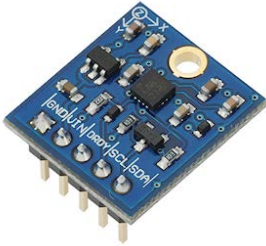


## Parallax 3-Axis Compass Module KickStart (#29133)



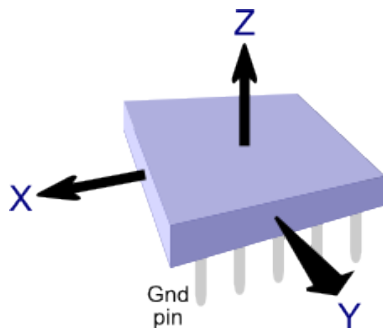
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### What It Can Do

- Measures the earth's magnetic field in three axes, with a 1–2 degree accuracy
- Provides individual readings for each axis, which may be used separately or together for 3D calculations
- Measures raw strength (gauss) of a nearby magnetic source

The 3-Axis Compass module measures magnetic fields in three directions – or axes, labeled X, Y, and Z. In its most simple form, the module can be used as a basic compass to find earth's magnetic north.

The compass module can also sense the relative strength of a nearby magnetic source, such as those caused by magnets or electric fields. As the sensor detects magnetism in three dimensions, it can determine relative distance and direction to these sources.



The compass is commonly used with a multi-axis accelerometer, where the data from both sensors can provide useful information detailing speed and direction of travel. The Memsic 2125 Dual-axis Accelerometer and MMA7455 3-Axis Accelerometer Module are good companion accelerometers for the 3-Axis Gyroscope module

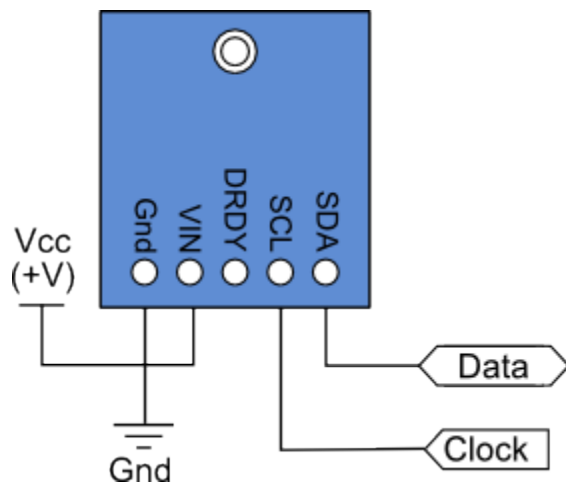
It may also be used with an accelerometer and 3-axis gyroscope to construct a 9-axis IMU (inertial measurement unit), common in unmanned aerial vehicles, such as drones and quadcopters.

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## Parts List

- 3-Axis Compass module
  - BASIC Stamp HomeWork Board, Propeller BOE, Propeller QuickStart, or Arduino Uno microcontroller (with breadboard, as needed)
  - 22 gauge solid conductor hookup wire
- 

## Basic Wiring

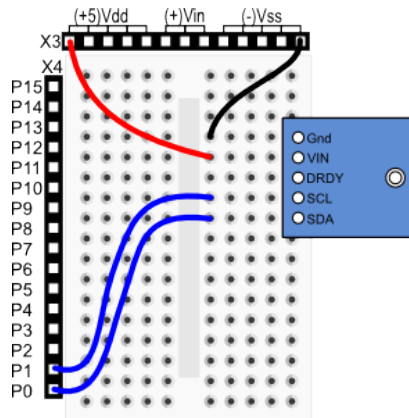


- Power Requirements: 2.7 to 6.5 VDC
  - Communication Interface: I2C (up to 400 kHz)
  - Dimensions: 0.725 x 0.650 in (1.8 x 1.7 cm)
- 

## Program KickStarts

The KickStart examples display raw data output for each of the three axes. Values are retrieved from the module using the I2C interface.

