

Fingerprint_Protocol_All_English

1. Protocol Format

Port: UART - TTL, 19200bps, 1 Start bit, 1 Stop bit, None check bit

1.1 Data length = 8 bytes, data format as follow:

| Byte | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|-----|----|----|----|---|-----|------|
| Command | 0xF5 | CMD | P1 | P2 | P3 | 0 | CHK | 0xF5 |
| Response | 0xF5 | CMD | Q1 | Q2 | Q3 | 0 | CHK | 0xF5 |

Write:

- CMD: Command Type
- P1, P2, P3: Command Parameters
- Q1, Q2, Q3: Return Parameters

Q3: About the operation is valid or not, here is the value:

```
#define ACK_SUCCESS           0x00    // Operate success
#define ACK_FAIL             0x01    // Operate failed
#define ACK_FULL             0x04    // Fingerprint database is full
#define ACK_NOUSER          0x05    // Users do not exist
#define ACK_USER_OCCUPIED   0x06    // User ID already exists
#define ACK_USER_EXIST      0x07    // Fingerprint already exists
#define ACK_TIMEOUT         0x08    // Acquisition timeout
```

- CHK: Checksum, calculated by XOR values between 2nd byte and 6th byte.

1.2 Data length > 8 bytes, contain Data Head and Data Packet

Data Head:

| Byte | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|-----|---------|----------|----|---|-----|------|
| Command | 0xF5 | CMD | Hi(Len) | Low(Len) | 0 | 0 | CHK | 0xF5 |
| Response | 0xF5 | CMD | Hi(Len) | Low(Len) | Q3 | 0 | CHK | 0xF5 |

Write:

- CMD, Q3 is defined as above
- Len: Length of data packet, 2 bytes(16 bit)
- Hi(Len): High 8 bit of data packet
- Low(Len): Low 8 bit of data packet
- CHK: Checksum, calculated by XOR values between 2nd byte and 6th byte.

Data Packet:

| <i>Byte</i> | 1 | 2...Len + 1 | Len + 2 | Len + 3 |
|-----------------|------|-------------|---------|---------|
| <i>Command</i> | 0xF5 | Data | CHK | 0xF5 |
| <i>Response</i> | 0xF5 | Data | CHK | 0xF5 |

Write:

- *Len* is the byte length of Data
- CHK: Checksum, Checksum, calculated by XOR values between 2nd byte and Len + 1 byte.

The data packet is sent after sending data head.

2. Command Format**2.1 Sleep Mode****Command :**

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|----------------|------|------|---|---|---|---|-----|------|
| <i>Command</i> | 0xF5 | 0x2C | 0 | 0 | 0 | 0 | CHK | 0xF5 |

Response :

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|------|---|---|---|---|-----|------|
| <i>Response</i> | 0xF5 | 0x2C | 0 | 0 | 0 | 0 | CHK | 0xF5 |

2.2 Fingerprint Repeat Mode

- **Allow repeat mode:** allow to add new user with the same fingerprint
- **No allow to repeat mode:** no allow to add new user with the same fingerprint. It will response error info when the fingerprint is already existed. *The system is default in this mode.*

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|------|---|---------------------------------|---|---|-----|------|
| <i>Command</i> | 0xF5 | 0x2D | 0 | 0: Allow repeat 1: No repeat | 0: Set new mode 1: Read current mode | 0 | CHK | 0xF5 |
| <i>Response</i> | 0xF5 | 0x2D | 0 | The current mode | ACK_SUCCUSS ACK_FAIL | 0 | CHK | 0xF5 |

2.3 Add a New Fingerprint

In order to ensure the effectiveness, the user must enter fingerprint 3 times, also the host

(your controller board) should send command to the sensor module 3 times.

i) The 1st time

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|------|----------------------|----------------------|--|---|-----|------|
| Command | 0xF5 | 0x01 | User ID (H 8 bit) | User ID (L 8 bit) | Permissions (1/2/3) | 0 | CHK | 0xF5 |
| Response | 0xF5 | 0x01 | 0 | 0 | ACK_SUCCESS ACK_FAIL ACK_FULL ACK_TIMEOUT ACK_USER_EXIST | 0 | CHK | 0xF5 |

Write:

Input range value of user ID: 0x0001 – 0x0FFF ;

User Permissions, value is 1, 2, 3. It is defined by developers.

ii) The 2nd time

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|------|----------------------|----------------------|--|---|-----|------|
| Command | 0xF5 | 0x02 | User ID (H 8 bit) | User ID (L 8 bit) | Permissions (1/2/3) | 0 | CHK | 0xF5 |
| Response | 0xF5 | 0x02 | 0 | 0 | ACK_SUCCESS ACK_FAIL ACK_TIMEOUT | 0 | CHK | 0xF5 |

iii) The 3rd time

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|------|----------------------|----------------------|--|---|-----|------|
| Command | 0xF5 | 0x03 | User ID (H 8 bit) | User ID (L 8 bit) | Permissions (1/2/3) | 0 | CHK | 0xF5 |
| Response | 0xF5 | 0x03 | 0 | 0 | ACK_SUCCESS ACK_FAIL ACK_TIMEOUT | 0 | CHK | 0xF5 |

Write:

In the command 3 times, the user ID and user permission must be the same.

