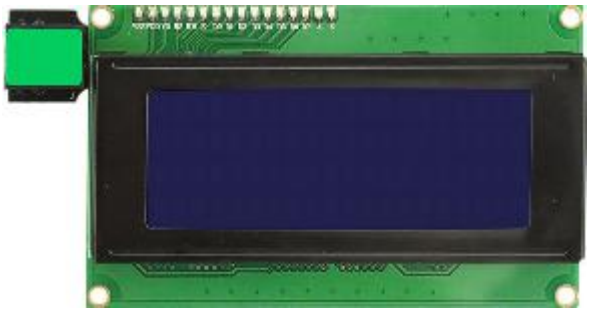
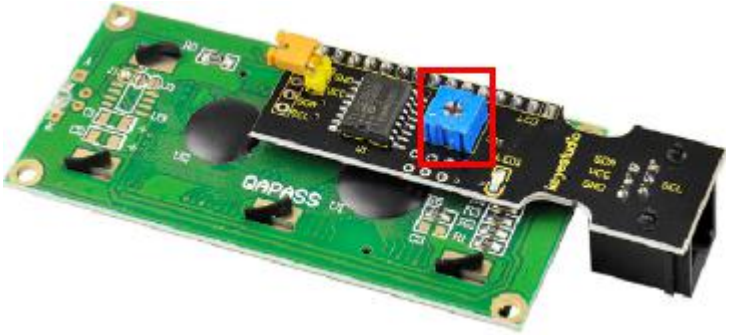
I2C 2004 LCD
(000x0000 Article Number)
(TS2160)

DESIGN THE WORLD

Product Details

This is a high-quality I2C LCD2004 display. It's in blue with white contents displayed.
It can display 4 rows with 20 characters for each like numbers, letters, symbols and ASCII code. Its screen integrates I2C interfaces, serial inputs and parallel outputs. Its chip is PCF8574T (PCF8574AT) and its I2C address is 0x27 (0x3F)





Note: rotate the blue potentiometer(screwdriver is not included)to adjust the brightness of the 1602 LCD.

Features and Benefits

- Compatible with RJ11 6P6C OKdo TelePort Control boards and expansion shields.
- High-quality 2004 LCD screen with I2C Adapter, Displays 4-lines X 20-characters.
- Backlight can be controlled using jumpers or programmatically.

Technical Specifications

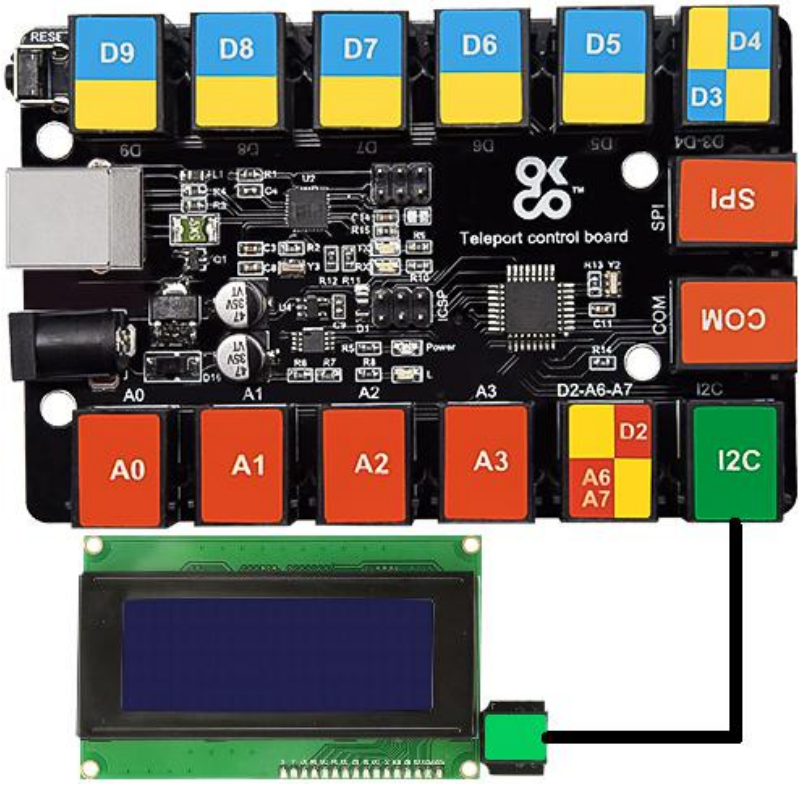
Sensor type	I2C
Working voltage	5V
I2C address	0x27
Back Light	Blue
Text Color	White
20 characters wide, 4 rows	
Dimensions	114mm*60mm*22mm
Weight	77.7g

Applications

- Environment detection screens
- Words and numbers display

This module is compatible with the TS2180-Raspberry Pi shield, the TS2179-Micro:bit shield and the TS2178-TelePort main board.

➢ Arduino Application



This module is compatible with the TS2178 TelePort control board.

