0XAA 0X00 0X00 0X00）**

Register

ADDR (Hex)	ADDR (Dec)	REGISTER NAME	FUNCTION	SERIAL I/F	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
00	00	SAVE	Save/Reboot/Reset	R/W	SAVE[15:0]															
01	01	CALSW	Calibretion Mode	R/W													CALSW[3:0]			
02	02	RSW	Output Content	R/W						GSA	QUATER	VELOCITY	GPS	PRESS	PORT	MAG	ANGLE	GYRO	ACC	TIME
03	03	RRATE	Output rate	R/W													RRATE[3:0]			
04	04	BAUD	Baud rate	R/W													BAUD[3:0]			

05	05	AXOFFSET	Acceleration X bias	R/W	AXOFFSET[15:0]												
06	06	AYOFFSET	Acceleration Y bias	R/W	AYOFFSET[15:0]												
07	07	AZOFFSET	Acceleration Z bias	R/W	AZOFFSET[15:0]												
08	08	GXOFFSET	Angular velocity X bias	R/W	GXOFFSET[15:0]												
09	09	GYOFFSET	Angular velocity Y bias	R/W	GYOFFSET[15:0]												
0A	10	GZOFFSET	Angular velocity Z bias	R/W	GZOFFSET[15:0]												
0B	11	HXOFFSET	Magnetic field X bias	R/W	HXOFFSET[15:0]												
0C	12	HYOFFSET	Magnetic field Y bias	R/W	HYOFFSET[15:0]												
0D	13	HZOFFSET	Magnetic field Z bias	R/W	HZOFFSET[15:0]												
0E	14	D0MODE	D0 Pin Mode	R/W													D0MODE[3:0]
0F	15	D1MODE	D1 Pin Mode	R/W													D1MODE[3:0]
10	16	D2MODE	D2 Pin Mode	R/W													D2MODE[3:0]
11	17	D3MODE	D3 Pin Mode	R/W													D3MODE[3:0]

1A	26	IICADDR	Device address	R/W									IICADDR[7:0]							
1B	27	LEDOFF	Turn off LED light	R/W																LED OFF
1C	28	MAGRANGX	Magnetic field X calibration range	R/W	MAGRANGX[15:0]															
1D	29	MAGRANGY	Magnetic field Y calibration range	R/W	MAGRANGY[15:0]															
1E	30	MAGRANGZ	Magnetic field Z calibration range	R/W	MAGRANGZ[15:0]															
1F	31	BANDWIDTH	Bandwidth	R/W													BANDWIDTH[3:0]			
20	32	GYRORANGE	Gyro range	R/W													GYRORANGE[3:0]			
21	33	ACCRANGE	Acceleration range	R/W													ACCRANGE[3:0]			
22	34	SLEEP	Sleep	R/W																SLEEP
23	35	ORIENT	Installation direction	R/W																ORIENT
24	36	AXIS6	Algorithm	R/W																AXIS6
25	37	FILTK	Dynamic filtering	R/W	FILTK[15:0]															

26	38	GPSBAUD	GPS Baud rate	R/W													GPSBAUD[3:0]			
27	39	READADDR	Read register	R/W									READADDR[7:0]							
2A	42	ACCFILT	Acceleration filtering	R/W	ACCFILT[15:0]															
2D	45	POWONSEND	command start	R/W													POWONSEND[3:0]			
2E	46	VERSION	Version number	R	VERSION[15:0]															
30	48	YYMM	Year/Mouth	R/W	MOUTH[15:8]								YEAR[7:0]							
31	49	DDHH	Hour/Day	R/W	HOUR[15:8]								DAY[7:0]							
32	50	MMSS	Minutes/Seconds	R/W	SECONDS[15:8]								MINUTE[7:0]							
33	51	MS	millisecond	R/W	MS[15:0]															
34	52	AX	Acceleration X	R	AX[15:0]															
35	53	AY	Acceleration Y	R	AY[15:0]															
36	54	AZ	Acceleration Z	R	AZ[15:0]															
37	55	GX	Angular velocity X	R	GX[15:0]															
38	56	GY	Angular velocity Y	R	GY[15:0]															
39	57	GZ	Angular velocity Z	R	GZ[15:0]															

3A	58	HX	Magnetic field X	R	HX[15:0]
3B	59	HY	Magnetic field Y	R	HY[15:0]
3C	60	HZ	Magnetic field Z	R	HZ[15:0]
3D	61	Roll	Roll	R	Roll[15:0]
3E	62	Pitch	Pitch angle	R	Pitch[15:0]
3F	63	Yaw	Heading	R	Yaw[15:0]
40	64	TEMP	Temperature	R	TEMP[15:0]
41	65	D0Status	D0 pin state	R	D0Status[15:0]
42	66	D1Status	D1pin state	R	D1Status[15:0]
43	67	D2Status	D2 pin state	R	D2Status[15:0]
44	68	D3Status	D3 pin state	R	D3Status[15:0]
45	69	PressureL	Air pressure low 16 bits	R	PressureL[15:0]
46	70	PressureH	Air pressure high16 bits	R	PressureH[15:0]
47	71	HeightL	Height lower 16 bits	R	HeightL[15:0]
48	72	HeightH	Height high 16 bits	R	HeightH[15:0]
49	73	LonL	Longitude lower 16 bits	R	LonL[15:0]
4A	74	LonH	Longitude	R	LonH[15:0]

			high 16 bits		
4B	75	LatL	Latitude lower 16 bits	R	LatL[15:0]
4C	76	LatH	Latitude high 16 bits	R	LatH[15:0]
4D	77	GPSHeight	GPS Altitute	R	GPSHeight[15:0]
4E	78	GPSYAW	GPS Heading	R	GPSYAW[15:0]
4F	79	GPSVL	GPS round speed low 16 bits	R	GPSVL[15:0]
50	80	GPSVH	GPS ground speed high 16 bits	R	GPSVH[15:0]
51	81	q0	Quaternion 0	R	q0[15:0]
52	82	q1	Quaternion1	R	q1[15:0]
53	83	q2	Quaternion2	R	q2[15:0]
54	84	q3	Quaternion3	R	q3[15:0]
55	85	SVNUM	Number of satellites	R	SVNUM[15:0]
56	86	PDOP	Position accuracy	R	PDOP[15:0]
57	87	HDOP	Horizontal accuracy	R	HDOP[15:0]
58	88	VDOP	Vertical accuracy	R	VDOP[15:0]

59	89	DELAYT	Alarm delay	R/W	DELAYT[15:0]			
5A	90	XMIN	X-axis angle alarm min.	R/W	XMIN[15:0]			
5B	91	XMAX	X-axis angle alarm max.	R/W	XMAX[15:0]			
5C	92	BATVAL	Supply voltage	R	BATVAL[15:0]			
5D	93	ALARMPIN	Alarm Pin Mapping	R/W	X-ALARM[15:12]	X+ALARM[11:8]	Y-ALARM[7:4]	Y+ALARM[3:0]
5E	94	YMIN	Y-axis alarm min.	R/W	YMIN[15:0]			
5F	95	YMAX	Y-axis alarm max.	R/W	YMAX[15:0]			
61	97	GYROCALITHR	Gyro Still Threshold	R/W	GYROCALITHR[15:0]			
62	98	ALARMLEVEL	Angle alarm level	R/W				ALARMLEVEL[3:0]
63	99	GYROCALTIME	Gyro auto calibration time	R/W	GYROCALTIME[15:0]			
68	104	TRIGTIME	Alarm continuous trigger time	R/W	TRIGTIME[15:0]			
69	105	KEY	Unlock	R/W	KEY[15:0]			
6A	106	WERROR	Gyro change	R	WERROR[15:0]			
6B	107	TIMEZONE	GPSTimezone	R/W			TIMEZONE[7:0]	

