TOPWAY HMT121BTA-D LCD Module User Manual

TOPWAY
SHENZHEN TOPWAY TECHNOLOGY CO., LTD.
HMT121BTA-D
LCD Module User Manual

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HMT121BTA-D LCD Module

Prepared by: **WangRuXuan** Date: 2024-04-22	Checked by: Date:	Approved by: DingXin Date: 2024-04-22

Rev.	Descriptions	Edit	Release Date
0.1	Preliminary release	WangRuXuan	2023-08-05
0.2	Revise Operating Voltage and outline DWG	WangRuXuan	2023-10-26
0.3	Minor Update	WangRuXuan	2024-04-22

Basic Specification

TOPWAY HMT121BTA-D is a Smart TFT Module with 32bit MCU on board. Its graphics engine provides numbers of outstanding features. It supports TOPWAY SGTools for preload and pre-design display interface that simplifies the host operation and development time. Suitable for industry control, instrumentation, medical electronics, power electric equipment applications.

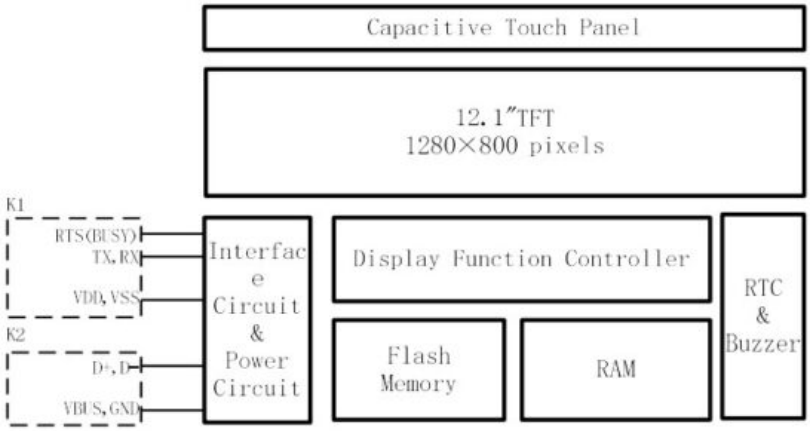
1.1 General Specification

Screen Size(Diagonal) :	12.1”
Resolution :	1280(RGB) x 800
Color Depth :	65k color (16bit)
Pixel Configuration :	RGB Stripe
Display Mode :	Transmissive / Normal Black
Viewing Direction :	Full viewing
Outline Dimension :	301.52 x 205.6x 27.5 (mm) (see attached drawing for details)
Active Area :	261.12 x 163.2 (mm)
Backlight :	White LED
Command I/F :	RS-232C
Project Download:	by PC or by U-Drive
Touch Panel:	Capacitive Touch Panel
Operating Temperature :	-20 ~ +70°C
Storage Temperature :	-30 ~ +80°C
Highlight:	RTC without battery, Support 90 degrees rotation Lua script engine, Buzzer,256MB Flash

Note:

1. For saturated color display content (eg. pure-red, pure-green, pure-blue, or pure-colors-combinations).
2. For “color scales” display content.
3. Color tone may slightly change by Temperature and Driving Condition.

1.2 Block Diagram



1.3 Terminal Function

1.3.1 RS-232C Interface Terminal (K1)

Pin No.	Pin Name	I/O	Descriptions
1,2	VDD	P	Power supply
3	RTS(BUSY)	O	Request To Send (function as busy BUSY signal) 1: Busy 0 No busy (eg. to PC’s RS232C pin8 <9pin D-connector>)
4	TX	O	Data output (eg. to PC’s RS232C pin2 <9pin D-connector>)
5,6	RX	I	Data Input (eg. to PC’s RS232C pin3 <9pin D-connector>
7,8	VSS	P	Ground, (0V)

Note.

*1. User data and commands transfer through this terminal.

*2. HOST using command hand shake during communication is suggested.

1.3.2 USB TYPE-C Interface Terminal (K2)

Pin No.	Pin Name	I/O	Descriptions
A1/B12	GND	P	Ground, (0V)
A4/B9	VBUS	P	Power supply
B8	NC	–	No connection
A5	ID	I	USB_ID,1:Client , 0:HOST
B7	D-	I/O	USB DATA negative signal
A6	D+	I/O	USB DATA positive signal
A7	D-	I/O	USB DATA negative signal
B6	D+	I/O	USB DATA positive signal
A8	NC	–	No connection
B5	ID	I	USB_ID,1:Client , 0:HOST
B4/A9	VBUS	P	Power supply
B1/A12	GND	P	Ground, (0V)

Note.

1. XML files and image files preload through this terminal.
2. Do NOT connect USB terminal ,while VDD(K1) is present.

Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Power Supply voltage	VDD	-0.3	26.0	V	
TX Out Voltage	VTx	-13.2	+13.2	V	
RX In Voltage	VRx	-25	+25	V	
Operating Temperature	TOP	-20	70	°C	No Condensation
Storage Temperature	TST	-30	80	°C	No Condensation

Note:

1. This rating applies to all parts of the module and should not be exceeded.
2. The operating temperature only guarantees operation of the circuit. The contrast, response speed, and the other specification related to electro-optical display quality is determined at the room temperature, TOP=25°C
3. Ambient temperature when the backlight is lit (reference value)
4. Any stresses exceeding the Absolute Maximum Ratings may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

Electrical Characteristics

3.1 DC Characteristics

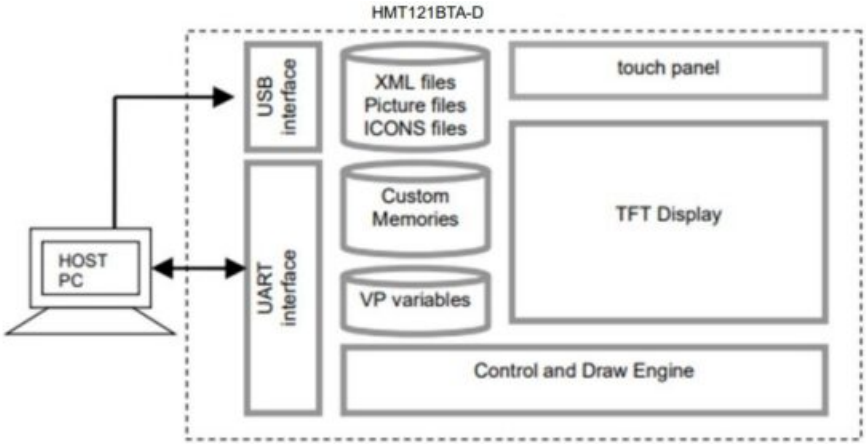
Items	Symbol	MIN.	TYP.	MAX.	Unit	Applicable Pin
Operating Voltage	VDD	11.0	12.0	26.0	V	VDD
RxD Input MARK(1)	VRxDM	-3.0	–	-15.0	V	Rx
RxD Input SPACE(0)	VRXDS	+3.0	–	+15.0	V	Rx
TxD Output MARK(1)	VTXDM	-3.0	–	-15.0	V	Tx
TxD Output SPACE(0)	VTXDS	+3.0	–	+15.0	V	Tx
RTS Output High	VTXDH	-3.0	–	-15.0	V	RTS(BUSY)
RTS Output Low	VTXDL	+3.0	–	+15.0	V	RTS(BUSY)
Operating Current	IDD	700	800	850	mA	VDD (*1)
Battery Supply Current	IBAT	1.0	2.5	4.0	uA	

Note.

