



深圳市拓普微科技开发有限公司  
SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

# HMT025ATA

## LCD Module User Manual

|                                                             |                                  |                                   |
|-------------------------------------------------------------|----------------------------------|-----------------------------------|
| Prepared by:<br><br><b>Li Ke Ke</b><br><br>Date: 2022-01-06 | Checked by:<br><br><br><br>Date: | Approved by:<br><br><br><br>Date: |
|-------------------------------------------------------------|----------------------------------|-----------------------------------|

| Rev. | Descriptions        | Edit    | Release Date |
|------|---------------------|---------|--------------|
| 0.1  | Preliminary release | Li KeKe | 2022-01-06   |
|      |                     |         |              |
|      |                     |         |              |
|      |                     |         |              |
|      |                     |         |              |
|      |                     |         |              |

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## 1 Basic Specification

TOPWAY HMT025ATA is a Smart TFT Module with 32bit MCU on board. Its graphics engine provides numbers of outstanding features. It supports TOPWAY TML 3.0 (Editor 2017) for preload and pre-design display interface that simplify the host operation and development time. Suitable for industry control, instrumentation, medical electronics, power electric equipment applications.

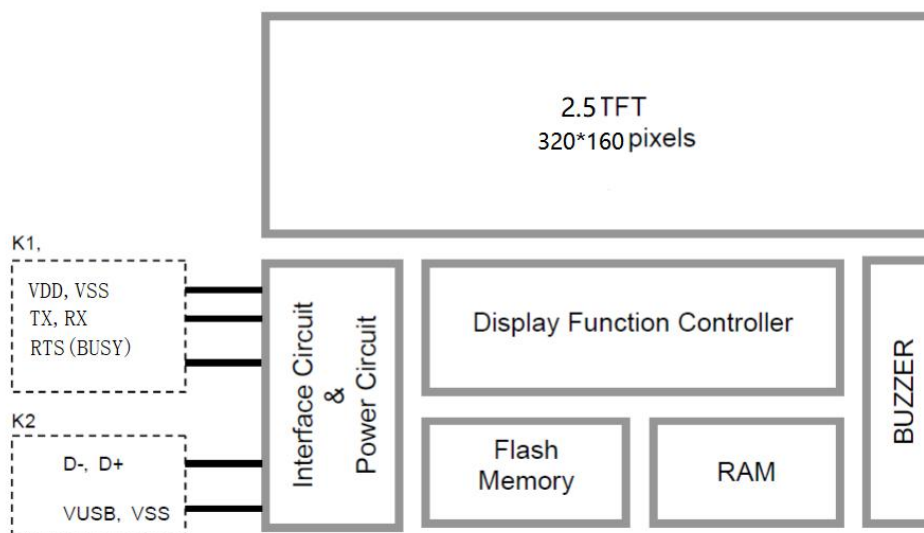
### 1.1 General Specification

|                         |                                                                |
|-------------------------|----------------------------------------------------------------|
| Screen Size(Diagonal) : | 2.5"                                                           |
| Resolution :            | 320X160(RGB)                                                   |
| Color Depth :           | 65K (16bit)                                                    |
| Pixel Configuration :   | RGB Stripe                                                     |
| Display Mode :          | Transmissive / Normal White                                    |
| Viewing Direction :     | Full View                                                      |
| Outline Dimension :     | 96.0x 38.3x 13 (max)(mm)<br>(see attached drawing for details) |
| Active Area :           | 56.64 x 28.32 (mm)                                             |
| Backlight :             | LED                                                            |
| Surface Treatment :     | HC                                                             |
| Command I/F:            | RS-232C                                                        |
| Project Download:       | by PC (*1)                                                     |
| Operating Temperature : | -20 ~ +70°C                                                    |
| Storage Temperature :   | -30 ~ +80°C                                                    |
| Highlight:              | Support 90 degrees rotation,Lua script engine                  |

Note:\*1.

\*1. Section 1.3 for configuration.

### 1.2 Block Diagram



### 1.3 Terminal Function

#### RS-232C Interface Terminal (K1)

| Pin No.  | Pin Name  | I/O | Descriptions                                                                                           |
|----------|-----------|-----|--------------------------------------------------------------------------------------------------------|
| 1, 2, 3  | VDD       | P   | Power supply                                                                                           |
| 4        | NC        | --  | No connection, leave open                                                                              |
| 5        | RX        | I   | Data Input<br>(eg. to PC's RS-232C pin3 <9pin D-connector>)                                            |
| 6        | TX        | O   | Data output<br>(eg. to PC's RS-232C pin2 <9pin D-connector>)                                           |
| 7        | RTS(BUSY) | O   | Request To Send (could function as busy BUSY signal)<br>(eg. to PC's RS-232C pin8 <9pin D-connector> ) |
| 8, 9, 10 | VSS       | P   | Ground, (0V)                                                                                           |

Note.

- \*1. User data and commands transfer through this terminal.
- \*2. HOST using command hand shake during communication is suggested.

#### USB Interface Terminal (K2)

| Pin No. | Pin Name | I/O | Descriptions              |
|---------|----------|-----|---------------------------|
| 1       | VUSB     | P   | Power supply (5.0 V)      |
| 2       | D-       | I/O | USB DATA negative signal  |
| 3       | D+       | I/O | USB DATA positive signal  |
| 4       | NC       | --  | No connection, leave open |
| 5       | VSS      | P   | Ground, (0V)              |

Note.

- \*1. Display files preload through this terminal.
- \*2. Standard "USB-drive" functions provided.
- \*3. For PC direct download project: R43=4R7, R45=4R7, R49=NC, R50=NC. (default)  
For U-Drive to download project: R43=NC, R45=NC, R49=4R7, R50=4R7.

## 2 Absolute Maximum Ratings

| Items                 | Symbol   | Min. | Max. | Unit | Condition       |
|-----------------------|----------|------|------|------|-----------------|
| Power Supply voltage  | $V_{dd}$ | -0.3 | 5.5  | V    |                 |
| Operating Temperature | $T_{OP}$ | -20  | 70   | °C   | No Condensation |
| Storage Temperature   | $T_{ST}$ | -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,  $T_{OP}=25^{\circ}\text{C}$
- \*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.