6E	110	WZTIME	Angular velocity continuous rest time	R/W	WZTIME[15:0]	
6F	111	WZSTATIC	Angular velocity integral threshold	R/W	WZSTATIC[15:0]	
74	116	MODDELAY	485 data response delay	R/W		
79	121	XREFROLL	Roll angle zero reference value	R	XREFROLL[15:0]	
7A	122	YREFPITCH	Pitch angle zero reference value	R	YREFPITCH[15:0]	
7F	127	NUMBERID1	Device No1-2	R	ID2[15:8]	ID1[7:0]
80	128	NUMBERID2	Device No3-4	R	ID4[15:8]	ID3[7:0]
81	129	NUMBERID3	Device No5-6	R	ID6[15:8]	ID5[7:0]
82	130	NUMBERID4	Device No7-8	R	ID8[15:8]	ID7[7:0]
83	131	NUMBERID5	Device No9-10	R	ID10[15:8]	ID9[7:0]
84	132	NUMBERID6	Device No11-12	R	ID12[15:8]	ID11[7:0]

Protocol Format

Read

- The Data is sent in hexadecimal, not ASCII.
- Each data is transmitted in sequence by low byte and high byte, and the two are combined into a signed short type of data. For example, for data DATA1, DATA1L is the low byte and DATA1H is the high byte. The conversion method is as follows:

Suppose DATA1 is the actual data, DATA1H is its high-byte part, DATA1L is its low-byte part.

Then: DATA1=(short)((short)DATA1H<<8|DATA1L). It must be noted here that DATA1H needs to be coerced into a signed short type of data before shifting, and the data type of DATA1 is also a signed short type, so that it can represent negative numbers.

Protocol header	Data content	Data lower 8 bits	Data higher 8 bits	Data lower 8 bits	Data higher 8 bits	Data lower 8 bits	Data higher 8 bits	Data lower 8 bits	Data higher 8 bits	SUMCRC
0x55	TYPE【1】	DATA1L[7:0]	DATA1H[15:8]	DATA2L[7:0]	DATA2H[15:8]	DATA3L[7:0]	DATA3H[15:8]	DATA4L[7:0]	DATA4H[15:8]	SUMCRC【2】

【1】TYPE(Data content):

TYPE	Remark
0x50	Time
0x51	Acceleration
0x52	Angular velocity
0x53	Angle

0x54	Magnetic field
0x55	Port
0x56	Barometric altitude
0x57	Latitude and Longitude
0x58	ground speed
0x59	Quaternion
0x5A	GPS Location accuracy
0x5F	Read

【2】SUMCRC(Data and calibration)：

SUMCRC=0x55+TYPE+DATA1L+DATA1H+DATA2L+DATA2H+DATA3L+DATA3H+DATA4L+DATA4H

SUMCRC is a char type, taking the lower 8 bits of the checksum

Time Output

0x55	0x50	YY	MM	DD	HH	MN	SS	MSL	MSH	SUM

Name	Describe	Remark
YY	Year	
MM	Mouth	
DD	Day	
HH	Hour	
MN	Minute	
SS	Seconds	
MSL	MS lower 8 bits	Millisecond calculation formula: milliseconds=((MSH<<8)|MSL)
MSH	MS higher 8 bits	
SUM	Checksum	SUM=0x55+0x50+YY+MM+DD+HH+MN+SS+MSL+MSH

Acceleration Output

0x55	0x51	AxL	AxH	AyL	AyH	AzL	AzH	TL	TH	SUM

Name	Description	Remark
AxL	Acceleration X low 8 bits	Acceleration X=((AxH<<8)|AxL)/32768*16g (g is the acceleration of gravity, preferably 9.8m/s2)
AxH	Acceleration X high 8 bits	
AyL	Acceleration Y low 8 bits	Acceleration Y=((AyH<<8)|AyL)/32768*16g (g is the acceleration of gravity, preferably 9.8m/s2)
AyH	Acceleration Yhigh 8 bits	
AzL	Acceleration Z low 8 bits	Acceleration Z=((AzH<<8)|AzL)/32768*16g (g is the acceleration of gravity, preferably 9.8m/s2)
AzH	Acceleration Z high 8 bits	
TL	8-bit lower temperature	Temperature calculation formula: Temperature=((TH<<8)|TL) /100 ℃
TH	8-bit higher temperature	
SUM	Check sum	SUM=0x55+0x51+AxL+AxH+AyL+AyH+AzL+AzH+TL+Th

Angular velocity output

0x55	0x52	WxL	WxH	WyL	WyH	WzL	WzH	VolL	VolH	SUM

Name	Description	Remark
WxL	Angular velocity X low 8 bits	Angular velocity X=((WxH<<8)|WxL)/32768*2000°/s
WxH	Angular velocity X high 8 bits	
WyL	Angular velocity Y low 8 bits	Angular velocity Y=((WyH<<8)|WyL)/32768*2000°/s
WyH	Angular velocity Y high 8 bits	
WzL	Angular velocity Z low 8 bits	Angular velocity Z=((WzH<<8)|WzL)/32768*2000°/s
WzH	Angular velocity Z high 8 bits	
VolL	Voltage lower 8 bits	（Non-Bluetooth products, the data is invalid) Voltage

VolH	Voltage higher 8 bits	calculation formula： Voltage=((VolH<<8)|VolL) /100 ℃
SUM	Check sum	SUM=0x55+0x52+WxL+WxH+WyL+WyH+WzL+WzH+VolH+VolL

Angular output

0x55	0x53	RollL	RollH	PitchL	PitchH	YawL	YawH	VL	VH	SUM

Name	Description	Remark
RollL	Roll angle X lower 8 bits	Roll angle X=((RollH<<8)|RollL)/32768*180(°)
RollH	Roll angle X highter 8 bits	
PitchL	Pitch angle Y low 8 bits	Pitch angleY=((PitchH<<8)|PitchL)/32768*180(°)
Pitch H	Pitch angle Y high 8 bits	
YawL	Yaw angle Z lower8 bits	Yaw angleZ=((YawH<<8)|YawL)/32768*180(°)
YawH	Yaw angle Z higher 8 bits	
VL	Version number lower 8 bits	Version number calculation formula: Version number=(VH<<8)|VL

VH	Version number higher 8 bits	
SUM	Check Sum	SUM=0x55+0x53+RollH+RollL+PitchH+PitchL+YawH+YawL+VH+VL

Magnetic field output

0x55	0x54	HxL	HxH	HyL	HyH	HzL	HzH	TL	TH	SUM

Name	Description	Remark
HxL	Magnetic field X lower 8 bits	Magnetic fieldX=((HxH<<8)|HxL)
HxH	Magnetic field X higher 8 bits	
HyL	Magnetic field Y lower 8 bits	Magnetic fieldY=((HyH <<8)|HyL)
HyH	Magnetic fieldY higher 8 bits	
HzL	Magnetic field Z lower 8 bits	Magnetic fieldZ=((HzH<<8)|HzL)
HzH	Magnetic field Z lower 8 bits	
TL	8-bit lower temperature	Temperature calculation formula: Temperature=((TH<<8)|TL) /100 ℃
TH	8-bit lhigher temperature	
SUM	Check Sum	SUM=0x55+0x54+HxH+HxL+HyH+HyL+HzH+HzL+TH+TL

