



FUTRONIC

Model: FS28

FIPS201/PIV Bluetooth Fingerprint Scanner

User's Manual

Version 2.5

Update: 18 Oct 2012

FCC STATEMENT

FCC declaration of conformity

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

Note:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Responsible party:

Futronic Technology Co. Ltd.

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Handling precautions

Do not let the FS28 unit come into contact with or immersed in water or other liquids.

If any liquid enters the unit, do not allow unit to power on. Remove the external power adapter if it is still connected. Also remove the battery from its compartment.

Send the unit back for servicing.

If moisture condensation occurs, allow the unit to dry before using.

Battery handling

The battery used in the FS28 is a Li-ion type of battery. Some safety precautions must be observed.

Failure to observe this precaution may cause the battery pack to leak fluid, generate heat or explode.

- Strictly prohibits throw and wet cell in liquid such as water 、 gasoline or drink etc.
- Strictly prohibits use or leave cell close to fire or inside of a car with temperature above 60°C .
Also do not charge / discharge in such conditions.
- Strictly prohibits put batteries in your pockets or bags together with metal objects such as necklaces, hairpins, coins, or screws. Do not store or transport batteries with the above objects.
- If liquid leaking from the Cell gets into your eyes, do not rub your eyes. Wash them well with clean edible oil and go to see a doctor immediately
-

Discontinue use immediately should you notice any changes in the battery pack, such as discoloration or deformation

Cleaning the optical sensor

Do not use any abrasive material to clean the optical sensor

Notice:

1. Product design and specifications are subject to change without notice. This includes primary product specifications, software, software drivers, and user's manual. This User Manual is a general reference guide for the product.
2. Futronic assumes no liability for any errors or discrepancies in this user manual.

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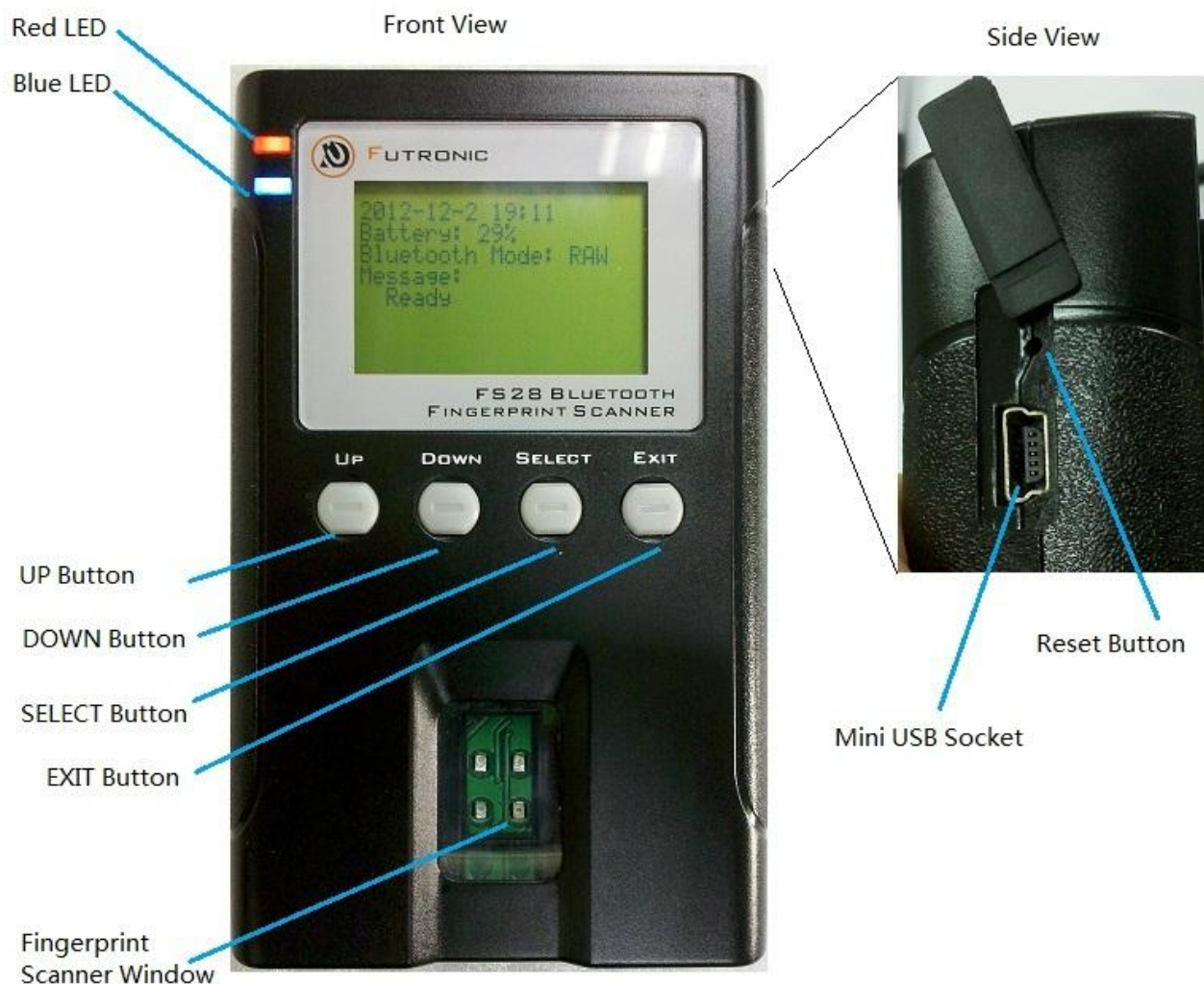
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Introduction

Futronic FS28 Bluetooth Fingerprint Scanner combines high performance optical fingerprint scanner and Bluetooth engine into one device. Under the control of any Bluetooth enable host device, it can capture fingerprint on-the-spot any time and transfer it to the host device via Bluetooth interface. This enables user to capture fingerprint easily with a mobile device such as smart phone or tablet PC in which Bluetooth is almost a standard interface, then transfer it to a remote Automated Fingerprint Identification System (AFIS) via mobile network.

FS28 was certified by FBI to be compliant with PIV-071006 Image Quality Specification for Single Finger Reader. So it meets the US Federal Information Processing Standard 201(FIPS 201) for Personal Identification Verification (PIV) of Federal Employees and Contractors.

FS28 can also work independently as a portable fingerprint matcher. The matching result will be show on the LCD. FS28 can also store 1000 fingerprint templates as well as 100,000 matching records. It can be used as attendance checker for field workers in remote locations.





Software and Demo program

Futronic provide starter kit for FS28, which include free demo program for Andorid Os, Windows XP/7. Please download the FS28 Starter Kit from Futronic's website.

http://www.futronic-tech.com/product_fs28.html

Operation and LEDs indication

Buttons Operation

Button	Function
UP	<ul style="list-style-type: none">· Move index up· Connect Bluetooth to last used host in the paired device list(PDL). The host's incoming port should be open before the FS28 make the connection to it.
DOWN	<ul style="list-style-type: none">· Move index down
SELECT	<ul style="list-style-type: none">· Select a menu item· Press and hold 2 seconds to enter administration menu
EXIT	<ul style="list-style-type: none">· Exit a menu item· Press and hold 5 seconds to Power On/OFF FS28
Reset	<ul style="list-style-type: none">· Reset FS28

LEDs indication

LEDs	Indication
Red LED flashes every 4-6 seconds	<ul style="list-style-type: none">· Battery Normal
Red LED flashes every 1 second	<ul style="list-style-type: none">· Battery Low
Red LED turns On solid	<ul style="list-style-type: none">· Battery charging. When battery is fully charged, the Red LED will go back to flash at every 4-6 seconds.
Red LED flashes 4 times per second.	<ul style="list-style-type: none">· Battery charging fails. At the same time the buzzer also beeps 4 times per seconds. Please check the battery connection.
Blue LED turns On solid	<ul style="list-style-type: none">· Bluetooth connected

Note:

1. Whenever FS28 is idle for 2 minutes (default setting), it will automatically enter power sleep mode, then the LCD will turn off. It will weak up if any button is pressed.
2. When FS28 is powered off, it still draws a little current for keeping its status. Please remove the battery when FS28 is planned not to use for a long period.

Operation Modes:

There are three Operation Modes in FS28 includes Bluetooth Mode, USB Mode and Local Mode.

Bluetooth Mode: This is used for transfer fingerprint image to a host (eg smart phone or PC) through Bluetooth. There are two types of images can be selected includes RAW image and WSQ image.

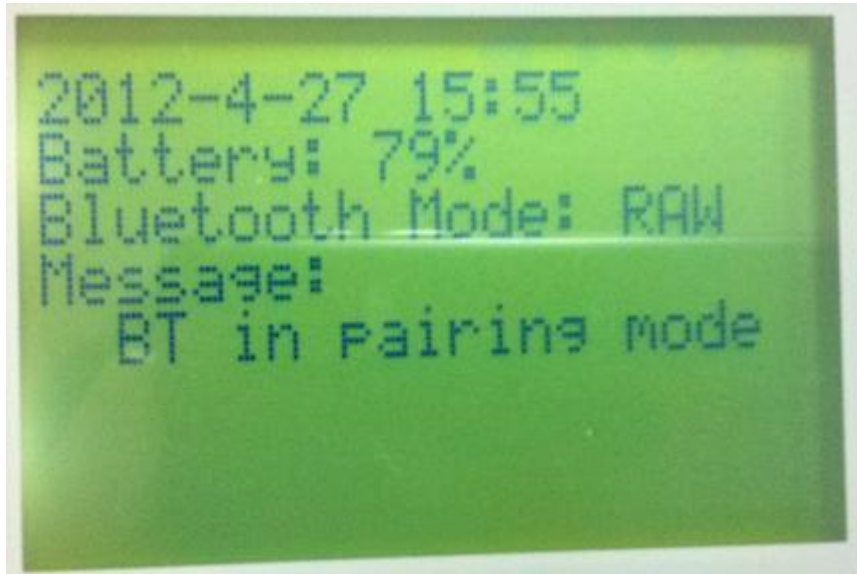
USB Mode: This is used for configuring FS28 with PC software. FS28 should connect to PC through USB cable. User data and logs can be sent to or got from PC. Other function include synchronize date time, fingerprint scanner testing and scanner firmware upgarde

Local Mode: In this mode, FS28 is working as a stand along fingerprint scanner. It can do fingerprint identification locally. You can store maximum 1000 fingerprint templates to FS28's local database.

