Capacitive Fingerprint Reader User Manual

OVERVIEW

The Capacitive Fingerprint Reader is a standard fingerprinting module designed for secondary development, allows fast and stable fingerprint verification.

Based on a high-speed digital processor STM32F105R8,combined with high-security commercial fingerprinting algorithm, and advanced semiconductor sensor, the Capacitive Fingerprint Reader becomes a simple but smart integration module, provides functionalities like fingerprint enrolling, image processing, feature finding, template generating and storing, fingerprint matching and searching, etc.

FEATURES

- Easy to use with some simple commands, you don't have to know any fingerprint technology, or the module inter structure/calculation
- Commercial fingerprinting algorithm, stable performance and fast verification.
- Sensitive detection, just touch the collecting window lightly, without pressing.
- Allows to freely input/output fingerprint images, fingerprint feature file and other fingerprinting actions
- Dual communication, UART or USB
- Processor will enter sleep and wake up when detecting, achieves low power consumption
- Comes with rich related resources (software on PC, development SDK, tools, and examples for Raspberry Pi/Arduino/STM32)

APPLICATIONS

Fingerprint lock, fingerprint safe deposit box, access control system, clock in and out and so on.

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HOW TO USE

SPECIFICATIONS

Parameter	Value
Processor (CPU)	STM32F105
Sensor	Semiconductor (capacitive)
Module dimension (mm)	45x30
Sensor dimension (mm)	33.4x20.4
Image	DPI508
Image resolution	192x256
Sensing area (mm)	9.6x12.8
Fingerprint capacity	1000 (expandable)
Security level	0-9 low to high security, 5 by default
Matching time	1s
False acceptance rate	0.0001%
False rejection rate	0.01%
Dynamic current	<40mA
Operating voltage	3.3V-5V
Communication	UART or USB
Anti-electrostatic	aerial discharge: ±15KV
	contact discharge: ±8KV

Note: Replace the memory chip with W25Q32, the capacity could be expanded to 4000

INTERFACE

VCC ·················· 3.3V or 5V

GND ·················· Ground

TXD (serial output of fingerprint module) ·················· RXD (serial input of PC or MCU)

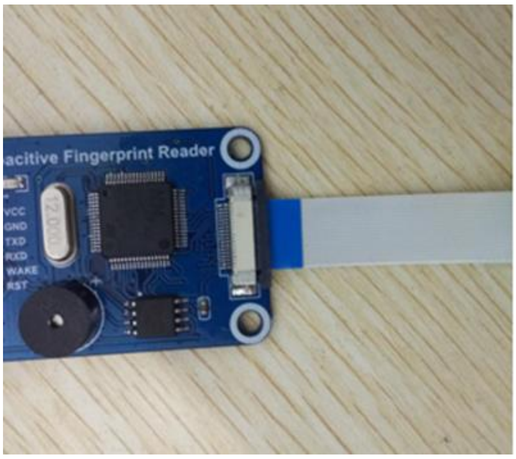
RXD (serial input of fingerprint module) ·················· TXD (serial output of PC or MCU)

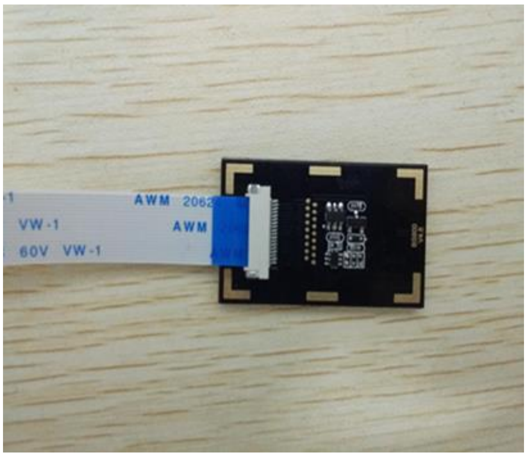
WAKE (collector wake up, connection is not a must) ·················· IO pin

RST (reset, connection is not a must) ·················· IO pin

HARDWARE CONNECTION

Connecting the sensor and control board with incongruous cable as below:


acitive Fingerprint Reader
VCC
GND
TXD
RXD
WAKE
RST
12.000


AWM 2062
VW-1
AWM
60V VW-1

After receiving the Fingerprint Reader, users can test the module firstly by test software. Users could use the protocols below for further developing after mastering enough information of this fingerprint reader.

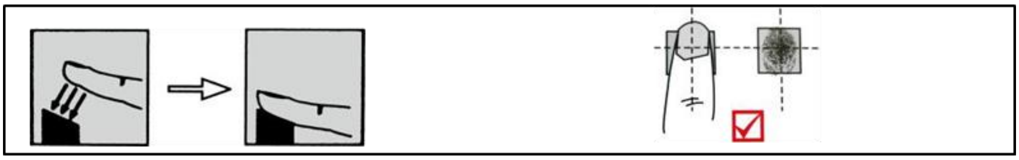
This Capacitive Fingerprint Reader communicate via UART or USB interface on board.

OPERATING INSTRUCTIONS

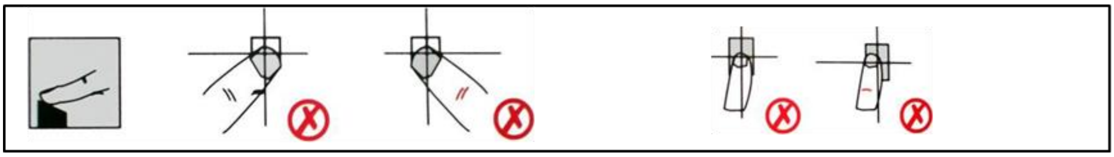
This module uses high-precision components, while collecting fingerprint:

You only need to touch the collecting window gently, not need to press it hard, fingerprint could be identified quickly.

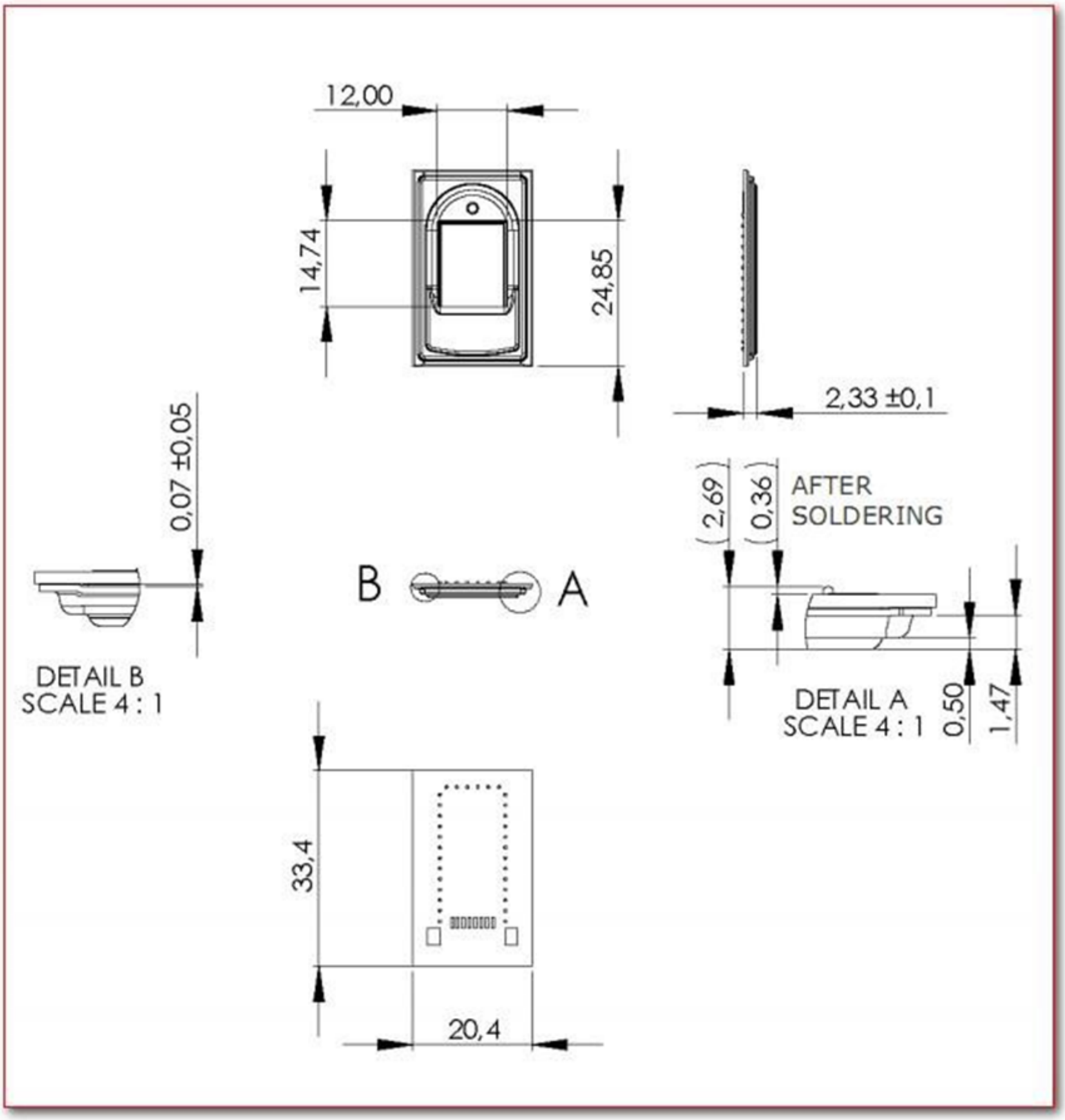
- **Correct Fingerprint**



- **Wrong Fingerprint**

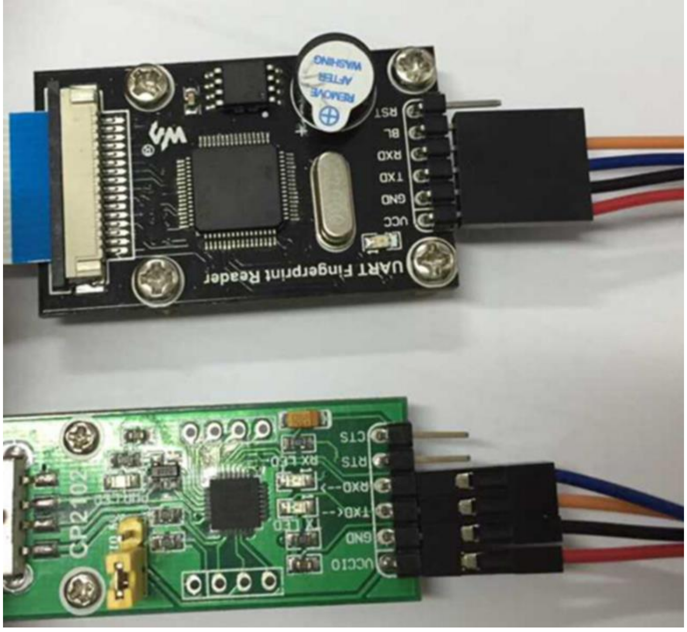


DIMENSION OF SENSOR

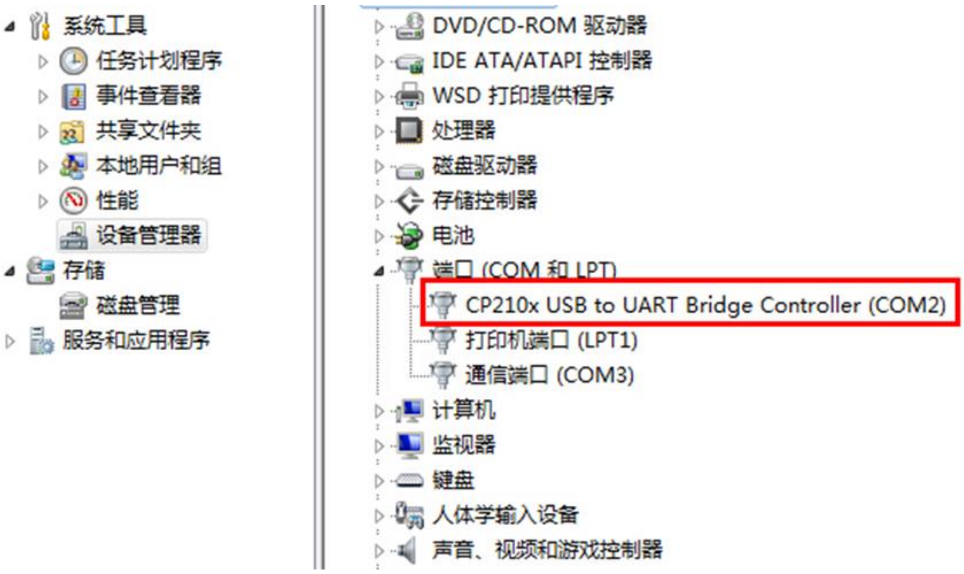

12,00
14,74
24,85
2,33 ±0,1
0,07 ±0,05
DETAIL B
SCALE 4 : 1
B
A
(2,69)
(0,36)
AFTER
SOLDERING
DETAIL A
SCALE 4 : 1
0,50
1,47
33,4
20,4