Port status output

0x55	0x55	D0L	D0H	D1L	D1H	D2L	D2H	D3L	D3H	SUM

Name	Description	Remark
D0L	D0 status lower 8 bits	D0 status=((D0H<<8)|D0L)
D0H	D0 status higher 8 bits	
D1L	D1 status lower 8 bits	D1status=((D1H<<8)|D1L)
D1H	D1 status higher 8 bits	
D2L	D2 status lower 8 bits	D2 status=((D2H<<8)|D2L)
D2H	D2 status higher 8 bits	
D3L	D3 status lower 8 bits	D3 status=((D3H<<8)|D3L)
D3H	D3 status higher 8 bits	
SUM	Check Sum	SUM=0x55+0x54+D0L+D0H+D1L+D1H+D2L+D2H+D3L+D3H

explanation：

● When the port mode is set to analog input, the port status data represents the analog voltage. The actual voltage is calculated according to the formula below:

U=DxStatus/1024*Uvcc

● Uvcc is the power supply voltage of the chip. Since there are LDOs on the chip, if the power supply voltage of the module is greater than 3.5V, Uvcc is 3.3V. If the module power supply voltage is less than 3.5V, Uvcc=pexplaower supply voltage - 0.2V.

● When the port mode is set to digital input, the port status data indicates the digital level status of the port, high level is 1 and low level is 0.

● When the port mode is set to high-level output mode, the port status data is 1.

● When the port mode is set to low-level output mode, the port status data bit is 0.

Air pressure altitude output

0x55	0x56	P0	P1	P2	P3	H0	H1	H2	H3	SUM

Name	Description	Remark
P0	Air pressure[7:0]	Air pressure[=(P3<<24)|(P2<<16)|(P1<<8)|P0(Pa)
P1	Air pressure[[15:8]	
P2	Air pressure[[23:16]	
P3	Air pressure[31:24]	
H0	Altitute[7:0]	Altitute=(H3<<24)|(H2<<16)|(H1<<8)|H0(cm)
H1	Altitute[15:8]	
H2	Altitute[23:16]	
H3	Altitute[31:24]	
SUM	Check sum	SUM=0x55+0x56+P0+P1+P2+P3+H0+H1+H2+H3

Latitude and longitude

0x55	0x57	Lon0	Lon1	Lon2	Lon3	Lat0	Lat1	Lat2	Lat3	SUM

Name	Description	Remark
Lon0	Longitude[7:0]	Longitude=(Lon3<<24)|(Lon2<<16)|(Lon1<<8)|Lon0
Lon1	Longitude[15:8]	
Lon2	Longitude[23:16]	
Lon3	Longitude[31:24]	
Lat0	Latitude[7:0]	Latitude=(Lat3<<24)|(Lat2<<16)|(Lat1<<8)|Lat0
Lat1	Latitude[15:8]	
Lat2	Latitude[23:16]	
Lat3	Latitude[31:24]	
SUM	Checksum	SUM=0x55+0x57+Lon0+Lon1+Lon2+Lon3+Lat0+Lat1+Lat2+Lat3

Explanation:

The NMEA8013 standard stipulates that the longitude output format of GPS is dd mm.mmmmm (dd is degrees, mm.mmmmm is minutes), and the decimal point is removed from the output of longitude/latitude, so the degrees of longitude/latitude can be calculated as follows:

dd=Lon [31:0]/10000000;

dd=Lat [31:0]/10000000;

Longitude/latitude fraction calculation:

mm.mmmmm= (Lon [31:0] %10000000)/100000(% indicates the remainder operation)

mm.mmmmm= (Lat [31:0] %10000000)/100000(% indicates the remainder operation)

GPS data output

0x55	0x58	GPS HeightL	GPS HeightH	GPS YawL	GPS YawH	GPSV0	GPSV1	GPSV2	GPSV3	SUM

Name	Description	Remark
GPS HeightL	GPS altitude[7:0]	GPS altitude=((GPSHeightH<<8)|GPSHeightL)/10(m)
GPS HeightH	GPS altitude[15:8]	
GPS YawL	GPS heading [7:0]	GPS heading =((GPSYawH<<8)|GPSYawL)/100(°)
GPS YawH	GPSheading [15:8]	
GPS V0	GPS Ground Speed[7:0]	GPS Ground Speed = ((GPSV3<<24)|(GPSV2<<16)|(GPSV1<<8)|GPSV0)/1000(km/h)
GPS V1	GPS Ground	

	Speed[15:8]	
GPSV2	GPS Ground Speed[23:16]	
GPSV3	GPS Ground Speed[31:24]	
SUM	Check sum	SUM=0x55+0x58+GPSHeightL+GPSHeightH+GPSYawL+GPSYawH+GPSV0+GPSV1+GPSV2+GPSV3

Quaternion output

0x55	0x59	Q0L	Q0H	Q1L	Q1H	Q2L	Q2H	Q3L	Q3H	SUM

<table>
<tr><th>Name</th><th>Description</th><th>Remark</th></tr>
<tr><td>Q0L</td><td>Q0 lower 8 bits</td><td rowspan="2">q0=((Q0H<<8) |Q0L)/32768</td></tr>
<tr><td>Q0H</td><td>Q0 high 8 bits</td></tr>
<tr><td>Q1L</td><td>Q1 lower 8 bits</td><td rowspan="2">q1=((Q1H<<8) |Q1L)/32768</td></tr>
<tr><td>Q1H</td><td>Q1 high 8 bits</td></tr>
<tr><td>Q2L</td><td>Q2 lower 8 bits</td><td rowspan="2">q2=((Q2H<<8) |Q2L)/32768</td></tr>
<tr><td>Q2H</td><td>Q2 high 8 bits</td></tr>
<tr><td>Q3L</td><td>Q3 lower 8 bits</td><td rowspan="2">q3=((Q3H<<8)|Q3L)/32768</td></tr>
<tr><td>Q3H</td><td>Q3 high 8 bits</td></tr>
<tr><td>SUM</td><td>Checksum</td><td>SUM=0x55+0x59+Q0L+Q0H+Q1L +Q1H
+Q2L+Q2H+Q3L+Q3H</td></tr>
</table>

GPS Positioning accuracy output

0x55	0x5A	SNL	SNH	PDOPL	PDOPH	HDOPL	HDOPH	VDOPL	VDOPH	SUM

Name	Description	Remark
SNL	Satellite number low 8 bits	GPSSatellite number=((SNH<<8) |SNL)
SNH	Satellite number high 8 bits	
PDOPL	Position accuracy low 8 bits	Position accuracy=((PDOPH<<8) |PDOPL)/100
PDOPH	Position accuracy high 8 bits	
HDOPL	Horizontal precision low 8 bits	Horizontal precision=((HDOPH<<8) |HDOPL)/100

<table>
<tr><td>HDOPH</td><td>Horizontal precision high 8 bits</td><td></td></tr>
<tr><td>VDOPL</td><td>Vertical precision low 8 bits</td><td rowspan="2">Vertical precision =((VDOPH<<8)|VDOPL)/100</td></tr>
<tr><td>VDOPH</td><td>Vertical precision high 8 bits</td></tr>
<tr><td>SUM</td><td>Checksum</td><td>SUM=0x55+0x5A+SNL+SNH+PDOPL+PDOPH+HDOPL+HDOPH+VDOPL+VDOPH</td></tr>
</table>

Read the return value of the register

- Read the value of the register specified by the user, read REG1, then return the value of the 4 registers of REG1~REG4, the protocol must return 4 registers.

