FS28 slave mode command description 1.5.1

5-Jun-2014

What's new in this release:

1. Added commands relate to processing ANSI ISO samples.
2. Correct the param 1 of capturing fingperint image with PIV.

New command and function are in red color.
To support commands relate to ANSI ISO sample, FS28 firmware version should be AVR v5.2.03 and BF v28.02E or above.

A. General guideline

StartByte	Command Byte	Param1	Param2	Error/Flag	CheckSum	StopByte
1byte	1byte	4byte	4byte	1byte	1byte	1byte

1. Start code: 1 byte. Indicates the beginning of a packet. 0x40, corresponding to '@.'
2. Command: 1 byte. Refer to the Command Table in a later chapter of this document.
3. Param1: 4 bytes. Indicates user ID or system parameters.
4. Param2: 4 bytes. Indicate Finger ID (FID) and Group ID (GID) or the size of binary data following the command packet such as fingerprint templates or images.
5. Error/Flag: 1 byte. Indicates flag data in the request command sent to the module, and error code in the response command received from the module, respectively.
6. Checksum: 1 byte. Checks the validity of a packet. Checksum is a remainder of the sum of each field, from the Start code to Error/Flag, divided by 256 (0x100).
7. End code: 1 byte. LF ('\n', 0x0D). Indicates the end of a packet. Also used as a code indicating the end of a binary data such as fingerprint templates.

Bluetooth serial COM port parameters:
115200, 8bit, 1 stop bit, no parity, no handshaking

Sample – minutia list from one fingerprint image.
Template – user data in data base (each template consists 1..10 samples)

Note:
Whole 13-byte data should be sent from host before sending extra data. i.e. Upload current sample, Upload individual template, Upload data to External Memory Blackfin.
Whole 13-byte data should be received by host before receiving extra data. i.e. Download RAW image / Sample / Template /User list, Download data from Boot flash, Download data from External Memory Blackfin

Following is the location of FID and GID in Param2 (Least Significant Byte first, arranged in Little Endian). **The location of FID and GID should be correct**. Otherwise, there may be malfunction.

LSB MSB

Param1				Param2			
User ID	User ID	User ID	User ID	reserved	reserved	FID	GID

i.e. If User ID is 0x12345678, then the sequence of Param1 is 0x78,0x56,0x34,0x12,
If GID is 0x90 and FID is 0x01, then the Param2 is 0x00,0x00,0x01,0x90

B. Basic commands for fingerprint registration and recognition

1. Check finger

	Code of command	Param1	Param2	Flag/Error	Description
Request from Host	0x4B	0x00000000	0x00000000	0x00	Check and inform host if there is finger on the scanning window
Return to Host	0xXX	Contrast value	0x00000000	0x40 (if finger is) 0x41(if there isn't finger)	

2. Capture fingerprint image

	Code of command	Param1	Param2	Flag/Error	Description
Request from Host	0x49	0x00000000 0x00000008 (PIV)	0x00000000	0x00	Image of existing on a window finger is stored to FAM's RAM
Return to Host	Dosage Number	Contrast value	Number White pixels	0x40 (0x41)	

If the Param1 of the command = 0x00000008, it is use to capture a PIV image;

3. Process the captured fingerprint image

	Code of command	Param1	Param2	Flag/Error	Description
Request from Host	0x50	0x00000000	0x00000000	0x00 / 0x06 (ANSI or ISO)	Process image to sample
Return to Host	0xXX	0x00000000	0x00000000	0x40 (0x42,0x43)	

For command request from host, if flag is 0x06, the image will be processed to specific sample for ANSI or ISO.

4. Find the fingerprint of an ordinary user (1 to 1 matching)

	Code of command	Param1	Param2	Flag/Error	Description
Request from Host	0x52	User ID	0x00000000	0x00 /0x80	Compare current sample with ID template
Return to Host	(Result>>2)	User ID	FID and GID	0x40 (0x4d,0x45)	

This function used for compare RamSlotN = 1;
For Request from Host, if Flag is 0x80, user log will be kept when doing matching. If Flag is 0x00, not log will be kept.

5. Find the fingerprint of a VIP user (1 to many matching)

	Code of command	Param1	Param2	Flag/Error	Description
Request from Host	0x52	0x00000000	0x00000000	0x01/0x81	Compare current sample with VIP users templates database
Return to Host	(Result>>2)	User ID	FID and GID	0x40 (0x5E 0x4d,0x45)	

This function used for compare RamSlotN = 1;
For Request from Host, if Flag is 0x81, user log will be kept when doing matching, if Flag is 0x01, not log will be kept.