1. Normal display condition and no usb connect.

Function Specifications

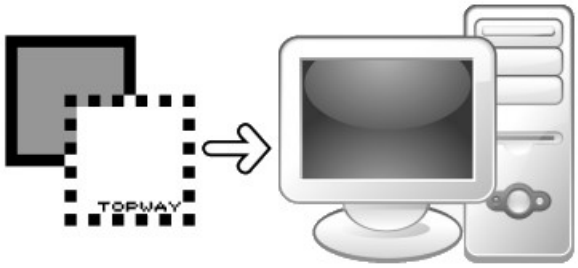
4.1 Basic Operation Function Descriptions



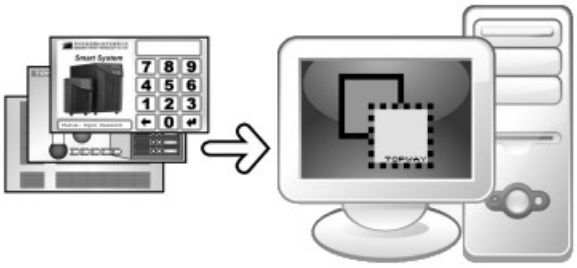
- XML files, Picture files, ICON files are stored inside FLASH memory area. They are preloaded to HMT121BTA-D for stand alone interface use.
- Those files are preloaded via USB interface as an USB drive.
- All the interface flow and the touch response are based on the preloaded XML files
- VP variables memory is inside RAM area, it provides real time access via UART by the HOST or display onto the TFT by XML file.
- Custom Memories are inside FLASH memory area It can be accessed via UART interface by the HOST.
- Control and Draw Engine executes HOST commands and response respectively
- It also reports the real time Touch Key number to the HOST

4.2 Quick Start Guide

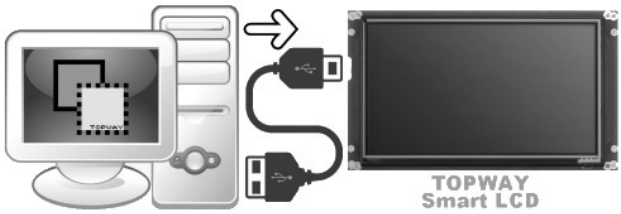
1. Install TOPWAY Graphics Editor



2. Import pictures design UI flow

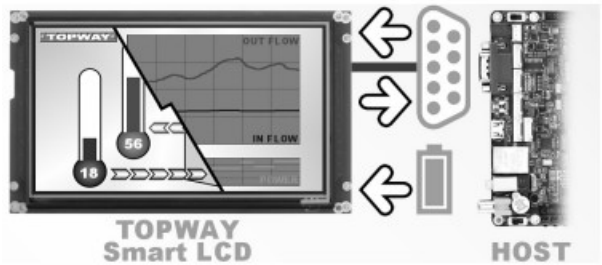


3. Download to Smart LCD



4. power on & display

5. Connect to host Show real time data



Command Descriptions

Please refer to “SMART LCD Command Manual” .

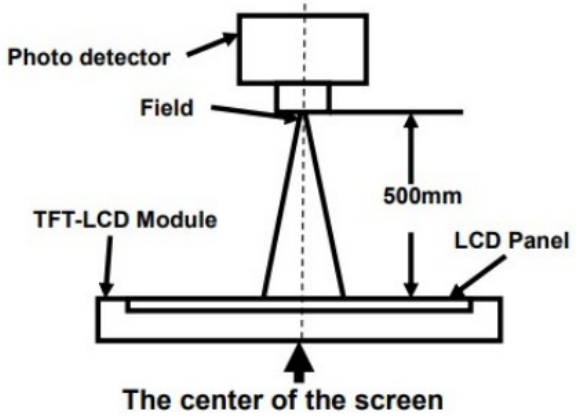
Optical Characteristics

Item		Symbol	Condition	MIN.	TYP.	MAX.	UNIT	Note.
Viewing angle		θT	(CR≥10)	75	85	–	Degree	Note 2
		θB		75	85	–		
		θL		75	85	–		
		θR		75	85	–		
Contrast ratio		CR	θ=0o	800	1000	–	–	Note 1,3
Response Time		Ton	25℃	–	25	40	ms	Note 1,4
		Toff						
Chromaticity	White	X	Backlight is on	0.250	0.30	0.350	–	Note 1,5
		Y		0.270	0.320	0.370		
	Red	X		0.593	0.643	0.693		
		Y		0.286	0.336	0.386		
	Green	X		0.253	0.303	0.353		
		Y		0.571	0.621	0.671		
	Blue	X		0.096	0.146	0.196		
		Y		0.032	0.082	0.132		
uniformity		U	–	70	75	–	%	Note 1,6
NTSC		–	–	67	72	–	%	Note 5
Luminance		L	–	300	350	–	cd/m^2	Note 1,7

Test Conditions:

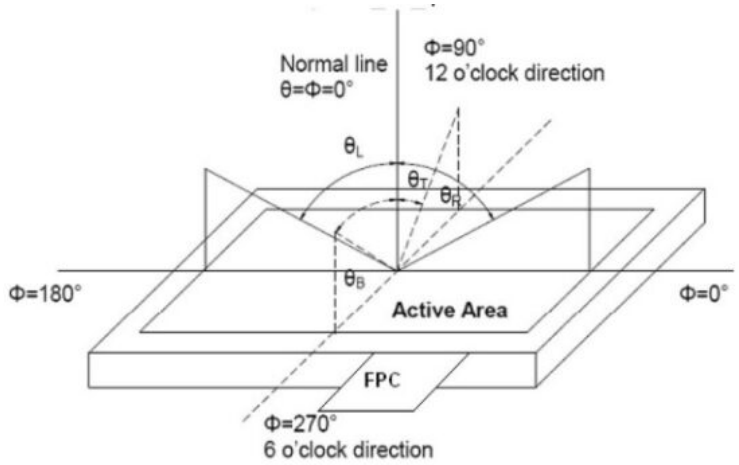
1. The ambient temperature is 25±2℃.humidity is 65±7%.
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.
The optical characteristics should be measured in dark room.
After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Note 2:

Definition of viewing angle range and measurement system.
viewing angle is measured at the center point of the LCD

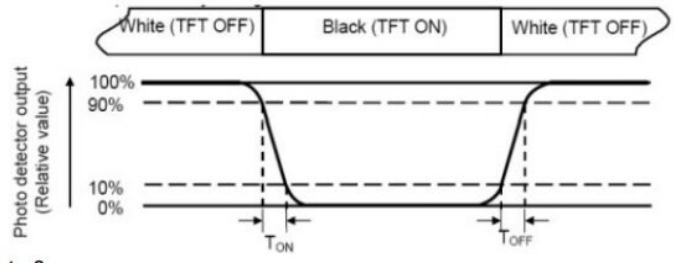


Note 3:
Definition of contrast ratio

$$\text{Contrast Ratio(CR)} = \frac{\text{Luminance When LCD is at "White" state}}{\text{Luminance When LCD is at "Black" state}}$$

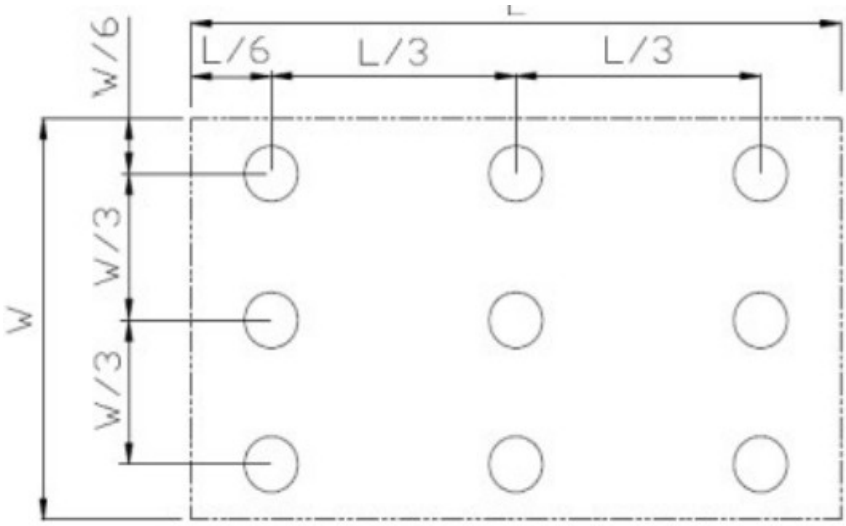
"White state ": The state is that the LCD should drive byVw hite.
"Black state": The state is that the LCD should drive by Vblack.
Vwhite: To be determined Vblack: To be determined.

Note 4:
Definition of Response time
The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (T ON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T OFF) is the time between photo detector output intensity changed from 10% to 90%.



Note 5:
Definition of color chromaticity (CIE1931)
Color coordinates measured at center point of LCD.

Note 6:
Definition of Luminance Uniformity
Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.
Luminance Uniformity (U) = Lmin/ Lmax
L——-Active area length W—— Active area width



LCD Module Design and Handling Precautions

- Please ensure V0, VCOM is adjustable, to enable LCD module get the best contrast ratio under different temperatures, view angles and positions.
- Normally display quality should be judged under the best contrast ratio within viewable area. Unexpected display pattern may com out under abnormal contrast ratio.
- Never operate the LCD module exceed the absolute maximum ratings.
- **WARNING!** Be aware of (if any) frame grounging of the LCD Module connection with the system which may cause safety issue(e.g. electric shock,etc).
- Never apply signal to the LCD module without power supply.
- Keep signal line as short as possible to reduce external noise interference.
- IC chip (e.g. TAB or COG) is sensitive to light. Strong light might cause malfunction. Light sealing structure casing is recommended.
- Make sure there is enough space (with cushion) between case and LCD panel, to prevent external force passed on to the panel; otherwise that may cause damage to the LCD and degrade its display result.
- Avoid showing a display pattern on screen for a long time (continuous ON segment).
- LCD module reliability may be reduced by temperature shock.
- When storing and operating LCD module, avoids exposure to direct sunlight, high humidity, high or low temperature. They may damage or degrade the LCD module.
- Never leave LCD module in extreme condition (max./min storage/operate temperature) for more than 48hr.
- Recommend LCD module storage conditions is 0 C~40 C <80%RH.
- LCD module should be stored in the room without acid, alkali and harmful gas.
- Avoid dropping & violent shocking during transportation, and no excessive pressure press, moisture and sunlight.
- LCD module can be easily damaged by static electricity. Please maintain an optimum anti-static working environment to protect the LCD module. (eg. ground the soldering irons properly)
- Be sure to ground the body when handling LCD module.
- Only hold LCD module by its sides. Never hold LCD module by applying force on the heat seal or TAB.
- When soldering, control the temperature and duration avoid damaging the backlight guide or diffuser which might degrade the display result such as uneven display.
- Never let LCD module contact with corrosive liquids, which might cause damage to the backlight guide or the

electric circuit of LCD module.

