

## 1. Test Platform Introduction

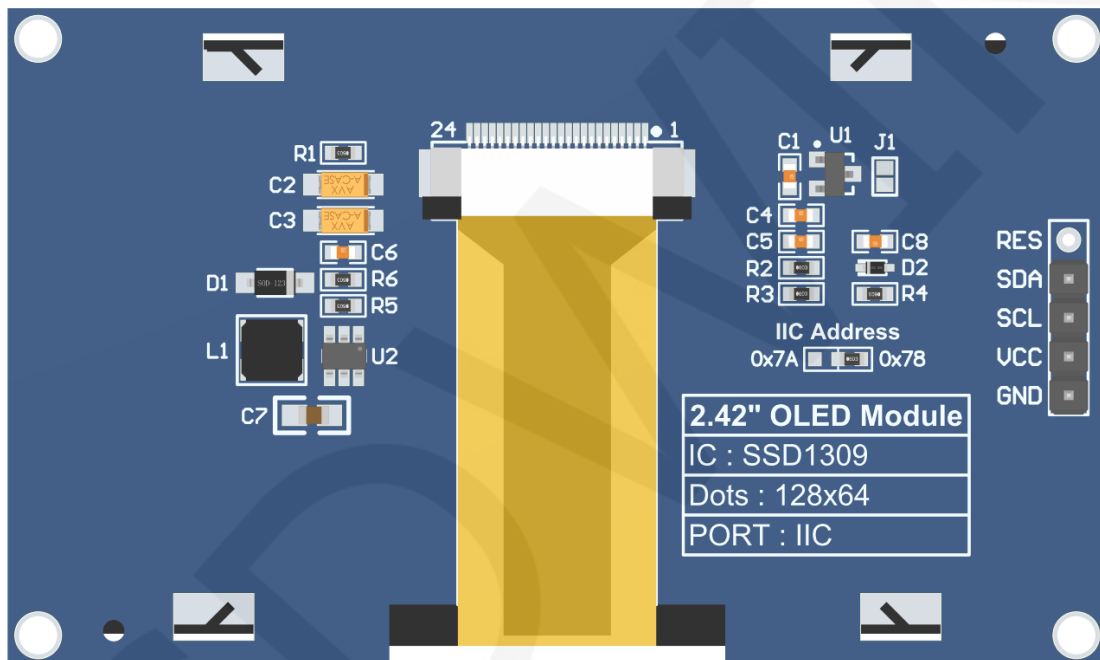
Development board: Raspberry Pi development board for each model

System: Raspberry Pi OS

GPIO library: bcm2835、wiringpi

## 2. Wiring Instructions

The display module is connected using DuPont cables and Raspberry Pi, with specific instructions as follows:



Module back pins

### NOTE:

- The **IIC Address** resistor is used to select the IIC slave device address. If it is soldered on the 0x78 side, select the 0x78 slave device address. If it is soldered on the 0x7A side, select the 0x7A slave device address;
- The RES pin row is not soldered by default. If the reset function needs to be controlled in the program, it needs to be soldered;

wiringPi 编码	BCM 编码	功能名	物理引脚 BOARD编码		功能名	BCM 编码	wiringPi 编码
		3.3V	1	2	5V		
8	2	SDA.1	3	4	5V		
9	3	SCL.1	5	6	GND		
7	4	GPIO.7	7	8	TXD	14	15
		GND	9	10	RXD	15	16
0	17	GPIO.0	11	12	GPIO.1	18	1
2	27	GPIO.2	13	14	GND		
3	22	GPIO.3	15	16	GPIO.4	23	4
		3.3V	17	18	GPIO.5	24	5
12	10	MOSI	19	20	GND		
13	9	MISO	21	22	GPIO.6	25	6
14	11	SCLK	23	24	CE0	8	10
		GND	25	26	CE1	7	11
30	0	SDA.0	27	28	SCL.0	1	31
21	5	GPIO.21	29	30	GND		
22	6	GPIO.22	31	32	GPIO.26	12	26
23	13	GPIO.23	33	34	GND		
24	19	GPIO.24	35	36	GPIO.27	16	27
25	26	GPIO.25	37	38	GPIO.28	20	28
		GND	39	40	GPIO.29	21	29