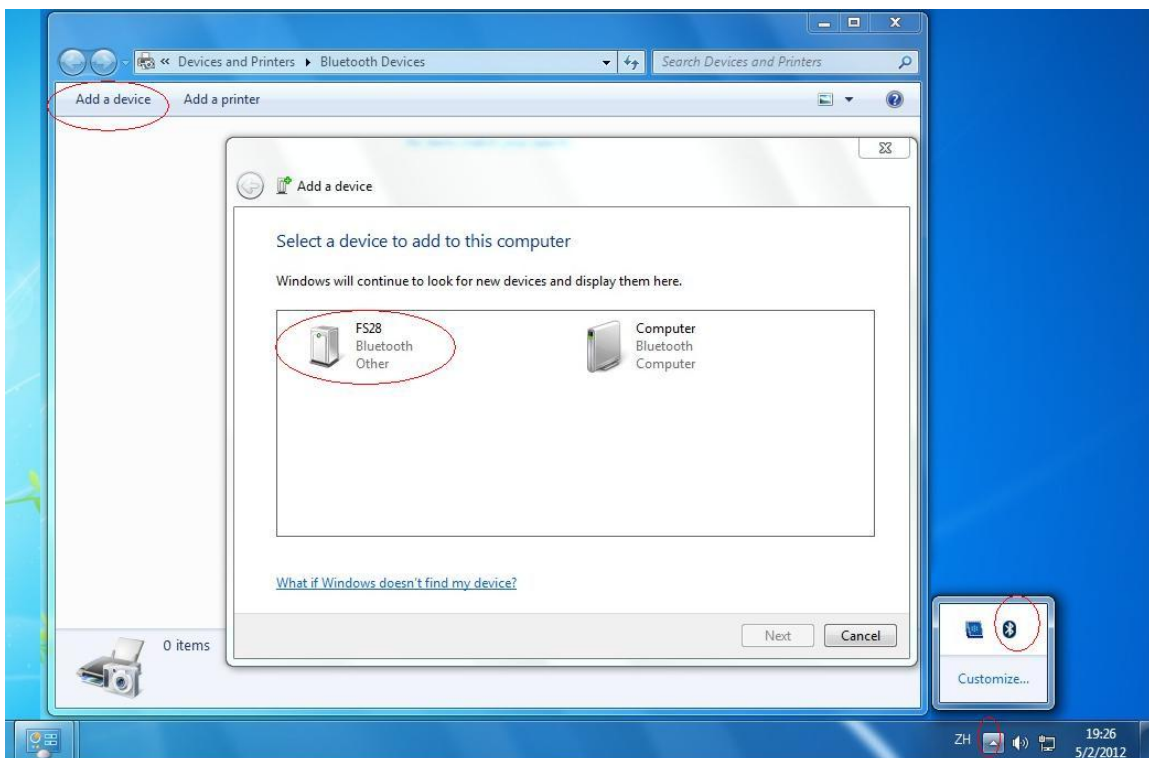
Connect FS28 with Windows

I. Pair FS28 with PC.

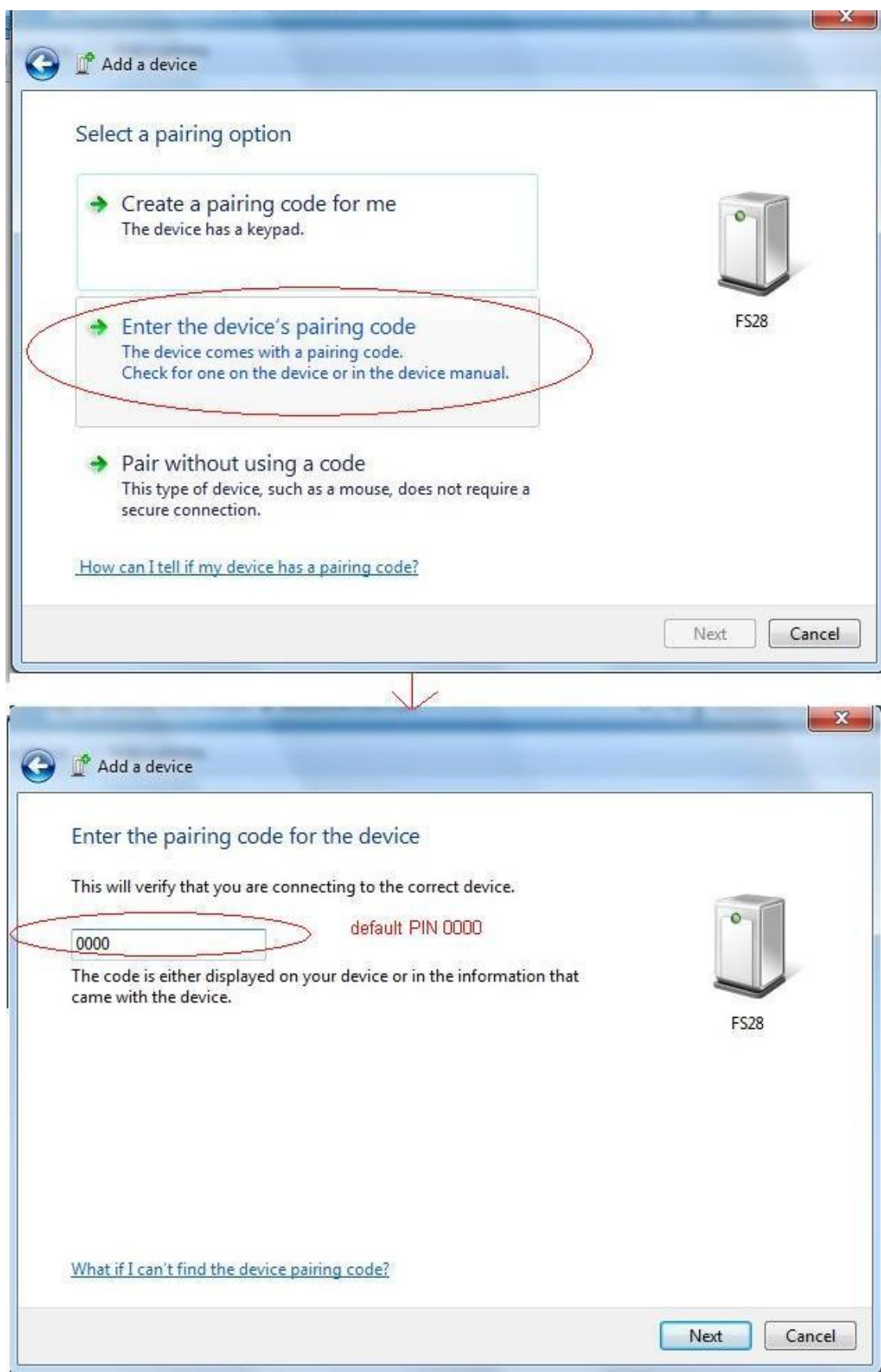
- A. Enter FS28 admin menu, go to 1.<Operating Mode> ,select 1.BT Mode (Bluetooth mode). Then go to 1.<BT Control> - > 3.enter pairing mode. Then return to Home menu, it will show:



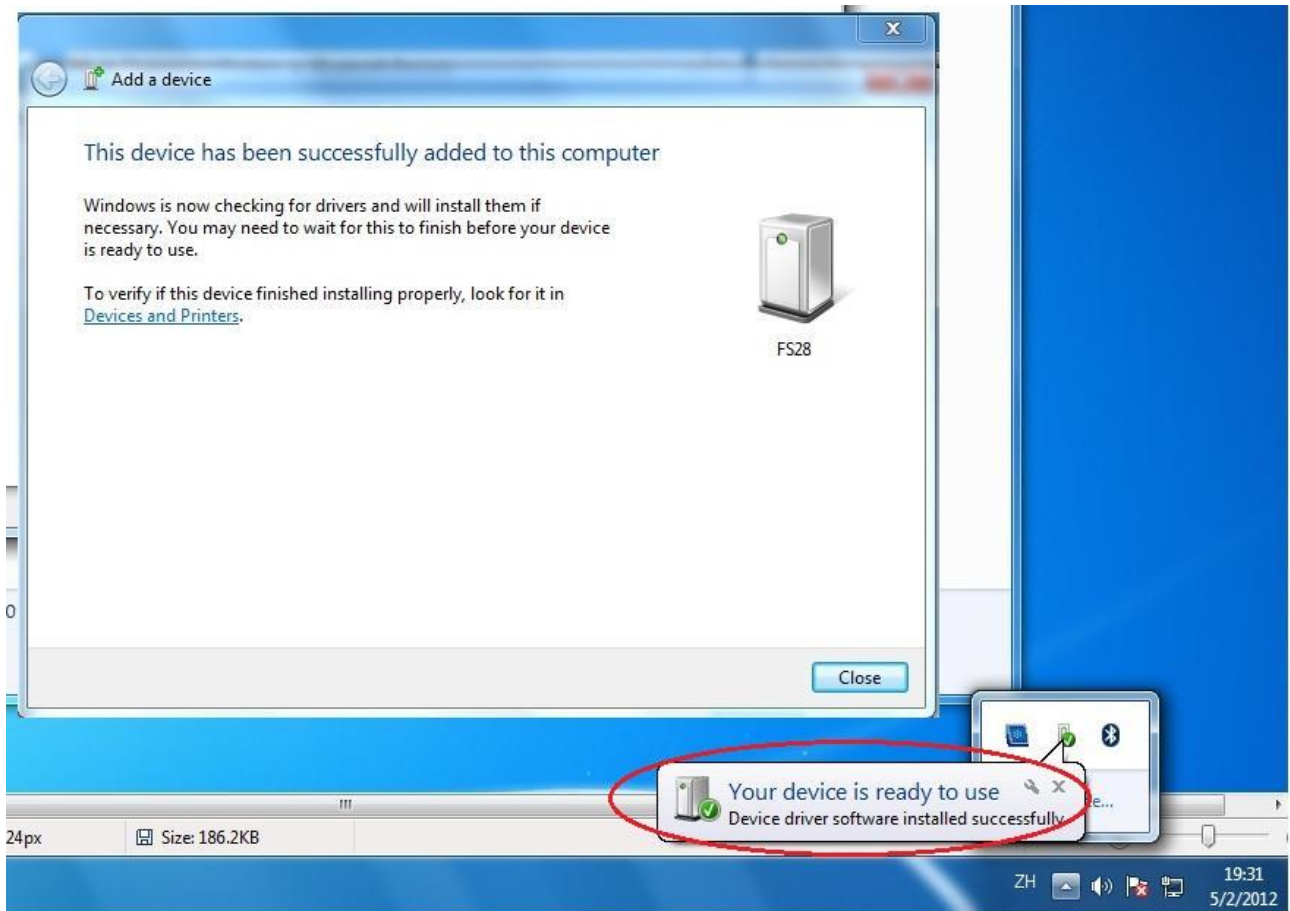
- B. Open the Bluetooth Device software in windows and add the FS28, please refer to following picture.