UART PORT

1. Testing the module by using CP2102 USB UART Board. (Should buy separately). If users use other UART to USB module, the operation is same.). Install CP2102 driver
2. Connecting as below: (note that RXD and TXD are connected crossly):


UART Fingerprint Reader
RST
BL
RXD
TXD
GND
VCC
CP2102
CTS
RTS
RXD
TXD
GND
VCCIO

3. Connecting the CP2102 board to the USB port of PC. Open Devices Manager to check the appropriate COM port:

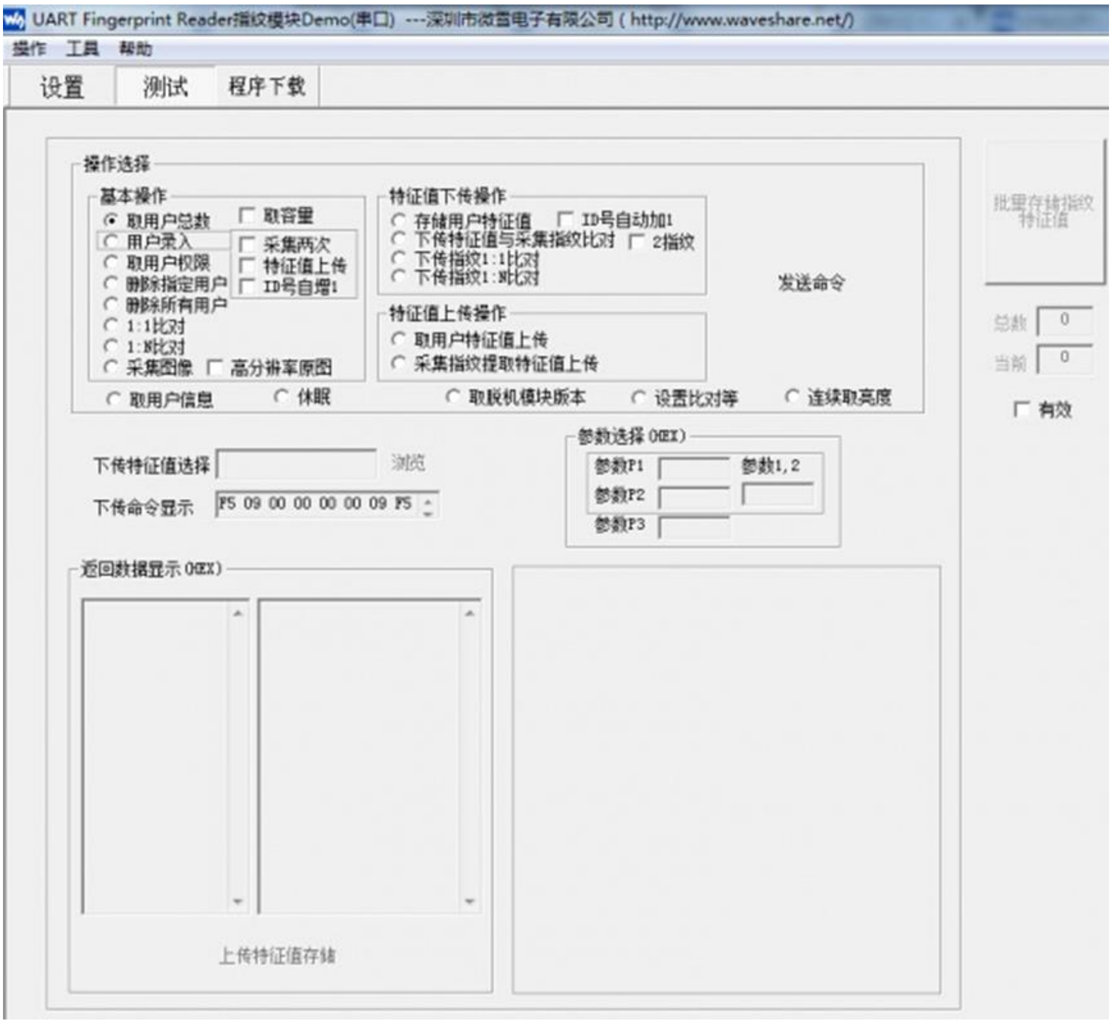

系统工具
任务计划程序
事件查看器
共享文件夹
本地用户和组
性能
设备管理器
存储
磁盘管理
服务和应用程序
DVD/CD-ROM 驱动器
IDE ATA/ATAPI 控制器
WSD 打印提供程序
处理器
磁盘驱动器
存储控制器
电池
端口 (COM 和 LPT)
CP210x USB to UART Bridge Controller (COM2)
打印机端口 (LPT1)
通信端口 (COM3)
计算机
监视器
键盘
人体学输入设备
声音、视频和游戏控制器

4. Download testing software: Capacitive-Fingerprint-Reader_(UART), you need to register the control at first use:

Registering MSCOMM32.OCX, if there is error prompt popped out that: *The module "mscomm32.ocx" was loaded but the call to DllRegisterServer failed with error code 0x8002801c.*

You can solve this problem with the following methods:

For 64-bit OS, copy the MSCOMM32.OCX file to the directory of C:\Windows\SysWOW64, and then run the register script. If it is still doesn't work, you need to copy the MSCOMM32.OCX to the directory of C:\Windows\System32, and run the register script. (It may require the administrator privilege to register the control successfully in this method). Open the UART Fingerprint Reader, you will see the operation interface as the below figure shows if the module works properly. (The default port of the USB to serial interface was set to COM1, if your COM1 isn't in use, there will be a prompt saying that *Comm port error!* .In this case, just click OK then choose the corresponding COM port in use

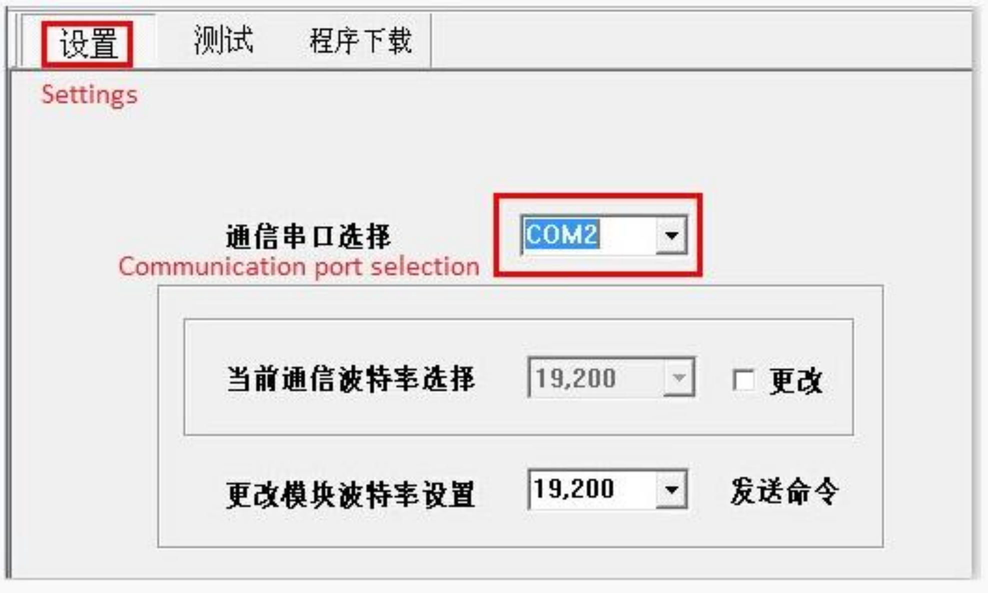

UART Fingerprint Reader指纹模块Demo(串口) ---深圳市微雪电子有限公司 (http://www.waveshare.net/)

下传命令显示 F5 09 00 00 00 00 09 F5

操作 工具 帮助
设置
测试
程序下载
操作选择
基本操作
● 取用户总数
☐ 取容量
○ 用户录入
☐ 采集两次
☐ 特征值上传
☐ ID号自增1
○ 取用户权限
○ 删除指定用户
○ 删除所有用户
○ 1:1比对
○ 1:N比对
○ 采集图像
☐ 高分辨率原图
○ 取用户信息
○ 休眠
特征值下传操作
○ 存储用户特征值
☐ ID号自动加1
○ 下传特征值与采集指纹比对
☐ 2指纹
○ 下传指纹1:1比对
○ 下传指纹1:N比对
特征值上传操作
○ 取用户特征值上传
○ 采集指纹提取特征值上传
○ 取脱机模块版本
○ 设置比对等
○ 连续取亮度
发送命令
批量存储指纹特征值
总数 0
当前 0
☐ 有效
下传特征值选择
浏览
参数选择(HEX)
参数P1
参数P2
参数P3
参数1,2
返回数据显示(HEX)
上传特征值存储

EXAMPLES OF OPERATING

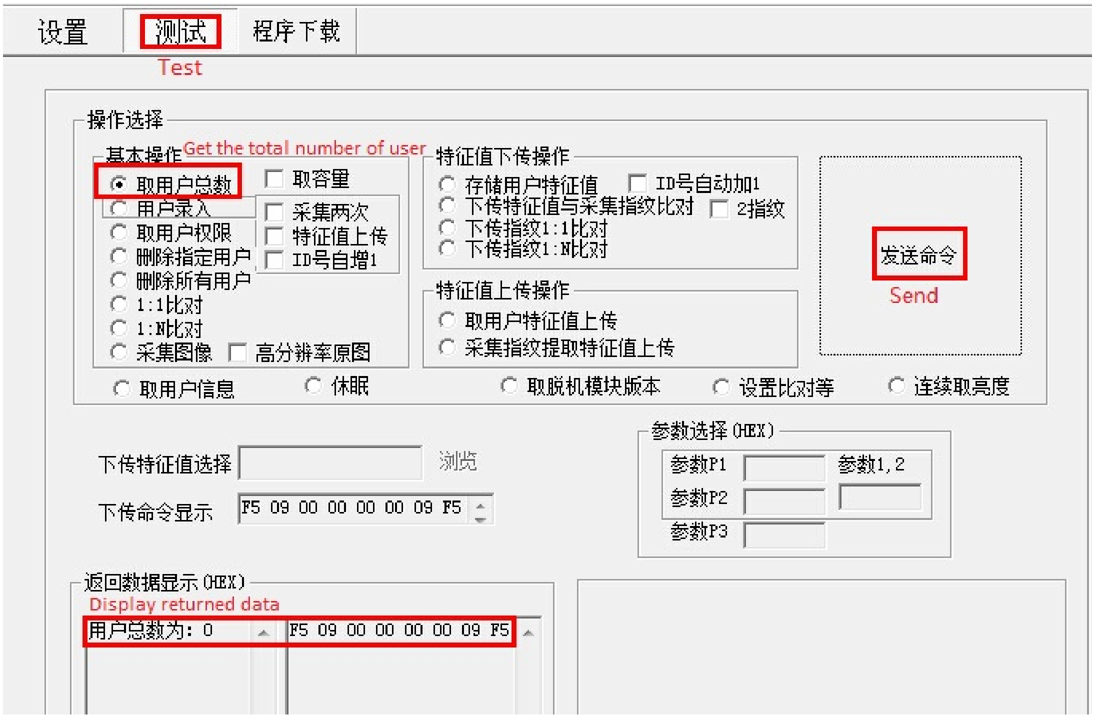
1. Configure the COM port: select the tab **Setting**, and choose the correct COM port in the option **Communication port selection** (Default baud rate: 19200).


设置
测试
程序下载
Settings
Communication port selection
□ 更改
发送命令
通信串口选择 COM2

当前通信波特率选择 19,200

更改模块波特率设置 19,200

2. Check the communication: select the tab **Test**, and choose the option **Get the total number of user** in the area of **Basic operation**. Then, click the button **Send**. You will see the relative information displayed in the box of **Display returned data** (e.g. it prompts "用户总数：0" which means "Total number is users: 0"), of the communication between the module and your PC is built up successfully. (In case of no information shown, please turn back to the previous steps to check carefully whether there are any mistakes.)