Raspberry Pi GPIO map

Raspberry Pi IIC test program wiring instructions			
Number	Module Pin	Corresponding to development board wiring pin	Remarks
1	GND	GND (Physical pin: 6,9,14,20,25,30,34,39)	OLED screen power supply ground
2	VCC	5V/3.3V (Physical pin: 1,2,4)	OLED screen power supply positive
3	SCL	Physical pin: 5 BCM coding: 3 wiringPi coding: 9	IIC bus clock signal

4	SDA	Physical pin: 3 BCM coding: 2 wiringPi coding: 8	IIC bus data signal
5	RES	Not welded	The pin arrangement is not soldered by default. If the reset function needs to be controlled in the program, it needs to be soldered

## NOTE:

- A. Physical pin refers to the GPIO pin number of the RaspBerry Pi development board
- B. BCM encoding refers to the GPIO pin encoding when using the BCM2835 GPIO library
- C. WiringPi encoding refers to the GPIO pin encoding when using the wiringPi GPIO library
- D. Which GPIO library is used in the code, and the corresponding GPIO library code needs to be used for pin definition. Please refer to the Raspberry Pi GPIO map table in the above figure for details

## 3. Demo Function Description

This set of testing program is applicable to various models of Raspberry Pi development boards, including the bcm2835 library, wiringPi GPIO library, and Python testing program. Each testing program has hardware IIC functional testing. The test program is located in **Demo\_RaspberryPI** directory, as shown in the following figure:



### ✧ Description of sample program content

The sample program includes the following content:

- A. Home screen display;
- B. Single color screen brushing
- C. Rectangle drawing display;
- D. Circular drawing display;
- E. Triangle drawing display;
- F. English display;
- G. Display of numbers and symbols
- H. Chinese display;
- I. BMP monochrome image display;
- J. Menu simulation display;

### ✧ Example program display direction switching instructions

When using the bcm2835 library or wiringPi GPIO library to test the program, find the macro definition **USE\_HORIZONTAL** and **COLOR\_State** in the **source\include\oled.h** file, as shown in the following figure:

```
#define USE_HORIZONTAL    0 //0-normal, 1-180degree
#define COLOR_STATE      0 //0-normal, 1-inverse
```

Modify **USE\_HORIZONTAL** and **COLOR\_STATE** macro according to the following definition:

```
#define USE_HORIZONTAL 0 //0 ° rotation (default value)
```

```
#define USE_HORIZONTAL 1 //180 ° rotation
#define COLOR_STATE 0 //Black background, monochrome display
                        content(Default value)
#define COLOR_STATE 1 //Monochrome background, black display content
```

When using Python to test program, Find the **COLOR** and **DIR** definitions in each `source\show_ xxx.py` file, as shown in the following figure:

```
# color and direction setting
COLOR = 0 #0-Normal display 1-Inverse display
DIR = 0 #0-Normal direction 1-Rotate 180 degrees
```

Modify the **DIR** and **COLOR** values as follows:

```
DIR = 0 # 0 ° rotation (default value)
DIR = 1 # 180 ° rotation
COLOR = 0 # Black background, monochrome display content (default value)
COLOR = 1 # Monochrome background, black display content
```

#### ✧ Example program IIC slave device address modification instructions

The IIC slave device address has been modified in hardware, and corresponding modifications need to be made in software.

When testing a program using the `bcm2835` library or `wiringPi` GPIO library, first locate the macro definition **IIC\_SLAVE\_ADDR** in the `source\include\iic.h` file, as shown in the following figure:

```
#define IIC_SLAVE_ADDR 0x3C //0x3D
```

Then modify **IIC\_SLAVE\_ADDR** macro definition according to the following definition is sufficient to:

```
#define IIC_SLAVE_ADDR 0x3C //Slave device address is 0x78 (default value)
#define IIC_SLAVE_ADDR 0x3D //Slave device address is 0x7A
```

The above slave device addresses have been left shifted by 1 bit in the code.

When using Python to test a program, first locate the macro definition **IIC\_SLAVE\_ADDR** in the `source\oled.py` file, as shown in the following figure:

```
IIC_SLAVE_ADDR = 0x3C #0x3D
```

Then modify the `IIC_SLAVE_ADDR` value according to the following definition:

```
IIC_SLAVE_ADDR = 0x3C # Slave device address is 0x78 (default value)
```

```
IIC_SLAVE_ADDR = 0x3D # Slave device address is 0x7A
```

The above slave device addresses have been left shifted by 1 bit in the code.