- Only clean LCD with a soft dry cloth, Isopropyl Alcohol or Ethyl Alcohol. Other solvents (e.g. water) may damage the LCD.
- Never add force to components of LCD module. It may cause invisible damage or degrade the module's reliability.
- When mounting LCD module, please make sure it is free from twisting, warping and bending.
- Do not add excessive force on surface of LCD, which may cause the display color change abnormally.
- LCD panel is made with glass. Any mechanical shock (e.g.dropping from high place) will damage the LCD module.
- Protective film is attached on LCD screen. Be careful when peeling off this protective film, since static electricity may be generated.
- Polarizer on LCD gets scratched easily. If possible, do not remove LCD protective film until the last step of installation.
- When peeling off protective film from LCD, static charge may cause abnormal display pattern. The symptom is normal, and it will turn back to normal in a short while.
- LCD panel has sharp edges, please handle with care.
- Never attempt to disassemble or rework LCD module.
- If display panel is damaged and liquid crystal substance leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes promptly wash it off using soap and water.

CTP Mounting Instructions

Surface Mounting (Figure 1)

- As the CTP assembling on the countersink area with double side adhesive.
  The countersink area should be flat and clean to ensure the double side adhesive installation result.
- The Bezel is recommend to keep a gap (≥0.3mm each side) around the cover lens for tolerance.
- It is recommended to provide an additional support bracket with gasket for backside support when necessary (e.g. TFT module without mounding structure). They should only provide appropriate support and keep the module in place.
- The mounting structure should be strong enough to prevent external uneven force or twist act onto the module

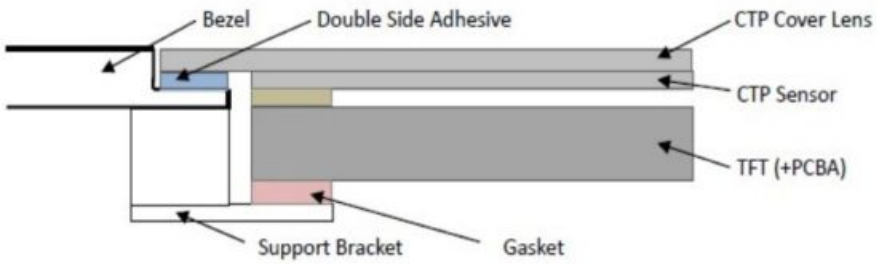


Figure 1

Warranty

This product has been manufactured to our company's specifications as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we cannot take responsibility if the product is used in medical devices, nuclear

power control equipment, aerospace equipment, fire and security systems, or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required. If the product is to be used in any of the above applications, we will need to enter into a separate product liability agreement.

- We cannot accept responsibility for any defect, which may arise form additional manufacturing of the product (including disassembly and reassembly), after product delivery.
- We cannot accept responsibility for any defect, which may arise after the application of strong external force to the product.
- We cannot accept responsibility for any defect, which may arise due to the application of static electricity after the product has passed our company's acceptance inspection procedures.
- When the product is in CCFL models, CCFL service life and brightness will vary according to the performance of the inverter used, leaks, etc. We cannot accept responsibility for product performance, reliability, or defect, which may arise.
- We cannot accept responsibility for intellectual property of a third part, which may arise through the application of our product to our assembly with exception to those issues relating directly to the structure or method of manufacturing of our product.

SMART LCD
Command V6.12
Manual

Prepared by: chenjian	**Checked by:**	**Approved by:**
Date: 2019-06-28	Date:	Date:

Rev.	**Descriptions**	**Release Date**
0.1	– Preliminary Draft release	2018-08-28
0.2	– add 0x94, 0x95	2018-11-22
0.3	– update section 2.1, 4.2.4, 4.2.7, 4.4.2, 4.4.9	2019-06-28

Basic Specifications

TOPWAY Smart LCD serial command is for real-time control and access. Host machine get the data which input through the Smart LCD interface or provide the data for display.

1.1 Hardware connection

Smart LCD serial UART interface are mainly base on RS232-C standard, by default, config as 8N1 115200bps.

Command Structure

2.1 Communication Packet Structure

TOPWAY SmartLCD offer 3 kinds of Communication Packet Structure, which can be defined in editor project setting.

2.1.1 Basic Packet:

Seq	Code	Code type	Description
1	0xAA	Packet header	1byte
2	Cmd-code	Command code	1byte
3	Par-data	Parameter or Data	(*1)
4	0xCC	Packet tail	4byte
	0x33		
	0xC3		
	0x3C		

2.1.2 Packet with length:

Seq	Code	Code type	Description
1	0xAA	Packet header	1byte
2	Len	Packet length	2byte(*2)
3	Cmd-code	Command code	1byte
4	Par-data	Parameter or Data	(*1)
5	0xCC	Packet tail	4byte
	0x33		
	0xC3		
	0x3C		

2.1.3 Packet with CRC:

Seq	Code	Code type	Description
1	0xAA	Packet header	1byte
2	Len	Packet length	2byte(*2)
3	Cmd-code	Command code	1byte
4	Par-data	Parameter or Data	(*1)
5	0xCC	Packet tail	2byte
	0x33		
6	CRCL		2byte(*3)
	CRCH		

Note.

1. Unless otherwise specified, all the multi-byte values, data, address' byte sequence are MSB first, LSB last.
2. Packet length: from Seq3 to the end. (no. of byte)
3. CRC Polynomial: x16+x15+x2+1, Calculate the CRC value from Seq3 to Seq5.Please refer to appendix 1.

2.2 Packet Timeout
TOPWAY SmartLCD support Timeout setting, which can be defined in editor project setting.
Timeout options: None, 1s, 2s, 3s, 5s, 10s, 20s. If timeout, The incomplete Packet will be discarded.
2.3 Packet Acknowledgment
Packet Acknowledgment is two byte in ASCII (module → host):

Response	**code**	**Description**
Command (in packet) executed and wait for next Command	":>"	In ASCII(0x3a, 0x3e)
Command (in packet) error and wait for next Command	"!>"	In ASCII (0x21,0x3e)

Note.

1. Packet Acknowledgement response to a valid packet only.

Data arrangement

3.1 Color Data Value Configuration
16 bit Color value

16 bit color value															
R4	**R3**	**R2**	**R1**	**R0**	**G5**	**G4**	**G3**	**G2**	**G1**	**G0**	**B4**	**B3**	**B2**	**B1**	**B0**
High byte (MSB)								Low byte (LSB)							
D7	D6	D5	D4	D3	D2	D1	D0	D7	D6	D5	D4	D3	D2	D1	D0

3.2 Data / Address / Page_ID / Location Values Configuration
64bit value

64 bit number value							
D63…D56	**D55…D48**	**D47…D40**	**D39..D32**	**D31…D24**	**D23…D16**	**D15…D8**	**D7…D0**
Byte7 (MSB)							Byte0 (LSB)
D7…D0	D7…D0	D7…D0	D7…D0	D7…D0	D7…D0	D7…D0	D7…D0

32bit value

32 bit number value			
D31…D24	**D23…D16**	**D15…D8**	**D7…D0**
Byte3 (MSB)			Byte0 (LSB)
D7…D0	D7…D0	D7…D0	D7…D0