Note: If you added **LiquidCrystal_I2C** and **wire** folders, just ignore the following instruction.
Unzip the library files, that is, copy the **LiquidCrystal_I2C** and **wire** folders into the libraries of Arduino IDE.
After pasting it, reboot the compiler
For instance: C:\Program Files\Arduino\libraries

```
//Compatible with the Arduino IDE 1.0
//Library version:1.1
#include <Wire.h>
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27,20,4);  // set the LCD address to 0x27 for a 16 chars and 2 line display
```

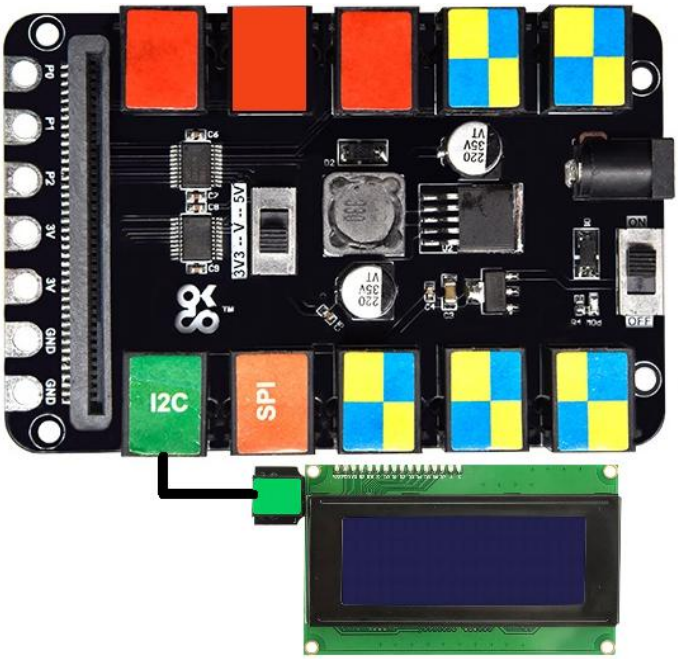
```
void setup()
{
  lcd.init();                    // initialize the lcd
  lcd.init();
  // Print a message to the LCD.
  lcd.backlight();
  lcd.setCursor(3,0);
  lcd.print("Hello,world!");
  lcd.setCursor(2,1);
  lcd.print("Hello,okdo!");
   lcd.setCursor(0,2);
  lcd.print("Arduino LCD i2c 2004");
   lcd.setCursor(2,3);
  lcd.print("Power By Ec-yuan!");
}
void loop()
{
}
```

Test Result

Wire up, upload code and power it up. I2C 2004 LCD will show Hello, world! At the first row, Hello, okdo! at the second row, Arduino LCD I2C 2004 at the third row and Power By Ec-yuan! At the fourth row.

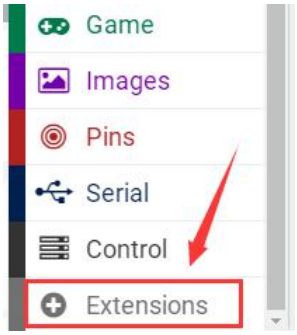
If you want to know more details about Arduino and the TelePort control board, you can refer to TS2178.

- **Micro:bit Application**

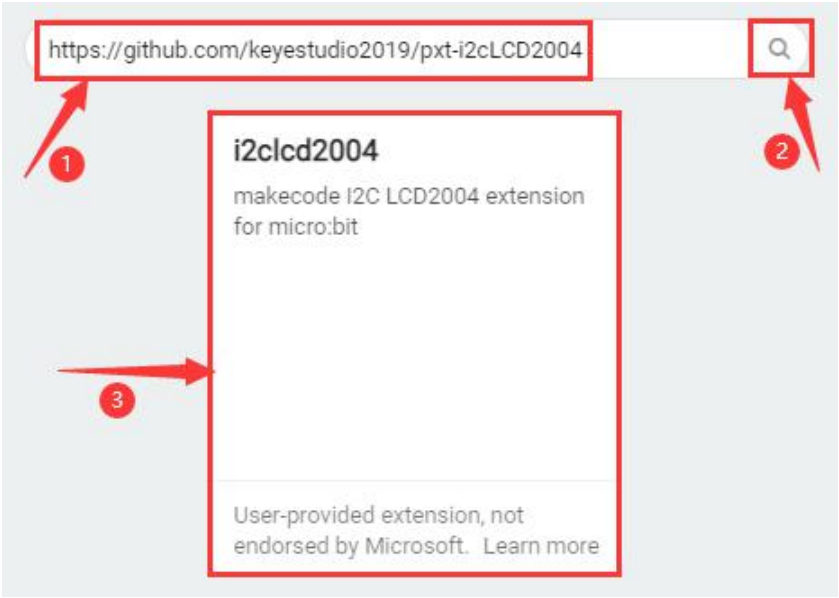


It is compatible with the Micro:bit board and the TS2179 Micro:bit expansion board.

