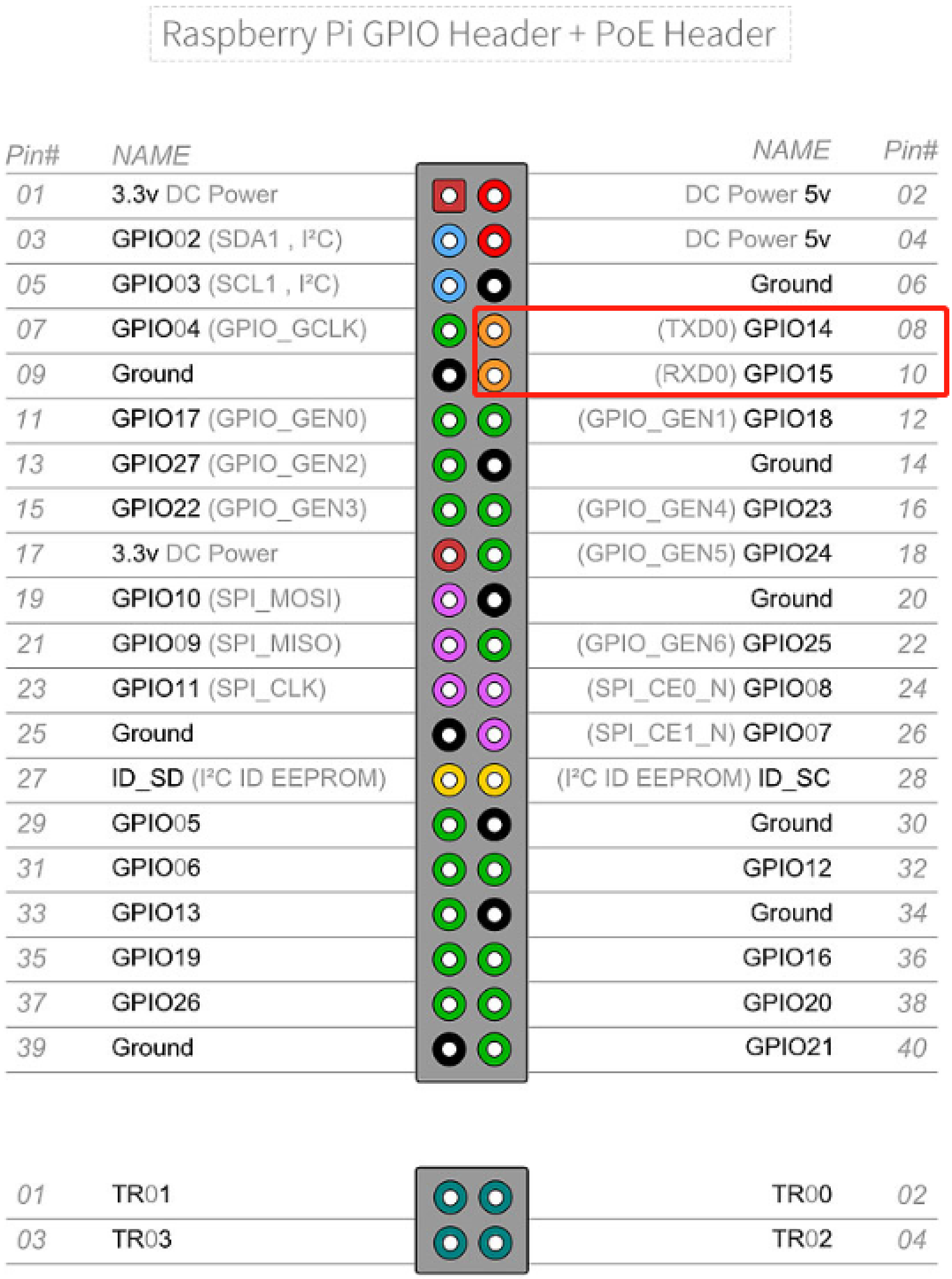
Serial communication

From the relevant information of Raspberry Pi, we can see that the physical pins 8 and 10 of Raspberry Pi can be mapped to two serial ports, one of which is the hardware serial port (/dev/ttyAMA0) and the other is the mini serial port (/dev/ttyS0). The hardware serial port has a separate baud rate clock source, which has good performance and strong stability; The mini serial port has simple functions and poor stability. The baud rate is provided by the CPU kernel clock and is affected by the kernel clock.

Raspberry Pi (3rd/4th generation) onboard Bluetooth module, the default hardware serial port is assigned to the Bluetooth module, while the poor performance mini serial port is assigned to the GPIO serial ports TXD0 and RXD0.