16bit value

16 bit number value	
D15…D8	**D7…D0**
High Byte (MSB)	Low Byte (LSB)
D7…D0	D7…D0

Command Descriptions

4.1 Command table

Functions	Name	Code	Description
Config/ Status Functions	hand_shake	0x30	Read a Hand Shake
	read_version	0x31	Read firmware version
	read_pg_id	0x32	Read Current page ID
	touch_response	0x72/0x73/ 0x77/0x78/ 0x79	see also set_sys_config
	set_sys_config	0xE0	System parameter configuration and Baud Rate
	sel_project	0xE1	Specify operating project folder
	touch_calib	0xE4	Touch panel calibration(only for RTP)
	screen_saver	0x5E	Screen saver (backlight dim down time out)
	backlight_ctrl	0x5F	backlight brightness control (64 levels)
	buzzer_touch_sound	0x79	buzzer enable time length (in 10ms step)
	buzzer_ctrl	0x7A	Buzzer control
	Flash_write	0x90	Write data to the flash
	Flash_read	0x91	Read data from the flash
	RTC_read	0x9B	Read the RTC values
	RTC_set	0x9C	Set the RTC
	USR_bin_read	0x93	Read data from the USR_bin
	U_drv_format	0xE2	Format the U_drv

	U_drv_unlock	0xE3	Unlock the U_drv with pre-stored password
Display Control Functions	disp_page	0x70	Display a pre-stored TML file (page)
	set_element_fg	0x7E	Set the foreground color of STR, N16, N32 or N64
	set_element_bg	0x7F	Set the background color of STR, N16, N32 or N64
	set_codepage	0xE7	Sets country character set and code-page character set
	suspend_vp_fresh	0xE8	Set the screen to pause the refresh and deactivate the touchkey or release the pause to refresh and enable the touchkey
VP Functions	Successive_write	0x82	Write successive value to VP_N16, VP_N32, VP_N64
	Successive_read	0x83	Read successive value from VP_N16, VP_N32, VP_N64
	VP_Backup	0x94	VP Backup to Flash or VP Restore from Flash
	VP_Preload	0x95	VP Preload from usr.bin
	BP1_write	0x4B	Write bit-map (1bpp) data to VP_BP1
	BP1_write_comp	0x4C	Write compressed bit-map (1bpp) data to VP_BP1
	G16_write	0x4D	Write 16bit (signed integer) graphic array to VP_G16
	G16_write_rotate	0x4E	Rotate the VP_G16 array data inside the module and write a 16bit (signed integer) value into end-of-array
	Reg_Write	0x3B	Write System Register
	Reg_Read	0x3C	Read System Register
	STR_write	0x42	Write string to VP_STR
	STR_read	0x43	Read string form VP_STR
	STR_fill	0x46	Fill strings to the VP_STR
	N16_write	0x3d	Write 16bit (signed integer) value to VP_N16
	N16_read	0x3e	Read 16bit (signed integer) value from VP_N16
	N16_fill	0x3f	Fill numbers to the VP_N16
	N32_write	0x44	Write 32bit (signed integer) value to VP_N32
	N32_read	0x45	Read 32bit (signed integer) value from VP_N32
	N32_fill	0x47	Fill numbers to the VP_N32
	N64_write	0x48	Write 64bit (signed integer) value to VP_N64
	N64_read	0x49	Read 64bit (signed integer) value from VP_N64
	N64_fill	0x4A	Fill numbers to the VP_N64

4.2 Config/ Status Function Commands Details

4.2.1 hand_shake (0x30)

seq	Cmd-code / Par-data	Descriptions
1	0x30	Read a Hand Shake

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

Response code:

Seq.	Content	Byte in Hex	Descriptions
1st	Header	0xAA	Communication packet header
2nd	Command	0x30	Command executed
3rd	“T”	0x54	“Topway HMT Ready\0” in ASCII ‘\0’(0x00): string end mark
4th	“o”	0x6f	
5th	“P”	0x70	
6th	“w”	0x77	
7th	“a”	0x61	
8th	“y”	0x79	
9th	“ “	0x20	
10th	“H”	0x48	
11th	“M”	0x4d	
12th	“T”	0x54	
13th	“ “	0x20	
14th	“R”	0x52	
15th	“e”	0x65	
16th	“a”	0x61	
17th	“d”	0x64	
18th	“y”	0x79	
19th	\0	0x00	
20th	Tail	0xCC	Communication packet tail
21st		0x33	
22nd		0xC3	
23rd		0x3C	

Note.

1. The Response code with communication packet format (see Communication Packet Structure Section for details)

4.2.2 read_version (0x31)

Seq	Cmd-code / Par-data	Descriptions
1	0x31	Read firmware version

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

Response code:

Seq.	Content	Byte in Hex	Descriptions
1st	Header	0xAA	Communication packet header
2nd	Command	0x31	Command executed
3rd	“1”	0x31	“1.06\0” in ASCII Where firmware version is V1.06(example) ‘\0’(0x00): string end mark
4th	“.”	0x2e	
5th	“0”	0x30	
6th	“6”	0x36	
7th	\0	0x00	
8th	Tail	0xCC	Communication packet tail
9th		0x33	
10th		0xC3	
11th		0x3C	

Note.

1. The Response code with communication packet format (see Communication Packet Structure Section for details)

4.2.3 read_pg_id (0x32)

Seq	Cmd-code / Par-data	Descriptions
1	0x32	Read Current page ID

1. Command should be transferred in communication packet structure (see Communication Packet Structure

Section for details)

Response code:

Seq.	Content	Byte in Hex	Descriptions
1st	Header	0xAA	Communication packet header
2nd	Command	0x32	Command executed
3rd	Page ID	Page_IDh	Current Page ID in 16bit binary value
4th		Page_IDl	
5th	Tail	0xCC	Communication packet tail
6th		0x33	
7th		0xC3	
8th		0x3C	

Note.

1. The Response code with communication packet format (see Communication Packet Structure Section for details)

4.2.4 touch_response (0x72/ 0x73/ 0x77/ 0x78/ 0x79)

seq	Cmd-code / Par-data	Descriptions
1	—	Use set_sys_config to config the functions

Touch Release Coordinate Response code (0x72):

Seq.	Content	Byte in Hex	Descriptions
1st	Header	0xAA	Communication packet header
2nd	Command	0x72	Touched release Coordinate
3rd	X coordinate	Xh	Coordinate in 16bit binary value X = horizontal coordinate Y = vertical coordinate
4th		Xl	
5th	Y coordinate	Yh	
6th		Yl	
7th	Tail	0xCC	Communication packet tail
8th		0x33	
9th		0xC3	
10th		0x3C	

Note.

1. The Response code with communication packet format (see Communication Packet Structure Section for details)

Touch Down Coordinate Response code (0x73):

Seq.	Content	Byte in Hex	Descriptions
1st	Header	0xAA	Communication packet header
2nd	Command	0x73	Touched down Coordinate
3rd	X coordinate	Xh	Coordinate in 16bit binary value X = horizontal coordinate Y = vertical coordinate
4th		Xl	
5th	Y coordinate	Yh	
6th		Yl	
7th	Tail	0xCC	Communication packet tail
8th		0x33	
9th		0xC3	
10th		0x3C	

Note.

1. The Response code with communication packet format (see Communication Packet Structure Section for details)

Touch Key ID Response code (0x78):

Seq.	Content	Byte in Hex	Descriptions
1st	Header	0xAA	Communication packet header
2nd	Command	0x78	Touched release Key_ID defined by TOPWAY TML Graphic E ditor will be response to host
3rd	Page_ID	Page_IDh	Page_ID = the touch key in page(16bit binary value)
4th		Page_IDl	
5th	Key_ID	Key_ID	Key_ID (8bit binary value)
6th	Tail	0xCC	Communication packet tail
7th		0x33	
8th		0xC3	
9th		0x3C	

1. The Response code with communication packet format (see Communication Packet Structure Section for details)

Touch Key ID Response code (0x79):

Seq.	Content	Byte in Hex	Descriptions
1st	Header	0xAA	Communication packet header
2nd	Command	0x79	Touched down Key_ID defined by TOPWAY TML Graphic Editor will be response to host
3rd	Page_ID	Page_IDh	Page_ID = the touch key in page(16bit binary value)
4th		Page_IDl	
5th	Key_ID	Key_ID	Key_ID (8bit binary value)
6th	Tail	0xCC	Communication packet tail
7th		0x33	
8th		0xC3	
9th		0x3C	

Note.

1. The Response code with communication packet format (see Communication Packet Structure Section for details)

Touch Key VP_ADD+VP_Value Response code (0x77):

Seq.	Content	Byte in Hex	Descriptions
1st	Header	0xAA	Communication packet header
2nd	Command	0x77	Touch Key VP_ADD+VP_Value Response code
3rd	VP_ADD	Addr3 MSB	VP Address 0x080000 ~ 0x08FFFF:VP_N16 Address 0x020000 ~ 0x02FFFF:VP_N32 Address 0x030000 ~ 0x03FFFF:VP_N64 Address 0x000000 ~ 0x01FFFF:VP_STR Address
4th		Addr2	
5th		Addr1	
6th		Addr0(LSB)	
7th	Data	:	No.of byte VP_N16: 2byte VP_N32: 4byte VP_N64: 8byte VP_STR: string (with end mark (‘‘\0’(0x00)))
:		:	
:		:	
:		:	
:	Tail	0xCC	Communication packet tail
:		0x33	
:		0xC3	
:		0x3C	

Note.