2.4 Delete Assigned User

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|------|----------------------|----------------------|-------------------------|---|-----|------|
| Command | 0xF5 | 0x04 | User ID (H 8 bit) | User ID (L 8 bit) | Permissions (1/2/3) | 0 | CHK | 0xF5 |
| Response | 0xF5 | 0x04 | 0 | 0 | ACK_SUCCESS ACK_FAIL | 0 | CHK | 0xF5 |

2.5 Delete All Users

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|------|---|---|-------------------------|---|-----|------|
| Command | 0xF5 | 0x05 | 0 | 0 | Permissions (1/2/3) | 0 | CHK | 0xF5 |
| Response | 0xF5 | 0x05 | 0 | 0 | ACK_SUCCESS ACK_FAIL | 0 | CHK | 0xF5 |

2.6 Get Number of Users

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|------|--------------------------|--------------------------|-------------------------|---|-----|------|
| Command | 0xF5 | 0x09 | 0 | 0 | Permissions (1/2/3) | 0 | CHK | 0xF5 |
| Response | 0xF5 | 0x09 | User Number (H 8 bit) | User Number (L 8 bit) | ACK_SUCCESS ACK_FAIL | 0 | CHK | 0xF5 |

2.7 Fingerprint Matching 1: 1

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|------|----------------------|----------------------|--|---|-----|------|
| Command | 0xF5 | 0x0B | User ID (H 8 bit) | User ID (L 8 bit) | 0 | 0 | CHK | 0xF5 |
| Response | 0xF5 | 0x0B | 0 | 0 | ACK_SUCCESS ACK_FAIL ACK_TIMEOUT | 0 | CHK | 0xF5 |

2.8 Fingerprint Matching 1: N

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-------------|---|---|---|---|---|---|---|---|
| | | | | | | | | |

| | | | | | | | | |
|-----------------|------|------|----------------------|----------------------|--|---|-----|------|
| Command | 0xF5 | 0x0C | 0 | 0 | 0 | 0 | CHK | 0xF5 |
| Response | 0xF5 | 0x0C | User ID (H 8 bit) | User ID (L 8 bit) | Permissions (1/2/3) ACK_NOUSER ACK_TIMEOUT | 0 | CHK | 0xF5 |

2.9 Get User Permissions

| Byte | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|------|----------------------|----------------------|--------------------------------------|---|-----|------|
| Command | 0xF5 | 0x0A | User ID (H 8 bit) | User ID (L 8 bit) | 0 | 0 | CHK | 0xF5 |
| Response | 0xF5 | 0x0A | 0 | 0 | Permissions (1/2/3) ACK_NOUSER | 0 | CHK | 0xF5 |

2.11 Set/ Read Fingerprint Matching Level

| Byte | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|------|---|--|---|---|-----|------|
| Command | 0xF5 | 0x28 | 0 | Byte5=0: New level; Byte5=1: 0; | 0: Set new level 1: Read current level | 0 | CHK | 0xF5 |
| Response | 0xF5 | 0x28 | 0 | MATCHING_ LEVEL | ACK_SUCCUSS ACK_FAIL | 0 | CHK | 0xF5 |

Write:

Input range value of matching level is 0-9, higher matching level, fingerprint matching is more strict. **The default level is 5.**

2.12 Get Fingerprint Image and Output (N/A for UART Port)

Command:

| Byte | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|----------------|------|------|---|---|---|---|-----|------|
| Command | 0xF5 | 0x24 | 0 | 0 | 0 | 0 | CHK | 0xF5 |

Response:

- 1) Data head:

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|------|---------|----------|--|---|-----|------|
| <i>Response</i> | 0xF5 | 0x24 | Hi(Len) | Low(Len) | ACK_SUCCESS ACK_FAIL ACK_TIMEOUT | 0 | CHK | 0xF5 |

2) Data packet:

| <i>Byte</i> | 1 | 2 --- Len + 1 | Len + 2 | Len + 3 |
|-----------------|------|---------------|---------|---------|
| <i>Response</i> | 0xF5 | Image data | CHK | 0xF5 |

Write :

Image resolution of fingerprint is 304*304 pix, each pix is a 8 bit grayscale. In order to decrease size of image data, the module get pixel by jump sampling in horizontal/vertical direction, then the image is 152*152. And take high 4 bit of grayscale, every two pixel transmitted into one byte (the ahead pixel in low 4 bit, the after pixel in high 4 bit).