6. Compare current sample with template in RAM

	Code of command	Param1	Param2	Flag/Error	Description
Request from Host	0x52	RamSlotN	0x00000000	0x02	Compare current sample with template in RAM
Return to Host	(Result>>2)	0x00000000	0x00000000	0x40 (0x45)	

RamSlotN must be in range 0..3.

7. Compare two templates in RAM

	Code of command	Param1	Param2	Flag/Error	Description
Request from Host	0x52	RamSlotN_0	RamSlotN_1	0x03	Compare two templates in RAM
Return to Host	0x00	0x00000000	0x00000000	0x40 (0x45)	

RamSlotN_# must be in range 0..3.

Security level is minimal between Global Secure Level and Secure level from RamSlotN_0.

When this function is used, current sample (from function Process image to sample) will be lost.

8. Find the fingerprint in group (1 to many matching)

	Code of command	Param1	Param2	Flag/Error	Description
Request from Host	0x52	0x00000000	GID	0x05	Compare current sample with GID
Return to Host	(Result>>2)	User ID	FID and GID	0x40 (0x4d,0x45)	

This function used for compare RamSlotN = 1

9. Store the fingerprint template to FAM flash memory

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x41	User ID	FID and GID	#bXxxxXXXX	Storage template to FAM flash memory
Return to Host	0xXX	User ID	FID and GID	0x40 (0x46) (0x4e)	

User ID must be in range 0.. 0xFFFFFFFF.
Flag
bit[1:0] - security level for individual user(0 - minimum,1,2,3 - maximum);
bit[2] - VIP / ordinary user: if bit[2] ==1 – VIP, bit[2] == 0 ordinary;
bit[3] - Suspend user. If bit[3]==1 – User suspended by matching(return error RESULT_USER_SUSPENDED). If bit[3]==0, normal
bit[4..6] - reserved for future use;
bit[7] - if bit[7] == 0, then template add to database with ID, security level, VIP/ordinary, as set in current command;
bit[7] - if bit[7] == 1, then template stored with default parameters (use this bit equal one only after command "Upload individual template") and ID, security level, VIP/ordinary, in current command ignored;

This function used for source template RamSlotN = 0;

Maximum number of VIP users is 800.

10. Store the sample in FAM RAM

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x53	Sample N	0x00000000	0x00	Store current sample in RAM
Return to Host	0xXX	Sample N	0x00000000	0x40	

Sample N is reserved in range 0..9. The number of samples depends on fingerprint features.

This function used for target RamSlotN = 0;

11. Cancel/Escape

	Code of command	Param1	Param2	Flag/Error	Description
Request from Host	0x4C	0x00000000	0x00000000	0x00	Escape from current sequence
Return to Host	0x00	0x00000000	0x00000000	0x40	

You cannot interrupt command!
You can interrupt sequence (Add user sequence or Recognize sequence) after any command without use this command.

C. System administration commands

1. Get FAM hardware and firmware version number

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x00	0x00000000	0x00000000	0x00	Get FAM version F/W,H/W
Return to Host	0x00	F/W low byte, 0x00, F/W high byte, 0x00	H/W low byte, 0x00, H/W high byte, 0x00	0x40	

2. Get FS28 hardware and firmware version number

	Code of command	Param1	Param2	Flag	Description
Request from Host	0xA3	0x00000000	0x00000000	0x00	Get FS28 version F/W,H/W
Return to Host	0x00	F/W 3rd digit, F/W 2nd digit, F/W 1st digit, 0x00	H/W, 0x00, 0x00, 0x00	0x40	

3. Get free memory space of FAM's NAND flash memory

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x4F	0x00000000	0x00000000	0x00	Get free space.
Return to Host	0x00	Number of free pages	0x00000000	0x40	

Each page has 512 bytes.

4. Toggle the user status between VIP and ordinary user

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x47	User ID	0x00000000	#bxxxxXXXX	Toggle the user status between VIP and ordinary user
Return to Host	0xXX	User ID	0x00000000	0x40 (0x4D) (0x47)	

User ID must be in range 0.. 0xFFFFFFFF (FID and GID ignored, status will changed for all Finger ID in current User ID).

