ZFM-60 series of optical fingerprint module

User Manual

Version V1.0

Foreword and Statement

Thank you for purchasing the ZFM-60 Series of Hangzhou Zhian Tec. Co., Ltd. (hereinafter referred to as "
Column optical fingerprint module (hereinafter referred to as: module).

The user manual for software and hardware application development engineers to write, including the hardware interface, system resources, command system, ins
Content. To ensure smooth application development, please read this manual carefully before proceeding with module development.

Keep the manual in a safe place so that you can check it in case of problems.

We have made our best efforts to ensure the accuracy of this manual. However, if you have any questions or find any errors, you can contact me directly
And / or our authorized agents contact, we will be very grateful.

Due to our continuous improvement of products to pursue the purpose of the module and the contents of the manual are subject to change without notice.
(Www.zhiantec.com) or by telephone to obtain the latest information.

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Chapter **1** Overview

1.1 Module Features

ZFM-60 Series Optical Fingerprint Module is a stable mass production product of Hangzhou Finger Technology Co., Ltd.

ZFM-60 series of optical fingerprint module to high-performance high-speed DSP processor as the core, with the company's own intellectual property rights of the c
Sensor, without the host computer to participate in the management of the case, with fingerprint entry, image processing, fingerprint matching, search and template s
Of the intelligent module. Compared with similar fingerprint products, ZFM-60 module has the following characteristics:

◆ independent intellectual property rights, imaging clarity

Optical fingerprint sensor, all the hardware module technology, developed independently by the Hangzhou Finger, access to a number of national patents, excellent
Can be collected to a clear fingerprint image.
At the same time, Hangzhou refers to the security chip is Hangzhou Sheng Yuan Technology Co., Ltd. fingerprint chip PS1802 and AS601
National distributor.

◆ responsive, strong fingerprint adaptability

Fingerprint image reading, the wet and dry fingers are sensitive to the reaction and judgment, to obtain the best image quality, for a wide range of people.
System self-learning adaptation function, according to the user's habits, climate and other changes in the automatic adjustment of parameters, to achieve better match
Can also be set.

◆ special green LED highlight light source, anti-aging performance excellent

The use of specific high-brightness green light source components, ultra-low-light failure, longer life, more durable performance.

◆ Fingerprint industry in line with the current highest standards

Through the national and the Ministry of Public Security security alarm system product quality supervision and inspection, in line with GA701-2007 "fingerprint anti
"Standard, can provide inspection reports, so that your product more quickly and easily through the relevant standard test.

◆ secondary development and application of simple

No need to have fingerprint recognition expertise can be applied, the user under the ZFM-60 module provides a wealth of control instructions, self-developed work
Can be a powerful fingerprint recognition application system.

◆ Flexible setting of security level

For different applications or environments, users can set their own 1-5 different levels of security.

◆ Uniqueness

Module provides 32-bit random number, 8-bit communication password and other functions, can make the application module development of the fingerprint recogn
One.

◆ wide range of applications

ZFM-60 module is widely used, as long as related to the authorization, management, switching and other functions, can be ZFM-60 module fingerprint
Do not function to replace the IC card, password, hardware switches, suitable for all systems from low to high end, such as:

● Fingerprint door locks, safes, gun boxes, financial and other security areas;

● access control systems, industrial computers, POS machines, driving training, attendance and other identity areas;

● management of private clubs, management software, licensing and other management areas;

● Medical insurance, pension receipt, fingerprint payment and other financial areas.

Refers to the technology has a complete technical team, all employees are from the fingerprint industry professionals, can provide a good user development techno
Technical support and pre-sale after-sales service work.

Developers can use this manual to provide technical information, from simple to complex to develop a variety of fingerprint identification applications.

The company also provides based on the PC (windows platform) PC testing software and based on the C51 MCU c language reference SDK development kit,

Convenient secondary development, specifically with my company.

ZFM-60 module can also be used in Linux platform and WinCE platform, the relevant information and use please contact us to obtain.

1.2 New Features

◆ Green LED backlight

ZFM-60 series of green LED backlight module, the visual feel softer.

◆ increase the long backlight mode

ZFM-60 series of modules on the user to open the LED backlight control interface. Can be achieved in the process of collecting images, LED backlight
Maintain a long light. (Long light collected by way of " Open fingerprint lighting backlight OPENLED", "Close fingerprint background lighting lamps CloseLED" and
"no light control fingerprint image GetImageFree "command combination thereof).

ZFM-60 series module retains the original command interface, the use of the original compatible command, you can also achieve the LED backlight flashing. (flash
Acquisition by way of light " recorded fingerprint image GenImg to achieve" command).

◆ faster response time

ZFM-60 series module adopts the optimized image acquisition and preprocessing driver, and its image preprocessing process is more time-saving.
, Better image quality, faster response. (To get faster response, please use the " non-light control fingerprint image GetImageFree "
command).

◆ Active handshake on power-on

ZFM-60 series module after power-on initialization, will automatically send a handshake flag (1 byte 0x55), to inform the host computer can open
To send commands.

◆ Single order to complete the registration and search

ZFM-60 series modules newly added " Auto Registration AutoLogin " and "Auto Search AutoSearch" command. So that the user through a
Order to complete the registration and search process.

Works **1.3**

Our fingers on the inside of the skin surface uneven pattern will produce a variety of patterns, skin lines in the pattern, breakpoints and cross
Each of the fingers has different characteristics, that is, it is unique. In the information processing, it is called "feature", and the characteristics of each finger are diffe
By relying on this uniqueness, we can associate a person with his fingerprint, by comparing his fingerprint with a pre-stored fingerprint,
You can verify his true identity.

Fingerprint identification system through a special photoelectric conversion equipment and image processing technology, the fingerprint collection, analysis and co
Quickly and accurately identify the individual identity.
The system mainly includes fingerprint image acquisition, fingerprint image processing, feature extraction, eigenvalue comparison
And matching process.

◆ Fingerprint image

Through the ZFM-60 module's optical components (such as the camera's camera function), you can clearly get the fingerprint of the finger image.

Fingerprint features

Fingerprint Algorithm The feature extracted from the fingerprint image, representing the fingerprint information.

ZFM-60 module to extract the fingerprint feature size is 256 Bytes.
Two signature files are combined into one fingerprint template file (512 Bytes).

Fingerprint storage, comparison and search are all through the operation of fingerprint features to complete.

◆ fingerprint processing

Which includes two processes: fingerprint registration process and fingerprint matching process [where fingerprint matching is divided into fingerprint matching (
Two ways].

When the fingerprint is registered, the input image is processed twice for each fingerprint, and the composite template is stored in the module. Fingerprint match
Time, through the fingerprint sensor, input to verify the fingerprint image and processing, and then with the module fingerprint template matching comparison (if
Module specified in a template to match, known as the fingerprint than the way, that is 1: 1 way; if more than one template to match, known as the fingerprint search
(1: N mode), the module gives the result of the match (pass or fail).

1.4 Ordering Information

The following rules apply to the complete model of our fingerprint module.

When ordering products from our company, please fill in the complete model according to your needs
Can provide you with better service.