引脚定义



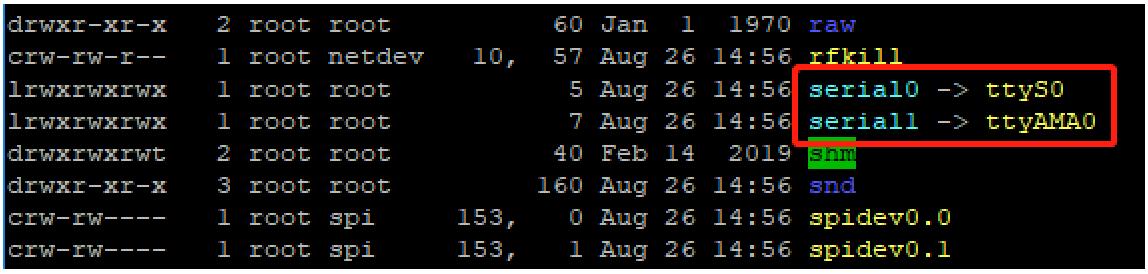
Raspberry Pi GPIO Header + PoE Header

Pin#	NAME	NAME	Pin#
01	3.3v DC Power	DC Power 5v	02
03	GPIO02 (SDA1 , I²C)	DC Power 5v	04
05	GPIO03 (SCL1 , I²C)	Ground	06
07	GPIO04 (GPIO_GCLK)	(TXD0) GPIO14	08
09	Ground	(RXD0) GPIO15	10
11	GPIO17 (GPIO_GEN0)	(GPIO_GEN1) GPIO18	12
13	GPIO27 (GPIO_GEN2)	Ground	14
15	GPIO22 (GPIO_GEN3)	(GPIO_GEN4) GPIO23	16
17	3.3v DC Power	(GPIO_GEN5) GPIO24	18
19	GPIO10 (SPI_MOSI)	Ground	20
21	GPIO09 (SPI_MISO)	(GPIO_GEN6) GPIO25	22
23	GPIO11 (SPI_CLK)	(SPI_CE0_N) GPIO08	24
25	Ground	(SPI_CE1_N) GPIO07	26
27	ID_SD (I²C ID EEPROM)	(I²C ID EEPROM) ID_SC	28
29	GPIO05	Ground	30
31	GPIO06	GPIO12	32
33	GPIO13	Ground	34
35	GPIO19	GPIO16	36
37	GPIO26	GPIO20	38
39	Ground	GPIO21	40

01	TR01	TR00	02
03	TR03	TR02	04

Run the following command to view the default serial port allocation method:

```
ls /dev -al
```



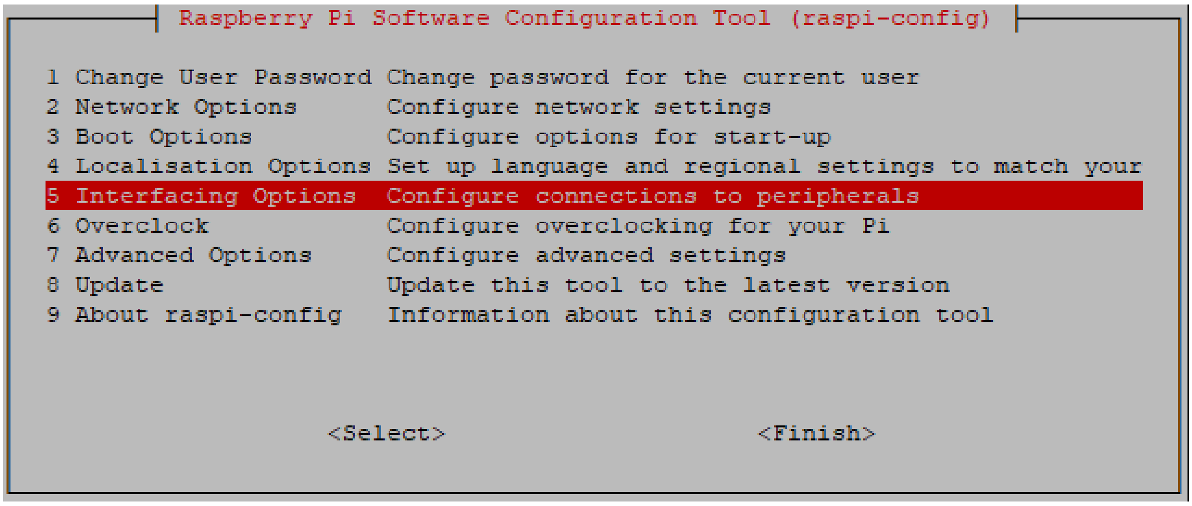
```
drwxr-xr-x    2 root root          60 Jan  1  1970 raw
crw-rw-r--    1 root netdev   10,  57 Aug 26 14:56 rfkill
lrwxrwxrwx    1 root root           5 Aug 26 14:56 serial0 -> ttyS0
lrwxrwxrwx    1 root root           7 Aug 26 14:56 serial1 -> ttyAMA0
drwxrwxrwt    2 root root          40 Feb 14  2019 shm
drwxr-xr-x    3 root root         160 Aug 26 14:56 snd
crw-rw----    1 root spi     153,   0 Aug 26 14:56 spidev0.0
crw-rw----    1 root spi     153,   1 Aug 26 14:56 spidev0.1
```