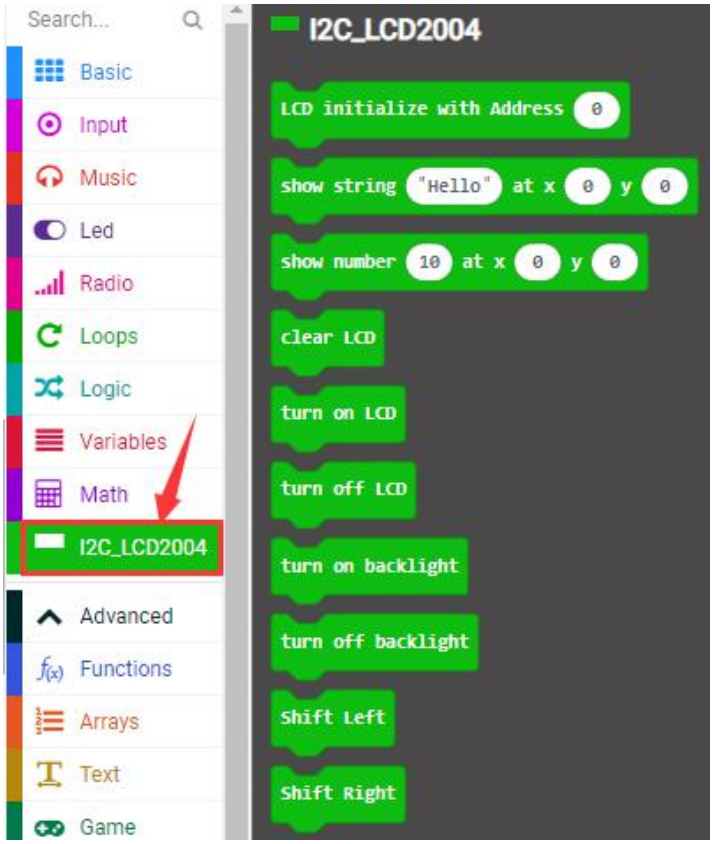
Add the library of the 2004 LCD display, as shown below;
Use the library file to set code, click“Extensions”



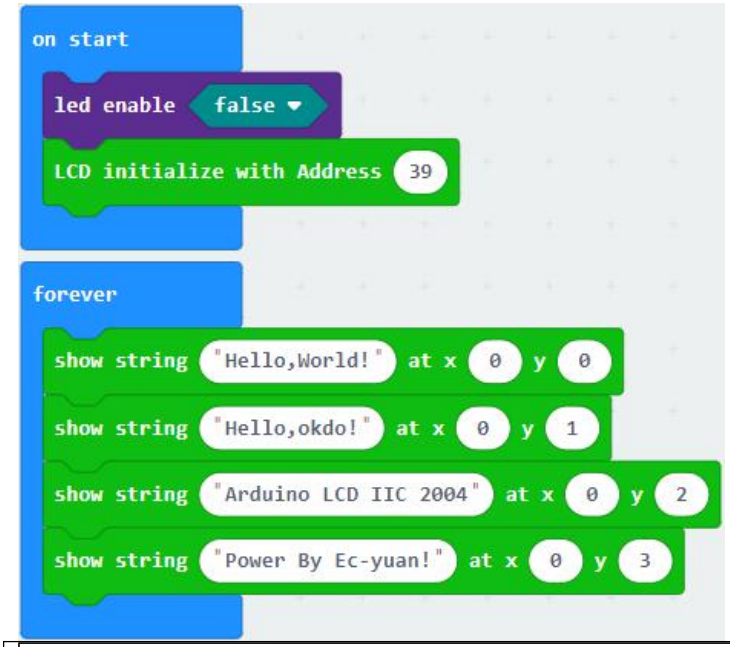
Enter **https://github.com/keyestudio2019/pxt-i2cLCD2004** to search, as shown below, click the library file and download it automatically.



After the library of the 2004 LCD display is installed, you can view the corresponding block in the blocks list.



Test Code



.....①Run the "on start" block to boot the program
.....②turn off the LED matrix
.....③Set the address of LCD2004 I2C to 39 (0x27)
.....④The program is run circularly under the command of "forever" block
.....⑤LCD shows Hello, world! at first row
.....⑥LCD shows Hello,okdo! at second row

.....⑦ LCD shows Arduino LCD i2c 2004 at third row

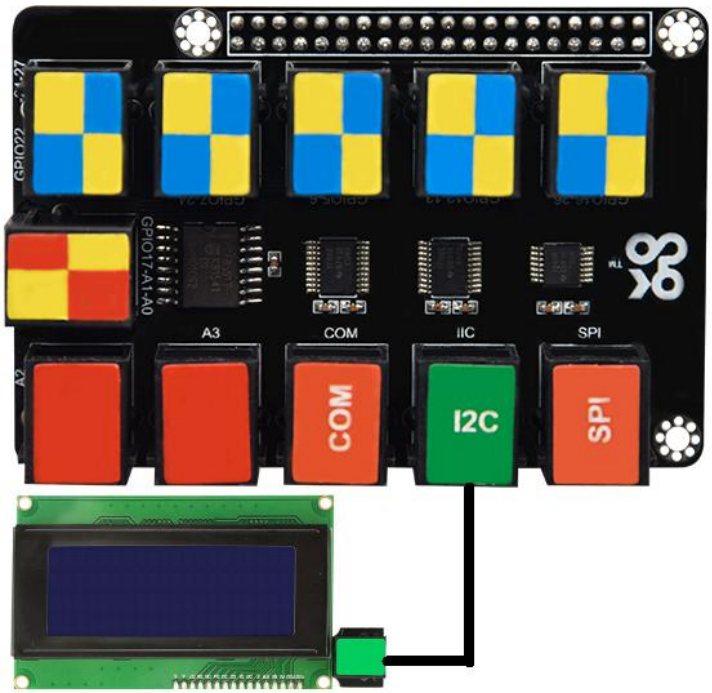
.....⑧LCD shows Power By Ec-yuan! at fourth row

