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FES4335U1-35C

TFT-LCD

Graphics Control Module

(Memory Mapping)

Interface: UART

Reference Manual (Preliminary)



Document No: doc-fes4335U1-35C-v11

PCB Bare Board: PB35C62-V11

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Revision histories

Rev. No.	Date	Substantial Changes
1.0	2017/01	First issue.
1.1	2022/02	1.Update communication option 1/2/3
		2.Showing FR-DCE and FR-E2S board





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1 General Description

FES4335U1-35C is a low cost, high efficiency and smart of TFT-LCD display control module which can provide characters or 2D graphics application within an embedded 768KB of display RAM.

FES4335U1-35C offers serial interface (UART-TTL) to establish a hardware communication with an external simple MCU (as like 8051 etc.), and providing the “*Commands Table*” for graphical effect calling and execution.

According to the “*Commands Table*” of graphics APIs, the external MCU only need to transmit the corresponding command code with parameters into FES4335U1-35C over serial interface. The command decoder inside of FES4335U1-35C would go to implement the graphics task by automatically.

Item	Specification	Remark
LCD size	3.5 (Diagonal)	inch
Resolution	320 x 3(RGB) x 240	dot
Color arrangement	64k colors w/ RGB-stripe	
Display type	Normally White. Transmissive type	
Active area	70.08(W) x 52.56(H)	mm
Module size	84.02(W) x 75.36(H) x 12.8(D)	mm
View angle	L:60/ R:60/ T:60/ B:60	θ
Contrast ratio	Typ. 600 @ ($\theta=0^\circ$)	CR
Backlight type	Build-in LED driver	
Brightness(Luminance)	Typ. 800	cd/m ²
Touch type	PCAP	
Interface	UART, 115200/ N/ 8/ 1	
Software offer	<i>Forenex's Free editing tool</i>	Note1
FlashROM for images storage	(Typ.)8MB/16MB	
Full screen image capacity	36 pages (8MB)/ 72 pages (16MB)	
Picture switching speed	About 18ms/frame	
Picture downloading	FG875D_Command_Encoder.exe	
Operation Temp	-20℃ to 70℃	
Storage Temp	-30℃ to 80℃	

Note1: The Forenex's Free editing tool that ([FG875D_Command_Encoder.exe](#)) is a windows app. In the utility, all of usable APIs that summarized in command Table can be selected and auto-encoding. Refer to document ([FG875D_Commands Table_vx.pdf](#)) and ([FG4335x_software_Note_V1.pdf](#)) for detail usage description for each command.





2 Pin Assignment

2-1 、UART Input interface (W1)

Connector on board (W1): Wafer_4pin/ 1.25mm/ side entry			
Connector Matching Suggest: Molex 51021 or compliant			
Pin num	Description	I/O	Note
Pin1	VCC		DC5V
Pin2	TX	O	
Pin3	RX	I	
Pin4	GND		

2-2 、GPIO interface (W3)

Connector on board (W3): Wafer_4pin/ 1.25mm/ side entry			
Connector Matching Suggest: Molex 51021 or compliant			
Pin num	Description	I/O	Note
Pin1	GPI 0	I	2
Pin2	GPI 1	I	2
Pin3	GPI 2	I	2
Pin4	GPI 3	I	2
Pin5	GPO 0	O	3
Pin6	GPO 1	O	3
Pin7	GPO 2	O	3
Pin8	GPO 3	O	3
Pin9	GND		

NOTE2: The GPO_0 ~ 3 are output with a series resister 100 Ohm.

NOTE3: The GPI_0 ~ 3 are 3.3V input with 5V tolerant.





3 Operation Specifications

3-1 Electrical specifications

3-1-1 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Note
Power Voltage	VCC	-0.3	5.2	V	
Operating Temperature	T _{OP}	-20	70	°C	
Storage Temperature	T _{ST}	-30	80	°C	

*The absolute maximum rating values of this product are not allowed to be exceeded at any times.