设置
测试
程序下载
Test
操作选择
基本操作
Get the total number of user
● 取用户总数
○ 用户录入
○ 取用户权限
○ 删除指定用户
○ 删除所有用户
○ 1:1比对
○ 1:N比对
○ 采集图像
□ 高分辨率原图
□ 取容量
□ 采集两次
□ 特征值上传
□ ID号自增1
特征值下传操作
○ 存储用户特征值
□ ID号自动加1
○ 下传特征值与采集指纹比对
□ 2指纹
○ 下传指纹1:1比对
○ 下传指纹1:N比对
特征值上传操作
○ 取用户特征值上传
○ 采集指纹提取特征值上传
发送命令
Send
○ 取用户信息
○ 休眠
○ 取脱机模块版本
○ 设置比对等
○ 连续取亮度
下传特征值选择
浏览
参数选择(HEX)
参数P1
参数P2
参数P3
参数1,2
Display returned data
下传命令显示 F5 09 00 00 00 00 09 F5

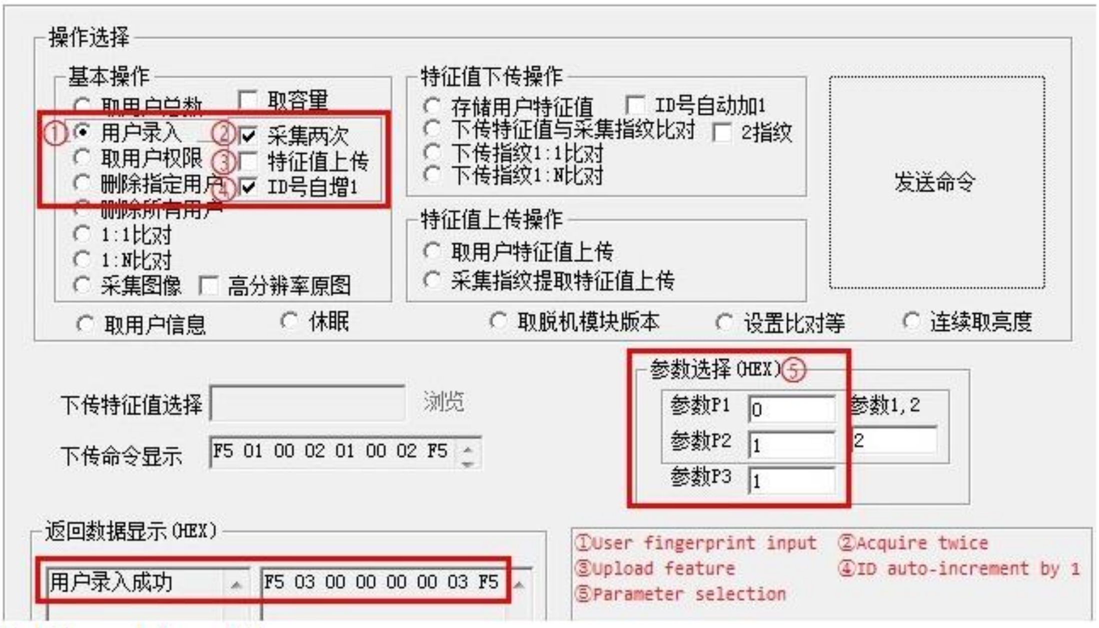
返回数据显示(HEX)

用户总数为: 0

F5 09 00 00 00 00 09 F5

3. User fingerprint input: In group **Basic Operation**, select the option **User fingerprint input**, and check the options **Acquire twice** and **ID auto-increment by 1**. Set the parameters P1, P2, and P3 in the group **Parameter selection** to 0, 1, 1, respectively. (You can set the parameters to other numbers as well, if only there is no ID duplicates) Click the button **Send**. When you hear a 'beep' from the module and find the fingerprint sensing area light up, you can put your finger on the sensing area for scanning. After the second scanning finished, it will prompt "用户录入成功" which means "Input Fingerprint Successfully".

   Please take a notice that do not check the option Upload feature. This option may upload the characteristics to the PC other than fingerprint reader, which will cause fingerprint marching failure and no increase in the total number of user, though you may get the information of 'fingerprint input success!' after a new fingerprint is added.



①● 用户录入
②☑ 采集两次
③□ 特征值上传
④☑ ID号自增1

参数选择 (HEX)⑤
参数P1 0
参数P2 1
参数P3 1
参数1,2 2

下传特征值选择
下传命令显示 F5 01 00 02 01 00 02 F5

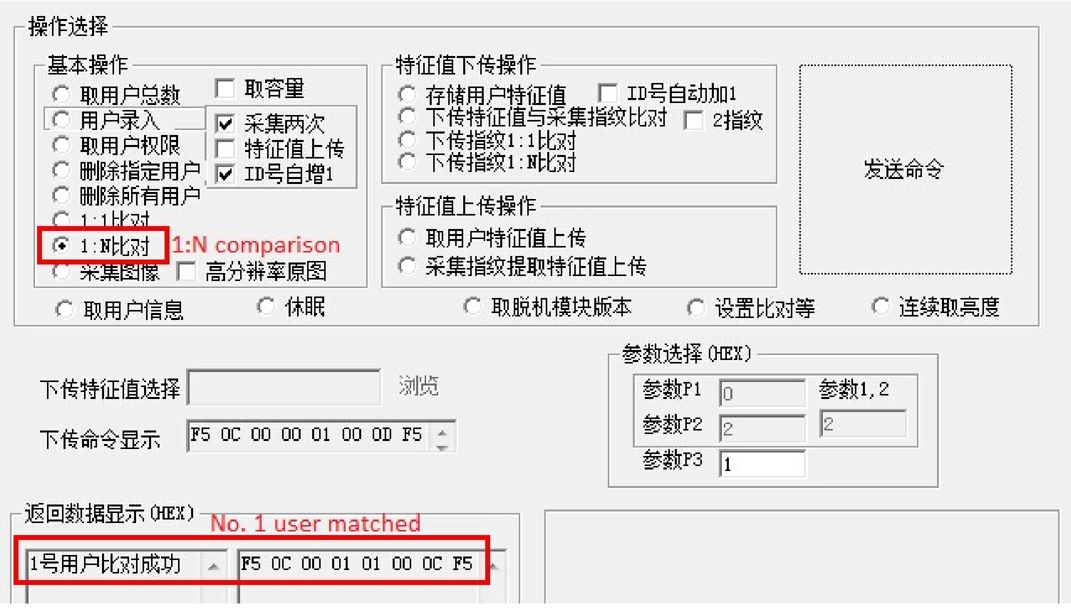
返回数据显示 (HEX)
用户录入成功
F5 03 00 00 00 00 03 F5

①User fingerprint input ②Acquire twice
③Upload feature ④ID auto-increment by 1
⑤Parameter selection

操作选择
基本操作
○ 取用户总数
□ 取容量
○ 取用户权限
○ 删除指定用户
○ 删除所有用户
○ 1:1比对
○ 1:N比对
○ 采集图像
□ 高分辨率原图
○ 取用户信息
○ 休眠
特征值下传操作
○ 存储用户特征值
□ ID号自动加1
○ 下传特征值与采集指纹比对
□ 2指纹
○ 下传指纹1:1比对
○ 下传指纹1:N比对
特征值上传操作
○ 取用户特征值上传
○ 采集指纹提取特征值上传
发送命令
○ 取脱机模块版本
○ 设置比对等
○ 连续取亮度
浏览

4. Fingerprint comparison: select the option **1:N comparison** in the area of **Basic operation**, and click the button **Send**. When you hear a 'beep' from the module and find the fingerprint sensing area light up, you can put your finger on the sensing area for scanning. If the fingerprint scanned is already stored into the module, the module will present the information "n 号用户比对成功" which means "No. n user matched". Or else, you may get

the information "No match".



操作选择

基本操作
○ 取用户总数 ☐ 取容量
○ 用户录入 ☑ 采集两次
○ 取用户权限 ☐ 特征值上传
○ 删除指定用户 ☑ ID号自增1
○ 删除所有用户
○ 1:1比对
● 1:N比对 1:N comparison
○ 采集图像 ☐ 高分辨率原图

特征值下传操作
○ 存储用户特征值 ☐ ID号自动加1
○ 下传特征值与采集指纹比对 ☐ 2指纹
○ 下传指纹1:1比对
○ 下传指纹1:N比对

特征值上传操作
○ 取用户特征值上传
○ 采集指纹提取特征值上传

○ 取用户信息 ○ 休眠 ○ 取脱机模块版本 ○ 设置比对等 ○ 连续取亮度

下传特征值选择
下传命令显示 F5 0C 00 00 01 00 0D F5

参数选择 (HEX)
参数P1 0 参数1,2
参数P2 2 2
参数P3 1

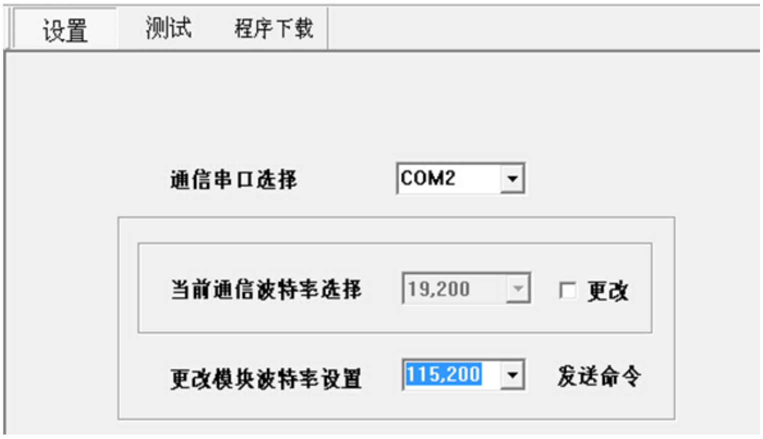
返回数据显示 (HEX) No. 1 user matched
1号用户比对成功 F5 0C 00 01 01 00 0C F5

No higher resolution available

ADDITIONAL OPERATIONS

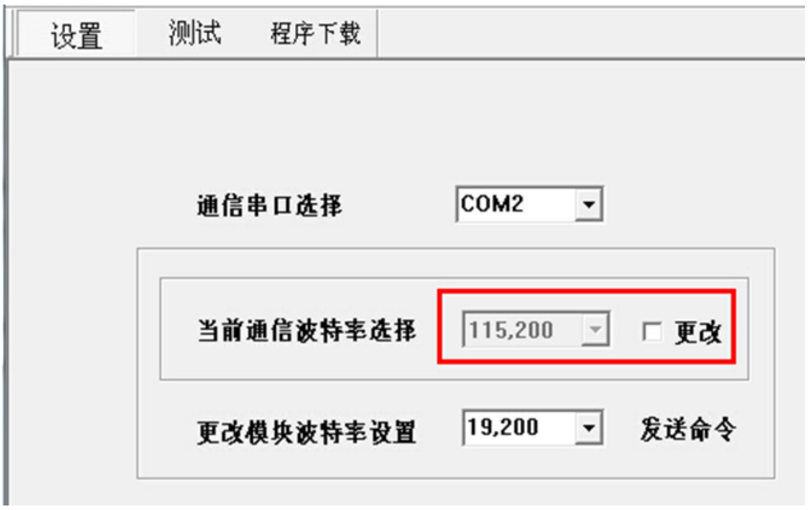
Note: the following operations involve the baud rate modifications, if you have changed the baud rate, and you can't already make connection next time. Please check the baud rate first, whether it is normal!

1. Baud rate change: for example, hang change the baud rate from 19200 to 115200:



通信串口选择 COM2
当前通信波特率选择 19,200 ☐ 更改
更改模块波特率设置 115,200

Note: in this case the baud rate has been changed to 115200, please notice before you use it next time that the baud rate is configured to 115200, otherwise the communication will be failed.



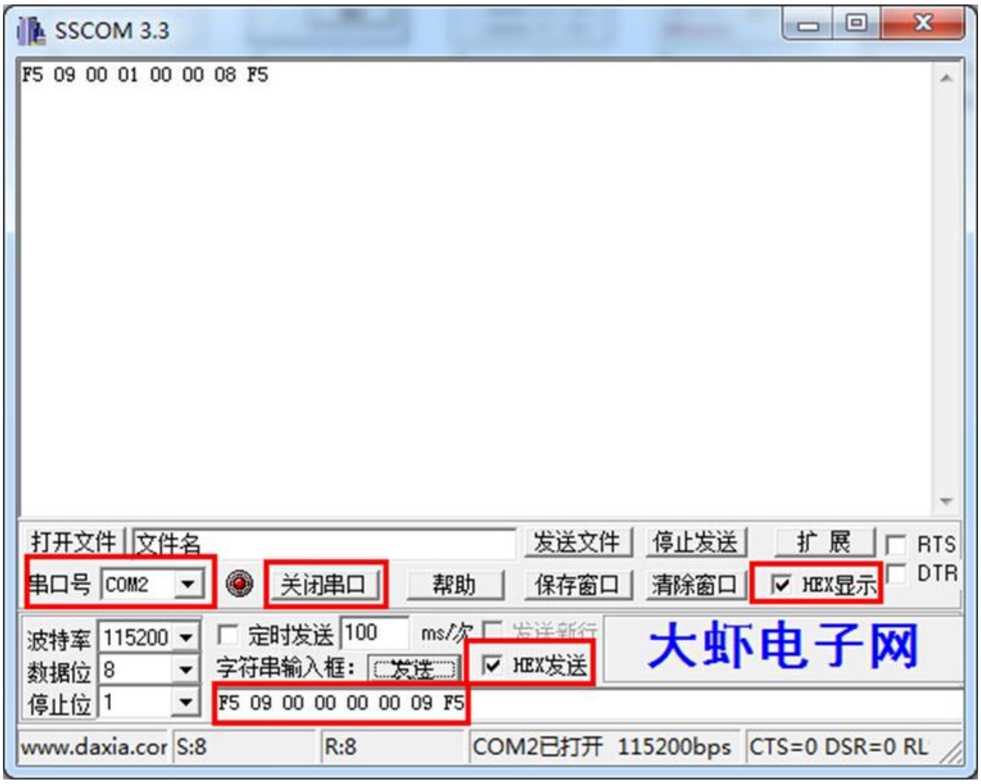
通信串口选择 COM2

当前通信波特率选择 115,200 ☐ 更改

更改模块波特率设置 19,200

If you've forgotten the baud rate, you can use this method to define it:

Start the software **Serial Debugging Assistant**, and select the corresponding COM port. Then, open the COM port and check the options HEX display and HEX transmission. Input a string off data, such as '5 09 00 00 00 00 09 F5', into the string input box, and click the button Send. If the baud rate setting is correct, the receive box will show the relative data, such as 'F5 09 00 01 00 00 08 F5' in here. For a wrong baud rate setting, there will be nothing displayed. In this way, you can get back the correct baud rate by trying different baud rate setting.



```
F5 09 00 01 00 00 08 F5
```

串口号 COM2

☑ HEX显示

波特率 115200

数据位 8

停止位 1

☐ 定时发送 100 ms/次

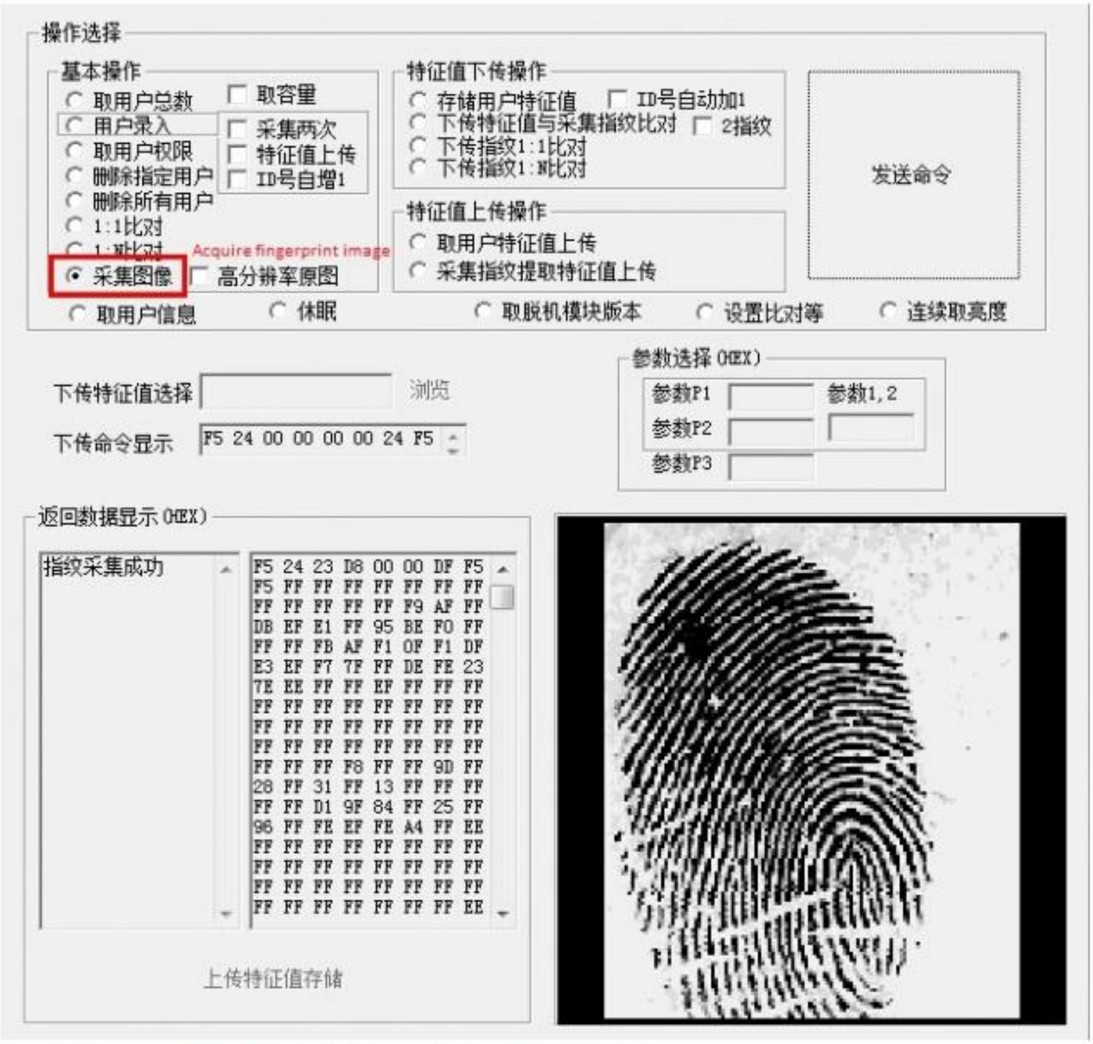
☑ HEX发送

F5 09 00 00 00 00 09 F5

www.daxia.cor S:8 R:8 COM2已打开 115200bps CTS=0 DSR=0 RL

2. Obtaining of fingerprint image: select the option Acquire fingerprint image in the area of Basic operation, and click the button Send. When you hear a 'beep' from the module and

find the fingerprint sensing area light up, you can put your finger on the sensing area for scanning. It may take 6 seconds before displaying the fingerprint image acquired on the PC. Note: If the module cannot acquire any image or the image acquired is imperfect, you should reduce the baud rate to make sure the quality of the image. It is recommended to use the baud rate of 9600 for fingerprint image acquirement.


操作选择
基本操作
○ 取用户总数
○ 用户录入
○ 取用户权限
○ 删除指定用户
○ 删除所有用户
○ 1:1比对
○ 1:N比对
● 采集图像
☐ 取容量
☐ 采集两次
☐ 特征值上传
☐ ID号自增1
☐ 高分辨率原图
Acquire fingerprint image
○ 取用户信息
○ 休眠
特征值下传操作
○ 存储用户特征值
○ 下传特征值与采集指纹比对
○ 下传指纹1:1比对
○ 下传指纹1:N比对
☐ ID号自动加1
☐ 2指纹
特征值上传操作
○ 取用户特征值上传
○ 采集指纹提取特征值上传
发送命令
○ 取脱机模块版本
○ 设置比对等
○ 连续取亮度
下传特征值选择
浏览
下传命令显示
参数选择 (HEX)
参数P1
参数P2
参数P3
参数1,2
返回数据显示 (HEX)
上传特征值存储

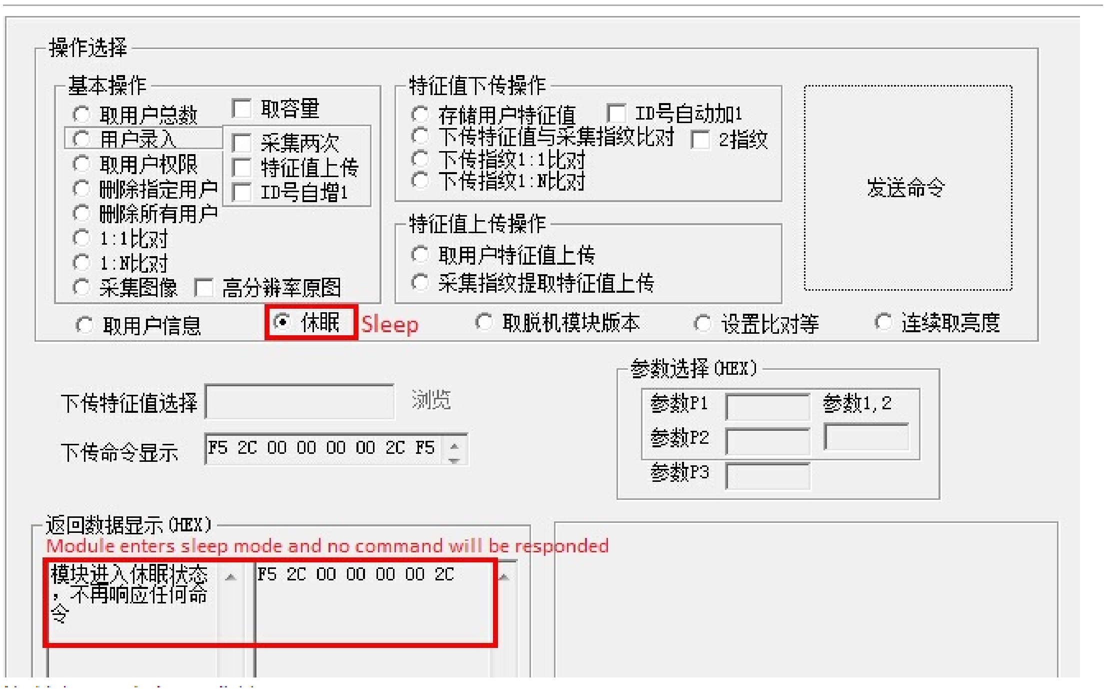
下传命令显示: F5 24 00 00 00 00 24 F5

指纹采集成功

```
F5 24 23 D8 00 00 DF F5
F5 FF FF FF FF FF FF FF
FF FF FF FF FF F9 AF FF
DB EF E1 FF 95 BE F0 FF
FF FF FB AF F1 0F F1 DF
E3 EF F7 7F FF DE FE 23
7E EE FF FF EF FF FF FF
FF FF FF FF FF FF FF FF
FF FF FF FF FF FF FF FF
FF FF FF FF FF FF FF FF
FF FF FF F8 FF FF 9D FF
28 FF 31 FF 13 FF FF FF
FF FF D1 9F 84 FF 25 FF
96 FF FE EF FE A4 FF EE
FF FF FF FF FF FF FF FF
FF FF FF FF FF FF FF FF
FF FF FF FF FF FF FF FF
FF FF FF FF FF FF FF EE
```

3. Sleep mode: select the option Sleep in the area of Basic operation, and click the button Send. Then, you will get the information of "模块进入休眠状态，不再响应任何命令" which means "Module enters sleep mode and no command will be responded". The only way to

wake up a sleeping module is to power it up once again.


操作选择
基本操作
○ 取用户总数
☐ 取容量
○ 用户录入
☐ 采集两次
○ 取用户权限
☐ 特征值上传
○ 删除指定用户
☐ ID号自增1
○ 删除所有用户
○ 1:1比对
○ 1:N比对
○ 采集图像
☐ 高分辨率原图
特征值下传操作
○ 存储用户特征值
☐ ID号自动加1
○ 下传特征值与采集指纹比对
☐ 2指纹
○ 下传指纹1:1比对
○ 下传指纹1:N比对
特征值上传操作
○ 取用户特征值上传
○ 采集指纹提取特征值上传
发送命令
○ 取用户信息
○ 取脱机模块版本
○ 设置比对等
○ 连续取亮度
参数选择(HEX)
参数P1
参数P2
参数P3
参数1,2
下传特征值选择
浏览
返回数据显示(HEX)

● 休眠 Sleep

下传命令显示 F5 2C 00 00 00 00 2C F5

Module enters sleep mode and no command will be responded

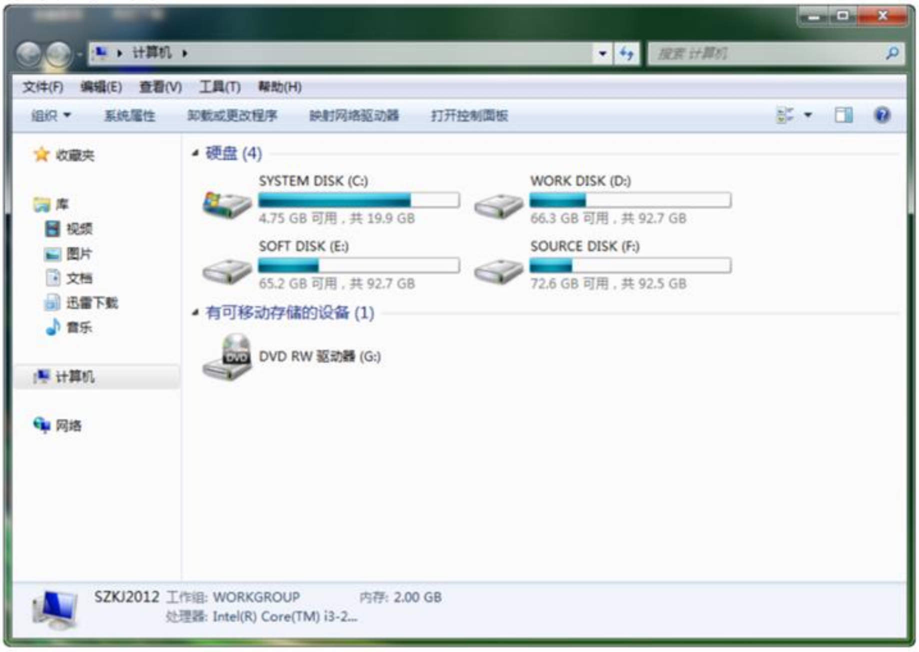
模块进入休眠状态，不再响应任何命令

F5 2C 00 00 00 00 2C

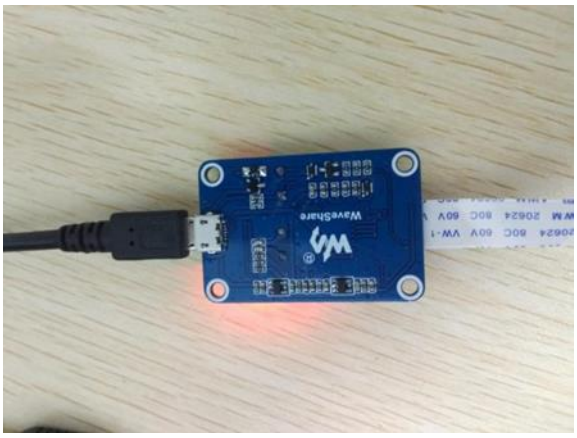
USB CONTROL DESCRIPTION

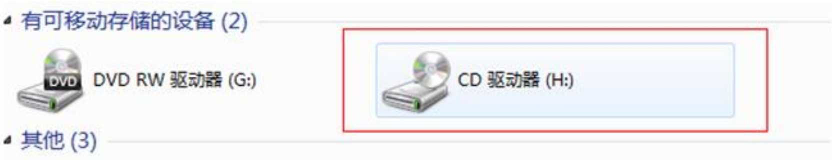
1 Plug the Fingerprint Reader. It simulates the CD driver interface, thus no need to install any driver. Plug directly and the module can be used immediately.