### 3 Electrical Characteristics

#### 3.1 DC Characteristics

VSS=0V, T<sub>OP</sub> =25°C

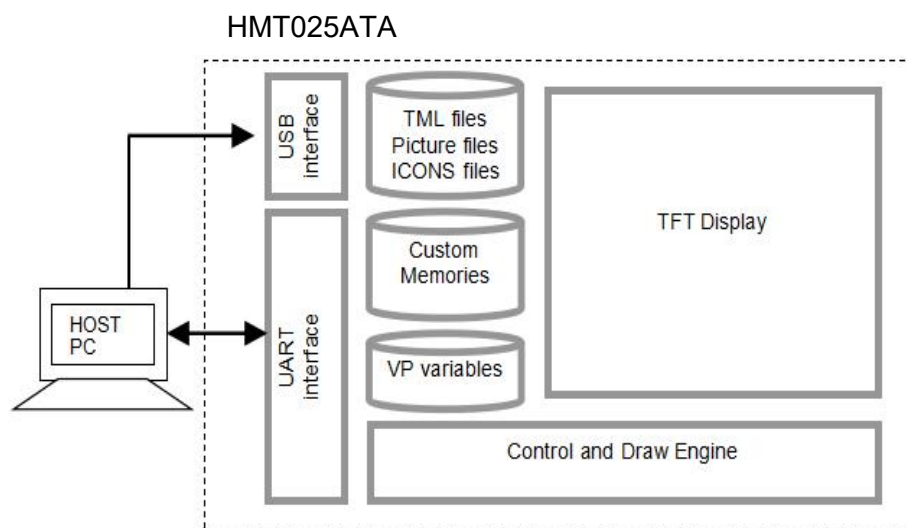
| Items                   | Symbol            | MIN. | TYP. | MAX.  | Unit | Applicable Pin/FUNC |
|-------------------------|-------------------|------|------|-------|------|---------------------|
| Operating Voltage       | V <sub>DD</sub>   | 4.8  | 5.0  | 5.2   | V    | VDD                 |
| Rx Input MARK(1)        | V <sub>RxDM</sub> | -3.0 | -    | -15.0 | V    | Rx                  |
| Rx Input SPACE(0)       | V <sub>RxDS</sub> | +3.0 | -    | +15.0 | V    | Rx                  |
| Tx Output MARK(1)       | V <sub>TxDM</sub> | -3.0 | -    | -15.0 | V    | Tx                  |
| Tx Output SPACE(0)      | V <sub>TxDS</sub> | +3.0 | -    | +15.0 | V    | Tx                  |
| RTS Output High         | V <sub>TXH</sub>  | -3.0 | -    | -15.0 | V    | RTS(BUSY)           |
| RTS Output Low          | V <sub>TXL</sub>  | +3.0 | -    | +15.0 | V    | RTS(BUSY)           |
| Operating Current       | I <sub>DD</sub>   | -    | 210  | -     | mA   | VDD (*1)            |
| Operating Current (USB) | I <sub>VUSB</sub> | -    | 100  | -     | mA   | VUSB                |

Note.

\*1. Normal display condition.

### 4 Function Specifications

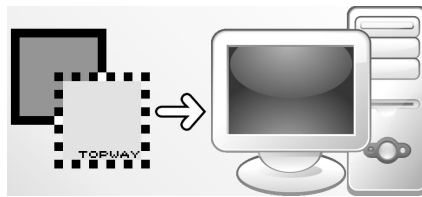
#### 4.1 Basic Operation Function Descriptions



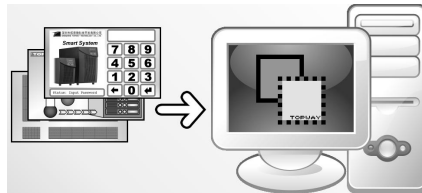
- Display files are stored inside FLASH memory area.  
They are preloaded to HMT025ATA for stand alone interface use.
- Those files are preloaded via USB interface (U-Drive or PC download).
- All the interface flow and the touch response are based on the preloaded files
- VP variables memory is inside RAM area,  
it provides real time access via UART by the HOST or display onto the TFT.
- 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

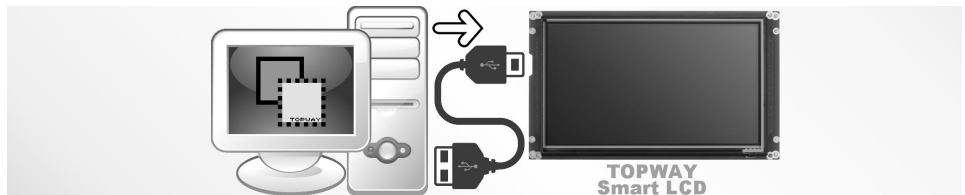
1. Install TOPWAY Graphics Editor



2. Import pictures design UI flow



3. Download to Smart LCD



4. power on & display



5. Connect to host Show real time data



## 4.3 Command Descriptions

Please refer to "SMART LCD Command Manual "

## 5 Optical Characteristics

| Item           |       | Symbol           | Condition          | Min    | Typ   | Max   | Unit   | Remark   |
|----------------|-------|------------------|--------------------|--------|-------|-------|--------|----------|
| View Angles    |       | θT               | CR≧10              | 70     | 80    | -     | Degree | Note3,4  |
|                |       | θB               |                    | 70     | 80    | -     |        |          |
|                |       | θL               |                    | 70     | 80    | -     |        |          |
|                |       | θR               |                    | 70     | 80    | -     |        |          |
| Contrast Ratio |       | CR               | θ =0°              | 600    | 800   | -     |        | Note 4   |
| Response Time  |       | T <sub>ON</sub>  | 25℃                | -      | 30    | 40    | ms     | Note 5   |
|                |       | T <sub>OFF</sub> |                    |        |       |       |        |          |
| Chromaticity   | White | x                | Backlight is<br>on | 0.252  | 0.302 | 0.352 |        | Note 1,6 |
|                |       | y                |                    | 0.265  | 0.315 | 0.365 |        |          |
|                | Red   | x                |                    | 0.575  | 0.625 | 0.675 |        | Note 1,6 |
|                |       | y                |                    | 0.271  | 0.321 | 0.371 |        |          |
|                | Green | x                |                    | 0.275  | 0.325 | 0.375 |        | Note 1,6 |
|                |       | y                |                    | 0.577  | 0.627 | 0.677 |        |          |
|                | Blue  | x                |                    | 0.107  | 0.157 | 0.207 |        | Note 1,6 |
|                |       | y                |                    | -0.005 | 0.045 | 0.095 |        |          |
| Uniformity     |       | U                |                    | 75     | 80    | -     | %      | Note 2   |
| NTSC           |       |                  |                    | 65     | 70    | -     | %      | Note 6   |
| Luminance      |       | L                |                    | 250    | 300   | -     | cd/m²  | Note 7   |