C. Pair with FS28, default PIN is “0000”. Please refer to following picture.



D. Window will show the message pair success and the device is ready to use. Then FS28 will show the message “paired, not connected” as below, that means although it is paired, but it have not been connected yet. Please refer to following pictures.

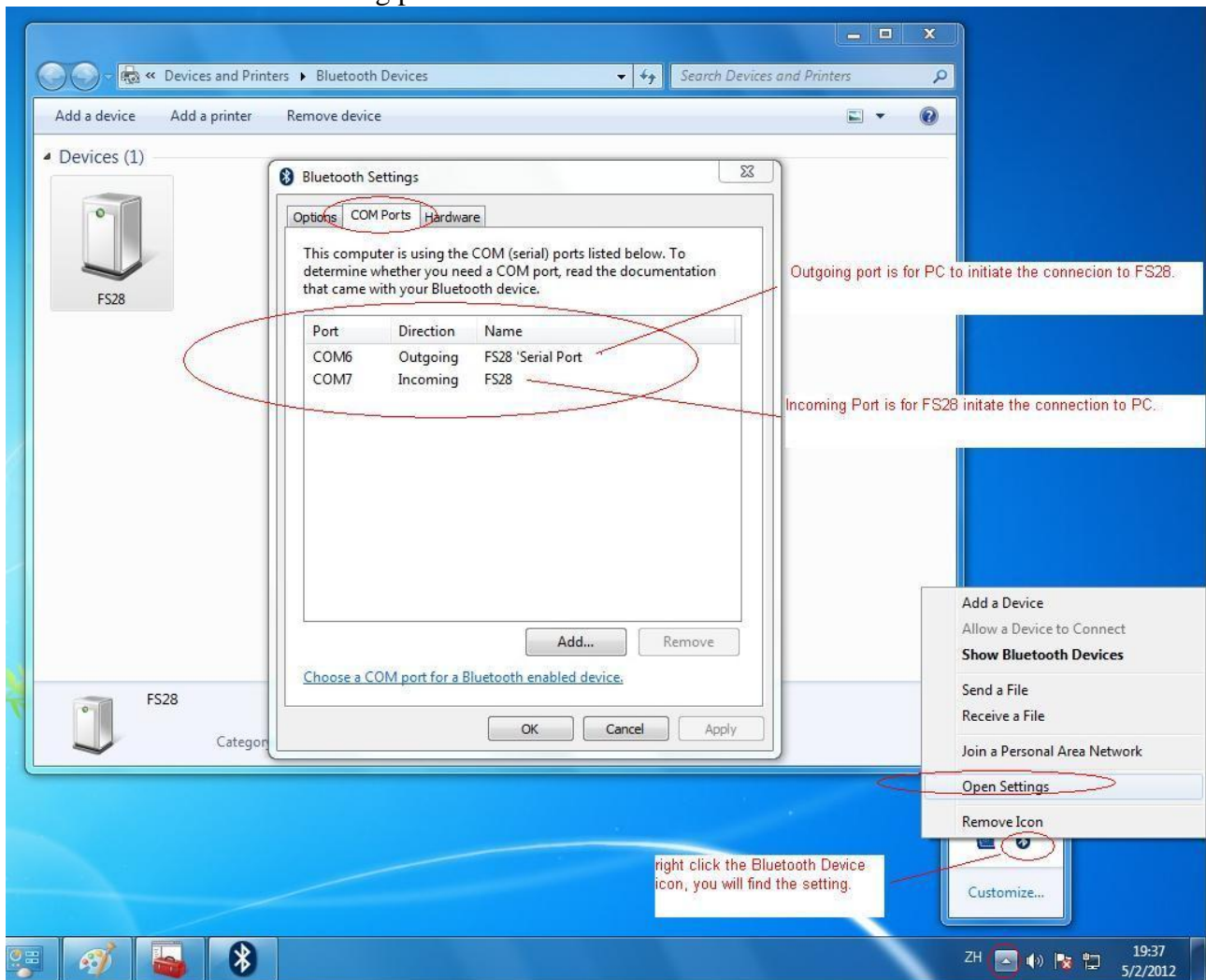


Although FS28 is paired, it has not been connected. The next step is to build the connection.



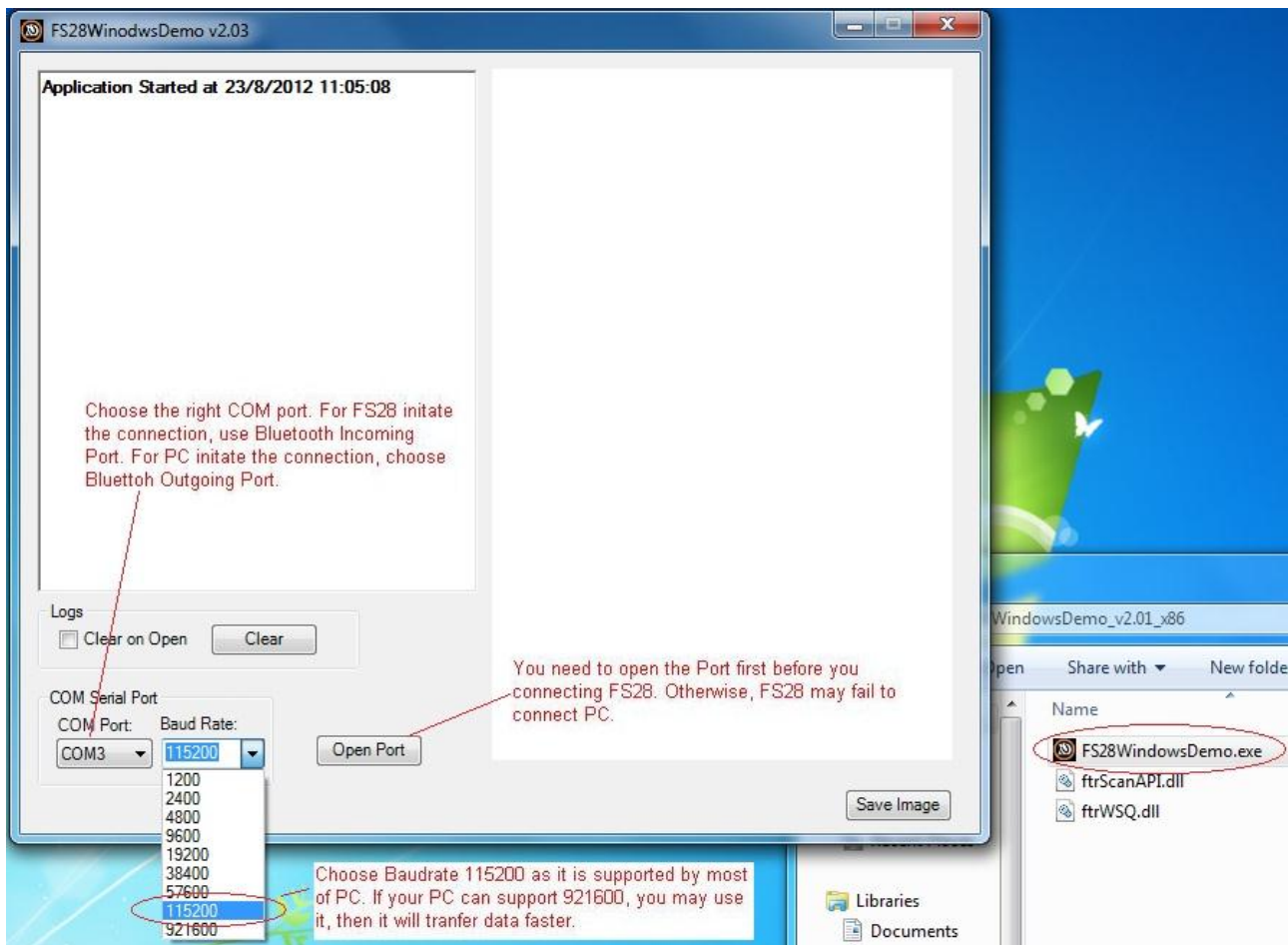
II. Open the Bluetooth COM port.

- A. Find Bluetooth Outgoing and Incoming port of Windows. Outgoing Port is used for PC to initiate the connection to FS28. Incoming Port is used for FS28 initiate the connection to PC. Please refer to following picture.