ZFM-60 xx-xxx-Vxx

- Software version (can be omitted)
- Lead length (in mm, can be omitted)
- Fingerprint capacity
  - A: 1,000 pieces
  - B: 150 pieces
- Interface type
  - U: USB2.0 / USB1.1
  - S: Serial (UART)
- Optical fingerprint module 60 series

Fingerprint Module, Hangzhou Finger Technology Co., Ltd

Note: 1) Lead length is the length of the fingerprint module connected to the fingerprint system cable, UART communication default is 150mm, USB
Letter default is 720mm.

2) The software version in the first order or non-designated version can be omitted, the default use of the latest version of our company.

3) The capacity of the fingerprint library B is the capacity of the customized self-learning adaptation function. The default storage capacity is 1000 pieces.

Chapter **2,** the major technical indicators

Power supply voltage: DC 3.8 ~ 7.0V / supply for 3.3V

Backlight color: green

On: long / flashing

Supply current: Working current: <65mA

Peak current: <95mA

Fingerprint image input time: <0.5 seconds

Window area: 14.5 ╳ 19.4 mm

Matching: Matching (1: 1)

Search method (1: N)

Profile: 256 bytes

Template file: 512 bytes

Storage capacity: 1000 pieces / 150 pieces

Security level: 5 (from low to high: 1,2,3,4,5)

False Accept Rate **(FAR): <0.001% (security** level is 3)

False Rejection Rate **(FRR): <1.0% (security** level 3)

Search time: <1.0 seconds (1: 500 mean)

Host computer interface: UART (TTL logic level) or USB2.0 / USB1.1

Baud rate **(UART): (9600╳N) bps** where N = 1 ~ 12 (default value N = 6, that is 57600bps)

working environment:

Temperature: -20 ° C to + 60 ° C

Relative humidity: 40% RH to 85% RH (non-condensing)

Storage environment:

Temperature: -40 ° C to + 85 ° C

Relative humidity: <85% H (no condensation)

Dimensions **(L ╳ W ╳ H):**

One: 54 ╳ 20 ╳ 20.5mm

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Chapter **3** Hardware Interface

3.1 PC Interface

Whether you order is UART or USB interface (PCB board hardware circuit factory configuration is different, do not mix), in the PCB On the board, the module and the user equipment connection connection all uses the same single row socket (6 cores 1.25 pitch).

3.2 Serial communication

The module with the user equipment using serial communications interface pins are as defined in Table 3 .1 shown , in fact, was shown in Figure 3.1.

Table 3.1 Serial communication interface definition

Pin number	Name	Types of	Functional description
1	-	-	
2	-	-	
3	Vin	In	Module power positive input. (Line color: red)
4	TD	Out	Serial data output. TTL logic level. (Line color: green)
5	RD	In	Serial data input. TTL logic level. (Line color: white)
6	GND	-	Signal ground. Connected internally to the power ground. (Line color: black)

Note: In the Type field, in indicates input to the module and out is output from the module.

Figure 3.1 Serial communication interface physical map

3.2.1 Hardware connection

Module through the serial communication interface, can be directly with the 3.3V or 5V power microcontroller or other MCU to communicate: Module data transmis (RXD) of the host computer, and the module data receiving pin (3-pin RD) is connected to the data transmitting terminal (TXD) of the host computer.

To communicate with the host computer of the RS-232 level (eg PC), add a level-shifting circuit between the module and the host computer Such as: MAX232 circuit); such as 232 circuit can not receive data properly, make sure there are multiple RXD lines on the Master side or other

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Circuit interference caused.

Taking into account the overall power consumption of the circuit, the fingerprint module only work and not work two states, no sleep or standby; normally turn off t
Module power input, the fingerprint module does not work; When the microcontroller (MCU) function need to access the fingerprint module to provide fingerprint mod
Fingerprint module work, complete the appropriate command, such as no longer use the fingerprint module, then cut off the fingerprint module power supply, fingerpr
status.

3.2.2 serial protocol

Using half-duplex asynchronous serial communication. The default baud rate is 57600bps and can be set to 9600 ~ 115200bps by command.

The transmitted frame format is 10 bits, a 0-level start bit, an 8-bit data bit (LSB first), and a stop bit with no parity bit.

Start bit Stop bit

1 Lt; /10 D0 D1 D2 D3 D4 D5 D6 D7 1

10-bit frame format

3.2.3 Power-on delay time

After the module is powered on, it takes about 300mS to initialize. During this time, the module can not respond to the host command. Module completed initial
After the work will immediately send a byte (0x55) to the host computer, that the module has been able to work and receive PC commands.

3.2.4 Electrical parameters (all levels to power / signal ground **GND** as a reference level)

power input

project	parameter			unit	Remarks
	Min	typical	maximum		
Supply voltage Vin	3.8		7.0	V	Normal operating value
Limit voltage Vinmax	-0.3		9.0	V	Exceeding this range may cause permanent damage
Operating current Icc	90	110	130	MA	
Peak current Ipeak			130	MA	

TXD (output, TTL logic level)

project	condition	parameter			unit	Remarks
		Min	typical	maximum		
VOL	IOL = -4 mA			0.4	V	Logic 0
VOH	IOH = 4 mA	2.4		3.3	V	Logic 1

RXD pin (input, TTL logic level)

project	condition	parameter			unit	Remarks
		Min	typical	maximum		
VIL				0.6	V	Logic 0
VIH		2.4			V	Logic 1
IIH	VIH = 5V		1		MA	
	VIH = 3.3V		30		UA	
VImax		-0.3		5.5	V	Limit input voltage

3.3 USB Communication

The module with the user device using the USB communication interface pin definitions listed in Table 3.2 , the fact was shown in Figure 3.1.

Table 3.2 USB communication interface definition

Pin number	name	Types of	Functional description
1	-	-	
2	-	-	
3	Vin	In	Module power positive input. (See Section 3.1.1.4 for electrical specifications)
4	DP +	In / Out	USB data cable.
5	DP-	In / Out	USB data cable.
6	GND	-	Signal ground. Connected internally to the power ground.

Note: In the Type field, in indicates input to the module and out is output from the module.

Figure 3.2 USB communication interface physical map

With USB communication, all commands are invoked through the API.

ZFM-60 module currently uses USB communication, the Master side enumeration, is not required to install the driver.

If it is windows platform, you can contact us to get the PC software and windows call no-drive API command format; if it is

Linux platform, we can contact the Secretary for Linux platform reference source code, reference to the relevant order inside, re-make in their own platform make file
You can; if it is WinCE platform, you can contact our company to obtain relevant reference materials.

USB communication is working in USB 2.0 full speed mode.

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Chapter **4** System Resources

To meet the different needs of customers, the module system provides a lot of resources to the user system.

4.1 Buffer

Module RAM is provided with a 72K bytes size image buffer ImageBuffer with two 512 bytes size of the file buffer
Area CharBuffer1 and CharBuffer2, the user can read and write instructions through any one buffer. Image buffers, and two signature files
The contents of the area are not saved when the module is powered down.

4.1.1 image buffer

Image Buffer ImageBuffer is used to store image data and internal image processing of the module. When uploading / downloading images, the image format is
256 x 288 pixels BMP.