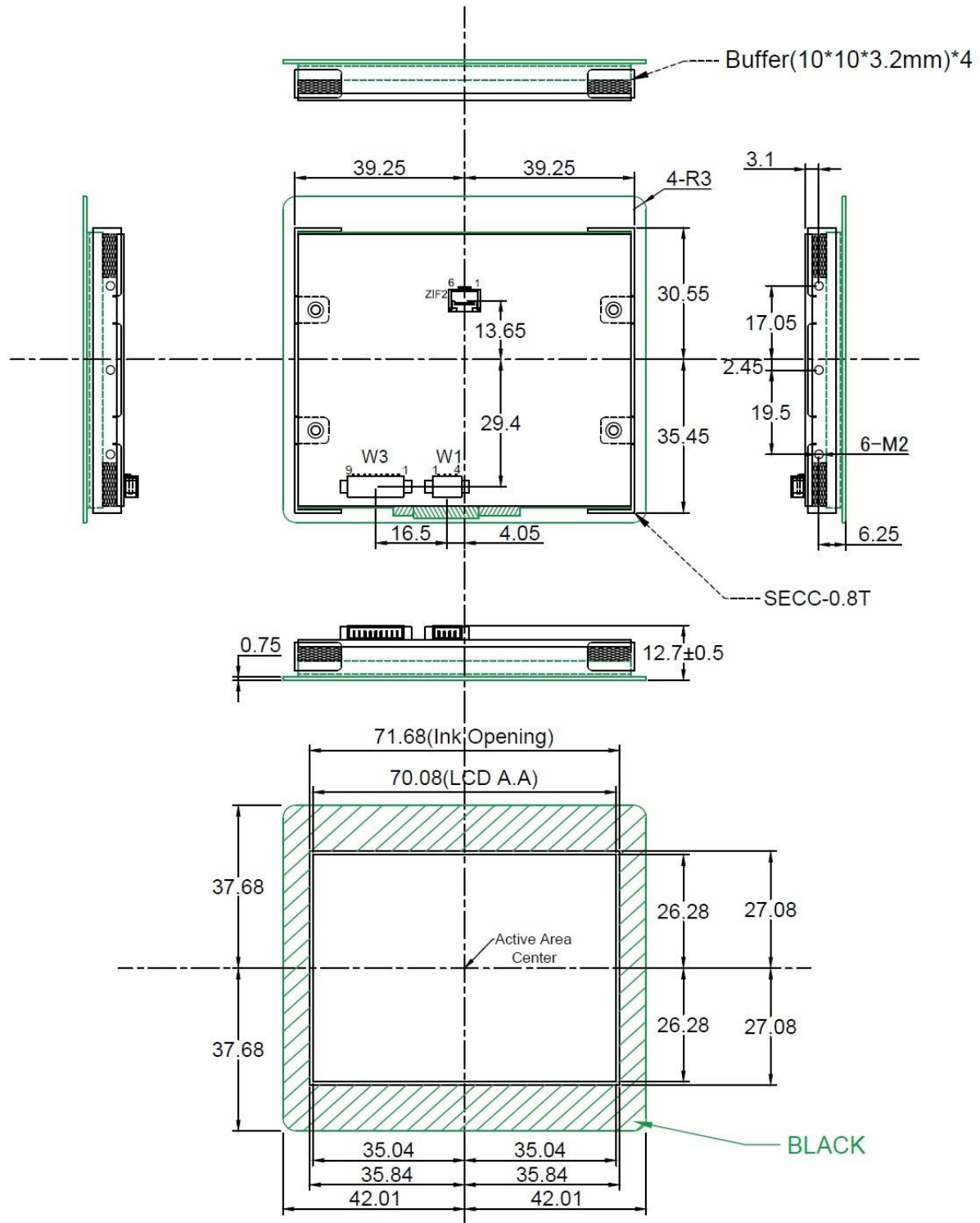
3-1-2 Recommended operating condition

Symbol	Description	Min.	Typ.	Max.	Unit	Note
VCC	Supply voltage	4.75	5	5.25	V	
I(VCC)	Supply Current	-	200	220	mA	
UART-(Tx/Rx),GPIOs signal level						
VIH	Input High Voltage	2	3.3	5	V	
VIL	Input Low Voltage	-0.3	-	0.8	V	
VOH	Output High Voltage	2.4	-	-	V	
VOL	Output Low Voltage	-	-	0.4	V	
I _{leak}	Input Leakage Current	-10	-	10	uA	
Optical Specifications (θ=0°)						
CR	Contrast Ratio	500	600			
L	Luminance	700	800	850	cd/m ²	
Power consumption @ 5v input, 100% brightness						
Consumption		3.5" , 320x240		1.1	W	





