# SFM SDK

## Reference Manual

Rev. 1.2

# Revision History

| Rev No. | Issued date | **Description** |
|---|---|---|
| 1.0 | Sep. 16, 2005 | Initial Release |
| 1.1 | Dec. 2, 2005 | Updates the changes made by V1.5 firmware |
| 1.2 | Apr. 25, 2006 | Incorporates the changes in V1.6 firmware |

# Contents

# 1. Introduction

The SFM SDK is a collection of APIs for interfacing with SFM modules and BioEntry readers. In addition to simple wrapper functions for Packet Protocol, it also provides high level APIs such as template DB management, image manipulation, etc. By using the SDK, developers could write Win32 applications quickly without knowing the minute details of Packet Protocol.

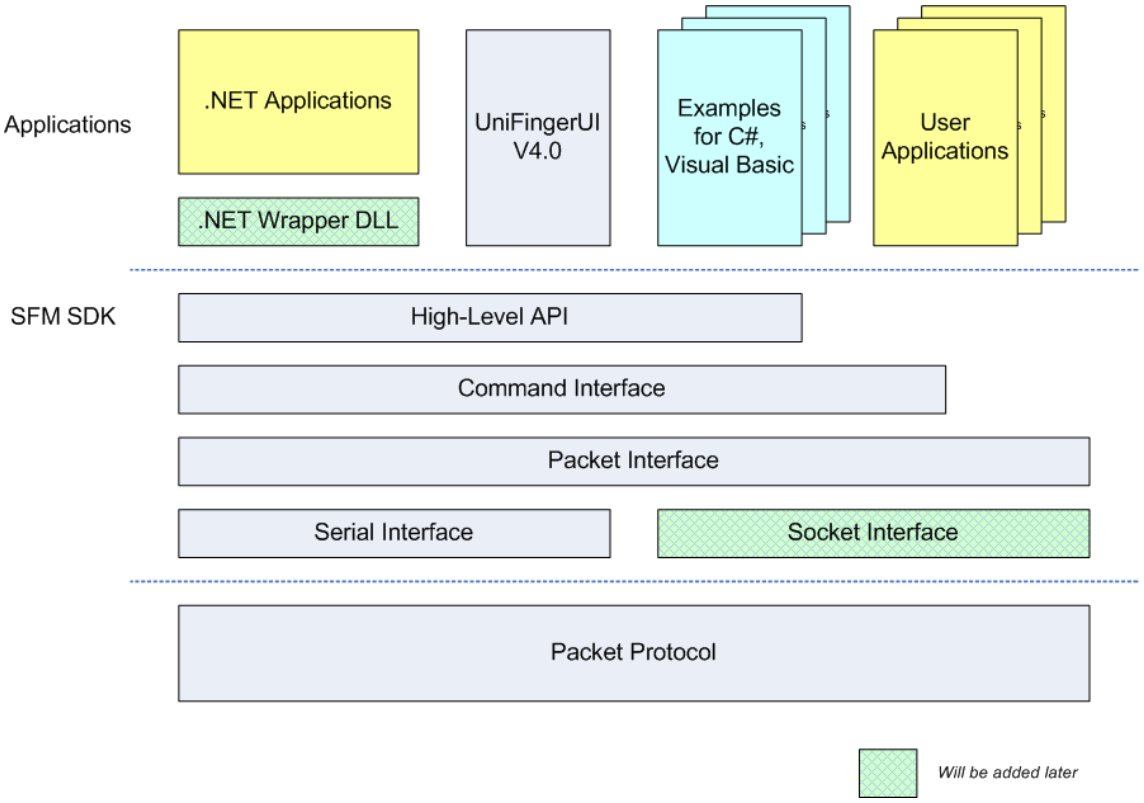


**Fig. 1. SFM SDK**

As Shown in Fig. 1, the SDK is composed of several layers and developers could choose whichever layer suited for their applications. Another strong point of the SDK is its extensibility. Many of core APIs provide callback mechanism, with which developers can add customized functions. UniFingerUI V4.x is a good example of this feature. Completely rewritten from scratch, UniFingerUI V4.x covers all the core functionalities of SFM modules and shows how to use the SDK in real applications. The source codes of it are also provided in the SDK.

## 1.1. Contents of the SDK

| Directory | Sub Directory | Contents |
|---|---|---|
| SDK | Document | - SFM SDK Reference Manual<br>- Packet Protocol Manual |
| | Include | - Header files of SFM SDK. |
| | Lib | - SFM_SDK.dll: SDK DLL file.<br>- SFM_SDK_Debug.dll: SDK DLL with debug information.<br>- SFM_SDK.lib: import library to be linked with C/C++ applications.<br>- SFM_SDK_Debug.lib: import library to be linked with C/C++ applications |
| UniFingerUI | | - Source codes<br>- Visual C++ 6.0 project file |
| Example | C# | - A simple example which shows how to use the SDK in .NET environment |

## 1.2. Usage

### 1.2.1. Compilation

To call APIs defined in the SFM SDK, 'UF_API.h' should be included in the source files and SDK\Include should be added to the include directories. To link user application with the SFM SDK, SFM_SDK.lib should be added to library modules.

The following snippet shows a typical source file.

```
#include "UF_API.h"
int main()
```

```
{
      // First, initialize the serial port
      UF_RET_CODE result = UF_InitCommPort( “COM1”, 115200, FALSE );

      If( result != UF_RET_SUCCESS )
      {
         return -1;
      }

      // Call APIs
      UINT32 userID;
      BYTE subID;

      result = UF_Identify( &userID, &subID );

      // …
}
```

#### 1.2.2. Using the DLL

To run applications compiled with the SFM SDK, the SFM_SDK.dll file should be in the system directory or in the same directory of the application.

## 1.3. UniFinger UI

UniFinger UI is a full-featured application by which users can test all the core functionalities of SFM modules. UniFinger UI is implemented using the SFM SDK and full source codes are available for SDK users.

#### 1.3.1. Optional Requirements

UniFinger UI uses Microsoft’s HTML Help Workshop for online help. You can download it from the MSDN web site.

#### 1.3.2. Compilation

Open UniFingerUI\UniFingerUI.dsw in Microsoft Visual C++ 6.0 or later. If you download and install HTML Help Workshop, changes the include directory and library path accordingly. If you don’t want online help, just select ‘Win32 Debug Without Help’ or ‘Win32 Release Without Help’ as the active configuration.

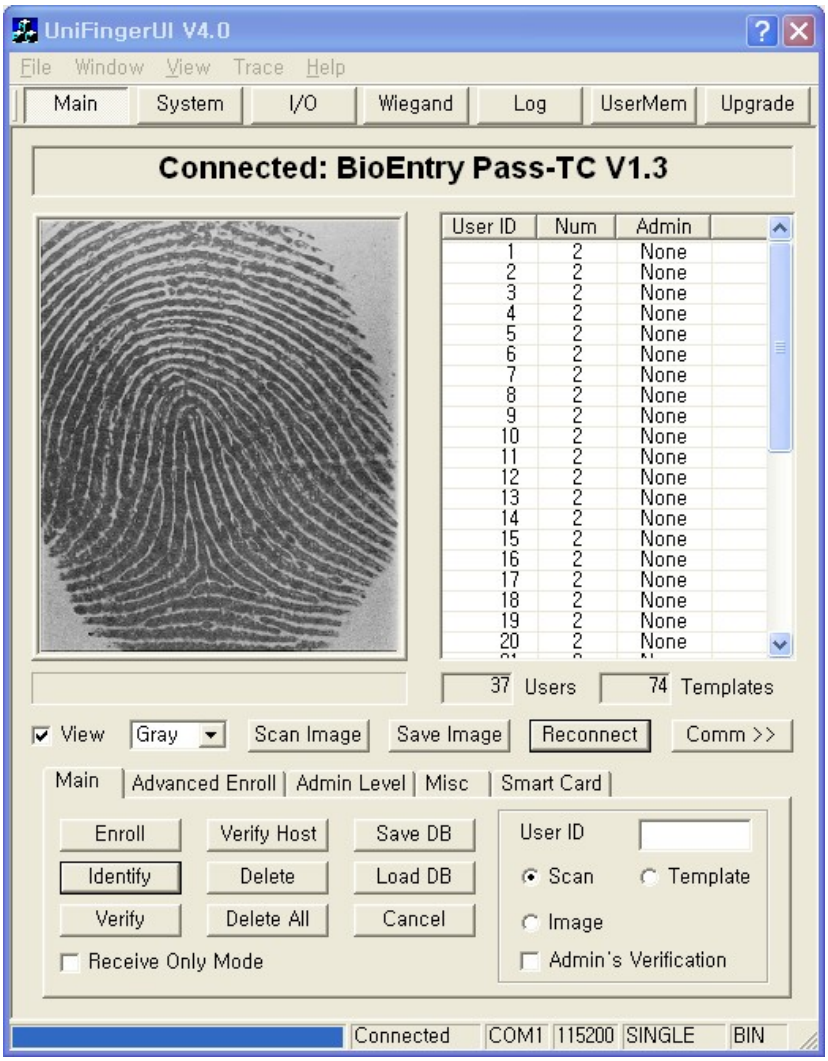


**Fig. 2. UniFingerUI**

# 2. API Compatibility

| Category | Function | SFM 3000 | SFM 3500 | BioEntry Pass | BioEntry Smart |
|---|---|---|---|---|---|
| Serial Comm. API | UF_InitCommPort | O | O | O | O |
| | UF_CloseCommPort | O | O | O | O |
| | UF_Reconnect | O | O | O | O |
| | UF_SetBaudrate | O | O | O | O |
| | UF_SetAsciiMode | O | O | O | O |
| Socket API | UF_InitSocket | O | O | O | O |
| | UF_CloseSocket | O | O | O | O |
| Low-Level Packet API | UF_SendPacket | O | O | O | O |
| | UF_ReceivePacket | O | O | O | O |
| | UF_SendNetworkPacket | O | O | O | O |
| | UF_ReceiveNetworkPacket | O | O | O | O |
| | UF_SendRawData | O | O | O | O |
| | UF_ReceiveRawData | O | O | O | O |
| | UF_SendDataPacket | O | O | O | O |
| | UF_SetSendPacketCallback | O | O | O | O |
| | UF_SetReceivePacketCallback | O | O | O | O |
| | UF_SetSendDataPacketCallback | O | O | O | O |
| | UF_SetReceiveDataPacketCallback | O | O | O | O |
| | UF_SetSendRawDataCallback | O | O | O | O |
| | UF_SetReceiveRawDataCallback | O | O | O | O |
| | UF_SetDefaultPacketSize | O | O | O | O |
| | UF_GetDefaultPacketSize | O | O | O | O |
| General Command API | UF_Command | O | O | O | O |
| | UF_CommandEx | O | O | O | O |
| | UF_CommandSendData | O | O | O | O |
| | UF_CommandSendDataEx | O | O | O | O |
| | UF_Cancel | O | O | O | O |
| | UF_SetProtocol | O | O | O | O |
| | UF_GetProtocol | O | O | O | O |
| | UF_GetModuleID | O | O | O | O |
| | UF_SetGenericCommandTimeout | O | O | O | O |

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|---|---|---|---|---|---|
| | UF_SetInputCommandTimeout | O | O | O | O |
| | UF_GetGenericCommandTimeout | O | O | O | O |
| | UF_GetInputCommandTimeout | O | O | O | O |
| | UF_SetNetworkDelay | O | O | O | O |
| | UF_GetNetworkDelay | O | O | O | O |
| Module API | UF_GetModuleInfo | O | O | O | O |
| | UF_GetModuleString | O | O | O | O |
| | UF_SearchModule | O | O | O | O |
| | UF_SearchModuleID | O | O | O | O |
| | UF_SearchModuleBySocket | O | O | O | O |
| | UF_SearchModuleIDEx | O | O | O | O |
| | UF_CalibrateSensor | O | O | O | O |
| | UF_Upgrade | O | O | O | O |
| | UF_Reset | O | O | O | O |
| | UF_Lock | X | O | O | O |
| | UF_Unlock | X | O | O | O |
| | UF_ChangePassword | X | O | O | O |
| System Parameters API | UF_InitSysParameter | O | O | O | O |
| | UF_GetSysParameter | O | O | O | O |
| | UF_SetSysParameter | O | O | O | O |
| | UF_GetMultiSysParameter | O | O | O | O |
| | UF_SetMultiSysParameter | O | O | O | O |
| | UF_Save | O | O | O | O |
| | UF_SaveConfiguration | O | O | O | O |
| | UF_ReadConfigurationHeader | O | O | O | O |
| | UF_LoadConfiguration | O | O | O | O |
| | UF_MakeParameterConfiguration | O | O | O | O |
| Template Mgmt. API | UF_GetNumOfTemplate | O | O | O | O |
| | UF_GetMaxNumOfTemplate | O | O | O | O |
| | UF_GetAllUserInfo | O | O | O | O |
| | UF_GetAllUserInfoEx | X | X | O | O |
| | UF_SortUserInfo | O | O | O | O |
| | UF_SetUserInfoCallback | O | O | O | O |
| | UF_SetAdminLevel | O | O | O | O |
| | UF_GetAdminLevel | O | O | O | O |

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|---|---|---|---|---|---|
| | UF_ClearAllAdminLevel | O | O | O | O |
| | UF_SaveDB | O | O | O | O |
| | UF_LoadDB | O | O | O | O |
| | UF_CheckTemplate | O | O | O | O |
| | UF_ReadTemplate | O | O | O | O |
| | UF_ReadOneTemplate | O | O | O | O |
| | UF_SetScanCallback | O | O | O | O |
| | UF_ScanTemplate | O | O | O | O |
| | UF_FixProvisionalTemplate | O | O | O | O |
| | UF_SetSecurityLevel | O | O | O | O |
| | UF_GetSecurityLevel | O | O | O | O |
| Image API | UF_ConvertToBitmap | O | O | O | O |
| | UF_SaveImage | O | O | O | O |
| | UF_LoadImage | O | O | O | O |
| | UF_ReadImage | O | O | O | O |
| | UF_ScanImage | O | O | O | O |
| Enroll API | UF_Enroll | O | O | O | O |
| | UF_EnrollContinue | O | O | O | O |
| | UF_EnrollAfterVerification | O | O | O | O |
| | UF_EnrollTemplate | O | O | O | O |
| | UF_EnrollMultipleTemplates | O | O | O | O |
| | UF_EnrollImage | O | O | O | O |
| | UF_SetEnrollCallback | O | O | O | O |
| Identify API | UF_Identify | O | O | O | O |
| | UF_IdentifyTemplate | O | O | O | O |
| | UF_IdentifyImage | O | O | O | O |
| | UF_SetIdentifyCallback | O | O | O | O |
| Verify API | UF_Verify | O | O | O | O |
| | UF_VerifyTemplate | O | O | O | O |
| | UF_VerifyHostTemplate | O | O | O | O |
| | UF_VerifyImage | O | O | O | O |
| | UF_SetVerifyCallback | O | O | O | O |
| Delete API | UF_Delete | O | O | O | O |
| | UF_DeleteOneTemplate | O | O | O | O |
| | UF_DeleteMultipleTemplates | O | O | O | O |

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|---|---|---|---|---|---|
| | UF_DeleteAll | O | O | O | O |
| | UF_DeleteByScan | O | O | O | O |
| | UF_SetDeleteCallback | O | O | O | O |
| I/O API | UF_InitIO | X | O | O | O |
| | UF_SetInputFunction | X | O | O | O |
| | UF_GetInputFunction | X | O | O | O |
| | UF_GetInputStatus | X | O | O | O |
| | UF_GetOutputEventList | X | O | O | O |
| | UF_ClearAllOutputEvent | X | O | O | O |
| | UF_ClearOutputEvent | X | O | O | O |
| | UF_SetOutputEvent | X | O | O | O |
| | UF_GetOutputEvent | X | O | O | O |
| | UF_SetOutputStatus | X | O | O | O |
| | UF_SetLegacyWiegandConfig | X | O | O | O |
| | UF_GetLegacyWiegandConfig | X | O | O | O |
| | UF_MakeIOConfiguration | X | O | O | O |
| GPIO API | UF_GetGPIOConfiguration | O | X | X | X |
| | UF_SetInputGPIO | O | X | X | X |
| | UF_SetOutputGPIO | O | X | X | X |
| | UF_SetSharedGPIO | O | X | X | X |
| | UF_DisableGPIO | O | X | X | X |
| | UF_ClearAllGPIO | O | X | X | X |
| | UF_SetDefaultGPIO | O | X | X | X |
| | UF_EnableWiegandInput | O | X | X | X |
| | UF_EnableWiegandOutput | O | X | X | X |
| | UF_DisableWiegandInput | O | X | X | X |
| | UF_DisableWiegandOutput | O | X | X | X |
| | UF_MakeGPIOConfiguration | O | X | X | X |
| User Memory API | UF_WriteUserMemory | O | O | O | O |
| | UF_ReadUserMemory | O | O | O | O |
| Log and Time Mgmt. API | UF_SetTime | X | O | O | O |
| | UF_GetTime | X | O | O | O |
| | UF_GetNumOfLog | X | O | O | O |
| | UF_ReadLog | X | O | O | O |