Through the UART port to upload or download images in order to speed up, only to the high byte of the four bytes, which uses 16 gray,
Section that two pixels (high four as a pixel, the lower four for the same line next to the adjacent column of a pixel, that is, the synthesis of two pixels a word
Section transmission). As the image is 16 gray levels, upload to the PC for display (corresponding to BMP format), should be extended gray scale
(Extended to 256 grayscale, that is 8bit bitmap format).

Through the USB port transfer is the entire 8-bit pixels, 256 gray scale.

4.1.2 Characteristics of file buffer

Feature Buffer CharBuffer1 or CharBuffer2 can be used to store both common profile and template signatures
.

4.2 fingerprint database

Module in the FLASH opened up a storage area as a fingerprint template storage area, the fingerprint library.
The data in the fingerprint library is power-down protected
of. If the fingerprint library is N, the serial number of the fingerprint template in the fingerprint library is defined as: 0,1,2 … N-2,
N-1.
The user can only access the fingerprint library according to the serial number of the corresponding storage and search functions are corresponding to the operation

4.3 System Configuration Parameters

For the convenience of users, the module open part of the system parameters, allowing the user through the instruction, a single modification to specify (by parame
Numerical value. See "6.1 .4 setting module system basic parameters SetSysPara" and "6.1.5 to read system parameters ReadSysPara".

When the host computer sends the instruction to modify the system parameter, the module will respond according to the original configuration, modify the system s
FLASH. When the system is powered up again, the module will operate according to the new configuration.

4.3.1 Baud Rate Control (parameter ID: **4)**

This parameter controls the communication baud rate when the module communicates with the host computer via the UART. If the parameter value is N (N is in the
The baud rate should be (9600 ╳ N) bps.

4.3.2 security level (parameter ID: 5)

This parameter controls the fingerprint matching and searching for the matching threshold. It is divided into five levels. The value range is 1, 2, 3, 4, 5.

Security rating of 1, the highest recognition rate, the lowest rate of rejection. Security rating of 5 when the lowest recognition rate, the highest rate of rejection.

4.3.3 package content length (parameter ID: 6)

This parameter control module and the host computer communication, each time the data transmission package to allow the maximum length of the content, the ra
3, the corresponding length (bytes) were: 32,64,128,256.

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4.4 Status Register

The system status register indicates the current operating status of the module. Can be read by the instruction ReadSysPara instruction, the length of 1Word.
Its all
Is defined as follows:

Bit number	15-4	3	2	1	Lt; / RTI & gt;
significance	Reserved	ImgBufStat	PWD	Pass	Busy

Note:

Busy: 1 bit, 1 means the system is executing the command, 0 means the system is idle;

Pass: 1 bit, 1 means that the fingerprint verification passes;

PWD: 1 bit, 1 means that the device handshake password is validated;

ImgBufStat: 1 bit, set to 1 indicates that the fingerprint image buffer exists valid fingerprint image.

4.5 module password

Module default password is 0x00000000, if the default password is not modified, the USB communication module does not require verification password, you can di
And communication with the host computer; if the UART communication or password is modified, the host computer and the module communication must be the first ir
After the password is verified, the module will enter the normal working state, receiving other instructions (that is, serial communication must first handshake signal p

After the password is changed, the new password is saved in the Flash, and the power is still saved (the modified password can not be obtained by the communicat
Forgetting the module can not communicate, please use caution).

See Verifying Password VfyPwd Instruction and Setting Password SetPwd Instruction.

4.6 module address

Each module has an identification address, the module and the host computer communication, each instruction / data are transmitted in the form of data packets, e
The packet contains an address; the module only responds to the same instruction and packet as its own address.

The module address is 4 bytes and the factory default value is 0xFFFFFFFF. Users can modify the command module address (see Setting
Module address instruction SetAddr). After the module address changes, the new address in the module after power is still preserved.

4.7 Notepad

Flash opens up a 512-byte memory area as the user Notepad, the notepad is logically divided into 16, 32 words per page
Section; PC can access any page by WriteNotepad ReadNotepad instruction and instruction. Note: Notepad to write any one time,
32-byte page content is written as a whole, the original content is overwritten.

NOTE: You can use the command module address or random numbers, and the only match the configuration module of the system, the system only recognizes the u
Replace the same kind of the same type of module can not access the system work; For more information, please contact refers to Science and Technology.

Chapter **5** Chapter protocol

Communication protocol defines the rules between ZFM-60 series modules and PC information exchange; using the UART interface in the form of hardware, referer
Following protocol and instruction set; such as using USB interface in the form, please contact us for API function calls (please inform you need to run the platform).
If the PC using a PC, it is recommended to order a USB interface in the form of modules to increase system speed (using USB upload image, image
Gradation and high upload speed, do fingerprint scanner module used).

5.1 packet format

UART module communicates with the host of commands, data, receive and transmit the results, both in the form of data packets. For multiple-word
Day, the high byte low byte after the first (such as 2 bytes of 0006 represents 0006, not 0600). Packet format and defined in Table 5.1
And Table 5.2 below.

Table 5.1 packet format

Baotou	address	Package Identity	Packet length	Package contents (instruction / data, parameters / identification code)	Checksum

Table 5.2 Packet detailed definition table

name	symbol	length	Description
Baotou	START	2 bytes	Fixed 0xef01, when transferring big endian.
address	ADDR	4 bytes	The default value 0xffffffff, the user can generate a new address by the instruction, the module will refuse to address Bad packet. When transferring big endian.
Package Identity	PID	1 byte	0x01 Represents the command packet (Command packet), can be followed by subsequent packets 0x02 It indicates a packet (Data packet), and a follow-up package. Not a single packet Alone into the implementation process must follow the instruction packet or a response packet back. 0x07 Represents a response packet (ACK packet), you can follow-up with the pack. 0x08 It represents the last data packet that end packet (EndData packet).
Packet length	LENGTH	2 bytes	Packet length refers to the package contents (instruction / data) plus the length of the efficacy and the length (ie, within the package Yung length +2). Length in bytes (ie, number of bytes), when transferring big endian.
Package Contents	DATA	-	It may be instructions, data, command parameters, like the answer. (Fingerprint characteristic value, means Pattern template are data)
Checksum	SUM	2 bytes	All byte single-byte arithmetic cumulative package ID, the packet length and content and that Checksum = packet length + + package identity package contents. More than two-byte binary ignored. When transferring big endian.

5.2 Summary Instruction Set

5.2.1 functional classification

Instruction set categorized according to function, the system can be divided into categories, fingerprint processing class and other classes. As shown in Table 5.3 , Table 5 .4 and Table 5.5.

Table 5.3 System class instruction

Serial number	Code	Function Description
1	0x13	Efficacy password
2	0x12	Set a password
3	0x15	Set Address
4	0x0e	Set system parameters
5	0x0f	Read system parameters

6	0x1f	Read fingerprint template index table
7	0x1d	Read fingerprint template number

Table 5.4 fingerprint processing class instruction

Serial number	Code	Function Description
1	0x01	Record fingerprint images
2	0x0a	Upload your image
3	0x0b	Download image
4	0x02	Image transfer feature
5	0x05	Synthetic template features
6	0x08	Upload feature
7	0x09	Download feature
8	0x06	Templates are stored
9	0x07	Read template
10	0x0c	Remove Templates
11	0x0d	Empty fingerprint database
12	0x03	Verification feature
13	0x04	Search Fingerprint
14	0x50	Open the fingerprint lighting backlight
15	0x51	Close fingerprint background lighting lamps
16	0x52	No light control fingerprint image
17	0x53	shake hands
18	0x54	Automatic registration
19	0x55	Auto Search
20	0x56	Search fingerprint (with residual judgment)

Table 5.5 Other types of instruction

Serial number	Code	Function Description
1	0x18	Write Notepad
2	0x19	Reading Notepad

5.2.2 according to the instruction code sequence

According to the instruction code is organized in the order, as shown in Table 5.6 below.

