SM630 Fingerprint Verification Module User Manual

2008-07-01

V1.0

Preface

Thank you for purchasing SM630 Fingerprint Verification Module (here in after referred to as MODULE) developed by **Miaxis Biometrics Co., Ltd.** (here in after referred to as Miaxis).

This user manual is written for software and hardware application engineers as reference. It consists of documents on various module functions, software/hardware interfaces, etc.

To make sure that application development is successful, please read this manual carefully before starting secondary development. Apart from understanding the technical concept and use instructions stated in this user manual, user shall also read carefully the sections about definitions of pin, use guidelines, etc.

Please keep this user manual within reach for handy reference in case of any problems.

※ Miaxis is engaged in sustained improvement of product. Module and User Manual are subject to changes without prior notice. Please visit our website (www.miaxis.com) or contact us by phone to obtain most updated information.

※ We have endeavored to guarantee the accuracy of this user manual. However, if you find any error or have any questions, we would appreciate if you could kindly contact us or our authorized distributors.

※ Any copying or adaptation of part/all of the user manual without written approval from Miaxis will be considered as severe infringement.

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Chapter 1 System Overview

SM630 background highlight optical fingerprint verification module is the latest release of Miaxis Biometrics Co., Ltd. It consists of optical fingerprint sensor, high performance DSP processor and Flash. It boasts of functions such as fingerprint Login, fingerprint deletion, fingerprint verification, fingerprint upload, fingerprint download, etc. Compared to products of similar nature, SM630 enjoys the following unique features:

- **Self-proprietary Intellectual Property**

  Optical fingerprint collection device, module hardware and fingerprint algorithm are all self developed by Miaxis.

- **High Adaptation to Fingerprints**

  When reading fingerprint images, it has self-adaptive parameter adjustment mechanism, which improves imaging quality for both dry and wet fingers. It can be applied to wider public.

- **Low Cost**

  Module adopts Miaxis' optical fingerprint collection device, which dramatically lowers the overall cost.

- **Algorithm with Excellent Performance**

  SM630 module algorithm is specially designed according to the image generation theory of the optical fingerprint collection device. It has excellent correction & tolerance to deformed and poor-quality fingerprint.

- **Easy to Use and Expand**

  User does not have to have professional know-how in fingerprint verification. User can easily develop powerful fingerprint verification application systems based on the rich collection of controlling command provided by SM630 module. All the commands are simple, practical and easy for development.

- **Low Power Consumption**

  Operation current <80mA, specially good for battery power occasions.

- **Integrated Design**

Fingerprint processing components and fingerprint collection components are integrated in the same module. The size is small. And there are only 4 cables connecting with HOST, much easier for installation and use.

- **Perfect Technical Support**

Miaxis is the leading company in the fingerprint verification industry. It has an excellent customer service team ready to offer powerful technical support in user development.

Chapter 2 Technical Specifications

Operating Voltage:

4.3V～6V

Rating Voltage:

6.5V（exceeding this value will cause permanent damage to the module）

Operating Current：

<80mA（Input voltage 5V）

Fingerprint Template：

768 templates

Search Time：

<1.5s（200 fingerprint, average value in test）

Power-on Time：

<200ms（Time lapse between module power-on to module ready to receive instructions）

Tolerated Angle Offset：

±45°

User Flash Memory：

64KByte

Interface Protocol:

Standard serial interface （TTL level）

Communication Baud Rate:

57600bps

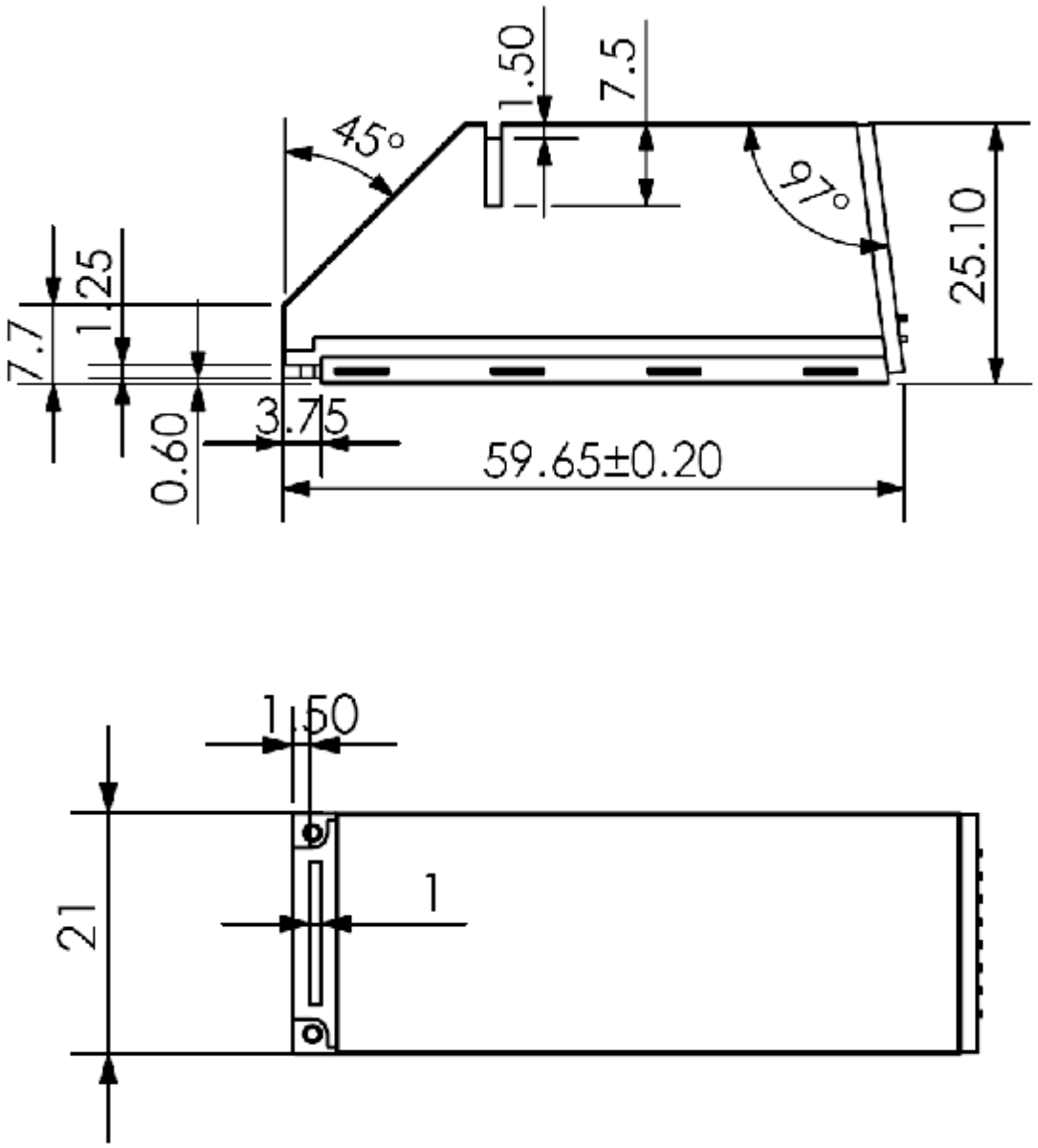
Operating Environment:

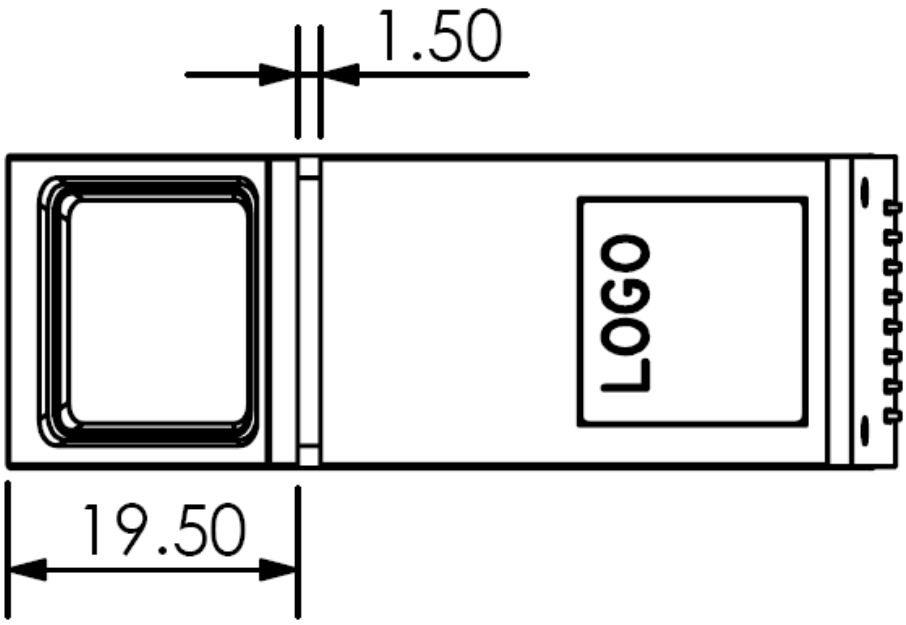
Temperature: -10℃～+40℃

Relative humidity: 40％RH～85％RH（no dew）

Chapter 3 System Specification & Interface

3.1 Dimension





3.2 Electrical Interface

Module is connected to HOST via 4PIN cable. The PIN definition is as follows:

No.	PIN Definition	Remarks
1	Power supply ＋	Power supply +
2	Module Tx	Open-drain output, need to use pull-up resistance in application (Typical value: 10KΩ)
3	Module Rx	Wide voltage input, 7V affordable
4	Power supply	Power supply －

Notes:

The PIN close to the edge of circuit board is PIN4: Power supply －.

Chapter 4 Communication Protocol

4.1 Command

No.	Name of Command	Command Code
1	Add fingerprint	0x40
2	Delete fingerprint	0x42
3	Search fingerprint	0x44
4	Empty fingerprint database	0x46
5	Search information in fingerprint database	0x4B
6	Download fingerprint template	0x50
7	Upload fingerprint template	0x52
8	Read ID number	0x60
9	Read user Flash	0x62
10	Write user Flash	0x64
11	Read product logo	0x80

4.2 Response Code

No.	Name of Command	Response Code
1	Receive correct	0x01
2	Receive error	0x02
3	Operation successful	0x31
4	Finger detected	0x32
5	Time out	0x33
6	Fingerprint process failure	0x34
7	Parameter error	0x35
8	Fingerprint matching with this ID found	0x37
9	No matching fingerprint with this ID	0x38
10	Fingerprint found	0x39
11	Fingerprint unfound	0x3A

4.3 Coding Method

The communication between HOST and Module must be coded as Communication Packet.

One communication packet includes the following:

Packet Head（2 bytes）

Packet flag（1 byte）

Packet length（1 byte）

Packet Content（N bytes）

Check sum（1 byte）

Packet head：0x4D 0x58

Packet flag：

0x10：command packet

0x20：data packet

0x21：last packet

0x30：response packet

Packet length：

Length of the Content in packet

Packet content：

Content of packet

Check sum：

Low 8 bytes of the SUM from packet head to check sum.

4.4 Brief Work Flowchart

Module waits for command from HOST after it is powered on. Module will respond by a Rx correct packet after receiving the correct command. Module will perform operations according to the command and will return corresponding information after the operation is successful. When the Module is performing operation, it will not respond to other command given by HOST. If the check sum for the received command is wrong, the module will send back receive error response.

Module receive correct packet:

0x4D + 0x58 + 0x30 + 0x01 + 0x01 + 0xD7

Module receive error packet:

0x4D + 0x58 + 0x30 + 0x01 + 0x02 + 0xD8

Chapter 5 Command Description

1 Add fingerprint

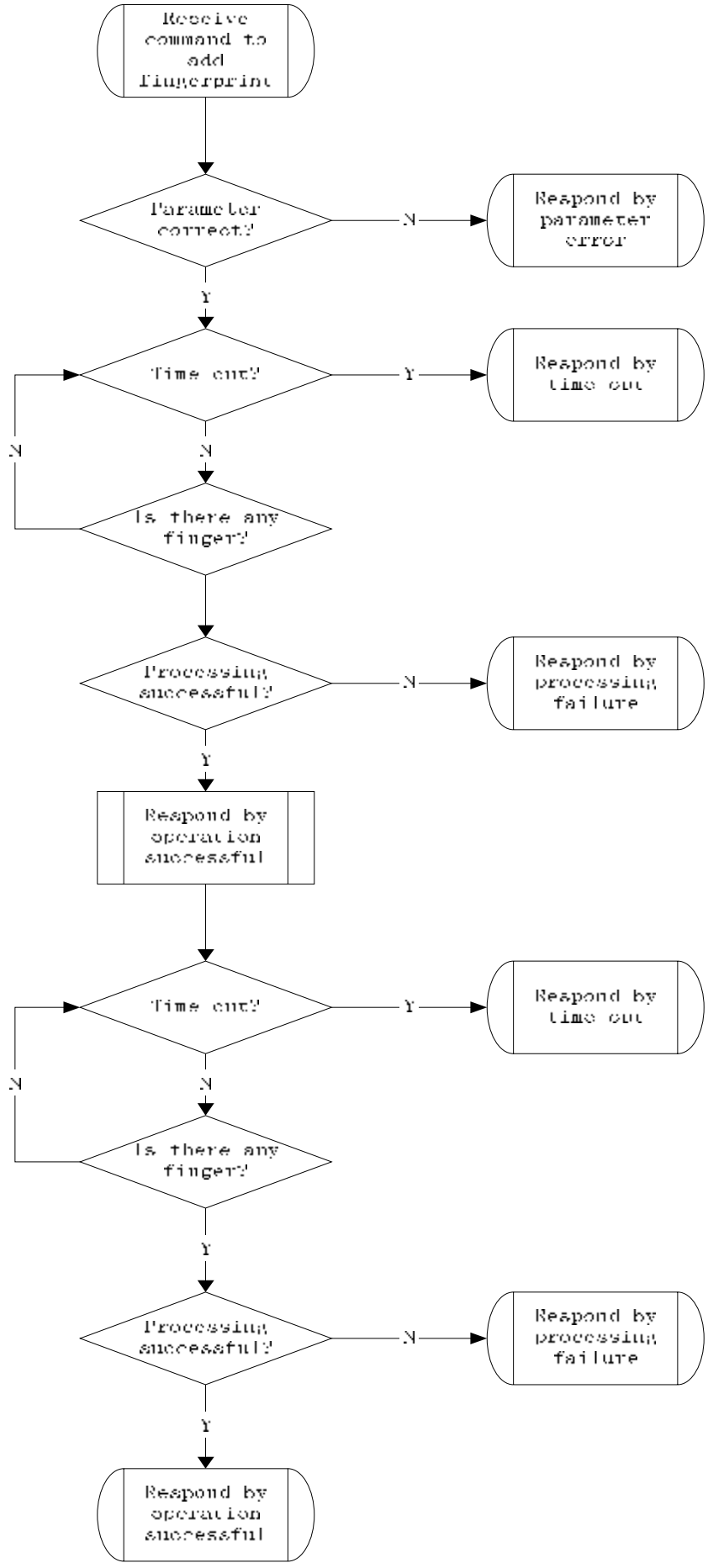
Description： Add fingerprint at the designated position

Length： 3 bytes

Format： Command code 0x40 + high byte of the to-be-added fingerprint ID + low byte of the to-be-added fingerprint ID

Flowchart：

After module receives the command to add fingerprint, it goes to the status of adding fingerprint. The flowchart is as follows:



For example：

1 HOST send command to add fingerprint at position 0:

0x4D + 0x58 + 0x10 + 0x03 + 0x40 + 0x00 + 0x00 + 0xF8

2 Module responds by receive correct: 0x4D + 0x58 + 0x30 + 0x01 + 0x01 + 0xD7

3 First time to press finger. Module will respond as operation successful after processing the first fingerprint:

0x4D + 0x58 + 0x30 + 0x02 + 0x40 + 0x31 + 0x48

4 Press finger again, and module will respond as operation successful after processing:

0x4D + 0x58 + 0x30 + 0x02 + 0x40 + 0x31 + 0x48

Remarks：

1 Fingerprint ID starts from 0

2 Fingerprint storage capacity: 768

3 If the ID is wrong in the command, module will responds as parameter error:

0x4D + 0x58 + 0x30 + 0x02 + 0x40 + 0x35 + 0x4C

4 If user press different finger at the first time and second time, or the fingerprint quality is poor, module will responds as fingerprint processing failure:

0x4D + 0x58 + 0x30 + 0x02 + 0x40 + 0x34 + 0x4B

5 If there is no finger pressing within 10 seconds, module will respond as time-out.

0x4D + 0x58 + 0x30 + 0x02 + 0x40 + 0x33 + 0x4A

2 Delete Fingerprint

Description: Delete the fingerprint of designated ID

Length： 3 bytes

Format： Command code 0x42 + high bytes of the to-be-deleted fingerprint ID + low bytes of the to-be-deleted fingerprint ID

For example:

1 HOST send command to delete fingerprint ID No. 0;

0x4D + 0x58 + 0x10 + 0x03 + 0x42 + 0x00 + 0x00 + 0xFA

2 Module responds as RX correct: 0x4D + 0x58 + 0x30 + 0x01 + 0x01 + 0xD7

3 Module responds as operation successful after execute the fingerprint deletion command:

0x4D + 0x58 + 0x30 + 0x02 + 0x42 + 0x31 + 0x4A

Remarks：

1 If fingerprint ID in the command is out of range, module will respond as parameter error:

0x4D + 0x58 + 0x30 + 0x02 + 0x42 + 0x35 + 0x4E

3 Search Fingerprint

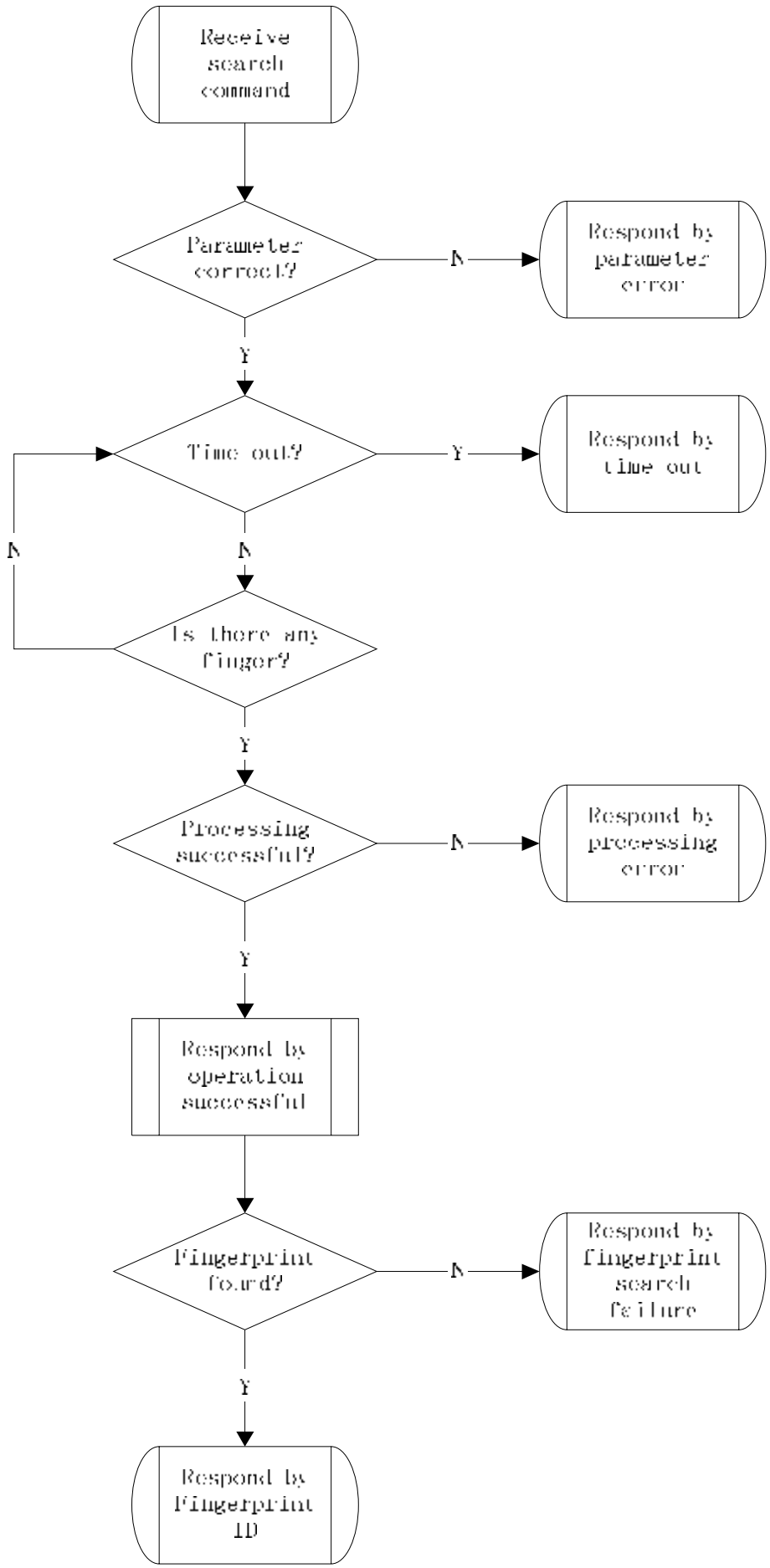
Description: Searching for designated fingerprint within range