Due to the hardware serial port being assigned to onboard Bluetooth, we need to release it and set the hardware serial port to be assigned to GPIO serial port.

1.After SSH logs into the Raspberry Pi system

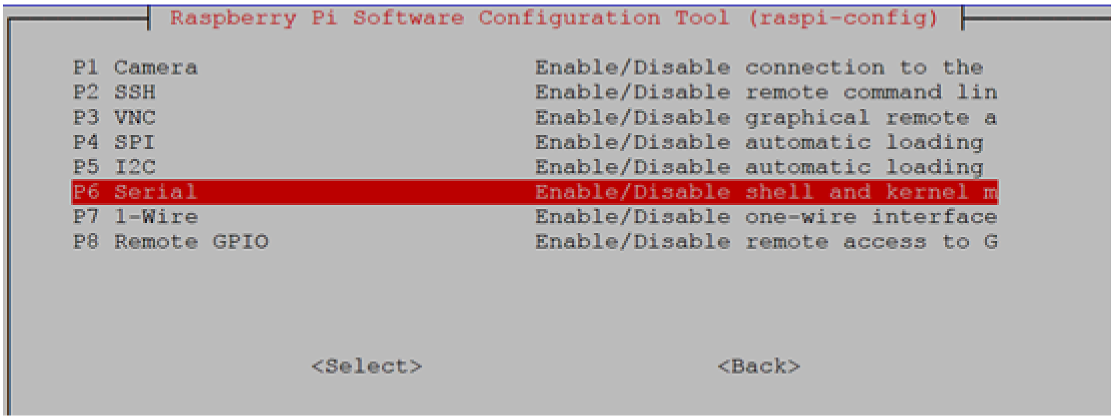
```
sudo raspi-config
```

Enter the Raspberry Pi system configuration interface and select Interfacing Options:



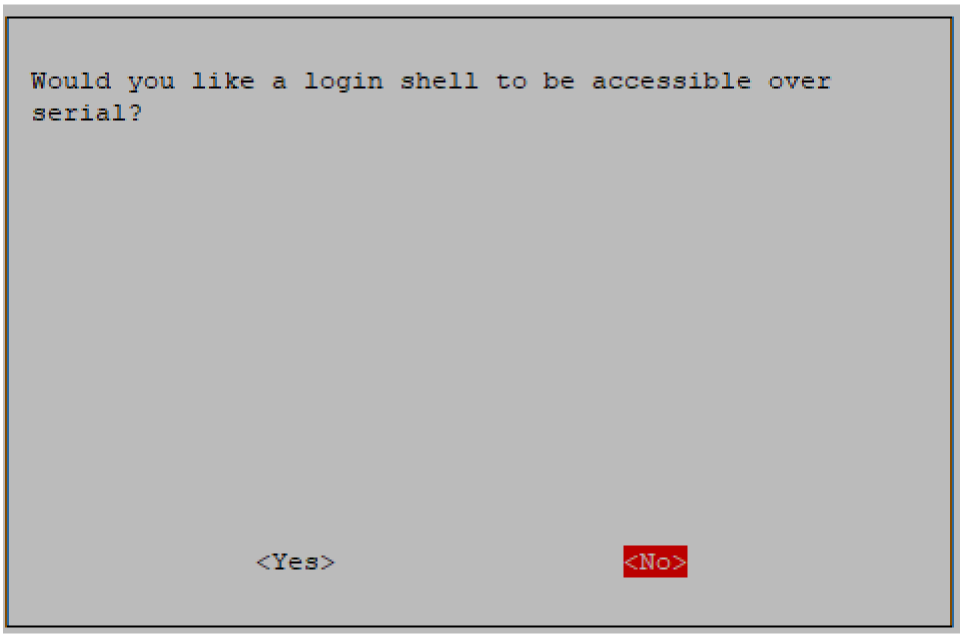
```
Raspberry Pi Software Configuration Tool (raspi-config)

 1 Change User Password Change password for the current user
 2 Network Options      Configure network settings
 3 Boot Options         Configure options for start-up
 4 Localisation Options Set up language and regional settings to match your
 5 Interfacing Options  Configure connections to peripherals
 6 Overclock            Configure overclocking for your Pi
 7 Advanced Options     Configure advanced settings
 8 Update               Update this tool to the latest version
 9 About raspi-config   Information about this configuration tool

                 <Select>                     <Finish>
```