Table 5.6 according to the code sequence choreography

Code	Command name	Function Description	Code	Command name	Function Description
0x01	GenImg	Record fingerprint images	0x12	SetPwd	Set a password
0x02	Img2Tz	Image transfer feature	0x13	VfyPwd	Efficacy password
0x03	Match	Feature comparison	0x14	GetRandomCode	Random sampling
0x04	Serach	Search Fingerprint	0x15	SetAddr	Set Address
0x05	RegModel	Synthetic template features	0x18	WriteNotepad	Write Notepad
0x06	Store	Templates are stored	0x19	ReadNotepad	Reading Notepad

0x07	LoadChar	Read template	0x1d	TemplateNum	Read fingerprint template number
0x08	UpChar	Upload feature	0x1f	ReadConList	Read fingerprint template index table
0x09	DownChr	Download feature	0x50	OpenLED	Open the fingerprint lighting backlight
0x0a	UpImage	Upload your image	0x51	CloseLED	Close fingerprint background lighting lamps
0x0b	DownImage	Download image	0x52	GetImageFree	No light control fingerprint image
0x0c	DeletChar	Remove Templates	0x53	GetEcho	shake hands
0x0d	Empty	Empty fingerprint database	0x54	AutoLogin	Automatic registration
0x0e	SetSysPara	Set system parameters	0x55	AutoSearch	Auto Search
0x0f	ReadSysPara	read system parameters	0x56	SearchResBack	Search fingerprint (with residual judgment)

5.3 Checking and response packet

Only instruction issued by the host computer module, the module up crew response.

The module receives instructions, through the response packet, the implementation of the relevant commands and results will be reported to the host computer. R
With subsequent packets. PC only after receiving a response packet module to confirm receiving packets and the situation of the implementation of the command mod

The response packet includes a confirmation code byte (must have) and possibly some return parameters. Confirmation code shown in Table 5.7 .

Table 5.7 confirmation code definition table

NO.	Confirmation code	Definition Description
1	0x00	Instruction is finished or OK;
2	0x01	Packet receive error;
3	0x02	No finger on the sensor;
4	0x03	Input fingerprint image failed;
5	0x06	Too messy fingerprint image feature not born;
6	0x07	Fingerprint image is normal, but too few feature points (or too small) feature not born;
7	0x08	Fingerprints do not match;
8	0x09	Not to search for fingerprints;
9	0x0a	Characterized merge failed;
10	0x0b	When accessing the address number of fingerprint database beyond the scope of the fingerprint database;
11	0x0c	Read from the fingerprint template library error or invalid;
12	0x0d	Upload feature failed;
13	0x0e	Modules can not accept subsequent data packet;
14	0x0f	Upload your image failed;
15	0x10	Remove Templates failure;
16	0x11	Empty fingerprint database failure;
17	0x13	Incorrect password;
18	0x15	No valid original image in the buffer zone and not a raw image;
19	0x18	FLASH write error;
20	0x1a	Invalid register number;
twenty one	0x20	Address code error
		You must verify the password;

twenty one twenty one Reservations system.

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5.4 Summary Workflow

Module initialization after power-up, wait for the PC to receive commands. After receiving the correct command, the rapid implementation of appropriate action, After the operation is complete returns the corresponding information. During the execution of the command module, the module will not respond to other commands

You can enroll their fingerprint, fingerprint matching capabilities to complete the search, you can also upload feature, downloading feature for remote fingerprint r Function; In summary, by combining a variety of commands to implement complex functions.

Command analysis (single-byte hexadecimal form to send a command packet):

Get image

FF FF FF FF 01 EF 01 00 03 01 00 05 (01 for the package, indicates the packet is a command packet)

NOTE: 01 indicates command word execution is to obtain images of instruction

After the module receives the correct command packet, it performs the appropriate action quickly, returns the corresponding information upon completion.

FF FF FF FF 01 EF 07 00 03 02 00 0c (07 for the package, indicates the packet is a response packet)

NOTE: Confirmation code 02 means no finger on the sensor

Suppose the response packet is received confirmation code module 00, the instruction execution OK:

Ef 01 ff ff ff 07 00 03 00 00 0a

In this case we assume that the instruction to continue generating features

FF FF FF FF 01 EF 01 00 04 02 01 00 08 (02 indicates that the command word, the instruction is executed to generate feature)

Note: 01 is the parameter that represents the characteristics of the file is generated in the profile storage buffer 1 (charbuffer1)

Refer to chapter on Syntax communication protocol, for detailed instructions, please consult the instruction chapter of the module.

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Chapter **6** Chapter module Instruction

ZFM-60 series modules have a wealth of instruction, application instruction through different combinations to achieve a variety of fingerprint recognition. All mean Order / transmission of data are transmitted in packets, packet format and definitions see Table 5 4.1 and 4.2 Table 5.2.

6.1 system class instruction

6.1.1 Verify password **VfyPwd**

Features: Password authentication module (serial communication must handshake).

Input parameters: PassWord

Return parameter: Confirmation code

Instruction code: 0x13

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction Code	Password	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	4 bytes	2 bytes
0xef01	XXXX	0x01	0x0007	0x13	PassWord	Sum

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation Code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x07	0x0003	X	Sum

1. Confirmation Code = 0x00 indicates the correct password verification;
   Confirmation code = 0x01 represents income package is wrong;
   Confirmation code = 0x13 means that the password is incorrect.

2. instruction packet checksum (2 bytes) = packet identifier (1 byte) + packet length (2 bytes) + instruction code (1 byte) + password (4 bytes);
Response packet checksum (2 bytes) = packet identifier (1 byte) + packet length (2 bytes) + confirmation code (1 byte);
Checksum bytes are added, more than two-byte binary ignored when transferring big endian.

3. The default module address is "0xffffffff"; the default password is "0x00000000".

6.1.2 Set a password **SetPwd**

Function: Set the module password (see "4 5 module password").

Input parameters: PassWord

Return parameter: Confirm word

Instruction code: 0x12

Instruction packet format:

Baotou	Module address	Package Identifier	Packet length	Instruction code	Password	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	4 bytes	2 bytes
0xef01	XXXX	0x01	0x0007	0x12	PassWord	Sum

Response packet format:

Baotou	Module address	Package Identifier	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes

0xef01	XXXX	0x07	0x0003	X	Sum

Confirmation Code = 0x00 indicates OK;

Confirmation code = 0x01 represents income package is wrong.

6.1.3 Setting the module address **SetAddr**

Function: Set the module address (see "4 . 6 module address").

