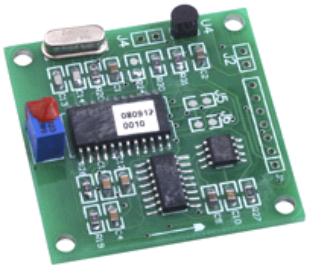
ZCC210N -I²C Electronic Compass



General Description

ZCC210N -I²C is a low cost 2-axis electronic compass module with low voltage input and power consumption. It communicates with upper-end computer via I2C interface in hexadecimal way. It features stable performance, high precision and dynamic balance adjustment as well as calibration. It has compensatory function of deviation angle and declination angle; It supports different operating voltage (voltage range： 6 VDC-9VDC:5VDC can be input direct) to suit different operational environment.

Features

- Small size:40X40x12mm.
- Cost effective.
- 2bytes output format and small system bandwidth.
- output adopt hexadecimal, easy to integrate with SCM.
- Support both mode of power and voltage, DC 6-9V or 5V optional.

Applications

- Automobile electron compass.
- Handheld electron instrument.
- Telescope position.
- Navigation system.
- Auto helm rudder.
- Aerial position.
- Automobile GPS navigation.
- Aero model position.
- Automobile orientation system.
- Robot orientation position.

Ordering Information ZCC210N -I²C

Specifications

Parameter	Value	Unit	Remark
Measuring Range	0° ～ 360°	°	Compass placed horizontally
Display Resolution	1	°	
Accuracy	＜3	°	
Response Frequency	3	Hz	
Non-linear	±1%		
Repeatability	＜1	°	
Voltage	5v	VDC	Or 6～9VDC
Operating Current	＜30	mA	5V Continuous output mode
Operating Temperature	-40 ～ 85	℃	
Storage Temperature	-45 ～ 125	℃	

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Size	40*40*12	mm	

Interface of I²C Protocol

Three wires are needed when host computer execute I²C communication with this module (I²C SDA，I²C SCL and GND wire shared by host computer and module). I²C communication protocol of this module adopts built-in I²C interface module which exchange information between host computer and module at frequency of 100KHz.

This module has been installed pull-up resistor so host computer can be used normally without installing pull-up resistor.

Communication Protocol

Compass use half-duplex communication mode and the course of communication is an answer to an ask mode.

Command Operation As Follows::

Caution： **Both writing in and reading out are first MSB and then LSB. Time lag is 2Ms between orders and order/operation.**

1 Write in declination angle (command 60H)

60(H) MSB LSB

60H is command word. MSB is high byte data and LSB is lower byte.

If input +6° declination angle: Send 60 send 00 06. If inputting negative declination angle is needed, please use positive declination angle to substitute.

For example: input -3° declination angle, you can use positive 357° to replace it (computing method: 360-3) and convert into Hex, that is you can input 01 65 to replace it (means 357°).

Note: The clockwise is positive and the counter clockwise is negative.

2 Read out declination angle (command 61H)

61(H)

Compass will return double byte binary data.

PC first accepts high byte data then lower byte data.

3 Write in deviation angle (command 64H)

60(H) MSB LSB

Compass will return double byte data in binary.

PC first accepts high byte data then lower byte data.

Note: The clockwise is positive and the counter clockwise is negative.

4 Read out deviation angle (command 65H)

65(H)

Compass will return double byte binary data.

PC first accepts high byte data then lower byte data.

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5 Enter into calibration mode (command 70H)

70(H)

Host computer send single byte hex command to compass. Then compass enter into calibration mode and execute data sampling/ processing per 0.1s.

6 Quit calibration mode (command 72H)

72(H)

Host computer sends single byte hex command to compass. Then compass quit the calibration mode and displays normal direction data.

7 Single sampling (command 74H)

74(H)

Compass will execute data sampling and processing once and store this data up to the next sampling command. During this period the angle output by compass will remains the same.

8 Consecutive collection (command 76H)

76(H)

Compass will execute data sampling and processing per second. Angle information also will refresh per one second.

9 Read out direction data (command 77H)

77(H)

After finishing sampling mode setting (74H/76H), host computer sends a command 77H to compass, this time compass module will return a set of double byte data including heading, angle value and working condition.

Data Format as Follows

1 Declination Angle

Declination angle is a binary data from 0° -360° , the former seven bits is zero and the latter nine bits is the data, ties up two bytes.

2 Deviation angle

Deviation angle is a binary data from 0° to 360° , the former seven bits is zero and the latter nine bits is the data, ties up two bytes.

3 Direction Angle

It ties up two bytes.

The fifteenth/fourteenth bit: mean working condition of compass. Definition: 01-query state, 10-normal state, 11-calibration state.

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The thirteenth/twelfth bit: Undefinition

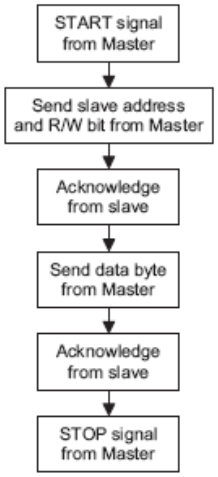
The eleventh/tenth/ninth: mean direction of compass. Definition: 000-north, 001- northeast, 010-east, 011-southeast, 100-south, 101-southwest, 110-west, 111-northwest.