3-2 Mechanical specification





3-3 Hardware specification

3-3-1 Block Diagram

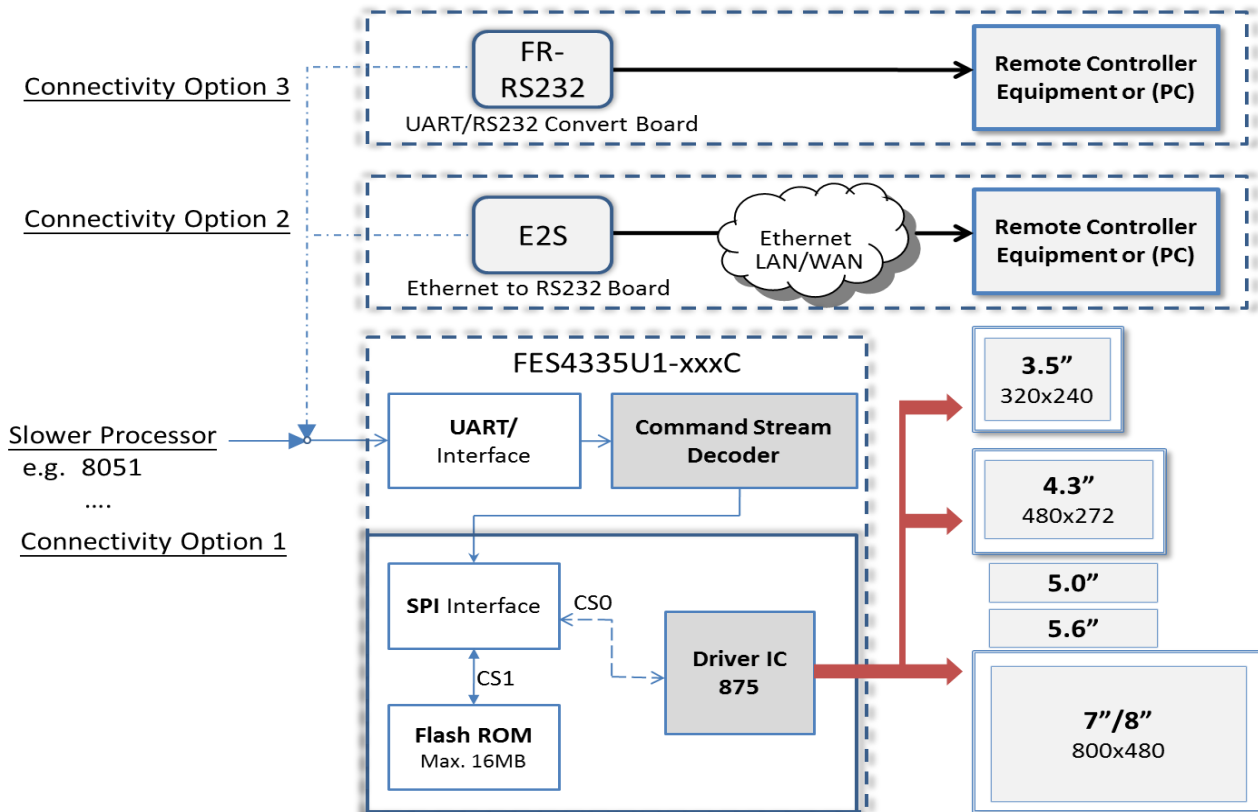
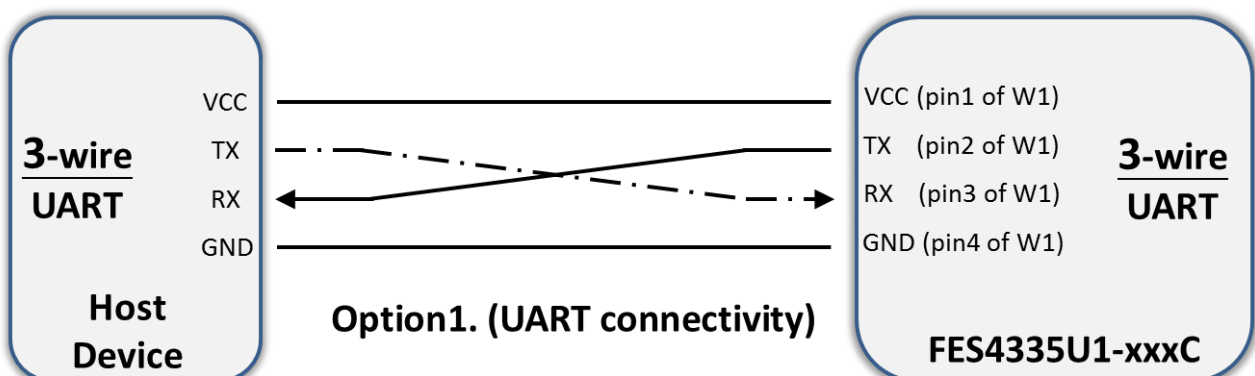


Figure 3-a : The Block Diagram of FES4335U1-xxxC

3-3-2 Serial communication option (1/2/3)