## BASIC Stamp HomeWork Board



```

' {$STAMP BS2}
' {$PBASIC 2.5}

SDA          PIN      0          ' SDA of compass to pin P0
SCL          PIN      1          ' SCL of compass to pin P1

WRITE_Data   CON      $3C        ' Requests Write operation
READ_Data    CON      $3D        ' Requests Read operation
MODE         CON      $02        ' Mode setting register
X_MSB        CON      $03        ' X MSB data output register

X            VAR      Word
Y            VAR      Word
Z            VAR      Word
rawl        VAR      Word
rawh        VAR      Word

' Variables for I2C communications
I2C_DATA     VAR      Byte
I2C_LSB      VAR      Bit
I2C_REG      VAR      Byte
I2C_VAL      VAR      Byte

PAUSE 100          ' Power up delay
I2C_REG = MODE    ' Set operating mode to continuous
I2C_VAL = $0
GOSUB I2C_Write_Reg

DO
  GOSUB GetRawReading ' Get raw Compass reading
  DEBUG HOME, "X = ",11, SDEC x, CR ' Print values
  DEBUG      "Y = ",11, SDEC y, CR
  DEBUG      "Z = ",11, SDEC z, CR
  DEBUG CR
LOOP

GetRawReading:
  PAUSE 400          ' Wait for new data
  
```

```

' Send request to X MSB register
GOSUB I2C_Start
I2C_DATA = WRITE_Data
GOSUB I2C_Write
I2C_DATA = X_MSB
GOSUB I2C_Write
GOSUB I2C_Stop

'Get data from register (6 bytes total, 2 bytes per axis)
GOSUB I2C_Start
I2C_DATA = READ_Data
GOSUB I2C_Write

' Get X
GOSUB I2C_Read
rawH = I2C_Data
GOSUB I2C_ACK
GOSUB I2C_Read
rawL = I2C_Data
GOSUB I2C_ACK
X = (rawH << 8) | rawL

' Get Z
GOSUB I2C_Read
rawH = I2C_Data
GOSUB I2C_ACK
GOSUB I2C_Read
rawL = I2C_Data
GOSUB I2C_ACK
Z = (rawH << 8) | rawL

' Get Y
GOSUB I2C_Read
rawH = I2C_Data
GOSUB I2C_ACK
GOSUB I2C_Read
rawL = I2C_Data
GOSUB I2C_NACK
Y = (rawH << 8) | rawL

GOSUB I2C_Stop

RETURN

'-----I2C functions-----
' Set I2C_REG & I2C_VAL before calling this
I2C_Write_Reg:
GOSUB I2C_Start
I2C_DATA = WRITE_DATA
GOSUB I2C_Write
I2C_DATA = I2C_REG
GOSUB I2C_Write
I2C_DATA = I2C_VAL
GOSUB I2C_Write
GOSUB I2C_Stop
RETURN