## 4. Demo Usage Instructions

### ✧ Establishing a development environment

Firstly, you need to download the Raspberry Pi system image file from the official website, and then use a microSD card to burn the image file. Please refer to the specific burning method online by yourself.

Official website address: <https://www.raspberrypi.org/downloads/raspbian/>

### ✧ Enable Raspberry Pi OS kernel SPI and IIC kernel drivers

After the system image file is burned, insert the microSD card into the Raspberry Pi, and then connect the display module to the Raspberry Pi using DuPont cables according to pin definitions. Next, plug the Raspberry Pi into the internet cable, and finally power up the Raspberry Pi. Open the terminal software (such as putty) and log in to Raspberry Pi using SSH (ensure that Raspberry Pi and PC are on the same network segment). Enter the following command in the terminal software:

```
sudo raspi-config
```

enable the IIC kernel driver, select **Interfacing Options ->I2C ->YES** in the pop-up interface

After completing the selection, press the **Esc** key continuously to save and exit the graphical interface.

### ✧ Installing GPIO software library

#### A. Install the bcm2835 library

There are three methods for downloading software libraries:

- 1) If Raspberry Pi cannot connect to the internet, it can be downloaded from a PC and then copied to Raspberry Pi OS using an SD card or FTP tool (such as FileZilla).

Download website: <http://www.airspayce.com/mikem/bcm2835/>

Enter the website and click on the link shown below to download.

#### C library for Broadcom BCM 2835 as used in Raspberry Pi

This is a C library for Raspberry Pi (RPI). It provides access to GPIO and other IO functions on the Broadcom BCM 2835 chip, as used in the RaspberryPi, allowing access to devices.

It provides functions for reading digital inputs and setting digital outputs, using SPI and I2C, and for accessing the system timers. Pin event detection is supported by poll.

Works on all versions up to and including RPI 4. Works with all versions of Debian up to and including Debian Buster 10. Reported to be working on Bullseye (Raspbian v

It is C++ compatible, and installs as a header file and non-shared library on any Linux-based distro (but clearly is no use except on Raspberry Pi or another board with BC

The version of the package that this documentation refers to can be downloaded from <http://www.airspayce.com/mikem/bcm2835/bcm2835-1.73.tar.gz> You can find the

Several example programs are provided.

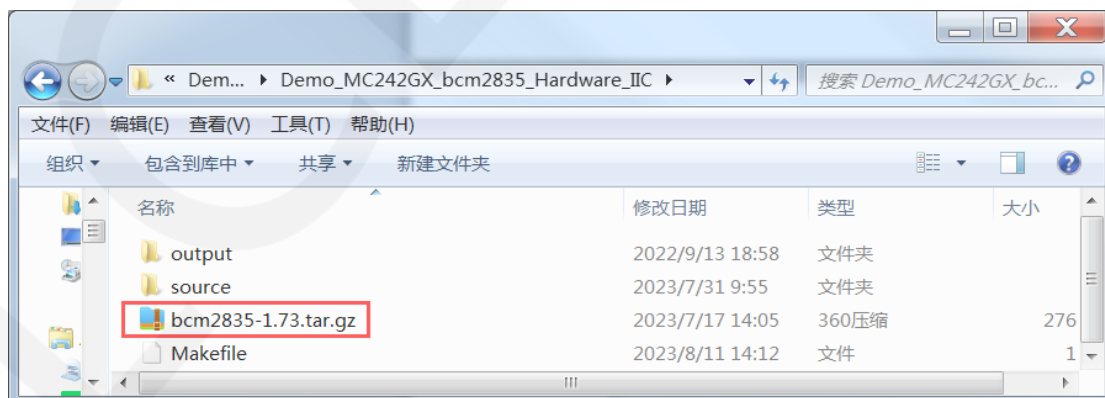
- 2) If Raspberry Pi can connect to the internet, it can be downloaded by entering the following command in Raspberry Pi OS through terminal software:

```
wget http://www.airspayce.com/mikem/bcm2835/bcm2835-X.XX.tar.gz
```

Among them, **X.XX** is the software library version number, as shown in the above figure. The version number is 1.73, so you can use the following command to download version 1.73:

```
wget http://www.airspayce.com/mikem/bcm2835/bcm2835-1.73.tar.gz
```

- 3) Directly use the bcm2835 library in the sample program directory (as shown in the following figure), and copy it to Raspberry Pi OS through an SD card or FTP tool (such as FileZilla).