Length： 5 bytes

Format： Command code 0x44 + search high bytes of starting ID + search low bytes of low bytes + high bytes of the number of fingerprints searched + low bytes of the number of fingerprints searched

Flowchart：

After receiving the command to search fingerprint, module will get ready to status of searching fingerprint. See below flowchart:



For example：

1 HOST send command to search 16 fingerprints starting from 0:

0x4D + 0x58 + 0x10 + 0x05 + 0x44 + 0x00 + 0x00 + 0x00 + 0x10 + 0x0E

2 When the fingerprint is placed on the sensor window, module will respond as operation successful:

0x4D + 0x58 + 0x30 + 0x02 + 0x44 + 0x31 + 0x4C

3 If the fingerprint is found, module will return the following:

0x4D + 0x58 + 0x30 + 0x04 + 0x44+ 0x39 + high bytes of ID for the found fingerprint + low bytes of ID for the found fingerprint + check sum

4 If no matching fingerprint is found, module will return the following:

0x4D + 0x58 + 0x30 + 0x02 + 0x44 + 0x3A + 0x55

Remarks：

1 The number of the fingerprints that are searched starts from the ID of the first fingerprint, for example, the search starts from fingerprint ID 0. the number of fingerprints searched is 0x10，then the fingerprint ID actually being searched is 0～0x0F, altogether 0x10 fingerprints.

2 If the ID in the command is wrong, module will responds as parameter error:

0x4D + 0x58 + 0x30 + 0x02 + 0x44 + 0x35 + 0x50

3If the fingerprint quality is poor, module will respond as fingerprint processing failure:

0x4D + 0x58 + 0x30 + 0x02 + 0x44 + 0x34 + 0x4F

4 If there is no finger placing on the sensor with 10 seconds, module will respond as time out:

0x4D + 0x58 + 0x30 + 0x02 + 0x44 + 0x33 + 0x4E

4 Empty Fingerprint Database

Description: Empty all fingerprints in fingerprint database

Length： 1 byte

Format： Command code 0x46

For example:

1 HOST send command to empty fingerprint database:

0x4D + 0x58 + 0x10 + 0x01 + 0x46 + 0xFC

2 Module will respond as Rx correct: 0x4D + 0x58 + 0x30 + 0x01 + 0x01 + 0xD7

3 Module will respond as operation successful after executing command to empty fingerprint database:

0x4D + 0x58 + 0x30 + 0x02 + 0x46 + 0x31 + 0x4E

5 Search Fingerprint Database Information

Description: Search and see if there is fingerprint matching the designated ID

Length: 3 bytes

Format: Command code 0x4B + high byte of the to-be-searched fingerprint ID + low byte of the to-be-searched fingerprint ID

For example:

1 HOST send command to search fingerprint with ID 0:

0x4D + 0x58 + 0x10 + 0x03 + 0x4B + 0x00 + 0x00 + 0x03

2 Module will respond as Rx correct: 0x4D + 0x58 + 0x30 + 0x01 + 0x01 + 0xD7

3 If there is fingerprint with ID 0, module will return the following:

0x4D + 0x58 + 0x30 + 0x02 + 0x4B + 0x37 + 0x59

4 If there is no fingerprint with ID 0, module will then return the following:

0x4D + 0x58 + 0x30 + 0x02 + 0x4B + 0x38 + 0x5A

Remarks:

1 If the fingerprint ID in the command is out of range, module will respond as parameter error:

0x4D + 0x58 + 0x30 + 0x02 + 0x4B + 0x35 + 0x57

6 Download Fingerprint Template

Description： Download a fingerprint into the module

Length： 3 bytes

Format： Command code 0x50 + high byte of the to-be-downloaded fingerprint ID + low byte of the to-be-downloaded fingerprint ID

For example：

1 HOST send a command to download a fingerprint to the position for ID 0:

0x4D + 0x58 + 0x10 + 0x03 + 0x50 + 0x00 + 0x00 + 0x08

2 Module will respond as Rx correct: 0x4D + 0x58 + 0x30 + 0x01 + 0x01 + 0xD7

3 HOST send the first data packet (packet content 128):

0x4D + 0x58 + 0x20 + 0x80 + ……128 bytes of data…… + check sum

4 Module will respond as Rx correct: 0x4D + 0x58 + 0x30 + 0x01 + 0x01 + 0xD7

5 HOST send the second data packet (packet content 128):

0x4D + 0x58 + 0x21 + 0x80 + ……128 bytes of data…… + check sum

6 Module will respond as Rx correct: 0x4D + 0x58 + 0x30 + 0x01 + 0x01 + 0xD7

7 Module will respond as operation successful: 0x4D + 0x58 + 0x30 + 0x02 + 0x50 + 0x31 + 0x58

Remarks：

1 If the fingerprint ID in the command is wrong, module will respond as parameter error:

0x4D + 0x58 + 0x30 + 0x02 + 0x50 + 0x35 + 0x5C

7 Upload Fingerprint Template

Description： Upload fingerprint template with the designated ID

Length： 3 bytes

Format： Command code 0x52 + high byte of the to-be-uploaded fingerprint ID + low

byte of the to-be-uploaded fingerprint ID.

For example:

1 HOST send a command to upload a fingerprint to the position for ID 0:

0x4D + 0x58 + 0x10 + 0x03 + 0x52 + 0x00 + 0x00 + 0x0A

2 Module will respond as Rx correct: 0x4D + 0x58 + 0x30 + 0x01 + 0x01 + 0xD7

3 Module send the first data packet

0x4D + 0x58 + 0x20 + 0x80 + ……128 bytes of data…… + check sum

4 HOST will respond as Rx correct 0x4D + 0x58 + 0x30 + 0x01 + 0x01 + 0xD7

5 Module send the second data packet

0x4D + 0x58 + 0x21 + 0x80 + ……128 bytes of data…… + check sum

Remarks：

1 If the fingerprint ID in the command is wrong, module will respond as parameter error:0x4D + 0x58 + 0x30 + 0x02 + 0x52 + 0x35 + 0x5E

8 Read ID Number

Description： Read module ID number

Length： 1 byte

Format： Command code 0x60

Example：

1 HOST send a command to read Module ID number:

0x4D + 0x58 + 0x10 + 0x01 + 0x60 + 0x16

2 Module will respond as Rx correct: 0x4D + 0x58 + 0x30 + 0x01 + 0x01 + 0xD7

3 Module will respond by 24-byte ID number after executing the command:

0x4D + 0x58 + 0x30 + 0x19 + 0x60 + ……24-byte ID number…… + check sum

Remarks：

1 ID number is set by manufacturer. User can read ID number only. Each module has its own ID number. User can tell different module by reading ID number.

9 Read User Flash

Description： Read the content of the designated address in user flash in the module

Length： 4 bytes

Format： Command code 0x62 + read high bytes of the address + read low bytes of the address + read the number

For example：

1 HOST send command to read 10 data starting from ADD 0 in user flash:

0x4D + 0x58 + 0x10 + 0x04 + 0x62 + 0x00 + 0x00 + 0x0A + 0x25

2 Module will respond as Rx correct: 0x4D + 0x58 + 0x30 + 0x01 + 0x01 + 0xD7

3 Module will respond by the data it read:

0x4D + 0x58 + 0x30 + number of data read + 0x62 + ……data read…… + check sum

Remarks：

1 The memory is 64K bytes in user flash (ADD 1~0xFFFF). Maximum 128Byte data can be read at one time.

10 Write User Flash

Description： Write data in the designated address in user Flash

Length： N+4 bytes

Format： Command code 0x64 + high bytes of the address where data to be written + low bytes of the address where data to be written + number of data to be written + ……N bytes of data to be written……