1. The Response code with communication packet format (see Communication Packet Structure Section for details)

4.2.5 set_sys_config (0xE0)

seq	Cmd-code / Par-data	Descriptions
1	0xE0	Baud Rate and system parameter configuration
2	0x55	
3	0xAA	
4	0x5A	
5	0xA5	
6	Baud_Set	Baudrate Set: 0x00 = 1200bps 0x01 = 2400bps 0x02 = 4800bps 0x03 = 9600bps 0x04 = 19200bps 0x05 = 38400bps 0x06 = 57600bps 0x07 = 115200bps
7	sys_par1	Bit7 = 0: Touch panel function disable Bit7 = 1: Touch panel functions enable (*3)(default) Bit[1..0]: Touch actions configuration (*2, *3)
8	0x00	Reserved

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)
2. Touch panel configuration:

Sys_par 1 Bit7	Sys_par 1 Bit1	Sys_par 1 Bit0	Response To host	Descriptions
0	0	0	Null	Not touch panel functions
1	0	1	Coordinates	Touch down Coordinate will be response to host
1	1	0	Coordinates	Touch release Coordinate will be response to host
1	1	1	Key ID	Touch Key_ID defined by TOPWAY TML Graphic Editor will be response to host

3. see set_touch section for response code

4.2.6 sel_project (0xE1)

seq	Cmd-code / Par-data	Descriptions
1	0xE1	Select project folder
2	Prj_ID	0~9, project ID 0: System execute the default project “THMT” 1~9: System execute the project “THMT01”~“THMT09”

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

4.2.7 touch_calib (0xE4)

seq	Cmd-code / Par-data	Descriptions
1	0xE4	Touch panel calibration
2	0x55	
3	0xAA	
4	0x5A	
5	0xA5	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)
2. Keep pressing the top right corner of touch panel during power on, could also trigger the touch_calib function (only for RTP)

4.2.8 screen_saver (0x5E)

seq	Cmd-code / Par-data	Descriptions
1	0x5E	Screen saver
2	Time1h	time out time in seconds, range: 0x0000 ~ 0xffff (0x0000: disable screen saver function) (*2)
3	Time1l	
4	PWM_LE	PWM_LE = 0 ~ 0x3F (default 0x19 in dim down), the backlight dimmed level in screen saving mode (*2) Screensavers brightness can not be greater than the backlight brightness.

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)
2. default value defined by TML graphic editor configuration

4.2.9 backlight_ctrl (0x5F)

seq	Cmd-code / Par-data	Descriptions
1	0x5F	backlight brightness control
2	PWM_LE	PWM_LE=0x00 ~ 0x3F (*2)

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)
2. default value defined by TML graphic editor configuration

4.2.10 buzzer_touch_sound (0x79)

seq	Cmd-code / Par-data	Descriptions
1	0x79	buzzer touch sound control
2	Time	Sounding time length (in 10ms), range 0x00~0x3F 0x00= disable (*2)

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)
2. default value defined by TML graphic editor configuration

4.2.11 buzzer_ ctrl (0x7A)

seq	Cmd-code / Par-data	Descriptions
1	0x7A	Buzzer control
2	Loop count	Loop count, Range: 0x01 ~ 0xFF. 0xFF = buzzer infinite loop
3	T1	Buzzer play time 1 Range: 0x00 ~ 0xFF (0~25.5s)(unit 100ms)
4	T2	Buzzer play time 2 Range: 0x00 ~ 0xFF (0~25.5s)(unit 100ms)
5	Freq1	T1 time Buzzer frequency, Unit 100 Hz Ranges: 0x05 ~ 0x32 (500Hz ~ 5KHz) 0x00 = T1 time period buzzer turn off
6	Freq2	T2 time Buzzer frequency, Unit 100 Hz Ranges: 0x05 ~ 0x32 (500Hz ~ 5 KHz) 0x00 = T1 time period buzzer turn off

Note:

1. The buzzer sound time is (T1 + T2)*100ms

4.2.12 Flash_write (0x90)

seq	Cmd-code / Par-data	Descriptions
1	0x90	Write data to the flash at specified address
2	Address3(MSB)	the specified start address to write Address range =0x00000 ~ 0x03FFF F
3	Address2	
4	Address1	
5	Address0(LSB)	
6	Data_Lengthh	The no. of data byte to write. Length =0x0001 ~ 0x0400
7	Data_Lengthl	
8	Data	data to write.
:	:	
:	:	
:	:	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

4.2.13 Flash_read (0x91)

seq	Cmd-code / Par-data	Descriptions
1	0x91	Read data from the flash at specified address
2	Address3(MSB)	the specified start address to write Address range =0x00000 ~ 0x03FFF F
3	Address2	
4	Address1	
5	Address0(LSB)	
6	Data_Lengthh	The no. of data byte to read Length =0x0001 ~ 0x0400
7	Data_Lengthl	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

Response code:

Seq.	Content	Byte in Hex	Descriptions
1st	Header	0xAA	Communication packet header
2nd	Command	0x91	Command executed
3rd	Data	data	Read back data
:		:	
:		:	
:	Tail	0xCC	Communication packet tail
:		0x33	
:		0xC3	
:		0x3C	

Note.

1. The Response code with communication packet format (see Communication Packet Structure Section for details)

4.2.14 USR_bin_read (0x93)

seq	Cmd-code / Par-data	Descriptions
1	0x93	Read USR_bin data from the flash at specified address
2	Address3(MSB)	the specified start address to write Address range = 0x00000 ~ 0x03FFF F
3	Address2	
4	Address1	
5	Address0(LSB)	
6	Data_Lengthh	The no. of data byte to read Length = 0x0001 ~ 0x0400
7	Data_Lengthl	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

Response code:

Seq.	Content	Byte in Hex	Descriptions
1st	Header	0xAA	Communication packet header
2nd	Command	0x93	Command executed
3rd	Data	data	Read back data
:		:	
:		:	
:	Tail	0xCC	Communication packet tail
:		0x33	
:		0xC3	
:		0x3C	

Note.

1. The Response code with communication packet format (see Communication Packet Structure Section for details)

4.2.15 RTC_read (0x9B)

seq	Cmd-code / Par-data	Descriptions
1	0x9B	Read the current RTC value

Response code:

Seq.	Content	Byte in Hex	Descriptions
1st	Header	0xAA	Communication packet header
2nd	Command	0x9B	Command executed
3rd	Date	Year	Year: 00~99 (00=year 2000) (8bit binary value) Month: 01~12 (8bit binary value) Day: 01~31 (8bit binary value)
4th		Month	
5th		Day	
6th	Time	Hour	Hour 00~23 (24hr format)(8bit binary value) Minutes 00~59 (8bit binary value) Second 00~59 (8bit binary value)
7th		Minute	
8th		Second	
9th	Tail	0xCC	Communication packet tail
10th		0x33	
11th		0xC3	
12th		0x3C	

Note.

1. The Response code with communication packet format (see Communication Packet Structure Section for details)

4.2.16 RTC_set (0x9C)

seq	Cmd-code / Par-data	Descriptions
1	0x9C	Set the RTC
2	Year	Year = 00~99(2000 ~ 2099) Month = 00~12 Date = 00~31 Hour = 00~23 Minute = 00~59 Second = 00~59
3	Month	
4	Date	
5	Hour	
6	Minute	
7	Second	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

4.2.17 U_drv_format (0xE2)

seq	Cmd-code / Par-data	Descriptions
1	0xE2	Format the USB drive. All the files (include the security lock file) will be erased.
2	0x55	
3	0xAA	
4	0x5A	
5	0xA5	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

4.2.18 U_drv_unlock (0xE3)

seq	Cmd-code / Par-data	Descriptions
1	0xE3	Unlock the USB drive of file read/write with pre-stored password.
2	PW	PW: password in ASCII Length = 127max.'\0'(0x00): string end mark
:	:	
:	:	
:	'\0'	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

4.3 Display Control Function Commands Details

4.3.1 disp_page (0x70)

seq	Cmd-code / Par-data	Descriptions
1	0x70	Display a pre-stored TML file(page)
2	Page_IDh	Page_ID = 0~999
3	Page_IDl	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

4.3.2 set_element_fg (0x7E)

Seq	Cmd-code / Par-data	Descriptions
1	0x7E	Set foreground colors of the STR, N16, N32 or N64
2	Element	0x00 = STR; 0x01 = N16, N32, N64
3	Page_IDh	Page_ID = 0~999
4	Page_IDl	
5	Element_ID	VP_STR = 0~127; N16, N32, N64 = 0~119
6	0x00	Reserve
7	FGh	Foreground color(0~0xffff)
8	FGl	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

4.3.3 set_element_bg (0x7F)

Seq	Cmd-code / Par-data	Descriptions
1	0x7F	Set background color of the STR, N16, N32 or N64
2	Element	0x00 = STR; 0x01 = N16, N32, N64
3	Page_IDh	Page_ID = 0~999
4	Page_IDl	
5	Element_ID	VP_STR = 0~127, N16, N32, N64 = 0~119
6	Mode	0x00: non transparent; 0x01 : transparent
7	BGh	Background color(0 ~ 0xffff)
8	BGl	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

4.3.4 set_codepage (0xE7)

Seq	Cmd-code / Par-data	Descriptions
1	0xE7	Sets country character set and code-page character set
2	Country	1 ~ 11, country character set
3	Codepage	1 ~ 22, code-page character set

Note.