0x55	0x5F	REG1L	REG1H	REG2L	REG2H	REG3L	REG3H	REG4L	REG4H	SUM

<table>
<tr><th>Name</th><th>Description</th><th>Remark</th></tr>
<tr><td>REG1L</td><td>Register 1 low 8 bits</td><td rowspan="2">REG1[15:0]=((REG1H<<8)|REG1L)</td></tr>
<tr><td>REG1H</td><td>Register 1 high 8 bits</td></tr>
<tr><td>REG2L</td><td>Register 2 low 8 bits</td><td rowspan="2">REG2[15:0]=((REG2H<<8)|REG2L)</td></tr>
<tr><td>REG2H</td><td>Register 2 high 8 bits</td></tr>
<tr><td>REG3L</td><td>Register 3 low 8 bits</td><td rowspan="2">REG3[15:0]=((REG3H<<8)|REG3L)</td></tr>
<tr><td>REG3H</td><td>Register 3 high 8 bits</td></tr>
</table>

REG 4L	Register 4 low 8 bits	REG4[15:0]=((REG4H<<8)|REG4L)
REG 5H	Register 4 high 8 bits	
SUM	Checksum	SUM=0x55+0x5F+REG1L+REG1H+REG2L+REG2H+REG3L+REG3H+REG4L+REG4H

Example:

Read register "AXOFFSET", return：0x55 0x5F AXOFFSET [7:0] AXOFFSET [15:8] AYOFFSET [7:0] AYOFFSET [15:8] AZOFFSET [7:0] AZOFFSET [15:8] GXOFFSET [7:0] GXOFFSET [15:8] SUM

Write Format

- The following data are all Hex codes in hexadecimal
- All settings need to operate the unlock register first(KEY)

Head	Head	Register	Data lower 8 bits	Data high 8 bits
0xFF	0xAA	ADDR	DATAL[7:0]	DATAH[15:8]

- The data is sent in hexadecimal not ASCII.
- Each data is divided into low byte and high byte and transmitted in turn, and the two are combined into a signed short data.

For example, DATA, DATAL is the low byte, DATAH is the high byte.

Conversion method: Assuming that DATA is the actual data, DATAH is its high-byte part, and DATAL is its low-byte part, then:DATA=(short)((short)DATAH<<8|DATAL)

DATAH must be cast to a signed short type before shifting, and the data type of DATA is also a signed short type, so that negative numbers can be represented.

Note:

There are three steps to perform the command write operation.

Step1. Unlock 0xFF 0XAA 0X69 0X88 0XB5

Step2. Send the command to be modified

Step3. Save 0xFF 0XAA 0X00 0X00 0X00

The flow chart is below.The data is sent in hexadecimal not ASCII.

Each data is divided into low byte and high byte and transmitted in turn, and the two are combined into a signed short data.

For example, DATA, DATAL is the low byte, DATAH is the high byte.

Conversion method: Assuming that DATA is the actual data, DATAH is its high-byte part, and DATAL is its low-byte part, then:DATA=(short)((short)DATAH<<8|DATAL)

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Note:

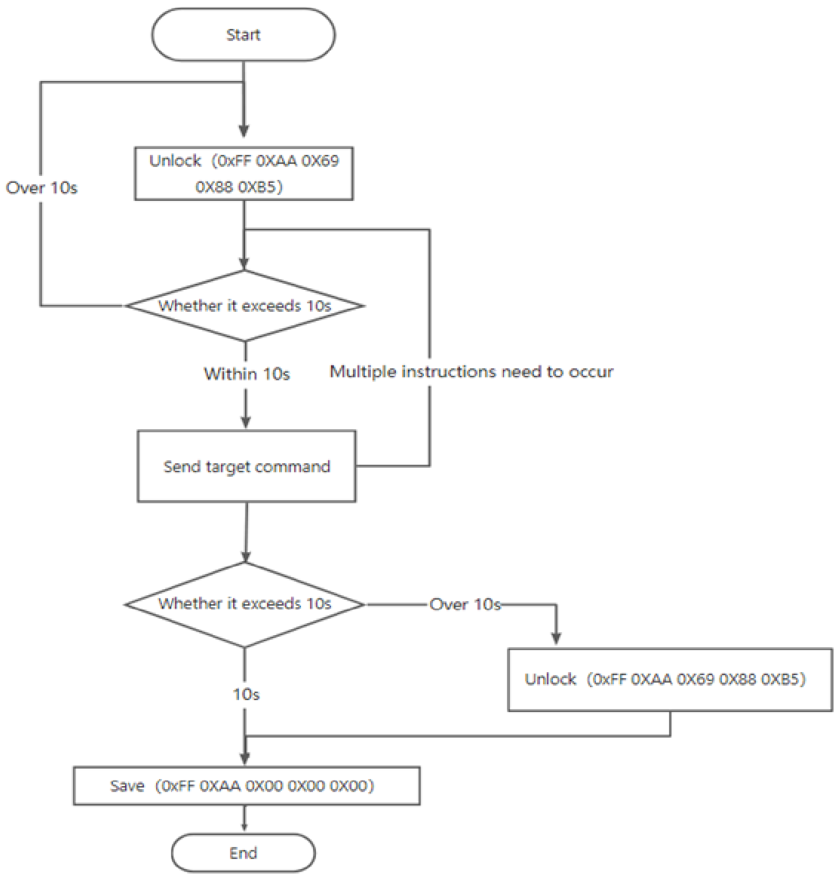
There are three steps to perform the command write operation.

Step1. Unlock 0xFF 0XAA 0X69 0X88 0XB5

Step2. Send the command to be modified

Step3. Save 0xFF 0XAA 0X00 0X00 0X00

The flow chart is below.



SAVE(Save/restart/reset)

Register Name: SAVE

Register Address: 0 (0x00)

Read and write direction: R/W

Default: 0x0000

Bit	NAME	FUNCTION
15:0	SAVE[15:0]	Save: 0x0000 Restart: 0x00FF Factory reset: 0x0001

Example：FF AA 00 FF 00（Restart）

CALSW（Calibration mode）

Register Name: CALSW Register Address: 1 (0x01) Read and write direction: R/W Default: 0x0000		
Bit	NAME	FUNCTION
15:4		
3:0	CAL[3:0]	Set calibration mode: 0000(0x00): Normal working mode 0001(0x01): Automatic accelerometer calibration 0011(0x03): Height reset 0100(0x04): Set the heading angle to zero 0111(0x07): Magnetic Field Calibration (Spherical Fitting) 1000 (0x08): Set the angle reference 1001(0x09): Magnetic Field Calibration (Dual Plane Mode)
Example：FF AA 01 04 00（Set heading angle to zero）		

RSW（Output content）

Register Name: RSW Register Address: 2 (0x02) Read and write direction: R/W Default: 0x001E		
Bit	NAME	FUNCTION
15:11		
10	GSA (0x5A)	0: off 1: on
9	QUATER (0x59)	0: off 1: on
8	VELOCITY (0x58)	0: off 1: on
7	GPS (0x57)	0: off 1: on
6	PRESS (0x56)	0: off 1: on
5	PORT (0x55)	0: off 1: on
4	MAG (0x54)	0: off 1: on
3	ANGLE (0x53)	0: off 1: on
2	GYRO (0x52)	0: off 1: on
1	ACC (0x51)	0: off 1: on
0	TIME (0x50)	0: off 1: on
Example: FF AA 02 3E 00 (set to only output acceleration, angular velocity, angle, magnetic field, port state)		