1. IF= 20 mA, and the ambient temperature is 25°C.

2. The test systems refer to Note 1 and Note

### Note 1:

The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment PR-705 (Φ8mm)

### Measuring condition:

- Measuring surroundings: Dark room
- Measuring temperature: Ta=25°C.
- Adjust operating voltage to get optimum contrast at the center of the display.

Measured value at the center point of LCD panel after more than 5 minutes while backlight turning on.

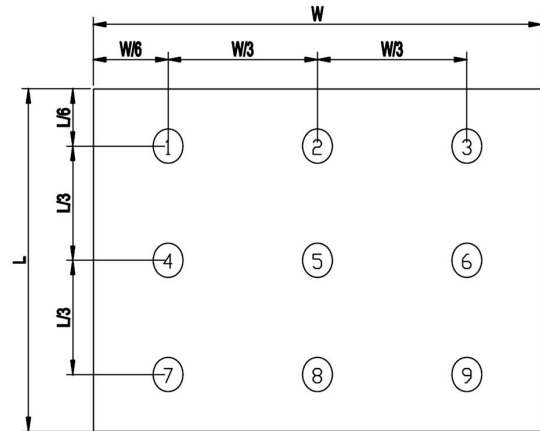
### Note 2:

The luminance uniformity is calculated by using following formula.

$$\Delta Bp = Bp (\text{Min.}) / Bp (\text{Max.}) \times 100 (\%)$$

Bp (Max.) = Maximum brightness in 9 measured spots

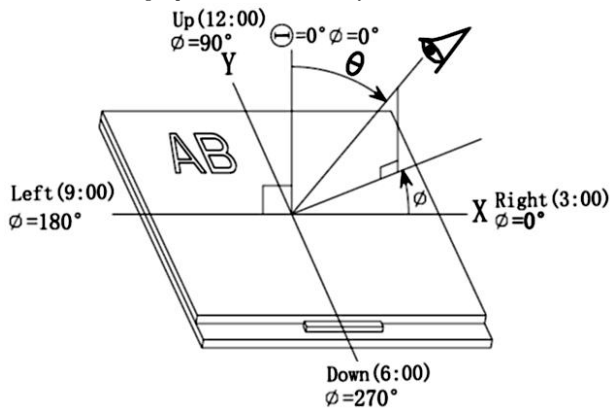
Bp (Min.) = Minimum brightness in 9 measured spots.



### Note 3:

The definition of viewing angle:

Refer to the graph below marked by  $\theta$  and  $\phi$



### Note 4:

The definition of contrast ratio (Test LCM using PR-705):

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

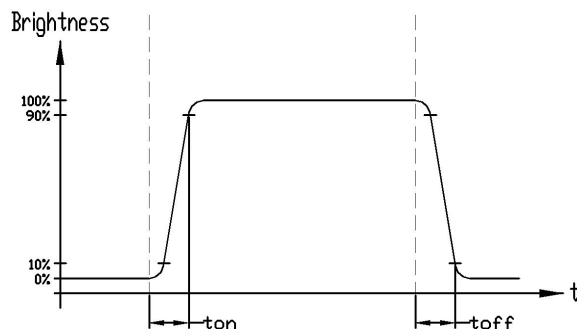
(Contrast Ratio is measured in optimum common electrode voltage)

### Note 5:

Definition of Response time. (Test LCD using DMS501):

The output signals of photo detector are measured when the input signals are changed from "black" to "white" (falling time) and from "white" to "black" (rising time), respectively.

The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.

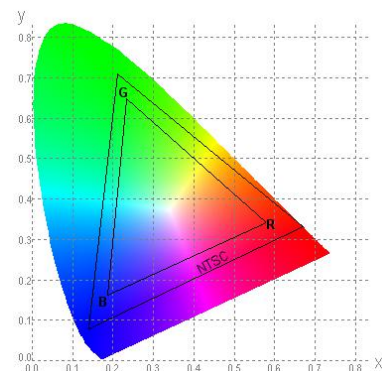


### Note 6:

Definition of Color of CIE Coordinate and NTSC Ratio.

Color gamut:

$$S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} \times 100\%$$







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SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

# SMART LCD

## Command V6.12 Manual

|                                                             |                                  |                                   |
|-------------------------------------------------------------|----------------------------------|-----------------------------------|
| Prepared by:<br><br><b>chenjian</b><br><br>Date: 2019-06-28 | Checked by:<br><br><br><br>Date: | Approved by:<br><br><br><br>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   |
|      |                                                  |              |
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## 1 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.

## 2 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<br>0x33<br>0xC3<br>0x3C | Packet tail       | 4byte       |

#### 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<br>0x33<br>0xC3<br>0x3C | Packet tail       | 4byte       |

#### 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<br>0x33 | Packet tail       | 2byte       |
| 6   | CRCL<br>CRCH |                   | 2byte(*3)   |

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:  $x^{16}+x^{15}+x^2+1$ , 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.

