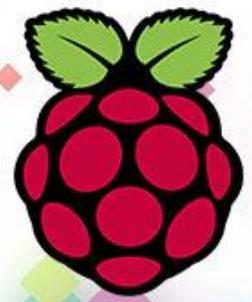




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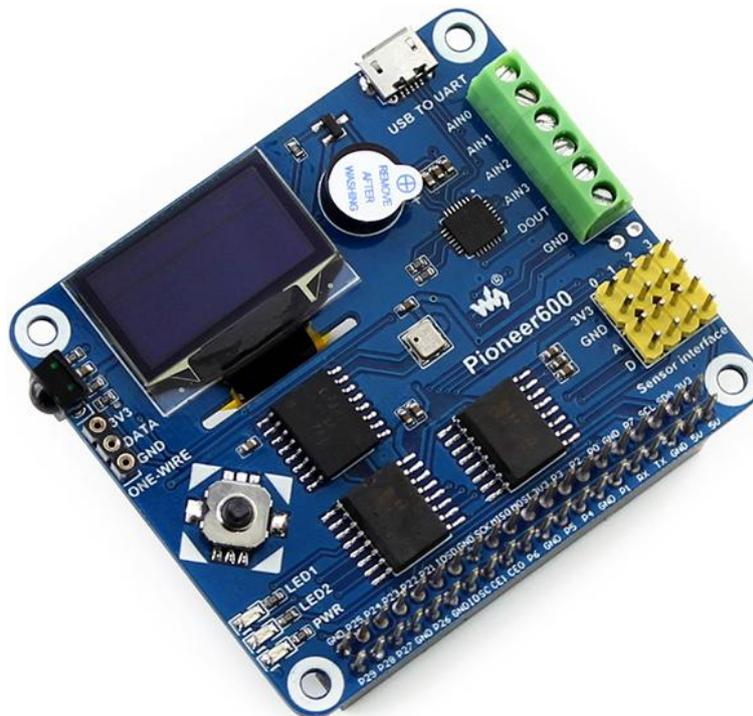
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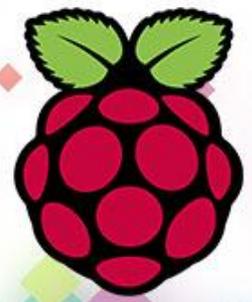
PIONEER600, Raspberry Pi Expansion Board

User Manual

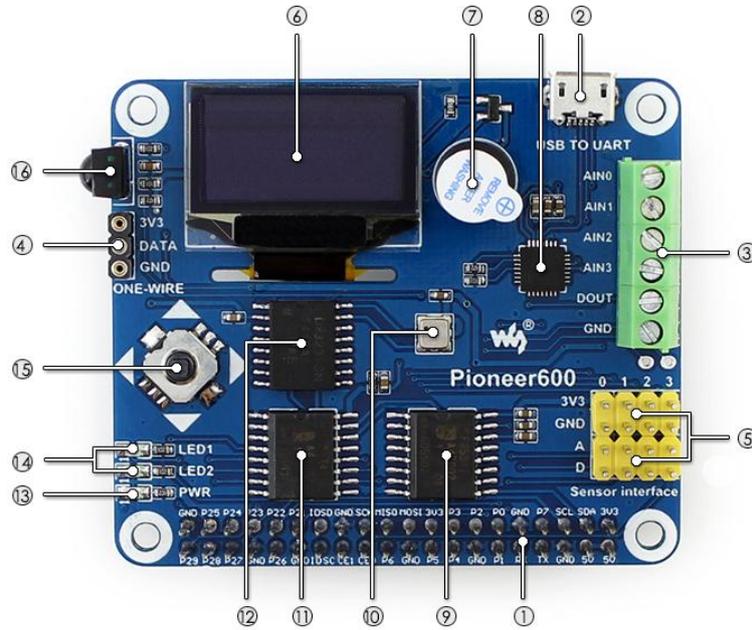
Features



- Supports Raspberry Pi A+/B+/2B
- **<Standard I/O>** dual LED, joystick, buzzer, the basic components
- **<USB TO UART>** CP2102, control the Pi through serial terminal
- **<Display>** 0.96inch OLED, big world in the little screen
- **<RTC>** DS3231, high precision, backup battery holder is also available
- **<AD/DA>** PCF8591, 8-bit resolution, screw terminal IO interface
- **<GPIO Expansion>** PCF8574, more GPIO, more possibility
- **<IR Control>** LFN0038K, Raspberry Pi remote control comes true
- **<Pressure Sensor>** BMP180, measuring air pressure and temperature
- **<1-WIRE>** for connecting 1-WIRE devices, DS18B20 is included
- **<Sensor Interface>** for connecting various sensors