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|---|---|---|---|---|---|
| | UF_ReadLatestLog | X | O | O | O |
| | UF_DeleteOldestLog | X | O | O | O |
| | UF_DeleteAllLog | X | O | O | O |
| | UF_ClearLogCache | X | O | O | O |
| | UF_ReadLogCache | X | O | O | O |
| | UF_SetCustomLogField | X | O | O | O |
| | UF_GetCustomLogField | X | O | O | O |
| Extended Wiegand API | UF_SetWiegandFormat | X | O | O | O |
| | UF_GetWiegandFormat | X | O | O | O |
| | UF_SetWiegandIO | X | O | O | O |
| | UF_GetWiegandIO | X | O | O | O |
| | UF_SetWiegandOption | X | O | O | O |
| | UF_GetWiegandOption | X | O | O | O |
| | UF_SetAltValue | X | O | O | O |
| | UF_ClearAltValue | X | O | O | O |
| | UF_GetAltValue | X | O | O | O |
| | UF_MakeWiegandConfiguration | X | O | O | O |
| Wiegand Command Card API | UF_AddWiegandCommandCard | X | O | O | O |
| | UF_GetWiegandCommandCardList | X | O | O | O |
| | UF_ClearAllWiegandCommandCard | X | O | O | O |
| SmartCard API | UF_ReadSmartCard | X | X | X | O |
| | UF_ReadSmartCardWithAG | X | X | X | O |
| | UF_WriteSmartCard | X | X | X | O |
| | UF_WriteSmartCardWithAG | X | X | X | O |
| | UF_FormatSmartCard | X | X | X | O |
| | UF_SetSmartCardMode | X | X | X | O |
| | UF_GetSmartCardMode | X | X | X | O |
| | UF_ChangePrimaryKey | X | X | X | O |
| | UF_ChangeSecondaryKey | X | X | X | O |
| | UF_SetKeyOption | X | X | X | O |
| | UF_GetKeyOption | X | X | X | O |
| | UF_SetCardLayout | X | X | X | O |
| | UF_GetCardLayout | X | X | X | O |
| | UF_SetSmartCardCallback | X | X | X | O |
| Access | UF_AddTimeSchedule | X | X | O | O |

| | | | | | |
|---|---|---|---|---|---|
| Control API | UF_GetTimeSchedule | X | X | O | O |
| | UF_DeleteTimeSchedule | X | X | O | O |
| | UF_DeleteAllTimeSchedule | X | X | O | O |
| | UF_AddHoliday | X | X | O | O |
| | UF_GetHoliday | X | X | O | O |
| | UF_DeleteHoliday | X | X | O | O |
| | UF_DeleteAllHoliday | X | X | O | O |
| | UF_AddAccessGroup | X | X | O | O |
| | UF_GetAccessGroup | X | X | O | O |
| | UF_DeleteAccessGroup | X | X | O | O |
| | UF_DeleteAllAccessGroup | X | X | O | O |
| | UF_SetUserAccessGroup | X | X | O | O |
| | UF_GetUserAccessGroup | X | X | O | O |

# 3. API Specification

## 3.1. Return Codes

Most APIs in the SDK return UF_RET_CODE. The return codes and their meanings are as follows;

| **Category** | **Code** | **Description** |
|---|---|---|
| Success | UF_RET_SUCCESS | The function succeeds. |
| Serial Comm. | UF_ERR_CANNOT_OPEN_SEREIAL | Cannot open the specified serial port. |
| | UF_ERR_CANNOT_SETUP_SERIAL | Cannot set the baud rate. |
| | UF_ERR_CANNOT_WRITE_SERIAL | Cannot write data to the serial port. |
| | UF_ERR_WRITE_SERIAL_TIMEOUT | Write timeout. |
| | UF_ERR_CANNOT_READ_SERIAL | Cannot read data from the serial port. |
| | UF_ERR_READ_SERIAL_TIMEOUT | Read timeout. |
| | UF_ERR_CHECKSUM_ERROR | Received packet has wrong checksum. |
| | UF_ERR_CANNOT_SET_TIMEOUT | Cannot set communication timeout. |
| Socket | UF_ERR_CANNOT_START_SOCKET | Cannot initialize the socket interface. |
| | UF_ERR_CANNOT_OPEN_SOCKET | Cannot open the socket. |
| | UF_ERR_CANNOT_CONNECT_ SOCKET | Cannot connect to the socket. |

| | | |
|---|---|---|
| | UF_ERR_CANNOT_READ_SOCKET | Cannot read data from the socket. |
| | UF_ERR_READ_SOCKET_TIMEOUT | Read timeout. |
| | UF_ERR_CANNOT_WRITE_SOCKET | Cannot write data to the socket. |
| | UF_ERR_WRITE_SOCKET_ TIMEOUT | Write timeout. |
| Protocol | UF_ERR_SCAN_FAIL | Sensor or fingerprint input has failed. |
| | UF_ERR_NOT_FOUND | Identification failed, or the requested data is not found. |
| | UF_ERR_NOT_MATCH | Fingerprint does not match. |
| | UF_ERR_TRY_AGAIN | Fingerprint image is not good. |
| | UF_ERR_TIME_OUT | Timeout for fingerprint input. |
| | UF_ERR_MEM_FULL | No more templates are allowed. |
| | UF_ERR_EXIST_ID | The specified user ID already exists. |
| | UF_ERR_FINGER_LIMIT | The number of fingerprints enrolled in same ID exceeds its limit. |
| | UF_ERR_UNSUPPORTED | The command is not supported. |
| | UF_ERR_INVALID_ID | The requested user ID is invalid or missing. |
| | UF_ERR_TIMEOUT_MATCH | Timeout for fingerprint identification. |
| | UF_ERR_BUSY | Module is processing another |

| | | |
|---|---|---|
| | | command. |
| | UF_ERR_CANCELED | The command is canceled. |
| | UF_ERR_DATA_ERROR | The checksum of a data packet is incorrect. |
| | UF_ERR_EXIST_FINGER | The finger is already enrolled. |
| | UF_ERR_DURESS_FINGER | A duress finger is detected. |
| | UF_ERR_CARD_ERROR | Cannot read a smart card. |
| | UF_ERR_LOCKED | Module is locked. |
| | UF_ERR_ACCESS_NOT_GRANTED | Access is not granted by time schedule and access group. |
| Application | UF_ERR_OUT_OF_MEMORY | Out of memory. |
| | UF_ERR_INVALID_PARAMETER | Invalid parameter. |
| | UF_ERR_FILE_IO | File I/O failed |
| | UF_ERR_INVALID_FILE | The configuration or DB file is invalid. |

## 3.2. Serial Communication API

To communicate with SFM modules, users should configure the serial port first.

- UF_InitCommPort: configures serial port parameters.
- UF_CloseCommPort: closes the serial port.
- UF_Reconnect: resets system parameters and IO settings.
- UF_SetBaudrate: changes the baud rate.
- UF_SetAsciiMode: changes the packet translation mode.

## UF_InitCommPort

Opens a serial port and configures communication parameters. This function should be called first before calling any other APIs.

### UF_RET_CODE UF_InitCommPort( const char* commPort, int baudrate, BOOL asciiMode )

#### Parameters

*commPort*

Pointer to a null-terminated string that specifies the name of the serial port.

*baudrate*

Specifies the baud rate at which the serial port operates. Available baud rates are 9600, 19200, 38400, 57600, 115200bps. The default setting of SFM modules is 115200bps.

*asciiMode*

Determines the packet translation mode. If it is set to TRUE, the binary packet is converted to ASCII format first before being sent to the module. Response packets are in ASCII format, too. The default setting of SFM modules is binary mode.

#### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

#### Example

```
UF_RET_CODE result = UF_InitCommPort( “COM1”, 115200, FALSE );
```

## UF_CloseCommPort

Closes the serial port opened by **UF_InitCommPort**.

**UF_RET_CODE UF_CloseCommPort.**

**Parameters**

None

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_Reconnect

To improve communication efficiency, the SDK caches basic information of a module such as system parameters and I/O settings. **UF_Reconnect** clears this cached information. When changing the modules connected to the serial port, this function should be called.

**void UF_Reconnect()**

**Parameters**

None

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetBaudrate

Changes the baud rate.

### UF_RET_CODE UF_SetBaudrate( int baudrate )

### Parameters

*baudrate*

Specifies the baud rate at which the serial port operates. Available baud rates are 9600, 19200, 38400, 57600, 115200bps. The default setting of SFM modules is 115200bps.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetAsciiMode

Changes the packet translation mode.

**void UF_SetAsciiMode( BOOL asciiMode )**

### Parameters

*asciiMode*

TRUE for ascii format, FALSE for binary format.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## 3.3. Socket API

In addition to serial ports, users can connect to the module by Ethernet-to-Serial converters. In this case, socket API should be used in place of serial API.

- UF_InitSocket: opens a socket and connects to the specified IP address.
- UF_CloseSocket: closes the socket.

## UF_InitSocket

Initializes the socket interface and connects to the module with specified IP address.

**UF_RET_CODE UF_InitSocket( const char* inetAddr, int port, BOOL asciiMode )**

### Parameters

*inetAddr*

IP address of the Ethernet-to-Serial converter.

*port*

TCP port of the socket interface.

*asciiMode*

Determines the packet translation mode. If it is set to TRUE, the binary packet is converted to ASCII format first before being sent to the module. Response packets are in ASCII format, too. The default setting of SFM modules is binary mode.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

### Example

```
UF_RET_CODE result = UF_InitSocket( “192.168.1.41”, 1470, FALSE );
```

## UF_CloseSocket

Closes the socket interface.

**UF_RET_CODE UF_CloseSocket()**

**Parameters**

None

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## 3.4. Low-Level Packet API

These functions provide direct interface to the low-level packet exchanges. In most cases, users need not to call these functions directly. Command API and other high level APIs are implemented on top of this API.
Packet API also let users set callback functions for data transfer. Examples of using these callback functions for GUI application can be found in UniFingerUI V4.0 source codes.

- UF_SendPacket: sends a 13 byte packet.
- UF_SendNetworkPacket: sends a 15 byte network packet.
- UF_ReceivePacket: receives a 13 byte packet.
- UF_ReceiveNetworkPacket: receives a 15 byte network packet.
- UF_SendRawData: sends raw data.
- UF_ReceiveRawData: receives raw data.
- UF_SendDataPacket: sends data using Extended Data Transfer Protocol.
- UF_ReceiveDataPacket: receives data using Extended Data Transfer Protocol.
- UF_SetSendPacketCallback: sets the callback function of sending packets.
- UF_SetReceivePacketCallback: sets the callback function of receiving packets.
- UF_SetSendDataPacketCallback: sets the callback function of sending data packets.
- UF_SetReceiveDataPacketCallback: sets the callback function of receiving data packets.
- UF_SetSendRawDataCallback: sets the callback function of sending raw data.
- UF_SetReceiveRawDataCallback: sets the callback function of receiving raw data.
- UF_SetDefaultPacketSize: sets the size of data packets.
- UF_GetDefaultPacketSize: gets the size of data packets.

## UF_SendPacket

Sends a 13 byte packet to the module. The packet is composed as follows;

| Start code | Command | Param | Size | Flag/Error | Checksum | End code |
|---|---|---|---|---|---|---|
| 1byte | 1byte | 4bytes | 4bytes | 1byte | 1byte | 1byte |

- Start code: 1 byte. Indicates the beginning of a packet. It always should be 0x40.
- Command: 1 byte. Refer to the *Packet Protocol Manual* for available commands.
- Param: 4 bytes. The meaning of this field varies according to each command.
- Size: 4 bytes. The meaning of this field varies according to each command.
- Flag/Error: 1 byte. Indicates flag data in the request packet, and error code in the response packet.
- Checksum: 1 byte. Checks the validity of a packet. Checksum is a remainder of the sum of each field, from the Start code to Flag/Error, divided by 256 (0x100).
- End code: 1 byte. Indicates the end of a packet. It always should be 0x0A. It is also used as a code indicating the end of binary data such as fingerprint templates.

**UF_RET_CODE UF_SendPacket( BYTE command, UINT32 param, UINT32 size, BYTE flag, int timeout )**

**Parameters**

*command*

Command field of a packet. Refer to the *Packet Protocol Manual* for available commands.

*param*

Param field of a packet.

*size*

Size field of a packet.

*flag*

Flag field of a packet.

*timeout*

Sets the timeout in milliseconds. If sending does not complete within this limit, UF_ERR_WRITE_SERIAL_TIMEOUT will be returned.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

**Example**

```
// To send ES command with user ID 10 and ADD_NEW(0x79) option,
UF_RET_CODE result = UF_SendPacket( UF_COM_ES, 10, 0, 0x79, 2000 );

If( result != UF_RET_SUCCESS )
{
     Return result;
}
```

## UF_SendNetworkPacket

Sends a 15 byte network packet to the specified module. In order to support RS422 or RS485 network interfaces, SFM modules support Network Packet Protocol. Network packet is composed of 15 bytes, whose start code is different from the standard packet, and includes 2 bytes for terminal ID. The terminal ID is equal to the lower 2 bytes of Module ID of system parameter.

| Field | Start code | Terminal ID | Command | Param | Size | Flag / Error | Checksum | End code |
|---|---|---|---|---|---|---|---|---|
| Bytes | 1 | 2 | 1 | 4 | 4 | 1 | 1 | 1 |
| Value | 0x41 | 1 ~ 0xFFFF | Same as standard protocol | | | | Checksum of 13 bytes | 0x0A |

**UF_SendNetworkPacket( BYTE command, USHORT terminalID, UINT32 param, UINT32 size, BYTE flag, int timeout )**

**Parameters**

*command*

Command field of a packet. Refer to the *Packet Protocol Manual* for available commands.

*terminalID*

Specifies the terminal ID of the receiving module.

*param*

Param field of a packet.

*size*

Size field of a packet.

*flag*

Flag field of a packet.

*timeout*

Sets the timeout in milliseconds. If sending does not complete within this limit, UF_ERR_WRITE_SERIAL_TIMEOUT will be returned.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ReceivePacket

Receives a 13 byte packet from the module. Most commands of Packet Protocol can be implemented by a pair of **UF_SendPacket**/**UF_ReceivePacket** or **UF_SendNetworkPacket**/**UF_ReceiveNetworkPacket.**

**UF_RET_CODE UF_ReceivePacket( BYTE* packet, int timeout )**

### Parameters

*packet*

Pointer to the 13 byte packet.

*timeout*

Sets the timeout in milliseconds. If receiving does not complete within this limit, UF_ERR_READ_SERIAL_TIMEOUT will be returned.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ReceiveNetworkPacket

Receives a 15 byte network packet from the specified module.

### UF_ReceiveNetworkPacket( BYTE* packet, int timeout )

#### Parameters

*packet*

Pointer to the 15 byte packet.

*timeout*

Sets the timeout in milliseconds. If receiving does not complete within this limit, UF_ERR_READ_SERIAL_TIMEOUT will be returned.

#### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SendRawData

Some commands such as ET(Enroll Template) and IT(Identify Template) send additional data after the 13/15 byte request packet. **UF_SendRawData** is used in these cases for sending the data.

**UF_RET_CODE UF_SendRawData( BYTE* buf, UINT32 size, int timeout )**

**Parameters**

*buf*

Pointer to a data buffer.

*size*

Number of bytes to be sent.

*timeout*

Sets the timeout in milliseconds. If sending does not complete within this limit, UF_ERR_WRITE_SERIAL_TIMEOUT will be returned.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ReceiveRawData

Some commands such as ST(Scan Template) and RT(Read Template) return additional data after the 13/15 byte response packet. **UF_ReceiveRawData** is used in these cases for receiving the data.

**UF_RET_CODE UF_ReceiveRawData( BYTE* buf, UINT32 size, int timeout, BOOL checkEndCode )**

### Parameters

*buf*

Pointer to a data buffer.

*size*

Number of bytes to be received.

*timeout*

Sets the timeout in milliseconds. If receiving does not complete within this limit, UF_ERR_READ_SERIAL_TIMEOUT will be returned.

*checkEndCode*

Data transfer ends with '0x0a'. If this parameter is FALSE, the function returns without checking the end code.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SendDataPacket

Sends data using Extended Data Transfer Protocol. Dividing large data into small blocks can reduce communication errors between the host and the module. Extended Data Transfer Protocol is an extension of Packet Protocol to provide a reliable and customizable communication for large data. In Extended Data Transfer Protocol, data is divided into multiple data packets. And a data packet consists of fixed-length header, variable-length data body, and 4 byte checksum. Commands which use the Extended Data Transfer Protocols are EIX, VIX, IIX, RIX, SIX, and UG.

**UF_SendDataPacket( BYTE command, BYTE* buf, UINT32 dataSize, UINT32 dataPacketSize )**

**Parameters**

*command*

Command field of a packet. Valid commands are EIX, VIX, IIX, RIX, SIX, and UG.

*buf*

Pointer to a data buffer.

*dataSize*

Number of bytes to be sent.

*dataPacketSize*

Size of data packet. For example, if dataSize is 16384 bytes and dataPacketSize is 4096 bytes, the data will be divided into 4 data packets.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ReceiveDataPacket

Receives data using Extended Data Transfer Protocol. The size of data packet should be specified before calling this function.

**UF_ReceiveDataPacket( BYTE command, BYTE* buf, UINT32 dataSize )**

**Parameters**

*command*

Command field of a packet. Valid commands are EIX, VIX, IIX, RIX, SIX, and UG.

*buf*

Pointer to a data buffer.

*dataSize*

Number of bytes to be received.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetSendPacketCallback

If **SendPacketCallback** is specified, it is called after sending a packet successfully. The argument of the callback is the pointer to the packet.

**void UF_SetSendPacketCallback( void (*callback)( BYTE* ) )**

### Parameters

*callback*

Pointer to the callback function.

### Return Values

None

### Example

See CMainFrame::SendPacketCallback in UniFingerUI source codes.

## UF_SetReceivePacketCallback

If **ReceivePacketCallback** is specified, it is called after receiving a packet successfully. The argument of the callback is the pointer to the received packet.

**void UF_SetReceivePacketCallback( void (*callback)( BYTE* ) )**

### Parameters

*callback*

Pointer to the callback function.

### Return Values

None

### Example

See CMainFrame::ReceivePacketCallback in UniFingerUI source codes.

## UF_SetSendDataPacketCallback

If **SendDataPacketCallback** is specified, it is called after sending a data packet successfully. The argument of the callback is the index of the data packet and the number of total data packets.

**UF_SetSendDataPacketCallback( void (*callback)( int index, int numOfPacket ) )**

**Parameters**

*callback*

Pointer to the callback function.

**Return Values**

None

**Example**

See CMainFrame::DataPacketCallback in UniFingerUI source codes.

## UF_SetReceiveDataPacketCallback

If **ReceiveDataPacketCallback** is specified, it is called after receiving a data packet successfully. The argument of the callback is the index of the data packet and the number of total data packets.