## 3 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        |

## 4 Command Descriptions

### 4.1 Command table

| Functions                       | Name               | Code                             | Description                                                                                                             |
|---------------------------------|--------------------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Config/<br>Status<br>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/<br>0x77/0x78/<br>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<br>Control<br>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<br>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                  |
|------------------|---------|-------------|-------------------------------|
| 1 <sup>st</sup>  | Header  | 0xAA        | Communication packet header   |
| 2 <sup>nd</sup>  | Command | 0x30        | Command executed              |
| 3 <sup>rd</sup>  | "T"     | 0x54        | "Topway HMT Ready\0" in ASCII |
| 4 <sup>th</sup>  | "o"     | 0x6f        |                               |
| 5 <sup>th</sup>  | "P"     | 0x70        |                               |
| 6 <sup>th</sup>  | "w"     | 0x77        |                               |
| 7 <sup>th</sup>  | "a"     | 0x61        |                               |
| 8 <sup>th</sup>  | "y"     | 0x79        |                               |
| 9 <sup>th</sup>  | " "     | 0x20        |                               |
| 10 <sup>th</sup> | "H"     | 0x48        |                               |
| 11 <sup>th</sup> | "M"     | 0x4d        |                               |
| 12 <sup>th</sup> | "T"     | 0x54        |                               |
| 13 <sup>th</sup> | " "     | 0x20        |                               |
| 14 <sup>th</sup> | "R"     | 0x52        |                               |
| 15 <sup>th</sup> | "e"     | 0x65        |                               |
| 16 <sup>th</sup> | "a"     | 0x61        |                               |
| 17 <sup>th</sup> | "d"     | 0x64        |                               |
| 18 <sup>th</sup> | "y"     | 0x79        |                               |
| 19 <sup>th</sup> | \0      | 0x00        | '\0'(0x00): string end mark   |
| 20 <sup>th</sup> | Tail    | 0xCC        | Communication packet tail     |
| 21 <sup>st</sup> |         | 0x33        |                               |
| 22 <sup>nd</sup> |         | 0xC3        |                               |
| 23 <sup>rd</sup> |         | 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 |

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                                                  |
|------------------|---------|-------------|---------------------------------------------------------------|
| 1 <sup>st</sup>  | Header  | 0xAA        | Communication packet header                                   |
| 2 <sup>nd</sup>  | Command | 0x31        | Command executed                                              |
| 3 <sup>rd</sup>  | "1"     | 0x31        | "1.06\0" in ASCII<br>Where firmware version is V1.06(example) |
| 4 <sup>th</sup>  | " "     | 0x2e        |                                                               |
| 5 <sup>th</sup>  | "0"     | 0x30        |                                                               |
| 6 <sup>th</sup>  | "6"     | 0x36        |                                                               |
| 7 <sup>th</sup>  | \0      | 0x00        | '\0'(0x00): string end mark                                   |
| 8 <sup>th</sup>  | Tail    | 0xCC        | Communication packet tail                                     |
| 9 <sup>th</sup>  |         | 0x33        |                                                               |
| 10 <sup>th</sup> |         | 0xC3        |                                                               |
| 11 <sup>th</sup> |         | 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 |

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                          |
|-----------------|---------|-------------|---------------------------------------|
| 1 <sup>st</sup> | Header  | 0xAA        | Communication packet header           |
| 2 <sup>nd</sup> | Command | 0x32        | Command executed                      |
| 3 <sup>rd</sup> | Page ID | Page_IDh    | Current Page ID in 16bit binary value |
| 4 <sup>th</sup> |         | Page_IDl    |                                       |
| 5 <sup>th</sup> | Tail    | 0xCC        | Communication packet tail             |
| 6 <sup>th</sup> |         | 0x33        |                                       |
| 7 <sup>th</sup> |         | 0xC3        |                                       |
| 8 <sup>th</sup> |         | 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                                                  |
|------------------|--------------|-------------|---------------------------------------------------------------|
| 1 <sup>st</sup>  | Header       | 0xAA        | Communication packet header                                   |
| 2 <sup>nd</sup>  | Command      | 0x72        | Touched release Coordinate                                    |
| 3 <sup>rd</sup>  | X coordinate | Xh          | Coordinate in 16bit binary value<br>X = horizontal coordinate |
| 4 <sup>th</sup>  |              | Xl          |                                                               |
| 5 <sup>th</sup>  | Y coordinate | Yh          | Y = vertical coordinate                                       |
| 6 <sup>th</sup>  |              | Yl          |                                                               |
| 7 <sup>th</sup>  | Tail         | 0xCC        | Communication packet tail                                     |
| 8 <sup>th</sup>  |              | 0x33        |                                                               |
| 9 <sup>th</sup>  |              | 0xC3        |                                                               |
| 10 <sup>th</sup> |              | 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                                                  |
|------------------|--------------|-------------|---------------------------------------------------------------|
| 1 <sup>st</sup>  | Header       | 0xAA        | Communication packet header                                   |
| 2 <sup>nd</sup>  | Command      | 0x73        | Touched down Coordinate                                       |
| 3 <sup>rd</sup>  | X coordinate | Xh          | Coordinate in 16bit binary value<br>X = horizontal coordinate |
| 4 <sup>th</sup>  |              | Xl          |                                                               |
| 5 <sup>th</sup>  | Y coordinate | Yh          | Y = vertical coordinate                                       |
| 6 <sup>th</sup>  |              | Yl          |                                                               |
| 7 <sup>th</sup>  | Tail         | 0xCC        | Communication packet tail                                     |
| 8 <sup>th</sup>  |              | 0x33        |                                                               |
| 9 <sup>th</sup>  |              | 0xC3        |                                                               |
| 10 <sup>th</sup> |              | 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                                                                         |
|-----------------|---------|-------------|--------------------------------------------------------------------------------------|
| 1 <sup>st</sup> | Header  | 0xAA        | Communication packet header                                                          |
| 2 <sup>nd</sup> | Command | 0x78        | Touched release Key_ID defined by TOPWAY TML Graphic Editor will be response to host |
| 3 <sup>rd</sup> | Page_ID | Page_IDh    | Page_ID = the touch key in page(16bit binary value)                                  |
| 4 <sup>th</sup> |         | Page_IDl    |                                                                                      |
| 5 <sup>th</sup> | Key_ID  | Key_ID      | Key_ID (8bit binary value)                                                           |
| 6 <sup>th</sup> | Tail    | 0xCC        | Communication packet tail                                                            |
| 7 <sup>th</sup> |         | 0x33        |                                                                                      |
| 8 <sup>th</sup> |         | 0xC3        |                                                                                      |
| 9 <sup>th</sup> |         | 0x3C        |                                                                                      |

Note.