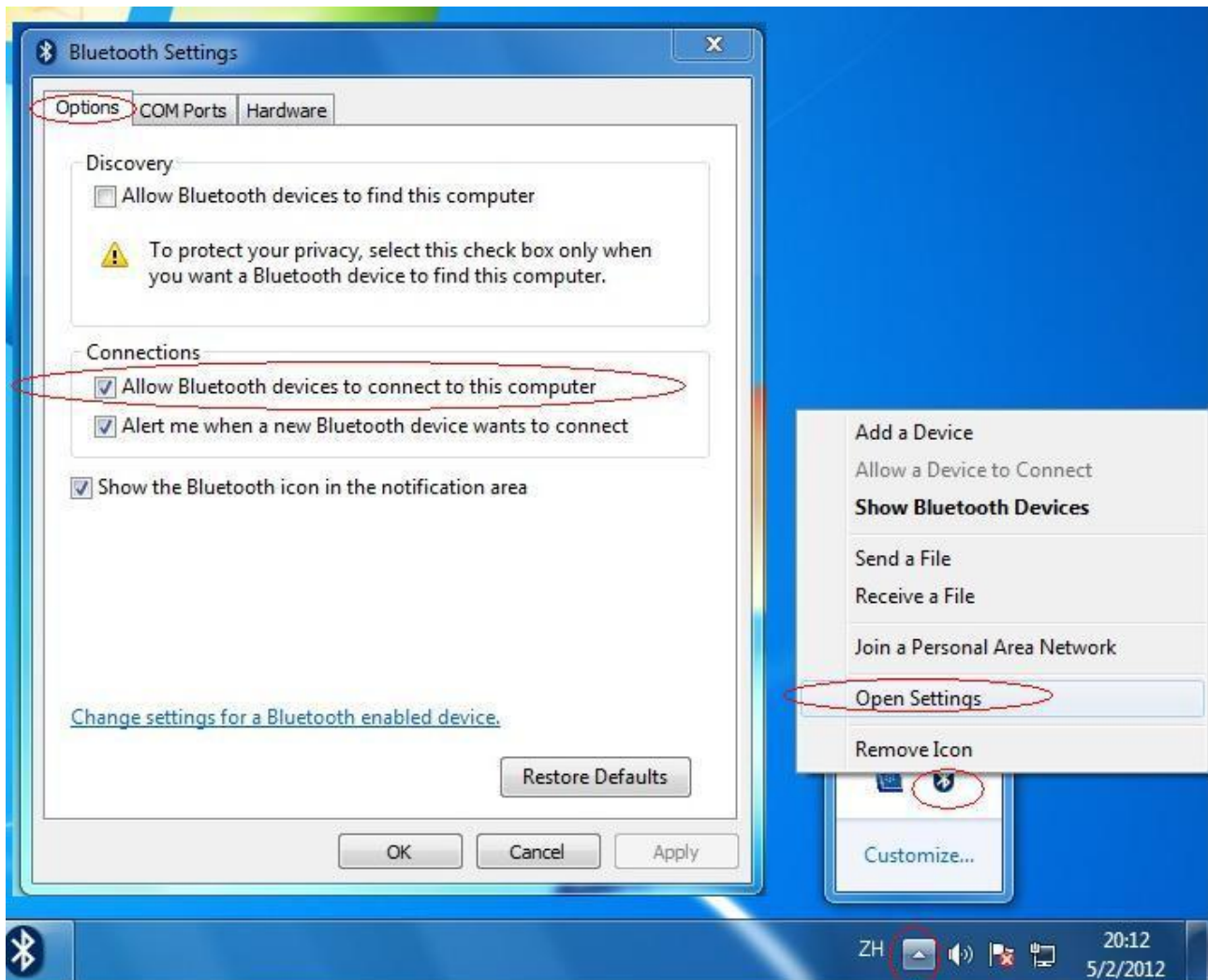
- B. For PC initiate the connection to FS28. Execute the “FS28WindowsDemo.exe”. Choose the Outgoing Port; select the Baudrate 115200 since most of the computers support this Baudrate. Please refer to following picture. When you open the outgoing port, the Bluetooth connection will be built.

Note: You need to have installed Microsoft .Net Framework 3.5 or above before you run the “FS28WindowsDemo.exe”. If your PC do not have Microsoft .Net Framework 3.5 or above, please download it from <http://www.microsoft.com/download/en/details.aspx?id=21>



III. Built up the Bluetooth Connection.

- A. For PC initiate the connection, please follow above the step in II B, then the Bluetooth will be built.
- B. For FS28 initiate the connection, first you should make sure the PC should allow the Bluetooth connection. Please refer to follow picture.



C. Press the UP button of FS28 to initiate the connection to PC. Windows may pop out “allow connection message”, select allow always.



D. If it is successfully connected, the blue LED of FS28 will turn on and the LCD will print Ready message as following picture, then you can scan you finger.



Connect FS28 to Smart Phone with Android OS.

I. Install FS28 demo program

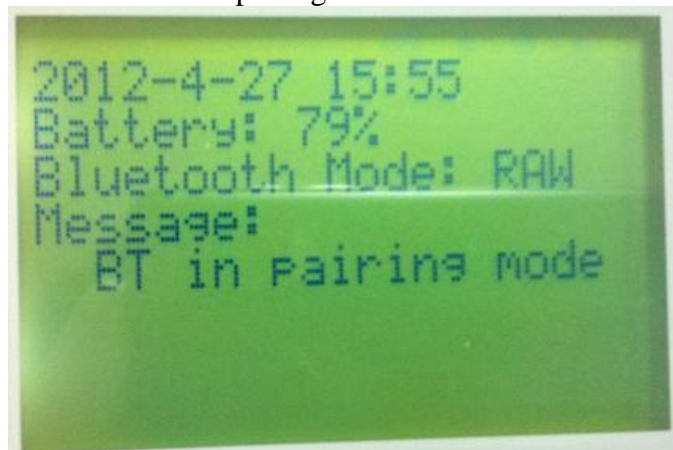
A. Go to application setting, select allow non-market applications.



B. Copy FS28DemoV2.0.apk to your Android device and install it.

II. Pair the FS28

Pair FS28 with Phone. Default PIN is "0000". Set FS28 to pairing mode. Enter FS28 admin menu, go to 1.<Operating Mode>, select 1.BT Mode (Bluetooth mode). Then go to 1.<BT Control> -> 3. enter pairing mode. Then return to Home menu, it will show:

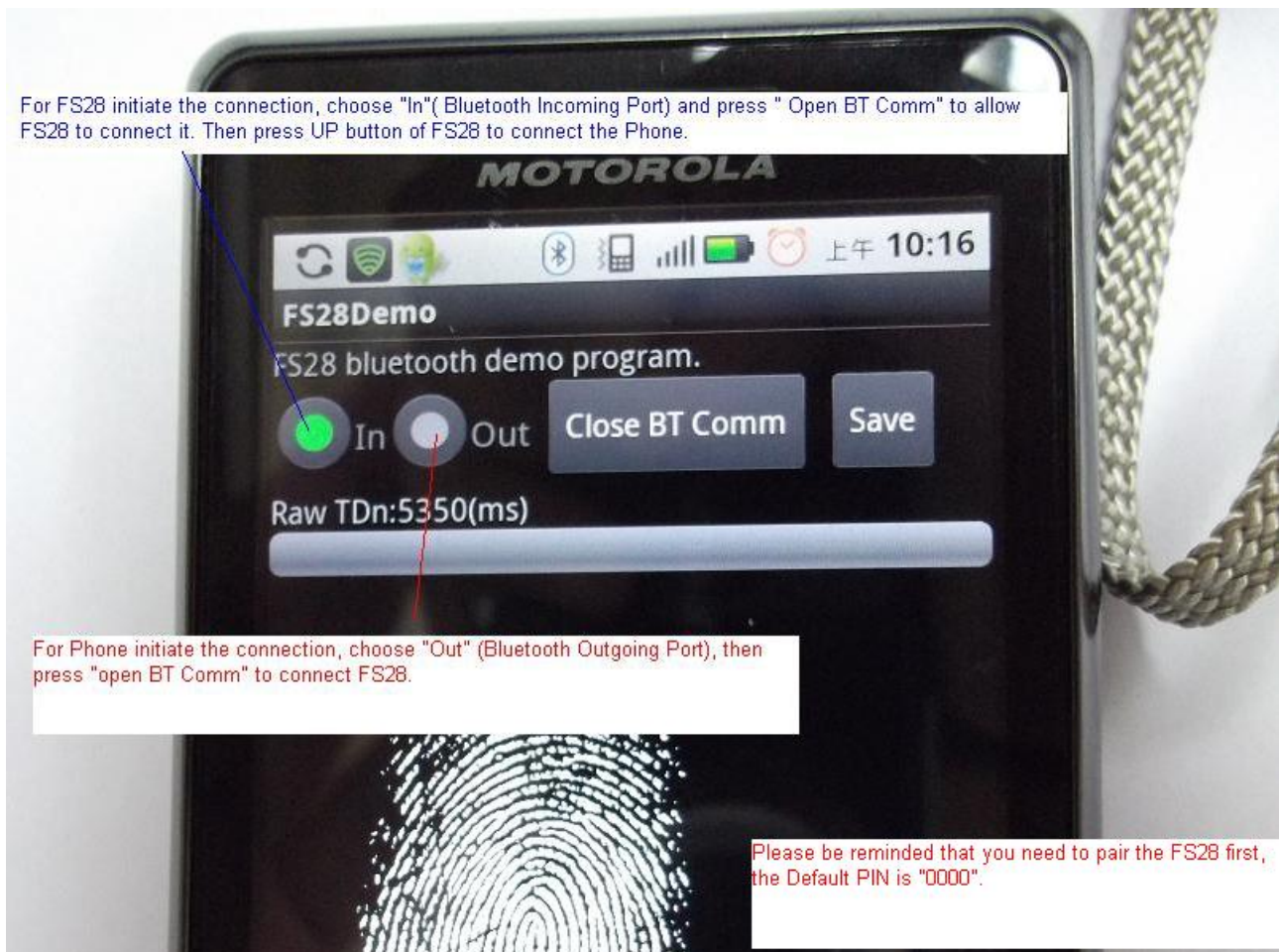


For the Android device, go to Setting/ Wireless and network/Bluetooth setting. Then search and pair FS28 with the Android device. Default PIN is "0000". Once you paired the FS28, it will show paired but not connected yet. You need to run the FS28Demo to build up the Bluetooth connection.

III. Connection Build up

After paired the FS28, please run the Android app FS28Demo.