What's on Board



1. Raspberry Pi GPIO interface: for connecting Raspberry Pi
2. USB TO UART: control the Pi through serial terminal
3. AD/DA IO interface: screw terminal
4. 1-WIRE interface: for connecting 1-WIRE devices like DS18B20
5. Sensor interface: for connecting various sensors
6. 0.96inch OLED: SSD1306 driver, 128×64 resolution, SPI interface
7. Buzzer
8. CP2102: USB TO UART converter
9. PCF8591: 8-bit AD/DA converter, I2C interface
10. BMP180: pressure sensor, I2C interface
11. PCF8574: I/O expansion chip, I2C interface
12. DS3231: high precision RTC chip, I2C interface
13. Power indicator
14. User LED
15. Joystick
16. LFN0038K IR receiver



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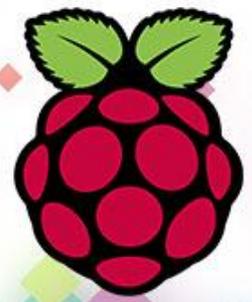


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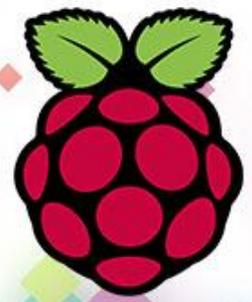
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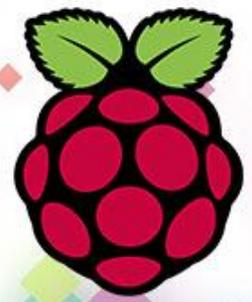


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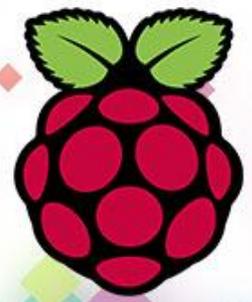


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1. Preparation – installing the libraries required

1.1. Installing the libraries required

Before using the PIONEER600, you shall install the `bcm2835`, `wiringPi` and `python` libraries to the RPi to add the additional APIs, and configure the settings to start up the core drivers of I²C, SPI and UART after the libraries installed. For more detailed information about the installation and configuration of the RPi library functions, please refer to [Libraries Installation for RPi](#). Of course, we have provided a system image file with the libraries installed as well. In case that you don't want to reinstall the libraries, you can program this ready-to-use system image file to your Raspberry Pi board.

When finished the configurations above, you need to download the sample programs, and unzip them to the directory of `/home/pi` (you can also copy them into the RPi board with your U-disk pen). Some of the sample programs can be implemented via different ways, such as the libraries of `bcm2835`, `wiringPi`, `sysfs`, `python` and so on. That means you can implement a same function by using different libraries. Therefore, the libraries of `bcm2835`, `wiringPi` and `python` should be installed to the RPi before used. In the next section, we will present the expansion functions provided by PIONEER600.

If the sample programs presented in the next section are unable to be performed after installing the libraries, you can try to apply the command `chmod +x filename` to grant the program the executable permission.

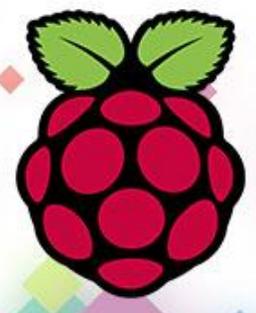
1.2. Connecting the expansion board and the RPi

The Pioneer600 expansion board supports the Raspberry Pi A+/B+/2B. Before running the sample programs, please make sure the Pioneer600 is connected to the RPi and the RPi is powered up by the USB power supply. Without the RPi main board, the sample programs cannot be used on the expansion board.

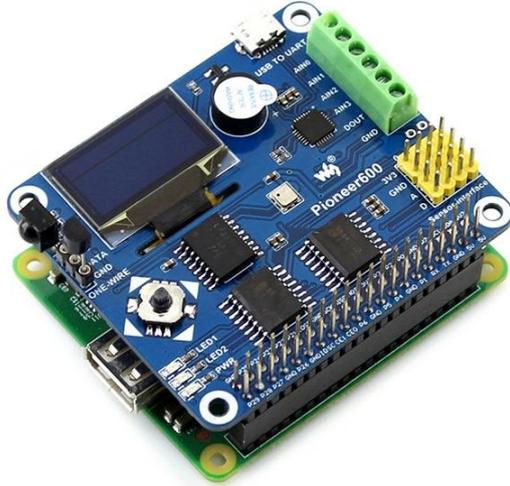


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Connected to Raspberry Pi A+:



Connected to Raspberry Pi B+/2B



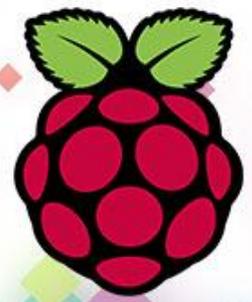


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2. LED sample programs – Changing the LED status

2.1. bcm2835 program

Open the Linux terminal and enter to the responding path and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/LED/bcm2835 $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/LED/bcm2835 $ sudo ./led
```

Expected result: The LED1 is blinking.

Press the keys **Ctrl+C** to end the program.

2.2. wiringPi program

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/LED/wiringPi $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/LED/wiringPi $ sudo ./led
```

Expected result: The LED1 is blinking.

Press the keys **Ctrl+C** to end the program.

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/LED/wiringPi $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/LED/wiringPi $ sudo ./pwm
```

Expected result: The brightness of the LED1 is changing gradually.

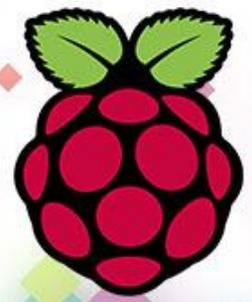
Press the keys **Ctrl+C** to end the program.



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2.3. sysfs program

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/LED/fs $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/LED/fs $ sudo ./led
```

Expected result: The LED1 blinks 10 times and then the program will automatically quit.

Press the keys **Ctrl+C** to end the program.

2.4. python program

Enter the Linux terminal, and run the following commands:

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/LED/python $ sudo python led.py
```

Expected result: The LED1 is blinking.

Press the keys **Ctrl+C** to end the program.

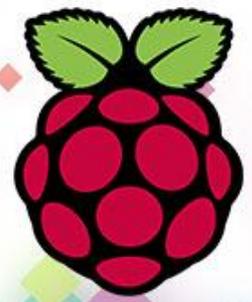
Enter the Linux terminal, and run the following commands:

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/LED/python $ sudo python pwm.py
```

Expected result: The brightness of the LED1 is changing gradually.

Press the keys **Ctrl+C** to end the program.



3. Key sample programs

3.1. bcm2835 program

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/KEY/bcm2835 $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/KEY/bcm2835 $ sudo ./key
```

Expected result:

Press the center key of the joystick, and the terminal will display the following information:

```
Key Test Program!!!!  
KEY PRESS  
KEY PRESS  
KEY PRESS
```

Press the keys **Ctrl+C** to end the program.

3.2. wiringPi program

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/KEY/wiringPi $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/KEY/wiringPi $ sudo ./key
```

Expected result:

Press the center key of the joystick, and the terminal will display the following information:

```
Key Test Program!!!  
KEY PRESS  
KEY PRESS  
KEY PRESS
```

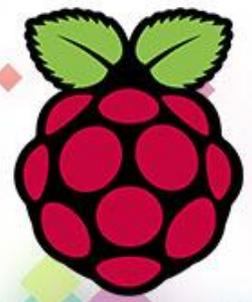


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Press the keys **Ctrl+C** to end the program.

3.3. python program

Enter the Linux terminal, and run the following commands:

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/KEY/python $ sudo ./key.py
```

Expected result:

Press the center key of the joystick, and the terminal will display the following information:

```
Key Test Program
KEY PRESS
KEY PRESS
KEY PRESS
```

Press the keys **Ctrl+C** to end the program.

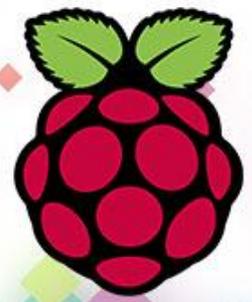


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4. PCF8574 sample programs - I/O expansion demos

4.1. bcm2835 program

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/PCF8574/bcm2835 $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/PCF8574/bcm2835 $ sudo ./led
```

Expected result: The LED2 is blinking.

Press the keys **Ctrl+C** to end the program.

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/PCF8574/bcm2835 $ make5
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/PCF8574/bcm2835 $ sudo ./pcf8574
```

Expected result: Press the direction keys, then the LED2 will light up, the buzzer will sound, and the terminal will display the following information:

```
PCF8574 Test Program !!!  
up  
left  
down  
right
```

Press the keys **Ctrl+C** to end the program.

4.2. python program

Enter the Linux terminal, and run the following commands:



The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/PCF8574/python $ sudo python led.py
```

Expected result: The LED2 is blinking.