\*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                                                                      |
|-----------------|---------|-------------|-----------------------------------------------------------------------------------|
| 1 <sup>st</sup> | Header  | 0xAA        | Communication packet header                                                       |
| 2 <sup>nd</sup> | Command | 0x79        | Touched down Key_ID defined by TOPWAY TML Graphic Editor will be response to host |
| 3 <sup>rd</sup> | Page_ID | Page_IDh    | Page_ID = the touch key in page(16bit binary value)                               |
| 4 <sup>th</sup> |         | Page_IDl    |                                                                                   |
| 5 <sup>th</sup> | Key_ID  | Key_ID      | Key_ID (8bit binary value)                                                        |
| 6 <sup>th</sup> | Tail    | 0xCC        | Communication packet tail                                                         |
| 7 <sup>th</sup> |         | 0x33        |                                                                                   |
| 8 <sup>th</sup> |         | 0xC3        |                                                                                   |
| 9 <sup>th</sup> |         | 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                                                                                                                                                       |
|-----------------|---------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 <sup>st</sup> | Header  | 0xAA        | Communication packet header                                                                                                                                        |
| 2 <sup>nd</sup> | Command | 0x77        | Touch Key VP_ADD+VP_Value Response code                                                                                                                            |
| 3 <sup>rd</sup> | VP_ADD  | Addr3 (MSB) | VP Address<br>0x080000 ~ 0x08FFFF:VP_N16 Address<br>0x020000 ~ 0x02FFFF:VP_N32 Address<br>0x030000 ~ 0x03FFFF:VP_N64 Address<br>0x000000 ~ 0x01FFFF:VP_STR Address |
| 4 <sup>th</sup> |         | Addr2       |                                                                                                                                                                    |
| 5 <sup>th</sup> |         | Addr1       |                                                                                                                                                                    |
| 6 <sup>th</sup> |         | Addr0(LSB)  |                                                                                                                                                                    |
| 7 <sup>th</sup> | Data    | :           | No.of byte                                                                                                                                                         |
| :               |         | :           | VP_N16: 2byte                                                                                                                                                      |
| :               |         | :           | VP_N32: 4byte                                                                                                                                                      |
| :               |         | :           | VP_N64: 8byte                                                                                                                                                      |
| :               | Tail    | :           | VP_STR: string (with end mark ("'\0'(0x00)))                                                                                                                       |
| :               |         | 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:<br>0x00 = 1200bps<br>0x01 = 2400bps<br>0x02 = 4800bps<br>0x03 = 9600bps<br>0x04 = 19200bps<br>0x05 = 38400bps<br>0x06 = 57600bps<br>0x07 = 115200bps |
| 7   | sys_par1            | Bit7 = 0: Touch panel function disable<br>Bit7 = 1: Touch panel functions enable (*3)(default)<br>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_par1 Bit7 | Sys_par1 Bit1 | Sys_par1 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<br>0: System execute the default project "THMT"<br>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<br>(0x0000: disable screen saver function) (*2)                                                                                    |
| 3   | Time1l              |                                                                                                                                                                                     |
| 4   | PWM_LE              | PWM_LE = 0 ~ 0x3F (default 0x19 in dim down),<br>the backlight dimmed level in screen saving mode (*2)<br>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<br>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.<br>0xFF = buzzer infinite loop                                                       |
| 3   | T1                  | Buzzer play time 1<br>Range: 0x00 ~ 0xFF (0~25.5s)(unit 100ms)                                                       |
| 4   | T2                  | Buzzer play time 2<br>Range: 0x00 ~ 0xFF (0~25.5s)(unit 100ms)                                                       |
| 5   | Freq1               | T1 time Buzzer frequency, Unit 100 Hz<br>Ranges: 0x05 ~ 0x32 (500Hz ~ 5KHz)<br>0x00 = T1 time period buzzer turn off |
| 6   | Freq2               | T2 time Buzzer frequency, Unit 100 Hz<br>Ranges: 0x05 ~ 0x32 (500Hz ~ 5KHz)<br>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<br>Address range =0x00000 ~ 0x03FFFF |
| 3   | Address2            |                                                                           |
| 4   | Address1            |                                                                           |
| 5   | Address0(LSB)       |                                                                           |
| 6   | Data_Lengthh        | The no. of data byte to write.<br>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<br>Address range =0x00000 ~ 0x03FFFF |
| 3   | Address2            |                                                                           |
| 4   | Address1            |                                                                           |
| 5   | Address0(LSB)       |                                                                           |
| 6   | Data_Lengthh        | The no. of data byte to read<br>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                |
|-----------------|---------|-------------|-----------------------------|
| 1 <sup>st</sup> | Header  | 0xAA        | Communication packet header |
| 2 <sup>nd</sup> | Command | 0x91        | Command executed            |
| 3 <sup>rd</sup> | 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<br>Address range = 0x00000 ~ 0x03FFFF |
| 3   | Address2            |                                                                            |
| 4   | Address1            |                                                                            |
| 5   | Address0(LSB)       |                                                                            |
| 6   | Data_Lengthh        | The no. of data byte to read<br>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                |
|-----------------|---------|-------------|-----------------------------|
| 1 <sup>st</sup> | Header  | 0xAA        | Communication packet header |
| 2 <sup>nd</sup> | Command | 0x93        | Command executed            |
| 3 <sup>rd</sup> | 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                                   |
|------------------|---------|-------------|------------------------------------------------|
| 1 <sup>st</sup>  | Header  | 0xAA        | Communication packet header                    |
| 2 <sup>nd</sup>  | Command | 0x9B        | Command executed                               |
| 3 <sup>rd</sup>  | Date    | Year        | Year: 00~99 (00=year 2000) (8bit binary value) |
| 4 <sup>th</sup>  |         | Month       | Month: 01~12 (8bit binary value)               |
| 5 <sup>th</sup>  |         | Day         | Day: 01~31 (8bit binary value)                 |
| 6 <sup>th</sup>  | Time    | Hour        | Hour 00~23 (24hr format)(8bit binary value)    |
| 7 <sup>th</sup>  |         | Minute      | Minutes 00~59 (8bit binary value)              |
| 8 <sup>th</sup>  |         | Second      | Second 00~59 (8bit binary value)               |
| 9 <sup>th</sup>  | Tail    | 0xCC        | Communication packet tail                      |
| 10 <sup>th</sup> |         | 0x33        |                                                |
| 11 <sup>th</sup> |         | 0xC3        |                                                |
| 12 <sup>th</sup> |         | 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) |
| 3   | Month               | Month = 00~12             |
| 4   | Date                | Date = 00~31              |
| 5   | Hour                | Hour = 00~23              |
| 6   | Minute              | Minute = 00~59            |
| 7   | Second              | Second = 00~59            |