**void UF_SetReceiveDataPacketCallback( void (*callback)( int index, int numOfPacket ) )**

### Parameters

*callback*

Pointer to the callback function.

### Return Values

None

### Example

See CMainFrame::DataPacketCallback in UniFingerUI source codes.

## UF_SetSendRawDataCallback

If **SendRawDataCallback** is specified, it is called during sending raw data. The argument of the callback is the written length and the total length of data.

**void UF_SetSendRawDataCallback( void (*callback)( int writtenLen, int totalSize ) )**

### Parameters

*callback*

Pointer to the callback function.

### Return Values

None

### Example

See CMainFrame::RawDataCallback in UniFingerUI source codes.

## UF_SetReceiveRawDataCallback

If **ReceiveRawDataCallback** is specified, it is called during receiving data. The argument of the callback is the read length and the total length of data.

**void UF_SetReceiveRawDataCallback( void (*callback)( int readLen, int totalSize ) )**

### Parameters

*callback*

Pointer to the callback function.

### Return Values

None

### Example

See CMainFrame::RawDataCallback in UniFingerUI source codes.

## UF_SetDefaultPacketSize

Sets the size of data packets used in Extended Data Transfer protocol. The default value is 4096. When BEACon is used as an Ethernet-to-Serial converter, this value should not be larger than 256.

**void UF_SetDefaultPacketSize( int defaultSize )**

**Parameters**

*defaultSize*

Size of data packet.

**Return Values**

None

## UF_GetDefaultPacketSize

Returns the size of data packet used in Extended Data Transfer protocol.

### int UF_GetDefaultPacketSize()

#### Parameters

None

#### Return Values

The size of data packet.

## 3.5. Generic Command API

The commands defined in the *Packet Protocol Manual* can be classified into several categories according to the types of packet exchange. Generic Command API provides functions which encapsulate these categories. Like low-level Packet API, users need not to call these functions directly. Most commands have corresponding high-level API in the SDK.

- UF_Command: encapsulates the commands composed of one request packet and one response packet.
- UF_CommandEx: encapsulates the commands composed of one request packet and multiple response packets.
- UF_CommandSendData: encapsulates the commands which send additional data after a request packet.
- UF_CommandSendDataEx: encapsulates the commands which send additional data and have multiple response packets.
- UF_Cancel: cancels the previously issued command.
- UF_SetProtocol: sets the type of packet protocol.
- UF_GetProtocol: gets the type of packet protocol.
- UF_GetModuleID: gets the module ID.
- UF_SetGenericCommandTimeout: sets the timeout for generic commands.
- UF_SetInputCommandTimeout: sets the timeout for commands which require user inputs.
- UF_GetGenericCommandTimeout: gets the timeout for generic commands.
- UF_GetInputCommandTimeout: gets the timeout for commands which require user inputs.
- UF_SetNetworkDelay: sets the delay for the Network Packet Protocol.
- UF_GetNetworKDelay: gets the delay for the Network Packet Protocol.

## UF_Command

Encapsulates the commands composed of one request packet and one response packet. The majority of commands can be implemented using **UF_Command**.

### UF_RET_CODE UF_Command( BYTE command, UINT32* param, UINT32* size, BYTE* flag )

#### Parameters

*command*

Command field of a packet. Refer to the *Packet Protocol Manual* for available commands.

*param*

Param field of a packet. This parameter is used both for input and output.

*size*

Size field of a packet. This parameter is used both for input and output.

*flag*

Flag field of a packet. This parameter is used both for input and output.

#### Return Values

If packets are transferred successfully, return UF_RET_SUCCESS. Otherwise, return the corresponding error code. UF_RET_SUCCESS only means that request packet is received successfully. To know if the operation succeeds, the flag field should be checked.

#### Example

```
// To read Timeout(0x62) system parameter,
UINT32 param = 0;
UINT32 size = 0;
BYTE flag = 0x62;
UINT32 timeout;

UF_RET_CODE result = UF_Command( UF_COM_SR, &param, &size, &flag );

If( result != UF_RET_SUCCESS ) // communication error
{
     return result;
}
```

```
If( flag != UF_PROTO_RET_SUCCESS ) // protocol error
{
     return UF_GetErrorCode( result );
}

// succeed
timeout = size;
```

## UF_CommandEx

Encapsulates the commands composed of one request packet and multiple response packets. Command such as ES(Enroll) and IS(Identify) can have more than one response packet. To handle these cases, **UF_CommandEx** requires a message callback function, which should return TRUE when the received packet is the last one.

**UF_RET_CODE UF_CommandEx( BYTE command, UINT32* param, UINT32* size, BYTE* flag, BOOL (*msgCallback)(BYTE) )**

### Parameters

*command*

Command field of a packet. Refer to the *Packet Protocol Manual* for available commands.

*param*

Param field of a packet. This parameter is used both for input and output.

*size*

Size field of a packet. This parameter is used both for input and output.

*flag*

Flag field of a packet. This parameter is used both for input and output.

*msgCallback*

Pointer to the callback function. This callback is called when a response packet is received. If the callback return TRUE, **UF_CommandEx** will return immediately. If the callback return FALSE, **UF_CommandEx** will wait for another response packet.

### Return Values

If packets are transferred successfully, return UF_RET_SUCCESS. Otherwise, return the corresponding error code. UF_RET_SUCCESS only means that request packet is received successfully. To know if the operation succeeds, the flag field should be checked.

### Example

```
// UF_Identify() is implemented as follows;
/**
```

```
 *   Message callback for identification
 */
BOOL UF_IdentifyMsgCallback( BYTE errCode )
{
     if( errCode == UF_PROTO_RET_SCAN_SUCCESS )
     {
         if( s_IdentifyCallback )
         {
             (*s_IdentifyCallback)( errCode );
         }

         return FALSE;
     }
     else
     {
         return TRUE;
     }
}

/**
 *   Identify
 */
UF_RET_CODE UF_Identify( UINT32* userID, BYTE* subID )
{
     UINT32 param = 0;
     UINT32 size = 0;
     BYTE flag = 0;

     int result = UF_CommandEx( UF_COM_IS, &param, &size, &flag,
     UF_IdentifyMsgCallback );

     if( result != UF_RET_SUCCESS )
     {
         return result;
     }
     else if( flag != UF_PROTO_RET_SUCCESS )
     {
         return UF_GetErrorCode( flag );
     }

     *userID = param;
     *subID = size;

     return UF_RET_SUCCESS;
}
```

## UF_CommandSendData

Encapsulates the commands which send additional data after a request packet. For example, GW(Write GPIO Configuration) command should send configuration data after the request packet.

**UF_RET_CODE UF_CommandSendData( BYTE command, UINT32* param, UINT32* size, BYTE* flag, BYTE* data, UINT32 dataSize )**

### Parameters

*command*

Command field of a packet. Refer to the *Packet Protocol Manual* for available commands.

*param*

Param field of a packet. This parameter is used both for input and output.

*size*

Size field of a packet. This parameter is used both for input and output.

*flag*

Flag field of a packet. This parameter is used both for input and output.

*data*

Pointer to the data buffer to be sent.

*dataSize*

Number of bytes to be sent.

### Return Values

If packets are transferred successfully, return UF_RET_SUCCESS. Otherwise, return the corresponding error code. UF_RET_SUCCESS only means that request packet is received successfully. To know if the operation succeeds, the flag field should be checked.

## UF_CommandSendDataEx

Encapsulates the commands which send additional data and have multiple response packets. For example, ET(Enroll Template) command sends template data after request packet and can have multiple response packets.

**UF_RET_CODE UF_CommandSendDataEx( BYTE command, UINT32* param, UINT32* size, BYTE* flag, BYTE* data, UINT32 dataSize, BOOL (*msgCallback)(BYTE), BOOL waitUserInput )**

### Parameters

*command*

Command field of a packet. Refer to the *Packet Protocol Manual* for available commands.

*param*

Param field of a packet. This parameter is used both for input and output.

*size*

Size field of a packet. This parameter is used both for input and output.

*flag*

Flag field of a packet. This parameter is used both for input and output.

*data*

Pointer to the data buffer to be sent.

*dataSize*

Number of bytes to be sent.

*msgCallback*

Pointer to the callback function. This callback is called when a response packet is received. If the callback return TRUE, **UF_CommandSendDataEx** will return immediately. If the callback return FALSE, **UF_CommandSendDataEx** will wait for another response packet.

*waitUserInput*

TRUE if the command needs user input. Otherwise, FALSE.

### Return Values

If packets are transferred successfully, return UF_RET_SUCCESS. Otherwise, return the corresponding error code. UF_RET_SUCCESS only means that request packet is received successfully. To know if the operation succeeds, the flag field

should be checked.

## UF_Cancel

Cancels the command which is being processed by the module. When the module is executing a command which needs user input to proceed, the status of the module will be changed to UF_SYS_BUSY. If users want to execute another command before finishing the current one, they can explicitly cancel it by this function.

**UF_RET_CODE UF_Cancel( BOOL receivePacket )**

**Parameters**

*receivePacket*

If TRUE, **UF_Cancel** waits until the response packet is received. If FALSE, **UF_Cancel** returns immediately after sending the request packet.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetProtocol

Selects packet protocol. If the host connects to the single module through RS232 interface, use UF_SINGLE_PROTOCOL. If there are multiple modules in RS422/485 networks, use UF_NETWORK_PROTOCOL. The protocol should also be compatible with the Network Mode system parameter.

| Network Mode | Supported Protocol | |
|---|---|---|
| | 13 byte Packet Protocol | 15 byte Network Packet Protocol |
| Single(0x30) | O | O |
| Network (0x31/0x32) | X | O |

**void UF_SetProtocol( UF_PROTOCOL protocol, UINT32 moduleID )**

**Parameters**

*protocol*

UF_SINGLE_PROTOCOL for 13 byte packet protocol, UF_NETWORK_PROTOCOL for 15 byte network packet protocol.

*moduleID*

Specifies the ID of the module. This parameter is applicable when the protocol is set to UF_NETWORK_PROTOCOL.

**Return Values**

None

## UF_GetProtocol

Gets the selected protocol.

### UF_PROTOCOL UF_GetProtocol()

#### Parameters

None

#### Return Values

UF_SINGLE_PROTOCOL or UF_NETWORK_PROTOCOL.

## UF_GetModuleID

Gets the ID of the module.

### UINT32 UF_GetModuleID()

**Parameters**

None

**Return Values**

ID of the module.

## UF_SetGenericCommandTimeout

Sets the timeout for generic commands. The default timeout is 2,000ms.

**void UF_SetGenericCommandTimeout( int timeout )**

**Parameters**

*timeout*

Specifies the timeout period in milliseconds.

**Return Values**

None

## UF_SetInputCommandTimeout

Sets the timeout for commands which need user input. The default timeout is 10,000ms.

**void UF_SetInputCommandTimeout( int timeout )**

**Parameters**

*timeout*

Specifies the timeout period in milliseconds.

**Return Values**

None

## UF_GetGenericCommandTimeout

Gets the timeout for generic commands.

### int UF_GetGenericCommandTimeout()

**Parameters**

None

**Return Values**

Timeout for generic commands.

## UF_GetInputCommandTimeout

Gets the timeout for commands which need user input.

### int UF_GetInputCommandTimeout()

**Parameters**

None

**Return Values**

Timeout for commands which need user input.

## UF_SetNetworkDelay

In half duplex mode, the same communication lines are shared for sending and receiving data. To prevent packet collisions on the shared line, there should be some delay between receiving and sending data. The default delay is set to 40ms. This value can be optimized for specific environments.

**void UF_SetNetworkDelay( int delay )**

**Parameters**

*delay*

Specified the delay in milliseconds.

**Return Values**

None

## UF_GetNetworkDelay

Gets the network delay.

**int UF_GetNetworkDelay()**

**Parameters**

None

**Return Values**

Delay in milliseconds.

## 3.6. Module API

These functions provide basic information about the module.

- UF_GetModuleInfo: gets the basic module information.
- UF_GetModuleString: gets a string describing the module.
- UF_SearchModule: searches a module and find out communication parameters.
- UF_SearchModuleID: searches an ID of a module.
- UF_SearchModuleBySocket: searches a module through socket interface.
- UF_SearchModuleIDEx: searches multiple models in a network.
- UF_CalibrateSensor: calibrates a sensor.
- UF_Upgrade: upgrades firmware.
- UF_Reset: resets the module.
- UF_Lock: locks the module.
- UF_Unlock: unlocks the module.
- UF_ChangePassword: changes the master password of a module.

## UF_GetModuleInfo

Retrieves the type, version and sensor information of the module.

**UF_RET_CODE UF_GetModuleInfo( UF_MODULE_TYPE* type, UF_MODULE_VERSION* version, UF_MODULE_SENSOR* sensorType )**

### Parameters

*type*

Available types are as follows;

| Value | Description |
|---|---|
| UF_MODULE_3000 | SFM 3000 series modules |
| UF_MODULE_3500 | SFM 3500 series modules |
| UF_BIOENTRY_SMART | BioEntry Smart |
| UF_BIOENTRY_PASS | BioEntry Pass |

*version*

Version number of the module.

*sensorType*

Sensor type of the module.

| Value | Sensor Type |
|---|---|
| UF_SENSOR_FL | Authentec AF-S2 |
| UF_SENSOR_FC | Atmel FingerChip |
| UF_SENSOR_OP | Optical Sensor |
| UF_SENSOR_OC | Optical Sensor II |
| UF_SENSOR_TC | UPEK TouchChip |

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetModuleString

Retrieves a string that describes the module information. This function should be called after **UF_GetModuleInfo**.

**char* UF_GetModuleString( UF_MODULE_TYPE type, UF_MODULE_VERSION version, UF_MODULE_SENSOR sensorType )**

### Parameters

*type*

Specifies the type of the module.

*version*

Specifies the version number of the module.

*sensorType*

Specifies the sensor type of the module.

### Return Values

Null-terminated string that describes the module information. This pointer is a static data in the SDK. So, it should not be shared or freed by applications.

## UF_SearchModule

Search a module connected to the specified serial port. **UF_SearchModule** tries all combinations of communication parameters. If it finds any module on the serial port, it returns the communication parameters and its module ID.

**UF_RET_CODE UF_SearchModule( const char* port, int* baudrate, BOOL* asciiMode, UF_PROTOCOL* protocol, UINT32* moduleID, void (*callback)( const char* comPort, int baudrate ) )**

### Parameters

*port*

Serial port.

*baudrate*

Pointer to the baud rate to be returned.

*asciiMode*

Pointer to the packet translation mode to be returned.

*protocol*

Pointer to the protocol type to be returned.

*moduleID*

Pointer to the module ID to be returned.

*callback*

Pointer to the callback function. The callback function can be used for displaying the progress of the search. This parameter can be NULL.

### Return Values

If it finds a module, return UF_RET_SUCCESS. If the search fails, return UF_ERR_NOT_FOUND. Otherwise, return the corresponding error code.

## UF_SearchModuleID

Until firmware V1.3, SFM modules respond both standard and network packets regardless of Network Mode system parameter. However, since firmware V1.4, the modules only respond to 15 byte network packets if Network Mode system parameter is not Single(0x30). So, if users don't know ID of the module, they cannot communicate with it in network environments. **UF_SerachModuleID** can be used to retrieve the ID of the module in these cases. Refer to ID command section in the *Packet Protocol Manua*l for details.

**UF_RET_CODE UF_SearchModuleID( UINT32* moduleID )**

**Parameters**

*moduleID*

Pointer to the module ID to be returned.

**Return Values**

If it finds a module, return UF_RET_SUCCESS. If the search fails, return UF_ERR_NOT_FOUND. Otherwise, return the corresponding error code.

## UF_SearchModuleBySocket

Search a module connected to the specified IP address. If it finds any module, it will return the communication parameters and the module ID.

**UF_RET_CODE UF_SearchModuleBySocket( const char* inetAddr, int tcpPort, BOOL* asciiMode, UF_PROTOCOL* protocol, UINT32* moduleID )**

### Parameters

*inetAddr*

IP address.

*tcpPort*

TCP port.

*asciiMode*

Pointer to the packet translation mode to be returned.

*protocol*

Pointer to the protocol type to be returned.

*moduleID*

Pointer to the module ID to be returned.

### Return Values

If it finds a module, return UF_RET_SUCCESS. If the search fails, return UF_ERR_NOT_FOUND. Otherwise, return the corresponding error code.

## UF_SearchModuleIDEx

**UF_SearchModuleID** is used for searching a module. To search multiple modules in a RS422/485 network, **UF_SearchModuleIDEx** should be used instead. By calling this function repetitively, users can search all the modules connected to a network.

**UF_RET_CODE UF_SearchModuleIDEx( unsigned short* foundModuleID, int numOfFoundID, unsigned short* moduleID, int* numOfID )**

### Parameters

*foundModuleID*

Pointer to the array of module IDs, which are already found. When the ID of a module is in this array, the module will ignore the search command.

*numOfFoundID*

Number of module IDs, which are already found.

*moduleID*

Pointer to the array of module IDs, which will be filled with newly found IDs.

*numOfID*

Pointer to the number of module IDs to be returned.

### Return Values

If it finds one or more modules, return UF_RET_SUCCESS. If the search fails, return UF_ERR_NOT_FOUND. Otherwise, return the corresponding error code.

### Example

```
int numOfModuleID;
unsigned short moduleID[32];

int numOfFoundID = 0;
BOOL foundNewID = FALSE;

do {
    result = UF_SearchModuleIDEx( moduleID, numOfFoundID, moduleID +
numOfFoundID, &numOfModuleID );

    if( result == UF_RET_SUCCESS )
    {
```

```
            foundNewID = TRUE;

            numOfFoundID += numOfModuleID;
        }
        else
        {
            foundNewID = FALSE;
        }
    } while( foundNewID && numOfFoundID < 32 );
```

## UF_CalibrateSensor

Calibrates fingerprint sensor. This function is supported for AuthenTec's FingerLoc AF-S2 and UPEK's TouchChip. After using the **UF_CalibrateSensor**, **UF_Save** should be called to save calibration data into flash memory.

