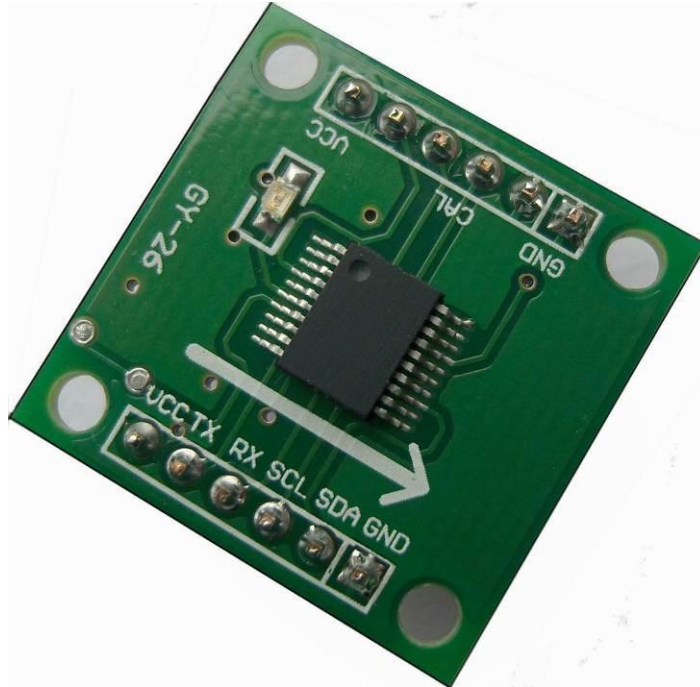# GY-26-USART Digital Compass Manual

General Description

GY-26-USART is a low cost plane digital compass module. The working principle is utilizing magnetoresistive sensor sensing the Earth's magnetic field component to get an azimuth angle. It communicates with upper computer through UART.   Output format is ASCII. With solid state compass design, it has stable operation, high accuracy and advanced hard iron compensation function. It can overcome surrounding magnetic interference. Baud rate is optional. The product has three work modes; Normal mode, continuous mode and calibration mode. You can choose UART or IIC communication to use it.

Features

- ±5 degrees   heading accuracy
- Advanced hard iron calibration
- Very low operating voltage（3~5VDC)
- DC single supply operation
- Small size (26.5mm X26.5mm X 11.5mm)
- Light weight
- High cost-effective
- Easy to integrate；

Applications

1. Hand-held electronic instruments.
2. Robot orientation and position.
3. Navigation system.
4. Telescope position.
5. Autohelm rudder.
6. Antenna position.
7. Automobile GPS navigation.
8. Aero model position.

Basic parameters

1. Directions (In level condition)

   Accuracy: <5 degrees

   Resolution: 0.5 degrees (typical)

   Repeatability: <3 degrees

2. Magnetic field characteristics

   Range: ±2 gauss

   Resolution：6 Milli-gauss

3. Electrical characteristics:

   Input voltage: 2.6V (min), 5V (max), 3.3V (typical)

   Input current: 5mA (min), 8mA (max), 6mA (typical) (Normal mode)

                         5mA (min), 7mA (max), 6mA (typical) (Continuous mode)

                         5mA (min), 12mA (max), 14mA (typical) (Calibration mode)

4. Temperature: 0 to 70 degrees centigrade, when operating

                   -40 to 110 degrees, when in storage

Pin Configuration

Pin number	Pin name	Description
1	VCC	Power Supply Input
2	TXD	Transmit Data Output
3	RXD	Receive Data Input
4	SCL	IIC SCL
5	SDA	IIC SDA
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	CAL	Calibrate
10	NC	No Connection
11	NC	No Connection
12	VCC	Power Supply Input
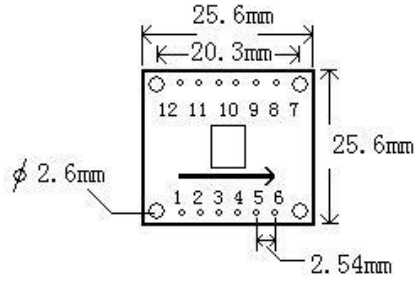

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1. VCC      7.  GND
2. TX       8.  GND
3. RX       9.  CAL
4. SCL      10. NC
5. SDA      11. NC
6. GND      12. VCC
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Technical terms

1. Declination Angle

It is the angle between magnetic north and true north. Declination angles of different place are different, even at the same place declination angles varies with the time. When we use compass to navigation, we get directions relative to magnetic north. So we can get directions relative to true north through declination angle compensation. For example, the current direction counted by compass is north by east 30 degrees and the declination angle is 5 degrees. So the direction relative to true north is 35 degrees (30+5°=35°).

2. Installation Angle

There is an arrowhead on the compass module and it's used to denote directions. When installed, it requests that forward direction of the object surveyed is consistent with the arrowhead. So the direction counted by the compass is the right direction. If installing direction is not consistent with the arrowhead, there is an included angle and it is the deviation angle. Only after we compensate it, the compass outputs the true direction.

3. Calibration

It's also called hard iron compensation. All digital compasses must be calibrated before been used. Once hard iron conditions changed, the magnetic field conditions will be changed too. At this time, angle information counted by the compass will be inaccurate. In order to remove the influence, it's necessary to calibrate the compass.