The following picture shows the case if there is no access.


计算机
搜索 计算机
文件(F)
编辑(E)
查看(V)
工具(T)
帮助(H)
组织
系统属性
卸载或更改程序
映射网络驱动器
打开控制面板
收藏夹
库
视频
图片
文档
迅雷下载
音乐
计算机
网络
硬盘 (4)
SYSTEM DISK (C:)
4.75 GB 可用，共 19.9 GB
WORK DISK (D:)
66.3 GB 可用，共 92.7 GB
SOFT DISK (E:)
65.2 GB 可用，共 92.7 GB
SOURCE DISK (F:)
72.6 GB 可用，共 92.5 GB
有可移动存储的设备 (1)
DVD RW 驱动器 (G:)
SZKJ2012 工作组: WORKGROUP
内存: 2.00 GB
处理器: Intel(R) Core(TM) i3-2...

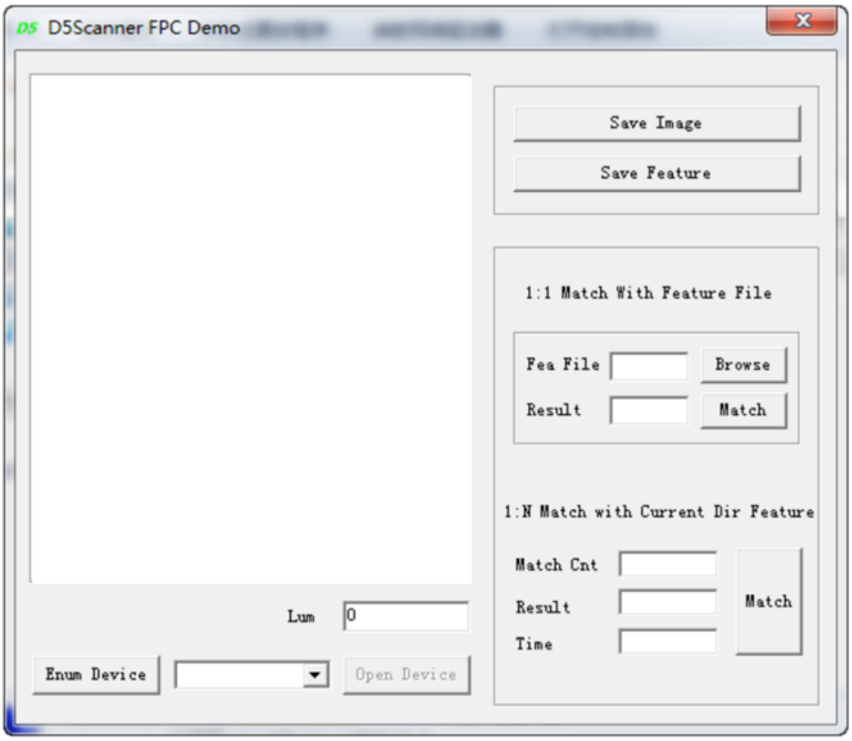
The following picture shows the case of access (devices is displayed as CD drive)



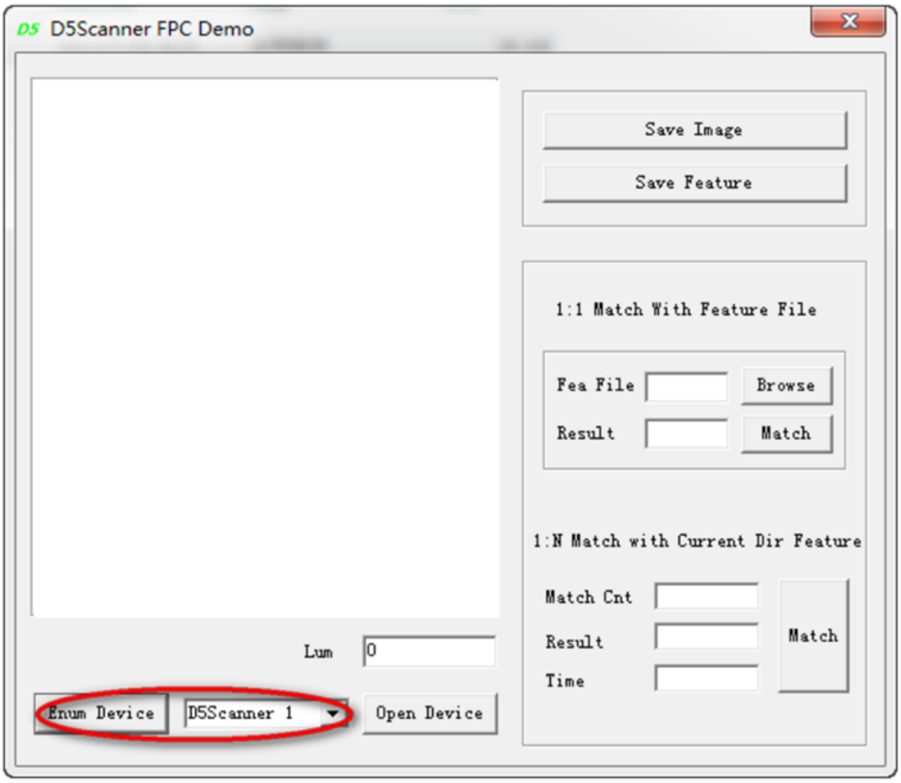

有可移动存储的设备 (2)
DVD RW 驱动器 (G:)
CD 驱动器 (H:)
其他 (3)

2 Start testing software

2.1 Download testing software: : Capacitive-Fingerprint-Reader_(UART), extract and open "\D5ScannerS77Demo\Release\D5ScannerS77Demo.exe"


D5Scanner FPC Demo
Save Image
Save Feature
1:1 Match With Feature File
Fea File
Browse
Result
Match
1:N Match with Current Dir Feature
Match Cnt
Result
Time
Match
Lum
0
Enum Device
Open Device

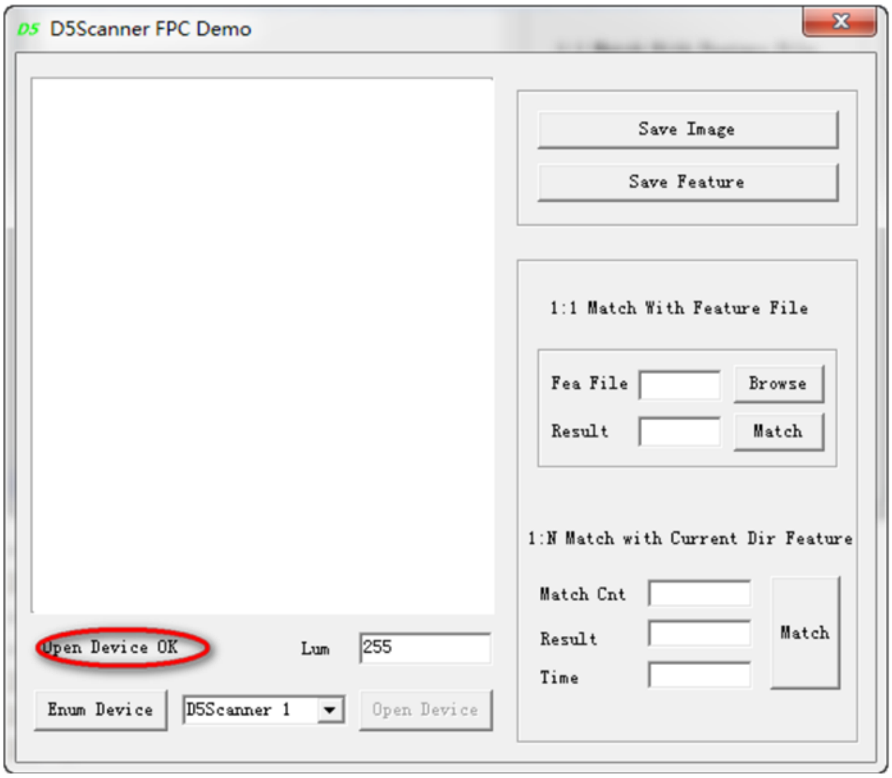
2.2 Define device, Click button "Enum Device" to enumerate all of Fingerprint Readers connected to PC this moment, then select appropriate device from the box as below:


D5Scanner FPC Demo
Save Image
Save Feature
1:1 Match With Feature File
Fea File
Browse
Result
Match
1:N Match with Current Dir Feature
Match Cnt
Result
Time
Match
Enum Device
Open Device

Lum: 0

D5Scanner 1

2.3 Open the device: Click the button “Open Device”, it will prompt that “Open Device OK” or “Open Device Fail”

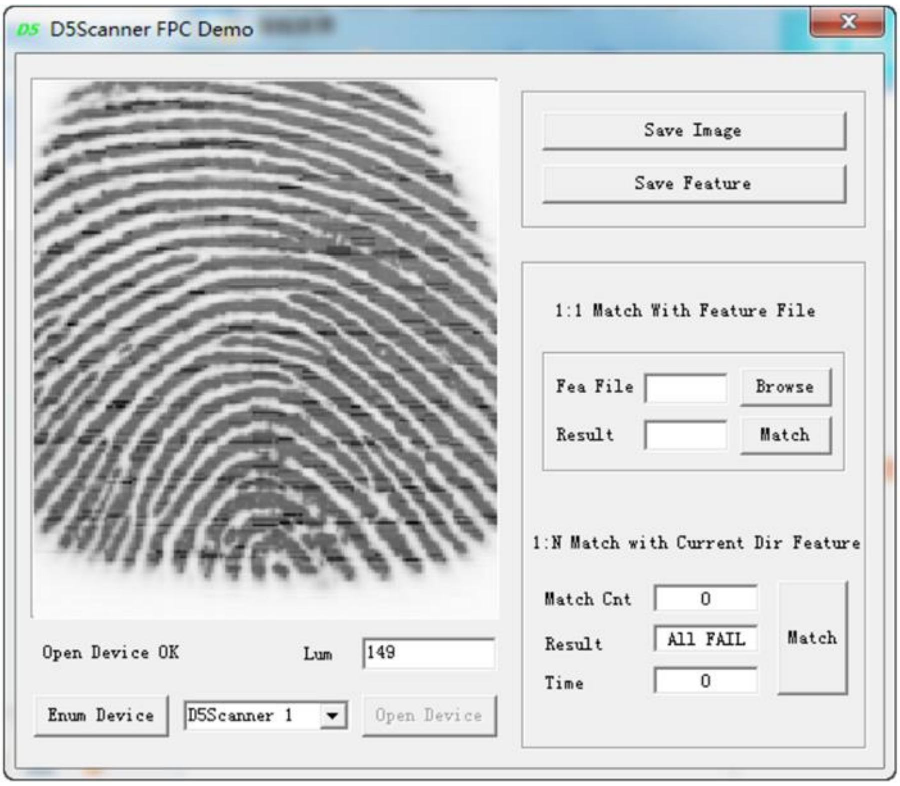

D5Scanner FPC Demo
Save Image
Save Feature
1:1 Match With Feature File
Fea File
Browse
Result
Match
1:N Match with Current Dir Feature
Match Cnt
Result
Time
Match
Enum Device
Open Device