Flag

bit[1:0] - security level for individual user(0 - minimum,1,2,3 - maximum);
bit[2] - VIP / ordinary user: if bit[2] ==1 – VIP, bit[2] == 0 ordinary;
bit[3] - suspend user: if bit[3]==1 – suspend, bit[3]==0 – normal;
bit[4..7] - reserved for future use;

5. Set security level for all users

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x4A	Security level(0..3)	0x00000000	0x00(for get level only) 0x01 (for change level)	Set/get security level for all users.
Return to Host	0x00	Security level(0..3)	Threshold (100...500)	0x40	

0 – minimum, 3 – maximum(default).

6. Read serial number of FS28

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x4A	0x00000000	0x00000000	0x02	Read serial number of FS28.
Return to Host	0x00	Serial number	0x00000000	0x40	

E.g. Serial number FP2800014, the first two characters ‘FP’ are not included in returned parameter 1, so the returned parameter 1 is 0x14 00 80 20. Note: Parameter is arranged in Little Endian (Least Significant Byte first)

7. Get Battery Voltage

	Code of command	Param1	Param2	Flag	Description
Request from Host	0xA4	0x00000000	0x00000000	0x00	Get Battery Voltage
Return to Host	0x00	Battery voltage in mV	0x00000000	0x40	

8. Get IR

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x61	0x00000000	0x00000000	0x00	Get IR
Return to Host	0x00	LSB = IR	0xXXXXXXXX	0x40	

9. FS28 Operating Mode Inquiry

	Code of command	Param1	Param2	Flag	Description
Request from Host	0xA6	0x00000000	0x00000000	0x00	Check the current operating mode
Return to Host	0x00	Mode, 0x00, 0x00, 0x00	0x00000000	0x40, 0x41, 0xB0, 0xB1	

Mode: 0x00= none mode, 0x01 = security locked, 0x02= Bluetooth master mode,

0x03= Bluetooth slave mode, 0x04 =local mode, 0x05 =USB mode

10. Buzzer Control

	Code of command	Param1	Param2	Flag	Description
Request from Host	0xA7	Pattern, 0x00, 0x00, 0x00	0x00000000	0x01(Buzzer On) 0x00 (Buzzer Mute)	Buzzer Control
Return to Host	0x00	0x00000000	0x00000000	0x40, 0x41, 0xB0, 0xB1	

Pattern: 0x00= Long beep 700ms (Fail indication), 0x01= short beep 100ms (event trigger indication), 0x02=double beep (ok indication), 0x03 =triple beep (error indication)

11. Turn On LCD Backlight

	Code of command	Param1	Param2	Flag	Description
Request from Host	0xA8	0x00000000	0x00000000	0x01	Turn on LCD backlight for 4 seconds
Return to Host	0x00	0x00000000	0x00000000	0x40, 0x41, 0xB0, 0xB1	

Note. The LCD will only on for 4 seconds.

D. Data manipulating commands

1. Erase all templates.

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x45	N/A	N/A	0x00	NAND flash is erased and host is informed about number of free 528 bytes pages
Return to Host	0x00	Number of free pages	N/A	0x40	

2. Download RAW image (320x480)

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x44	OffSet	Length	0x00	Raw image is sent from FAM to host
Return to Host	0x00	0x00000000	0x00000000	0x40	

If(OffSet == 0)

+ Line0(320bytes) + Line1(320bytes) +.....(depends of length) ..+ CheckSum + 0x0D; (to Host)

3. Download individual template

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x54	User ID, (Not used if Flag==0x01)	FID and GID (Not used if Flag==0x01)	0x00 (With ID), 0x01 (Without ID; Download current (raw) template)	Template with (without) ID is sent from FAM to host
Return to Host	0x00	0x00000000	Length	0x40, 0x4D, 0x47	

+ Byte0 .....Byte(length-1) ..+ CheckSum1 + 0x0D;

This function used RamSlotN = 1 (If Flag = 0), RamSlotN = 0 (If Flag = 1);

4. Download current sample

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x4d	0x00000000	0x00000000	0x00 0x01	Send current sample to host
Return to Host	0x00	0x00000000	Length	0x40	

FS28 will return 13 byte respond + Sample data Byte0 + Byte1+..... Byte(Length-1) + CheckSum + 0x0D;

If flag = 0x00, the sample download will be 664 bytes. If flag = 0x01, the sample download will be 582 bytes.