1. Country and CodePage table

Country Code	Descriptions	Code Page	Descriptions
1	USA	1	437 (OEM – United States)
2	France	2	737 (OEM – Greek 437G)
3	Germany	3	852 (OEM – Latin II)
4	United Kingdom	4	860 (OEM – Portuguese)
5	Demark I	5	863 (OEM – Canadian French)
6	Demark II	6	865 (OEM – Nordic)
7	Sweden	7	866 (OEM – Russian)
8	Italy	8	874 (ANSI/OEM – Thai)
9	Spain	9	932 (ANSI/OEM – Japanese Shift-JIS)
10	Japan	10	1250 (ANSI – Central Europe)
11	Norway	11	1251 (ANSI – Cyrillic)
—	—	12	1252 (ANSI – Latin I)
—	—	13	1253 (ANSI – Greek)
—	—	14	1254 (ANSI – Turkish)
—	—	15	1255 (ANSI – Hebrew)
—	—	16	1256 (ANSI – Arabic)
—	—	17	1257 (ANSI – Baltic)
—	—	18	1258 (ANSI – Viet Nam)
—	—	19	GB2312
—	—	20	GBK
—	—	21	EUC_KR
—	—	22	Big5

4.3.5 suspend_vp_refresh (0xE8)

Seq	Cmd-code / Par-data	Descriptions
1	0xE8	Set the screen to pause the refresh and deactivate the touchkey or release the pause to refresh and enable the touchkey
2	55	
3	AA	
4	5A	
5	A5	
6	Mode	0x00: release the pause to refresh and enable the touchkey 0x01: pause the refresh and deactivate the touchkey

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

4.4 VP Function Commands Details

4.4.1 Successive_write (0x82)

Seq	Cmd-code / Par-data	Descriptions
1	0x82	Write successive value to VP_N16, VP_N32, VP_N64
2	Addr3(MSB)	VP_N16 Address = 0x080000 ~ 0x08FFFF (should be aligned every 2 byte) VP_N32 Address = 0x020000 ~ 0x02FFFF (should be aligned every 4 byte) VP_N64 Address = 0x030000 ~ 0x03FFFF (should be aligned every 8 byte)
3	Addr2	
4	Addr1	
5	Addr0(LSB)	
6	Length	The number of data to write (Length = 1~255)
7	Data 1(MSB)	the value to write No. of byte of Data: VP_N16 = Length *2, VP_N32 = Length *4, VP_N64 = Length *8,
8	Data 2	
9	Data 3	
: :	: Data n(LSB)	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

4.4.2 Successive_read (0x83)

Seq	Cmd-code / Par-data	Descriptions
1	0x83	Read successive value to VP_N16, VP_N32, VP_N64
2	Addr3(MSB)	VP_N16 Address = 0x080000 ~ 0x08FFFF (should be aligned every 2 byte) VP_N32 Address = 0x020000 ~ 0x02FFFF (should be aligned every 4 byte) VP_N64 Address = 0x030000 ~ 0x03FFFF (should be aligned every 8 byte)
3	Addr2	
4	Addr1	
5	Addr0(LSB)	
6	Length	The number of data to write (Length = 1 ~ 255)

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

Response code:

Seq.	Content	Byte in Hex	Descriptions
1st	Header	0xAA	Communication packet header
2nd	Command	0x83	Command executed
3rd	VP_ADD	Addr3(MSB	VP Address 0x080000 ~ 0x08FFFF:VP_N16 Address 0x020000 ~ 0x02FFFF:VP_N32 Address 0x030000 ~ 0x03FFFF:VP_N64 Address
4th		Addr2	
5th		Addr1	
6th		Addr0(LSB)	
7th	Length	NO.	No. of data
8th	Data	Data n(MSB)	No. of byte of Data: VP_N16 = Length *2, VP_N32 = Length * 4, VP_N64 = Length *8,
: :		: :	
$(n-1)^{th}$		Data1	
nth		Data0(LSB)	
$(n+1)^{th}$	Tail	0xCC	Communication packet tail
$(n+2)^{th}$		0x33	
$(n+3)^{th}$		0xC3	
$(n+4)^{th}$		0x3C	

Note.

1. The Response code with communication packet format (see Communication Packet Structure Section for

details)

4.4.3 VP_Backup (0x94)

seq	Cmd-code / Par-data	Descriptions
1	0x94	VP Backup to Flash or VP Restore from Flash
2	Dir	1: VP Restore 0: VP Backup
3	Addr3(MSB)	the specified Flash start address Address range = 0x000000 ~ 0x3FFFFF
4	Addr2	
5	Addr1	
6	Addr0(LSB)	
7	VP Addr3(MSB)	VP Address 0x080000 ~ 0x08FFFF:VP_N16 Address 0x020000 ~ 0x02FFFF:VP_N32 Address 0x030000 ~ 0x03FFFF:VP_N64 Address 0x000000 ~ 0x01FFFF:VP_STR Address
8	VP Addr2	
9	VP Addr1	
10	VP Addr0(LSB)	
11	VP_Lengthh	The no. of VP VP _Length = 0x0001 ~ 0x8000
12	VP _Lengthl	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)
2. Random data may be restore, before the first time VP backup operation.

4.4.4 VP_Preload (0x95)

seq	Cmd-code / Par-data	Descriptions
1	0x95	VP Preload from USR_bin
2	01	
3	Addr3(MSB)	the specified usr.bin start address . Address range = 0x000000 ~ 0x3FFFFF
4	Addr2	
5	Addr1	
6	Addr0(LSB)	
7	VP Addr3(MSB)	VP Address 0x080000 ~ 0x08FFFF:VP_N16 Address 0x020000 ~ 0x02FFFF:VP_N32 Address 0x030000 ~ 0x03FFFF:VP_N64 Address 0x000000 ~ 0x01FFFF:VP_STR Address
8	VP Addr2	
9	VP Addr1	
10	VP Addr0(LSB)	
11	VP_Lengthh	The no. of VP VP_Length = 0x0001 ~ 0x8000
12	VP_Lengthl	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)
2. If usr.bin read invalid, VP may not be update correctly.

4.4.5 BP1_write (0x4B)

Seq	Cmd-code / Par-data	Descriptions
1	0x4B	Write raw bit-map data to the VP_BP1
2	Addr3(MSB)	VP_BP1 Address = 0x040000 ~ 0x05FFFF
3	Addr2	
4	Addr1	
5	Addr0(LSB)	
6	Length3(MSB)	the number of data Length = 1 ~ 98304
7	Length2	
8	Length1	
9	Length0(LSB)	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure

Section for details)

2. After the above command issued, it follow with the raw data byte with out communication packet structure.
3. over all command flow

HOST	Flow	module
BP1_write Command (in communication packet structure)	→	Instruct to wait for data….
Raw 1bpp image data (without communication packet structure)	→	Store the data into VP_BP1
	→	Response code ":>" in ASCII (without communication packet structure)

4.4.6 BP1_write_compress (0x4C)

Seq	Cmd-code / Par-data	Descriptions
1	0x4C	Write compressed bit-map data to the VP_BP1
2	Addr3(MSB)	VP_BP1 Address = 0x040000 ~ 0x05FFFF
3	Addr2	
4	Addr1	
5	Addr0(LSB)	
6	Length3(MSB)	the number of data Length = 1 ~ 98304
7	Length2	
8	Length1	
9	Length0(LSB)	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)
2. After the above command issued, it follow with the compressed data byte with out communication packet structure.
3. over all command flow

HOST	Flow	module
BP1_write Command (in communication packet s tructure)	→	Instruct to wait for data….
compressed 1bpp image data (without communic ation packet structure)	→	Store the data into VP_BP1
	→	Response code ":>" in ASCII (without communi cation packet structure)