Test Result

Wire up, insert the Micro:bit V2, upload test code, turn DIP switches to 5V and ON and power it up. After rotating the potentiometer at the back of the I2C 2004 LCD module, characters "Hello,world!","Hello,okdo!","Arduino LCD I2C 2004"and"Power By Ec-yuan!"will be displayed .

If you want to know more details about the Micro:bit board and Micro:bit shield, you can refer to TS2179.

➢ **Raspberry Pi Application**



This module is compatible with the Raspberry Pi board and the TS2180 Raspberry Pi shield.

PCF8591 A/D Conversion:

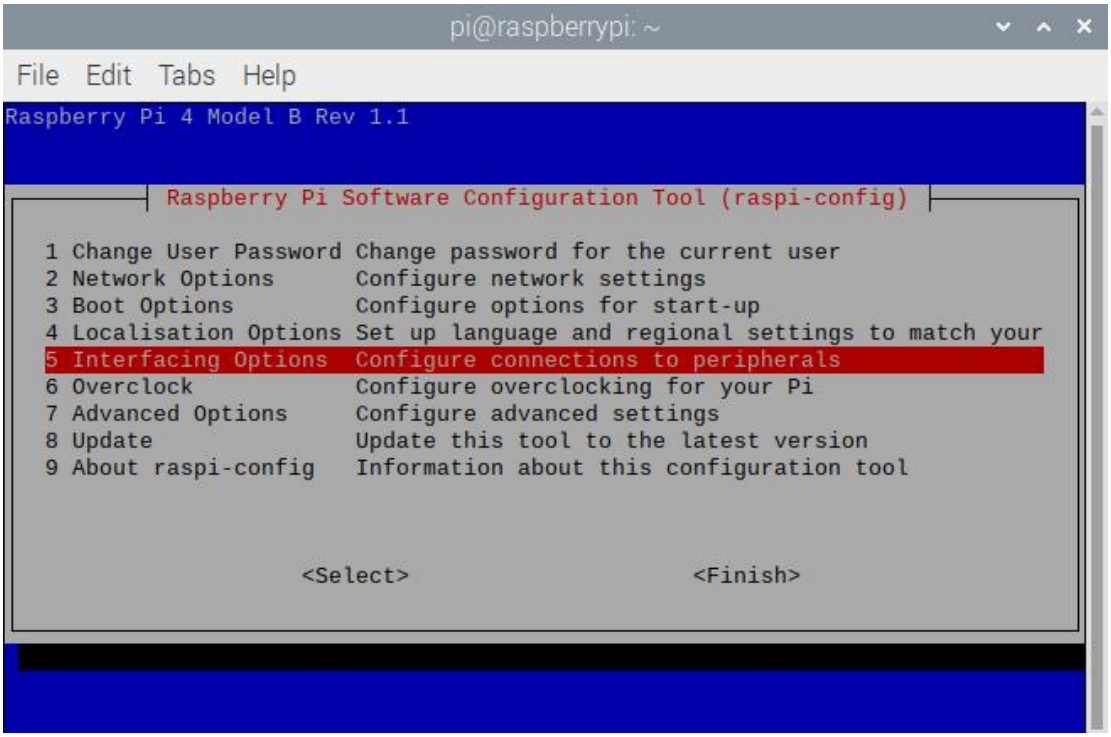
The Raspberry Pi itself does not have AD/DA function; therefore an expansion board with this function is required when connected to external analog sensors. And here we use a PCF8591 A/D converter with I2C communication.