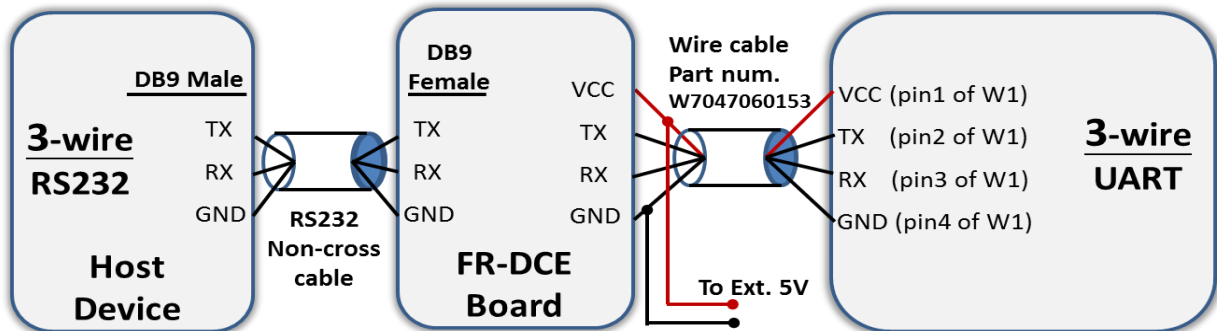
Baud Rate: be fixed at 115200 bps/N/8/1.

Option 1: By 3-wire UART (TX, RX, GND).





Option2: By RS232 with an external board FR-DCE (UART to RS232 converter)

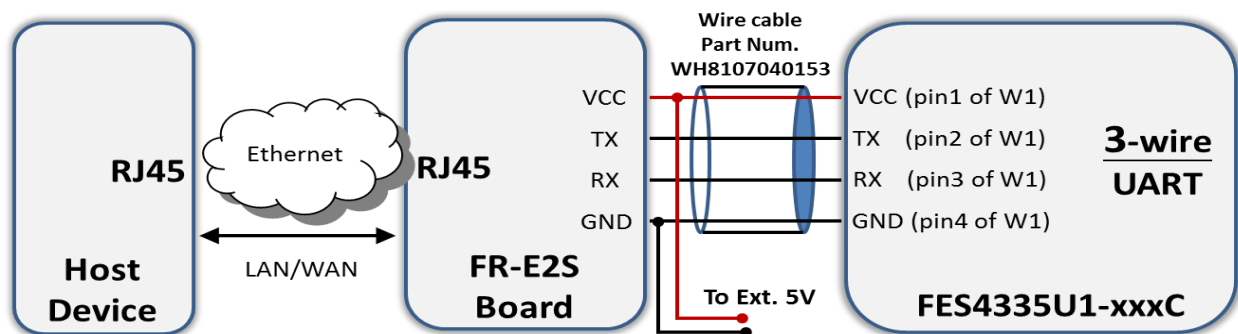


Option2. (RS232 connectivity w/ FR-DCE board)



FR-DCE-W

Option3: By Ethernet with an external board FR-E2S (UART to Ethernet converter)



Option3. (LAN connectivity w/ FR-E2S board)





4 Software

4-1 Communication (handshaking)

Due to the serial interfaces (UART) those FES4335U1 series have offer to establish a communication with an external host. The host is able to transmit a command stream to FES4335U1 for a task implementation asking.

According to the capacity of transmission, the command stream format is simply defined into two categories.

- **Standard Command Stream:** This is an essential command stream format for each one task which is listed in the Commands Table. (Refer to [FG875D_Commands Table_vx.pdf](#)).
- **Bulk Data Transmission Stream:** Only provide to some tasks will ask for a bulk data transmission, and the asking has confirmed during the standard command stream stage.

Currently only below two tasks which will ask for a Bulk Data Transmission protocol.

- 1). FG875D_WriteToSerialROM (function code 0x21).
- 2). FG875D_Display_Block_RW (function code 0x24).

According to the Commands Table, each command has a unique function code for a specific operation task.

Therefore, once the FES4335U1 has received a complete of Standard Command Stream and which part of checksum is checked firstly. After that, the part of function code would be identified and implemented along with parameters part.

There are a specifically code area 0x50~0x5F where will dedicate to define some message code and also be isolated from the all of function code.

Return message code	ASCII	hex	Description
Wrong code	"X"	0x58	Checksum error
Waiting code	"W"	0x57	FES4335 is busy
Ready code	"S"	0x53	FES4335 is ready
Timeout code	"T"	0x54	Receive Timeout
Touch Interrupt code	"P"	0x50	Touch panel has been touched
Command success code	Function code		Command implement success
Bulk transmission success code	0x55,0xAA		Bulk data transmission success





- **If there is no error encountered during transmission.**

The FES4335U1 will implement command according to function code that has received in Standard Command Stream Stage, and return function code to Host for success checking.

or

Return function code (0x55,0xAA) to indicate this time of Bulk Data Transmission has completed without problem in "Bulk Data Transmission stage".