Press the keys **Ctrl+C** to end the program.

Enter the Linux terminal, and run the following commands:

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/PCF8574/python $ sudo python pcf8574.py
```

Expected result: Press the direction keys, then the LED2 will light up, the buzzer will sound, and the terminal will display the following information:

```
PCF8574 Test Program !!!
up
left
down
right
```

Press the keys **Ctrl+C** to end the program.

4.3. fs program

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/PCF8574/fs $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/PCF8574/fs $ sudo ./led
```

Expected result: The LED2 is blinking.

Press the keys **Ctrl+C** to end the program.

4.4. wiringPi program

Enter the Linux terminal, and run the following commands:

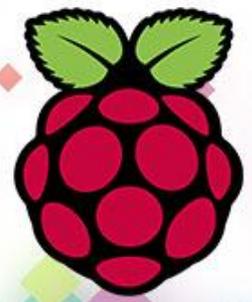


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The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/PCF8574/wiringPi $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/PCF8574/wiringPi $ sudo ./led
```

Expected result: The LED2 is blinking.

Press the keys **Ctrl+C** to end the program.

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

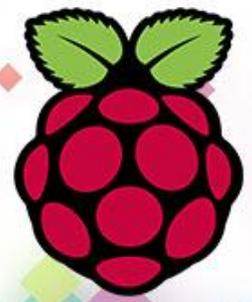
```
pi@raspberrypi ~/Pioneer600/PCF8574/wiringPi $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/PCF8574/wiringPi $ sudo ./LED
```

Expected result: The LED2 is blinking.

Press the keys **Ctrl+C** to end the program.



5. BMP180 sample programs- Barometer Demos

5.1. bcm2835 program

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/BMP180/bcm2835 $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/BMP180/bcm2835 $ sudo ./BMP180
```

Expected result: The terminal will display the following information:

```
BMP180 Test Program ...
Temperature: 34.20 C
Pressure:    1005.12 Pa
Altitude:   67.66 m
```

Press the keys **Ctrl+C** to end the program.

5.2. wiringPi program

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/BMP180/wiringPi $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/BMP180/wiringPi $ sudo ./BMP180
```

Expected result: The terminal will display the following information:

```
BMP180 Test Program ...
Temperature: 34.20 C
Pressure:    1005.12 Pa
Altitude:   67.66 m
```

Press the keys **Ctrl+C** to end the program.

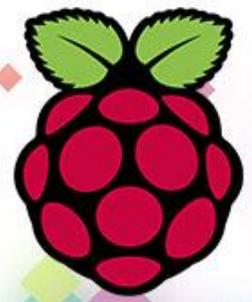


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5.3. python program

Enter the Linux terminal, and run the following commands to execute the program:

```
pi@raspberrypi ~/Pioneer600/BMP180/python $ sudo python BMP180_example.py
```

Expected result: The terminal will display the following information:

```
Temperature: 34.00 C
Pressure:    638.71 hPa
Altitude:   3726.81 m
```

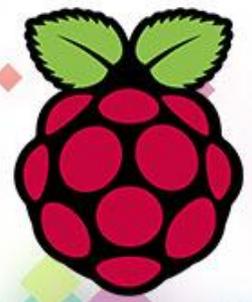
Press the keys **Ctrl+C** to end the program.



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6. DS3231 sample programs – High precision RTC Demos

6.1. bcm2835 program

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/DS3231/bcm2835 $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/DS3231/bcm2835 $ sudo ./ds3231
```

Expected result: The terminal will display the following information:

```
start.....
2015/08/12 18:00:00 Wed
2015/08/12 18:00:01 Wed
2015/08/12 18:00:02 Wed
2015/08/12 18:00:03 Wed
```

Press the keys **Ctrl+C** to end the program.