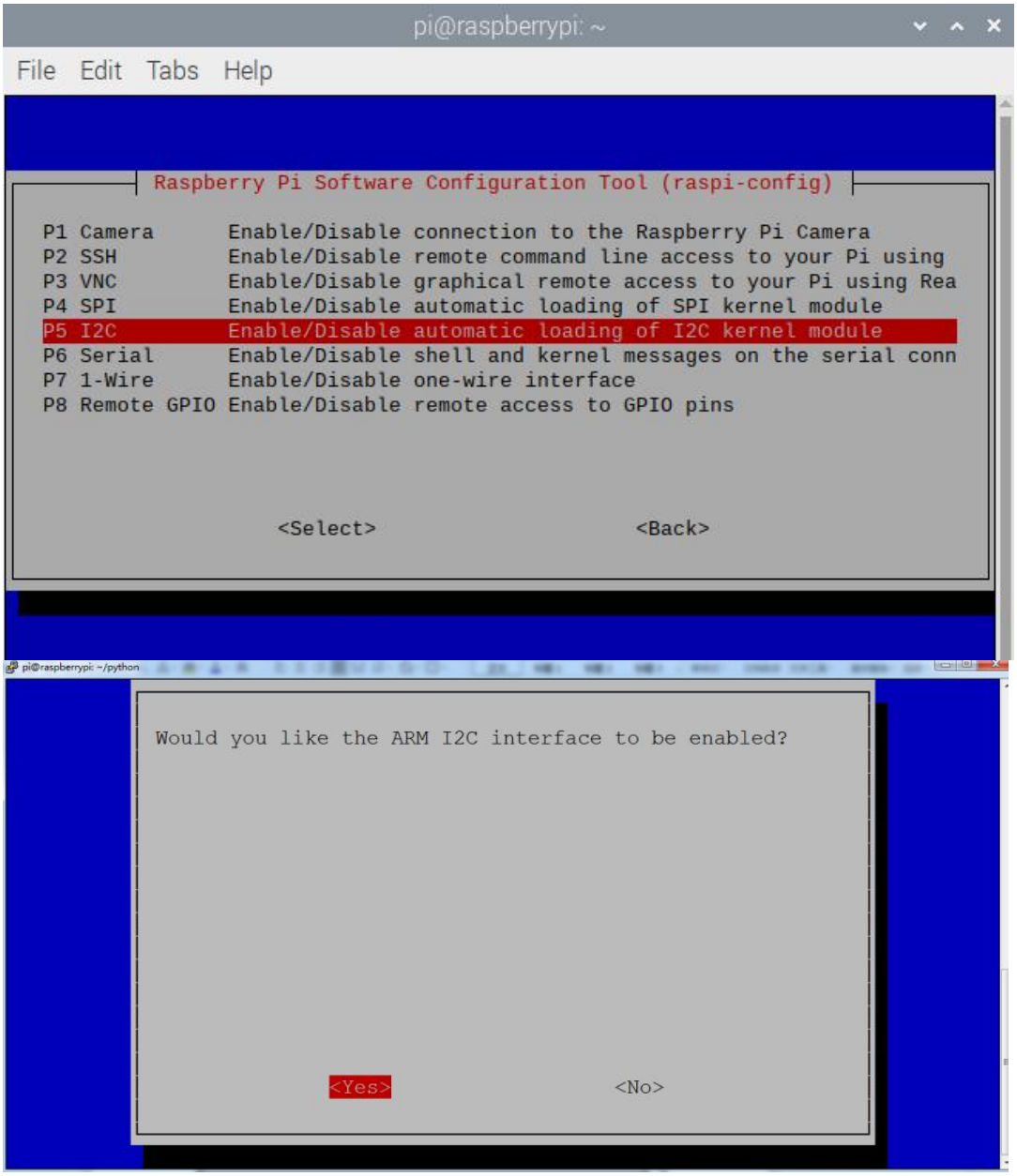
Enable the I2C communication function of the Raspberry Pi as follows:

a. Raspberry Pi does not enable the I2C function by default. Enter sudo raspi-config in the terminal to enter the Raspberry Pi configuration interface.

```
pi@raspberrypi:~/python $ sudo raspi-config
```

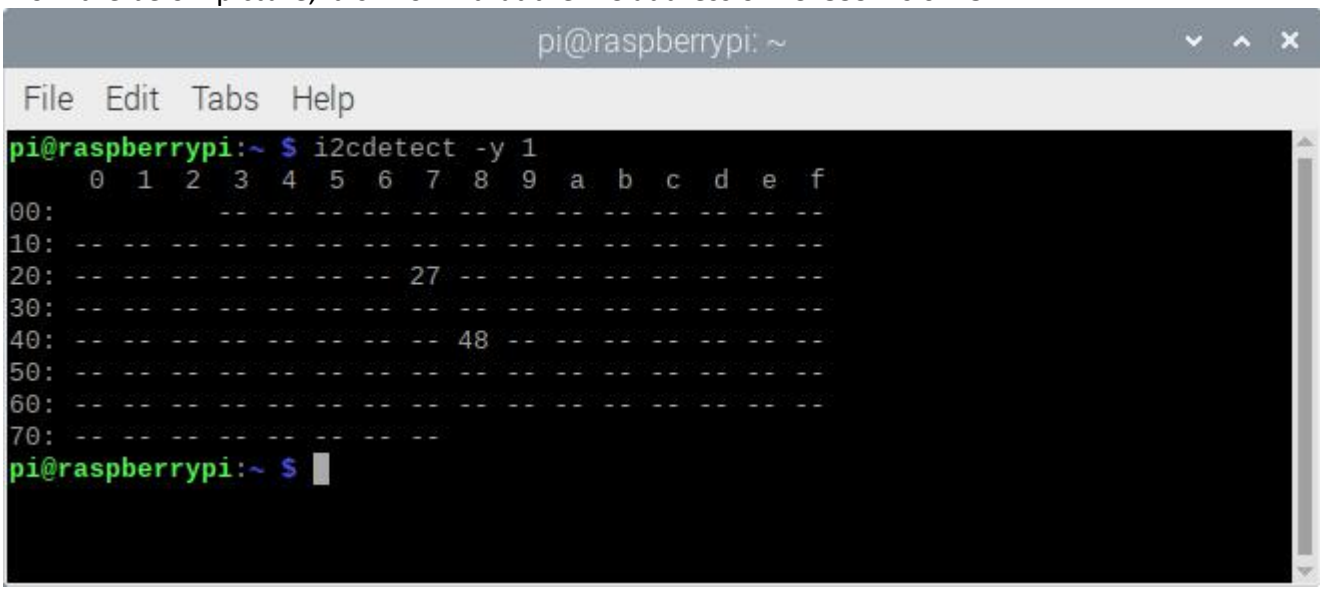
Follow the below instructions to enable the I2C function of Raspberry Pi:(press ←,↑,↓,→ then“Enter”)