Input parameters: The new module address (such as forgetting address to send a default proper instruction address, you can get a new address)

Return parameter: Confirm word

Instruction code: 0x15

Instruction packet format:

Baotou	Module original address	Package Identifier	Packet length	Instruction code	The new module address	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	4 bytes	2 bytes
0xef01	XXXX	0x01	0x0007	0x15	XXXX	Sum

Response packet format:

Baotou	The new module address	Package Identifier	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x07	0x0003	X	Sum

Confirmation Code = 0x00 indicates successful set address;

Confirmation code = 0x01 represents income package is wrong.

6.1.4 set the basic parameters of the system module **SetSysPara**

Function: basic parameter settings (see "4 3 system configuration parameters").

Input parameters: Parameter No. + content (see "Table 6.1 Parameter number and contents correspondence table ")

Return parameter: Confirm word

Instruction code: 0x0e

Instruction packet format:

Baotou	Module address	Package Identifier	Packet length	Instruction code	Parameter No.	content	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	1 byte	2 bytes
0xef01	XXXX	0x01	0x0005	0x0e	4/5/6	X	Sum

Response packet format:

Baotou	Module address	Package Identifier	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x07	0x0003	X	Sum

Confirmation Code = 0x00 indicates OK;

Confirmation code = 0x01 represents income package is wrong;

Confirmation code = 0x1a the register number is incorrect.

Table 6.1 Parameter number and contents correspondence table

name	Parameter No.	Description

Baud Rate	4	N (N Range: 1 to 12, for a baud rate of 9600 * N bps)
Security Level	5	N (Range: 1,2,3,4,5)
Package Contents Length	6	N (Range: 0,1,2,3, corresponding to the length (number of bytes) were: 32,64,128,256)

6.1.5 Reading system parameters **ReadSysPara**

Function: read the module status registers and basic system configuration parameters (see "4.3 System Configuration Parameters" and "System Status 4.4 Register ").

Input parameters: none

Return parameter: + word confirm the basic parameters
Instruction code: 0x0f

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction Code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x01	0x0003	0x0f	Sum

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation Code	Basic parameters	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	16 bytes	2 bytes
0xef01	XXXX	0x07	0x0013	X	See " Table 6. The 2" the	Sum

Confirmation Code = 0x00 indicates OK;

Confirmation code = 0x01 represents income package is wrong.

Table 6.2 Basic System Parameters

name	Description	Offset (word)	Size (word)
Status Register	State of the system register content, see Lt; / RTI & gt;	0	1
System identification code	Fixed value: 0x0000	1	1
Fingerprint database size	Fingerprint storage capacity	2	1
Security Level	Security Level code number (1,2,3,4,5)	3	1
Device Address	32-bit device address	4	2
Packet size	Packet size codes (0,1,2,3)	6	1
Baud rate setting	N corresponding to a baud rate of 9600 (10 × N bps)	7	1

6.1.6 read fingerprint template index table **ReadConList**

Function: read module fingerprint template index table, and each read up to 256 fingerprint template of the index table.

Input parameters: the index page, the value of 0-3.

0 represents the index page reads 0 to 255 fingerprint templates index table

1 represents the index page reads 256 to 511 fingerprint templates index table

2 represents an index page reads 512 to 767 fingerprint templates index table

3 represents an index page reads 768 to 1,024 fingerprint templates index table

Return parameter: + word confirm the fingerprint template index table

Instruction code: 0x1f

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction Code	Index page	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes
0xef01	XXXX	0x01	0x0004	0x1f	0/1/2/3	Sum

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation Code	Index Table	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	32 bytes	2 bytes
0xef01	XXXX	0x07	0x0023	X	Table structure	Sum

1. Confirmation Code = 0x00 indicates read success index table;
   Confirmation code = 0x01 represents income package is wrong;
2. Each read up to 256 fingerprint template index data, insufficient data complement 256 "0."
3. The index table data structure: every eight to a group, and each output from the peak beginning. See Table 6.3 .

Table 6.3 index data table structure

Transmission order: High output from the low byte byte order, and each byte output from the peak beginning.

lowest	Template number	7	6	5	4	3	2	1	Lt; / RTI & gt;
Significant Byte	Template index table data	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
The lower two	Template number	15	14	13	12	11	10	9	8
Significant Byte	Template index table data	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
…	…	…							
highest	Template number	255	254	253	252	251	250	249	248
Significant Byte	Template index table data	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

NOTE: The index table data "0" represents the corresponding position without a valid template; "1" represents the corresponding location of a valid template.

6.1.7 Reading a valid template number **TemplateNum**

Function: read the number of fingerprint templates stored in the module.

Input parameters: none

Return parameter: + word template confirm the number N

Instruction code: 0x1d

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction Code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x01	0x0003	0x1d	sum

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation code	The number of template	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes	2 bytes
0xef01	XXXX	0x07	0x0005	X	Lt; / RTI & gt;	Sum

Confirmation Code = 0x00 indicates read success;

Confirmation code = 0x01 represents income package is wrong.

6.2 fingerprint processing class instruction

6.2.1 record fingerprint images **GenImg**

Function: detecting a finger, after detecting the input fingerprint image stored in ImageBuffer, and returns successfully enter confirmation code; if undetectable Fingers, no finger directly return a confirmation code (quick response module for each instruction, therefore, as a continuous detection, the need for loop processing c Or the total number of times a given cycle time).

Input parameters: none

Return parameter: Confirm word

Instruction code: 0x01

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction Code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x01	0x0003	0x01	sum

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x07	0x0003	X	Sum

Confirmation code = 0x00, indicates successful entry;

Confirmation code = 0x01, indicates receiving packets is wrong;

Confirmation code = 0x02, indicating no finger on the sensor;

Confirmation code = 0x03, indicates entry fails.

6.2.2 Open the fingerprint lighting backlight **OpenLED**

Function: Open the fingerprint background lighting lamps.

Input parameters: None.

Instruction code: 0x50

Instruction packet format:

Baotou	Module address	Pack logo	Packet length	Instruction code	Checksum
2 bytes	4 bytes	1 bytes	2 bytes	1 bytes	2 bytes
0xEF01	XXXX	0x01	0x0003	0x50	0x54

Response packet format:

Baotou	Module address	Pack logo	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 bytes	2 bytes	1 bytes	2 bytes
0xEF01	XXXX	0x07	0x0003	XX	XX

Confirmation code = 0x00, indicates success;

Confirmation code = other, indicates that the operation failed.

6.2.3 Close fingerprint lighting backlight **CloseLED**

Function: Close fingerprint background lighting lamps

Input parameters: None

Instruction code: 0x51

Instruction packet format:

Baotou	Module address	Pack logo	Packet length	Instruction code	Checksum
2 bytes	4 bytes	1 bytes	2 bytes	1 bytes	2 bytes
0xEF01	XXXX	0x01	0x0003	0x51	0x55

Response packet format:

Baotou	Module address	Pack logo	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 bytes	2 bytes	1 bytes	2 bytes
0xEF01	XXXX	0x07	0x0003	XX	XX

Confirmation code = 0x00, indicates success;

Confirmation code = other, indicates that the operation failed.