Transmission from the first line by line, each line from the first pixel, a total of $(152*152 / 2)$ bytes of data.

Image data length *Len* is constant 11552 bytes.

2.13 Get Fingerprint Characteristics and Output

Command:

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|----------------|------|------|---|---|---|---|-----|------|
| <i>Command</i> | 0xF5 | 0x23 | 0 | 0 | 0 | 0 | CHK | 0xF5 |

Response:

1) Data head:

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|------|---------|----------|--|---|-----|------|
| <i>Response</i> | 0xF5 | 0x23 | Hi(Len) | Low(Len) | ACK_SUCCESS ACK_FAIL ACK_TIMEOUT | 0 | CHK | 0xF5 |

2) Data packet:

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 --- Len + 1 | Len + 2 | Len + 3 |
|-----------------|------|---|---|---|---------------------|---------|---------|
| <i>Response</i> | 0xF5 | 0 | 0 | 0 | Characteristic data | CHK | 0xF5 |

Write :

Length of Characteristic data is 193 bytes.

2.14 Upload Fingerprint Characteristics and Make Matching with Current Fingerprint

Command:

1) Data head:

| | | | | | | | | |
|----------------|------|------|---------|----------|---|---|-----|------|
| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| <i>Command</i> | 0xF5 | 0x44 | Hi(Len) | Low(Len) | 0 | 0 | CHK | 0xF5 |

2) Data packet:

| | | | | | | | |
|----------------|------|---|---|---|---------------------|---------|---------|
| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 --- Len + 1 | Len + 2 | Len + 3 |
| <i>Command</i> | 0xF5 | 0 | 0 | 0 | Characteristic data | CHK | 0xF5 |

Write:

Length of Characteristic data is 193 bytes.

Response:

| | | | | | | | | |
|-----------------|------|------|---|---|--|---|-----|------|
| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| <i>Response</i> | 0xF5 | 0x44 | 0 | 0 | ACK_SUCCESS ACK_FAIL ACK_TIMEOUT | 0 | CHK | 0xF5 |

2.15 Upload Fingerprint Characteristics and Make 1:1 Matching with Fingerprint in DSP Module Database

Command:

1) Data head:

| | | | | | | | | |
|----------------|------|------|---------|----------|---|---|-----|------|
| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| <i>Command</i> | 0xF5 | 0x42 | Hi(Len) | Low(Len) | 0 | 0 | CHK | 0xF5 |

2) Data packet:

| | | | | | | | |
|----------------|------|----------------------|----------------------|---|---------------------|---------|---------|
| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 --- Len + 1 | Len + 2 | Len + 3 |
| <i>Command</i> | 0xF5 | User ID (H 8 bit) | User ID (L 8 bit) | 0 | Characteristic data | CHK | 0xF5 |

Write:

Length of Characteristic data is 193 bytes.

Response:

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|------|---|---|-------------------------|---|-----|------|
| <i>Response</i> | 0xF5 | 0x42 | 0 | 0 | ACK_SUCCESS ACK_FAIL | 0 | CHK | 0xF5 |

2.16 Upload Fingerprint Characteristics and Make 1:N Matching with Fingerprint in DSP Module Database**Command:**

1) Data head:

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|----------------|------|------|---------|----------|---|---|-----|------|
| <i>Command</i> | 0xF5 | 0x43 | Hi(Len) | Low(Len) | 0 | 0 | CHK | 0xF5 |

2) Data packet:

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 --- Len + 1 | Len + 2 | Len + 3 |
|----------------|------|---|---|---|---------------------|---------|---------|
| <i>Command</i> | 0xF5 | 0 | 0 | 0 | Characteristic data | CHK | 0xF5 |

Write:

Length of Characteristic data is 193 bytes.

Response:

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|------|----------------------|----------------------|-------------------------|---|-----|------|
| <i>Response</i> | 0xF5 | 0x43 | User ID (H 8 bit) | User ID (L 8 bit) | ACK_SUCCESS ACK_FAIL | 0 | CHK | 0xF5 |

2.17 Download Assigned User Characteristics from DSP Database**Command:**

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|----------------|------|------|----------------------|----------------------|---|---|-----|------|
| <i>Command</i> | 0xF5 | 0x31 | User ID (H 8 bit) | User ID (L 8 bit) | 0 | 0 | CHK | 0xF5 |

Response:

1) Data head:

| | | | | | | | | |
|----------------|------|------|---------|----------|---------------------------------------|---|-----|------|
| Command | 0xF5 | 0x41 | Hi(Len) | Low(Len) | ACK_SUCCESS ACK_FAIL ACK_NOUSER | 0 | CHK | 0xF5 |
|----------------|------|------|---------|----------|---------------------------------------|---|-----|------|

2) Packet data :

| | | | | | | | |
|-----------------|------|----------------------|----------------------|------------------------|--------------------------------|---------|---------|
| Byte | 1 | 2 | 3 | 4 | 5 -- Len + 1 | Len + 2 | Len + 3 |
| Response | 0xF5 | User ID (H 8 bit) | User ID (L 8 bit) | Permissions (1/2/3) | Fingerprint Characteristics | CHK | 0xF5 |

Write:

Data length of *Len* is 193 bytes.