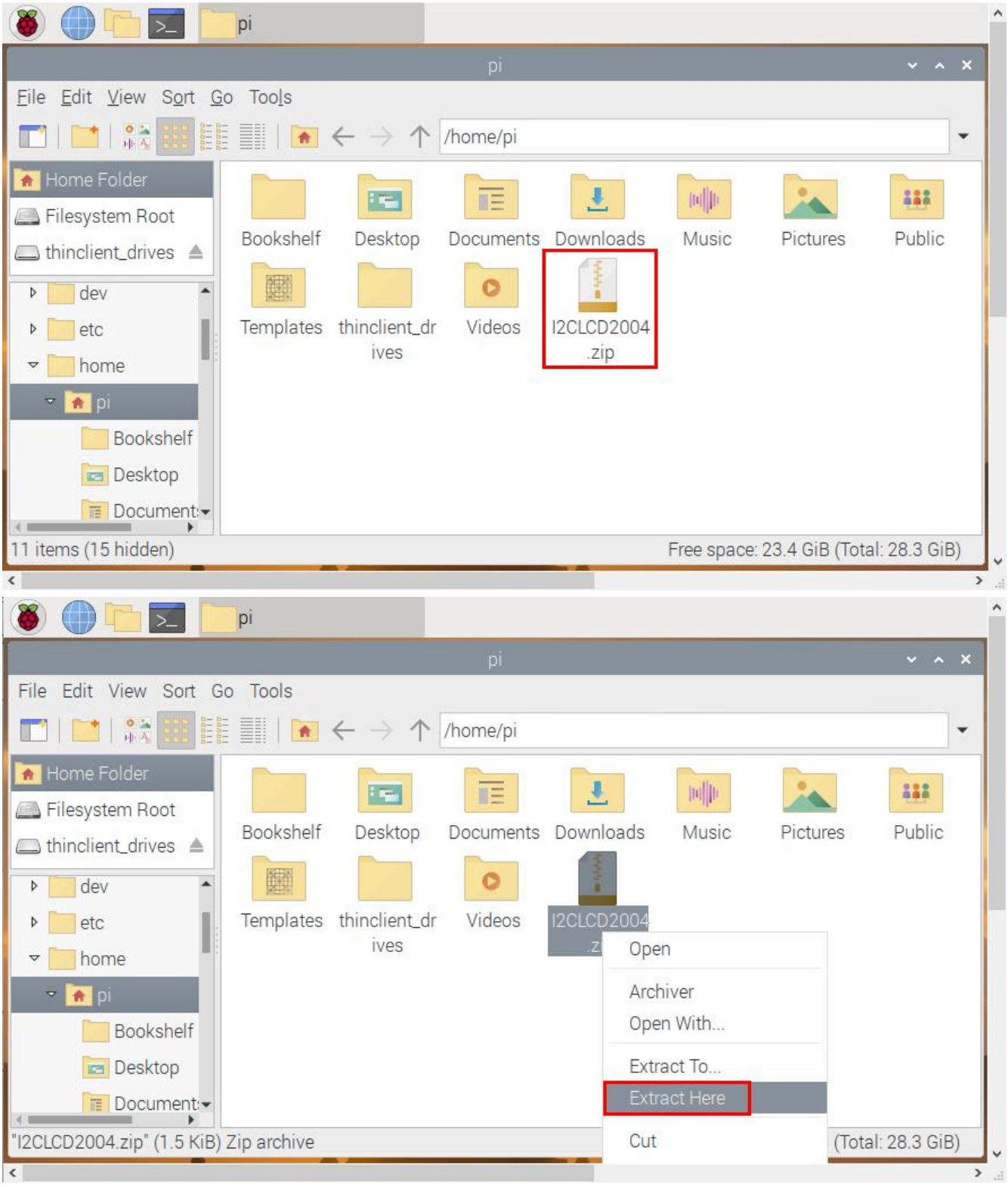
Check the address of the I2C module (PCF8591) connected to the Raspberry Pi, enter the command i2cdetect -y 1, and then press **Enter**.