4.4.7 G16_write (0x4D)

Se q	Cmd-code / Par-data	Descriptions
1	0x4D	Write graph values to the VP_G16 array
2	Addr1_H	VP_G16 Address = 0x060000 ~ 0x07FFFF
3	Addr1l	
4	Addr2h	
5	Addr2l	
6	Sizeh	Array-size = 1 ~ 1024 (*2, *3)
7	Sizel	
8	Data(MSB)	16 bit data array (no. of byte = 2x array-size)
9	Data(LSB)	
10	Data(MSB)	
11	Data(LSB)	
:	:	
:	:	
:	:	
:	:	
:	:	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)
2. Array-size = no. of 16bit values
3. Array-size suggest to be same at the size value defined in TML editor

4.4.8 G16_write_rotate (0x4E)

Seq	Cmd-code / Par-data	Descriptions
1	0x4E	Write graph values to the last position of VP_G16 array with rotation effect
2	Addr1_H	VP_G16 Address = 0x060000 ~ 0x07FFFF
3	Addr1_L	
4	Addr2_H	
5	Addr2_L	
6	Size_H	Array-size to be rotate = 1 ~ 65535 (*2. *3)
7	Size_L	
8	Data(MSB)	16 bit data value to be add to the end-of-array
9	Data(LSB)	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)
2. Array-size = no. of 16bit values
3. Array-size suggest to be same at the value defined in TML editor

4.4.9 Reg_Write (0x3B)

seq	Cmd-code / Par-data	Descriptions
1	0x3B	System Register Write Command
2	Addr3(MSB)	Address = 0xFFFF00 Address = 0xFFFFFF
3	Addr2	
4	Addr1	
5	Addr0(LSB)	
6	Data	the value to write

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

4.4.10 Reg_Read (0x3C)

seq	Cmd-code / Par-data	Descriptions
1	0x3C	System Register Read Command
2	Addr3(MSB)	Address = 0xFFFF00 Address = 0xFFFFFF
3	Addr2	
4	Addr1	
5	Addr0(LSB)	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

Response code:

Seq.	Content	Byte in Hex	Descriptions
1st	Header	0xAA	Communication packet header
2nd	Command	0x3C	Command executed
3rd	Address	Addr3(MSB)	Address = 0xFFFF00 Address = 0xFFFFFF
4th		Addr2	
5th		Addr1	
6th		Addr0(LSB)	
7th	Data	Data(1Byte)	the value of the register
8th	Tail	0xCC	Communication packet tail
9th		0x33	
10th		0xC3	
11th		0x3C	

Note.

1. The Response code with communication packet format (see Communication Packet Structure Section for details)
2. When Timer reach the 0x00000000 or 0x7FFFFFFF, a notification will be provided a 0x77 response code with the corresponding
   Timer Address and Value.(See touch_response(0x77)for details)

4.4.11 STR_write (0x42)

Seq	Cmd-code / Par-data	Descriptions
1	0x42	Write string to VP_STR
2	Addr3(MSB)	the VP_STR Address = 0x00000 ~ 0x01FFFF (each VP_STR = 128 bytes) (address value must be divisible by 128)
3	Addr2	
4	Addr1	
5	Addr0(LSB)	
6	data	String to write Total no. of byte in string ≤128
:	:	
:	:	
:	'\0'	'\0'(0x00): string end mark

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

4.4.12 STR_read (0x43)

Seq	Cmd-code / Par-data	Descriptions
1	0x43	Read string from VP_STR
2	Addr3(MSB)	the VP_STR Address = 0x00000 ~ 0x01FFFF (each VP_STR = 128 bytes)(address value must be divisible by 128)
3	Addr2	
4	Addr1	
5	Addr0(LSB)	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

Response code:

Seq.	Content	Byte in Hex	Descriptions
1st	Header	0xAA	Communication packet header
2nd	Command	0x43	Command executed
3rd	String data	data	String code
:		:	
:		:	
:	\0	0x00	‘‘\0’(0x00): string end mark
:	Tail	0xCC	Communication packet tail
:		0x33	
:		0xC3	
:		0x3C	

Note.

1. The Response code with communication packet format (see Communication Packet Structure Section for details)

4.4.13 STR_fill (0x46)

Seq	Cmd-code / Par-data	Descriptions
1	0x46	Write string to VP_STR
2	Addr3(MSB)	he VP_STR Address = 0x00000 ~ 0x01FFFF (each VP_STR = 128 bytes)(address value must be divisible by 128)
3	Addr2	
4	Addr1	
5	Addr0(LSB)	
6	Lengthh	the number of VP_STR (including the start address) to be filled Length = 1 ~ 1024
7	Lengthl	
8	data	String to write Total no. of byte in string ≤128
:	:	
:	:	
:	‘\0’	‘\0’(0x00): string end mark

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

4.4.14 N16_write (0x3D)

Seq	Cmd-code / Par-data	Descriptions
1	0x3D	Write 16bit number to VP_N16
2	Addr3(MSB)	VP_N16 Address = 0x080000 ~ 0x08FFFF (each VP_N16 = 2 byte) (address value must be divisible by 2)
3	Addr2	
4	Addr1	
5	Addr0(LSB)	
6	High Byte	The 16 bit value to write
7	Low Byte	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

4.4.15 N16_read (0x3E)

Seq	Cmd-code / Par-data	Descriptions
1	0x3E	Read 16bit number from VP_N16
2	Addr3(MSB)	VP_N16 Address = 0x080000 ~ 0x08FFFF (each VP_N16 = 2 byte) (address value must be divisible by 2)
3	Addr2	
4	Addr1	
5	Addr0(LSB)	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details

Response code:

Seq.	Content	Byte in Hex	Descriptions
1st	Header	0xAA	Communication packet header
2nd	Command	0x3E	Command executed
3rd	N16 value	Data1(MSB)	16 bit value
4th		Data0(LSB)	
5th	Tail	0xCC	Communication packet tail
6th		0x33	
7th		0xC3	
8th		0x3C	

Note.

1. The Response code with communication packet format (see Communication Packet Structure Section for details)

4.4.16 N16_fill (0x3F)

Seq	Cmd-code / Par-data	Descriptions
1	0x3F	Fill 16bit number to the VP_N16
2	Addr3(MSB)	VP_N16 Address = 0x080000 ~ 0x08FFFF (each VP_N16 = 2 byte) (address value must be divisible by 2)
3	Addr2	
4	Addr1	
5	Addr0(LSB)	
6	Lengthh	the number of VP_N16 (including the start address) to be filled Length = 1 ~ 32768
7	Lengthl	
8	High Byte	the 16 bit value to fill
9	Low Byte	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

4.4.17 N32_write (0x44)

Seq	Cmd-code / Par-data	Descriptions
1	0x44	Write 32bit number to VP_N32
2	Addr3(MSB)	VP_N32 Address = 0x020000 ~ 0x02FFFF (each VP_N32 = 4 byte) (address value must be divisible by 4)
3	Addr2	
4	Addr1	
5	Addr0(LSB)	
6	Data3(MSB)	the 32 bit no. value write.
7	Data2	
8	Data1	
9	Data0(LSB)	

4.4.18 N32_read (0x45)

Seq	Cmd-code / Par-data	Descriptions
1	0x45	Read 32bit number from VP_N32
2	Addr3(MSB)	VP_N32 Address = 0x020000 ~ 0x02FFFF (each VP_N32 = 4 byte) (address value must be divisible by 4)
3	Addr2	
4	Addr1	
5	Addr0(LSB)	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details

Response code:

Seq.	Content	Byte in Hex	Descriptions
1st	Header	0xAA	Communication packet header
2nd	Command	0x45	Command executed
3rd	N32 value	Data3(MSB)	32 bit value
4th		Data2	
5th		Data1	
6th		Data0(LSB)	
7th	Tail	0xCC	Communication packet tail
8th		0x33	
9th		0xC3	
10th		0x3C	

Note.