Choose P6 Serial

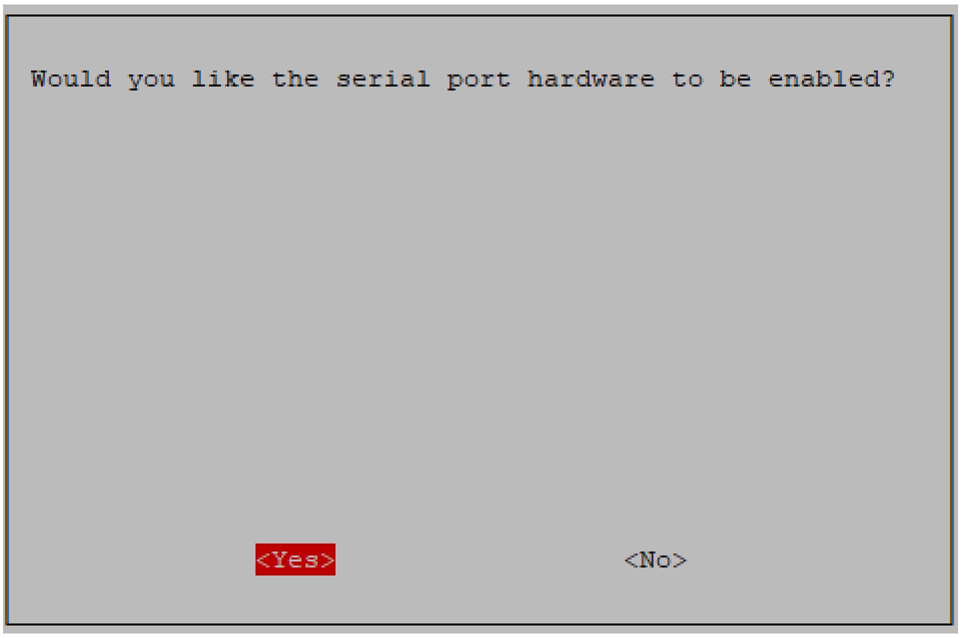


```
Raspberry Pi Software Configuration Tool (raspi-config)

 P1 Camera                           Enable/Disable connection to the
 P2 SSH                              Enable/Disable remote command lin
 P3 VNC                              Enable/Disable graphical remote a
 P4 SPI                              Enable/Disable automatic loading
 P5 I2C                              Enable/Disable automatic loading
 P6 Serial                           Enable/Disable shell and kernel m
 P7 1-Wire                           Enable/Disable one-wire interface
 P8 Remote GPIO                      Enable/Disable remote access to G

               <Select>                     <Back>
```

Select to turn off the serial port login function and turn on the hardware serial port debugging function.

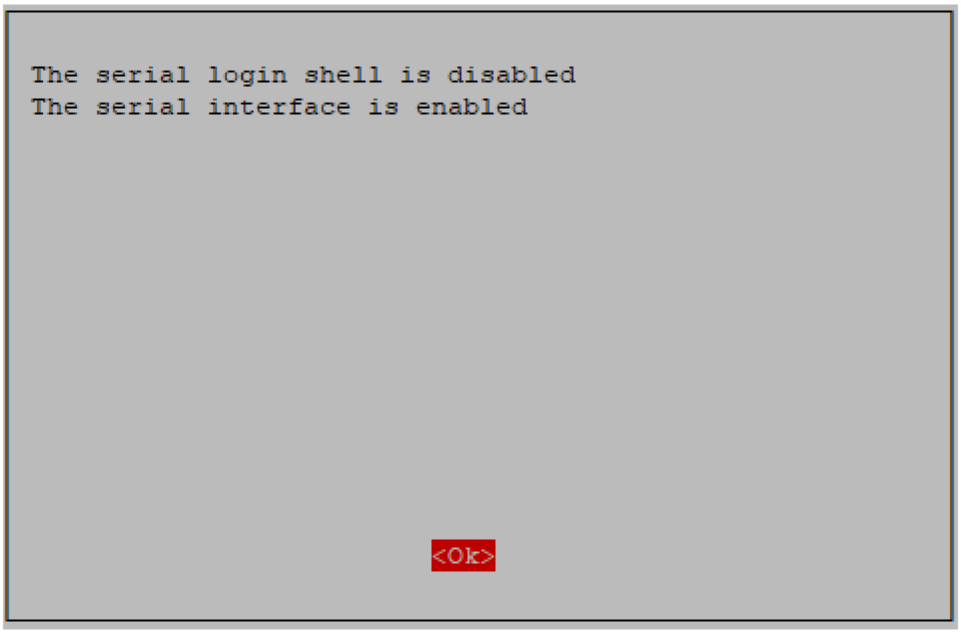


```
Would you like a login shell to be accessible over
serial?
```



```
Would you like the serial port hardware to be enabled?
```