- Return Success code or (0x55,0xAA), informing a success status.

Function Code

Standard Command Stream success

OR

0x55, 0xAA

Bulk Data Transmission success

Host could send next new command stream.

- **If there is any unexpected condition has encountered during transmission.**

The FES4335 will return a corresponding error code message and along with the received function code for error checking.

- If return **Wrong code (0x58)** like below. (indicate a **Checksum** error has occurred)

0x58 (X)

Function Code

Standard Command Stream stage error

or

0x58 (X)

0x55, 0xAA

Bulk Data Transmission stage error

Host should repeat the previously command stream.

- If return **Timeout code (0x54)** like below, (indicate a **Timeout** error has occurred)

0x54 (T)

Function Code

Standard Command Stream stage error

or

0x54 (T)

0x55, 0xAA

Bulk Data Transmission stage error

Host should repeat the previously command stream.

- Return **Wait code (0x57)** like below, (indicate a **wait** status has occurred)

0x57 (W)

Function Code

Standard Command Stream is Busy

or

0x57 (W)

0x55, 0xAA

Bulk Data Transmission is Busy

To inform host that FES4335U1 is in a busy status. Host should temporary stop transmission until FES4335U1 return Ready code (0x53) and then continue the command stream or bulk data stream those do not finish data yet.





- Return **Ready code (0x53)** like below, (indicate a **ready** message has occurred)
- | | |
|-----------------|----------------------|
| 0x53 (S) | Function Code |
|-----------------|----------------------|
- Standard Command Stream is Ready
or

0x53 (S)	0x55, 0xAA
-----------------	-------------------

Bulk Data Transmission is Ready

To inform host that FES4335U1 has released from the period of busy status. The Host can continue the rest of command stream or bulk data stream.

- A specific code to inform the touch interrupt has occurred and also would return the coordinate (x,y) value of touch panel automatically.

- Return **Touch interrupt code (0x50)** with **coordinate (x,y)** value like below,

0x50 (P)	(2byte) X-axis	(2byte) Y-axis
-----------------	---------------------------	---------------------------

- In a bulk data transmission stage, the FES4335U1 will temporary to disable touch function and stop return the coordinate (x,y) of touch.
- Out of a bulk data transmission stage. FES4335U1 would automatically return the coordinate (x,y) of touch when a touch interrupt has occurred.
- Host could also to poll the coordinate (x,y) value by sending Function code 0x03 (*APIs:FG875D_Detect_Touch*).