2.18 Add New User with a Fingerprint Characteristics

Command :

1) Data head :

| | | | | | | | | |
|----------------|------|------|---------|----------|---|---|-----|------|
| Byte | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Command | 0xF5 | 0x41 | Hi(Len) | Low(Len) | 0 | 0 | CHK | 0xF5 |

2) Packet data :

| | | | | | | | |
|-----------------|------|----------------------|----------------------|------------------------|--------------------------------|---------|---------|
| Byte | 1 | 2 | 3 | 4 | 5 --- Len + 1 | Len + 2 | Len + 3 |
| Response | 0xF5 | User ID (H 8 bit) | User ID (L 8 bit) | Permissions (1/2/3) | Fingerprint Characteristics | CHK | 0xF5 |

Write: <Len - 3> is in length of 193 bytes.

Response:

| | | | | | | | | |
|-----------------|------|------|---|---|-------------------------|---|-----|------|
| Byte | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Response | 0xF5 | 0x41 | 0 | 0 | ACK_SUCCESS ACK_FAIL | 0 | CHK | 0xF5 |

2.19 Get Users ID and Users Permissions

Command :

| | | | | | | | | |
|-------------|---|---|---|---|---|---|---|---|
| Byte | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-------------|---|---|---|---|---|---|---|---|

| | | | | | | | | |
|----------------|------|------|---|---|---|---|-----|------|
| Command | 0xF5 | 0x2B | 0 | 0 | 0 | 0 | CHK | 0xF5 |
|----------------|------|------|---|---|---|---|-----|------|

Response:

1) Data head:

| | | | | | | | | |
|-----------------|------|------|---------|----------|-------------------------|---|-----|------|
| Byte | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Response | 0xF5 | 0x2B | Hi(Len) | Low(Len) | ACK_SUCCESS ACK_FAIL | 0 | CHK | 0xF5 |

2) Data Packet:

| | | | | | | |
|-----------------|------|--------------------------|--------------------------|---|---------|---------|
| Byte | 1 | 2 | 3 | 4 --- Len + 1 | Len + 2 | Len + 3 |
| Response | 0xF5 | User number (H 8 bit) | User number (L 8 bit) | User Data (User ID and User Permissions) | CHK | 0xF5 |

Write: Len = User Number* 3 + 2

3) User Data Format:

| | | | | | | | |
|-------------|-----------------------|-----------------------|------------------------------|-----------------------|-----------------------|------------------------------|-----|
| Byte | 4 | 5 | 6 | 7 | 8 | 9 | ... |
| Data | User1 ID (H 8 bit) | User1 ID (L 8 bit) | User1 Permissions (1/2/3) | User2 ID (H 8 bit) | User2 ID (L 8 bit) | User2 Permissions (1/2/3) | ... |

2.20 Set/Read Fingerprint Acquisition Waiting Time

| | | | | | | | | |
|-----------------|------|------|---|--------------------------------------|---|---|-----|------|
| Byte | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Command | 0xF5 | 0x2E | 0 | Byte5=0: New Time; Byte5=1: 0; | 0: Set new waiting time 1: Read Current waiting time | 0 | CHK | 0xF5 |
| Response | 0xF5 | 0x2E | 0 | Current waiting time | ACK_SUCCUSS ACK_FAIL | 0 | CHK | 0xF5 |

Write:

Fingerprint acquisition waiting time is in range of 0-255 second. If the value is 0 and no fingerprints on the sensor, acquisition process will continue; If this value is not 0, the system will response timeout info if no fingerprints on the system. **This value is 0 by default.**

2.21 Get Module Internal Serial Number

| <i>Byte</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|------|------|------------------------------|------------------------------|------------------------------|---|-----|------|
| <i>Command</i> | 0xF5 | 0x2A | 0 | 0 | 0 | 0 | CHK | 0xF5 |
| <i>Response</i> | 0xF5 | 0x2A | Serial Number (H 8bit) | Serial Number (M 8bit) | Serial Number (L 8bit) | 0 | CHK | 0xF5 |

Write :

Serial number is 24 bit, each module has a standalone serial number.