- A. For Phone initiate the connection, open Bluetooth Outgoing Port. The connection is built.
- B. For FS28 initiate the connection, open Bluetooth Incoming Port, and then press UP Button of FS28 to connect.



FS28 working in USB mode.

USB mode is used for checking functionality of the fingerprint scanner module. It also use for enrolling user into the FS28's local database.

Please follow the procedures below to use USB mode.

Step 1: disconnect the BT connection if it is connected.

Step 2: Enter FS28 admin menu, go to 1.<Operating Mode> - > 2.USB mode.

After selecting USB mode, the Home menu will be upgrade as below:

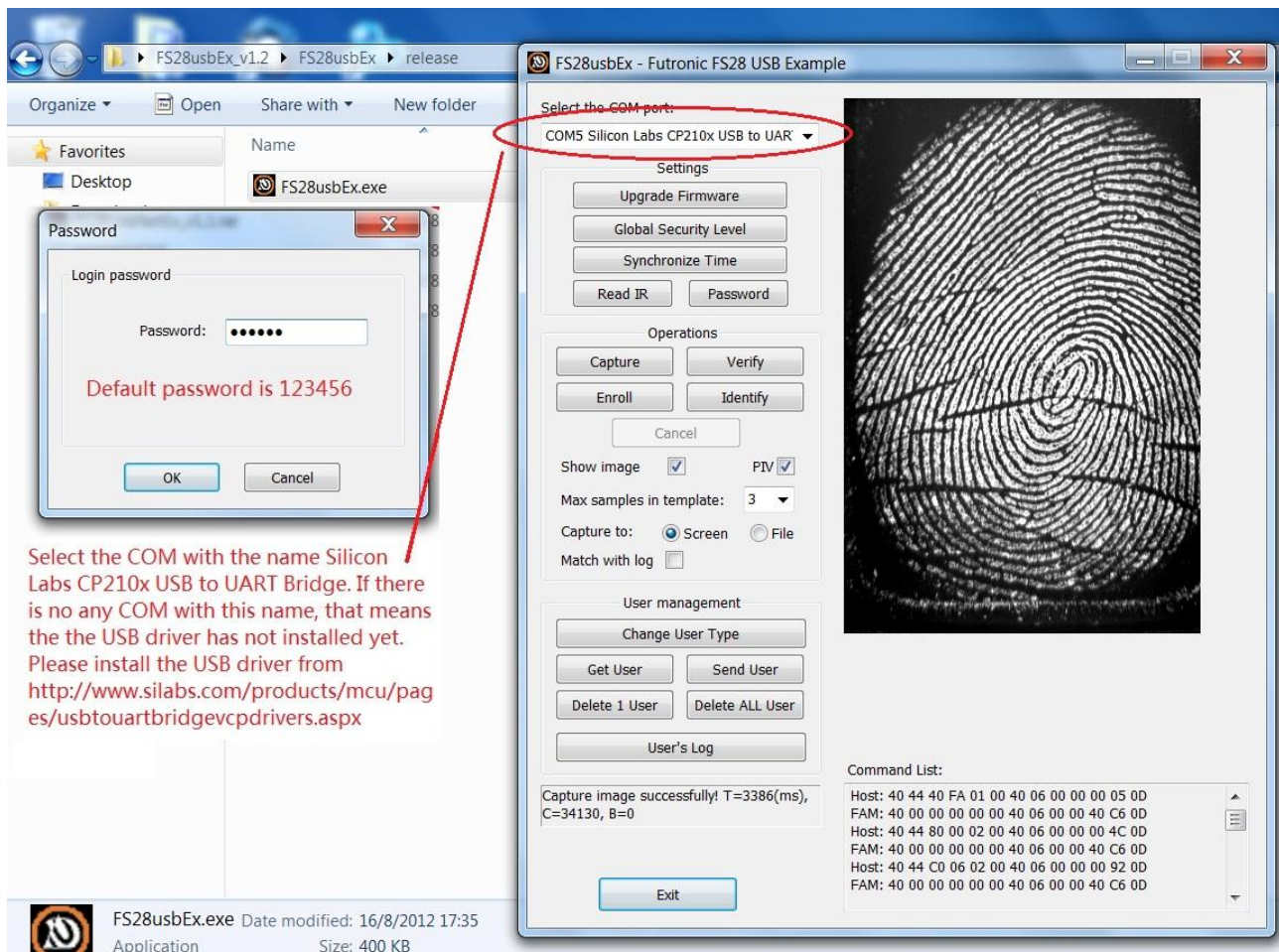


Step 3: Connect the FS28 to your PC with the Mini -USB cable. If it is the first time you connect FS28 to PC. It will pop up message to install USB driver for CP2101 USB to UART Bridge. Please install the USB driver “CP210x_VCP_Win_XP_S2K3_Vista_7.exe” from the FS28 Starter Kit or you can download it from

<http://www.silabs.com/products/mcu/pages/usbtouartbridgevcpdrivers.aspx>

After installing the USB driver, you need to reconnect the USB cable in order take effect.

Step 4: run the “FS28usbEx.exe” or “FS28UsbNetEx.exe” in your Window and chose the right COM port which name is CP2101 to USB Bridge. Password is need for running these tools. Default password is 123456, you can change the password with that tools.



Here are some introductions of the functions.

Upgrade Firmware: FS28 has two firmwares. One is called BF/FW, which is the firmware of fingerprint scanner module. The other one is called AVR/FW, which is the firmware of AVR MCU. This function is only used for upgrade the BF/FW but not uses for upgrading AVR/FW. For introduction of upgrade AVR/FW, please refer to the section “Upgrade AVR Firmware” on page 16.

Global Security Level: The security level is from 0-3, the level 3 is the highest security level and level 0 is the lowest. The higher the security level, the more detail of the fingerprint image needs to check during identification.

Synchronize Time: It is use to synchronized the time of PC to FS28. Note, the synchronized time will not be shown on FS28 when it is in USB mode. The synchronized time will be shown when FS28 leave the USB mode.

Capture: use to capture a RAW fingerprint image.

Verify: use for 1:1 matching, USER ID is needed to select before scanning the finger.

Identify: use for 1:N matching.

Enroll: use to enroll a user to FS28’s local database.

Get User: use to send user from FS28 to PC.

Send user: use to send user from PC to FS28

Match with log: select it if you want to save access log when doing identification.

User Log: use to view or get user log that store in the FS28’s local database.

Change User Type: There are two types of user. Ordinary user (1:1) matching, USER ID is needed to select before scanning the finger. Ordinary user only can be used in USB mode. VIP user(1:N) matching, no need to enter user ID before scanning, identification is done in whole local database of FS28. VIP user should be registered if they have to be identified in Local mode. Ordinary users cannot be identified in Local mode.

Please be remained that when FS28 is working in USB mode, all the Bluetooth function will be disabled. If want to use Bluetooth function, please leave USB mode and select Bluetooth mode.

FS28 working in Local mode.

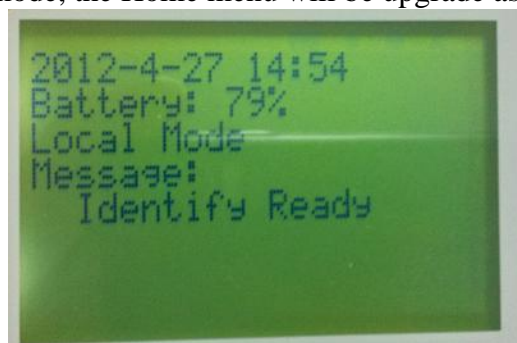
Local Mode is used for identify users which are stored in FS28's local database. It can also be used to enroll vip user to the FS28's local database.

Please follow the procedures below to use Local mode.

Step 1: disconnect the BT connection if it is connected.

Step 2: Enter FS28 admin menu, go to 1.<Operating Mode> -> 3.Local Mode. Then go to Home Menu and it will ready to identify user.

After selecting local mode, the Home menu will be upgrade as below:



Enroll a new user.

For enroll a new user to the FS28's local database. Please follow these steps:

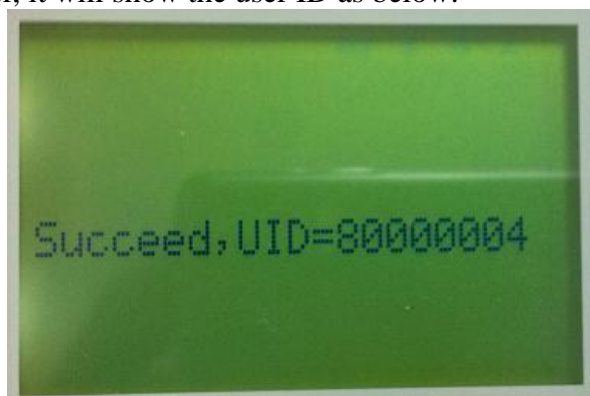
Step 1: disconnect the BT connection if it is connected.

Step 2: Enter FS28 admin menu, go to 1.<Operating Mode> -> 3.Local Mode.

Step 3: Choose the Enrol Finger function by entering FS28 admin menu.

Go to 1.<Operating Mode> -> 4.Local Enrol finger.

Then it will ask you to scan finger 3 times in order to get 3 samples of your finger. After successfully enrolled a user, it will show the user ID as below:



Security Lock

Security Lock is use to prevent un-authorized persons to use the FS28. If this function is enabled, security finger is needed to be checked before log on to FS28. The locked screen is shown as below.



To enable security lock, a security finger is needed to be registered first. The procedure of registering a security finger is shown below.

Step 1: select Local Mode.

Step 2: Go to **4. <Security Finger> / 1. Enrol Security Fin** , follow the instruction to enroll an security finger.

Step 3: Go to **4. <Security Finger> / 2. VerifySecurity Fin**, verify the security finger enrolled. If verify fail, you need to delete that enrolled finger and try to enroll again. To delete an enrolled finger, go to **4. <Security Finger> / 3. DeleteSecurityFin**.

Step 4: If the enrolled security finger is verified success, you can starter using the security lock. Just turn on the security lock at **4. <Security Finger> / 4.Security Lock On**. Then whenever FS28 is powered on or wake up from sleep mode, security finger is needed to be checked before entering the system.