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.                                          |
| 2   | 0x55                | All the files (include the security lock file) will be erased. |
| 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<br>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)                                           |
| 3   | Addr2               |                                                                                                                 |
| 4   | Addr1               | VP_N32 Address = 0x020000 ~ 0x02FFFF (should be aligned every 4 byte)                                           |
| 5   | Addr0(LSB)          |                                                                                                                 |
| 6   | Length              | VP_N64 Address = 0x030000 ~ 0x03FFFF (should be aligned every 8 byte)                                           |
| 7   | Data 1(MSB)         | The number of data to write (Length = 1~255)                                                                    |
| 8   | Data 2              | the value to write<br>No. of byte of Data:<br>VP_N16 = Length *2,<br>VP_N32 = Length *4,<br>VP_N64 = Length *8, |
| 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) |
| 3   | Addr2               |                                                                       |
| 4   | Addr1               | VP_N32 Address = 0x020000 ~ 0x02FFFF (should be aligned every 4 byte) |
| 5   | Addr0(LSB)          |                                                                       |
| 6   | Length              | VP_N64 Address = 0x030000 ~ 0x03FFFF (should be aligned every 8 byte) |
| 7   | 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                                                                                                                 |
|---------------------|---------|-------------|------------------------------------------------------------------------------------------------------------------------------|
| 1 <sup>st</sup>     | Header  | 0xAA        | Communication packet header                                                                                                  |
| 2 <sup>nd</sup>     | Command | 0x83        | Command executed                                                                                                             |
| 3 <sup>rd</sup>     | VP_ADD  | Addr3(MSB)  | VP Address<br>0x080000 ~ 0x08FFFF:VP_N16 Address<br>0x020000 ~ 0x02FFFF:VP_N32 Address<br>0x030000 ~ 0x03FFFF:VP_N64 Address |
| 4 <sup>th</sup>     |         | Addr2       |                                                                                                                              |
| 5 <sup>th</sup>     |         | Addr1       |                                                                                                                              |
| 6 <sup>th</sup>     |         | Addr0(LSB)  |                                                                                                                              |
| 7 <sup>th</sup>     | Length  | NO.         | No. of data                                                                                                                  |
| 8 <sup>th</sup>     | Data    | Data n(MSB) | No. of byte of Data:<br>VP_N16 = Length *2,<br>VP_N32 = Length *4,<br>VP_N64 = Length *8,                                    |
| :                   |         | :           |                                                                                                                              |
| :                   |         | :           |                                                                                                                              |
| (n-1) <sup>th</sup> |         | Data1       |                                                                                                                              |
| n <sup>th</sup>     |         | Data0(LSB)  |                                                                                                                              |
| (n+1) <sup>th</sup> | Tail    | 0xCC        | Communication packet tail                                                                                                    |
| (n+2) <sup>th</sup> |         | 0x33        |                                                                                                                              |
| (n+3) <sup>th</sup> |         | 0xC3        |                                                                                                                              |
| (n+4) <sup>th</sup> |         | 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<br>Address range = 0x000000 ~ 0x3FFFFFF                                                                                          |
| 4   | Addr2               |                                                                                                                                                                    |
| 5   | Addr1               |                                                                                                                                                                    |
| 6   | Addr0(LSB)          |                                                                                                                                                                    |
| 7   | VP Addr3(MSB)       | VP Address<br>0x080000 ~ 0x08FFFF:VP_N16 Address<br>0x020000 ~ 0x02FFFF:VP_N32 Address<br>0x030000 ~ 0x03FFFF:VP_N64 Address<br>0x000000 ~ 0x01FFFF:VP_STR Address |
| 8   | VP Addr2            |                                                                                                                                                                    |
| 9   | VP Addr1            |                                                                                                                                                                    |
| 10  | VP Addr0(LSB)       |                                                                                                                                                                    |
| 11  | VP_Lengthh          | The no. of VP                                                                                                                                                      |
| 12  | VP_Lengthl          | VP_Length = 0x0001 ~ 0x8000                                                                                                                                        |

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 .<br>Address range = 0x000000 ~ 0x3FFFFFF                                                                                      |
| 4   | Addr2               |                                                                                                                                                                    |
| 5   | Addr1               |                                                                                                                                                                    |
| 6   | Addr0(LSB)          |                                                                                                                                                                    |
| 7   | VP Addr3(MSB)       | VP Address<br>0x080000 ~ 0x08FFFF:VP_N16 Address<br>0x020000 ~ 0x02FFFF:VP_N32 Address<br>0x030000 ~ 0x03FFFF:VP_N64 Address<br>0x000000 ~ 0x01FFFF:VP_STR Address |
| 8   | VP Addr2            |                                                                                                                                                                    |
| 9   | VP Addr1            |                                                                                                                                                                    |
| 10  | VP Addr0(LSB)       |                                                                                                                                                                    |
| 11  | VP_Lengthh          | The no. of VP                                                                                                                                                      |
| 12  | VP_Lengthl          | VP_Length = 0x0001 ~ 0x8000                                                                                                                                        |

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<br>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<br>(in communication packet structure)        | →    | Instruct to wait for data....                                          |
| Raw 1bpp image data<br>(without communication packet structure) | →    | Store the data into VP_BP1                                             |
|                                                                 | ←    | Response code ">" in ASCII<br>(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<br>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<br>(in communication packet structure)               | →    | Instruct to wait for data....                                          |
| compressed 1bpp image data<br>(without communication packet structure) | →    | Store the data into VP_BP1                                             |
|                                                                        | ←    | Response code ">" in ASCII<br>(without communication packet structure) |