6.2. wiringPi program

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/DS3231/wiringPi $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/DS3231/wiringPi $ sudo ./ds3231
```

Expected result: The terminal will display the following information:

```
start.....
2015/08/12 18:00:00 Wed
2015/08/12 18:00:01 Wed
2015/08/12 18:00:02 Wed
2015/08/12 18:00:03 Wed
```

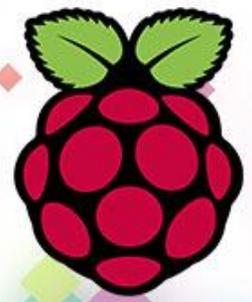


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Press the keys **Ctrl+C** to end the program.

6.3. python program

Enter the Linux terminal, and run the following commands to execute the program:

```
pi@raspberrypi ~/Pioneer600/DS3231/python $ sudo python ds3231.py
```

Expected result: The terminal will display the following information:

```
2015/08/12 18:00:00 Wed
2015/08/12 18:00:01 Wed
2015/08/12 18:00:02 Wed
2015/08/12 18:00:03 Wed
2015/08/12 18:00:04 Wed
```

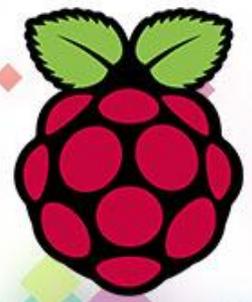
Press the keys **Ctrl+C** to end the program.



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7. DS18B20 sample programs – Temperature sensor Demos

To use the DS18B20 program, you should add a line `dtoverlay=w1-gpio-pullup` to the end of the Raspberry Pi boot file `/boot/config.txt`, and restart the RPi to make it take effect. For more detailed information, please refer to the relative Raspberry Pi documents.

7.1. sysfs program

Enter the Linux terminal, and run the following commands to execute the program:

```
pi@raspberrypi ~/Pioneer600/DS18B20/fs $ sudo ./ds18b20
```

Expected result: The terminal will display the following information:

```
rom: 28-00000674869d
temp: 30.437 °C
temp: 30.375 °C
```

Press the keys **Ctrl+C** to end the program.

7.2. python program

Enter the Linux terminal, and run the following commands to execute the program:

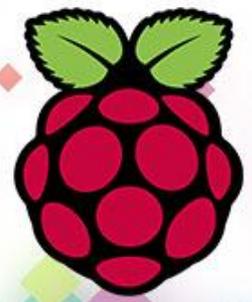
```
pi@raspberrypi ~/Pioneer600/DS18B20/python $ sudo python ds18b20.py
```

Expected result: The terminal will display the following information:

```
rom: 28-00000674869d

C=29.687 F=85.437
C=29.687 F=85.437
C=29.687 F=85.437
```

Press the keys **Ctrl+C** to end the program.



8. IRM sample programs - Infrared reflective sensor program

8.1. bcm2835 program

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/IRM/bcm2835 $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/IRM/bcm2835 $ sudo ./irm
```

Expected result: Press the keys on the infrared remote controller, and the terminal will display the relative value of the pressed key.

```
irm test start:  
Get the key: 0x0c  
Get the key: 0x18  
Get the key: 0x5e
```

Press the keys **Ctrl+C** to end the program.

8.2. wiringPi program

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/IRM/wiringPi $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/IRM/wiringPi $ sudo ./irm
```

Expected result: Press the keys on the infrared remote controller, and the terminal will display the relative value of the pressed key.

```
irm test start:  
Get the key: 0x0c  
Get the key: 0x18  
Get the key: 0x5e
```

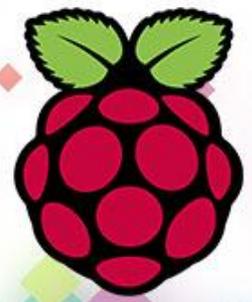


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Press the keys **Ctrl+C** to end the program.

8.3. python program

Enter the Linux terminal, and run the following commands to execute the program:

```
pi@raspberrypi ~/Pioneer600/IRM/python $ sudo python irm.py
```

Expected result: Press the keys on the infrared remote controller, and the terminal will display the relative value of the pressed key.

```
IRM Test Start ...  
Get the key: 0x0c  
Get the key: 0x18  
Get the key: 0x5e
```

Press the keys **Ctrl+C** to end the program.

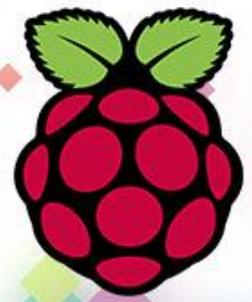


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9. UART sample programs – Transmitting the serial data received

Notices: The serial port of RPi is set to terminal debugging mode by default. However, in order to run this sample program, you should disable the terminal debugging function, which means you cannot debug the RPi via the serial port communication any more. In this case, you should employ other methods to debug the RPi before running this program. For example, you can connect an external HDMI displayer to the RPi or use SSH.

9.1. wiringPi program

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/UART/wiringPi $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/UART/wiringPi $ sudo ./UART
```

Expected result: Connect the expansion board to the PC via the USB TO UART interface, and configure the serial communication software on the PC (Here, you can use the software PuTTY to monitor the serial port), selecting the right serial port number and setting the Baud rate to 115200. Then, you can use your PC to send data to the RPi via the serial communication. After the data is received by the RPi, it will be echoed to the serial monitor on the PC.