After completion, prompt the following interface and press OK



```
The serial login shell is disabled
The serial interface is enabled
```

Exit raspi config settings and follow the prompts to restart Raspberry Pi.

2.Set the hardware serial port to GPIO serial port

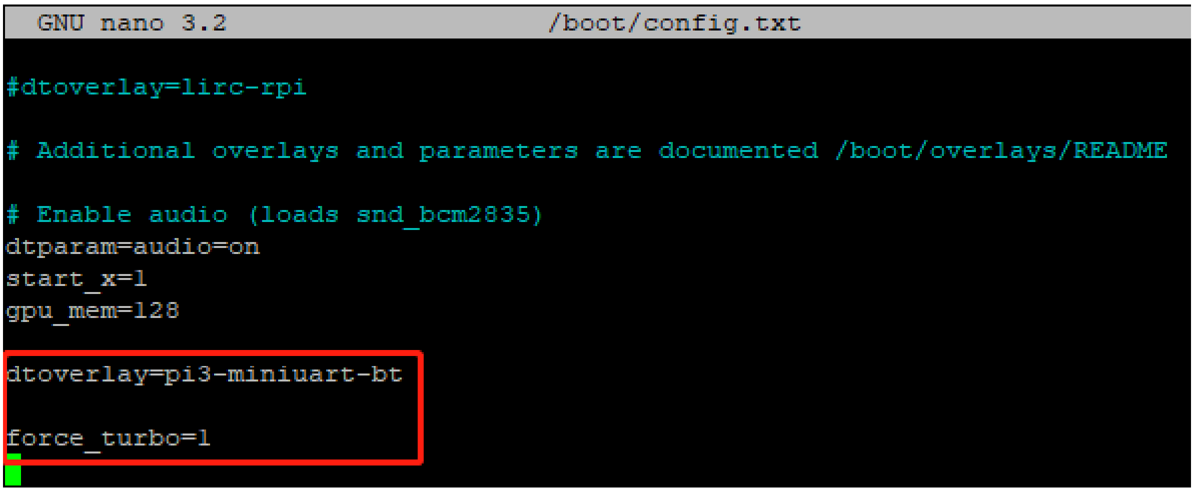
Edit the config.txt file in the/boot directory

```
sudo nano /boot/config.txt
```

Add the following two lines to the end:

```
dtoverlay=pi3-miniuart-bt

force_turbo=1
```

The modified image is shown below.



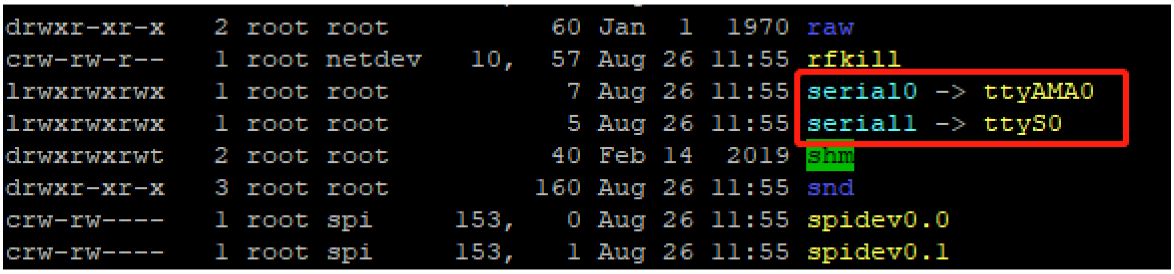
```
  GNU nano 3.2                              /boot/config.txt

#dtoverlay=lirc-rpi

# Additional overlays and parameters are documented /boot/overlays/README

# Enable audio (loads snd_bcm2835)
dtparam=audio=on
start_x=1
gpu_mem=128

dtoverlay=pi3-miniuart-bt

force_turbo=1
```