**UF_RET_CODE UF_CalibrateSensor()**

**Parameters**

None

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_Upgrade

Upgrades the firmware of the module. Users should not turn off the module when upgrade is in progress.

**UF_RET_CODE UF_Upgrade( const char* firmwareFilename, int dataPacketSize )**

**Parameters**

*firmwareFilename*

Null-terminated string that specifies the firmware file name.

*dataPacketSize*

The packet size of firmware data. If it is 16384, the firmware is divided into 16384 byte packets before transferring to the module.

**Return Values**

If upgrade succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_Reset

Resets the module.

**UF_RET_CODE UF_Reset()**

**Parameters**

None

**Return Values**

UF_RET_SUCCESS

## UF_Lock

Locks the module. When the module is locked, it returns UF_ERR_LOCKED to functions other than **UF_Unlock**.

**UF_RET_CODE UF_Lock()**

**Parameters**

None

**Return Values**

If the module is locked successfully, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_Unlock

Unlocks a locked module.

**UF_RET_CODE UF_Unlock( const unsigned char* password )**

**Parameters**

*password*

16 byte master password. The default password is a string of 16 NULL characters.

**Return Values**

If the password is wrong, return UF_ERR_NOT_MATCH. If it is successful, return UF_RET_SUCCESS.

## UF_ChangePassword

Changes the master password.

**UF_RET_CODE UF_ChangePassword( const unsigned char* newPassword, const unsigned char* oldPassword )**

### Parameters

*newPassword*

16 byte new password.

*oldPassword*

16 byte old password.

### Return Values

If the old password is wrong, return UF_ERR_NOT_MATCH. If it is successful, return UF_RET_SUCCESS.

## 3.7. System Parameters API

Functions for managing system parameters. Available system parameters are defined in UF_SysParameter.h. See the *Packet Protocol Manual* for available values for each parameter.
This API also provides functions for saving and loading system configurations.

- UF_InitSysParameter: clears the system parameter cache.
- UF_GetSysParameter: gets the value of a system parameter.
- UF_SetSysParameter: sets the value of a system parameter.
- UF_GetMultiSysParameter: gets the values of multiple system parameters.
- UF_SetMultiSysParameter: sets the values of multiple system parameters.
- UF_Save: saves system parameters into the flash memory.
- UF_SaveConfiguration: saves system configurations into the specified file.
- UF_ReadConfigurationHeader: reads configuration information stored in a file.
- UF_LoadConfiguration: loads system configurations from the specified file.
- UF_MakeParameterConfiguration: makes parameter configuration data to be saved.

## UF_InitSysParameter

To prevent redundant communication, the SFM SDK caches the system parameters previously read or written. **UF_InitSysParameter** clears this cache. It is called in **UF_Reconnect**.

**void UF_InitSysParameter()**

**Parameters**

None

**Return Values**

None

## UF_GetSysParameter

Reads the value of a system parameter.

**UF_RET_CODE UF_GetSysParameter( UF_SYS_PARAM parameter, UINT32* value )**

### Parameters

*parameter*

System parameter to be read.

*value*

Pointer to the value of the specified system parameter to be returned.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. If there is no such parameter, return UF_ERR_NOT_FOUND. Otherwise, return the corresponding error code.

## UF_SetSysParameter

Writes the value of a system parameter. The parameter value is changed in memory only. To make the change permanent, **UF_Save** should be called after this function. For BioEntry Smart and Pass, users cannot change the UF_SYS_MODULE_ID system parameter.

**UF_RET_CODE UF_SetSysParameter( UF_SYS_PARAM parameter, UINT32 value )**

### Parameters

*parameter*

System parameter to be written.

*value*

Value of the system parameter. Refer to the *Packet Protocol Manual* for available values for each parameter.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. If there is no such parameter, return UF_ERR_NOT_FOUND. Otherwise, return the corresponding error code.

## UF_GetMultiSysParameter

Reads the values of multiple system parameters.

**UF_RET_CODE UF_GetMultiSysParameter( int parameterCount, UF_SYS_PARAM* parameters, UINT32* values )**

### Parameters

*parameterCount*

Number of system parameters to be read.

*parameters*

Array of system parameters to be read.

*values*

Array of the values of the specified system parameters to be read.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

### Example

```
// To read 3 system parameters, UF_SYS_TIMEOUT, UF_SYS_ENROLL_MODE,
// UF_SYS_SECURITY_LEVEL,

UF_SYS_PARAM parameters[3] = { UF_SYS_TIMEOUT, UF_SYS_ENROLL_MODE,
UF_SYS_SECURITY_LEVEL };
UINT32 values[3];

UF_RET_CODE result = UF_GetMultiSysParameter( 3, parameters, values );
```

## UF_SetMultiSysParameter

Writes the values of multiple system parameters. The parameter value is changed in memory only. To make the change permanent, **UF_Save** should be called.

**UF_RET_CODE UF_SetMultiSysParameter( int parameterCount, UF_SYS_PARAM* parameters, UINT32* values )**

### Parameters

*parameterCount*

Number of system parameters to be written.

*parameters*

Array of system parameters to be written.

*values*

Array of the values of the specified system parameters to be written.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_Save

Saves the system parameters into the flash memory.

### UF_RET_CODE UF_Save()

### Parameters

None

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SaveConfiguration

Saves system configurations into the specified file. The configuration file consists of a file header and multiple configuration components. There are 5 configuration components to be saved.

```
typedef enum {
     UF_CONFIG_PARAMETERS  = 0x01, // System parameters
     UF_CONFIG_GPIO        = 0x02, // GPIO configurations for
                                   // SFM3000
     UF_CONFIG_IO          = 0x04, // IO configurations for
                                   // SFM3500
     UF_CONFIG_WIEGAND     = 0x08, // Extended Wiegand
     UF_CONFIG_USER_MEMORY = 0x10, // User memory
} UF_CONFIG_TYPE;
```

**UF_RET_CODE UF_SaveConfiguration( const char* filename, const char* description, int numOfComponent, UFConfigComponentHeader* componentHeader, void** componentData )**

### Parameters

*filename*

Null-terminated string that specifies the file name.

*description*

Null-terminated string describing the configuration file. The maximum length of description is 256 bytes.

*numOfComponent*

Number of components to be saved.

*componentHeader*

Pointer to an array of UFConfigComponentHeader structures to be saved.

```
typedef struct {
    UF_CONFIG_TYPE type;
    UINT32 dataSize;
    UINT32 checksum;
} UFConfigComponentHeader;
```

*componentData*

Pointer to an array of component data to be saved.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

**Example**

```
// To save system parameters and IO configuration
// of a SFM 3500 module into “SFM3500.cfg” file,
UF_ConfigComponentHeader configHeader[2];
void* configData[2];

// Make system parameter component
UFConfigParameter* parameter = (UFConfigParameter*)malloc( sizeof(int) +
      NUM_OF_PARAMETER * sizeof(UFConfigParameterItem) );
UF_MakeParameterConfiguration( &configHeader[0],(BYTE*)parameter );
configData[0] = (void*)parameter;

// Make IO component
UFConfigIO* io = (UFConfigIO*)malloc( sizeof(UFConfigIO) +
      sizeof(UFConfigOutputItem) * (UF_MAX_OUTPUT_EVENT - 1) );
UF_MakeIOConfiguration( &configHeader[1], (BYTE*)io );
configData[1] = (void*)io;

UF_RET_CODE result = UF_SaveConfiguration( “SFM3500.cfg”, “Configuration
      file for SFM3500”, 2, configHeader, configData );
```

## UF_ReadConfigurationHeader

Reads the header information from a file which is saved by **UF_SaveConfiguration**.

**UF_RET_CODE UF_ReadConfigurationHeader( const char* filename, UFConfigFileHeader* header )**

### Parameters

*filename*

Null-terminated string that specifies the file name.

*header*

Pointer to the UFConfigFileHeader to be read.

```
typedef struct {
    UINT32     magicNo; // if valid, UF_VALID_CONFIG_FILE
    UINT32     numOfComponent;
    char       description[256];
} UFConfigFileHeader;
```

### Return Values

If the header is read successfully, return UF_RET_SUCCESS. If the file is of invalid type, return UF_ERR_INVALID_FILE. Otherwise, return the corresponding error code.

## UF_LoadConfiguration

Loads system configurations into a module from the specified file. To make permanent the configuration changes, **UF_Save** should be called after **UF_LoadConfiguration**.

**UF_RET_CODE UF_LoadConfiguration( const char* filename, int numOfComponent, UF_CONFIG_TYPE* type )**

### Parameters

*filename*

Null-terminated string that specifies the file name.

*numOfComponent*

Number of configuration components to be loaded.

*type*

Array of component types to be loaded.

### Return Values

If the configurations are loaded successfully, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

### Example

```
// To load system parameters and IO configuration
// of a SFM 3500 module from “SFM3500.cfg” file,
UF_CONFIG_TYPE configType[2] = { UF_CONFIG_PARAMETERS, UF_CONFIG_IO };

UF_RET_CODE result = UF_LoadConfiguration( “SFM3500.cfg”, 2, configType );
```

## UF_MakeParameterConfiguration

Make a UFConfigComponentHeader and a UFConfigParameter structure to be used in **UF_SaveConfiguration**.

**UF_RET_CODE**
**UF_MakeParameterConfiguration( UFConfigComponentHeader* configHeader, BYTE* configData )**

### Parameters

*configHeader*

Pointer to the UFConfigComponentHeader structure.

*configData*

Pointer to the UFConfigParameter structure. It should be preallocated large enough to store all the parameter information.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## 3.8. Template Management API

These functions provide template management interfaces such as read, delete and fix. Users can also manage user ids and administration levels associated with templates using these APIs.

- UF_GetNumOfTemplate: gets the number of template stored in a module.
- UF_GetMaxNumOfTemplate: gets the template capacity of a module.
- UF_GetAllUserInfo: gets all the template and user information stored in a module.
- UF_GetAllUserInfoEx: gets all the template and user information stored in a BioEntry reader.
- UF_SortUserInfo: sorts UFUserInfo structures.
- UF_SetUserInfoCallback: sets the callback function for getting user information.
- UF_SetAdminLevel: sets the administration level of a user.
- UF_GetAdminLevel: gets the administration level of a user.
- UF_ClearAllAdminLevel: clears all the administration levels of users.
- UF_SaveDB: saves templates and user information into the specified file.
- UF_LoadDB: loads templates and user information from the specified file.
- UF_CheckTemplate: checks if the specified ID has templates.
- UF_ReadTemplate: reads the templates of the specified user ID.
- UF_ReadOneTemplate: reads one template of the specified user ID.
- UF_SetScanCallback: sets the callback function for scanning fingerprints.
- UF_ScanTemplate: scans a fingerprint on the sensor and retrieves the fingerprint template.
- UF_FixProvisionalTemplate: saves the provisional templates into the flash memory.
- UF_SetSecurityLevel: sets the security level of a user.
- UF_GetSecurityLevel: gets the security level of a user.

## UF_GetNumOfTemplate

Gets the number of templates stored in the module.

**UF_RET_CODE UF_GetNumOfTemplate( UINT32* numOfTemplate )**

**Parameters**

*numOfTemplate*

Pointer to the number of templates to be returned.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetMaxNumOfTemplate

Gets the template capacity of the module.

**UF_RET_CODE UF_GetMaxNumOfTemplate( UINT32* maxNumOfTemplate )**

**Parameters**

*maxNumOfTemplate*

Pointer to the template capacity to be returned.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetAllUserInfo

Retrieves all the user and template information stored in the module.

### UF_RET_CODE UF_GetAllUserInfo( UFUserInfo* userInfo, UINT32* numOfUser, UINT32* numOfTemplate )

#### Parameters

*userInfo*

Array of UFUserInfo structures, which will store all the information. This pointer should be preallocated large enough to store all the information. UFUserInfo structure is defined as follows;

```
typedef struct {
    UINT32     userID;
    BYTE       numOfTemplate;
    BYTE       adminLevel; // See UF_SetAdminLevel
    BYTE       securityLevel; // See UF_SetSecurityLevel
    BYTE       reserved;
} UFUserInfo;
```

*numOfUser*

Pointer to the number of users to be returned.

*numOfTemplate*

Pointer to the number of templates to be returned.

#### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

#### Example

```
UINT32 maxUser;
UINT32 numOfUser, numOfTemplate;

UF_RET_CODE result = UF_GetSysParameter( UF_SYS_ENROLLED_FINGER,
&maxUser );

UFUserInfo* userInfo = (UFUserInfo*)malloc( maxUser * sizeof(UFUserInfo) );

result = UF_GetAllUserInfo( userInfo, &numOfUser, &numOfTemplate );
```

## UF_GetAllUserInfoEx

Retrieves all the user and template information stored in the BioEntry reader.

### UF_RET_CODE UF_GetAllUserInfoEx( UFUserInfoEx* userInfo, UINT32* numOfUser, UINT32* numOfTemplate )

#### Parameters

*userInfo*

Array of UFUserInfoEx structures, which will store all the information. This pointer should be preallocated large enough to store all the information. UFUserInfoEx structure is defined as follows;

```
typedef struct {
    UINT32  userID;
    UINT32  checksum[10]; // checksum of each template data
    BYTE    numOfTemplate;
    BYTE    adminLevel;
    BYTE    duress[10];
    BYTE    securityLevel;
} UFUserInfoEx;
```

*numOfUser*

Pointer to the number of users to be returned.

*numOfTemplate*

Pointer to the number of templates to be returned.

#### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SortUserInfo

Sorts an UFUserInfo array in ascending order of user ID.

**void UF_SortUserInfo( UFUserInfo* userInfo, int numOfUser )**

### Parameters

*userInfo*

Array of UFUserInfo structures.

*numOfUser*

Number of UFUserInfo.

### Return Values

None

## UF_SetUserInfoCallback

Sets the callback function for getting user information. It is also called when enrolling templates in **UF_LoadDB** and reading templates in **UF_SaveDB**.

**void UF_SetUserInfoCallback( void (*callback)( int index, int numOfTemplate ) )**

### Parameters

*callback*

Pointer to the callback function.

### Return Values

None

### Example

See CMainFrame::UserInfoCallback in UniFingerUI source codes.

## UF_SetAdminLevel

Sets the administration level of a user. See **UF_EnrollAfterVerification** and **UF_DeleteAllAfterVerificatoin** for usage of administration level.

**UF_RET_CODE UF_SetAdminLevel( UINT32 userID, UF_ADMIN_LEVEL adminLevel )**

**Parameters**

*userID*

User ID.

*adminLevel*

Specifies the administration level of the user.

| Value | Note |
|---|---|
| UF_ADMIN_NONE | |
| UF_ADMIN_ENROLL | Can enroll users. |
| UF_ADMIN_DELETE | Can delete users. |
| UF_ADMIN_ALL | Can enroll and delete users. |

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetAdminLevel

Gets the administration level of a user.

**UF_RET_CODE UF_GetAdminLevel( UINT32 userID, UF_ADMIN_LEVEL* adminLevel )**

**Parameters**

*userID*

User ID.

*adminLevel*

Pointer to the administration level of the user to be returned.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ClearAllAdminLevel

Resets administration levels of all users to UF_ADMIN_NONE.

### UF_RET_CODE UF_ClearAllAdminLevel()

### Parameters

None

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SaveDB

Saves all the templates and user information stored in a module into the specified file.

**UF_RET_CODE UF_SaveDB( const char* fileName )**

### Parameters

*fileName*

Null-terminated string that specifies the file name.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_LoadDB

Loads templates and user information from the specified file. All the templates previously stored in the module will be erased before loading the DB.

**UF_RET_CODE UF_LoadDB( const char* fileName )**

### Parameters

*fileName*

Null-terminated string that specifies the file name.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_CheckTemplate

Checks if the specified user ID has enrolled templates.

**UF_RET_CODE UF_CheckTemplate( UINT32 userID, UINT32* numOfTemplate )**

**Parameters**

*userID*

User ID.

*numOfTemplate*

Pointer to the number of templates of the user ID to be returned.

**Return Values**

If there are templates of the user ID, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ReadTemplate

Reads the templates of the specified user ID.

**UF_RET_CODE UF_ReadTemplate( UINT32 userID, UINT32* numOfTemplate, BYTE* templateData )**

**Parameters**

*userID*

User ID.

*numOfTemplate*

Pointer to the number of templates of the user ID to be returned.

*templateData*

Pointer to the template data to be returned. This pointer should be preallocated large enough to store all the template data.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ReadOneTemplate

Reads one template of the specified user ID.

**UF_RET_CODE UF_ReadOneTemplate( UINT32 userID, int subID, BYTE* templateData )**

**Parameters**

*userID*

User ID.

*subID*

Sub index of the template. It is between 0 and 9.

*templateData*

Pointer to the template data to be returned. This pointer should be preallocated large enough to store all the template data.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetScanCallback

Sets the callback function of scanning fingerprints. This callback is called when SCAN_SUCCESS message is received.

**void UF_SetScanCallback( void (*callback)( BYTE ) )**

### Parameters

*callback*

Pointer to the callback function.

### Return Values

None

## UF_ScanTemplate

Scans a fingerprint on the sensor and receives the template of it.

**UF_RET_CODE UF_ScanTemplate( BYTE* templateData, UINT32* templateSize, UINT32* imageQuality )**

**Parameters**

*templateData*

Pointer to the template data to be returned.

*templateSize*

Pointer to the template size to be returned.

*imageQuality*

Pointer to the image quality score to be returned. The score shows the quality of scanned fingerprint and is in the range of 0 ~ 100.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_FixProvisionalTemplate

UF_SYS_PROVISIONAL_ENROLL determines if enrolled templates are saved permanently into flash memory or temporarily into DRAM. With provisional enroll, enrolled templates on DRAM will be erased if the module is turned off. **UF_FixProvisionalTemplate** saves the provisional templates into the flash memory.

**UF_RET_CODE UF_FixProvisionalTemplate()**

**Parameters**

None

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetSecurityLevel

Since V1.6 firmware, the security level can be assigned per user basis for 1:1 matching. 1:N matching – identification – is not affected by this setting.