6.2.4 No light control fingerprint image **GetImageFree**

Features: No light control fingerprint image

Input parameters: None

Instruction code: 0x52

Instruction packet format:

Baotou	Module address	Pack logo	Packet length	Instruction code	Checksum
2 bytes	4 bytes	1 bytes	2 bytes	1 bytes	2 bytes
0xEF01	XXXX	0x01	0x0003	0x52	0x56

Response packet format:

Baotou	Module address	Pack logo	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 bytes	2 bytes	1 bytes	2 bytes
0xEF01	XXXX	0x07	0x0003	XX	XX

Confirmation code = 0x00, indicates successful collection;

Confirmation code = 0x01, indicates receive packet error;

Confirmation code = 0x02, indicating no finger on the sensor;
Confirmation code = 0x03, indicate the acquisition fails.

6.2.5 Handshake **GetEcho**

Function: to send handshake command module, if the module is working properly, will return confirmation code 0x55, the PC will continue to send to the module me
Order; if no response or other confirmation code to indicate equipment malfunction.

Input parameters: None

Instruction code: 0x53

Instruction packet format

Baotou	Module address	Pack logo	Packet length	Instruction code	Checksum
2 bytes	4 bytes	1 bytes	2 bytes	1 bytes	2 bytes
0xEF01	XXXX	0x01	0x0003	0x53	0x57

Response packet format

Baotou	Module address	Pack logo	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 bytes	2 bytes	1 bytes	2 bytes
0xEF01	XXXX	0x07	0x0003	XX	XX

Confirmation code = 0x55, normally indicates that the device can receive commands;

Confirmation code = other or no answer, indicate equipment malfunction.

In addition, the module automatically sends power after shaking hands as a sign 0x55, 0x55 microcontroller detects, you can send commands to immediately enter t
For the state.

6.2.6 Automatic registration **AutoLogin**

Function Description: Send this command, the module can automatically complete image acquisition, generating job characteristics, template synthesis and storage
" Recorded fingerprint image GenImg" , "image generation feature Img2Tz", "features a template for synthesis RegModel", "storage template Store" these four
Synthesis of a command instruction.

Input parameters: refers to the length to be the number of times + Press & Storage Reference

Instruction code: 0x54

Instruction packet format:

Baotou	Module address	Pack logo	Packet length	Instruction code	Wait for the long	By means of the number	Storage number	Register Mark	Checksum
2 bytes	4 bytes	1 bytes	2 bytes	1 bytes	1 bytes	1 bytes	2 bytes	1byte	2 bytes
0xEF01	XXXX	0x01	0x0008	0x54	XX	2/3	xxxx	0/1	xxxx

1. The long wait to be refers to the longest finger pressed each time image acquisition, if the finger is not pressed within the time set for this parameter,
Believes that no fingers. The field in the range of 1 to 255, the greater the value, the longer the time. Series 60, generally a value of 54 (0x36), for
Time should be 3.5 seconds, other time intervals as follows:

When the value of a long value to be corresponding to the actual time interval (approximately)	Long to be the actual time interval (approximately)	When the value of the value of	Long to be the actual time interval (approximately)
31 (0x1f)	2	62 (0x3e)	4
38 (0x26)	2.5	69 (0x45)	4.5
46 (0x2e)	3	77 (0x4d)	5
54 (0x36)	3.5	85 (0x55)	5.5

2. Press the number of times when the number of registered fingerprint by means of confirmation, only a value of 2 or 3. 2 represents a value of twice the fingerpri
3 is representative confirmed three times by the fingerprint.

3. Press the number of times is 2, the command will be collected twice a finger to be registered as a template, wherein the first collection will be sent after a succes
0x56 (PS_AUTOLOGIN_OK1) response code, and then continue with the second fingerprint process.

According to the number of times is 3, the command will be collected three times to register the fingerprint template, which will be the first collection after sending
Will be sent after 0x56 (PS_AUTOLOGIN_OK1) response code, the second fingerprint successful 0x57 (PS_AUTOLOGIN_OK2) response code,
Then continue with the third fingerprint process.

4. Repeat the registration mark is set whether to allow re-registration. 0 for duplicate registrations are not allowed, that is, if the current registration fingers
Fingerprint library has been registered, then this will no longer be registered. 1 represents allow re-registration, which currently registered finger regardless of whet
It has been registered, all of this registration.

Response packet format

Baotou	Module address	Pack logo	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 bytes	2 bytes	1 bytes	2 bytes

0xEF01	XXXX	0x07	0x0003	XX	XX

Confirmation code = 0x00, means the automatic registration is successful;

Confirmation code = 0x02, indicating no finger on the sensor;

Confirmation code = 0x06, an image is too messy, failed;

Confirmation code = 0x07, indicates the feature point too, failed;

Confirmation code = 0x0a, represents the merger failed (by means not the same finger);

Confirmation Code = 0x0b, indicates storage number exceeds the valid range;

Confirmation code = 0x56, the first fingerprint successfully;

Confirmation code = 0x57, the second fingerprint successfully;

Confirmation code = 0x24, showing due duplicate registrations fail (ie, the current registration fingerprint in the fingerprint database already exists).

6.2.7 Automatic Search **AutoSearch**

Features: send the command, the module will automatically complete image acquisition, as well as generating a characteristic fingerprint template library to search
The " record fingerprint images GenImg ", "image generation feature Img2Tz", "search fingerprint Search" This is a synthesis of three instructions to complete the instruction.

Input parameters: length + + Search initial number refers to the number of pending.

Instruction code: 0x55

Instruction packet format

Baotou	Module address	Packet length	Instruction code	Starting serial number of the long search time and check to be mean				
2 bytes	4 bytes	1 bytes	2 bytes	1 bytes	1 bytes	2 bytes	2 bytes	2 bytes
0xEF01	XXXX	0x01	0x0008	0x55	XX	xxxx	xxxx	xxxx

Refers to the long wait until the finger is pressed each time the maximum time image acquisition, if within the time set by this parameter no finger pressed, That there is no fingers. The field in the range of 1 to 255, the greater the value, the longer the time. Series 60, generally a value of 54 (0x36), while the corresponding Between 3.5 seconds, other time intervals as follows ::

When the value of the value corresponds to	The value corresponds to the actual time (approximately s)	The value corresponds to	The value corresponds to the actual time (approximately s)
31 (0x1f)	2	62 (0x3e)	4
38 (0x26)	2.5	69 (0x45)	4.5
46 (0x2e)	3	77 (0x4d)	5
54 (0x36)	3.5	85 (0x55)	5.5

Response packet format

Baotou	Module address	Package logo	Packet length	Confirmation code	Serial number	Score	Checksum
2 bytes	4 bytes	1 bytes	2 bytes	1 bytes	2 bytes	2 bytes	2 bytes
0xEF01	XXXX	0x07	0x0007	XX	xxxx	xxxx	XX

Confirmation code = 0x00, indicates to the search;

Confirmation code = 0x09, said they were not searched;

Confirmation code = 0x02, indicating no finger on the sensor;

Confirmation code = 0x06, an image is too messy, failed;

Confirmation code = 0x07, indicates the feature point too, failed;

Confirmation Code = 0x22 indicates residual fingerprint;

Confirmation code = 0x23, indicates that the specified interval no valid fingerprint template.