## 4.4.7 G16\_write ( 0x4D )

| Seq | 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<br>(*2, *3)                  |
| 7   | Sizel               |                                                    |
| 8   | Data(MSB)           | 16 bit data array<br>(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<br>(*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<br>:<br>Address = 0FFFFFFF |
| 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<br>:<br>Address = 0FFFFFFF |
| 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                                  |
|------------------|---------|-------------|-----------------------------------------------|
| 1 <sup>st</sup>  | Header  | 0xAA        | Communication packet header                   |
| 2 <sup>nd</sup>  | Command | 0x3C        | Command executed                              |
| 3 <sup>rd</sup>  | Address | Addr3(MSB)  | Address = 0xFFFF00<br>:<br>Address = 0FFFFFFF |
| 4 <sup>th</sup>  |         | Addr2       |                                               |
| 5 <sup>th</sup>  |         | Addr1       |                                               |
| 6 <sup>th</sup>  |         | Addr0(LSB)  |                                               |
| 7 <sup>th</sup>  | Data    | Data(1Byte) | the value of the register                     |
| 8 <sup>th</sup>  | Tail    | 0xCC        | Communication packet tail                     |
| 9 <sup>th</sup>  |         | 0x33        |                                               |
| 10 <sup>th</sup> |         | 0xC3        |                                               |
| 11 <sup>th</sup> |         | 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<br>(each VP_STR = 128 bytes)<br>(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<br>(each VP_STR = 128 bytes)<br>(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                |
|-----------------|-------------|-------------|-----------------------------|
| 1 <sup>st</sup> | Header      | 0xAA        | Communication packet header |
| 2 <sup>nd</sup> | Command     | 0x43        | Command executed            |
| 3 <sup>rd</sup> | 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)          | the VP_STR Address = 0x00000 ~ 0x01FFFF<br>(each VP_STR = 128 bytes)<br>(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<br>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<br>(each VP_N16 = 2 byte)<br>(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<br>(each VP_N16 = 2 byte)<br>(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                |
|-----------------|-----------|-------------|-----------------------------|
| 1 <sup>st</sup> | Header    | 0xAA        | Communication packet header |
| 2 <sup>nd</sup> | Command   | 0x3E        | Command executed            |
| 3 <sup>rd</sup> | N16 value | Data1(MSB)  | 16 bit value                |
| 4 <sup>th</sup> |           | Data0(LSB)  |                             |
| 5 <sup>th</sup> | Tail      | 0xCC        | Communication packet tail   |
| 6 <sup>th</sup> |           | 0x33        |                             |
| 7 <sup>th</sup> |           | 0xC3        |                             |
| 8 <sup>th</sup> |           | 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<br>(each VP_N16 = 2 byte)<br>(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<br>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<br>(each VP_N32 = 4 byte)<br>(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)          |                                                                                                          |

Note.

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

## 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<br>(each VP_N32 = 4 byte)<br>(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                |
|------------------|-----------|-------------|-----------------------------|
| 1 <sup>st</sup>  | Header    | 0xAA        | Communication packet header |
| 2 <sup>nd</sup>  | Command   | 0x45        | Command executed            |
| 3 <sup>rd</sup>  | N32 value | Data3(MSB)  | 32 bit value                |
| 4 <sup>th</sup>  |           | Data2       |                             |
| 5 <sup>th</sup>  |           | Data1       |                             |
| 6 <sup>th</sup>  |           | Data0(LSB)  |                             |
| 7 <sup>th</sup>  | Tail      | 0xCC        | Communication packet tail   |
| 8 <sup>th</sup>  |           | 0x33        |                             |
| 9 <sup>th</sup>  |           | 0xC3        |                             |
| 10 <sup>th</sup> |           | 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<br>(each VP_N32 = 4 byte)<br>(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<br>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<br>(each VP_N64 = 8 byte)<br>(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<br>(each VP_N64 = 8 byte)<br>(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                |
|------------------|-----------|-------------|-----------------------------|
| 1 <sup>st</sup>  | Header    | 0xAA        | Communication packet header |
| 2 <sup>nd</sup>  | Command   | 0x49        | Command executed            |
| 3 <sup>rd</sup>  | N64 value | Data7(MSB)  | 64 bit value                |
| 4 <sup>th</sup>  |           | Data6       |                             |
| :                |           | :           |                             |
| :                |           | :           |                             |
| 9 <sup>th</sup>  |           | Data1       |                             |
| 10 <sup>th</sup> |           | Data0(LSB)  |                             |
| 11 <sup>th</sup> | Tail      | 0xCC        | Communication packet tail   |
| 12 <sup>th</sup> |           | 0x33        |                             |
| 13 <sup>th</sup> |           | 0xC3        |                             |
| 14 <sup>th</sup> |           | 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<br>(each VP_N64 = 8 byte)<br>(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<br>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
481,0x0440,

0xcc01,0x0cc0,0xd80,0xcd41,0xf00,0xfc1,0xce81,0xe40,0xa00,0xcac1,0xcb81,0xb40,0xc901,0x09c0,0x0
880,0xc841,

0xd801,0x18c0,0x1980,0xd941,0xb00,0xdbc1,0xda81,0x1a40,0x1e00,0xdec1,0xdf81,0x1f40,0xdd01,0x1dc0,0x1
c80,0xdc41,

0x1400,0xd4c1,0xd581,0x1540,0xd701,0x17c0,0x1680,0xd641,0xd201,0x12c0,0x1380,0xd341,0x1100,0xd1c1,0xd
081,0x1040,