There are total four security fingers can be registered. If all security finger are deleted the security lock function will be turned off automatically. All security fingers will be assigned in Group 2. Normal fingers are assigned in Group 1. To delete a security finger, you should go to **4. <Security Finger> / 3. DeleteSecurityFin**. You should never delete any security finger by using PC software in USB mode.

If you no longer need security lock, just turn off security lock by **4. <Security Finger> / 4.Security Lock Off**.

Upgrade AVR Firmware

FS28 has two firmwares. One is called BF/FW, which is the firmware of fingerprint scanner module. The other one is called AVR/FW, which is the firmware of AVR MCU. In this section, only the procedure of upgrading AVR/FW is introduced. For introduction of upgrade BF/FW, please refer to the section “FS28 working in USB mode” on Page 12.

Warning:

Please be reminded that if the current version of AVR/FW works fine in the FS28, you are suggested NOT to upgrade it as the FS28 may be damaged whenever there is any problem during upgrade.

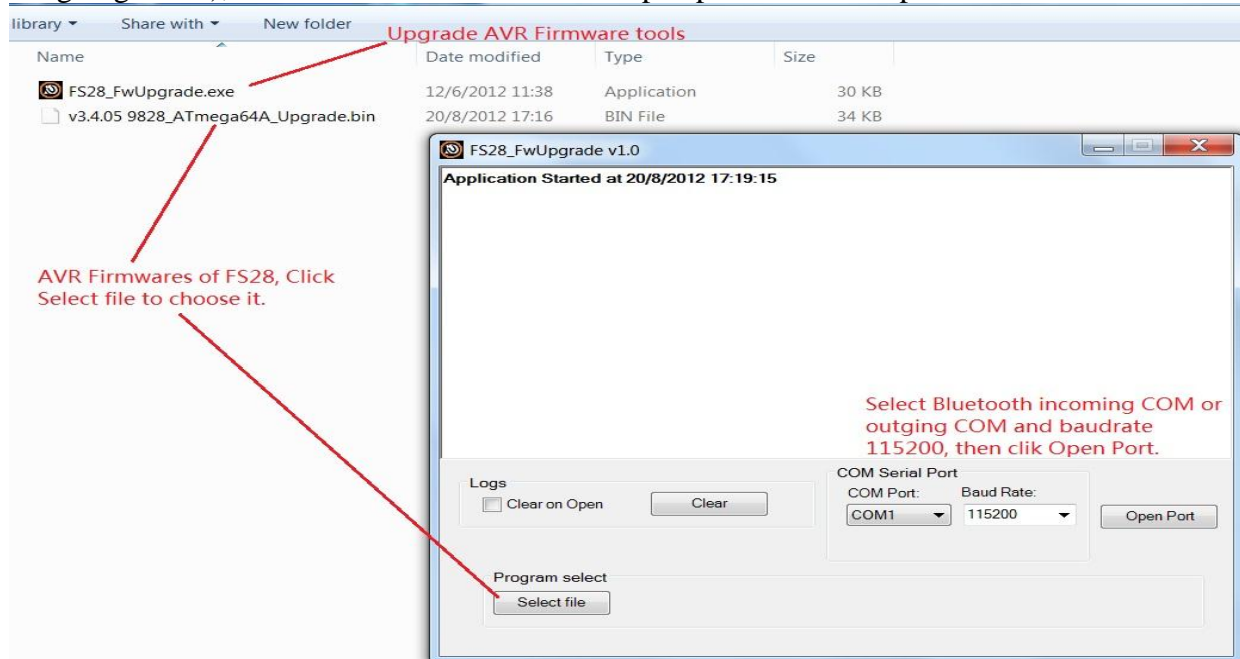
The procedure of upgrading FS28:

Step 1: Make sure the battery level is higher than 50%. If the battery level low, please plug in USB cable to supply power to FS28.

Step 2: select and enter Bluetooth mode.

Step 3: Pair and build up Bluetooth connection to a PC running Windows XP/ 7. For the procedures of pair and connect Bluetooth, please refer to the section “Connect FS28 with Windows” on page 2.

Step 4: Run the FS28_FwUpgrade.exe, choose the right COM port (Bluetooth incoming COM or Outgoing COM), Baudrate 115200. Then select open port and build up the Bluetooth connection.



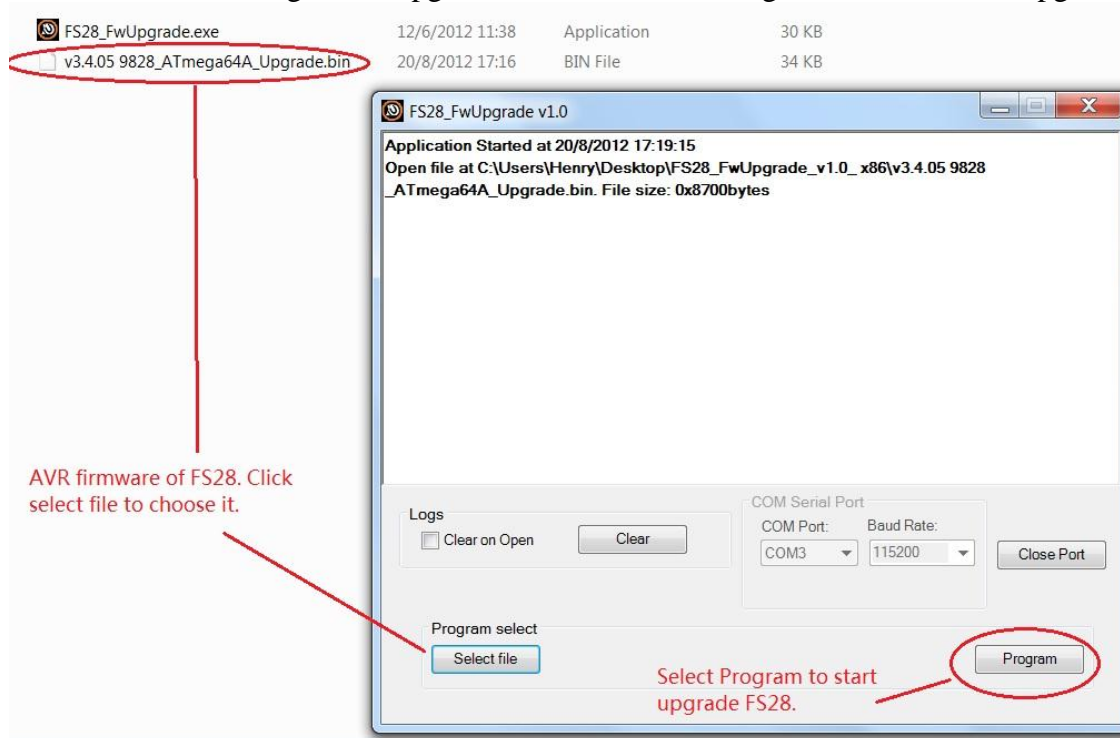
Make sure the Bluetooth is connected, the Blue LED is on and the LCD show “Ready”.



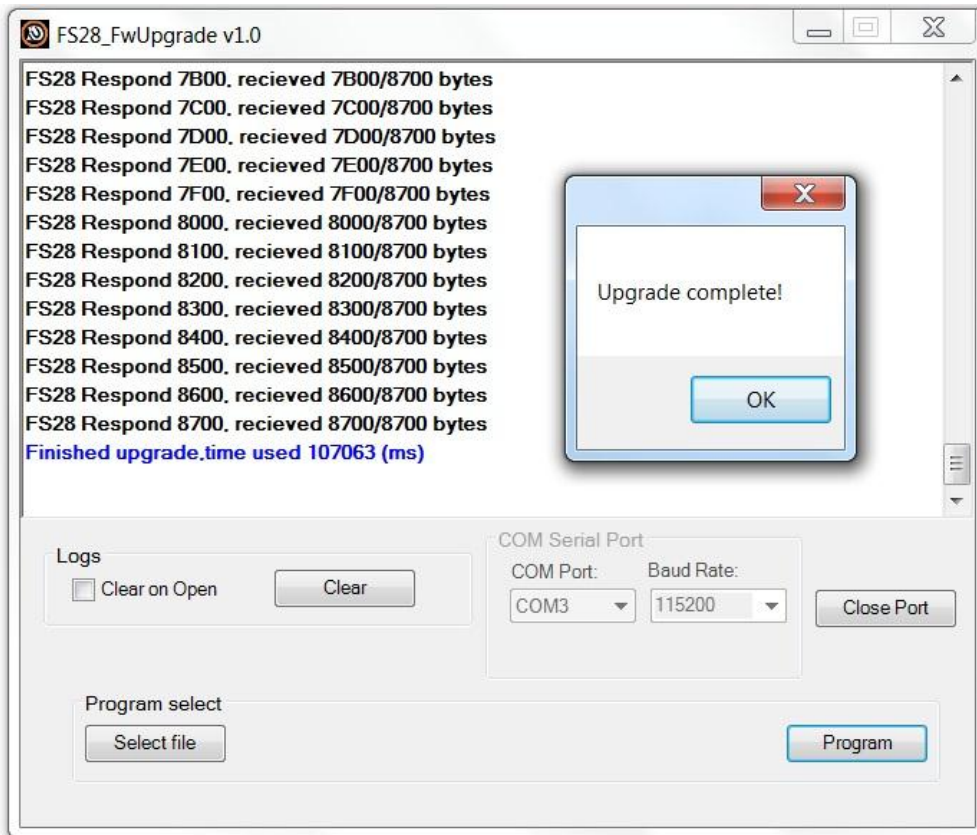
Step 5: go to FS28: 6.<Firmware> / 2.Upgrade AVR and select proceed until it show following screen: The Blue LED and read LED both turn On.



Step 6: Go to FS28_FwUpgrade.exe on PC side; Select the AVR firmware, the name is looks like 'vX.X.X 9828_ATmega64A_Upgrade.bin'. Then click Program button to start upgrade FS28.