9.2. python program

Enter the Linux terminal, and run the following commands to execute the program:

```
pi@raspberrypi ~/Pioneer600/UART/python $ sudo python uart.py
```

Expected result: It is the same as in the above case.

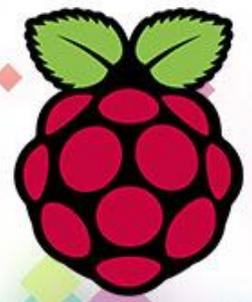


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10. OLED sample programs

10.1. bcm2835 program

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/OLED/bcm2835 $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/OLED/bcm2835 $ sudo ./main
```

Expected result: The OLED shows the LOGO of Waveshare for 2 seconds, and then it will switch to display the current system time.

Press the keys **Ctrl+C** to end the program.

10.2. wiringPi program

Enter the Linux terminal, and run the following commands:

The command for compiling the program:

```
pi@raspberrypi ~/Pioneer600/OLED/wiringPi $ make
```

The command for executing the program:

```
pi@raspberrypi ~/Pioneer600/OLED/wiringPi $ sudo ./main
```

Expected result: The OLED shows the LOGO of Waveshare for 2 seconds, and then it will switch to display the current system time.

Press the keys **Ctrl+C** to end the program.

10.3. python program

When using this python program to control the OLED, you need to install another library python-imaging. To install the python-imaging library, you should connect the RPi to the network, and use the line below:

```
sudo apt-get python-imaging
```

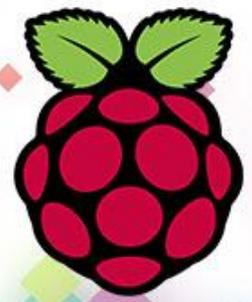


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Expected result: Entering the following commands under the Terminal to execute the program, you will get different displayed information.

```
pi@raspberrypi ~/Pioneer600/OLED/python $ sudo python oled.py
```

```
pi@raspberrypi ~/Pioneer600/OLED/python $ sudo python dispchar.py
```

```
pi@raspberrypi ~/Pioneer600/OLED/python $ sudo python image.py
```

```
pi@raspberrypi ~/Pioneer600/OLED/python $ sudo python animate.py
```

```
pi@raspberrypi ~/Pioneer600/OLED/python $ sudo python waveshare.py
```

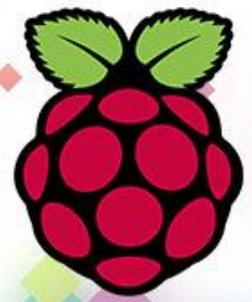
For more detailed information, please refer to the relative Raspberry Pi documents.



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11. How to use Pioneer600 with external sensor kits (purchased separately)

Pioneer600 has four interfaces for external sensors, so that you can not only use the on-board sensors, but also other external sensors.

Before using the external sensors, you should:

- 1) Connect the sensor kits to the expansion board, and install the expansion board to the RPi.
- 2) Make sure that the libraries are installed and the I²C core driver is start up, since the on-board chip PCF8591 need to use the I²C interface to provide AD/DA function.
- 3) Download the sample programs, and unzip them to the directory of `/home/pi` (you can also copy them into the RPi board with your U-disk pen). Of course, we have provided a system image file with the libraries installed as well. In case that you don't want to reinstall the sample programs, you can program this ready-to-use system image file to your Raspberry Pi board.



12. Color Sensor sample program

Please connect the color sensor to the Pioneer600 according to the list below.

Pins of Color Sensor	Pins of Pioneer600
LED	3.3V
OUT	P0
S3	D3(P26)
S2	D2(P23)
S1	D1(P22)
S0	D0(P21)
GND	GND
VCC	3.3V

Enter the folder of `/Pioneer600/Sensor/Color_Sensor`, and run the following command under the terminal:

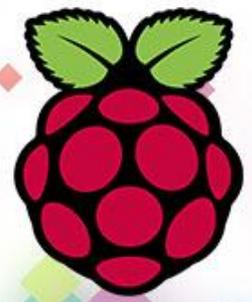
```
sudo ./Color_Sensor
```



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Expected result: The program performs the white balance adjustment to the sensor and it may take 2 seconds. When finished, you can see relative data of RGB are outputted on the terminal. A color check list is helpful for finding out what the measured color it is.

Press the keys **Ctrl+C** to end the program.

13. Flame Sensor sample program

Please connect the flame sensor to the Pioneer600 according to the list below.

Pins of Flame Sensor	Pins of Pioneer600
DOUT	D3
AOUT	A3
GND	GND
VCC	3.3V

Enter the folder of /Pioneer600/Sensor/Flame_Sensor, and run the following command under the terminal:

```
sudo ./General_Sensor
```

Expected result: The signal indicator will turn on when the sensor is close to a fire. And it will turn off when the sensor is away from the fire. The serial output changes along with the distance from the sensor to the fire.

Press the keys **Ctrl+C** to end the program.

Notices: The flame sensor is designed to detect fire only, but it is not fireproof itself. When using it, please keep a safe distance from the fire to avoid burning out.

14. Hall Sensor sample program

Please connect the hall sensor to the Pioneer600 according to the list below.

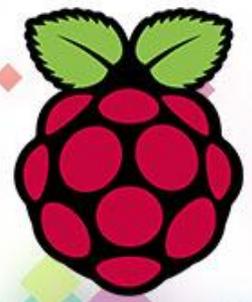
Pins of Hall Sensor	Pins of Pioneer600
DOUT	D3
AOUT	A3
GND	GND
VCC	3.3V



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Enter the folder of /Pioneer600/Sensor/Hall_Sensor, and run the following command under the terminal:

```
sudo ./General_Sensor
```

Expected result: The signal indicator will turn on, when the sensor is close to a magnet. And it will turn off, when the sensor is away from the magnet. The serial output changes along with the distance from the sensor to the magnet.

Press the keys **Ctrl+C** to end the program.

15. Infrared Reflective Sensor sample program

Please connect the infrared reflective sensor to the Pioneer600 according to the list below.

Pins of Infrared Reflective Sensor	Pins of Pioneer600
DOUT	D3
AOUT	A3
GND	GND
VCC	3.3V

Enter the folder of /Pioneer600/Sensor/Infrared_Reflective_Sensor, and run the following command under the terminal:

```
sudo ./General_Sensor
```

Expected result: The signal indicator will turn on, when the sensor is close to a barrier. And it will turn off, when the sensor is away from the barrier. The serial output changes along with the distance from the sensor to the barrier.

Press the keys **Ctrl+C** to end the program.

16. Laser Sensor sample program

Please connect the laser sensor to the Pioneer600 according to the list below.

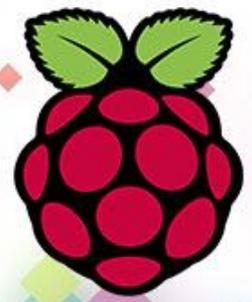
Pins of Laser Sensor	Pins of Pioneer600
DOUT	D3
AOUT	A3
GND	GND
VCC	3.3V



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Enter the folder of /Pioneer600/Sensor/Laser_Sensor, and run the following command under the terminal:

```
sudo ./General_Sensor
```

Expected result: The signal indicator will turn on, when a barrier is placed above the sensor. And the signal indicator will turn off, when the barrier is away from the sensor. By reading the status of the indicator, you can get to know whether the sensor has detected the barrier.

Press the keys **Ctrl+C** to end the program.

17. Moisture Sensor sample program

Please connect the moisture sensor to the Pioneer600 according to the list below.

Pins of Moisture Sensor	Pins of Pioneer600
DOUT	D3
AOUT	A3
GND	GND
VCC	3.3V

Enter the folder of /Pioneer600/Sensor/Moisture_Sensor, and run the following command under the terminal:

```
sudo ./General_Sensor
```

Expected result: Insert the sensor into the soil and water the soil little by little. And then you may find the serial output changes.

Press the keys **Ctrl+C** to end the program.

18. Rotation Sensor sample program

Please connect the rotation sensor to the Pioneer600 according to the list below.

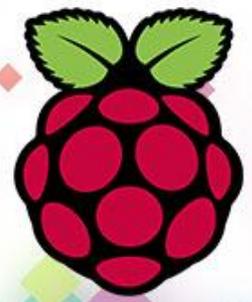
Pins of Rotation Sensor	Pins of Pioneer600
SIA	D0
SIB	D1
SW	D2
GND	GND
VCC	3.3V



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Enter the folder of /Pioneer600/Sensor/Rotation_Sensor, and run the following command under the terminal:

```
sudo ./Rotation_Sensor
```

Expected result: There are three actions of the rotary encoder: clockwise rotation, anticlockwise rotation, and button press. The serial output of the module varies with different actions.