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
881,0x3840,

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
881,0x6840,

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,

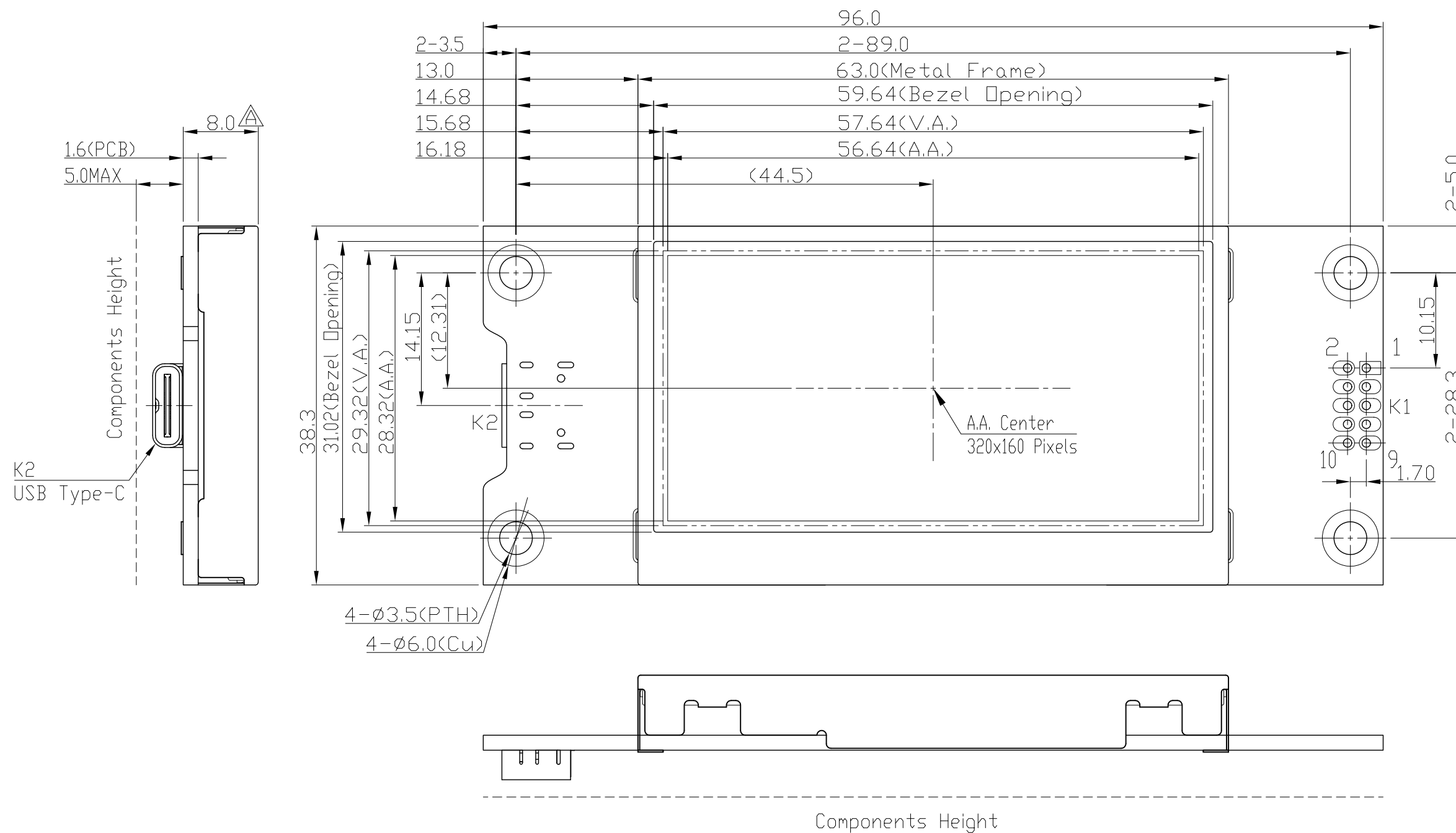
0x5000,0x90c1,0x9181,0x5140,0x9301,0x53c0,0x5280,0x9241,0x9601,0x56c0,0x5780,0x9741,0x5500,0x95c1,0x9
481,0x5440,

0x9c01,0x5cc0,0x5d80,0x9d41,0x5f00,0x9fc1,0x9e81,0x5e40,0x5a00,0x9ac1,0x9b81,0x5b40,0x9901,0x59c0,0x5
880,0x9841,

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
081,0x4040,
};

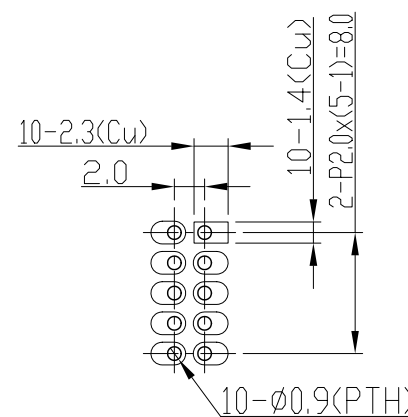
static __inline uint16_t rshiftul6(uint16_t value, int nb)
{
    return (uint16_t)((value >> nb) & ~((( uint16_t) 0x8000) >> (nb-1)));
}
uint16_t crc16_calc(unsigned char *q, int len)
{
    uint16_t crc = 0xffff;
    while (len-- > 0)
        crc=(rshiftul6(crc,8) ^ CRC16[(crc ^ *q++) & 0xff]);
    return crc;
}
```



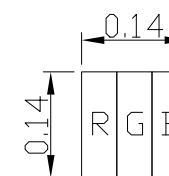
| Terminal K1 |           |      |
|-------------|-----------|------|
| No.         | Pin       | Name |
| 1           | VDD       |      |
| 2           | VDD       |      |
| 3           | VDD       |      |
| 4           | NC        |      |
| 5           | RX        |      |
| 6           | TX        |      |
| 7           | RTS(BUSY) |      |
| 8           | VSS       |      |
| 9           | VSS       |      |
| 10          | VSS       |      |

Note:

- \*1. LCD Display Type : TFT,Transmissive (Full View)
- \*2. Operating Voltage : 5.0V
- \*3. Backlight Color : White LEDs
- \*4. Pixel Arrangement : RGB-STRIFE
- \*5. Color Depth : 65k Colors
- \*6. Interface : K1 RS-232C , K2 USB Type-C
- \*7. Operating Temperature : -20°C~70°C
- \*8. Storage Temperature : -30°C~80°C



K1 Details  
Scale=2/1



Pixels Details  
Scale=100/1

|           |                       |                            |
|-----------|-----------------------|----------------------------|
| C         |                       |                            |
| B         |                       |                            |
| A         | Revise Thickness      | Qiu Shaoping<br>2021-12-15 |
| Rev       | Note                  | Date                       |
| Dwg Title | HMT025ATA Outline Dwg |                            |
| Dwg No.   | MK-007364a-1-1        | Date<br>2021-09-09         |
| Scale     | 2/1                   | Tol. ±0.3                  |
| Unit      | mm                    | Paper Size A3              |
| Approved  | Checked               | Drawn<br>Qiu Shaoping      |

**TOPWAY**