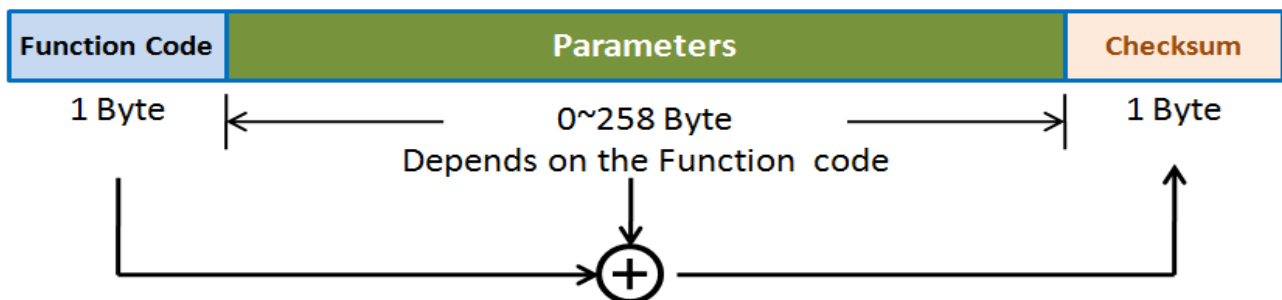




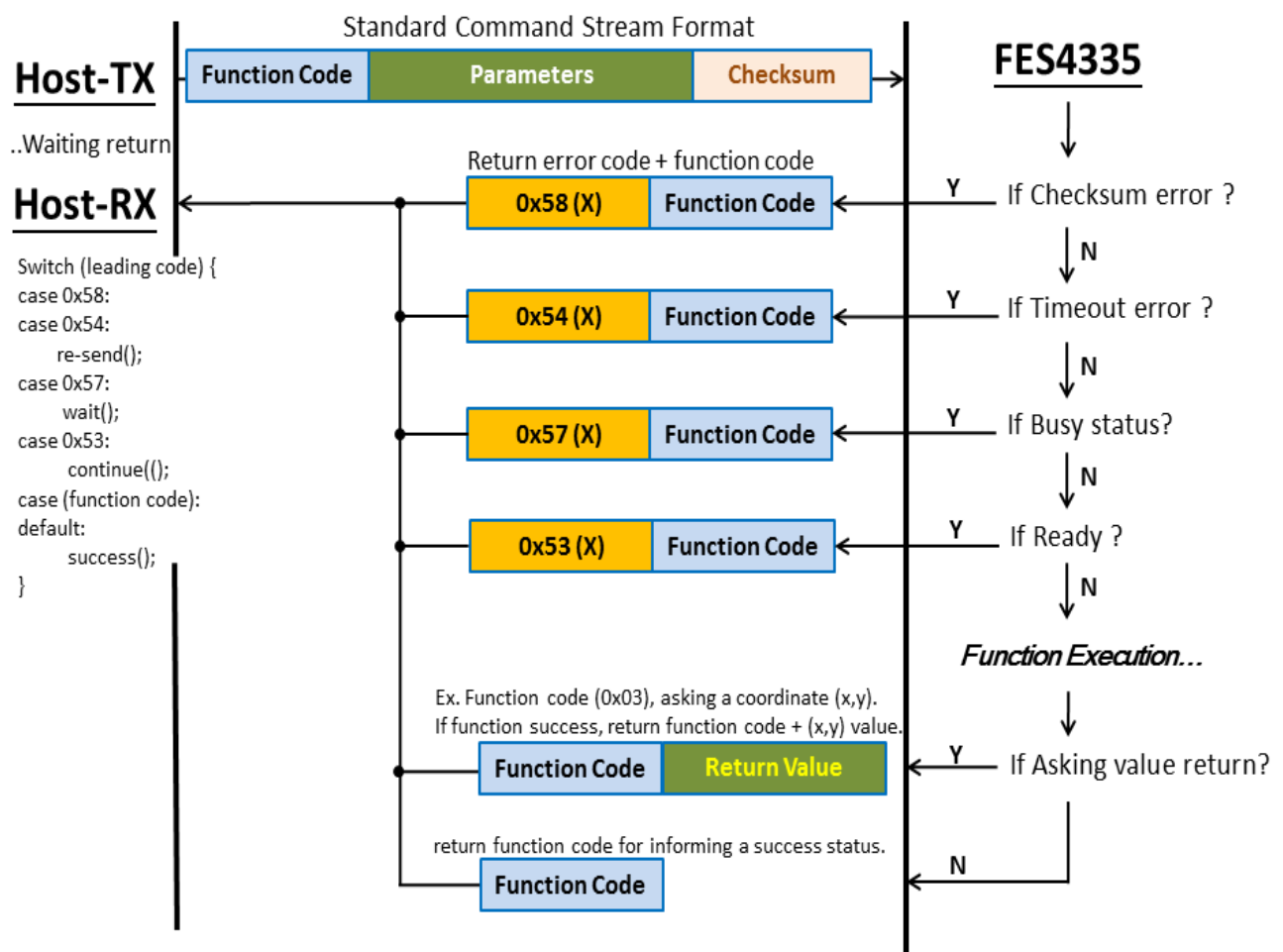
4-2 Command (Stream /Format /protocol)

4-2-1 Standard Command Stream

- **Format:** This format combines a byte of function code and several parameter bytes and a byte of checksum code.



- **Protocol:**



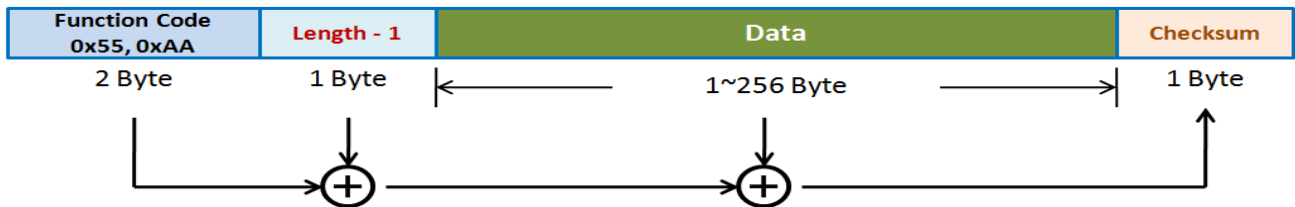
Figure(1). Standard Command Stream Stage