Open Device OK

Lum: 255

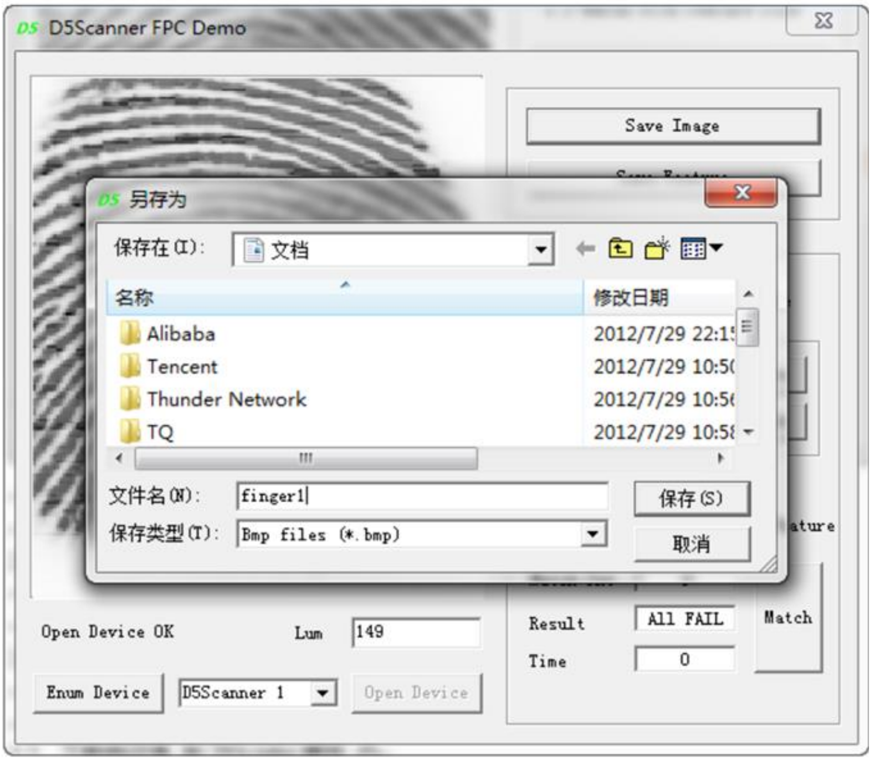
D5Scanner 1

2.4 Press the Fingerprint Reader by finger, ever fingerprint scanned, it will sound “beep”.


D5Scanner FPC Demo
Save Image
Save Feature
1:1 Match With Feature File
Browse
Match
1:N Match with Current Dir Feature
Match
Enum Device
Open Device

Fea File
Result
Match Cnt 0
Result All FAIL
Time 0
Open Device OK
Lum 149
D5Scanner 1

2.5 Save image by pushing “Save Image” button, select *.bmp file extension


D5Scanner FPC Demo
另存为
Save Image
名称
修改日期
保存(S)
取消
Match
Enum Device
Open Device

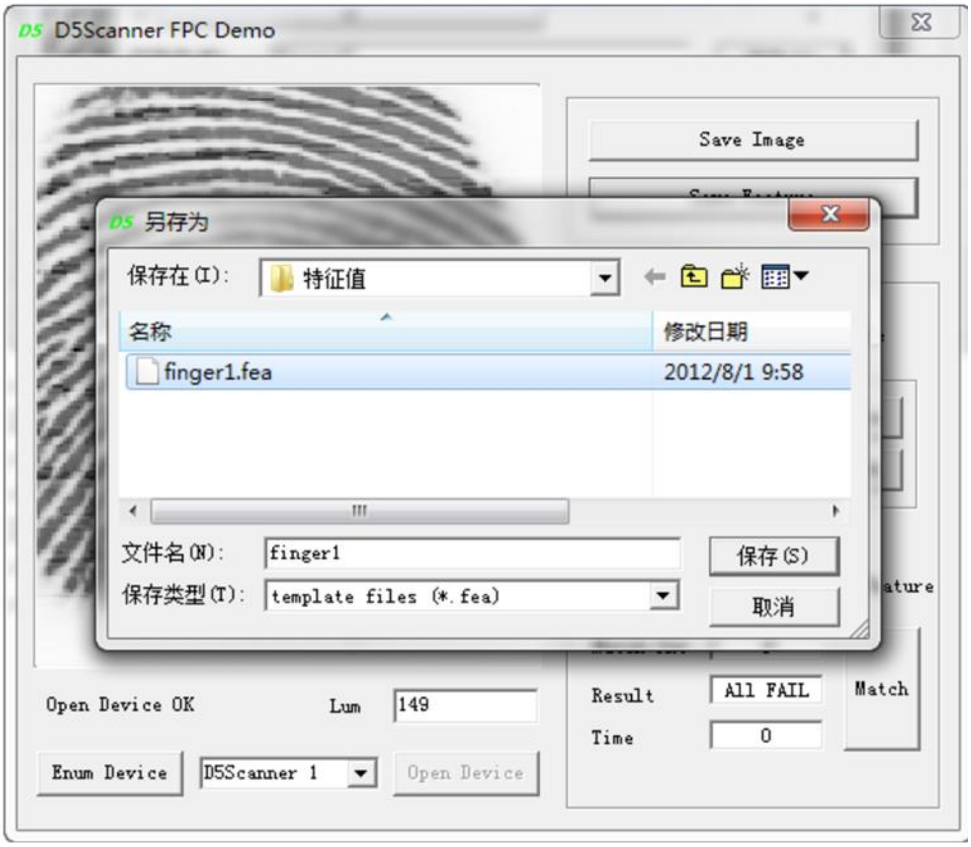
保存在(I): 文档

名称	修改日期
Alibaba	2012/7/29 22:1
Tencent	2012/7/29 10:5
Thunder Network	2012/7/29 10:5
TQ	2012/7/29 10:5

文件名(N): finger1
保存类型(T): Bmp files (*.bmp)

Open Device OK
Lum 149
D5Scanner 1
Result All FAIL
Time 0

2.6 Save characteristics by pushing “Save Feature” button, select *.fea extension


D5Scanner FPC Demo
Save Image
Save Feature
另存为
保存在(I):
名称
修改日期
文件名(N):
保存类型(T):
保存(S)
取消
Result
Time
Match
Lum
Enum Device
Open Device

保存在(I): 特征值

名称	修改日期
finger1.fea	2012/8/1 9:58

文件名(N): finger1

保存类型(T): template files (*.fea)

Open Device OK

Lum: 149

D5Scanner 1

Result: All FAIL

Time: 0

EXAMPLES

In this chapter, we use XNUCLEO-F103RB, UNO PLUS and Raspberry Pi 3B to show you how to use the fingerprint reader. (using UART serial port).

XNUCLEO-F103RB

- Based on STM32F103RBT6
- Based on HAL library, it can be ported to any other STM chip by STM32CubeMX
- Can be compiled in Keil v5

HARDWARE CONNECTION

Capacitive Fingerprint Reader	**XNUCLEO-F103RB**
VCC	3.3V
GND	GND

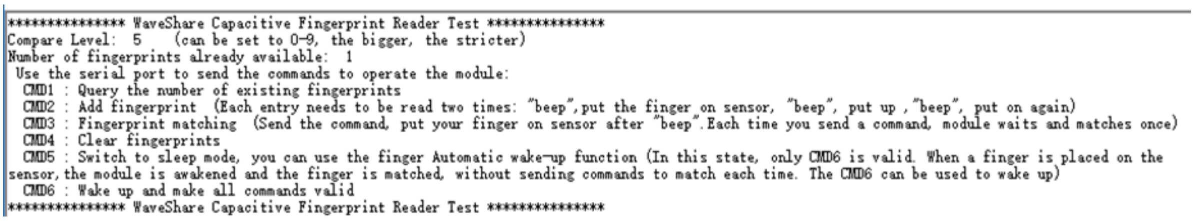
TXD	D2 (PA10)
RXD	D8 (PA9)
WAKE	D3 (PB3)
RST	D4 (PB5)

PROGRAMMING

1 After connecting the module to development board, plug the ST-Link programmer, open file *Capacitive Fingerprint Reader.uvprojx* which is under MDK-ARM directory. Click "Build" to compile the project, then click "Download" button, the project will be flashed into the chip.

2 Connecting the development board to PC by USB cable, open the serial port monitoring application, select right serial port number, and setup following settings:
baud rate: 115200; bits: 8; stop bit: 1;check bit: none; control flow: none

3 Press button "Reset" on the board, you can see operation tips are printed in the serial port assistant:

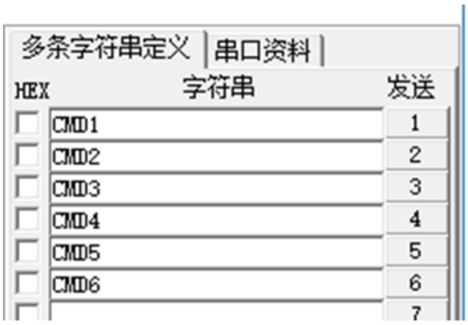


```
*************** WaveShare Capacitive Fingerprint Reader Test ***************
Compare Level:  5    (can be set to 0-9, the bigger, the stricter)
Number of fingerprints already available:  1
 Use the serial port to send the commands to operate the module:
  CMD1 : Query the number of existing fingerprints
  CMD2 : Add fingerprint  (Each entry needs to be read two times: "beep",put the finger on sensor, "beep", put up ,"beep", put on again)
  CMD3 : Fingerprint matching  (Send the command, put your finger on sensor after "beep".Each time you send a command, module waits and matches once)
  CMD4 : Clear fingerprints
  CMD5 : Switch to sleep mode, you can use the finger Automatic wake-up function (In this state, only CMD6 is valid. When a finger is placed on the
sensor,the module is awakened and the finger is matched, without sending commands to match each time. The CMD6 can be used to wake up)
  CMD6 : Wake up and make all commands valid
*************** WaveShare Capacitive Fingerprint Reader Test ***************
```

Note: if the serial assistant always returns the error message "***ERROR***', please ensure that the module is powered by 3.3V or 5V, the serial wired connection is correct and the module baud rate is 19200 by default. Then power off, and power on it again.

4 The message above informs that the current matching level of module is 5, the current comparison level is 5 (can be set to 0-9, the bigger, the stricter). And there is one fingerprint saved in the module. Users can send commands CMD1-CMD6 by serial assistant to operate the module.

Note: Do not check the option "发送新行" (send new line) and "HEX 发送" (HEX to send), after sending commands, please pay attention to the operation tips responded!



CMD1
CMD2
CMD3
CMD4
CMD5
CMD6

COMMANDS DESCRIPTION

CMD1: Query the number of existing fingerprints.

CMD2: Add fingerprint (Each entry should be read twice, “beep”, put your finger on the sensor. “beep”, take away, “beep”, put your finger again). Please put the finger on the center of the sensor.

CMD3: Fingerprint match (Send command, put your fingerprint after is sound “beep”. Each time you send a command, the module waits and matches one). Please put the finger on the center of the sensor.

CMD4: Clear database of fingerprints.

CMD5: Switch to sleep mode. You can use the finger automatic wake-up function (after sending this command, only the CMD6 is available. When a finger being putted on the sensor the module wakes up and matches the fingerprint. Needn’t send CMD3 for matching every time. Send CMD6 to exit the sleep mode).

CMD6: Switch to work mode. Wake up and make all commands valued

UNO PLUS

HARDWQRE CONNECTION

Capacitive Fingerprint Reader	Arduino UNO PLUS
VCC	3.3V or 5V
GND	GND

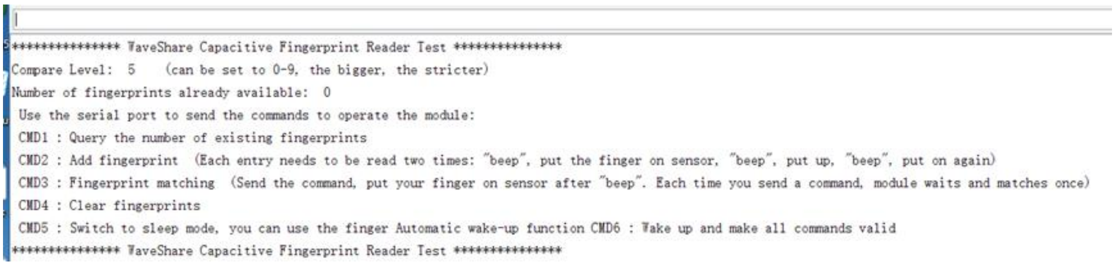
TXD	D10
RXD	D11
WAKE	D8
RST	D9

Note: since the Arduino UNO PLUS has only one hardware serial port and this port us used to connect to the PC for downloading and as debugging tool, so here we use D10, D11 to simulate a software serial port for communication with Capacitive Fingerprint Reader.

PROGRAMMING

1 Copy the Arduino\Capacitive_Fingerprint_Reader folder from package to Arduino installation directory Arduino\libraries. Open project at File → Examples → Capacitive_Fingerprint_Reader → Finger_Test, compile and download.

2 Click Tools →Port, select serial port number of Arduino development board, Open the serial monitor and configure is as No line ending, 115200 baud. Press the button "Reset" on the board, you can easily see in the serial port assistant following:



```
*************** WaveShare Capacitive Fingerprint Reader Test ***************
Compare Level:  5    (can be set to 0-9, the bigger, the stricter)
Number of fingerprints already available:  0
 Use the serial port to send the commands to operate the module:
 CMD1 : Query the number of existing fingerprints
 CMD2 : Add fingerprint  (Each entry needs to be read two times: "beep", put the finger on sensor, "beep", put up, "beep", put on again)
 CMD3 : Fingerprint matching  (Send the command, put your finger on sensor after "beep". Each time you send a command, module waits and matches once)
 CMD4 : Clear fingerprints
 CMD5 : Switch to sleep mode, you can use the finger Automatic wake-up function CMD6 : Wake up and make all commands valid
*************** WaveShare Capacitive Fingerprint Reader Test ***************
```

Note: if the serial assistant always returns the error message "***ERROR***', please ensure that the module is powered by 3.3V or 5V, the serial wired connection is correct and the module baud rate is 19200 by default. Then power off, and power on it again.