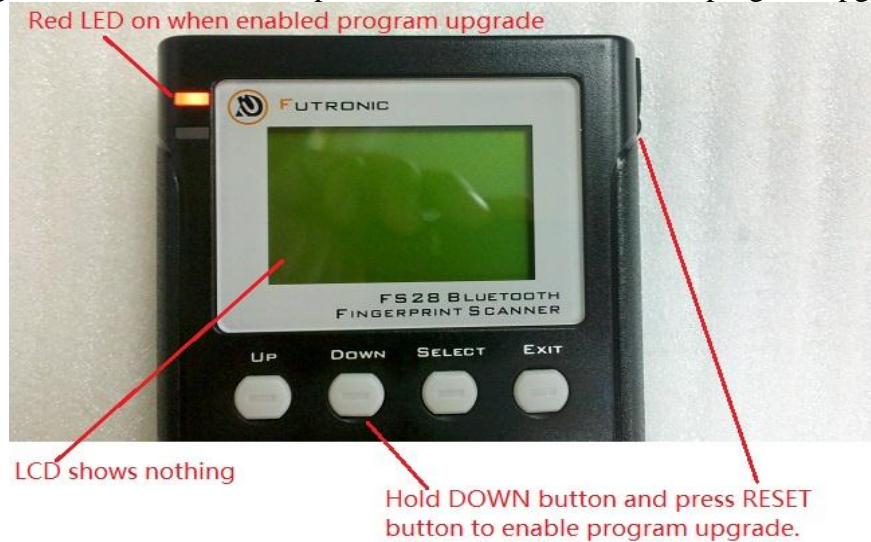
Step 7: Do not press any buttons of FS28 and do not disconnect the Bluetooth until finish upgrading FS28. When finish upgrading, it will pop up message box like following and FS28 will automatically reboot. Then you can start using the new firmware.



How to do if there is a problem during upgrading AVR firmware?

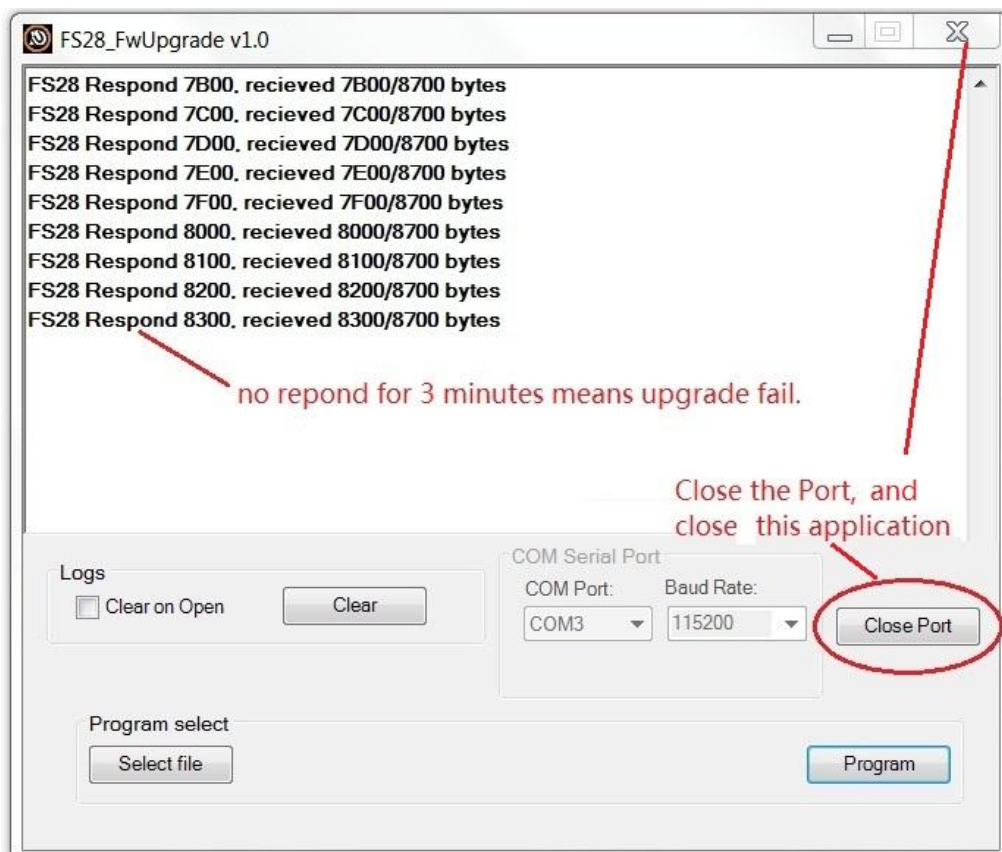
If FS28 does not respond for 3 minutes during upgrading the AVR firmware, then it may hang and the upgrade process is fail. In this case, you need to re-enable program upgrade by following this procedure.

Step 1: Holding the DOWN button and press reset button to re-enable program upgrade.



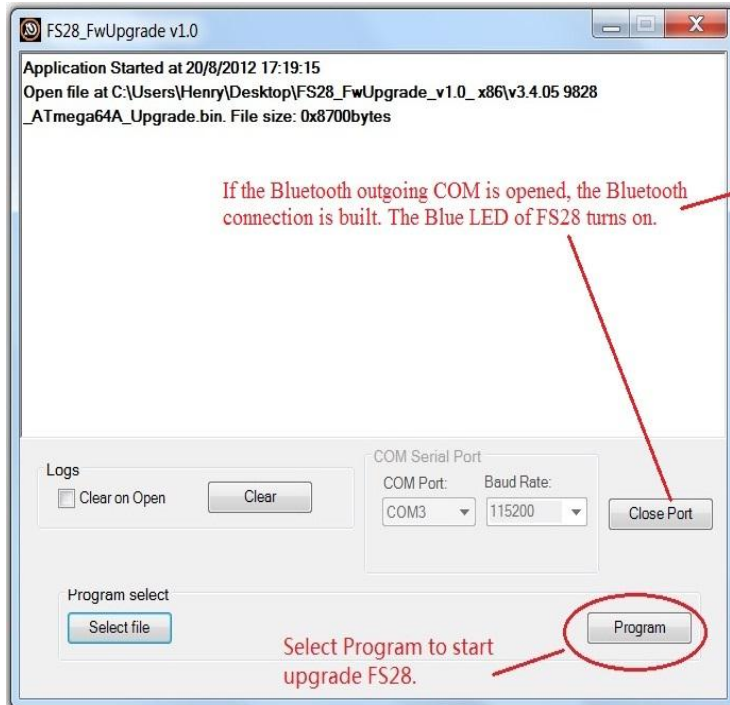
There will be a "beep beep" from buzzer when enabled program upgrade

Step 2: Close the port and quit the application in PC side.

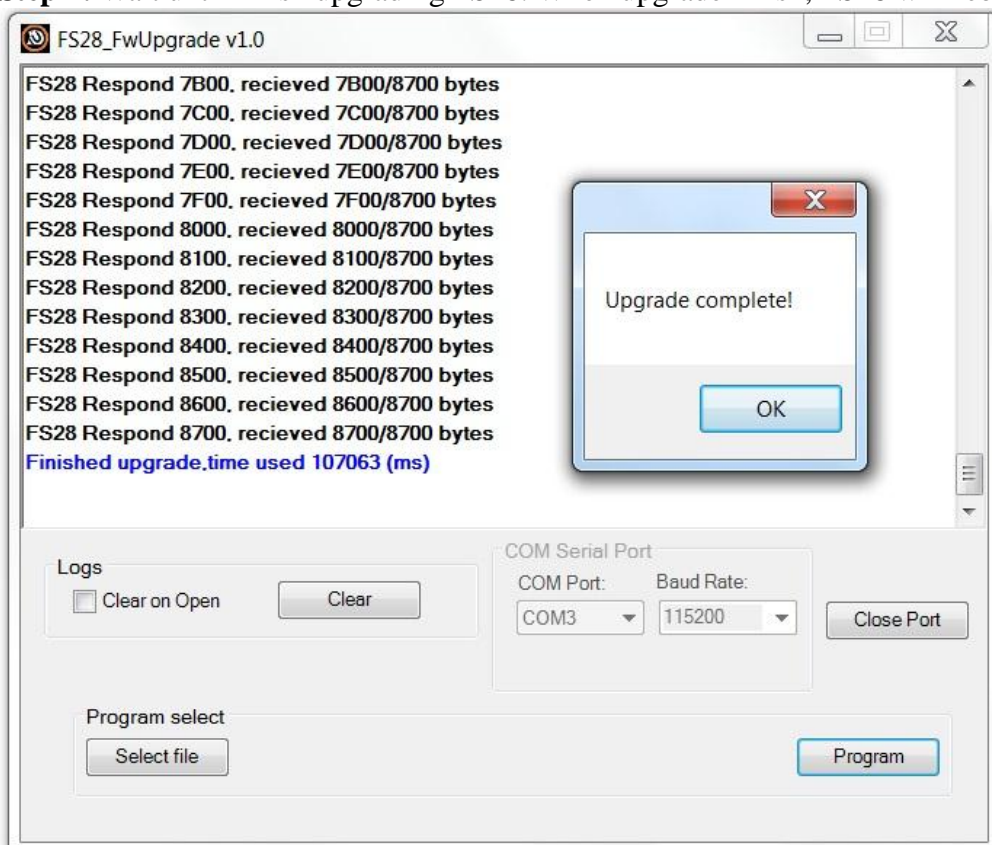


Step 3: Run the FS28_FwUpgrade.exe again. Choose Bluetooth outgoing COM port. If you do not know which COM is Bluetooth outgoing COM, please go back to page 5 about “Open the Bluetooth COM port”. If you fail to open this COM port, you have to re-boot your PC and try again.

If the Bluetooth outgoing COM is opened, the Bluetooth connection is built. The Blue LED of FS28 turns on. Then you can select the AVR firmware and start upgrade the FS28 again.



Step 4: Wait until finish upgrading FS28. When upgrade finish, FS28 will reboot.