```

```

' Set I2C_REG before calling this, I2C_DATA will have result
I2C_Read_Reg:
  GOSUB I2C_Start
  I2C_DATA = WRITE_DATA
  GOSUB I2C_Write
  I2C_DATA = I2C_REG
  GOSUB I2C_Write
  GOSUB I2C_Stop
  GOSUB I2C_Start
  I2C_DATA = READ_DATA
  GOSUB I2C_Write
  GOSUB I2C_Read
  GOSUB I2C_NACK
  GOSUB I2C_Stop
RETURN

I2C_Start:
  LOW SDA
  LOW SCL
RETURN

I2C_Stop:
  LOW SDA
  INPUT SCL
  INPUT SDA
RETURN

I2C_ACK:
  LOW SDA
  INPUT SCL
  LOW SCL
  INPUT SDA
RETURN

I2C_NACK:
  INPUT SDA
  INPUT SCL
  LOW SCL
RETURN

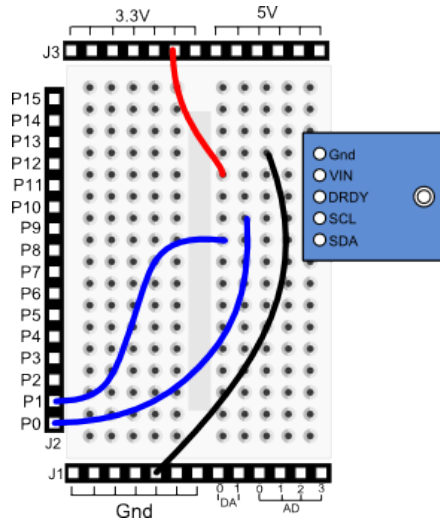
I2C_Read:
  SHIFTIN SDA, SCL, MSBPRE, [I2C_DATA]
RETURN

I2C_Write:
  I2C_LSB = I2C_DATA.BIT0
  I2C_DATA = I2C_DATA / 2
  SHIFTOUT SDA, SCL, MSBFIRST, [I2C_DATA\7]
  IF I2C_LSB THEN INPUT SDA ELSE LOW SDA
  INPUT SCL
  LOW SCL
  INPUT SDA
  INPUT SCL
  LOW SCL
RETURN

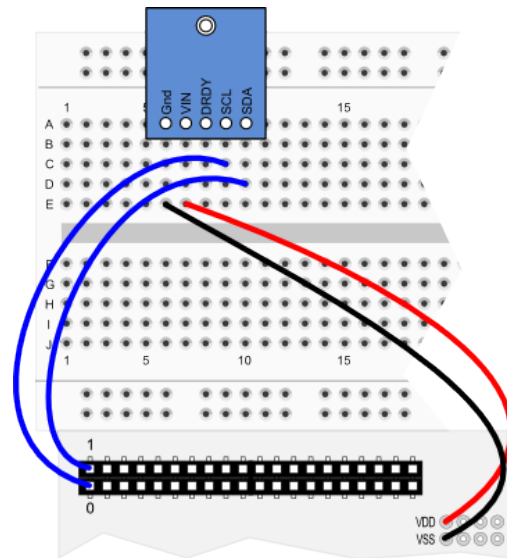
```

**Note:** When this program is run, the BASIC Stamp Debug Terminal will automatically open.

## Propeller BOE and Propeller QuickStart



Propeller BOE Wiring Diagram



Propeller QuickStart Wiring Diagram

OBJ

```
pst      :    "FullDuplexSerial"    ' Comes with Propeller Tool
```

CON

```
_clkmode    = xtall + pll16x
_clkfreq    = 80_000_000

datapin    = 1          ' SDA of compass to pin P1
clockPin    = 0          ' SCL of compass to pin P0

WRITE_DATA  = $3C ' Requests Write operation
READ_DATA   = $3D ' Requests Read operation
MODE        = $02 ' Modesetting register
OUTPUT_X_MSB = $03 ' X MSB data output register
```

VAR

```
long x
long y
long z
```

PUB Main

```
waitcnt(clkfreq/100_000 + cnt)    ' Power up delay
pst.start(31, 30, 0, 115200)
SetCont
repeat
  SetPointer(OUTPUT_X_MSB)
```

```

    getRaw                ' Gather raw data from compass
    pst.tx(1)
    ShowVals

PUB SetCont
    ' Sets compass to continuous output mode

    start
    send(WRITE_DATA)
    send(MODE)
    send($00)
    stop

PUB SetPointer(Register)
    ' Start pointer at user specified register (OUT_X_MSB)

    start
    send(WRITE_DATA)
    send(Register)
    stop

PUB GetRaw
    ' Get raw data from continuous output

    start
    send(READ_DATA)
    x := ((receive(true) << 8) | receive(true))
    z := ((receive(true) << 8) | receive(true))
    y := ((receive(true) << 8) | receive(false))
    stop
    ~~x
    ~~z
    ~~y
    x := x
    z := z
    y := y

PUB ShowVals
    ' Display XYZ compass values

    pst.str(string("X="))
    pst.dec(x)
    pst.str(string(", Y="))
    pst.dec(y)
    pst.str(string(", Z="))
    pst.dec(z)
    pst.str(string("    "))

PRI send(value)

    value := ((!value) >< 8)

    repeat 8
        dira[dataPin] := value
        dira[clockPin] := false
        dira[clockPin] := true
        value >>= 1