**UF_RET_CODE UF_SetSecurityLevel( UINT32 userID,**
**UF_USER_SECURITY_LEVEL securityLevel )**

**Parameters**

*userID*

User ID.

*securityLevel*

Specifies the security level of the user.

| Value | Note |
|---|---|
| UF_USER_SECURITY_DEFAULT | Same as defined by Security Level system parameter |
| UF_USER_SECURITY_1_TO_1000 | |
| ... | |
| UF_USER_SECURITY_1_TO_100000000 | |

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetSecurityLevel

Gets the security level of a user.

**UF_RET_CODE UF_GetSecurityLevel( UINT32 userID,**
**UF_SECURITY_LEVEL* securityLevel )**

**Parameters**

*userID*

User ID.

*securityLevel*

Pointer to the security level of the user to be returned.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## 3.9. Image Manipulation API

UFImage is a data structure for exchanging image data between the host and the module. It consists of 28 byte header and raw image data.

```
typedef struct {
     int width;      // width of the fingerprint image
     int height;     // height of the fingerprint image
     int compressed; // compression status – currently not used
     int encrypted; // encryption status – currently not used
     int format;     // 0- gray, 1- binary, 2- 4bit gray
     int imgLen;     // width * height
     int templateLen; // size of fingerprint template – currently not used
     BYTE buffer[1];// pointer to the raw pixel data
} UFImage;
```

- UF_ConvertToBitmap: converts a UFImage structure into HBITMAP.
- UF_SaveImage: saves a UFImage structure into BMP file.
- UF_LoadImage: loads a BMP file and convert it into a UFImage structure.
- UF_ReadImage: retrieves the last scanned fingerprint image.
- UF_ScanImage: scans a fingerprint on the sensor and retrieves the image data.

## UF_ConvertToBitmap

To display a UFImage on the PC screen, it should be converted to a bitmap first. **UF_ConvertToBitmap** converts a UFImage into a device independent bitmap and returns the handle of it. After drawing the bitmap, it should be destroyed by calling DeleteObject().

### HBITMAP UF_ConvertToBitmap( UFImage* image )

#### Parameters

*image*

Pointer to the UFImage structure to be converted.

#### Return Values

If the function succeeds, return the HBITMAP of the bitmap. Otherwise, return NULL.

#### Example

```
// The following snippet is from FingerprintViewer.cpp in UniFingerUI
// source codes
class CFingerprintViewer : public CStatic
{
     // …
Private:
     UFImage* m_Image;
     HBITMAP m_Bitmap;
};

void CFingerprintViewer::OnPaint()
{
     CPaintDC dc( this );
     CBitmap bmp;

     if( m_Bitmap )
     {
         DeleteObject( m_Bitmap );
     }

     if( m_Image )
     {
         m_Bitmap = UF_ConvertToBitmap( m_Image );
```

```
            bmp.Attach( m_Bitmap );
        }
        else
        {
            bmp.LoadBitmap( IDB_LOGO );
        }

        CDC bmDC;
        bmDC.CreateCompatibleDC(&dc);
        CBitmap *pOldbmp = bmDC.SelectObject(&bmp);

        BITMAP  bi;
        bmp.GetBitmap(&bi);

        CRect rect;
        this->GetClientRect(&rect);

        dc.SetStretchBltMode( HALFTONE );
        dc.StretchBlt( 1, 1, rect.Width() - 2, rect.Height() - 2, &bmDC, 0, 0,
bi.bmWidth, bi.bmHeight, SRCCOPY );

        bmDC.SelectObject(pOldbmp);
}
```

## UF_SaveImage

Converts a UFImage into a bitmap and save it into the specified file.

**UF_RET_CODE UF_SaveImage( const char* fileName, UFImage* image )**

### Parameters

*fileName*

Null-terminated string that specifies the file name.

*image*

Pointer to the UFImage to be saved.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_LoadImage

Loads a bmp file into a UFImage structure.

**UF_RET_CODE UF_LoadImage( const char* fileName, UFImage* image )**

**Parameters**

*fileName*

Null-terminated string that specifies the file name.

*image*

Pointer to the UFImage structure.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ReadImage

Reads the last scanned fingerprint image.

### UF_RET_CODE UF_ReadImage( UFImage* image )

### Parameters

*image*

Pointer to the UFImage structure.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

### Example

```
UFImage* image = (UFImage*)malloc( UF_IMAGE_HEADER_SIZE +
                 UF_MAX_IMAGE_SIZE );

UF_RET_CODE result = UF_ReadImage( image );
```

## UF_ScanImage

Scans a fingerprint input on the sensor and retrieves the image of it.

**UF_RET_CODE UF_ScanImage( UFImage* image )**

### Parameters

*image*

Pointer to the UFImage structure.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## 3.10. Enroll API

There are three ways to enroll fingerprints; scanning live fingerprints, using scanned images, or sending templates acquired elsewhere. The enrollment process varies according to UF_SYS_ENROLL_MODE parameter. Users can also fine tune the enrollment process by selecting enroll options.

- UF_Enroll: enrolls fingerprint inputs on the sensor.
- UF_EnrollContinue: continues the enrollment process when the enroll mode is UF_ENROLL_TWO_TIMES2 or UF_ENROLL_TWO_TEMPLATES2.
- UF_EnrollAfterVerification: enrolls after an administrator is verified.
- UF_EnrollTemplate: enrolls a template.
- UF_EnrollMultipleTemplates: enrolls multiple templates to the specified ID.
- UF_EnrollImage: enrolls a fingerprint image.
- UF_SetEnrollCallback: sets the callback function for enrollment process.

## UF_Enroll

Enrolls fingerprint inputs on the sensor. The enrollment process varies according to the UF_SYS_ENROLL_MODE system parameter.

| Enroll Mode | Description |
|---|---|
| UF_ENROLL_ONE_TIME | Scans a fingerprint and enrolls it. |
| UF_ENROLL_TWO_TIMES1 | Scans two fingerprints and enrolls the better one of the two. The scanning of the second fingerprint starts automatically. |
| UF_ENROLL_TWO_TIMES2 | Same as UF_ENROLL_TWO_TIMES1, but the scanning of the second fingerprint should be initiated by another request packet. |
| UF_ENROLL_TWO_TEMPLATES1 | Scans two fingerprints and enrolls both of them. The scanning of the second fingerprint starts automatically. |
| UF_ENROLL_TWO_TEMPLATES2 | Same as UF_ENROLL_TWO_TEMPLATES1, but the scanning of the second fingerprint should be initiated by another request packet. |

Users can also fine tune the enrollment process by selecting one of the following UF_ENROLL_OPTIONs.

| Option | Description |
|---|---|
| UF_ENROLL_NONE | Overwrites existing templates of the same ID. |
| UF_ENROLL_ADD_NEW | Adds templates to the same user ID. The maximum number of templates per user is 10. |
| UF_ENROLL_AUTO_ID | The user ID will be assigned automatically by the module. |
| UF_ENROLL_CHECK_ID | Before enrolling, checks if the user ID has already some templates. If it does, UF_ERR_EXIST_ID will be returned. |

| | |
|---|---|
| | This option is useful when users do not want to overwrite existing templates. |
| UF_ENROLL_CHECK_FINGER | Before enrolling, checks if the same fingerprint is already enrolled. If the identification succeeds, return UF_ERR_EXIST_FINGER error. If the identification fails, continue enroll process with UF_ENROLL_ADD_NEW option. |
| UF_ENROLL_CHECK_FINGER_AUTO_ID | Before enrolling, checks if the same fingerprint is already enrolled. If the identification succeeds, return UF_ERR_EXIST_FINGER error. If the identification fails, continue enroll process with UF_ENROLL_AUTO_ID option. |
| UF_ENROLL_DURESS | Adds another fingerprint as duress finger to the specified user ID. Under duress, users can authenticate with duress finger to notify the threat. When duress finger is matched, the module will return UF_ERR_DURESS_FINGER error code and write a log. Users can also setup output signals for duress events. When enrolling, the duress finger should not match with non-duress fingerprints of the same ID. If it is the case, UF_ERR_EXIST_FINGER error will be returned. |

**UF_RET_CODE UF_Enroll( UINT32 userID, UF_ENROLL_OPTION option, UINT32* enrollID, UINT32* imageQuality )**

**Parameters**

*userID*

User ID.

*option*

Enroll option.

*enrollID*

Pointer to the enrolled user ID. This parameter can be different from userID when AUTO_ID option is used.

*imageQuality*

Pointer to the image quality score to be returned. The score shows the quality of scanned fingerprint and is in the range of 0 ~ 100.

**Return Values**

If enroll succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_EnrollContinue

Continues the enrollment process when the enroll mode is UF_ENROLL_TWO_TIMES2 or UF_ENROLL_TWO_TEMPLATES2.

**UF_RET_CODE UF_EnrollContinue( UINT32 userID, UINT32* enrollID, UINT32* imageQuality )**

### Parameters

*userID*

User ID.

*enrollID*

Pointer to the enrolled user ID. This parameter can be different from userID when AUTO_ID option is used.

*imageQuality*

Pointer to the image quality score to be returned. The score shows the quality of scanned fingerprint and is in the range of 0 ~ 100.

### Return Values

If enroll succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

### Example

```
// To enroll user ID 10 with enroll option of ADD_NEW,
UINT32 mode;
UF_RET_CODE result = UF_GetSysParameter( UF_SYS_ENROLL_MODE, &mode );

UINT32 userID, imageQuality;
result = UF_Enroll( 10, UF_ENROLL_ADD_NEW, &userID, &imageQuality );

// If enroll mode is UF_ENROLL_TWO_TIMES2 or UF_ENROLL_TWO_TEMPLATES2
If( result == UF_RET_SUCCESS
     && (mode == UF_ENROLL_TWO_TEMPLATES2
         || mode == UF_ENROLL_TWO_TIMES2 ) )
{
     result = UF_EnrollContinue( 10, &userID, &imageQuality );
}
```

## UF_EnrollAfterVerification

Enroll and Delete functions change the fingerprint DB stored in the module. For some applications, it might be necessary to obtain administrator's permission before enrolling or deleting fingerprints. To process these functions, a user with proper administration level should verify himself first. If there is no user with corresponding administration level, these commands will fail with UF_ERR_UNSUPPORTED error code. If the verification fails, UF_ERR_NOT_MATCH error code will be returned. The only exception is that **UF_EnrollAfterVerification** will succeed when the fingerprint DB is empty. In that case, the first user enrolled by **UF_EnrollAfterVerification** will have UF_ADMIN_LEVEL_ALL.

**UF_RET_CODE UF_EnrollAfterVerification( UINT32 userID, UF_ENROLL_OPTION option, UINT32* enrollID, UINT32* imageQuality )**

### Parameters

*userID*

User ID.

*option*

Enroll option.

*enrollID*

Pointer to the enrolled user ID. This parameter can be different from userID when AUTO_ID option is used.

*imageQuality*

Pointer to the image quality score to be returned. The score shows the quality of scanned fingerprint and is in the range of 0 ~ 100.

### Return Values

If enroll succeeds, return UF_RET_SUCCESS. If there is no user with corresponding administration level, return UF_ERR_UNSUPPORTED. If administrator's verification fails, return UF_ERR_NOT_MATCH. Otherwise, return the corresponding error code.

## UF_EnrollTemplate

Enrolls a fingerprint template.

**UF_RET_CODE UF_EnrollTemplate( UINT32 userID, UF_ENROLL_OPTION option, UINT32 templateSize, BYTE* templateData, UINT32* enrollID )**

### Parameters

*userID*

User ID.

*option*

Enroll option.

*templateSize*

Size of the template data.

*templateData*

Pointer to the template data.

*enrollID*

Pointer to the enrolled user ID. This parameter can be different from userID when AUTO_ID option is used.

### Return Values

If enroll succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_EnrollMultipleTemplates

Enrolls multiple templates to the specified ID.

**UF_RET_CODE UF_EnrollMultipleTemplates( UINT32 userID, UF_ENROLL_OPTION option, int numOfTemplate, UINT32 templateSize, BYTE* templateData, UINT32* enrollID )**

### Parameters

*userID*

User ID.

*option*

Enroll option.

*numOfTemplate*

Number of templates to be enrolled.

*templateSize*

Size of one template data. For example, when enroll 3 templates of 384 byte, this parameter is 384 not 1152.

*templateData*

Pointer to the template data.

*enrollID*

Pointer to the enrolled user ID. This parameter can be different from userID when AUTO_ID option is used.

### Return Values

If enroll succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_EnrollImage

Enrolls a fingerprint image.

**UF_RET_CODE UF_EnrollImage( UINT32 userID, UF_ENROLL_OPTION option, UINT32 imageSize, BYTE* imageData, UINT32* enrollID, UINT32* imageQuality )**

### Parameters

*userID*

User ID.

*option*

Enroll option.

*imageSize*

Size of the image data.

*imageData*

Pointer to the raw image data. Note that it is not the pointer to UFImage, but the pointer to the raw pixel data without the UFImage header.

*enrollID*

Pointer to the enrolled user ID. This parameter can be different from userID when AUTO_ID option is used..

*imageQuality*

Pointer to the image quality score to be returned. The score shows the quality of scanned fingerprint and is in the range of 0 ~ 100.

### Return Values

If enroll succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetEnrollCallback

Sets the callback function for enrollment process. This callback is called after receiving response packets with UF_PROTO_RET_SCAN_SUCCESS, UF_PROTO_RET_SUCCESS, or UF_PROTO_RET_CONTINUE messages.

**void UF_SetEnrollCallback( void (*callback)( BYTE errCode, UF_ENROLL_MODE enrollMode, int numOfSuccess ) )**

### Parameters

*callback*

Pointer to the callback function.

### Return Values

None

## 3.11. Identify API

Checks if a fingerprint input is among the enrolled user ids. While verification checks only the fingerprints of a specified user id, identification searches all the enrolled fingerprints until a match is found. As in enrollment, there are three ways to identify fingerprints; scanning live fingerprints, using scanned images, or sending templates acquired elsewhere.

- UF_Identify: identifies the fingerprint input on the sensor.
- UF_IdentifyTemplate: identifies a template.
- UF_IdentifyImage: identifies a fingerprint image.
- UF_SetIdentifyCallback: sets the callback function for identification.

## UF_Identify

Identifies the fingerprint input on the sensor.

**UF_RET_CODE UF_Identify( UINT32* userID, BYTE* subID )**

### Parameters

*userID*

Pointer to the user ID to be returned.

*subID*

Pointer to the index of the template to be returned.

### Return Values

If matching succeeds, return UF_RET_SUCCESS. If matching fails, return UF_ERR_NOT_FOUND. Otherwise, return the corresponding error code.

## UF_IdentifyTemplate

Identifies a template.

**UF_RET_CODE UF_IdentifyTemplate( UINT32 templateSize, BYTE* templateData, UINT32* userID, BYTE* subID )**

### Parameters

*templateSize*

Size of the template data.

*templateData*

Pointer to the template data.

*userID*

Pointer to the user ID to be returned.

*subID*

Pointer to the index of the template to be returned.

### Return Values

If matching succeeds, return UF_RET_SUCCESS. If matching fails, return UF_ERR_NOT_FOUND. Otherwise, return the corresponding error code.

## UF_IdentifyImage

Identifies a fingerprint image.

**UF_RET_CODE UF_IdentifyImage( UINT32 imageSize, BYTE* imageData, UINT32* userID, BYTE* subID )**

### Parameters

*imageSize*

Size of the image data.

*imageData*

Pointer to the raw image data. Note that it is not the pointer to UFImage, but the pointer to the raw pixel data without the UFImage header.

*userID*

Pointer to the user ID to be returned.

*subID*

Pointer to the index of the template to be returned.

### Return Values

If matching succeeds, return UF_RET_SUCCESS. If matching fails, return UF_ERR_NOT_FOUND. Otherwise, return the corresponding error code.

## UF_SetIdentifyCallback

Sets the callback function for identification process. This callback is called after receiving UF_PROTO_RET_SCAN_SUCCESS message.

**void UF_SetIdentifyCallback( void (*callback)( BYTE ) )**

### Parameters

*callback*

Pointer to the callback function.

### Return Values

None

## 3.12. Verify API

Verifies if a fingerprint input matches the enrolled fingerprints of the specified user id. As in enroll process, there are three ways to verify fingerprints; scanning live fingerprints, using scanned images, or sending templates acquired elsewhere.

- UF_Verify: verifies the fingerprint input on the sensor.
- UF_VerifyTemplate: verifies a template.
- UF_VerifyHostTemplate: verifies the fingerprint input on the sensor with the templates sent by the host.
- UF_VerifyImage: verifies a fingerprint image.
- UF_SetVerifyCallback: sets the callback function for verification process.

## UF_Verify

Verifies if a fingerprint input on the sensor matches the enrolled fingerprints of the specified user id.

**UF_RET_CODE UF_Verify( UINT32 userID, BYTE* subID )**

**Parameters**

*userID*

User ID.

*subID*

Pointer to the index of the template to be returned.

**Return Values**

If matching succeeds, return UF_RET_SUCCESS. If matching fails, return UF_ERR_NOT_MATCH. Otherwise, return the corresponding error code.

## UF_VerifyTemplate

Verifies a template.

**UF_RET_CODE UF_VerifyTemplate( UINT32 templateSize, BYTE* templateData, UINT32 userID, BYTE* subID )**

**Parameters**

*templateSize*

Size of the template data.

*templateData*

Pointer to the template data to be sent.

*userID*

User ID.

*subID*

Pointer to the index of the template to be returned.

**Return Values**

If matching succeeds, return UF_RET_SUCCESS. If matching fails, return UF_ERR_NOT_MATCH. Otherwise, return the corresponding error code.

## UF_VerifyHostTemplate

Transmits fingerprint templates from the host to the module and verifies if they match the live fingerprint input on the sensor.

**UF_RET_CODE UF_VerifyHostTemplate( UINT32 numOfTemplate, UINT32 templateSize, BYTE* templateData )**

**Parameters**

*numOfTemplate*

Number of templates to be transferred to the module.