RRATE (Output rate)

Register Name: RRATE Register Address: 3 (0x03) Read and write direction: R/W Default: 0x0006		
Bit	NAME	FUNCTION
15:4		
3:0	RRATE[3:0]	Set the output rate: 0001(0x01): 0.2Hz 0010(0x02): 0.5Hz 0011(0x03): 1Hz 0100(0x04): 2Hz 0101(0x05): 5Hz 0110(0x06): 10Hz 0111(0x07): 20Hz 1000(0x08): 50Hz 1001(0x09): 100Hz 1011(0x0B): 200Hz 1011(0x0C): single return 1100(0x0D): no return

Example: FF AA 03 03 00 (set 1Hz output)

Note: HWT906, WT931 can output 500Hz, 1000Hz

FF AA 03 0C 00: 500HzFF AA 03 0D 00: 1000Hz

FF AA 03 10 00 : single return

BAUD（Serial baud rate）

Register Name: BAUD Register Address: 4 (0x04) Read and write direction: R/W Default: 0x0002		
Bit	NAME	FUNCTION
15:4		
3:0	BAUD[3:0]	Set the serial port baud rate: 0001(0x01): 4800bps 0010(0x02): 9600bps 0011(0x03): 19200bps 0100(0x04): 38400bps 0101(0x05): 57600bps 0110(0x06): 115200bps 0111(0x07): 230400bps 1000(0x08): 460800bps（Only supportsWT931/JY931/HWT606/HWT906） 1001(0x09): 921600bps（Only supportsWT931/JY931/HWT606/HWT906）
Example：FF AA 04 06 00（Set serial port baud rate115200）		

AXOFFSET~HZOFFSET（Zero bias setting）

Register Name: AXOFFSET~HZOFFSET Register Address: 5~13 (0x05~0x0D) Read and write direction: R/W Default: 0x0000		
Bit	NAME	FUNCTION
15:0	AXOFFSET[15:0]	Acceleration X-axis zero offset, actualvalue=AXOFFSET[15:0]/10000(g)
15:0	AYOFFSET[15:0]	Acceleration Y-axis zero offset, actualvalue=AYOFFSET[15:0]/10000(g)
15:0	AZOFFSET[15:0]	Acceleration Z-axis zero offset, actualvalue=AZOFFSET[15:0]/10000(g)
15:0	GXOFFSET[15:0]	Angular velocity X-axis zero offset, actual value=GXOFFSET[15:0]/10000(°/s)
15:0	GYOFFSET[15:0]	Angular velocity Y-axis zero offset, actual value=GYOFFSET[15:0]/10000(°/s)
15:0	GZOFFSET[15:0]	Angular velocity Z-axis zero offset, actual value=GZOFFSET[15:0]/10000(°/s)
15:0	HXOFFSET[15:0]	Magnetic field X-axiszero offset
15:0	HYOFFSET[15:0]	Magnetic field Y-axiszero offset
15:0	HZOFFSET[15:0]	Magnetic field Z-axiszero offset

Example: FF AA 05 E8 03 (set acceleration X-axis offset 0.1g),0x03E8=1000，1000/10000=0.1(g)

D0MODE~D3MODE（Port Mode Settings）

Register Name: D0MODE~D3MODE

Register Address: 14~17 (0x0E~0x11)

Read and write direction: R/W

Default: 0x0000

Bit	NAME	FUNCTION
3:0	D0MODE[3:0]	Set D0 port mode 0000(0x00): Analog input (default) 0001 (0x01): Digital input 0010 (0x02): Output digital high level 0011(0x03): Output digital low level
3:0	D1MODE[3:0]	Set D1 port mode 0000(0x00): Analog input (default) 0001(0x01): Digital input 0010(0x02): Output digital high level 0011(0x03): Output digital low level 0101(0x05): Set relative pose
3:0	D2MODE[3:0]	Set D2 port mode

		0000(0x00): Analog input (default) 0001(0x01): Digital input 0010(0x02): Output digital high level 0011(0x03): Output digital low level
3:0	D3MODE[3:0]	Set D3 port mode 0000(0x00): Analog input (default) 0001(0x01): Digital input 0010(0x02): Output digital high level 0011(0x03): Output digital low level
Example: FF AA 0E 03 00 (set D0 as the output digital low level mode)		

IICADDR（Device address）

Register Name: IICADDR Register Address: 26 (0x1A) Read and write direction: R/W Default: 0x0050		
Bit	NAME	FUNCTION
15:8		
7:0	IICADDR[7:0]	Set the device address for I2C and Modbus communication 0x01~0x7F
Example：FF AA 1A 02 00（set the device address to 0x02）		

LEDOFF

Register Name: LEDOFF Register address: 27 (0x1B) Read and write direction: R/W Default value: 0x0000		
Bit	NAME	FUNCTION
15:1		
0	LEDOFF	1: Turn off the LED light 0: Turn on the LED light
Example: FF AA 1B 01 00 (turn off the LED light)		

MAGRANGX~MAGRANGZ

Register Name: MAGRANGX~MAGRANGZ

Register Address: 28~30 (0x1C~0x1E)

Read and write direction: R/W

Default: 0x01F4

Bit	NAME	FUNCTION
15:0	MAGRANGX[15:0]	Magnetic field calibration X-axis range
15:0	MAGRANGY[15:0]	Magnetic Field Calibration Y-axis range
15:0	MAGRANGZ[15:0]	Magnetic field calibration Z-axis range

Example: FF AA 1C F4 01 (set the calibration X-axis range to 500)

BANDWIDTH

Register Name: BANDWIDTH

Register Address: 31 (0x1F)

Read and write direction: R/W

Default: 0x0004

Bit	NAME	FUNCTION
15:4		
3:0	BANDWIDTH[3:0]	Set bandwidth 0000(0x00): 256Hz 0001(0x01): 188Hz 0010(0x02): 98Hz 0011(0x03): 42Hz 0100(0x04): 20Hz 0101(0x05): 10Hz 0110(0x06): 5Hz

Example: FF AA 1F 01 00 (set the bandwidth to 188Hz)

GYRORANGE

Register Name: GYRORANGE Register Address: 32 (0x20) Read and write direction: R/W Default: 0x0003		
Bit	NAME	FUNCTION
15:4		
3:0	GYRORANGE[3:0]	Set the gyro range 0011(0x03): 2000°/s The default is 2000°/s, fixed and cannot be set
Example: FF AA 20 03 00 (set the gyro range to 2000°/s)		

ACCRANGE

Register Name: ACCRANGE Register Address: 33 (0x21) Read and write direction: R/W Default: 0x0000		
Bit	NAME	FUNCTION
15:4		
3:0	ACCRANGE[3:0]	Set the accelerometer range 0000(0x00): ±2g 0011(0x03): ±16g This parameter cannot be set. The product's internal adaptive acceleration range will automatically switch to 16g when the acceleration exceeds 2g.
Example: FF AA 21 00 00 (set the accelerometer range to 16g)		

SLEEP

Register Name: SLEEP Register Address: 34 (0x22) Read and write direction: R/W Default: 0x0000		
Bit	NAME	FUNCTION
15:1		
0	SLEEP	set hibernate 1(0x01): sleep Any serial data to wake up
Example: FF AA 22 01 00 (go to sleep)		