After the bcm2835 library is successfully downloaded or copied, enter the following command in the terminal software to decompress, compile, and install:

```
tar -zxvf bcm2835-X.XX.tar.gz
cd bcm2835-X.XX
./configure
sudo make
sudo make check
sudo make install
```

Among them, X.XX is the version number of the bcm2835 library, which needs to be filled in according to the actual situation, such as 1.73

#### B. Install wiringPi GPIO library

There are four methods for downloading software libraries:

- 1) If Raspberry Pi cannot connect to the internet, it can be downloaded from a PC and then copied to Raspberry Pi OS using an SD card or FTP tool (such as FileZilla).

Download website: <https://project-downloads.drogon.net/wiringpi-latest.deb>

Enter the website address in the browser or click on it to download.

- 2) If Raspberry Pi can connect to the internet, it can be downloaded by entering the following command in Raspberry Pi OS through terminal software:

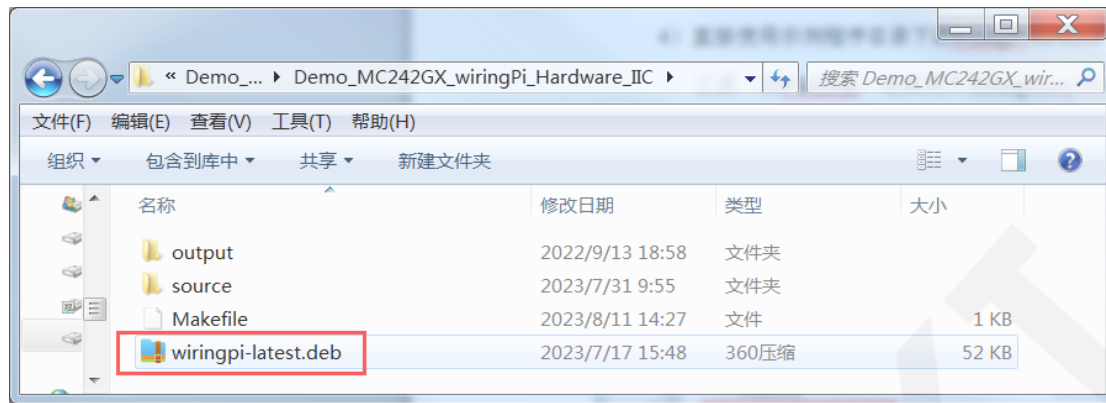
```
wget https://project-downloads.drogon.net/wiringpi-latest.deb
```

- 3) If Raspberry Pi can connect to the internet, it can also be downloaded from github by entering the following command in Raspberry Pi OS through terminal software:

```
git clone https://github.com/WiringPi/WiringPi
```

- 4) Directly use the wiringPi GPIO library in the sample program directory (as shown in the following figure), and copy it to Raspberry Pi OS through an SD card or FTP tool (such as FileZilla).





If the software library is not downloaded or copied from GitHub, enter the following command in the terminal software for compilation and installation:

```
sudo dpkg -i -B wiringpi latest.deb
```

If the software library is downloaded from Github, enter the following command in the terminal software for compilation and installation:

```
cd Wiring Pi
```

```
./build
```

After the installation of the wiringPi GPIO library is completed, you can enter the following command in the terminal software to check if the installation is successful

```
gpio -v
```

```
gpio readall
```