5. Download ANSI/ISO sample

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x4d	0x00000000	0x00000000	0x28/ 0x38/ 0x68/ 0x78	Send current sample to host
Return to Host	0x00	0x00000000	Length	0x40	

For command request from host:

- Flag 0x68, FS28 will just return 13 byte respond and the returned parameter 2 is the length of ANSI sample. No ANSI sample data will follow the 13 byte respond.
- Flag 0x78, FS28 will just return 13 byte respond and the returned parameter 2 is the length of ISO sample. No ISO sample data will follow the 13 byte respond.
- Flag 0x28, ANSI sample data will follow the 13 byte respond.
- Flag 0x38, ISO sample data will follow the 13 byte respond.

ie. For request command flag 0x28 and 0x38, FS28 will return 13 byte respond + Sample Data Byte0 + Byte1+..... Byte(SampleLength-1) + CheckSum + 0x0D;

6. Upload current sample

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x4d	0	Length	0x02 0x03	Receive sample from host
	+ Byte0 .....Byte(length-1) ..+ CheckSum1				
Return to Host	0x00	0x00000000	0x00000000	0x40, 0x47, 0x49, 0x4A	

If (flag==0x02) Length = 664bytes; If (flag==0x03) Length = 582bytes;

7. Load individual template from Flash to RAM

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x54	User ID	FID and GID	0x02 (RamSlotN = 0), 0x03 (RamSlotN = 1), 0x04 (RamSlotN = 2), 0x05 (RamSlotN = 3),	Template with ID is loaded from flash to RAM
Return to Host	0x00	0x00000000	0x00000000	0x40, 0x4D,0x47	

8. Upload individual template

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x55	RamSlotN	Length	0x00	Template sent from host to FAM
	+ Byte0 .....Byte(length-1) ..+ CheckSum1				
Return to Host	0x00	0x00000000	0x00000000	0x40, 0x49, 0x4A	

RamSlotN must be in range 0..3.

If you will use command Store the fingerprint template to FAM flash memory after this command please set RamSlotN = 0.

9. Erase individual template

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x48	User ID	FID (if Flag==0, ignored)	0x00(all FID in UserID); 0x01(one FID)	Erase individual template
Return to Host	0x00	0x00000000	0x00000000	0x40 (0x4D, 0x44)	

User ID must be in range 0.. 0xFFFFFFFF.

10. Change communication baud rate

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x39	0x00000001 – 9600, 0x00000005 – 115200, 0x00000007 – 460800	0x00000000	0x00	Change communication rate
Return to Host	0x00	0x00000001 – 9600, 0x00000005 – 115200, 0x00000007 – 460800	0x00000000	0x40	

0 – 4800; 1 - 9600 ; 2 – 19200 ; 3 – 38400 ; 4 - 57600 ; 5 – 115200 ; 6 – 230400 ; 7 – 460800 ; 8 – 921600.

11. Get number Users in Database

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x57	0x00000000	0x00000000	0x00	Get number Users in DataBase
Return to Host	0x00	Number Users in database	Number of VIP Users in database	0x40	

12. Download User List

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x57	0x00000000	0x00000000	0x01	Download User List.
Return to Host	0x00	Number Users in database	Length in bytes	0x40	

- bytes0 + bytes1 +.....(depends of length) ..+ CheckSum1 + 0x0D;
- 12 bytes per user:
- bytes[0..7] – UserID+FID+GID; byte[8] – Flag byte; bytes[9..11]-reserved.

13. Download data from Boot flash

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x42	External flash Address	Length	0x00	Download data from boot flash.
Return to Host	0x00	0x00000000	0x00000000	0x40	

+ bytes0 + bytes1 +.....(depends of length) ..+ CheckSum1 + 0x0D;

Length must be in range 0x00 ...0xFFFF;

14. Download data from External Memory Blackfin

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x0F	External flash Address	Length	0x00	Download data from External RAM.
Return to Host	0x00	0x00000000	0x00000000	0x40	

+ bytes0 + bytes1 +.....(depends of length) ..+ CheckSum1 + 0x0D;

15. Upload data to External Memory Blackfin

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x0D	Address	Length	0x00	Upload data to External RAM
	+ Byte0 .....Byte(Length-1) ..+ CheckSum1				
Return to Host	0x00	0x00000000	0x00000000	0x40, 0x49, 0x4A	

16. Write firmware from RAM to flash.

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x10	Length	0x00000000	0x00	Write firmware
Return to Host	0x00	0x00000000	0x00000000	0x40, 0x47	

17. Convert RAW to WSQ

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x36	Quality/ Bitrate	0x00000000	0x01	Convert RAW image to WSQ
Return to Host	0x00	0x00000000	Converted WSQ size	0x40, 0x41	

Quality/ Bitrate range is 0x4B to 0xFF.