ORIENT（Installation direction）

Register Name: ORIENT Register Address: 35 (0x23) Read and write direction: R/W Default: 0x0000		
Bit	NAME	FUNCTION
15:1		
0	ORIENT	Set the installation direction 0 (0x00): horizontal installation 1(0x01): Vertical installation (the Y-axis arrow of the coordinate axis must be upwards)
Example: FF AA 23 01 00 (set vertical installation)		

AXIS6（Algorithm)

Register Name: AXIS6 Register Address: 36 (0x24) Read and write direction: R/W Default: 0x0000		
Bit	NAME	FUNCTION
15:1		
0	AXIS6	set algorithm 0(0x00): 9-axis algorithm (magnetic field solution heading angle, absolute heading angle) 1 (0x01): 6-axis algorithm (integral solution heading angle, relative heading angle)
Example: FF AA 24 01 00 (set 6-axis algorithm mode)		

FILTK（K-value filtering）

Register Name: FILTK

Register Address: 37 (0x25)

Read and write direction: R/W

Default: 0x001E

Bit	NAME	FUNCTION
15:0	FILTK[15:0]	Range: 1~10000, default 30 (modification is not recommended) The smaller the FILTK [15:0], the stronger the seismic performance and the weaker the real-time performance. The larger the FILTK[15:0], the weaker the seismic performance and the stronger the real-time performance.

Example: FF AA 25 1E 00 (set K value filter to 30)

GPSBAUD（GPS Baud Rate）

Register Name: GPSBAUD Register Address: 38 (0x26) Read and write direction: R/W Default: 0x0002		
Bit	NAME	FUNCTION
15:4		
3:0	GPSBAUD[3:0]	Set GPS baud rate： 0001(0x01): 4800bps 0010(0x02): 9600bps 0011(0x03): 19200bps 0100(0x04): 38400bps 0101(0x05): 57600bps 0110(0x06): 115200bps 0111(0x07): 230400bps
Example: FF AA 26 02 00 (set GPS baud rate 9600)		

READADDR（Read registers）

Register Name: READADDR Register Address: 39 (0x27) Read and write direction: R/W Default: 0x00FF		
Bit	NAME	FUNCTION
15:8		
7:0	READADDR[7:0]	Read register range: Please refer to "Register Table"
Example: Send: FF AA 27 34 00 (read acceleration X axis 0x34) Return: 55 5F AXL AXH AYL AYH AZL AZH GXL GXH SUM For details, please refer to "Read Register Return Value" in the "Read Format" chapter		

ACCFILT（Acceleration filtering）

Register Name: ACCFILT Register Address: 42 (0x2A) Read and write direction: R/W Default: 0x01F4		
Bit	NAME	FUNCTION
15:0	ACCFILT[15:0]	Range: 1~10000, default 500 (It is not recommended to modify, once modified, if the angle does not meet the requirements for use, please modify it to 500) The smaller the ACCFILT [15:0], the stronger the seismic performance and the weaker the real-time performance. The larger the ACCFILT [15:0], the weaker the seismic performance and the stronger the real-time performance. This parameter is an empirical value and needs to be debugged according to different environments. For example, in a tractor environment: ACCFILT[15:0] can be adjusted to 100, the vibration of the tractor is serious, and the seismic performance needs to be improved.
Example: FF AA 2A F4 01 (set acceleration filter 500)		

POWONSEND（Power-on output）

Register Name: POWONSEND Register Address: 45 (0x2D) Read and write direction: R/W Default: 0x0001		
Bit	NAME	FUNCTION
15:4		
3:0	POWONSEND[3:0]	Set the command to start: 0000(0x00): Turn off power-on data output 0001(0x01): Turn on power-on data output
Example: FF AA 2D 00 00 (turn on power-on data output)		

VERSION（Version number）

Register Name: VERSION

Register Address: 46 (0x2E)

Read and write direction: R

Default: none

Bit	NAME	FUNCTION
15:0	VERSION[15:0]	Different products, different version numbers

Example:

Send: FF AA 27 2E 00 (read version number, 0x27 means read, 0x2E is version number register)

Return：55 5F VL VH XX XX XX XX XX XX SUM

VERSION[15:0]=(short)(((short)VH<<8)|VL)

YYMM~MS（Chip time）

Register Name: YYMM~MS

Register address: 48~51 (0x30~0x33)

Read and write direction: R/W

Default: 0x0000

Bit	NAME	FUNCTION
15:8	YYMM[15:8]	Month
7:0	YYMM[7:0]	Year
15:8	DDHH[15:8]	Hour
7:0	DDHH[7:0]	Day
15:8	MMSS[15:8]	Seconds
7:0	MMSS[7:0]	Minute
15:0	MS[15:0]	Millisecond

Example:

FF AA 30 16 03 (set year 22-03)

FF AA 31 0C 09 (set hour 12-09)

FF AA 32 1E 3A (set minute seconds 30:58)

FF AA 33 F4 01 (set ms 500)

Example:

Send: FF AA 27 30 00 (read version number, 0x27 means read, 0x30 is year month register)

Return：55 5F YYMM[7:0] YYMM[15:8] DDHH[7:0] DDHH[15:8] MMSS[7:0] MMSS[15:8] MS[7:0] MS[15:8] SUM

AX~AZ（Acceleration）

Register Name: AX~AZ

Register address: 52~54 (0x34~0x36)

Read and write direction: R

Default: 0x0000

Bit	NAME	FUNCTION
15:0	AX[15:0]	Acceleration X=AX[15:0]/32768*16g (g is the acceleration of gravity, preferably 9.8m/s2)
15:0	AY[15:0]	Acceleration Y=AY[15:0]/32768*16g (g is the acceleration of gravity, preferably 9.8m/s2)
15:0	AZ[15:0]	Acceleration Z=AZ[15:0]/32768*16g (g is the acceleration of gravity, preferably 9.8m/s2)

Read 3-axis acceleration: 50 03 00 34

GX~GZ（Angular velocity）

Register Name: GX~GZ Register address: 55~57 (0x37~0x39) Read and write direction: R Default: 0x0000		
Bit	NAME	FUNCTION
15:0	GX[15:0]	Angular velocity X=GX[15:0]/32768*2000°/s
15:0	GY[15:0]	Angular velocity Y=GY[15:0]/32768*2000°/s
15:0	GZ[15:0]	Angular velocity Z=GZ[15:0]/32768*2000°/s

HX~HZ（Magnetic field）

Register name: HX~HZ Register Address: 58~60 (0x3A~0x3C) Read and write direction: R Default: 0x0000		
Bit	NAME	FUNCTION
15:0	HX[15:0]	Magnetic field X=HX[15:0] (unit: LSB)
15:0	HY[15:0]	Magnetic field Y=HY[15:0] (unit: LSB)
15:0	HZ[15:0]	Magnetic field Z=HZ[15:0] (unit: LSB)

Roll~Yaw（Angle）

Register Name: Roll~Yaw

Register address: 61~63 (0x3D~0x3F)

Read and write direction: R

Default: 0x0000

Bit	NAME	FUNCTION
15:0	Roll[15:0]	Roll X=Roll[15:0]/32768*180°
15:0	Pitch[15:0]	Pitch Y=Pitch[15:0]/32768*180°
15:0	Yaw[15:0]	Heading Z=Yaw[15:0]/32768*180°

TEMP（Temperature）

Register Name: TEMP

Register Address: 64 (0x40)