As shown in the following figure, the red box displays the version number and GPIO encoding number of the wiringPi library. If these contents do not appear, it indicates that the installation was not successful.

```

pi@raspberrypi:~ $ gpio -v
gpio version: 2.52
Copyright (c) 2012-2018 Gordon Henderson
This is free software with ABSOLUTELY NO WARRANTY.
For details type: gpio -warranty

Raspberry Pi Details:
Type: Pi 4B, Revision: 04, Memory: 8192MB, Maker: Sony
* Device tree is enabled.
*--> Raspberry Pi 4 Model B Rev 1.4
* This Raspberry Pi supports user-level GPIO access.
pi@raspberrypi:~ $ gpio readall
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| BCM | wPi |   Name   | Mode | V | Physical | V | Mode |   Name   | wPi | BCM |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|     |     | 3.3v     |      |   | 1 | 2 |     | 5v       |     |     | |
|  2  |  8  | SDA.1    | OUT  | 1 | 3 | 4 |     | 5v       |     |     |
|  3  |  9  | SCL.1    | OUT  | 1 | 5 | 6 |     | 0v       |     |     |
|  4  |  7  | GPIO. 7  | IN   | 1 | 7 | 8 | 1 | IN  | TxD    | 15  | 14  |
|     |     | 0v       |      |   | 9 | 10 | 1 | IN  | RxD    | 16  | 15  |
| 17  |  0  | GPIO. 0  | IN   | 0 | 11 | 12 | 1 | OUT | GPIO. 1 | 1   | 18  |
| 27  |  2  | GPIO. 2  | IN   | 0 | 13 | 14 |   |     | 0v     |     |     |
| 22  |  3  | GPIO. 3  | IN   | 0 | 15 | 16 | 0 | IN  | GPIO. 4 | 4   | 23  |
|     |     | 3.3v     |      |   | 17 | 18 | 0 | IN  | GPIO. 5 | 5   | 24  |
| 10  | 12  | MOSI     | ALT0 | 0 | 19 | 20 |   |     | 0v     |     |     |
|  9  | 13  | MISO     | ALT0 | 0 | 21 | 22 | 0 | IN  | GPIO. 6 | 6   | 25  |
| 11  | 14  | SCLK     | ALT0 | 0 | 23 | 24 | 1 | OUT | CE0    | 10  |  8  |
|     |     | 0v       |      |   | 25 | 26 | 1 | ALT0 | CE1    | 11  |  7  |
|  0  | 30  | SDA.0    | IN   | 1 | 27 | 28 | 1 | IN  | SCL.0  | 31  |  1  |
|  5  | 21  | GPIO.21  | IN   | 1 | 29 | 30 |   |     | 0v     |     |     |
|  6  | 22  | GPIO.22  | IN   | 1 | 31 | 32 | 0 | IN  | GPIO.26 | 26  | 12  |
| 13  | 23  | GPIO.23  | IN   | 0 | 33 | 34 |   |     | 0v     |     |     |
| 19  | 24  | GPIO.24  | IN   | 0 | 35 | 36 | 0 | IN  | GPIO.27 | 27  | 16  |
| 26  | 25  | GPIO.25  | IN   | 0 | 37 | 38 | 0 | IN  | GPIO.28 | 28  | 20  |
|     |     | 0v       |      |   | 39 | 40 | 0 | IN  | GPIO.29 | 29  | 21  |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| BCM | wPi |   Name   | Mode | V | Physical | V | Mode |   Name   | wPi | BCM |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+

```

### C. Installing Python libraries

At present, the latest Raspberry Pi OS is compatible with Python 2 using the Python 3 library, so only the Python 3 library needs to be installed. Before installation, execute the following command on the terminal software to check if the required Python 3 libraries have been installed on the system. If all of them have been installed, there is no need to install them again.

```
dpkg -l | grep -e python3 pip -e python3 pil -e python3 numpy
```

As shown in the figure below, it indicates that all have been installed and no further installation is required.

```

pi@raspberrypi:~ $ dpkg -l | grep -e python3-pip -e python3-pil -e python3-numpy
ii python3-numpy          1:1.19.5-1                armhf
ii python3-pil:armhf     8.1.2+dfsg-0.3+deb11u1    armhf
ii python3-pip           20.3.4-4+rpt1+deb11u1     all

```

If not installed, execute the following command to install the terminal software:

```
sudo apt get update
sudo apt get install python3 pip
sudo apt get install python3 pil
sudo apt get install python3 numpy
sudo pip3 install RPi. GPIO
```

If the Raspberry Pi OS running is using Python 2, execute the following command to install on the terminal software:

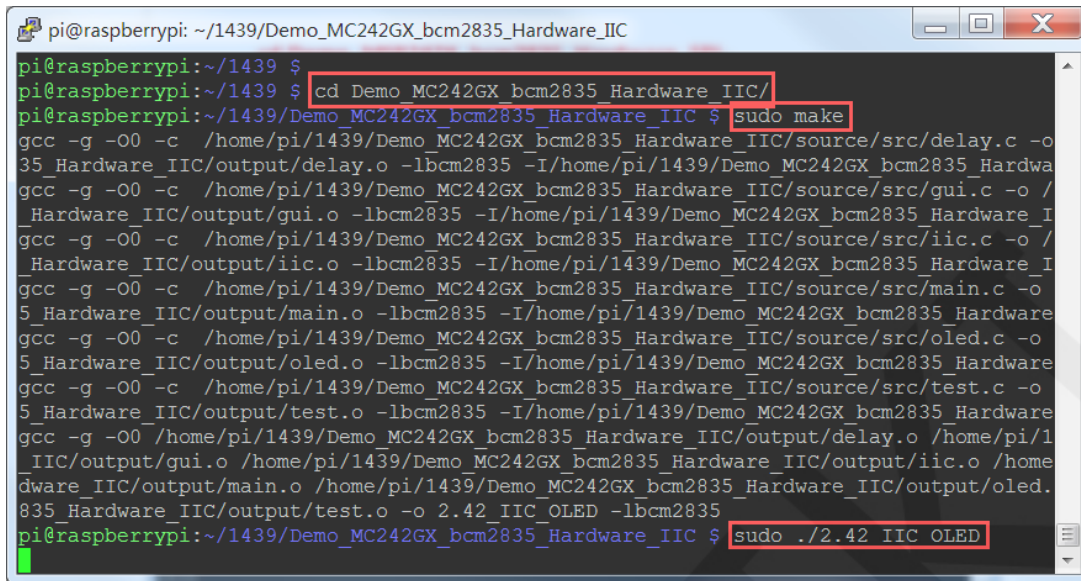
```
sudo apt get update
sudo apt get install python pip
sudo apt get install python pil
sudo apt get install python numpy
sudo pip install RPi. GPIO
```

## ✧ Compile and Run Programs

### A. Compile and run the bcm2835 library test program

First use an SD card or FTP tool (such as FileZilla) to copy the **Demo\_MC242GX\_bcm2835\_Hardware\_IIC** directory to Raspberry Pi OS, and then execute the following command in the terminal software to compile and run the program:

```
cd Demo_MC242GX_bcm2835_Hardware_IIC
sudo make
sudo/ 2.42_ IIC_ OLED
```



```

pi@raspberrypi: ~/1439/Demo_MC242GX_bcm2835_Hardware_IIC
pi@raspberrypi:~/1439 $ cd Demo_MC242GX_bcm2835_Hardware_IIC/
pi@raspberrypi:~/1439/Demo_MC242GX_bcm2835_Hardware_IIC $ sudo make
gcc -g -O0 -c /home/pi/1439/Demo_MC242GX_bcm2835_Hardware_IIC/source/src/delay.c -o
35_Hardware_IIC/output/delay.o -lbcm2835 -I/home/pi/1439/Demo_MC242GX_bcm2835_Hardwa
gcc -g -O0 -c /home/pi/1439/Demo_MC242GX_bcm2835_Hardware_IIC/source/src/gui.c -o /
Hardware_IIC/output/gui.o -lbcm2835 -I/home/pi/1439/Demo_MC242GX_bcm2835_Hardware_I
gcc -g -O0 -c /home/pi/1439/Demo_MC242GX_bcm2835_Hardware_IIC/source/src/iic.c -o /
Hardware_IIC/output/iic.o -lbcm2835 -I/home/pi/1439/Demo_MC242GX_bcm2835_Hardware_I
gcc -g -O0 -c /home/pi/1439/Demo_MC242GX_bcm2835_Hardware_IIC/source/src/main.c -o
5_Hardware_IIC/output/main.o -lbcm2835 -I/home/pi/1439/Demo_MC242GX_bcm2835_Hardware
gcc -g -O0 -c /home/pi/1439/Demo_MC242GX_bcm2835_Hardware_IIC/source/src/oled.c -o
5_Hardware_IIC/output/oled.o -lbcm2835 -I/home/pi/1439/Demo_MC242GX_bcm2835_Hardware
gcc -g -O0 -c /home/pi/1439/Demo_MC242GX_bcm2835_Hardware_IIC/source/src/test.c -o
5_Hardware_IIC/output/test.o -lbcm2835 -I/home/pi/1439/Demo_MC242GX_bcm2835_Hardware
gcc -g -O0 /home/pi/1439/Demo_MC242GX_bcm2835_Hardware_IIC/output/delay.o /home/pi/1
Hardware_IIC/output/gui.o /home/pi/1439/Demo_MC242GX_bcm2835_Hardware_IIC/output/iic.o /home
dware_IIC/output/main.o /home/pi/1439/Demo_MC242GX_bcm2835_Hardware_IIC/output/oled.
835_Hardware_IIC/output/test.o -o 2.42_IIC_OLED -lbcm2835
pi@raspberrypi:~/1439/Demo_MC242GX_bcm2835_Hardware_IIC $ sudo ./2.42_IIC_OLED