Save: Ctrl+O， Exit: Ctrl+X。

Reboot Raspberry Pi.

```
sudo reboot
```

After restarting the Raspberry Pi, enter ls/dev - al again, and you can see that the two serial ports have switched positions with each other:



```
drwxr-xr-x   2 root root          60 Jan  1  1970 raw
crw-rw-r--   1 root netdev   10,  57 Aug 26 11:55 rfkill
lrwxrwxrwx   1 root root           7 Aug 26 11:55 serial0 -> ttyAMA0
lrwxrwxrwx   1 root root           5 Aug 26 11:55 serial1 -> ttyS0
drwxrwxrwt   2 root root          40 Feb 14  2019 shm
drwxr-xr-x   3 root root         160 Aug 26 11:55 snd
crw-rw----   1 root spi     153,   0 Aug 26 11:55 spidev0.0
crw-rw----   1 root spi     153,   1 Aug 26 11:55 spidev0.1
```

3. Minicom serial port assistant testing

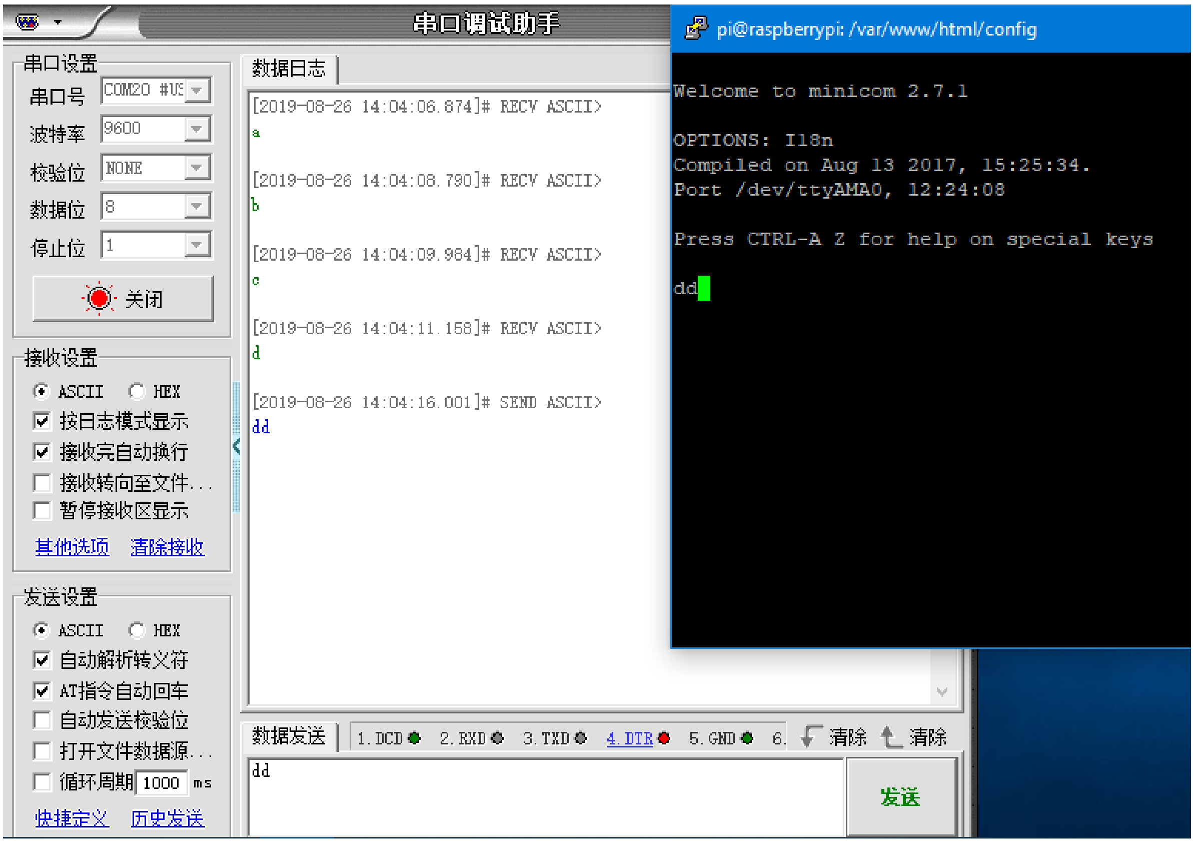
Installing Minicom

```
sudo apt-get install minicom
```

Start Minicom after installation is complete

```
minicom -D /dev/ttyAMA0 -b 9600
```

Among them, - D represents selecting serial port/dev/ttyAMA0, and - b sets the baud rate to 9600. This parameter can be set without any need, with a default of 115200.