Read and write direction: R

Default: 0x0000

Bit	NAME	FUNCTION
15:0	TEMP[15:0]	Temperature=TEMP[15:0]/100℃

D0Status~D3Status（Port status）

Register Name: D0Status~D3Status Register address: 65~68 (0x41~0x44) Read and write direction: R Default: 0x0000		
Bit	NAME	FUNCTION
15:0	D0Status[15:0]	D0 state value
15:0	D1Status[15:0]	D1 status value
15:0	D2Status[15:0]	D2 state value
15:0	D3Status[15:0]	D3 state value

PressureL~HeightH（Air pressure altitude）

Register Name: PressureL~HeightH

Register address: 69~72 (0x45~0x48)

Read and write direction: R

Default: 0x0000

Bit	NAME	FUNCTION
15:0	PressureL[15:0]	Air pressure=((int)PressureH[15:0]<<16)|PressureL[15:0](Pa)
15:0	PressureH[15:0]	
15:0	HeightL[15:0]	Altitude=((int)HeightH[15:0]<<16)|HeightL[15:0](cm)
15:0	HeightH[15:0]	

LonL~LatH（Longitude and latitude）

Register Name: LonL~LatH

Register address: 73~76 (0x49~0x4C)

Read and write direction: R

Default: 0x0000

Bit	NAME	FUNCTION
15:0	LonL[15:0]	Lon[31:0]=((int)LonH[15:0]<<16)|LonL[15:0](Pa)
15:0	LonH[15:0]	
15:0	LatL[15:0]	Lat[31:0]=((int)LatH[15:0]<<16)|LatL[15:0](cm)
15:0	LatH[15:0]	

The NMEA8013 standard stipulates that the longitude output format of GPS is dd mm. mmmmm (dd is degrees, mm. mmmmm is minutes), and the decimal point is removed from the longitude/latitude output, so the degrees of longitude/latitude can be calculated as follows:

dd=Lon [31:0]/10000000;

dd=Let [31:0]/10000000;

Longitude/latitude fraction calculation:

mm.mmmmm= (Lon [31:0] %10000000)/100000； (% means remainder operation)

mm.mmmmm=(Lat[31:0]%10000000)/100000；(% means remainder operation)

GPSHeight~GPSVH（GPS Data）

Register Name: GPSHeight~GPSVH

Register address: 77~80 (0x4D~0x50)

Read and write direction: R

Default: 0x0000

Bit	NAME	FUNCTION
15:0	GPSHeight[15:0]	GPS Altitude=GPSHeight[15:0]/10(m)
15:0	GPSYAW[15:0]	GPS heading=GPSYAW[15:0]/100(°)
15:0	GPSVL[15:0]	GPS ground speed=(((int)GPSVH[15:0]<<16)|GPSVL[15:0])/1000(km/h)
15:0	GPSVH[15:0]	

q0~q3（Quaternion）

Register name: q0~q3

Register address: 81~84 (0x51~0x54)

Read and write direction: R

Default: 0x0000

Bit	NAME	FUNCTION
15:0	q0[15:0]	Quaternion0=q0[15:0]/32768
15:0	q1[15:0]	Quaternion1=q1[15:0]/32768
15:0	q2[15:0]	Quaternion2=q2[15:0]/32768

15:0	q3[15:0]	Quaternion3=q3[15:0]/32768

SVNUM~VDOP（GPS Location Accuracy）

Register Name: SVNUM~VDOP

Register address: 85~88 (0x55~0x58)

Read and write direction: R

Default: 0x0000

Bit	NAME	FUNCTION
15:0	SVNUM[15:0]	GPS satellites=SVNUM[15:0]
15:0	PDOP[15:0]	Location longitude=PDOP[15:0]/100
15:0	HDOP[15:0]	Horizontal positioning longitude=HDOP[15:0]/100
15:0	VDOP[15:0]	Longitude of vertical positioning=VDOP[15:0]/100

DELAYT（Alarm signal delay）

Register Name: DELAYT Register Address: 89 (0x59) Read and write direction: R/W Default: 0x0000		
Bit	NAME	FUNCTION
15:0	DELAYT[15:0]	Unit: ms After the angle alarm occurs, the port will generate the corresponding alarm signal. When the alarm is removed, the alarm signal will continue to DELAYT[15:0] and then disappear
Example: FF AA 59 E8 03 (set alarm signal delay 1000ms)		

XMIN~XMAX（X-axis angle alarm threshold)

Register Name: XMIN~XMAX

Register address: 90~91 (0x5A~0x5B)

Read and write direction: R/W

Default: 0x0000

Bit	NAME	FUNCTION
15:0	XMIN[15:0]	Set the X-axis angle alarm minimum value X-axis min=XMIN[15:0]*180/32768(°)
15:0	XMAX[15:0]	Set the X-axis angle alarm maximum value X-axis max=XMAX[15:0]*180/32768(°)

Example:

FF AA 5A 72 FC (set -5 degrees), 0xFC72=-910, -910*180/32768=-5

FF AA 5B 8E 03 (set 5 degrees), 0x038E=910, 910*180/32768=5

The X axis will not alarm between -5°~5°, once it exceeds this range, an alarm will occur

BATVAL（Voltage）

Register Name: BATVAL Register Address: 92 (0x5C) Read and write direction: R Default: 0x0000		
Bit	NAME	FUNCTION
15:0	BATVAL[15:0]	Voltage=BATVAL[15:0]/100 ℃

ALARMPIN（Alarm pin mapping）

Register Name: ALARMPIN Register Address: 93 (0x5D) Read and write direction: R/W Default: 0x4365		
Bit	NAME	FUNCTION
15:12	X-ALARM[15:12]	0001(0x01): D0 0010(0x02): D1 0011(0x03): D2 0100(0x04): D3 0101(0x05): SCL 0110(0x06): SDA
11:8	X+ALARM[11:8]	0001(0x01): D0 0010(0x02): D1 0011(0x03): D2 0100(0x04): D3 0101(0x05): SCL 0110(0x06): SDA
7:4	Y-ALARM[7:4]	0001(0x01): D0 0010(0x02): D1 0011(0x03): D2

		0100(0x04): D3 0101(0x05): SCL 0110(0x06): SDA
3:0	Y+ALARM[3:0]	0001(0x01): D0 0010(0x02): D1 0011(0x03): D2 0100(0x04): D3 0101(0x05): SCL 0110(0x06): SDA
Example: Set X-alarm signal to output on D3 port Set the X+ alarm signal to output at port D1 Set the Y-alarm signal to output on the SCL port Set the Y+ alarm signal to output at the SCL port Send: FF AA 5D 55 42		

YMIN~YMAX（Y-axis angle alarm threshold）

Register Name: YMIN~YMAX Register address: 94~95 (0x5E~0x5F) Read and write direction: R/W Default: 0x0000		
Bit	NAME	FUNCTION
15:0	YMIN[15:0]	Set the Y-axis angle alarm minimum value Y axis angle alarm minimum value=YMIN[15:0]*180/32768(°)
15:0	YMAX[15:0]	Set the Y-axis angle alarm maximum value Y-axis angle alarm maximum value=YMAX[15:0]*180/32768(°)
Example: FF AA 5E 72 FC (set -5 degrees)， 0xFC72=-910，-910*180/32768=-5 FF AA 5F 8E 03(set 5 degrees)， 0x038E=910，910*180/32768=5 The Y axis does not alarm between -5°~5°, and an alarm occurs once it exceeds the range		

GYROCALITHR（Gyro static threshold)