For example:

1 HOST send a command to write 2 Byte data in to the ADD 0 in user Flash

0x4D + 0x58 + 0x10 + 0x06 + 0x64 + 0x00 + 0x00 + 0x02 + 0x00 + 0x00 + 0x21

2 Module will respond as Rx correct: 0x4D + 0x58 + 0x30 + 0x01 + 0x01 + 0xD7

3 Module will respond after executing the command:

0x4D + 0x58 + 0x30 + 0x02 + 0x64 + 0x31 + 0x6C

Remarks：

1 The memory is 64K bytes in user flash. Maximum 128Byte data can be written at one time.

2 Please do not let address go beyond limit. It will cause unpredictable consequences if there is data outflow.

3 Please do not power off when writing in Flash. Powering off will cause unpredictable consequences.

11 Read Product Flag

Description： Read product flag

Length： 1 byte

Format： Command code 0x80

For example：

1 HOST send command to read product flag

0x4D + 0x58 + 0x10 + 0x01 + 0x80 + 0x36

2 Module will respond by Rx correct: 0x4D + 0x58 + 0x30 + 0x01 + 0x01 + 0xD7

3 Module will respond after executing command:

0x4D + 0x58 + 0x30 + 0x19 + 0x80 + ……24-byte product flag…… + check sum

Remarks：

1 Product flag is defined as 24Byte ASCII code, including 8-Byte manufacturer flag, 8-Byte product flag and 8-byte version flag.

Chapter 6 Q & A in Development

Q：How to correspond my product with Module?

A：Each module has a different ID number. You can make your system remember this ID number, so that each time before use your system will read Module ID number to check if the module matches. There is user flash in the module, where user can write some related user info to be distinguished from other modules.

Q：How to record the correspondence between fingerprint data and fingerprint owner?

A：User is responsible for setting up the correspondence between fingerprint data and fingerprint owner. For example, if the maximum capacity in your system is for 100 people with 2 fingerprints for each person in your system, you make your own rules of managing the fingerprints and the owners, such as Person No. 0's No. 0 fingerprint corresponding to the fingerprint template in ADD 0 in the module; Person No. 0's No. 1 fingerprint corresponding to the fingerprint template in ADD 1 in the module; Person No. 1's No. 0 fingerprint corresponding to the fingerprint template in ADD 2 in the module, etc.

When searching, module will respond by the address of the matching fingerprint template to determine the fingerprint owner. If the module returns ADD 4 of the matching fingerprint, it means it matches with Person No. 2's No. 0 fingerprint.

There is a 64Kbyte user Flash to store relevant information. You can set up a table to record all people's related information. Please update this table if user adds or deletes fingerprints.

Q：How to improve the speed of response?

A：When searching fingerprints, module will respond by operation successful after detecting the finger. HOST can give indication after receiving the operation successful response, such as buzz for some period of time (such as 400ms). By

doing so, User may feel much quicker.

Q：How to make it easier to use?

A：There are plenty of ways to make module easier to use:

1 Try to use the THUMB or INDEX finger, because the size is big and the fingerprint quality is better.

2 Try to place the finger in alignment with the sensor window

3 When use, try to place the fingerer at the same position as when it enrolls.

4 Avoid direct sunshine when use.

Q：How to decrease power consumption?

A：Power off the module when it is not being used. Power on the module when system requires fingerprint verification. It takes a very short time to start the module. Module responds quickly.

Q：For login and search command, if there is no finger placed, it takes long to get a response. What to do if I want the module to execute other functions?

A：User will have to wait until the current command is executed. Or user can power off the module and re-power on. It takes a very short time to start the module. Module responds quickly.

Q：If there is an existing fingerprint in a certain address, and what will happen if I add fingerprint at this same address?

A：The old fingerprint will be covered.

Q：How to set different user authorization?

A：You can set by yourself in your program. For example, if your setting is that fingerprints 0-9 are for Administration, the 10 fingerprints have to be all verified when login or delete fingerprint.