串口调试助手

串口设置
串口号 COM20 #US
波特率 9600
校验位 NONE
数据位 8
停止位 1

接收设置
● ASCII ○ HEX
☑ 按日志模式显示
☑ 接收完自动换行
□ 接收转向至文件...
□ 暂停接收区显示

发送设置
● ASCII ○ HEX
☑ 自动解析转义符
☑ AT指令自动回车
□ 自动发送校验位
□ 打开文件数据源...
□ 循环周期 1000 ms

数据日志

```
[2019-08-26 14:04:06.874]# RECV ASCII>
a

[2019-08-26 14:04:08.790]# RECV ASCII>
b

[2019-08-26 14:04:09.984]# RECV ASCII>
c

[2019-08-26 14:04:11.158]# RECV ASCII>
d

[2019-08-26 14:04:16.001]# SEND ASCII>
dd
```

数据发送

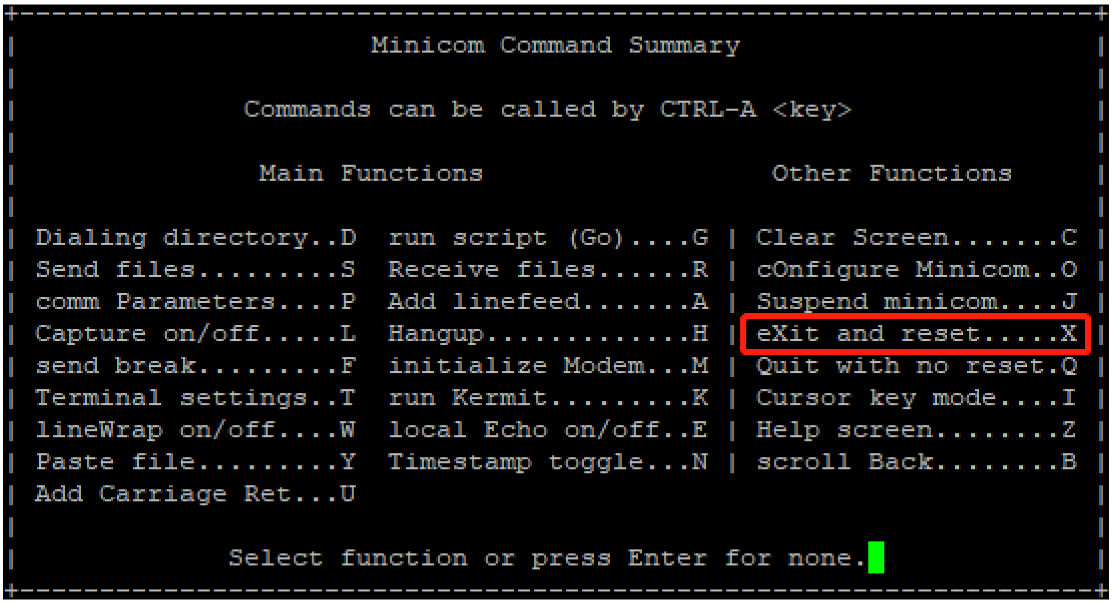
```
dd
```

pi@raspberrypi: /var/www/html/config

```
Welcome to minicom 2.7.1

OPTIONS: I18n
Compiled on Aug 13 2017, 15:25:34.
Port /dev/ttyAMA0, 12:24:08

Press CTRL-A Z for help on special keys

dd
```

Open the serial port to transfer data through the USB to TTL module.

The operation of exiting Minicom is quite complicated. According to the prompt, you need to first press Ctrl+A, then press Z to pop up the following menu.



```
+-------------------------------------------------------------------+
|                    Minicom Command Summary                        |
|                                                                   |
|              Commands can be called by CTRL-A <key>               |
|                                                                   |
|               Main Functions                  Other Functions    |
|                                                                   |
| Dialing directory..D  run script (Go)....G | Clear Screen.......C |
| Send files.........S  Receive files......R | cOnfigure Minicom..O |
| comm Parameters....P  Add linefeed.......A | Suspend minicom....J |
| Capture on/off.....L  Hangup.............H | eXit and reset.....X |
| send break.........F  initialize Modem...M | Quit with no reset.Q |
| Terminal settings..T  run Kermit.........K | Cursor key mode....I |
| lineWrap on/off....W  local Echo on/off..E | Help screen........Z |
| Paste file.........Y  Timestamp toggle...N | scroll Back........B |
| Add Carriage Ret...U                                              |
|                                                                   |
|             Select function or press Enter for none.              |
+-------------------------------------------------------------------+
```