```

## B. Compile and run the wiringPi GPIO library test program

First use an SD card or FTP tool (such as FileZilla) to copy the

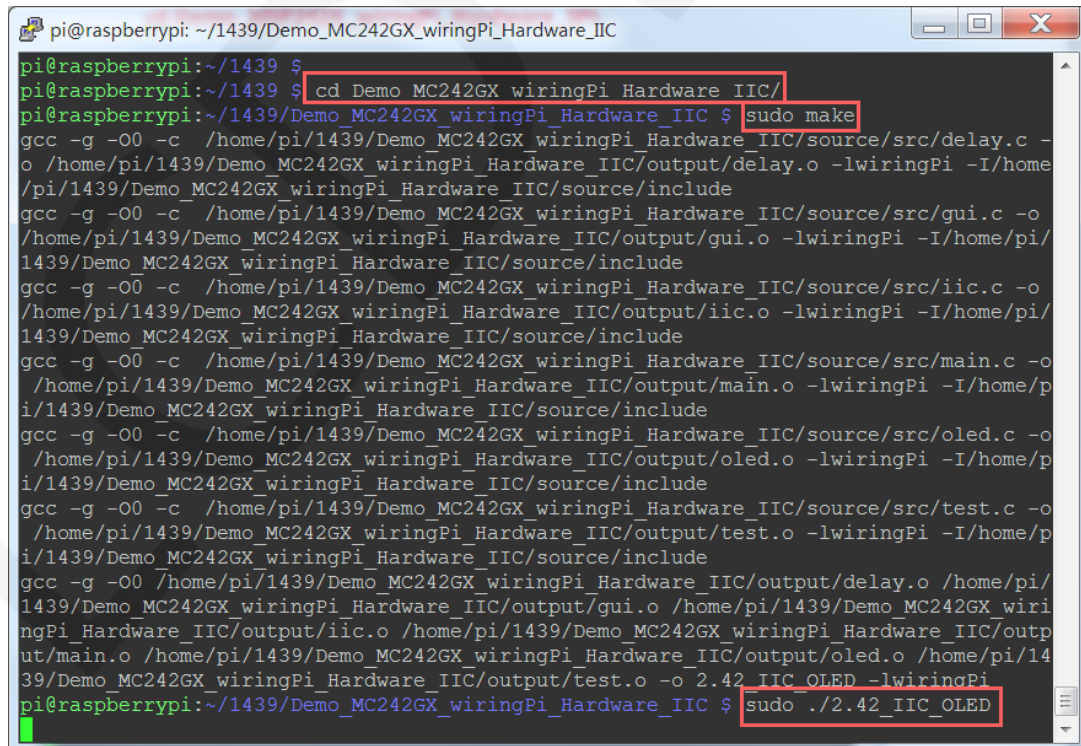
**Demo\_MC242GX\_wiringPi\_Hardware\_IIC** directory to Raspberry Pi OS, and

then execute the following command in the terminal software to compile and run the program:

```

cd Demo_MC242GX_wiringPi_Hardware_IIC
sudo make
sudo ./2.42_SPI_IIC_OLED