4. Calibrating methods and functions

When magnetic field changes angle information counted by compass will be inaccurate. This time it is necessary to calibrate the compass to remove the influence.

Methods:

Send "0xC0" command, and then rotate the compass two circles slowly, equably and flatly, fast not allowed. One cycle needs more than one minute. Then send "0xC1" command to finish calibration.

Use serial communication

1. **Parameters**

Baud rate: 9600bps

Verify bit: N

Data bits: 8

Stop bit: 1

2. Output format of the module,8 bytes included in each frame

(1)Byte0:0x0D   (ASCII: enter)

(2)Byte1:0x0A   (ASCII: new line)

(3)Byte2:0x30~0x33   (ASCII: hundreds of angle 0~3)

(4)Byte3:0x30~0x39   (ASCII: tens of angle 0~3)

(5)Byte4:0x30~0x39   (ASCII: bits of angle 0~3)

(6)Byte5:0x2E   (ASCII: decimal point of angle)

(7)Byte6: 0x30~0x39   (ASCII: decimal of angle)

(8)Byte7: 0x00~0xFF   (calibrate sum)

Byte7= the lower 8 bits of (Byte0+ Byte1+ Byte2+……Byte6)

Example: <0x0D-0x0A-0x33-0x35-0x39-0x2E-0x36-0x1C> = 359.6°

3 Commands been sent to the module

(1)0x31: measure the angle (return the value of the angle)

(2)0xC0: start calibration

(3)0xC1: end calibration

(4) 0xA0-0xAA-0xA5-0xC5: return to the settings of the factory

(5) 0xA0-0xAA-0xA5-IIC_ADDR: change the IIC bus address

(6)0x03-DECL_high: set the high 8 bits of declination angle

(7)0x04-DECL_low: set the low 8 bits of declination angle

Example1: send 0xC0 to the module, it return

<0x0D-0x0A-0x30-0x30-0x30-0x2E-0x30-0x05>, which means starting calibration successfully.

Example2: send 0x03，0x00，0x04，0x64 to the module, it return

<0x0D-0x0A-0x30-0x30-0x30-0x2E-0x30-0x05> which means the declination angle been changed to 10.0 degrees successfully.

Use IIC

1 Address

When using the IIC communication, the module is similar to a 24C04，EEPROM. The communication is very simple. The addresses of the data in the module are shown in the following table.

address in the module	its meanings
0x00	not been used
0x01	high 8 bits of the angle
0x02	low 8 bits of the angle
0x03	high 8 bits of the declination angle
0x04	low 8 bits of the declination angle
0x05	not been used
0x06	not been used
0x07	Level value calibration

2 Commands(been sent to the module through IIC)

command	function
0x00+ 0x31	angle measure
0x00+ 0xC0	Start calibration
0x00+ 0xC1	End calibration

0x00+（0xA0+0xAA+0xA5+0xC5）	Return to the factory settings
0x00+（0xA0+0xAA+0xA5+IIC_ADDR）	Change the IIC address
0x03 + DECL_HIGH	Change the high 8 bits of declination angle
0x04 + DECL_LOW	Change the low 8 bits of declination angle

3 Change the IIC address

The IIC address of the module can be changed. The default factory address of the module is 0xE0.When powering the module, the Led blinks according to its address.

address	Blinking times
0xe0	0
0xe2	1
0xe4	2
0xe6	3
0xe8	4
0xea	5
0xec	6
0xee	7
0xf0	8
0xf2	9
0xf4	10

0xf6	11
0xf8	12
0xfa	13
0xfc	14
0xfe	15

Command：

Send 0x31：（get angle）

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x0D	0x0A	0x30~0x33	0x30~0x39	0x30~0x39	0x2E	0x30~0x39	0x00~0xFF

Send 0x35：（get temperature）

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x0D	0x0A	0x30~0x33	0x30~0x39	0x30~0x39	0x2E	0x30~0x39	0x00~0xFF

Send 0xC0：（Calibration）

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x0D	0x0A	0x30	0x30	0x30	0x2E	0x30	0x05

Send 0xC1：（finish Calibration）

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x0D	0x0A	0x30~0x33	0x30~0x39	0x30~0x39	0x2E	0x30~0x39	0x00~0xFF

Send 0xA0＋0xAA＋0xA5＋0xC5：（Restoring Factory Calibration）

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7

| 0x0D | 0x0A | 0x30 | 0x30 | 0x30 | 0x2E | 0x30 | 0x05 |

Send 0 x 0 3 ＋：Compass bearing high 8bit

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x0D	0x0A	0x30	0x30	0x30	0x2E	0x30	0x05

Send 0 x 0 4 ＋：Compass bearing low 8bit

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x0D	0x0A	0x30	0x30	0x30	0x2E	0x30	0x05

Remarks

1. All the parameters of the module are tested with the standard 5V power supply, so we advise you to use the power with small ripples.

2. When using the module, please keep it level so that it can get the accurate results.

3. The module can be connected with SCM or some other device with the right interface, but it can not be connected to the serial port of the computer directly. However, you can use a USB to serial module to connect it to the computer.