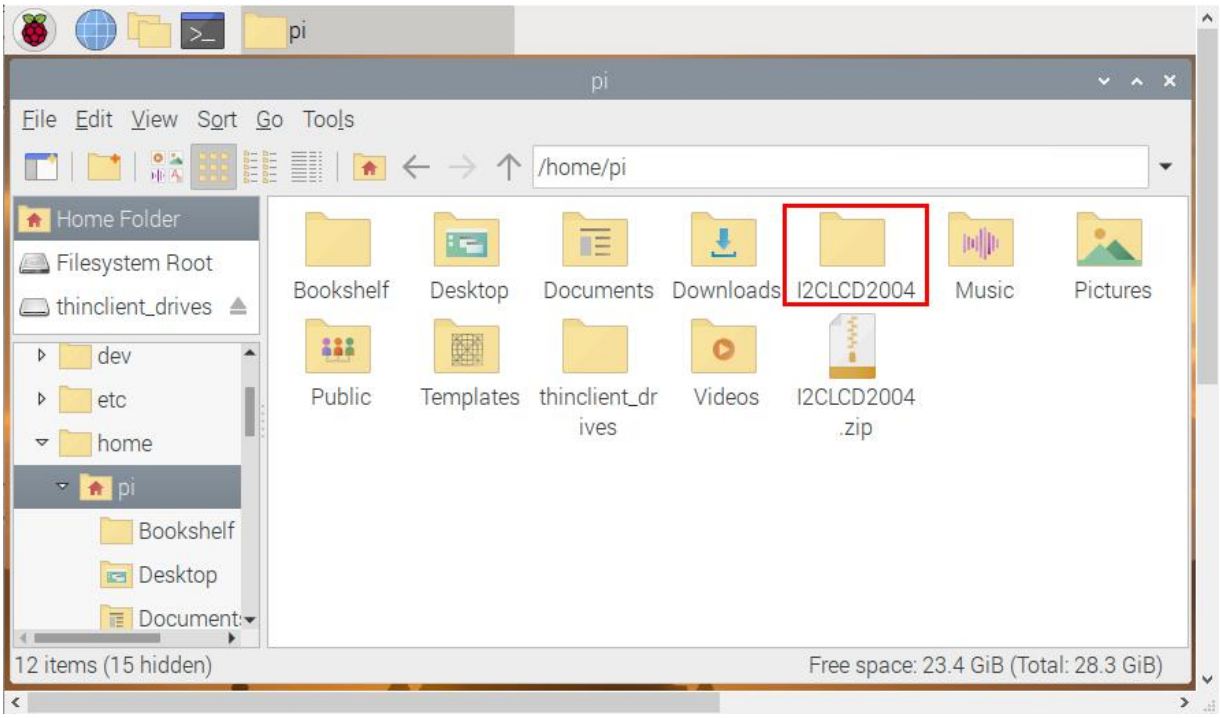
From the below picture, it is known that the I2C address of PCF8591 is 0x48 .



Copy the test code to Raspberry Pi system to run it

(1) Save the test code in the **pi** folder of Raspberry Pi system. Then place the I2CLCD2004.zip file we provide in the **pi** folder, right-click and click **Extract Here.** As shown below:





(2) Compile and run test code:

Input the following code and press"Enter"

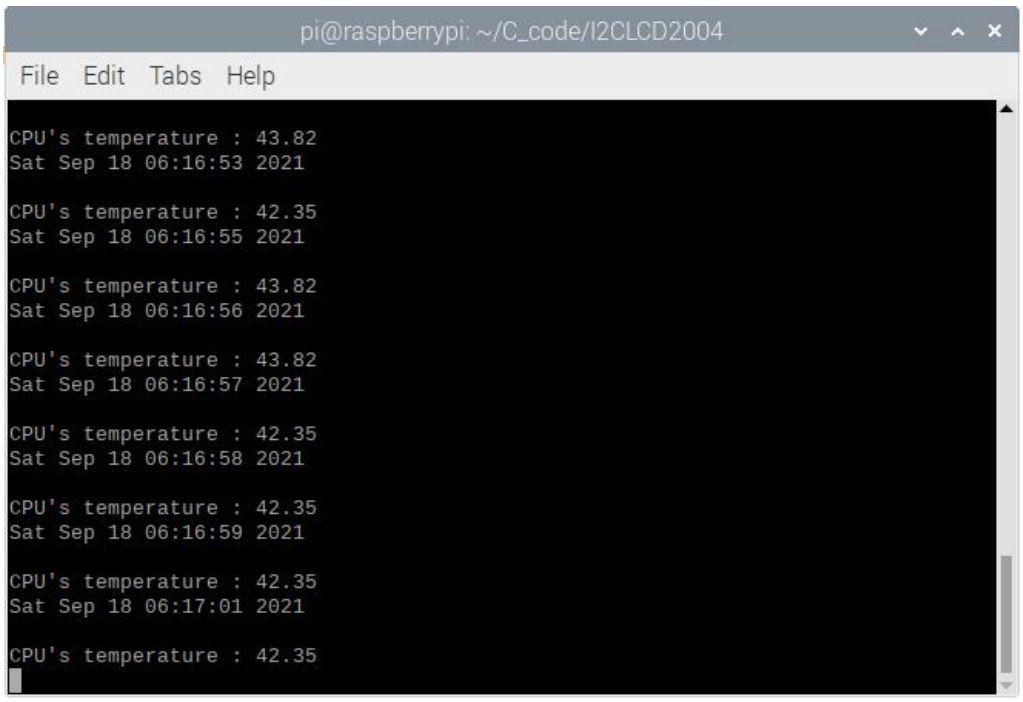
```
cd /home/pi/I2CLCD2004
gcc I2CLCD2004.c -o I2CLCD2004 -lwiringPiDev -lwiringPi
sudo ./I2CLCD2004
```