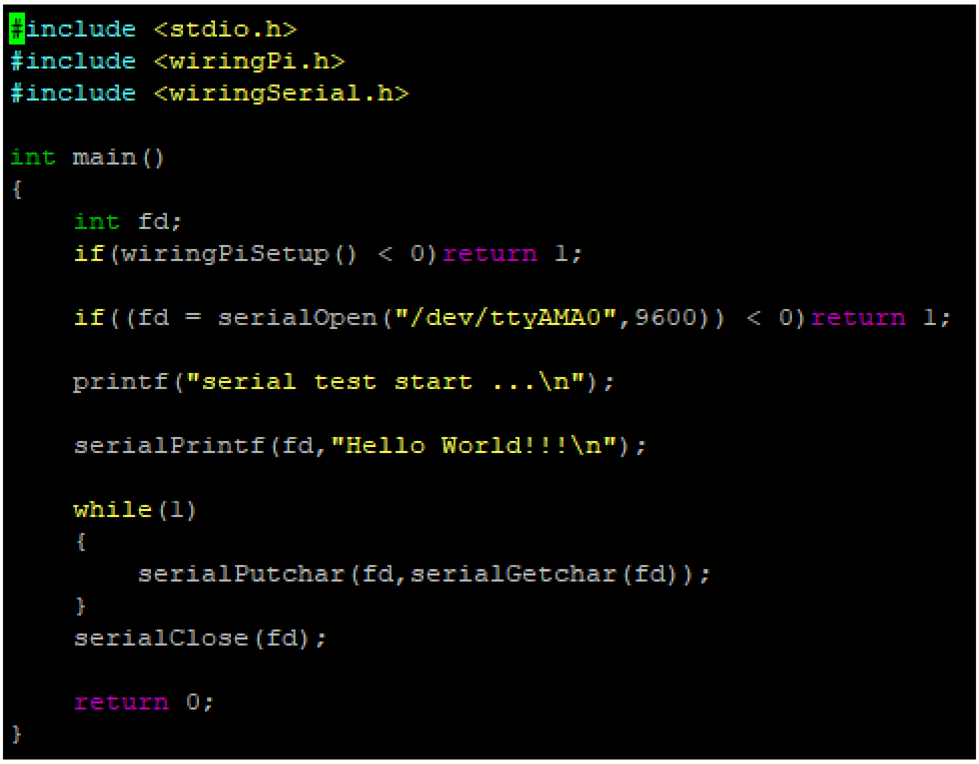
Next, press X, and finally select YES and press Enter to confirm.

4.C language test code

Print hello world

The code is as follows:

```
#include <stdio.h>
#include <wiringPi.h>
#include <wiringSerial.h>

int main()
{
  int fd;
  if(wiringPiSetup() < 0)return 1;
  if((fd = serialOpen("/dev/ttyAMA0",9600)) < 0)return 1;
  printf("serial test start ...n");
  serialPrintf(fd,"Hello World!!!n");
  while(1)
  {
    serialPutchar(fd,serialGetchar(fd));
  }
  serialClose(fd);
  return 0;
}
```



```
#include <stdio.h>
#include <wiringPi.h>
#include <wiringSerial.h>

int main()
{
    int fd;
    if(wiringPiSetup() < 0)return 1;

    if((fd = serialOpen("/dev/ttyAMA0",9600)) < 0)return 1;

    printf("serial test start ...\n");

    serialPrintf(fd,"Hello World!!!\n");

    while(1)
    {
        serialPutchar(fd,serialGetchar(fd));
    }
    serialClose(fd);

    return 0;
}
```

Create a new testCom. c file and copy the above code into it

```
nano testCom.c
```

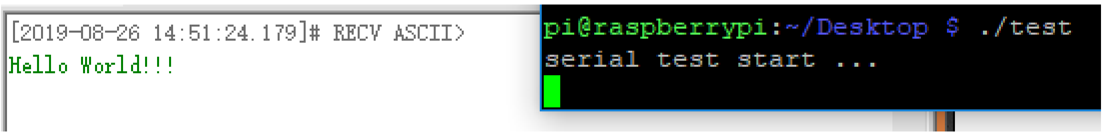
Save: Ctrl+O, exit Ctrl+X

Use the gcc compiler to compile programs:

```
gcc testCom.c -o test -lwiringPi
```

Run a program

```
./test
```



```
[2019-08-26 14:51:24.179]# RECV ASCII>
Hello World!!!
```

```
pi@raspberrypi:~/Desktop $ ./test
serial test start ...
```

You can also send data to Raspberry Pi through the serial port, and Raspberry Pi will directly return it to the serial port for display.

Note: If there is a display of garbled code, please check the baud rate and set it to 9600, which corresponds to the above code.