*templateSize*

Size of a template.

*templateData*

Pointer to the template data to be transferred to the module.

**Return Values**

If matching succeeds, return UF_RET_SUCCESS. If matching fails, return UF_ERR_NOT_MATCH. Otherwise, return the corresponding error code.

## UF_VerifyImage

Verifies a fingerprint image.

**UF_RET_CODE UF_VerifyImage( UINT32 imageSize, BYTE* imageData, UINT32 userID, BYTE* subID )**

### Parameters

*imageSize*

Size of the fingerprint image.

*imageData*

Pointer to the raw image data. Note that it is not the pointer to UFImage, but the pointer to the raw pixel data without the UFImage header.

*userID*

User ID.

*subID*

Pointer to the index of the template to be returned.

### Return Values

If matching succeeds, return UF_RET_SUCCESS. If matching fails, return UF_ERR_NOT_MATCH. Otherwise, return the corresponding error code.

## UF_SetVerifyCallback

Sets the callback function for verification process. The callback function is called after receiving UF_PROTO_RET_SCAN_SUCCESS message.

**void UF_SetVerifyCallback( void (*callback)( BYTE ) )**

### Parameters

*callback*

Pointer to the callback function.

### Return Values

None

## 3.13. Delete API

Provides functions for deleting stored templates.

- UF_Delete: deletes the templates of the specified user ID.
- UF_DeleteOneTemplate: deletes one template of the specified user ID.
- UF_DeleteMultipleTemplates: deletes the template of multiple user IDs.
- UF_DeleteAll: deletes all the templates.
- UF_DeleteAllAfterVerification: deletes templates after administrator's verification.
- UF_SetDeleteCallback: sets the callback function for delete process.

## UF_Delete

Deletes the enrolled templates of the specified user ID.

**UF_RET_CODE UF_Delete( UINT32 userID )**

**Parameters**

*userID*

User ID.

**Return Values**

If delete succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_DeleteOneTemplate

Deletes one template of the specified user ID.

**UF_RET_CODE UF_DeleteOneTemplate( UINT32 userID, int subID )**

**Parameters**

*userID*

User ID.

*subID*

Sub index of the template. It is between 0 and 9.

**Return Values**

If delete succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_DeleteMultipleTemplates

Deletes the enrolled templates of multiple user IDs.

### UF_RET_CODE UF_DeleteMultipleTemplates( UINT32 startUserID, UINT32 lastUserID, int* deletedUserID )

#### Parameters

*startUserID*

First user ID to be deleted.

*lastUserID*

Last user ID to be deleted.

*deletedUserID*

Pointer to the number of IDs to be actually deleted by the module.

#### Return Values

If delete succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

#### Example

```
// Delete templates of ID 10 ~ ID 20
int numOfDeleted;
UF_RET_CODE result = UF_DeleteMultipleTemplates( 10, 20, &numOfDeleted );
```

## UF_DeleteAll

Deletes all the templates stored in a module.

### UF_RET_CODE UF_DeleteAll()

#### Parameters

None

#### Return Values

If delete succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_DeleteAllAfterVerification

Deletes all the templates after administrator's verification.

### UF_RET_CODE UF_DeleteAllAfterVerification()

#### Parameters

None

#### Return Values

If delete succeeds, return UF_RET_SUCCESS. If there is no user with corresponding administration level, return UF_ERR_UNSUPPORTED. If administrator's verification fails, return UF_ERR_NOT_MATCH. Otherwise, return the corresponding error code.

## UF_SetDeleteCallback

Sets the callback function for delete process. This callback is called after receiving UF_PROTO_RET_SCAN_SUCCESS or UF_PROTO_RET_CONTINUE.

**void UF_SetDeleteCallback( void (*callback)( BYTE ) )**

### Parameters

*callback*

Pointer to the callback function.

### Return Values

None

## 3.14. IO API for SFM3500

SFM3500 modules have three input ports, three output ports, and three LED ports which are configurable for specific functions. For BioEntry Smart and Pass, there are two input ports, two output ports, and 2 LED ports. These functions are provided to configure these IO ports.

- UF_InitIO: clears the output event caches.
- UF_SetInputFunction: sets the function of an input port.
- UF_GetInputFunction: gets the function of an input port.
- UF_GetInputStatus: gets the status of an input port.
- UF_GetOutputEventList: gets the output events list assigned to an output port.
- UF_ClearAllOutputEvent: clears all the output events assigned to an output port.
- UF_ClearOutputEvent: clears an output event assigned to an output port.
- UF_SetOutputEvent: adds an output event to an output port.
- UF_GetOutputEvent: gets the signal data of an output event.
- UF_SetOutputStatus: sets the status of an output port.
- UF_SetLegacyWiegandConfig: sets the Wiegand format.
- UF_GetLegacyWiegandConfig: gets the Wiegand format.
- UF_MakeIOConfiguration: makes IO configuration data to be saved into a file.

## UF_InitIO

To prevent redundant communication, the SFM SDK caches the output events previously read or written. **UF_InitIO** clears the cache. It is called in **UF_Reconnect.**

**void UF_InitIO()**

**Parameters**

None

**Return Values**

None

## UF_SetInputFunction

Sets the function of an input port. Available functions are as follows;

| Function | Description |
|---|---|
| UF_INPUT_NO_ACTION | No action |
| UF_INPUT_ENROLL | Enroll |
| UF_INPUT_IDENTIFY | Identify |
| UF_INPUT_DELETE | Delete |
| UF_INPUT_DELETE_ALL | Delete all |
| UF_INPUT_ENROLL_BY_WIEGAND | Enroll by Wiegand ID |
| UF_INPUT_VERIFY_BY_WIEGAND | Verify by Wiegand ID |
| UF_INPUT_DELETE_BY_WIEGAND | Delete by Wiegand ID |
| UF_INPUT_ENROLL_VERIFICATION | Enroll after administrator's verification |
| UF_INPUT_ENROLL_BY_WIEGAND _VERIFICATION | Enroll by Wiegand ID after administrator's verification |
| UF_INPUT_DELETE_VERIFICATION | Delete after administrator's verification |
| UF_INPUT_DELETE_BY_WIEGAND _VERIFICATION | Delete by Wiegand ID after administrator's verification |
| UF_INPUT_DELETE_ALL _VERIFICATION | Delete all after administrator's verification |
| UF_INPUT_CANCEL | Cancel |
| UF_INPUT_TAMPER_SWITCH_IN | Tamper switch. When the tamper switch is on, Tamper Switch On(0x64) event occurred. When it gets off, Tamper Switch Off(0x65) event occurred. Both events are recorded in log, too. In BioEntry Smart and Pass, UF_INPUT_PORT2 is assigned to Tamper SW. |
| UF_INPUT_RESET | Reset the module |

**UF_RET_CODE UF_SetInputFunction( UF_INPUT_PORT port, UF_INPUT_FUNC inputFunction, UINT32 minimumTime )**

**Parameters**

*port*

One of the three input ports – UF_INPUT_PORT0, UF_INPUT_PORT1, and UF_INPUT_PORT2. For BioEntry Smart and Pass, UF_INPUT_PORT2 is assigned to Tamper SW and not configurable.

*inputFunction*

Input function.

*minimumTime*

Minimum duration after which the input signal is acknowledged as active.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetInputFunction

Gets the function assigned to an input port.

**UF_RET_CODE UF_GetInputFunction( UF_INPUT_PORT port, UF_INPUT_FUNC* inputFunction, UINT32* minimumTime )**

**Parameters**

*port*

Input port.

*inputFunction*

Pointer to the input function to be returned.

*minimumTime*

Pointer to the minimum duration of input signal to be returned.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetInputStatus

Gets the status of an input port.

**UF_RET_CODE UF_GetInputStatus( UF_INPUT_PORT port, BOOL remainStatus, UINT32* status )**

**Parameters**

*port*

Input port.

*remainStatus*

If TRUE, don't change the status of the input port after reading. If FALSE, clear the status of the input port.

*status*

Pointer to the status of the input port to be read. 0 for inactive and 1 for active status.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

### UF_GetOutputEventList

Gets the list of output events assigned to an output/LED port. Available output events are as follows;

| Category | Event |
|---|---|
| Enroll | UF_OUTPUT_ENROLL_WAIT_WIEGAND |
| | UF_OUTPUT_ENROLL_WAIT_FINGER |
| | UF_OUTPUT_ENROLL_PROCESSING |
| | UF_OUTPUT_ENROLL_BAD_FINGER |
| | UF_OUTPUT_ENROLL_SUCCESS |
| | UF_OUTPUT_ENROLL_FAIL |
| Verify | UF_OUTPUT_VERIFY_WAIT_WIEGAND |
| | UF_OUTPUT_VERIFY_WAIT_FINGER |
| | UF_OUTPUT_VERIFY_PROCESSING |
| | UF_OUTPUT_VERIFY_BAD_FINGER |
| | UF_OUTPUT_VERIFY_SUCCESS |
| | UF_OUTPUT_VERIFY_FAIL |
| Identify | UF_OUTPUT_IDENTIFY_WAIT_FINGER |
| | UF_OUTPUT_IDENTIFY_PROCESSING |
| | UF_OUTPUT_IDENTIFY_BAD_FINGER |
| | UF_OUTPUT_IDENTIFY_SUCCESS |
| | UF_OUTPUT_IDENTIFY_FAIL |
| Delete | UF_OUTPUT_DELETE_WAIT_WIEGAND |
| | UF_OUTPUT_DELETE_WAIT_FINGER |
| | UF_OUTPUT_DELETE_PROCESSING |
| | UF_OUTPUT_DELETE_BAD_FINGER |
| | UF_OUTPUT_DELETE_SUCCESS |
| | UF_OUTPUT_DELETE_FAIL |
| Detect | UF_OUTPUT_DETECT_INPUT0 |
| | UF_OUTPUT_DETECT_INPUT1 |
| | UF_OUTPUT_DETECT_INPUT2 |
| | UF_OUTPUT_DETECT_WIEGAND |
| | UF_OUTPUT_DETECT_FINGER |
| End Processing | UF_OUTPUT_END_PROCESSING |
| Duress | UF_OUTPUT_VERIFY_DURESS |

| | |
|---|---|
| | UF_OUTPUT_IDENTIFY_DURESS |
| Tamper SW | UF_OUTPUT_TAMPER_SWITCH_ON |
| | UF_OUTPUT_TAMPER_SWITCH_OFF |
| System | UF_OUTPUT_SYS_STARTED |
| SmartCard (Available | UF_OUTPUT_DETECT_SMARTCARD |
| only for BioEntry | UF_OUTPUT_BAD_SMARTCARD |
| Smart) | UF_OUTPUT_WAIT_SMARTCARD |

**UF_RET_CODE UF_GetOutputEventList( UF_OUTPUT_PORT port, UF_OUTPUT_EVENT* events, int* numOfEvent )**

**Parameters**

*port*

Output/LED port.

*events*

Array of output events to be returned.

*numOfEvent*

Pointer to the number of output events to be returned.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

**Example**

```
// To read the output events assigned to OUT0
UF_OUTPUT_EVENT events[UF_MAX_OUTPUT_PER_PORT];
int numOfEvent;

UF_RET_CODE result = UF_GetOutputEventList( UF_OUTPUT_PORT0, events,
&numOfEvent );
```

## UF_ClearAllOutputEvent

Clears all the output events assigned to an output/LED port.

**UF_RET_CODE UF_ClearAllOutputEvent( UF_OUTPUT_PORT port )**

### Parameters

*port*

Output/LED port.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ClearOutputEvent

Clears the specified output event from the output port.

**UF_RET_CODE UF_ClearOutputEvent( UF_OUTPUT_PORT port, UF_OUTPUT_EVENT event )**

### Parameters

*port*

Output/LED port.

*event*

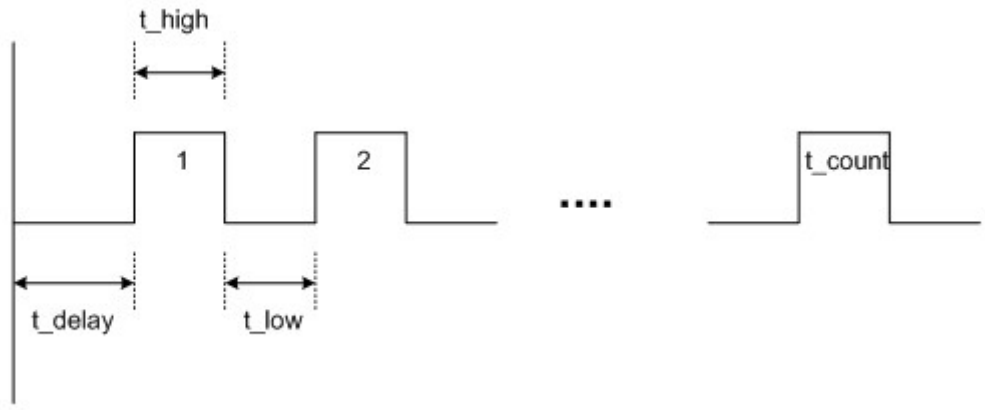
Output event to be deleted from the output/LED port.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetOutputEvent

Adds an output event to the specified output/LED port. The characteristics of output signal is also specified.




```
typedef struct {
     unsigned short delay; // t_delay
     unsigned short count; // t_count
     unsigned short active; // t_high
     unsigned short inactive; // t_low
} UFOutputSignal;
```

**UF_RET_CODE UF_SetOutputEvent( UF_OUTPUT_PORT port, UF_OUTPUT_EVENT event, UFOutputSignal signal )**

### Parameters

*port*

Output/LED port.

*event*

Output event to be added.

*signal*

Signal specification of the output event.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

**Example**

```
// To turn on the LED0 for 500ms when verification succeeds,
UFOutputSignal signal;
signal.delay = 0;
signal.count = 1;
signal.active = 500;
signal.inactive = 0;

UF_RET_CODE result = UF_SetOutputEvent( UF_OUTPUT_LED0,
UF_OUTPUT_VERIFY_SUCCESS, signal );
```

## UF_GetOutputEvent

Gets the signal data of an output event on the specified output/LED port.

**UF_RET_CODE UF_GetOutputEvent( UF_OUTPUT_PORT port, UF_OUTPUT_EVENT event, UFOutputSignal* signal )**

### Parameters

*port*

Output/LED port.

*event*

Output event.

*signal*

Pointer to the signal data to be returned.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetOutputStatus

Sets the status of an output/LED port.

**UF_RET_CODE UF_SetOutputStatus( UF_OUTPUT_PORT port, BOOL status )**

**Parameters**

*port*

Output/LED port.

*status*

TRUE for active and FALSE for inactive status.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetLegacyWiegandConfig(Deprecated)

Until the firmware V1.3, SFM 3500 modules only support 26 bit Wiegand format. Since the firmware V1.4, Extended Wiegand Interface is provided, which is much more powerful and flexible. **UF_SetLegacyWiegandConfig** configures the legacy 26 bit Wiegand format and is provided only for firmwares older than V1.4.

**UF_RET_CODE UF_SetLegacyWiegandConfig( BOOL enableInput, BOOL enableOutput, UINT32 fcBits, UINT32 fcCode )**

### Parameters

*enableInput*

If TRUE, the module starts verification process when receiving Wiegand inputs.

*enableOutput*

If TURE, the module outputs the user ID when verification or identification succeeds.

*fcBits*

Specifies the number of facility bits.

*fcCode*

Specifies the facility code.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetLegacyWiegandConfig(Deprecated)

Gets the configuration of the 26 bit Wiegand format.

**UF_RET_CODE UF_GetLegacyWiegandConfig( BOOL* enableInput, BOOL* enableOutput, UINT32* fcBits, UINT32* fcCode )**

**Parameters**

*enableInput*

Pointer to the input enable status.

*enableOutput*

Pointer to the output enable status.

*fcBits*

Pointer to the number of facility bits to be returned.

*fcCode*

Pointer to the facility code to be returned.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_MakeIOConfiguration

Makes IO configuration data to be saved into a file. See the example of **UF_SaveConfiguration** for the usage of this function.

**UF_RET_CODE UF_MakeIOConfiguration( UFConfigComponentHeader* configHeader, BYTE* configData )**

### Parameters

*configHeader*

Pointer to the configuration header to be returned.

*configData*

Pointer to the configuration data to be returned.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## 3.15. GPIO API for SFM3000

SFM3000 series modules have 8 GPIO ports, which are configurable for specific functions. The function of each GPIO can be read and programmed via these APIs. . GPIO port can be configured as input, output, shared I/O, Wiegand input, or Wiegand output. In the input mode, enroll, identify, and delete functions are supported. In the output mode, the port can send output patterns corresponding to the various events such as match success, enroll fail, and so on.

- UF_GetGPIOConfiguration: gets the configuration data of a GPIO port.
- UF_SetInputGPIO: configures an input GPIO port.
- UF_SetOutputGPIO: configures an output GPIO port.
- UF_SetSharedGPIO: configures a shared I/O port.
- UF_DisableGPIO: disables a GPIO port.
- UF_ClearAllGPIO: clears all the GPIO configurations.
- UF_SetDefaultGPIO: resets to default GPIO configurations.
- UF_EnableWiegandInput: enables Wiegand input.
- UF_EnableWiegandOutput: enables Wiegand output.
- UF_DisableWiegandInput: disables Wiegand input.
- UF_DisableWiegandOutput: disables Wiegand output.
- UF_MakeGPIOConfiguration: makes GPIO configuration data to be saved into a file.

## UF_GetGPIOConfiguration

Gets the configuration data of a GPIO port.

**UF_RET_CODE UF_GetGPIOConfiguration( UF_GPIO_PORT port, UF_GPIO_MODE* mode, int* numOfData, UFGPIOData* data )**

### Parameters

*port*

GPIO port from UF_GPIO_0 to UF_GPIO_7.