(3) Test Result:

Insert the shield into the Raspberry Pi board. After programming finishes, LCD2004 display will show the temperature of main board of Raspberry Pi and time.

Note: if you can't see the screen clearly, rotate the blue potentiometer at the back of LCD 2004 until you can see the displayed time and temperature.

Note: press Ctrl + C to exit code running



Test Code

File name: I2CLCD2004.c

```
#include <stdlib.h>
#include <stdio.h>
#include <wiringPi.h>
#include <wiringPiI2C.h>
#include <pcf8574.h>
#include <lcd.h>
#include <time.h>

int pcf8574_address = 0x27;       // PCF8574T:0x27, PCF8574AT:0x3F
#define BASE 64         // BASE any number above 64
//Define the output pins of the PCF8574, which are directly connected to the LCD1602 pin.
#define RS      BASE+0
#define RW      BASE+1
#define EN      BASE+2
#define LED     BASE+3
#define D4      BASE+4
#define D5      BASE+5
#define D6      BASE+6
#define D7      BASE+7

int lcdhd;// used to handle LCD
void printCPUTemperature(){// sub function used to print CPU temperature
   FILE *fp;
   char str_temp[15];
   float CPU_temp;
   // CPU temperature data is stored in this directory.
   fp=fopen("/sys/class/thermal/thermal_zone0/temp","r");
   fgets(str_temp,15,fp);      // read file temp
   CPU_temp = atof(str_temp)/1000.0;   // convert to Celsius degrees
   printf("CPU's temperature : %.2f \n",CPU_temp);
   lcdPosition(lcdhd,0,0);     // set the LCD cursor position to (0,0)
   lcdPrintf(lcdhd,"CPU:%.2fC",CPU_temp);// Display CPU temperature on LCD
   fclose(fp);
}
void printDataTime(){//used to print system time
   time_t rawtime;
   struct tm *timeinfo;
   time(&rawtime);// get system time
   timeinfo = localtime(&rawtime);//convert to local time
   printf("%s \n",asctime(timeinfo));
   lcdPosition(lcdhd,0,1);// set the LCD cursor position to (0,1)
```

```
    lcdPrintf(lcdhd,"Time:%02d:%02d:%02d",timeinfo->tm_hour,timeinfo->tm_min,timeinfo->tm_sec); //Display sys
}
int detectI2C(int addr){
    int _fd = wiringPiI2CSetup (addr);
    if (_fd < 0){
        printf("Error address : 0x%x \n",addr);
        return 0 ;
    }
    else{
        if(wiringPiI2CWrite(_fd,0) < 0){
            printf("Not found device in address 0x%x \n",addr);
            return 0;
        }
        else{
            printf("Found device in address 0x%x \n",addr);
            return 1 ;
        }
    }
}
int main(void){
    int i;

    printf("Program is starting ...\n");

    wiringPiSetup();
    if(detectI2C(0x27)){
        pcf8574_address = 0x27;
    }else if(detectI2C(0x3F)){
        pcf8574_address = 0x3F;
    }else{
        printf("No correct I2C address found, \n"
        "Please use command 'i2cdetect -y 1' to check the I2C address! \n"
        "Program Exit. \n");
        return -1;
    }
    pcf8574Setup(BASE,pcf8574_address);//initialize PCF8574
    for(i=0;i<8;i++){
        pinMode(BASE+i,OUTPUT);     //set PCF8574 port to output mode
    }
    digitalWrite(LED,HIGH);     //turn on LCD backlight
    digitalWrite(RW,LOW);       //allow writing to LCD
            lcdhd = lcdInit(2,16,4,RS,EN,D4,D5,D6,D7,0,0,0,0);// initialize LCD and return “handle” used to handle LCD
    if(lcdhd == -1){
```

```
        printf("lcdInit failed !");
        return 1;
    }
    while(1){
        printCPUTemperature();//print CPU temperature
        printDataTime();        // print system time
        delay(1000);
    }
    return 0;
}
```

If you want to know how to utilize Raspberry Pi and the Raspberry Pi shield, you can refer to TS2180.

END