4-2-2 Bulk Data Transmission

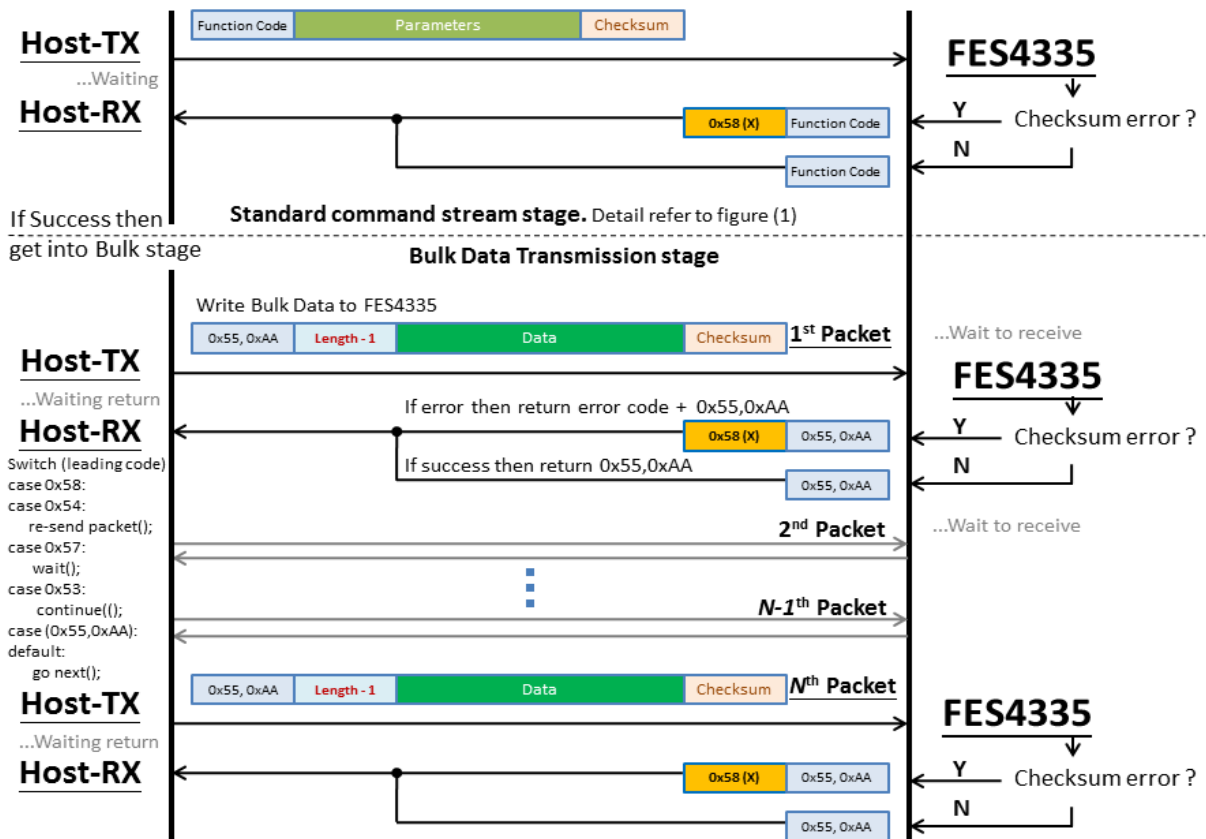
Since the function code in Standard Command Stream is (0x21) or (0x24) that will ask a bulk data transmission task after those function code have be identified by FES4335U1. In this case, the whole communication process will be separated into two stages (Standard Command Stream stage + Bulk Data Transmission protocol stage).

- Format:** This format is available for bulk data transmission stage only. The leading code (0x55,0xAA) will replace function code to indicate a Bulk Data Transmission beginning and then the value be set into length byte is indicated how many data byte will comes up in continuously. Notice to set length byte with real data quantity minus 1.



- Protocol:**

The illustration to show the standard command stream which ask to **write** a bulk data transmission to FES4335U1.