```

```

    dira[dataPin] := false
    dira[clockPin] := false
    result        := !(ina[dataPin])
    dira[clockPin] := true
    dira[dataPin]  := true

PRI receive(aknowledge)

    dira[dataPin] := false

    repeat 8
        result <= 1
        dira[clockPin] := false
        result         |= ina[dataPin]
        dira[clockPin] := true

    dira[dataPin] := aknowledge
    dira[clockPin] := false
    dira[clockPin] := true
    dira[dataPin]  := true

PRI start

    outa[dataPin] := false
    outa[clockPin] := false
    dira[dataPin]  := true
    dira[clockPin] := true

PRI stop

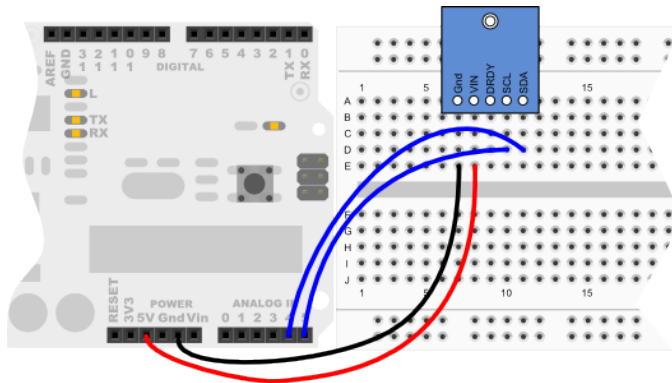
    dira[clockPin] := false
    dira[dataPin]  := false

```

**Note:** To view the results of the demonstration, after uploading is complete run the Parallax Serial Terminal from the Run menu or press F12. Click the Enable button, and momentarily depress the Reset button on the Propeller QuickStart board to restart the program.



## Arduino Uno



```
#include <Wire.h>

#define Addr 0x1E // 7-bit address of HMC5883 compass

void setup() {
  Serial.begin(9600);
  delay(100); // Power up delay
  Wire.begin();

  // Set operating mode to continuous
  Wire.beginTransmission(Addr);
  Wire.write(byte(0x02));
  Wire.write(byte(0x00));
  Wire.endTransmission();
}

void loop() {
  int x, y, z;

  // Initiate communications with compass
  Wire.beginTransmission(Addr);
  Wire.write(byte(0x03)); // Send request to X MSB register
  Wire.endTransmission();

  Wire.requestFrom(Addr, 6); // Request 6 bytes; 2 bytes per axis
  if(Wire.available() <=6) { // If 6 bytes available
    x = Wire.read() << 8 | Wire.read();
    z = Wire.read() << 8 | Wire.read();
    y = Wire.read() << 8 | Wire.read();
  }

  // Print raw values
  Serial.print("X=");
  Serial.print(x);
  Serial.print(", Y=");
  Serial.print(y);
  Serial.print(", Z=");
  Serial.println(z);

  delay(500);
}
```

**Note:** To view the results of the demonstration, after uploading is complete click the Serial Monitor icon in the Arduino IDE. This displays the Serial Monitor window. Momentarily depress the Reset button on the Arduino board to restart the sketch.

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## For More Information

- [3-Axis Compass \(#29133\)](#) data sheet and application notes
  - Combine the 3-axis compass with the [Memsic 2125 Dual-Axis Accelerometer](#), or [MM7455 3-Axis Accelerometer](#)
  - Combine the 3-axis compass with the [Parallax MMA7455 3-Axis Accelerometer Module](#) and [Gyroscope Module 3-Axis L3G4200D](#) to create a 9-axis inertial momentum unit (IMU)
  - More information on magnetometers and other forms of digital compasses may be found by searching on Wikipedia: Magnetometer.
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