6.2.8 search fingerprint (with residual judgment) **SearchResBack**

Function: In CharBuffer1 or CharBuffer2 the feature to search the entire document or part of the fingerprint database. If the search returns order number.

This command is distinguished from Search (command code 0x04) is different from the residual fingerprint return code, SearchResBack detectable residues The return code is 0x22, and the Search command detected residual return code 0x09

Input parameters: BufferID + StartPage (starting number) + PageNum (number)

Return parameter: + word confirmation number (matching fingerprint template)

Instruction code: 0x56

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes	2 bytes	2 bytes
Baotou	Module address	Package logo	Packet length	Instruction code	BufferID	Starting serial number	Number	Checksum
0xef01	XXXX	0x01	0x0008	0x56	BufferID	StartPage	PageNum	Sum

Note: The buffer CharBuffer1, CharBuffer2 of BufferID are 0x01 and 0x02

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes	2 bytes	2 bytes
Baotou	Module address	Package logo	Packet length	Confirmation code	page number	Score	Checksum
0xef01	XXXX	0x07	0x007	X	PageID	MatchScore	Sum

Confirmation code = 0x00, indicates to the search;

Confirmation code = 0x01, indicates receiving packets is wrong;

Confirmation code = 0x09, said they were not searched;

Confirmation code = 0x22, indicates the residual fingerprint.

6.2.9 Upload your image **UpImage**

Function: the data module in the image buffer ImageBuffer uploaded to the host computer (see "4 .1.1 image buffer").

Input parameters: none

Return parameter: Confirm word

Instruction code: 0x0a

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction Code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x01	0x0003	0x0a	sum

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x07	0x0003	X	Sum

Packets (follow-up package) format:

Baotou	Module address	Package Identity	Packet length	Package Contents	Checksum
2 bytes	4 bytes	1 byte	2 bytes	N bytes	2 bytes
0xef01	XXXX	0x02	N + 2	Image data	Sum

End packet (no follow-up package) format:

Baotou	Module address	Package Identity	Packet length	Package Contents	Checksum
2 bytes	4 bytes	1 byte	2 bytes	N bytes	2 bytes
0xef01	XXXX	0x08	N + 2	Image data	Sum

1. Confirmation Code = 0x00 indicates then sends subsequent packets;
   Confirmation code = 0x01 represents income package is wrong;
   Confirmation Code = 0x0f that they can not send subsequent packets.
2. Send command packet, the module immediately sends the response packet and end of packet, and packet end packet and no response packet.
3. The package content value is determined by the number of bytes of packet length N content, the factory package content length is set to 128 bytes.

6.2.10 Download image **DownImage**

Function: PC to download image data to the image buffer module ImageBuffer (see "4 . .1 1 image buffer"), images must be 256 * 288 size BMP format.

Input parameters: none

Return parameter: Confirm word

Instruction code: 0x0b

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction Code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x01	0x0003	0x0b	sum

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x07	0x0003	X	Sum

Packets (follow-up package) format:

Baotou	Module address	Package Identity	Packet length	Package Contents	Checksum
2 bytes	4 bytes	1 byte	2 bytes	N bytes	2 bytes
0xef01	XXXX	0x02	N + 2	Image data	Sum

End packet (no follow-up package) format:

Baotou	Module address	Package Identity	Packet length	Package Contents	Checksum
2 bytes	4 bytes	1 byte	2 bytes	N bytes	2 bytes
0xef01	XXXX	0x08	N + 2	Image data	Sum

1. confirmation code = 0x00 means that you can receive the subsequent data packet;
   Confirmation code = 0x01 represents income package is wrong;
   Confirmation code = 0x0e unable to receive subsequent data packets.
2. Send command packet, receive packet after packet or the end of the module response.
3. The package content value is determined by the number of bytes of packet length N content, the factory package content length is set to 128 bytes.

6.2.11 Image generation feature **Img2Tz**

Function Description: ImageBuffer original fingerprint image generation feature, feature, or stored in CharBuffer1 CharBuffer2.

Input parameters: BufferID (feature buffer number)

Return parameter: Confirm word

Instruction code: 0x02

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction Code	Buffer No.	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes
0xef01	XXXX	0x01	0x0004	0x02	BufferID	Sum

Buffer CharBuffer1, CharBuffer2 of BufferID are 0x01 and 0x02, if you specify a different value according to CharBuffer2 deal with.

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x07	0x0003	X	Sum

Confirmation code = 0x00, indicates success generating feature;

Confirmation code = 0x01, indicates receiving packets is wrong;

Confirmation code = 0x06, indicates the fingerprint image is too messy and not green features;

Confirmation code = 0x07, indicates the fingerprint image is normal, but too few students not feature point feature;

Confirmation code = 0x15, indicates that no valid image buffer within the original image and the image is not a student.

6.2.12 Characterized synthetic template **RegModel**

Function Description: CharBuffer1 and CharBuffer2 the merge feature to generate a template file, the template stored in CharBuffer1 CharBuffer2 (both the same content).

Input parameters: none

Return parameter: Confirm word

Instruction code: 0x05

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction Code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x01	0x0003	0x05	Sum

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x07	0x0003	X	Sum

1. confirmation code = 0x00, indicates successful merger;
   Confirmation code = 0x01, indicates receiving packets is wrong;
   Confirmation code = 0x0a, represents the merger failed (two fingerprints do not belong to the same finger).

6.2.13 Upload feature or template **UpChar**

Function: the feature buffer CharBuffer1 or CharBuffer2 the signature file uploaded to the host machine.

Input parameters: BufferID (buffer number)

Return parameter: Confirm word

Instruction code: 0x08

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction code	Buffer No.	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes
0xef01	XXXX	0x01	0x0004	0x08	BufferID	Sum

Buffer CharBuffer1, CharBuffer2 of BufferID are 0x01 and 0x02

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x07	0x0003	X	Sum

Packets (follow-up package) format:

Baotou	Module address	Package Identity	Packet length	Package Contents	Checksum
2 bytes	4 bytes	1 byte	2 bytes	N bytes	2 bytes
0xef01	XXXX	0x02	N + 2	Template data	Sum

End packet (no follow-up package) format:

Baotou	Module address	Package Identity	Packet length	Package Contents	Checksum
2 bytes	4 bytes	1 byte	2 bytes	N bytes	2 bytes
0xef01	XXXX	0x08	N + 2	Template data	Sum

1. confirmation code = 0x00, and then send the data packet represents;
   Confirmation code = 0x01, indicates receiving packets is wrong;
   Confirmation code = 0x0d, indicates instruction execution failed.
2. Send command packet transmitted packets or after the end packet response module, and the data packet and an end packet without response packet.
3. The package content value is determined by the number of bytes of packet length N content, the factory package content length is set to 128 bytes.
4. The directive does not affect the contents of the buffer module features.

6.2.14 Download or feature template **DownChar**

Function: PC to download the file to a characteristic feature buffer module.