```
Turn right!
Turn left!
Turn down!
```

Press the keys **Ctrl+C** to end the program.

19. Sound Sensor sample program

Please connect the sound sensor to the Pioneer600 according to the list below.

Pins of Sound Sensor	Pins of Pioneer600
DOUT	D3
AOUT	A3
GND	GND
VCC	3.3V

Enter the folder of /Pioneer600/Sensor/Sound_Sensor, and run the following command under the terminal:

```
sudo ./General_Sensor
```

Expected result: The signal indicator will turn on, when the microphone of the module is close to a sound source. And it will turn off, when the microphone is away from the sound source. The serial output changes along with the distance from the sensor to the sound source.

Press the keys **Ctrl+C** to end the program.

20. Temperature-Humidity Sensor sample program

Please connect the temperature-humidity sensor to the Pioneer600 according to the list below.

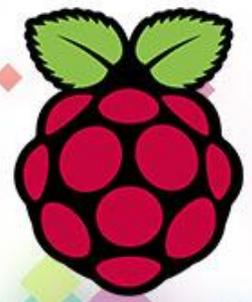
Pins of Temperature-Humidity Sensor	Pins of Pioneer600
DOUT	D3



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GND	GND
VCC	3.3V

Enter the folder of /Pioneer600/Sensor/Temperature-Humidity_Sensor, and run the following command under the terminal:

```
sudo ./DHT11
```

Expected result: The data of temperature and humidity detected are shown on the terminal. For example:

```
Humidity=33
Temperature=28
```

Press the keys **Ctrl+C** to end the program.

21. MQ-5 Gas Sensor sample program

Please connect the MQ-5 gas sensor to the Pioneer600 according to the list below.

Pins of MQ-5 Gas Sensor	Pins of Pioneer600
DOUT	D3
AOUT	A3
GND	GND
VCC	3.3V

Enter the folder of /Pioneer600/Sensor/MQ-5_Gas_Sensor, and run the following command under the terminal:

```
sudo ./General_Sensor
```

Expected result: Warn-up the sensor for a minute. And then, put the sensor into a container filled with sensitive gas, you will find the indicator turns on. While take the sensor out of the container, you can see the indicator turns off. By checking the indicator, you can get to know whether the concentration of the sensitive gas is beyond the index.

Press the keys **Ctrl+C** to end the program.

22. Tilt Sensor sample program

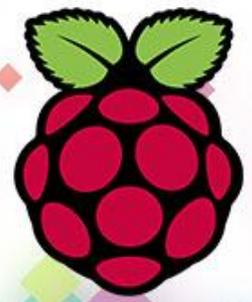
Please connect the title sensor to the Pioneer600 according to the list below.



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Pins of Tilt Sensor	Pins of Pioneer600
DOUT	D3
GND	GND
VCC	3.3V

Enter the folder of /Pioneer600/Sensor/Tilt_Sensor, and run the following command under the terminal:

```
sudo ./General_Sensor
```

Expected result: The signal indicator will turn on, when the sensor is being vibrated or in a tilted state. And it will turn off, when the sensor is laid flat. By checking the indicator, you can get to know whether the module is in a condition of vibrating or tilting.

Press the keys **Ctrl+C** to end the program.

23. UV Sensor sample program

Please connect the UV sensor to the Pioneer600 according to the list below.

Pins of UV Sensor	Pins of Pioneer600
AOUT	A3
GND	GND
VCC	3.3V

Enter the folder of /Pioneer600/Sensor/UV_Sensor, and run the following command under the terminal:

```
sudo ./General_Sensor
```

Expected result: Place the sensor close to the sun light. The serial output changes along with the distance from the sensor to the light source.

Press the keys **Ctrl+C** to end the program.

24. Liquid Level Sensor sample program

Please connect the liquid level sensor to the Pioneer600 according to the list below.

Pins of Liquid Level Sensor	Pins of Pioneer600
AOUT	A3

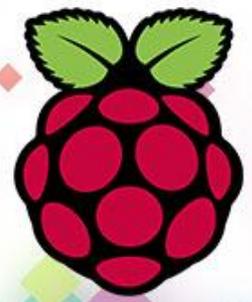


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GND	GND
VCC	3.3V

Enter the folder of /Pioneer600/Sensor/Liquid_Level_Sensor, and run the following command under the terminal:

```
sudo ./General_Sensor
```

Expected result: Immerse the sensor into the water deeply. The serial output changes along with the water depth.

Press the keys **Ctrl+C** to end the program.