The specification of operation methods, commands and warning description see in XBUCLEO-F103RB usage description above.

RASPBERRY PI

HRDWARE CONNECTION

Usage of Raspberry Pi 3 Model B. Pin connection uses BCM coding of pins.

Capacitive Fingerprint Reader	**RaspberryPi 3B**

VCC	3.3V or 5V
GND	GND
TXD	15 (BCM)
RXD	14 (BCM)
WAKE	23 (BCM)
RST	24 (BCM)

Note: before running the device you need to install necessary libraries (WiringPi, bcm2835, python), installation procedure refers to: Libraries installation for RPi

RASPBERRY PI SERIAL PORT CONFIGURATION

- Since the Raspberry Pi serial port is used for debugging terminal, you need to modify the Raspberry Pi settings. Execute the following:

  ```
  sudo raspi-config
  ```

- Select Advanced Options -> Serial -> no to close serial port terminal (there are some differences between different versions of Raspbian, you need check them in internet)
- Open file /boot/config.txt, find the following configuration statements, uncomment it to enable the serial port. If it is missing, add it to the end of the file:

  ```
  enable_uart=1
  ```

- Restart to apply changes.

Note: in the case of Raspberry Pi 3B the serial device number is in ttyS0. In case of Raspberry Pi 2B/zero user need to set the serial device number as ttyAMA0.

PYTHON

Download the code for Raspberry Pi, install all of required libraries and configure serial port.

Input the command “**sudo python3.5 main.py**” or “**sudo ./main.py**” to run the program

(the program is based on python version 3.5 and above).

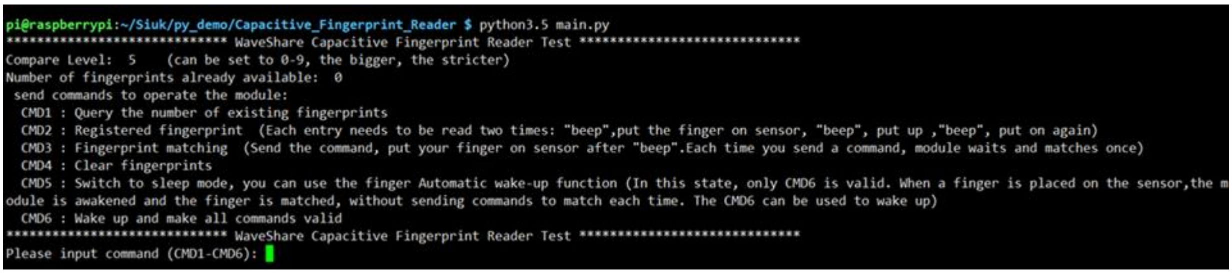
WIRINGPI

Input the command “**make**”, to compile the code and assign name “test” to executable file.

Input the command “**sudo ./test**” to run the program

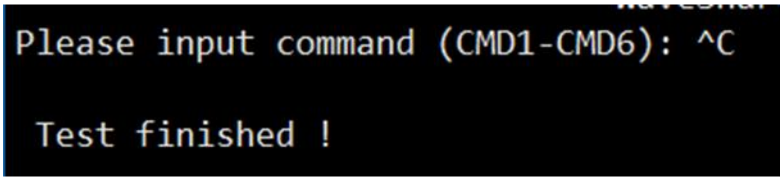
EXECUTION RESULTS

The specification of operation methods, command and warning description see in XNUCLEO-F103RB usage description.



```
pi@raspberrypi:~/Siuk/py_demo/Capacitive_Fingerprint_Reader $ python3.5 main.py
***************************** WaveShare Capacitive Fingerprint Reader Test *****************************
Compare Level:  5    (can be set to 0-9, the bigger, the stricter)
Number of fingerprints already available:  0
 send commands to operate the module:
  CMD1 : Query the number of existing fingerprints
  CMD2 : Registered fingerprint  (Each entry needs to be read two times: "beep",put the finger on sensor, "beep", put up ,"beep", put on again)
  CMD3 : Fingerprint matching  (Send the command, put your finger on sensor after "beep".Each time you send a command, module waits and matches once)
  CMD4 : Clear fingerprints
  CMD5 : Switch to sleep mode, you can use the finger Automatic wake-up function (In this state, only CMD6 is valid. When a finger is placed on the sensor,the m
odule is awakened and the finger is matched, without sending commands to match each time. The CMD6 can be used to wake up)
  CMD6 : Wake up and make all commands valid
***************************** WaveShare Capacitive Fingerprint Reader Test *****************************
Please input command (CMD1-CMD6):
```

You can exit of program by pressing Ctrl+C



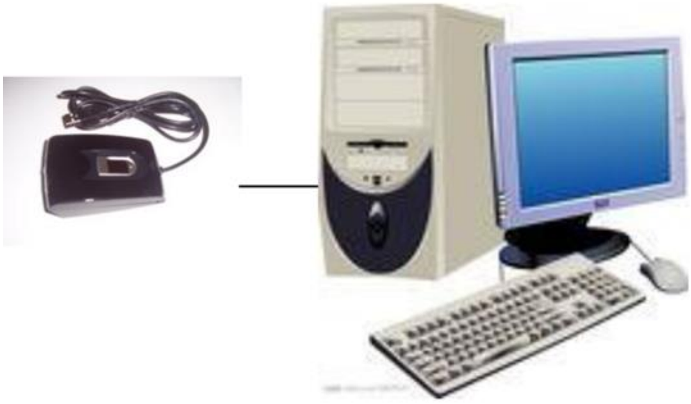
```
Please input command (CMD1-CMD6): ^C

 Test finished !
```

Note: If the serial assistant always returns the error message“***ERROR***”, then please ensure that the module is powered by 3.3V or 5V, whether the serial wired connection is correct, the module baud rate is 19200 by default, and finally power off, then power on again.

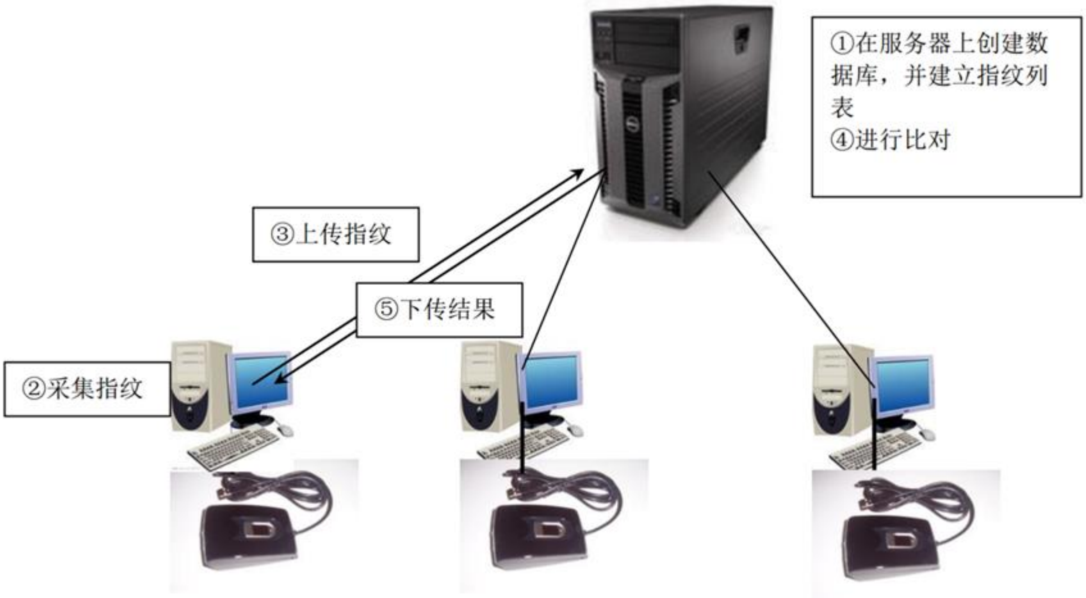
APPENDINX: APPLICATION EXAMPLE

1. **Fingerprint reading application (case A) include devices**: scammer and comparing terminal



2. **Fingerprint reading application (case B) includes devices**: scanner terminal and comparing server

   1) Create database and list for fingerprint
   2) Obtain fingerprints
   3) Upload fingerprint
   4) Comparison
   5) Download results



3. **Online comparison application (case A) includes devices**: ID input terminal, fingerprint database, comparator:

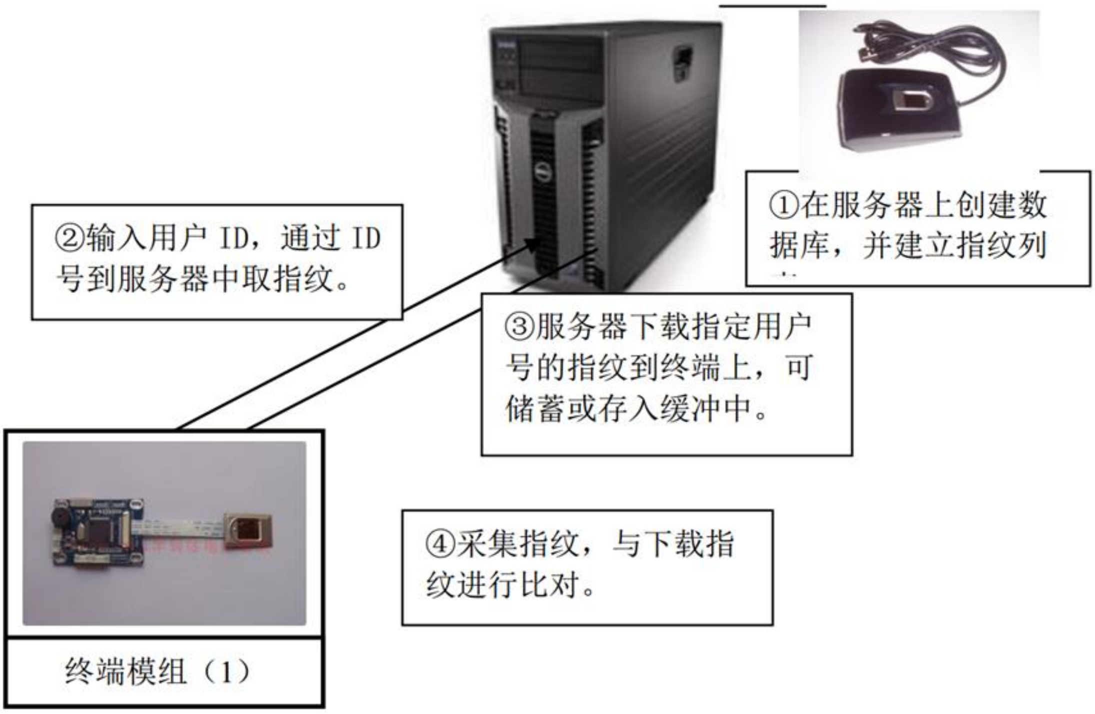
   (1) terminal module

   1) Create database and fill it by fingerprint’s data

2) Input user ID, send ID to server with fingerprints

3) Download from server fingerprint according user ID to terminal, save or keep in buffer

4) Scanning and comparison of fingerprints



①在服务器上创建数据库，并建立指纹列

②输入用户 ID，通过 ID 号到服务器中取指纹。

③服务器下载指定用户号的指纹到终端上，可储蓄或存入缓冲中。

④采集指纹，与下载指纹进行比对。

终端模组（1）

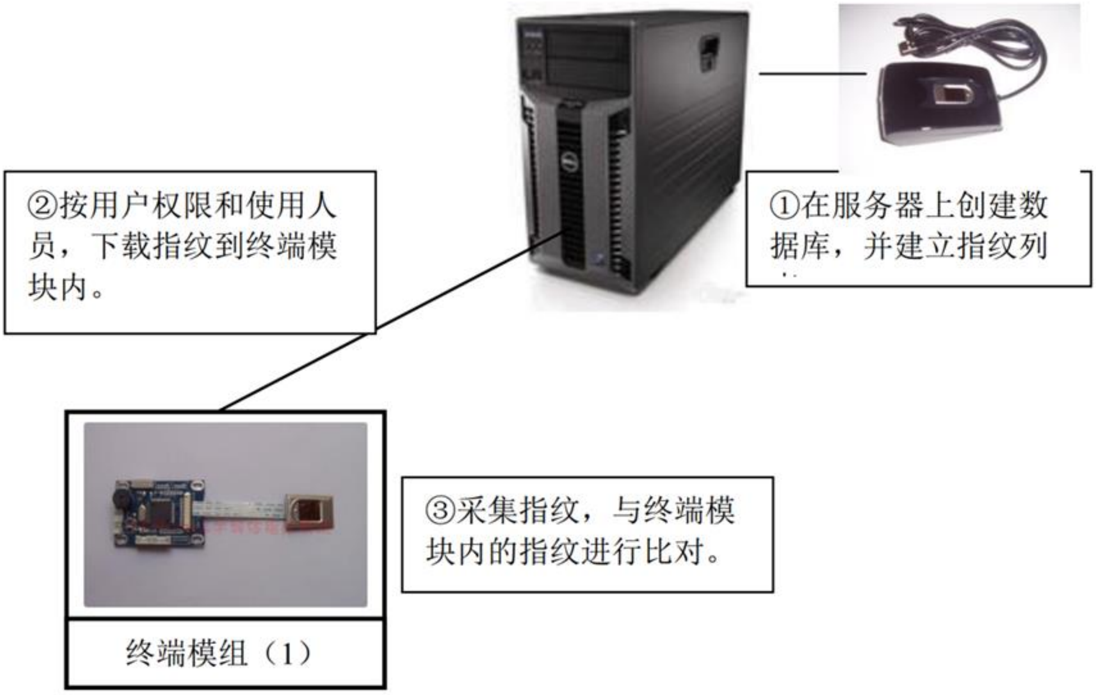
4. **Online comparison application (case B) includes devices**: download fingerprint to terminal, compare in terminal.