Input parameters: BufferID (buffer number)

Return parameter: Confirm word

Instruction code: 0x09

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction code	Buffer No.	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes
0xef01	XXXX	0x01	0x0004	0x09	BufferID	Sum

Note: The buffer CharBuffer1, CharBuffer2 of BufferID are 0x01 and 0x02

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x07	0x0003	X	Sum

Packets (follow-up package) format:

Baotou	Module address	Package Identity	Packet length	Package Contents	Checksum
2 bytes	4 bytes	1 byte	2 bytes	N bytes	2 bytes
0xef01	XXXX	0x02	N + 2	Template data	Sum

End packet (no follow-up package) format:

Baotou	Module address	Package Identity	Packet length	Package Contents	Checksum
2 bytes	4 bytes	1 byte	2 bytes	N bytes	2 bytes
0xef01	XXXX	0x08	N + 2	Template data	Sum

1. confirmation code = 0x00, means it can receive subsequent data packet;
   Confirmation code = 0x01, indicates receiving packets is wrong;
   Confirmation code = 0x0e, was unable to receive subsequent data packets.

2. Send command packet, receive packet after packet or the end of the module response.
3. The package content value is determined by the number of bytes of packet length N content, the factory package content length is set to 128 bytes.

6.2.15 Storage template **Store**

Function: The characteristics specified buffer (CharBuffer1 or CharBuffer2) template data stored in the Flash finger fingerprint database Given location.

Input parameters: BufferID (buffer number) + PageID (fingerprint location number, two bytes, high byte first).

Return parameter: Confirm word

Instruction code: 0x06

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction code	Buffer No.	Position number	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes	2 bytes
0xef01	XXXX	0x01	0x0006	0x06	BufferID	PageID	Sum

Note: The buffer CharBuffer1, CharBuffer2 of BufferID are 0x01 and 0x02

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x07	0x0003	X	Sum

Confirmation code = 0x00, indicate saved successfully;

Confirmation code = 0x01, indicates receiving packets is wrong;

Confirmation Code = 0x0b, represents PageID beyond the scope of the fingerprint database;

Confirmation code = 0x18, indicating a write FLASH error.

6.2.16 Read template **LoadChar**

Function: The flash specified in the database ID number read into the fingerprint template or stencil buffer CharBuffer1 CharBuffer2.

Input parameters: BufferID (buffer number) + PageID (fingerprint template library number, two bytes, high byte first).

Return parameter: Confirm word

Instruction code: 0x07

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction code	Buffer No.	page number	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes	2 bytes
0xef01	XXXX	0x01	0x0006	0x07	BufferID	PageID	Sum

Note: The buffer CharBuffer1, CharBuffer2 of BufferID are 0x01 and 0x02

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x07	0x0003	X	Sum

Confirmation code = 0x00, read indicates success;

Confirmation code = 0x01, indicates receiving packets is wrong;

Confirmation code = 0x0c, represents read wrong or template is invalid;

Confirmation Code = 0x0b, represents PageID beyond the scope of the fingerprint database.

6.2.17 Remove Templates **DeleteChar**

Function: Remove module fingerprint database for a specified period (the beginning of the specified ID number N of fingerprint template) template.

Input parameters: PageID (fingerprint template library number) + N Delete template number.

Return parameter: Confirm word

Instruction code: 0x0c

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction code	page number	Delete number	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes	2 bytes	2 bytes
0xef01	XXXX	0x01	0x0007	0x0c	PageID	Lt; / RTI & Sum	

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x07	0x0003	X	Sum

Confirmation code = 0x00, success means to delete the template;

Confirmation code = 0x01, indicates receiving packets is wrong;

Confirmation code = 0x10, means to delete the template failed.

6.2.18 Empty fingerprint database **Empty**

Function: Remove all modules in the library fingerprint fingerprint template.

Input parameters: none

Return parameter: Confirm word

Instruction code: 0x0d

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction Code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x01	0x0003	0x0d	sum

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x07	0x0003	X	Sum

Confirmation code = 0x00, success showing empty;

Confirmation code = 0x01, indicates receiving packets is wrong;

Confirmation code = 0x11, indicates empty failure.

6.2.19 Exact matching two fingerprint characteristics **Match**

Function: Module Exact match (1: 1) CharBuffer1 CharBuffer2 with the signature file, and gives comparison result.

Input parameters: none

Return parameter: + word confirm alignment score

Instruction code: 0x03

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction Code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x01	0x0003	0x03	0x0007

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation code	Score	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes	2 bytes
0xef01	XXXX	0x07	0x0005	X	XX	Sum

1. confirmation code = 0x00, indicates the fingerprint matching;

   Confirmation code = 0x01, indicates receiving packets is wrong;

   Confirmation code = 0x08, indicates the fingerprint mismatch.

2. The instruction is executed, two features the buffer contents remain unchanged.

6.2.20 Search Fingerprint **Search**

Function: In CharBuffer1 or CharBuffer2 the feature to search the entire document or part of the fingerprint database. If the search returns order number.

Input parameters: BufferID + StartPage (starting number) + PageNum (number)

Return parameter: + word confirmation number (matching fingerprint template)

Instruction code: 0x04

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction Code	BufferID	Starting sequence number	Number of checks	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes	2 bytes	2 bytes
0xef01	XXXX	0x01	0x0008	0x04	BufferID	StartPage	PageNum	Sum

Note: The buffer CharBuffer1, CharBuffer2 of BufferID are 0x01 and 0x02

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation code	page number	Score	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes	2 bytes	2 bytes
0xef01	XXXX	0x07	0x007	X	PageID	MatchScore	Sum

1. confirmation code = 0x00, indicates to the search;

   Confirmation code = 0x01, indicates receiving packets is wrong;

   Confirmation code = 0x09, said they were not found.

2. The instruction is executed, the buffer contents remain unchanged characteristics.

6.3 Other instructions

6.3.1 writing notepad **WriteNotepad**

Function: used to write 32 bytes of user data to the specified notepad page (see "4 .8 Notepad").

Input parameters: NotePageNum, user content

Return parameter: Confirm word

Instruction code: 0x18

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction code	page number	User Info	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	32 bytes	2 bytes
0xef01	XXXX	0x01	0x0024	0x18	0x00-0x0e	32 bytes	Sum

Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation code	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x07	0x0003	X	Sum

Confirmation code = 0x00, indicates success;

Confirmation code = 0x01, indicates receiving packets wrong.

6.3.2 Reading Notepad **ReadNotepad**

Function: is used to read the contents of the specified user data written notes on this page (see "4 .8 Notepad").

Input parameters: NotePagenum

Return parameter: + word confirm user information

Instruction code: 0x19

Instruction packet format:

Baotou	Module address	Package Identity	Packet length	Instruction page number	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
0xef01	XXXX	0x01	0x0004	0x19	0x00-0x0e	sum

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Response packet format:

Baotou	Module address	Package Identity	Packet length	Confirmation code	User Info	Checksum
2 bytes	4 bytes	1 byte	2 bytes	1 byte	32 bytes	2 bytes
0xef01	XXXX	0x07	0x0023	X	content	Sum

Confirmation code = 0x00, indicates success;

Confirmation code = 0x01, indicates receiving packets wrong.

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Chapter **7** Chapter flowchart of an exemplary program development

7.1 Entry fingerprint flowchart

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7.2 search elements fingerprint flowchart

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annex

Optical fingerprint sensor (or integrated module) Dimensions (Unit: mm)