The eighth to the zero: mean angle of compass, binary data from 0° to 360° .

I²C Bus Wire Communication

I²C bus wire communication needs four steeps，START signal，transmitting address of module, transmitting data, the last STOP signal. When a START signal is transmitted to I²C bus wire all SCM can receive this signal. The former seven bits of data is the address of module and the first bit is MSB. After transmitting of the seven bits of address of module has finished, the eighth bit is a reading/writing bit used to determine to enter into transmitting mode or receiving mode.

I²C float chart of communication



I²C time order of communication

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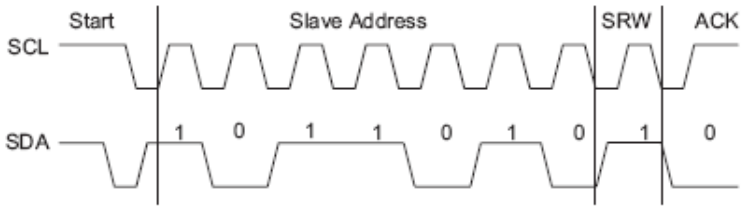
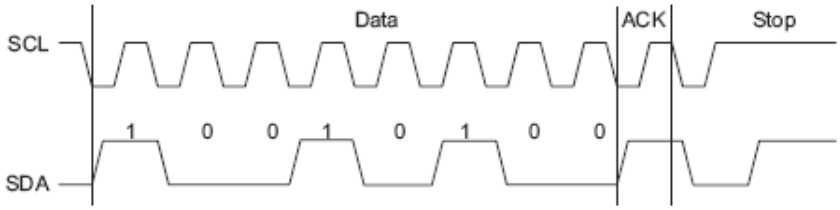
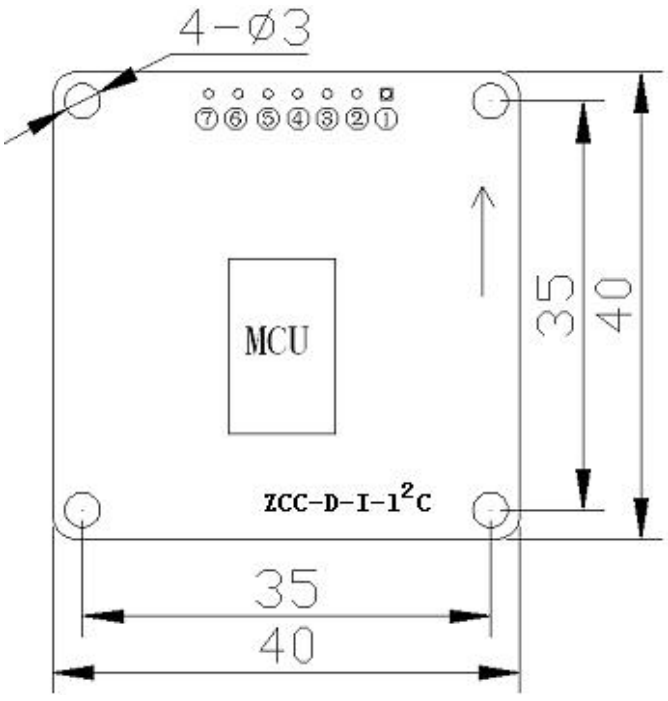




S=Start (1 bit)
SA=Slave Address (7 bits)
SR=SRW bit (1 bit)
M=Slave device send acknowledge bit (1 bit)
D=Data (8 bits)
A=ACK (RXAK bit for transmitter, TXAK bit for receiver 1 bit)
P=Stop (1 bit)

More details please refer to standard of I²C Communication Protocol

Installing Size and Connection Definition



Connection Definition:

① GND
② VCC (+5V)
③ VDD (+12)
④ I²C SDA correspond to I²C Protocol data line end.
⑤ I²C SCL coerrespond to I²C Protocol colock line end.
⑥ NC
⑦ NC

Note： compass must share the ground with upper-end computer. It can only choose one working voltage.

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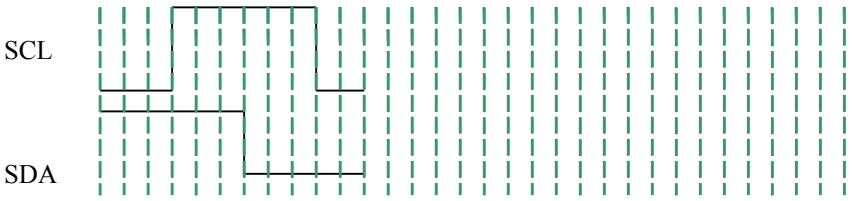
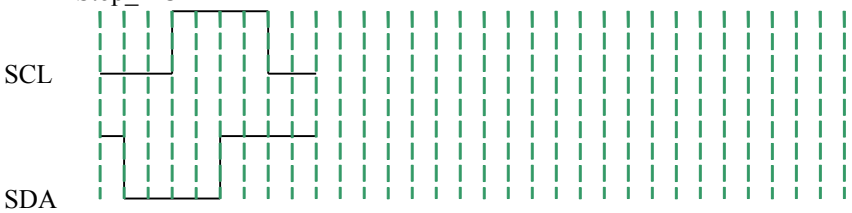
Subprogram Time Order