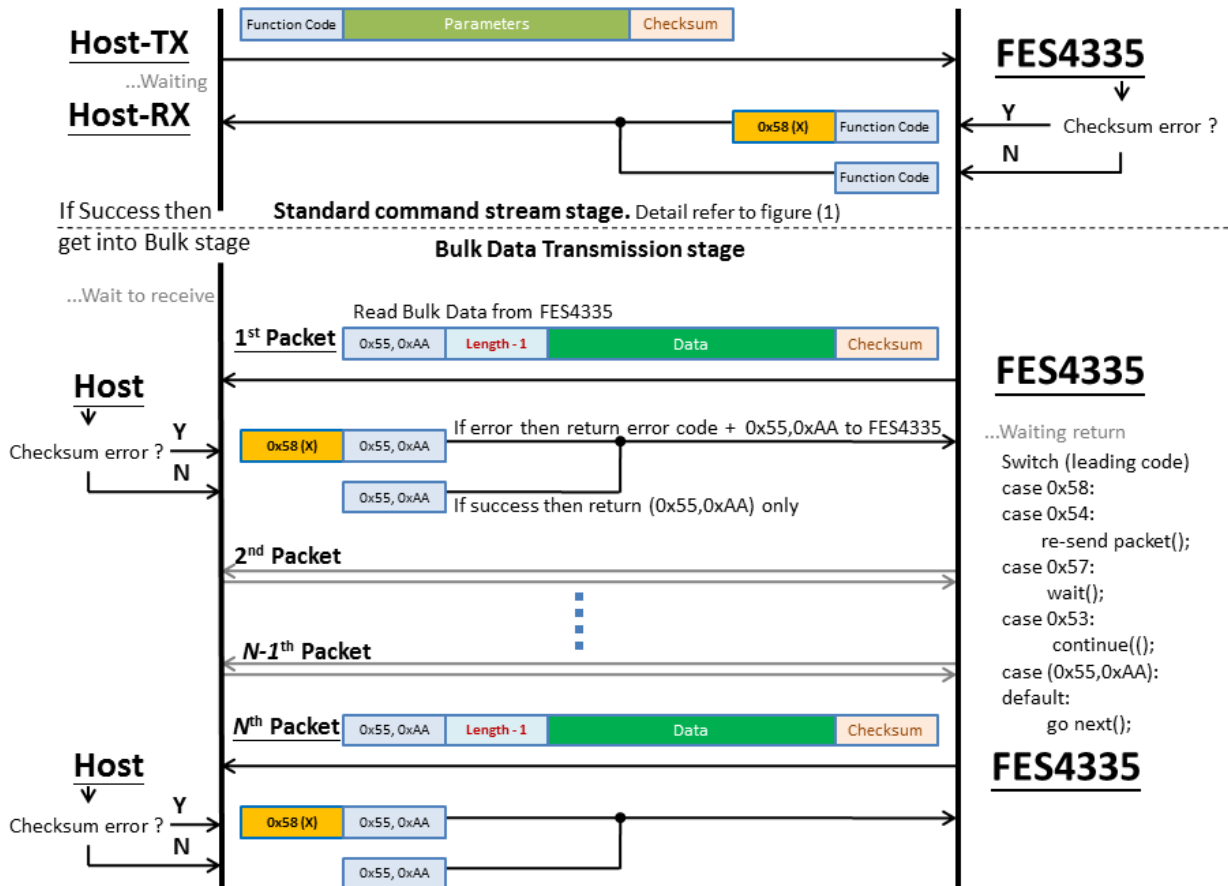


Figure(2). Bulk data-(write) Transmission Stage





The illustration to show the standard command stream which ask to **read** a bulk data transmission from FES4335U1.



Figure(3). Bulk data-(read) Transmission Stage



5 Appendix (Tips):

5-1 Three steps to show a still images on screen more quickly.

Step1): Converting image to a .bin file:

Due to the FES4335U1's Flash-ROM that only accepts (.bin) file of image. Therefore, firstly to use the utility [FES87x_Image_Tool.exe](#) that able convert the (.BMP/.JPG) file into (.BIN) file. Refer to document "[FES87x_Image_Tool_User_Guide_v1.0.pdf](#)" for detail.

Step2): Loading .bin file to the internal SPI-FlashROM(AMIC A25LQ64).

①. Using the function code 0x21 (APIs: [FG875D_WriteToSerialROM](#)) to require FES4335U1 to go into the bulk data transmission stage.

②. After the Command success code(0x21) is returned from FES4335U1, then external MPU be allowed to transmit images according to the protocol description about the bulk data-(write) transmission on section 4-2-2. Refer to figure (2).

③. Another way to skip ① & ②:

On PC side, to execute utility software ([FG875D_command_encoder.exe](#)) that is a useful free tool from Forenex. and choose function item ([FG875D_WriteToSerialROM](#)) in selection dialog. After then, the utility software will take care all about communication protocol and uploading image file into SPI-FlashROM.

Regarding to the usage of utility software ([FG875D_command_encoder.exe](#)), please refer to document "[FG875D_Command_Encoder-UsersMenu.pdf](#)".

Step3): Using the function code 0x22 (APIs: [FG875D_DisplayIMG_FromSerialROM](#)) to require FES4335 to display images from internal SPI_FlashROM to an indicated location of panel.