(1) terminal module

1) Create database and fill it by fingerprint's data

2) Download the fingerprint by stuff according user permission from server to module

3) Scan user’s fingerprint and compare it with loaded fingerprint


②按用户权限和使用人员，下载指纹到终端模块内。
①在服务器上创建数据库，并建立指纹列
③采集指纹，与终端模块内的指纹进行比对。
终端模组（1）

5. **Online comparison application (case C) includes devices:** terminal scanning fingerprint, uploading server for “1:1” comparison

(1) terminal module

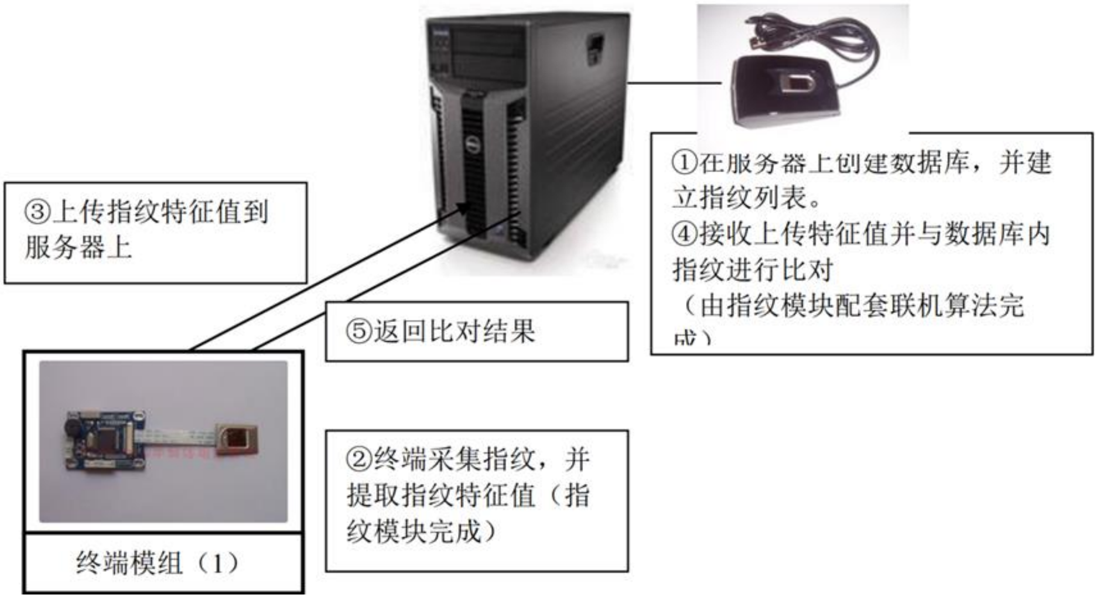
1) Create database and file it by fingerprint’s data

2) Scan fingerprint, obtain fingerprint’s characteristics (at fingerprint module)

3) Upload fingerprint’s characteristics to server

4) Accept uploaded characteristics and compare with certain characteristics from database

5) Return comparison result


①在服务器上创建数据库，并建立指纹列表。
④接收上传特征值并与数据库内指纹进行比对
（由指纹模块配套联机算法完成）
③上传指纹特征值到服务器上
⑤返回比对结果
②终端采集指纹，并提取指纹特征值（指纹模块完成）
终端模组（1）

6. **Online comparison application (case D) includes devices:** terminal scanning fingerprint, uploading server for “1:N” comparison

(1) terminal module

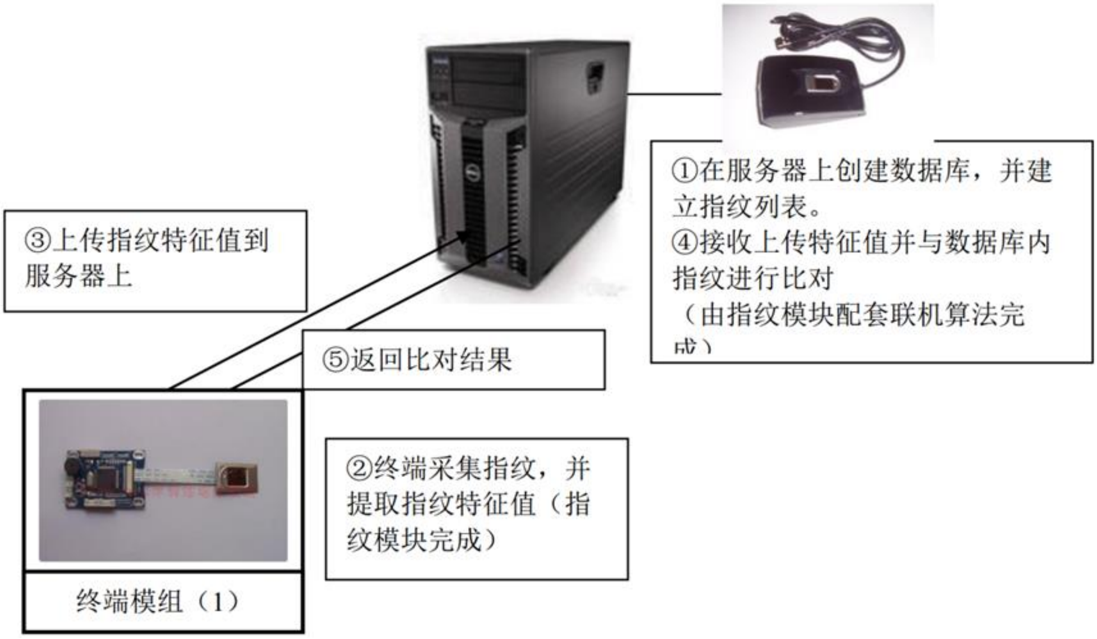
1) Create database and fill it by fingerprint’s data

2) Scan fingerprint, obtain fingerprint’s characteristics (at fingerprint module)

3) Upload fingerprint’s characteristics to the server.

4)Accept uploaded characteristics and compare with all characteristics from databse

5) Return comparison’s result.


①在服务器上创建数据库，并建立指纹列表。
④接收上传特征值并与数据库内指纹进行比对
（由指纹模块配套联机算法完成）
③上传指纹特征值到服务器上
⑤返回比对结果
②终端采集指纹，并提取指纹特征值（指纹模块完成）
终端模组（1）

7. **Fingerprint card application (case A):** loader of fingerprint from database by card ID, fingerprint scanning and comparing terminal

(1) terminal module

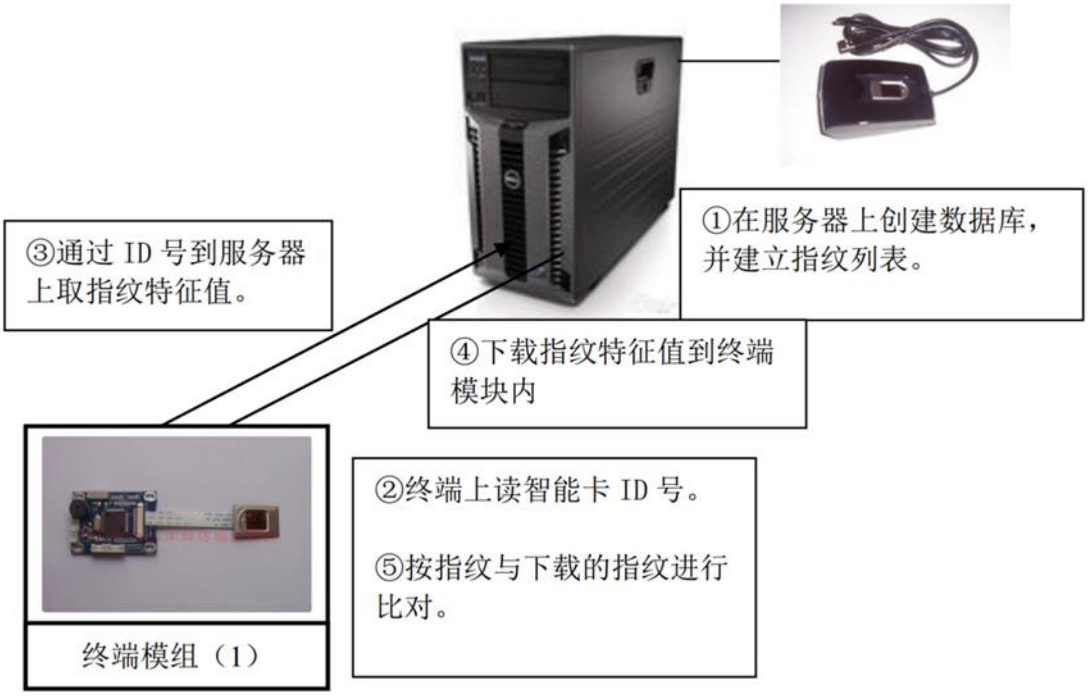
1) Create database and fill it by fingerprint’s data

2) Read card’s ID at terminal

3) Send ID to the server for getting fingerprint characteristics

4) Download the characteristics to fingerprint module.

5) Compare scanned fingerprint with download one



①在服务器上创建数据库，并建立指纹列表。

②终端上读智能卡 ID 号。

③通过 ID 号到服务器上取指纹特征值。

④下载指纹特征值到终端模块内

⑤按指纹与下载的指纹进行比对。

终端模组（1）

8. **Fingerprint card application (case B):** fingerprint memory card saver, fingerprint memory card downloader and comparator

(1) terminal module

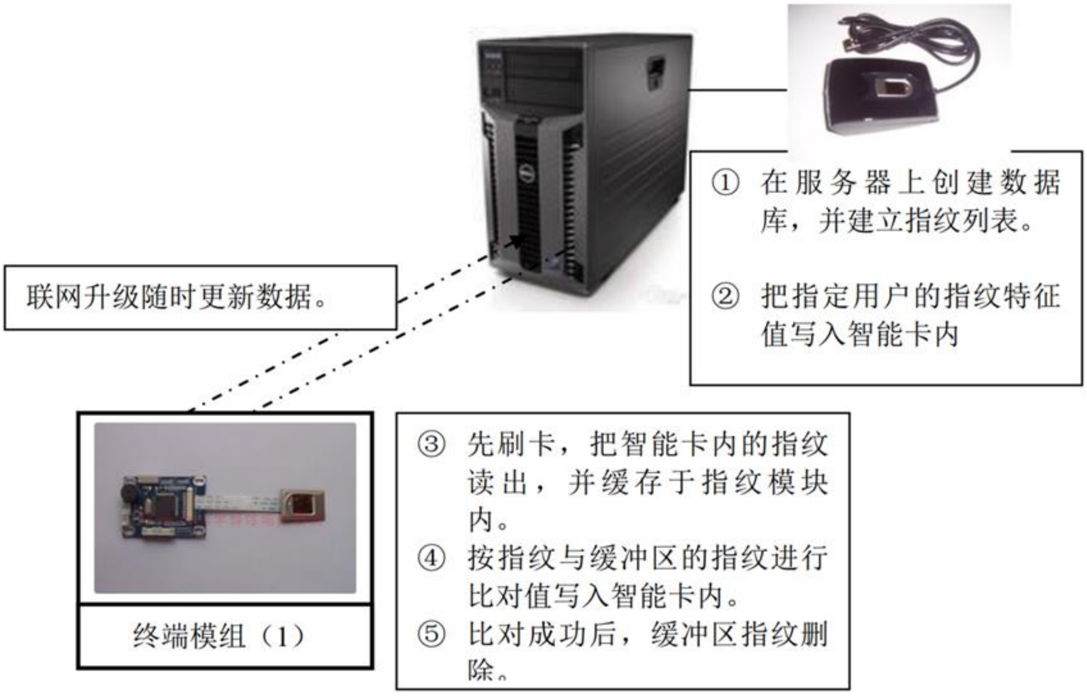
1) Create database and fill it by fingerprint’s data

2) Save fingerprint characteristics of the user into the memory of card

3) Use the card to obtain fingerprint characteristics and save them in it.

4) Compare characteristics of scanned fingerprint and kept in card memory one

5) Delete data from card’s memory after successful comparison.



① 在服务器上创建数据库，并建立指纹列表。

② 把指定用户的指纹特征值写入智能卡内

联网升级随时更新数据。

终端模组（1）

③ 先刷卡，把智能卡内的指纹读出，并缓存于指纹模块内。

④ 按指纹与缓冲区的指纹进行比对值写入智能卡内。

⑤ 比对成功后，缓冲区指纹删除。