*mode*

Pointer to the GPIO mode to be returned. Available GPIO modes are as follows;

| Mode | Description |
|---|---|
| UF_GPIO_INPUT | Input port |
| UF_GPIO_OUTPUT | Output port |
| UF_GPIO_SHARED_IO | Shared IO port |
| UF_GPIO_WIEGAND_INPUT | Wiegand input port |
| UF_GPIO_WIEGAND_OUTPUT | Wiegand output port |

*numOfData*

Number of configuration data assigned to the port.

*data*

Array of GPIO configuration data to be returned.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

### Example

```
// To retrieve the configuration data of GPIO 0
UFGPIOData configData[UF_MAX_GPIO_OUTPUT_EVENT];
UF_GPIO_MODE mode;
int numOfData;

UF_RET_CODE result = UF_GetGPIOConfiguration( UF_GPIO_0, &mode, &numOfData,
configData );
```

## UF_SetInputGPIO

Configures an input GPIO port.

### UF_RET_CODE UF_SetInputGPIO( UF_GPIO_PORT port, UFGPIOInputData data )

#### Parameters

*port*

GPIO port. Only GPIO 0 to GPIO 3 can be an input port.

*data*

UFGPIOInputData is defined as follows;

```
typedef struct {
    unsigned short    inputFunction; // See UF_GPIO_INPUT_FUNC
                                     // in UF_3000IO.h
    unsigned short    activationLevel; // See UF_GPIO_INPUT_ACTIVATION
                                     // in UF_3000IO.h
    unsigned short    timeout;       // valid only if inputFUnction is
                             // UF_GPIO_IN_DELETE_ALL or
                             // UF_GPIO_IN_DELETE_ALL_VERIFICATION
    unsigned short    reserved;
} UFGPIOInputData;
```

#### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

#### Example

```
// To assign identify to GPIO 0 with ACTIVE_HIGH signal
UFGPIOInputData inputData;
inputData.inputFunction = UF_GPIO_IN_IDENTIFY;
inputData.activationLevel = UF_GPIO_IN_ACTIVE_HIGH;

UF_RET_CODE result = UF_SetInputGPIO( UF_GPIO_0, inputData );
```

## UF_SetOutputGPIO

Configures an output GPIO port.

### UF_RET_CODE UF_SetOutputGPIO( UF_GPIO_PORT port, int numOfData, UFGPIOOutputData* data )

#### Parameters

*port*

GPIO port.

*numOfData*

Number of UFGPIOOutputData to be assigned to the GPIO port.

*data*

Array of UFGPIOOutputData to be assigned to the GPIO port.

UFGPIOOutputData is defined as follows;

```
typedef struct {
    unsigned short event; // see UF_GPIO_OUTPUT_EVENT
                          // in UF_3000IO.h
    unsigned short level; // see UF_GPIO_OUTPUT_LEVEL
    unsigned short interval; // in milliseconds
    unsigned short blinkingPeriod; // valid only if the level is
                // UF_GPIO_OUT_HIGH_BLINK or UF_GPIO_OUT_LOW_BLINK
} UFGPIOOutputData;
```

#### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetSharedGPIO

Configures the shared I/O GPIO port.

**UF_RET_CODE UF_SetSharedGPIO( UF_GPIO_PORT port, UFGPIOInputData inputData, int numOfOutputData, UFGPIOOutputData* outputData )**

### Parameters

*port*

GPIO port. Only GPIO 0 to GPIO 3 can be a shared I/O port.

*inputData*

Input data to be assigned.

*numOfOutputData*

Number of UFGPIOOutputData to be assigned.

*outputData*

Array of UFGPIOOutputData to be assigned.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_DisableGPIO

Disables a GPIO port.

**UF_RET_CODE UF_DisableGPIO( UF_GPIO_PORT port )**

**Parameters**

*port*

GPIO port.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ClearAllGPIO

Clears all the configurations of GPIO ports.

### UF_RET_CODE UF_ClearAllGPIO()

**Parameters**

None

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetDefaultGPIO

Resets the configurations of GPIO ports to default.

### UF_RET_CODE UF_SetDefaultGPIO()

#### Parameters

None

#### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_EnableWiegandInput

Enables Wiegand input. Wiegand input uses GPIO 2 and GPIO 3 as input signal.

### UF_RET_CODE UF_EnableWiegandInput( UFGPIOWiegandData data )

#### Parameters

*data*

UFGPIOWiegandData is defined as follows;

```
typedef struct {
    unsigned short  totalBits; // fixed at 26 bit
    unsigned short  fcBits;    // number of facility bits
    unsigned short  idBits;    // number of id bits
    unsigned short  fcCode;    // facility code
} UFGPIOWiegandData;
```

#### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_EnableWiegandOutput

Enables Wiegand output. Wiegand output use GPIO 4 and GPIO 5 as output signal.

**UF_RET_CODE UF_EnableWiegandOutput( UFGPIOWiegandData data )**

**Parameters**

*data*

Wiegand configuration data.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_DisableWiegandInput

Disables Wiegand input.

### UF_RET_CODE UF_DisableWiegandInput()

**Parameters**

None

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_DisableWiegandOutput

Disables Wiegand output.

### UF_RET_CODE UF_DisableWiegandOutput()

**Parameters**

None

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_MakeGPIOConfiguration

Makes GPIO configuration data to be saved into a file.

**UF_RET_CODE UF_MakeGPIOConfiguration( UFConfigComponentHeader* configHeader, BYTE* configData )**

**Parameters**

*configHeader*

Pointer to the configuration header.

*configData*

Pointer to the configuration data.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

**Example**

See CUniFingerUI3000IOView::OnGpioSaveFile in UniFingerUI source codes.

## 3.16. User Memory API

SFM modules reserve 256 bytes for user data. This area can be read and written by these APIs.

- UF_WriteUserMemory: writes data to the user memory.
- UF_ReadUserMemory: reads the contents of the user memory.

## UF_WriteUserMemory

Writes data into the user memory.

**UF_RET_CODE UF_WriteUserMemory( BYTE* memory )**

**Parameters**

*memory*

Pointer to the 256 byte array to be written.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ReadUserMemory

Reads the contents of the user memory.

**UF_RET_CODE UF_ReadUserMemory( BYTE* memory )**

### Parameters

*memory*

Pointer to the 256 byte array to be read.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## 3.17. Log Management API

SFM3500 modules provide logging facility for recording important events. Users can receive logs from the module and delete unwanted ones. The format of a log record is as follows;

| Item | Description | Size |
|---|---|---|
| Source | UF_LOG_SOURCE_HOST_PORT | 1 byte |
| | UF_LOG_SOURCE_AUX_PORT | |
| | UF_LOG_SOURCE_WIEGAND_INPUT | |
| | UF_LOG_SOURCE_IN0 | |
| | UF_LOG_SOURCE_IN1 | |
| | UF_LOG_SOURCE_IN2 | |
| | UF_LOG_SOURCE_FREESCAN | |
| | UF_LOG_SOURCE_SMARTCARD | |
| Event ID | One of the UF_OUTPUT_EVENT | 1 byte |
| Date | (DD << 16) \| (MM << 8) \| YY | 3 bytes |
| Time | (ss << 16) \| (mm << 8) \| hh | 3 bytes |
| User ID | User ID | 4 bytes |
| Custom Field | Customizable by user | 4 bytes |

In V1.6 firmware, there are two enhancements for logging functions. First, 4 byte custom field is added to log records. Making use of this field, users can add customized events to log records. Second, the log cache is added for real-time monitoring.

- UF_SetTime: sets the time of the module.
- UF_GetTime: gets the time of the module.
- UF_GetNumOfLog: gets the number of log records.
- UF_ReadLog: reads log records.
- UF_ReadLatestLog: reads latest log records.
- UF_DeleteOldestLog: deletes oldest log records.
- UF_DeleteAllLog: deletes all the log records.
- UF_ClearLogCache: clears the log cache.
- UF_ReadLogCache: reads the log records in the cache.

- UF_SetCustomLogField: sets the custom field of log records.
- UF_GetCustomLogField: gets the custom field of log records.

## UF_SetTime

Sets the time of the module.

**UF_RET_CODE UF_SetTime( time_t timeVal )**

**Parameters**

*timeVal*

Number of seconds elapsed since midnight (00:00:00), January 1, 1970.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetTime

Gets the time of the module.

**UF_RET_CODE UF_GetTime( time_t* timeVal )**

### Parameters

*timeVal*

Pointer to the time value to be returned by the module.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetNumOfLog

Retrieves the number of log records.

**UF_RET_CODE UF_GetNumOfLog( int* numOfLog, int* numOfTotalLog )**

### Parameters

*numOfLog*

Pointer to the number of log records to be returned.

*numOfTotalLog*

Pointer to the maximum log records to be returned.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ReadLog

Reads log records.

**UF_RET_CODE UF_ReadLog( int startIndex, int count, UFLogRecord* logRecord, int* readCount )**

**Parameters**

*startIndex*

Start index of log records to be read.

*count*

Number of log records to be read.

*logRecord*

Pointer to the log records to be read.

*readCount*

Pointer to the number of log records actually read.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ReadLatestLog

Reads latest log records.

**UF_RET_CODE UF_ReadLatestLog( int count, UFLogRecord* logRecord, int* readCount )**

### Parameters

*count*

Number of latest log records to be read.

*logRecord*

Pointer to the log records to be read.

*readCount*

Pointer to the number of log records actually read.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_DeleteOldestLog

Deletes oldest log records.

**UF_RET_CODE UF_DeleteOldestLog( int count, int* deletedCount )**

### Parameters

*count*

Number of oldest log records to be deleted. It should be a multiple of 256.

*deletedCount*

Pointer to the number of log records actually deleted.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_DeleteAllLog

Deletes all the log records.

### UF_RET_CODE UF_DeleteAllLog()

#### Parameters

None

#### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ClearLogCache

Clears the log cache.

### UF_RET_CODE UF_ClearLogCache()

**Parameters**

None

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ReadLogCache

Reads the log records in the cache. After reading, the cache will be cleared. The maximum number of log records in the cache is 256.

**UF_RET_CODE UF_ReadLogCache( int dataPacketSize, int* numOfLog, UFLogRecord* logRecord )**

### Parameters

*dataPacketSize*

Data packet size used in Extended Data Transfer protocol.

*numOfLog*

Pointer to the number of log records to be returned.

*logRecord*

Pointer to the log records to be returned. This pointer should be preallocated large enough to store the log records.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetCustomLogField

There is a 4 byte reserved field in each log record. This function is used for setting this custom value. If the custom field is not set, it will be filled with NULL.

**UF_RET_CODE UF_SetCustomLogField( UF_LOG_SOURCE source, unsigned customField )**

### Parameters

*source*

Users can set 4 different custom values according to the source of log records.

| Source | Description |
|---|---|
| UF_LOG_SOURCE_OTHER | If the log is generated by Packet Protocol commands or freescan, this value will be used. |
| UF_LOG_SOURCE_IN0<br>UF_LOG_SOURCE_IN1<br>UF_LOG_SOURCE_IN2 | If the log is generated by an Input port, the respective values will be used. |

*customField*

4 byte custom value.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetCustomLogField

Reads the custom value of the specified log source.

**UF_RET_CODE UF_GetCustomLogField( UF_LOG_SOURCE source, unsigned* customField )**

**Parameters**

*source*

Log source.

*customField*

Pointer to the 4 byte custom value to be returned.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## 3.18. Extended Wiegand API

Extended Wiegand Interface supports up to 64 bit Wiegand formats. The only constraint is that the ID field is limited to 32 bits. It also supports advanced options such as Fail ID and Inverse Parity on Fail.

- UF_SetWiegandFormat: configures the Wiegand format.
- UF_GetWiegandFormat: gets the Wiegand format information.
- UF_SetWiegandIO: configures the Wiegand IO ports.
- UF_GetWiegandIO: gets the configurations of the Wiegand IO ports.
- UF_SetWiegandOption: sets the advanced options.
- UF_GetWiegandOption: gets the advanced options.
- UF_SetAltValue: sets the alternative value of a field.
- UF_ClearAltValue: clears the alternative value of a field.
- UF_GetAltValue: gets the alternative value of a field.
- UF_MakeWiegandConfiguration: makes Wiegand configuration data to be saved into a file.

## UF_SetWiegandFormat

Configures the Wiegand format.

**UF_RET_CODE UF_SetWiegandFormat( UFWiegandFormatHeader* header, UFWiegandFormatData* data, int pulseWidth, int pulseInterval )**

### Parameters

*header*

UFWiegandFormatHeader is defined as follows;

```
typedef struct {
    UF_WIEGAND_FORMAT  format; // UF_WIEGAND_26BIT,
                               // UF_WIEGAND_PASS_THRU,
                               // UF_WIEGAND_CUSTOM
    int                totalBits;
} UFWiegandFormatHeader;
```

*data*

Wiegand format data. If the format is UF_WIEGAND_26BIT, there is no format data and this parameter will be ignored. UFWiegandFormatData is defined as follows;

```
typedef struct {
    int                numOfIDField;
    UFWiegandField     field[MAX_WIEGAND_FIELD];
} UFWiegandPassThruData;

typedef struct {
    int                numOfField;
    UINT32             idFieldMask;
    UFWiegandField     field[MAX_WIEGAND_FIELD];
    int                numOfParity;
    UFWiegandParity    parity[MAX_WIEGAND_PARITY];
} UFWiegandCustomData;

typedef union {
    UFWiegandPassThruData     passThruData;
    UFWiegandCustomData       customData;
} UFWiegandFormatData;
```

*pulseWidth*

Specifies the width of Wiegand signal.

*pulseInterval*

Specifies the interval of Wiegand signal.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetWiegandFormat

Gets the Wiegand format data.

**UF_RET_CODE UF_GetWiegandFormat( UFWiegandFormatHeader* header, UFWiegandFormatData* data, int* pulseWidth, int* pulseInterval )**

### Parameters

*header*

Pointer to the format header to be returned.

*data*

Pointer to the format data to be returned.

*pulseWidth*

Pointer to the width of Wiegand signal.

*pulseInterval*

Pointer to the interval of Wiegand signal.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetWiegandIO

Configures the Wiegand IO ports.

**UF_RET_CODE UF_SetWiegandIO( UF_WIEGAND_INPUT_MODE inputMode, UF_WIEGAND_OUTPUT_MODE outputMode, int numOfChar )**

### Parameters

*inputMode*

| Mode | Description |
|---|---|
| UF_WIEGAND_INPUT_DISABLE | Ignores Wiegand inputs. |
| UF_WIEGAND_INPUT_VERIFY | Starts verification after receiving Wiegand inputs. |

*outputMode*

| Mode | Description |
|---|---|
| UF_WIEGAND_OUTPUT_DISABLE | Disables Wiegand output. |
| UF_WIEGAND_OUTPUT_WIEGAND_ONLY | Outputs Wiegand signal only if the verification is initiated by Wiegand input. |
| UF_WIEGAND_OUTPUT_ALL | Outputs Wiegand signal if matching succeeds. |
| UF_WIEGAND_OUTPUT_ABA_TRACK_II | Outputs ABA Track II characters instead of Wiegand signal. |

*numOfChar*

Number of characters in ABA Track II output format. It is ignored if outputMode is not UF_WIEGAND_OUTPUT_ABA_TRACK_II.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetWiegandIO

Gets the configurations of Wiegand IO ports.

**UF_RET_CODE UF_GetWiegandIO( UF_WIEGAND_INPUT_MODE* inputMode, UF_WIEGAND_OUTPUT_MODE* outputMode, int* numOfChar )**

### Parameters

*inputMode*

Pointer to Wiegand input mode to be returned.

*outputMode*

Pointer to Wiegand output mode to be returned.

*numOfChar*

Pointer to the number of characters in ABA Track II output format. It is ignored if outputMode is not UF_WIEGAND_OUTPUT_ABA_TRACK_II.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetWiegandOption

Sets advanced options.

**UF_RET_CODE UF_SetWiegandOption( BOOL useFailID, UINT32 failID, BOOL inverseParityOnFail )**

**Parameters**

*useFailID*

Normally the module outputs Wiegand signal only if matching succeeds. If this option is TRUE, the module outputs the fail ID when matching fails.

*failID*

ID to be output if useFailID is TRUE.

*inverseParityOnFail*

If this option is TRUE, the module outputs Wiegand signals with inverted parities when matching fails.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetWiegandOption

Gets the advanced options.

**UF_RET_CODE UF_GetWiegandOption( BOOL* useFailID, UINT32* failID, BOOL* inverseParityOnFail )**

**Parameters**

*userFailID*

Pointer to the useFailID option to be returned.

*failID*

Pointer to the fail ID to be returned.

*inverseParityOnFail*

Pointer to the inverseParityOnFail option to be returned.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetAltValue

If the Wiegand format is UF_WIEGAND_26BIT or UF_WIEGAND_CUSTOM, users can set alternative values for non-ID fields. If an alternative value is set for a non-ID field, the module will replace the field with the alternative value before outputting the signal.

**UF_RET_CODE UF_SetAltValue( int fieldIndex, UINT32 value )**

**Parameters**

*fieldIndex*

Index of the field.

*value*

Alternative value of the field.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ClearAltValue

Clears the alternative value of a field.

**UF_RET_CODE UF_ClearAltValue( int fieldIndex )**

**Parameters**

*fieldIndex*

Index of the field.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetAltValue

Gets the alternative value of a field.

**UF_RET_CODE UF_GetAltValue( int fieldIndex, UINT32* value )**

### Parameters

*fieldIndex*

Index of the field.

*value*

Alternative value of the field to be returned.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. If alternative value is not set to the field, return UF_ERR_NOT_FOUND. Otherwise, return the corresponding error code.

## UF_MakeWiegandConfiguration

Makes Wiegand configuration data to be saved into a file.

**UF_RET_CODE**
**UF_MakeWiegandConfiguration( UFConfigComponentHeader* configHeader, BYTE* configData )**

**Parameters**

*configHeader*

Pointer to the configuration header to be returned.

*configData*

Pointer to the configuration data to be returned.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

**Example**

See CUniFingerUIWiegandView::OnWiegandSaveFile in UniFingerUI source codes.

## 3.19. Wiegand Command Card API

Users can map an input function to a Wiegand ID. When the module detects the mapped IDs in Wiegand input port, it will execute the corresponding input function.