Battery

I. Specification of the battery:

Type: rechargeable polymer lithium-ion battery

Capacity: 1500mAh

Nominal Voltage: 3.7V

NTC: 10K Ω

Battery discharge period listed as below:

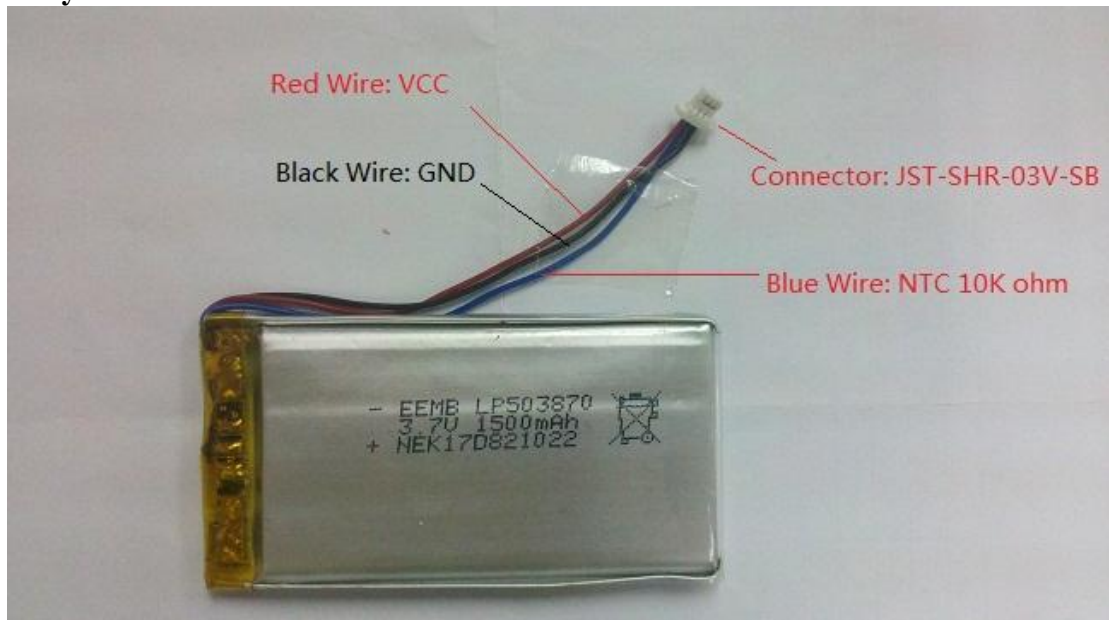
Active mode (for continuously run in maximum rating): 5 hours

Idle sleep mode: 1 day

Power off mode: 3 days

Please be reminded that FS28 still draw some current in power off mode and the battery can only maintain for 3 days in this mode. Therefore, if FS28 is planned to not use for a long period, please remove the battery completely to prevent battery from over-discharged.

II. Battery Cables



III. Warning for battery usage

1. Strictly prohibits throw and wet cell in liquid such as water、 gasoline or drink etc.
2. Strictly prohibits use or leave cell close to fire or inside of a car with temperature above 60 °C. Also do not charge / discharge in such conditions.
3. Strictly prohibits put batteries in your pockets or bags together with metal objects such as necklaces, hairpins, coins, or screws. Do not store or transport batteries with the above objects.
4. If liquid leaking from the Cell gets into your eyes, do not rub your eyes. Wash them well with clean edible oil and go to see a doctor immediately

IV. Battery level indication:

Battery charging:

When battery is charging, the red LED will turn on and it will turn off when the battery is fully charged.

Please be reminded that the battery level show on the LCD may not correct during charging. It may show the battery level is 100%; however, the charging is not complete yet. User need to wait until the red LED turn off which indicates the battery is fully charged.

Battery Normal:

When battery level is between 20 -100%, the red LED will flash slowly (flash per 5 seconds).

Battery Low:

When battery level is below 20%, the red LED will flash fast (flash per second). The LCD will show Low battery.

Battery Cut -off:

When battery level is too low (about 1%), FS28 will automatically turn off. The LCD will show message “Too low battery power off” before FS28 turn off.

Specification

FS28 Specification:

- Mobile ID FAP 20 device.
- Bluetooth 2.1, class 2, 10 meter communication range (barrier-free space).
- Display: 128 x 64 dot matrix LCD
- Supply voltage: 3.7V from 1500mAH lithium-ion rechargeable battery
- With built in charger
- Output image format: Binary or WSQ
- Interface to host: Bluetooth and USB
- Status indicator: buzzer and red/blue LED
- Current consumption: Active: 250mA, idle: 45mA
- Size: 130mm(L) x 82mm(W) x 30mm(H)
- Weight: 400 grams
- Operation temperature (without Battery charging): -10 to +55 Degree Celsius
- Battery charging temperature: 0 to +43 Degree Celsius

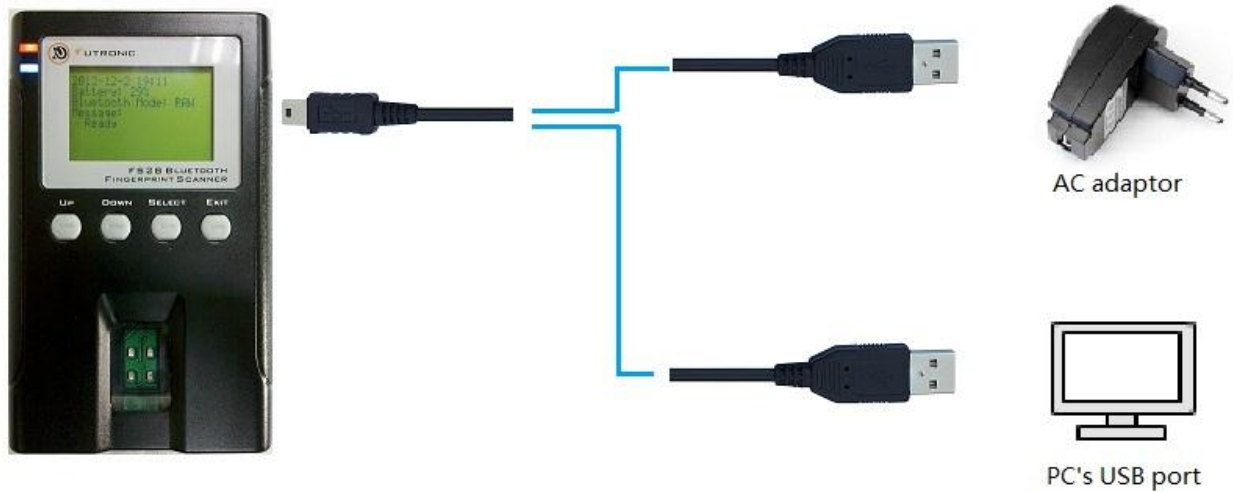
Fingerprint Scanner specification:

	Full	PIV certified
Image size(mm)	16.26x24.38	15.24x21.33
Image resolution(pixels)	320x480	300x420

- 500 DPI, 8 bit grey level.
- Raw fingerprint image file size is 150K byte
- Illumination: Infrared LED
- Operating systems: Windows, Linux and Android.
- Processor: Analog Device ADSP-BF532
- Can enroll and store 1000 fingerprint templates
- Can store up and 100,000 matching records
- With Futronic fingerprint recognition algorithm
- Fingerprint recognition accuracy: FAR=10-6, FRR=10-2
- It can be linked with other Futronic products to form a system because the fingerprint template format is compatible.

AC Adaptor

FS28 can also be charged from PC's USB port or an AC adaptor. Just connect the mini-USB cable from FS28's USB port to PC or AC adaptor's USB port.



AC adaptor is not come with FS28. Users are suggested to use an AC adaptor with following electrical characteristic.

Input: 100-240V AC 50/60Hz

Output: DC5V / 500-1000mA

With USB socket

Q&A.

1. **FS28 has been built up a connection to PC and the Blue LED is turned on, However, FS28 cannot send image to PC.**

Answer: Please check whether you have selected the right Bluetooth COM port for the PC demo program (FS28WindowsDemo.exe). For FS28 initiate the connection, you should choose the Bluetooth incoming port. For PC initiates the connection, you should choose the Bluetooth outgoing port. Please check you Bluetooth incoming port and outgoing port by following the procedure on Page 5. After you have chosen the right COM port, please open it before you start scanning your finger. Otherwise, the FS28 will pop out the message “Pc/Phone Rsp timeout”, that means PC is timeout to receive the image as the COM port has not been opened.

2. **I see the Bluetooth incoming and outgoing COM port, but I fail to open them.**

Answer: This may due to that the COM port is occupied by other application. Please close the application that occupied the Bluetooth COM port. It may also due to wrong setting of Baud rate, most of the PC can support Bluetooth Baud rate 115200, please try to this baud rate. If your PC can support Bluetooth Baud rate 921600, of course you can use it to transfer the image faster.

3. **My PC cannot run the FS28WindowsDemo.exe.**

Answer: Have you installed Microsoft .Net Framework 3.5 or above? It is need to be installed before you run the “FS28WindowsDemo.exe”. If Microsoft .Net Framework is not installed, please download and install it from <http://www.microsoft.com/download/en/details.aspx?id=21>

4. **FS28WindowsDemo.exe is hanged when receiving WSQ image but it can receive RAW image successfully.**

Answer: You need to copy the ftrWSQ.dll to the same directory as FS28WindowsDemo.exe. ftrWSQ.dll is used to show the WSQ image after it is received from FS28.

5. **I forget the Bluetooth PIN code that I set before.**

Answer: You may just set the PIN code again by go to 5.<System Setting> -> set BT PIN. You can also just select 4. Set Factory Default, it will reset the BT PIN code to “0000”.

6. **I have falsely enabled AVR Firmware upgrade; I want to quit the upgrade process and go back to normal operation.**

Answer: If you have not started downloading AVR firmware from PC to FS28, you can quit by holding SELECT button and press REST button. Then FS28 will leave Firmware upgrade menu and reboot to normal operation. If the AVR firmware has been started downloading to FS28, you should not quit this process and have to wait for upgrade process complete.

7. **FS28 cannot take log.**

Answer: FS28 fail to take log as the time have been set wrongly before. First update the date and time of FS28. Then export the log to your PC and erase the entire log on FS28 with FS28usbEx.exe under USB mode.

<END>