Register Name: GYROCALITHR

Register Address: 97 (0x61)

Read and write direction: R/W

Default: 0x0000

Bit	NAME	FUNCTION
15:0	GYROCALITHR[15:0]	Set the gyroscope static threshold: Gyro static threshold=GYROCALITHR[15:0]/1000(°/s)

Example：Set the gyroscope static threshold to 0.05°/s

FF AA 61 32 00

When the angular velocity change is less than 0.05°/s and lasts for the time of "GYROCALTIME", the sensor recognizes that it is stationary, and automatically resets the angular velocity less than 0.05°/s to zero

The setting rule of the static threshold of the gyroscope can be determined by reading the value of the "WERROR" register. The general setting rule is: GYROCALITHR=WERROR*1.2, unit: °/s

This register needs to be used in combination with the GYROCALTIME register

ALARMLEVEL（Angle alarm level）

Register Name: ALARMLEVEL

Register Address: 98 (0x62)

Read and write direction: R/W

Default: 0x0000

Bit	NAME	FUNCTION
15:4		
3:0	ALARMLEVEL[3:0]	To set the alarm level: 0000(0x00): Low level alarm (high level when not alarming, low level when alarming) 0001(0x01): High level alarm (low level when not alarming, high level when alarming)

Example: Setting a high level alarm

FF AA 62 01 00

GYROCALTIME（Gyro auto calibration time）

Register Name: GYROCALTIME

Register Address: 99 (0x63)

Read and write direction: R/W

Default: 0x03E8

Bit	NAME	FUNCTION
15:0	GYROCALTIME[15:0]	Set gyroscope auto-calibration time

Example: Set gyroscope auto-calibration time to 500ms

FF AA 63 F4 01

When the angular velocity change is less than "GYROCALITHR" and lasts for 500ms, the sensor recognizes that it is stationary and automatically resets the angular velocity less than 0.05°/s to zero.

This register needs to be used in combination with the GYROCALTIME register

TRIGTIME（Alarm continuous trigger time）

Register Name: TRIGTIME

Register Address: 104 (0x68)

Read and write direction: R/W

Default: 0x0000

Bit	NAME	FUNCTION
15:0	TRIGTIME[15:0]	Set the alarm continuous trigger time

Example: Set the alarm continuous trigger time to 500ms

FF AA 68 F4 01

When the angle alarm occurs, the alarm signal will not be output immediately, and it will only be output when it needs to last for 500ms

The register is used to filter out alarms caused by malfunctions

KEY（Unlock）

Register Name: KEY

Register Address: 105 (0x69)

Read and write direction: R/W

Default: 0x0000

Bit	NAME	FUNCTION
15:0	KEY[15:0]	Unlock register: When performing a write operation, you need to set this register first

Example: Unlock, write 0xB588 to this register (other values are invalid)

FF AA 69 88 B5

WERROR（Gyroscope change value）

Register Name: WERROR

Register Address: 106 (0x6A)

Read and write direction: R

Default: 0x0000

Bit	NAME	FUNCTION
15:0	WERROR[15:0]	Gyroscope change value=WERROR[15:0]/1000*180/3.1415926(°/s) When the sensor is stationary, the "GYROCALITHR" register can be set by changing this register.

TIMEZONE（GPS time zone）

Register Name: TIMEZONE

Register Address: 107 (0x6B)

Read and write direction: R/W

Default: 0x0014

Bit	NAME	FUNCTION
15:8		
7:0	TIMEZONE[7:0]	Set GPS time zone: 00000000(0x0000): UTC-12 00000001(0x0001): UTC-11 00000010(0x0002): UTC-10 00000011(0x0003): UTC-9 00000100(0x0004): UTC-8 00000101(0x0005): UTC-7 00000110(0x0006): UTC-6 00000111(0x0007): UTC-5 00001000(0x0008): UTC-4 00001001(0x0009): UTC-3 00001010(0x000A): UTC-2 00001011(0x000B): UTC-1

		00001100(0x000C): UTC 00001101(0x000D): UTC+1 00001110(0x000E): UTC+2 00001111(0x000F): UTC+3 00010000(0x0010): UTC+4 00010001(0x0011): UTC+5 00010010(0x0012): UTC+6 00010011(0x0013): UTC+7 00010100(0x0014): UTC+8（Default east 8th district） 00010101(0x0015): UTC+9 00010110(0x0016): UTC+10 00010111(0x0017): UTC+11 00011000(0x0018): UTC+12
Example: FF AA 6B 15 00 (set GPS time zone to East 9)		

WZTIME（Angular velocity continuous stationary time）

Register Name: WZTIME

Register Address: 110 (0x6E)

Read and write direction: R/W

Default: 0x01F4

Bit	NAME	FUNCTION
15:0	WZTIME[15:0]	Angular velocity continuous rest time

Example: Set the angular velocity continuous static time to 500ms

FF AA 6E F4 01

When the angular velocity is less than "WZSTATIC" for 500ms, the angular velocity output is 0, and the Z-axis heading angle is not integrated

This register needs to be used in combination with the "WZSTATIC" register.

WZSTATIC（Angular velocity integration threshold）

Register Name: WZSTATIC

Register Address: 111 (0x6F)

Read and write direction: R/W

Default: 0x012C

Bit	NAME	FUNCTION
15:0	WZSTATIC[15:0]	Angular velocity integral threshold=WZSTATIC[15:0]/1000(°/s)

Example: Set the angular velocity integral threshold to 0.5°/s

FF AA 6F F4 01

When the angular velocity is greater than 0.5°/s, the Z axis heading angle begins to integrate the acceleration

When the angular velocity is less than 0.5°/s, and the duration set by the register "WZTIME" is continued, then the angular velocity output is 0, and the Z-axis heading angle is not integrated

This register needs to be used in combination with the "WZTIME" register

MODDELAY（485 Data reply delay）

Register Name: MODDELAY

Register Address: 116 (0x74)

Read and write direction: R/W

Default: 0x0BB8

Bit	NAME	FUNCTION
15:0	MODDELAY[15:0]	Set 485 data response delay, default 3000, unit: us

Example: Set 485 data response delay to 1000us

FFAA 74 E8 03

When the sensor receives the Mod bus read command, the sensor delays 1000us and returns the data

This register only supports Modbus version sensors

XREFROLL~YREFPITCH（Angle zero reference）

Register Name: XREFROLL~YREFPITCH

Register address: 121~122 (0x79~0x7A)

Read and write direction: R/W

Default: 0x00000

Bit	NAME	FUNCTION
15:0	XREFROLL[15:0]	Roll angle zero reference =XREFROLL[15:0]/32768*180(°)
15:0	YREFPITCH[15:0]	Pitch angle zero reference =YREFPITCH[15:0]/32768*180(°)

Example: The current roll angle is 2°, set the zero position of the roll angle, and subtract 2°, then

XREFROLL [15:0] =2*32768/180=364=0x016C

FF AA 79 6C 01

NUMBERID1~NUMBERID6（Device No.）

Register Name: NUMBERID1~NUMBERID6

Register address: 127~132 (0x7F~0x84)

Read and write direction: R

Default: none

Bit	NAME	FUNCTION
15:0	NUMBERID1[15:0]	
15:0	NUMBERID2[15:0]	
15:0	NUMBERID3[15:0]	
15:0	NUMBERID4[15:0]	
15:0	NUMBERID5[15:0]	
15:0	NUMBERID6[15:0]	

Device number：WT4200000001