18. Download WSQ

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x0F	0x00000000	WSQ size	0x00	Download WSQ
Return to Host	0x00	0x00000000	Converted WSQ size	0x40, 0x41	

19. Enable keep log

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x64	0x00000001	0x00000000	0x05	Enable keep log
Return to Host	0x00	0x00000000	0x00000000	0x40, 0x41	

20. Get No. of user log

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x64	0x00000000	0x00000000	0x02	View the number of log
Return to Host	0x00	No. of log	XXXXXXXX	0x40, 0x41	

21. Download user log

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x64	0x00000000	No. of log	0x01	Download user log
Return to Host	0x00	0x00000000	log size	0x40, 0x41	

+ bytes0 + bytes1 +.....(depends of length) ..+ CheckSum1 + 0x0D;

22. Erase user log

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x64	0x00000000	0x00000000	0x03	erase log
Return to Host	0x00	0x00000000	XXXXXXXX	0x40, 0x41	

23. Enable printing host message

	Code of command	Param1	Param2	Flag	Description
Request from Host	0xA0	0x00000000	0x00000000	0x01(enable) 0x00(disable)	Enable/disable printing host message
Return to Host	0x00	0x00000000	0x00000000	0x40, 0x41, 0xB0, 0xB1	

24. Send message to FS28

	Code of command	Param1	Param2	Flag	Description
Request from Host	0xA1	0x00000000	Length	Position(0-3)	Upload data to External RAM
	+ Byte0 .....Byte(Length-1) ..+ CheckSum1				
Return to Host	0x00	0x00000000	0x00000000	0x40, 0xB0, 0xB1	

The position is the line on the FS28 LCD message session, range is 0x00 - 0x03; Each line cans print Max 21 chars.

25. Clear host message

	Code of command	Param1	Param2	Flag	Description
Request from Host	0xA2	0x00000000	0x00000000	0x00	Clear host message
Return to Host	0x00	0x00000000	0x00000000	0x40, 0x41, 0xB0, 0xB1	

26. Read date time

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x38	0x00000000	0x00000000	0x00	Read date and time
Return to Host	0x00	0xDDHHMMSS	0x0000YYMM	0x40, 0x41	

The return Param 1 and Param 2 in sequence is SS:MM:HH:DD:MM:YY:00:00.

27. Set date time

	Code of command	Param1	Param2	Flag	Description
Request from Host	0x38	0xDDHHMMSS	0x0000YYMM	0x07	Set date and time
Return to Host	0x00	0x00000000	0x00000000	0x40, 0x41	

The request Param 1 and Param 2 in sequence is SS:MM:HH:DD:MM:YY:00:00.

28. Refresh date time

	Code of command	Param1	Param2	Flag	Description
Request from Host	0xA5	0x00000000	0x00000000	0x00	Refresh the date time on FS28 LCD
Return to Host	0x00	0x00000000	0x00000000	0x40, 0x41	

E. Error Codes

Code	Description
0x40	RESULT_OK
0x41	RESULT_NO_IMAGE
0x42	RESULT_BAD_QUALITY
0x43	RESULT_TOO_LITTLE_POINTS
0x44	RESULT_EMPTY_BASE
0x45	RESULT_UNKNOWN_USER
0x46	RESULT_NO_SPACE
0x47	RESULT_BAD_ARGUMENT
0x49	RESULT_CRC_ERROR
0x4A	RESULT_RXD_TIMEOUT
0x4D	RESULT_USER_ID_IS_ABSENT
0x4E	RESULT_USER_ID_IS_USED_ALREADY
0x4F	RESULT_VERY_SIMILAR_SAMPLE
0x54	RESULT_USER_SUSPENDED
0x55	RESULT_UNKNOWN_COMMAND
0x57	RESULT_INVALID_STOP_BYTE
0x58	RESULT_HARDWARE_ERROR
0x59	RESULT_BAD_TEST_OBJECT
0x5A	RESULT_BAD_FLASH
0x5B	RESULT_TOO_MANY_VIP
0x5D	RESULT_TOO_BIG_GROUP
0x5E	LOG FULL
0xB0	FS28 BUSY
0xB1	FS28 IN SLEEP MODE
0xB2	FS28 IN SECURITY LOCKED
0xE1	ERROR_9866B_HAS_NOT_ON

END