```



```

pi@raspberrypi: ~/1439/Demo_MC242GX_wiringPi_Hardware_IIC
pi@raspberrypi:~/1439 $ cd Demo_MC242GX_wiringPi_Hardware_IIC/
pi@raspberrypi:~/1439/Demo_MC242GX_wiringPi_Hardware_IIC $ sudo make
gcc -g -O0 -c /home/pi/1439/Demo_MC242GX_wiringPi_Hardware_IIC/source/src/delay.c -o
/home/pi/1439/Demo_MC242GX_wiringPi_Hardware_IIC/output/delay.o -lwiringPi -I/home
/pi/1439/Demo_MC242GX_wiringPi_Hardware_IIC/source/include
gcc -g -O0 -c /home/pi/1439/Demo_MC242GX_wiringPi_Hardware_IIC/source/src/gui.c -o
/home/pi/1439/Demo_MC242GX_wiringPi_Hardware_IIC/output/gui.o -lwiringPi -I/home/pi/
1439/Demo_MC242GX_wiringPi_Hardware_IIC/source/include
gcc -g -O0 -c /home/pi/1439/Demo_MC242GX_wiringPi_Hardware_IIC/source/src/iic.c -o
/home/pi/1439/Demo_MC242GX_wiringPi_Hardware_IIC/output/iic.o -lwiringPi -I/home/pi/
1439/Demo_MC242GX_wiringPi_Hardware_IIC/source/include
gcc -g -O0 -c /home/pi/1439/Demo_MC242GX_wiringPi_Hardware_IIC/source/src/main.c -o
/home/pi/1439/Demo_MC242GX_wiringPi_Hardware_IIC/output/main.o -lwiringPi -I/home/p
i/1439/Demo_MC242GX_wiringPi_Hardware_IIC/source/include
gcc -g -O0 -c /home/pi/1439/Demo_MC242GX_wiringPi_Hardware_IIC/source/src/oled.c -o
/home/pi/1439/Demo_MC242GX_wiringPi_Hardware_IIC/output/oled.o -lwiringPi -I/home/p
i/1439/Demo_MC242GX_wiringPi_Hardware_IIC/source/include
gcc -g -O0 -c /home/pi/1439/Demo_MC242GX_wiringPi_Hardware_IIC/source/src/test.c -o
/home/pi/1439/Demo_MC242GX_wiringPi_Hardware_IIC/output/test.o -lwiringPi -I/home/p
i/1439/Demo_MC242GX_wiringPi_Hardware_IIC/source/include
gcc -g -O0 /home/pi/1439/Demo_MC242GX_wiringPi_Hardware_IIC/output/delay.o /home/pi/
1439/Demo_MC242GX_wiringPi_Hardware_IIC/output/gui.o /home/pi/1439/Demo_MC242GX_wiri
ngPi_Hardware_IIC/output/iic.o /home/pi/1439/Demo_MC242GX_wiringPi_Hardware_IIC/outp
ut/main.o /home/pi/1439/Demo_MC242GX_wiringPi_Hardware_IIC/output/oled.o /home/pi/14
39/Demo_MC242GX_wiringPi_Hardware_IIC/output/test.o -o 2.42_IIC_OLED -lwiringPi
pi@raspberrypi:~/1439/Demo_MC242GX_wiringPi_Hardware_IIC $ sudo ./2.42_IIC_OLED

```

### C. Compile and run Python test programs

First use an SD card or FTP tool (such as FileZilla) to copy the **Demo\_MC242GX\_python\_Hardware\_IIC** directory to Raspberry Pi OS, and then execute the following command in the terminal software to compile and run the program.

Using Python 3, execute the following command:

```
cd Demo_MC242GX_python_Hardware_IIC/source /  
sudo python3 show_char.py  
sudo python3 show_graph.py  
sudo python3 show_bmp.py
```

```
pi@raspberrypi:~/1439 $ cd Demo_MC242GX_python_Hardware_IIC/source/  
pi@raspberrypi:~/1439/Demo_MC242GX_python_Hardware_IIC/source $ sudo python3 show_char.py  
pi@raspberrypi:~/1439/Demo_MC242GX_python_Hardware_IIC/source $  
pi@raspberrypi:~/1439/Demo_MC242GX_python_Hardware_IIC/source $ sudo python3 show_graph.py  
pi@raspberrypi:~/1439/Demo_MC242GX_python_Hardware_IIC/source $  
pi@raspberrypi:~/1439/Demo_MC242GX_python_Hardware_IIC/source $ sudo python3 show_bmp.py
```

Using Python 2, execute the following command:

```
cd Demo_MC242GX_python_Hardware_IIC/source /  
sudo python show_char.py  
sudo python show_graph.py  
sudo python show_bmp.py
```

```
pi@raspberrypi:~/1439 $  
pi@raspberrypi:~/1439 $ cd Demo_MC242GX_python_Hardware_IIC/source/  
pi@raspberrypi:~/1439/Demo_MC242GX_python_Hardware_IIC/source $ sudo python show_char.py  
pi@raspberrypi:~/1439/Demo_MC242GX_python_Hardware_IIC/source $  
pi@raspberrypi:~/1439/Demo_MC242GX_python_Hardware_IIC/source $ sudo python show_graph.py  
pi@raspberrypi:~/1439/Demo_MC242GX_python_Hardware_IIC/source $  
pi@raspberrypi:~/1439/Demo_MC242GX_python_Hardware_IIC/source $ sudo python show_bmp.py
```