1. The Response code with communication packet format (see Communication Packet Structure Section for details)

4.4.19 N32_fill (0x47)

Seq	Cmd-code / Par-data	Descriptions
1	0x47	Fill 32bit number to the VP_N32
2	Addr3(MSB)	VP_N32 Address = 0x020000 ~ 0x02FFFF (each VP_N32 = 4 byte) (address value must be divisible by 4)
3	Addr2	
4	Addr1	
5	Addr0(LSB)	
6	Lengthh	the number of VP_N32 (including the start address) to be filled Length = 1 ~ 16384
7	Lengthl	
8	Data3(MSB)	the 32 bit no. value to fill
9	Data2	
10	Data1	
11	Data0(LSB)	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

4.4.20 N64_write (0x48)

Seq	Cmd-code / Par-data	Descriptions
1	0x48	Write 64bit number to VP_N64
2	Addr3(MSB)	VP_N64 Address= 0x030000 ~ 0x03FFFF (each VP_N64 = 8 byte)(address value must be divisible by 8)
3	Addr2	
4	Addr1	
5	Addr0(LSB)	
6	Data7(MSB)	the 64bit no. value write.
7	Data6	
: :	: :	
12	Data1	
13	Data0(LSB)	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

4.4.21 N64_read (0x49)

Seq	Cmd-code / Par-data	Descriptions
1	0x49	Read 64bit number from VP_N64
2	Addr3(MSB)	VP_N64 Address= 0x030000 ~ 0x03FFFF (each VP_N64 = 8 byte) (address value must be divisible by 8)
3	Addr2	
4	Addr1	
5	Addr0(LSB)	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details

Response code:

Seq.	Content	Byte in Hex	Descriptions
1st	Header	0xAA	Communication packet header
2nd	Command	0x49	Command executed
3rd	N64 value	Data7(MSB)	64 bit value
4th		Data6	
: :		: :	
9th		Data1	
10th		Data0(LSB)	
11th	Tail	0xCC	Communication packet tail
12th		0x33	
13th		0xC3	
14th		0x3C	

Note.

1. The Response code with communication packet format (see Communication Packet Structure Section for details)

4.4.22 N64_fill (0x4A)

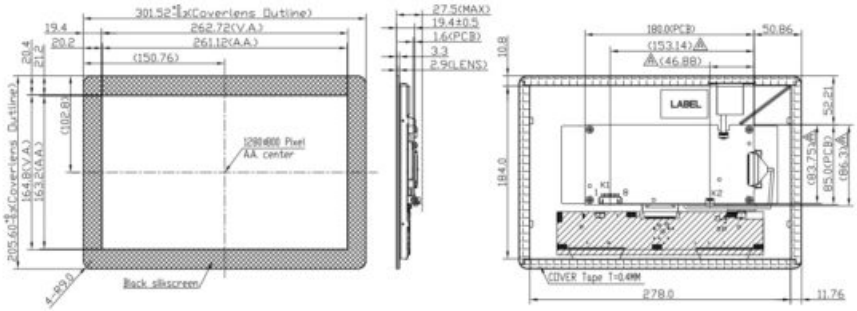
Seq	Cmd-code / Par-data	Descriptions
1	0x4A	Fill 64bit number to the VP_N64
2	Addr3(MSB)	VP_N64 Address= 0x030000 ~ 0x03FFFF (each VP_N64 = 8 byte) (address value must be divisible by 8)
3	Addr2	
4	Addr1	
5	Addr0(LSB)	
6	Lengthh	the number of VP_N64 (including the start address) to be filled Length = 1 ~ 8192
7	Lengthl	
8	Data7(MSB)	the 64 bit no. value to fill
9	Data6	
: :	: :	
14	Data1	
15	Data0(LSB)	

Note.

1. Command should be transferred in communication packet structure (see Communication Packet Structure Section for details)

Appendix 1 CRC Calculate

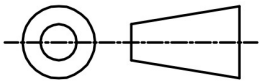
```
uint16_t const CRC16[256]={/* 16: 8005 reflected */
0x0000,0xc0c1,0xc181,0x0140,0xc301,0x03c0,0x0280,0xc241,0xc601,0x06c0,0x0780,0xc741,0x0500,0xc5c1,0xc
481,0×0440,
0xcc01,0x0cc0,0x0d80,0xcd41,0x0f00,0xcfc1,0xce81,0x0e40,0x0a00,0xcac1,0xcb81,0x0b40,0xc901,0x09c0,0x0
880,0xc841,
0xd801,0x18c0,0x1980,0xd941,0x1b00,0xdbc1,0xda81,0x1a40,0x1e00,0xdec1,0xdf81,0x1f40,0xdd01,0x1dc0,0x1
c80,0xdc41,
0x1400,0xd4c1,0xd581,0x1540,0xd701,0x17c0,0x1680,0xd641,0xd201,0x12c0,0x1380,0xd341,0x1100,0xd1c1,0xd
081,0×1040,
0xf001,0x30c0,0x3180,0xf141,0x3300,0xf3c1,0xf281,0x3240,0x3600,0xf6c1,0xf781,0x3740,0xf501,0x35c0,0x3
480,0xf441,
0x3c00,0xfcc1,0xfd81,0x3d40,0xff01,0x3fc0,0x3e80,0xfe41,0xfa01,0x3ac0,0x3b80,0xfb41,0x3900,0xf9c1,0xf
881,0×3840,
0x2800,0xe8c1,0xe981,0x2940,0xeb01,0x2bc0,0x2a80,0xea41,0xee01,0x2ec0,0x2f80,0xef41,0x2d00,0xedc1,0xe
c81,0x2c40,
0xe401,0x24c0,0x2580,0xe541,0x2700,0xe7c1,0xe681,0x2640,0x2200,0xe2c1,0xe381,0x2340,0xe101,0x21c0,0x2
080,0xe041,
0xa001,0x60c0,0x6180,0xa141,0x6300,0xa3c1,0xa281,0x6240,0x6600,0xa6c1,0xa781,0x6740,0xa501,0x65c0,0x6
480,0xa441,
0x6c00,0xacc1,0xad81,0x6d40,0xaf01,0x6fc0,0x6e80,0xae41,0xaa01,0x6ac0,0x6b80,0xab41,0x6900,0xa9c1,0xa
881,0×6840,
0x7800,0xb8c1,0xb981,0x7940,0xbb01,0x7bc0,0x7a80,0xba41,0xbe01,0x7ec0,0x7f80,0xbf41,0x7d00,0xbdc1,0xb
c81,0x7c40,
0xb401,0x74c0,0x7580,0xb541,0x7700,0xb7c1,0xb681,0x7640,0x7200,0xb2c1,0xb381,0x7340,0xb101,0x71c0,0x7
080,0xb041,
0x5000,0x90c1,0x9181,0x5140,0x9301,0x53c0,0x5280,0x9241,0x9601,0x56c0,0x5780,0x9741,0x5500,0x95c1,0x9
481,0×5440,
0x9c01,0x5cc0,0x5d80,0x9d41,0x5f00,0x9fc1,0x9e81,0x5e40,0x5a00,0x9ac1,0x9b81,0x5b40,0x9901,0x59c0,0x5
880,0×9841,
0x8801,0x48c0,0x4980,0x8941,0x4b00,0x8bc1,0x8a81,0x4a40,0x4e00,0x8ec1,0x8f81,0x4f40,0x8d01,0x4dc0,0x4
c80,0x8c41,
0x4400,0x84c1,0x8581,0x4540,0x8701,0x47c0,0x4680,0x8641,0x8201,0x42c0,0x4380,0x8341,0x4100,0x81c1,0x8
081,0×4040,
};
static __inline uint16_t rshiftu16(uint16_t value, int nb)
{
return (uint16_t)((value >> nb) & ~((( uint16_t) 0x8000) >> (nb-1)));
}
uint16_t crc16_calc(unsigned char *q, int len)
{
uint16_t crc = 0xffff;
while (len– > 0)
crc=(rshiftu16(crc,8) ^ CRC16[(crc ^ *q++) & 0xff]);
return crc;
}
```



Note:

1. LCD Display Type: TFT.Transmissive(Full View)
2. Pixel Arrangment: RGB-STRIPE
3. Color Depth: 65K Colors
4. Operating Voltage: 12.0V(11.0~26.0V) ⚠A⚠B
5. Backlight: White LED
6. Interface: RS-232C
7. Terminal:
   K1: JST S8B-XH-SM3-TB or equivalent
   K2: USB Type-C
8. Touch Panel Type Capacitive Touch Panel (Cover Lens Thickness=2.9mm)
   Surface treatment: anti-glare
9. Operating Temperature: -20°C~70°C
10. Storage Temperature: -30°C~80°C
11. Unmarked Tolerace ≤150,±0.3; >150,±0.5

K1 Terrninal	
No	**Pin Name**
1	VDD
2	VDD
3	RTS(BUSY)
4	Tx
5	Rx
6	Rx
7	VSS
8	VSS

B	Revise Operating Voltage			HeiYichen 2024-04-22
A	Revise PCBA and Operating Voltage			HeiYichen 2023-10-25
Rev	Note			Date
Dwg Title HVT1P1BTA—D Lutline Dwg				
Dwg No,				Date 2023-06-20
Dwg Title Mk 0080920 1 1				
Scale 2/5	Tol.	Unit mm	Paper Size A 3	
Approved		Checked	Drawn , HeiYichen	
TOPWAY				

TOPWAY

Documents / Resources

	TOPWAY HMT121BTA-D LCD Module [pdf] User Manual HMT121BTA-D LCD Module, HMT121BTA-D, LCD Module, Module

References

- -TFT |
- -TFT |
- User Manual