- UF_AddWiegandCommandCard: adds a mapping of input function to the specified ID.
- UF_GetWiegandCommandCardList: gets all the mapping data.
- UF_ClearAllWiegandCommandCard: clears all the mappings.

## UF_AddWiegandCommandCard

Maps the input function to the specified ID.

**UF_RET_CODE UF_AddWiegandCommandCard( UINT32 userID, UF_INPUT_FUNC function )**

**Parameters**

*userID*

User ID.

*function*

Among the input functions, the followings can be assigned to command cards.

| Function | Description |
|---|---|
| UF_INPUT_ENROLL | Enroll |
| UF_INPUT_IDENTIFY | Identify |
| UF_INPUT_DELETE | Delete |
| UF_INPUT_DELETE_ALL | Delete all |
| UF_INPUT_ENROLL_BY_WIEGAND | Enroll by Wiegand ID |
| UF_INPUT_DELETE_BY_WIEGAND | Delete by Wiegand ID |
| UF_INPUT_ENROLL_VERIFICATION | Enroll after administrator's verification |
| UF_INPUT_ENROLL_BY_WIEGAND _VERIFICATION | Enroll by Wiegand ID after administrator's verification |
| UF_INPUT_DELETE_VERIFICATION | Delete after administrator's verification |
| UF_INPUT_DELETE_BY_WIEGAND _VERIFICATION | Delete by Wiegand ID after administrator's verification |
| UF_INPUT_DELETE_ALL _VERIFICATION | Delete all after administrator's verification |

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetWiegandCommandCardList

Gets the list of all the command cards.

**UF_RET_CODE UF_GetWiegandCommandCardList( int* numOfCard, UFWiegandCommandCard* commandCard )**

### Parameters

*numOfCard*

Number of command cards to be returned.

*commandCard*

Array of command card information to be returned. UFWiegandCommandCard is defined as follows;

```
typedef struct {
    UINT32            userID;
    UF_INPUT_FUNC     function;
} UFWiegandCommandCard;
```

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ClearAllWiegandCommandCard

Clears all the command card mappings.

### UF_RET_CODE UF_ClearAllWiegandCommandCard()

**Parameters**

None

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## 3.20. SmartCard API

BioEntry Smart readers support MIFARE types of smartcards. These functions provide basic functionalities such as read, write, and format smartcards.

- UF_ReadSmartCard: reads a smartcard.
- UF_ReadSmartCardWithAG: reads a smartcard with access group information.
- UF_WriteSmartCard: writes templates into a smartcard.
- UF_WriteSmartCardWIthAG: writes templates and access group information into a smartcard.
- UF_FormatSmartCard: formats a smartcard.
- UF_SetSmartCardMode: sets the operation mode.
- UF_GetSmartCardMode: gets the operation mode.
- UF_ChangePrimaryKey: changes the primary key.
- UF_ChangeSecondaryKey: changes the secondary key.
- UF_SetKeyOption: sets the site key options.
- UF_GetKeyOption: gets the site key options.
- UF_SetCardLayout: sets the layout of smartcard.
- UF_GetCardLayout: gets the layout of smartcard.
- UF_SetSmartCardCallback: sets the callback function for smartcard operation.

## UF_ReadSmartCard

Reads a smart card.

### UF_RET_CODE UF_ReadSmartCard( UFCardHeader* header, BYTE* template1, BYTE* template2 )

#### Parameters

*header*

UFCardHeader is defined as follows;

```
typedef struct {
    UINT32     csn; // 4 byte card serial number
    UINT32     wiegandLower; // lower 4 bytes of Wiegand string
    UINT32     wiegandHigher;// higher 4 bytes of Wiegand string
    BYTE       version;
    BYTE       commandType; // reserved for command cards
    BYTE       securityLevel; // security level of the user
    BYTE       numOfTemplate; // number of templates stored
                              // in the card
    BYTE       template1Duress; // 1 if the template1 is
                              // of duress finger
    BYTE       template1Length[2]; // length of template1
    BYTE       template2Duress;
    BYTE       template2Length[2];
} UFCardHeader;
```

*template1*

Pointer to the first template data read from the smartcard.

*template2*

Pointer to the second template data read from the smartcard.

#### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ReadSmartCardWithAG

Reads a smart card with access group information. As for access group, see **UF_AddAccessGroup**.

**UF_RET_CODE UF_ReadSmartCardWithAG( UFCardHeader* header, BYTE* template1, BYTE* template2, int* numOfAccessGroup, BYTE* accessGroup )**

### Parameters

*header*

Pointer to the UFCardHeader to be returned.

*template1*

Pointer to the first template data read from the smartcard.

*template2*

Pointer to the second template data read from the smartcard.

*numOfAccessGroup*

Pointer to the number of access groups assigned to the smartcard.

*accessGroup*

Pointer to the IDs of access groups assigned to the smartcard. The length of each ID is 1 byte.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_WriteSmartCard

Writes template data and header information into a smartcard.

**UF_RET_CODE UF_WriteSmartCard( UINT32 userID, UF_CARD_SECURITY_LEVEL securityLevel, int numOfTemplate, int templateSize, BYTE* template1, BOOL duress1, BYTE* template2, BOOL duress2 )**

### Parameters

*userID*

User ID.

*securityLevel*

Security level. If it is set to UF_SECURITY_READER_DEFAULT, the security level is same as defined in the BioEntry reader. If it is set to UF_SECURITY_BYPASS, the BioEntry reader will bypass the fingerprint authentication.

*numOfTemplate*

Number of templates to be written.

*templateSize*

Size of a template.

*template1*

Pointer to the first template data.

*duress1*

Specifies if the first template is of a duress finger.

*template2*

Pointer to the second template data.

*duress2*

Specifies if the second template is of a duress finger.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_WriteSmartCardWithAG

Writes template data and access group information into a smartcard.

**UF_RET_CODE UF_WriteSmartCardWithAG( UINT32 userID, UF_CARD_SECURITY_LEVEL securityLevel, int numOfTemplate, int templateSize, BYTE* template1, BOOL duress1, BYTE* template2, BOOL duress2, int numOfAccessGroup, BYTE* accessGroup )**

### Parameters

*userID*

User ID.

*securityLevel*

Security level. If it is set to UF_SECURITY_READER_DEFAULT, the security level is same as defined in the BioEntry reader. If it is set to UF_SECURITY_BYPASS, the BioEntry reader will bypass the fingerprint authentication.

*numOfTemplate*

Number of templates to be written.

*templateSize*

Size of a template.

*template1*

Pointer to the first template data.

*duress1*

Specifies if the first template is of a duress finger.

*template2*

Pointer to the second template data.

*duress2*

Specifies if the second template is of a duress finger.

*numOfAccessGroup*

Number of access groups assigned to the smartcard.

*accessGroup*

Pointer to the IDs of access group to be written.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_FormatSmartCard

Formats a smartcard.

**UF_RET_CODE UF_FormatSmartCard( BOOL templateOnly )**

**Parameters**

*templateOnly*

If TRUE, erases only the template area and don't change the header information. If FALSE, erase the header information, too.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetSmartCardMode

Sets the operation mode of the BioEntry Smart reader.

**UF_RET_CODE UF_SetSmartCardMode( UF_CARD_MODE mode )**

**Parameters**

*mode*

Operation mode.

| Mode | Description |
|---|---|
| UF_CARD_DISABLE | Disables the smartcard operation. |
| UF_CARD_VERIFY_ID | After detecting a smartcard, verifies the fingerprint input with the templates stored in the BioEntry reader. |
| UF_CARD_VERIFY_TEMPLATE | After detecting a smartcard, verifies the fingerprint input with the templates stored in the card. |

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetSmartCardMode

Gets the operation mode.

**UF_RET_CODE UF_GetSmartCardMode( UF_CARD_MODE* mode )**

**Parameters**

*mode*

Pointer to the operation mode to be returned.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ChangePrimaryKey

To prevent illegal access, MIFARE card is encrypted using 48bit site key. The site key should be handled with utmost caution. If it is disclosed, the data on the smartcard will not be secure any more. **UF_ChangePrimaryKey** is used to change the primary site key.

**UF_RET_CODE UF_ChangePrimaryKey( BYTE* oldPrimaryKey, BYTE* newPrimaryKey )**

**Parameters**

*oldPrimaryKey*

Pointer to the old site key.

*newPrimaryKey*

Pointer to the new site key.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_ChangeSecondaryKey

Changes the secondary site key. The secondary site key is used only when the useSecondaryKey option is set by **UF_SetKeyOption**.

**UF_RET_CODE UF_ChangeSecondaryKey( BYTE* primaryKey, BYTE* newSecondaryKey )**

### Parameters

*primaryKey*

Pointer to the primary key.

*newSecondaryKey*

Pointer to the new secondary key.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetKeyOption

When changing the site key, BioEntry readers have to handle cards with new site key and cards with old site key at the same time. In that case, useSecondaryKey option can be used. If the secondary key is set to old site key, the reader will handle both types of cards. If autoUpdate option is on, the reader automatically replaces the old site key with new one whenever detecting a smartcard with old key.

**UF_RET_CODE UF_SetKeyOption( BYTE* primaryKey, BOOL useSecondaryKey, BOOL autoUpdate )**

### Parameters

*primaryKey*

Pointer to the primary key.

*useSecondaryKey*

If TRUE, process the cards encrypted with the secondary key.

*autoUpdate*

If TRUE, replace the secondary key with primary key when detecting a smartcard encrypted with the secondary key.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetKeyOption

Gets the site key options.

**UF_RET_CODE UF_GetKeyOption( BOOL* useSecondaryKey, BOOL* autoUpdate )**

**Parameters**

*useSecondaryKey*

Pointer to userSecondaryKey option.

*autoUpdate*

Pointer to autoUpdate option.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetCardLayout

Changes the layout of the smartcard. By default, a smartcard stores two fingerprint templates. If there are not sufficient spaces on the card, or some blocks of it are reserved for other data, users can change the layout using this function. Changing card layout should be handled with utmost caution. If you aren't sure what to do, contact to support@supremainc.com first before trying yourself.

### UF_RET_CODE UF_SetCardLayout( UFCardLayout* layout )

#### Parameters

*layout*

Pointer to the layout information. UFCardLayout is defined as follows;

```
typedef struct {
    unsigned short    templateSize;
    BYTE              headerBlock;
    BYTE              template1StartBlock;
    BYTE              template1BlockSize;
    BYTE              template2StartBlock;
    BYTE              template2BlockSize;
} UFCardLayout;
```

#### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetCardLayout

Gets the card layout information.

**UF_RET_CODE UF_GetCardLayout( UFCardLayout* layout )**

**Parameters**

*layout*

Pointer to UFCardLayout.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetSmartCardCallback

Sets the callback function for smartcard operation. This callback is called after scanning a smartcard successfully.

**void UF_SetSmartCardCallback( void (*callback)( BYTE ) )**

### Parameters

*callback*

Pointer to the callback function.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## 3.21. Access Control API

Since V1.6 firmware, BioEntry readers provide access control features such as time schedule and access group. By using these functions, user's access can be controlled in finer detail.

- UF_AddTimeSchedule: adds a time schedule.
- UF_GetTimeSchedule: reads the specified time schedule.
- UF_DeleteTimeSchedule: deletes a time schedule.
- UF_DeleteAllTimeSchedule: deletes all time schedules.
- UF_AddHoliday: adds a holiday schedule.
- UF_GetHoliday: reads the specified holiday schedule.
- UF_DeleteHoliday: deletes a holiday schedule.
- UF_DeleteAllHoliday: deletes all holiday schedules.
- UF_AddAccessGroup: adds an access group.
- UF_GetAccessGroup: reads the specified access group.
- UF_DeleteAccessGroup: deletes an access group.
- UF_DeleteAllAccessGroup: deletes all access groups.
- UF_SetUserAccessGroup: assigns access groups to a user.
- UF_GetUserAccessGroup: gets the access groups of a user.

## UF_AddTimeSchedule

A BioEntry reader can store up to 64 time schedules. Each time schedule consists of 7 daily schedules and an optional holiday schedule. And each daily schedule may have up to 5 time segments.

```
#define UF_TIMECODE_PER_DAY       5

typedef struct {
     unsigned short startTime; // start time in minutes
     unsigned short endTime; // end time in minutes
} UFTimeCodeElem;

typedef struct {
     UFTimeCodeElem codeElement[UF_TIMECODE_PER_DAY];
} UFTimeCode;

typedef struct {
     int scheduleID;
     UFTimeCode timeCode[7]; // 0 - Sunday, 1 - Monday, ...
     int holidayID;
} UFTimeSchedule;
```

### UF_RET_CODE UF_AddTimeSchedule( UFTimeSchedule* schedule )

#### Parameters

*schedule*

Pointer to the time schedule to be added.

#### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

#### Example

```
UFTimeSchedule timeSchedule;

memset( &timeSchedule, 0, sizeof(UFTimeSchedule) ); // clear the structure

timeSchedule.scheduleID = 1;
timeSchedule.holidayID = 1;
```

```
// Monday- 09:00 ~ 18:00
timeSchedule.timeCode[1].codeElement[0].startTime = 9 * 60;
timeSchedule.timeCode[1].codeElement[0].endTime = 18 * 60;

// Tuesday- 08:00 ~ 12:00 and 14:30 ~ 20:00
timeSchedule.timeCode[2].codeElement[0].startTime = 8 * 60;
timeSchedule.timeCode[2].codeElement[0].endTime = 12 * 60;
timeSchedule.timeCode[2].codeElement[1].startTime = 14 * 60 + 30;
timeSchedule.timeCode[2].codeElement[1].endTime = 20 * 60;

// …

UF_RET_CODE result = UF_AddTimeSchedule( &timeSchedule );
```

## UF_GetTimeSchedule

Reads the specified time schedule.

**UF_RET_CODE UF_GetTimeSchedule( int ID, UFTimeSchedule* schedule )**

### Parameters

*ID*

ID of the time schedule.

*schedule*

Pointer to the time schedule to be read.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_DeleteTimeSchedule

Deletes the specified time schedule.

**UF_RET_CODE UF_DeleteTimeSchedule( int ID )**

**Parameters**

*ID*

ID of the time schedule.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_DeleteAllTimeSchedule

Deletes all the time schedules stored in a BioEntry reader.

### UF_RET_CODE UF_DeleteAllTimeSchedule()

### Parameters

None

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_AddHoliday

Each time schedule may have an optional holiday schedule. A holiday schedule consists of a holiday list and a daily schedule for it.

```
typedef struct {
     int holidayID;
     int numOfHoliday;
     unsigned short holiday[32]; // (month << 8) | day
     UFTimeCode timeCode;
} UFHoliday;
```

### UF_RET_CODE UF_AddHoliday( UFHoliday* holiday )

#### Parameters

*holiday*

Pointer to the holiday schedule to be added.

#### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

#### Example

```
UFHoliday holiday;

memset( &holiday, 0, sizeof(UFHoliday) ); // clear the structure

holiday.holidayID = 1;
holiday.numOfHoliday = 10;

// Jan. 1 is holiday
holiday.holiday[0] = (1 << 8) | 1;

// Mar. 5 is holiday
holiday.holiday[1] = (3 << 8) | 5;

// …

// Access is granted during 09:00 ~ 10:00 on holideys
holiday.timeCode.codeElement[0].startTime = 9 * 60;
holiday.timeCode.codeElement[0].endTime = 10 * 60;
```

```
UF_RET_CODE result = UF_AddHoliday( &holiday );
```

## UF_GetHoliday

Reads the specified holiday schedule.

**UF_RET_CODE UF_GetHoliday( int ID, UFHoliday* holiday )**

### Parameters

*ID*

ID of the holiday schedule.

*holiday*

Pointer to the holiday schedule to be read.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_DeleteHoliday

Deletes the specified holiday schedule.

**UF_RET_CODE UF_DeleteHoliday( int ID )**

**Parameters**

*ID*

ID of the holiday schedule.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_DeleteAllHoliday

Deletes all the holiday schedules stored in a BioEntry reader.

### UF_RET_CODE UF_DeleteAllHoliday()

### Parameters

None

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_AddAccessGroup

Each access group may have up to 16 time schedules. The access of members is granted only when the time belongs to the time schedules of the group.

```
#define UF_SCHEDULE_PER_GROUP      16

typedef struct {
     int groupID;
     int numOfSchedule;
     int scheduleID[UF_SCHEDULE_PER_GROUP];
} UFAccessGroup;
```

### UF_RET_CODE UF_AddAccessGroup( UFAccessGroup* group )

#### Parameters

*group*

Pointer to the access group to be added.

#### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetAccessGroup

Reads the specified access group.

**UF_RET_CODE UF_GetAccessGroup( int ID, UFAccessGroup* group )**

### Parameters

*ID*

ID of the access group.

*group*

Pointer to the access group to be read.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_DeleteAccessGroup

Deletes the specified access group.

**UF_RET_CODE UF_DeleteAccessGroup( int ID )**

**Parameters**

*ID*

ID of the access group.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_DeleteAllAccessGroup

Deletes all the access groups stored in a BioEntry reader.

### UF_RET_CODE UF_DeleteAllAccessGroup()

#### Parameters

None

#### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_SetUserAccessGroup

Assigns access groups to a user. A user can be a member of up to 4 access groups.

**UF_RET_CODE UF_SetUserAccessGroup( UINT32 userID, int numOfGroup, int* groupID )**

**Parameters**

*userID*

User ID.

*numOfGroup*

Number of access groups to be assigned.

*groupID*

Array of access group IDs to be assigned.

**Return Values**

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

## UF_GetUserAccessGroup

Reads the IDs of access groups assigned to a user.

**UF_RET_CODE UF_GetUserAccessGroup( UINT32 userID, int* numOfGroup, int* groupID )**

### Parameters

*userID*

User ID.

*numOfGroup*

Pointer to the number of access groups to be returned.

*groupID*

Array of access group IDs to be returned.

### Return Values

If the function succeeds, return UF_RET_SUCCESS. Otherwise, return the corresponding error code.

# Contact Info

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