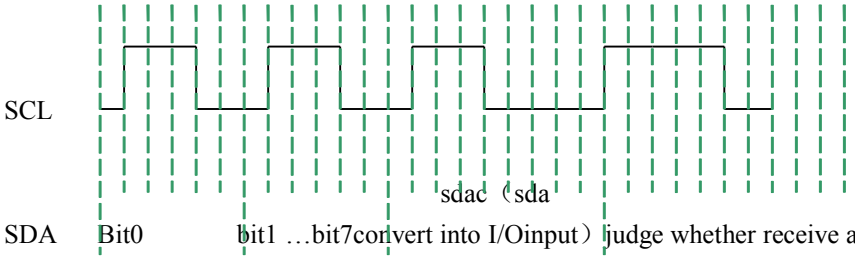
- Start_I2C



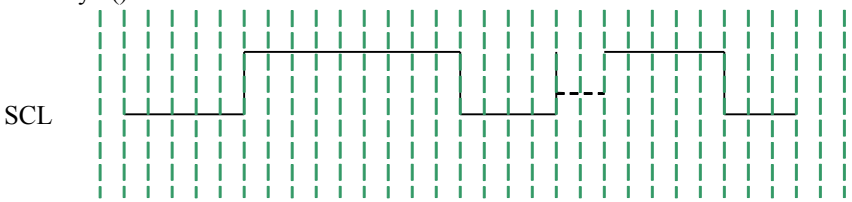
- Stop_I2C



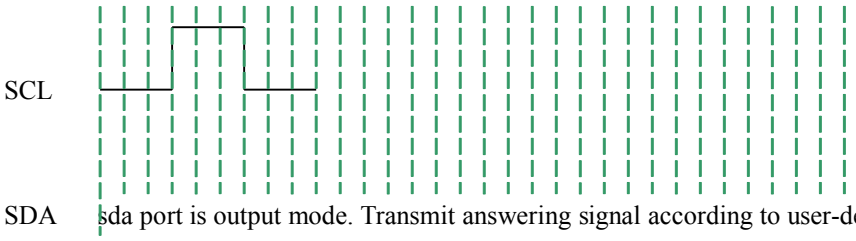
- SendByte(unsigned int c)



RcvByte()



- Ack_I2C



Questions

> 1、Whether I2C address of the compass I2C is 0x42 or not，how to read and write；

Answer：actually，according to I2C protocol. The high seven of byte is address of module and the last bit is reading/writing bit. 1:host reads，0:host writes. So writing address of compass is 0x42 and reading address is 0x43.

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> 2、If write in 6° declination angle, transmitting 0x42,0x60,0x00,0x06 in order is necessary or not ? If read out declination angle，pre-transmitting 0x42,0x61 is necessary or not?

Answer：write in 6° declination angle：start bit,0x42,0x60,0x00,0x06,stop bit.

read out 6°：start bit,0x42,0x61,stop bit,startbit,0x43,AngleMSB（host read）,answering bit ,AngleLSB（host read）,answering bit ,stop bit, ie. for reading out data,you must write in command 0x61 then read data.

> 3、Which setting are necessary if want host computer read out direction measured by compass?

Answer：It is unnecessary to set before reading data. Follow the following steps is ok. Course: start bit,0x42,command word ,stop bit, start bit ,0x43, read MSB data1, read LSB data1,read MSBdata2,read LSB data2...,stop bit.

Technical Terms

1 Declination Angle

It is the angle between magnetic north and true north. Declination angle of different place are different, even at the same place declination angle varies with the time. When we use compass to navigate, 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 Deviation Angle

There is an arrowhead on the compass module meaning directions. When installed, it is requested that heading direction of the measured object 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 a included angle and it is the deviation angle. Only after compensation the compass outputs the true direction.

3 Calibration

It's also called hard iron compensation. All digital compasses must be calibrated before used. Once hard iron conditions change, 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 Methods and Effect

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

Methods: Send “70H” command, and then rotate the compass two circles flatly. Then send “72H” command to finish calibration.

PC Demonstration Program

PC Demonstration program “project1.exe” can be run direct and no appendix is needed. You can choose RS232/RS485 protocol on the menu of program; also can choose com-port of serial communication and baud rate. There is a circular compass drawn on the Window’s left, the data sent by PC or accept by module displayed in the middle and the command word communicated between PC and compass module on the right. The 77 button is some especial. Because module only executes once data sampling and processing under inquiry state, PC also reads data once only after 77 button pressed.； However, under state of calibration and normal state, PC would read the latest data per 0.3 seconds after 77 button pressed because compass executes data sampling and processing without stop. Under the Window, status bar can simultaneously display communication state and actual operating state of compass.

Specification subject to change without notice!

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