T5L_TA Instruction Set Development Guide

Catalog

1 Selection Guide

1.1 Naming Rule

E.g. DMT10768T080_A2WT

DM	The production line of DWIN smart LCMs.
T	Color: T=16bit(65K); G=24bit(16.7M)
10	Vertical resolution: 32=320; 48=480; 64=640; 80=800 85=854 10=1024 12=1280 13=1364 14=1440 19=1920
768	Horizontal resolution: 240=240; 480=480; 600=600; 720=720; 768=768; 800=800; 108=1080; 128=1280
T	Application Classification: M or L=Simple application grade C=Commercial grade T=industrial grade K=medical grade Q=automotive grade S=military grade F= Product integrates application solution platform.
080	Display size: 080= display the diagonal dimension of 8.0 inches
_	
A	Classification,O-Z,where A refers to DWIN smart LCMs based on DGUSII kernel.
2	Hardware serial number: 0-9, to distinguish between different hardware versions
W	N=Normal temperature W=Wide temperature
T	N=without touch panel TR=resistive touch panel TC=capacitive touch panel T=touch panel(distinguish touch panel categories by serial number)
Note 1	None=standard product, Z**=ODM product, ** ranges from 01-99.
Note 2	None=standard product, F*=extend FLASH（F1=1GB F2=2GB）

1.2 T5L Smart LCMs Selection Guide

Size	Model Number	Resolution	Remarks
3.5	DMG48320L035_01W	480*320	
3.5	DMG48320L035_03W	480*320	IPS
4.0	DMG80480L040_03W	800*480	IPS
4.3	DMG80480L043_03W	800*480	IPS
5.0	DMG80480L050_01W	800*480	
5.0	DMG85480L050_03W	854*480	IPS
7.0	DMG80480L070_01W	800*480	
7.0	DMG10600L070_03W	1024*600	IPS
8.0	DMG80600L080_01W	800*600	
8.0	DMG10768L080_03W	1024*768	IPS
10.1	DMG10600L101_03W	1024*600	IPS

2 Introduction

2.1 Kernel Versions Development Modes

Based on different resolutions, T5L includes two versions that are T5L1(supports at highest 1280*800, 24bit) and T5L2(supports at highest 1920*1080, 24bit), adopting 55nm process for T5L1 and 40nm process for T5L2.

Users can switch the developing modes as wish by downloading underlying kernel firmware program. Both of T5L1 and T5L2 can be developed through DGUS II or TA instruction set.

This document is only designed for TA instruction set. For DGUS II development mode, please check "T5L_DGUS II Application Development Guide."

T5L kernel versions	Development mode	PC software ver	Reference
T5L1	DGUS II	DGUS_V7.52	T5L_DGUSII Application Development Guide
	TA	Debugging toolbox for TA	T5L_TA Instruction Set Development Guide
T5L2	DGUS II	DGUS_V7.52	T5L_DGUSII Application Development Guide
	TA	Debugging toolbox for TA	T5L_TA Instruction Set Development Guide

2.2 Overview

Features of T5L ASIC serial instruction screen(TA):

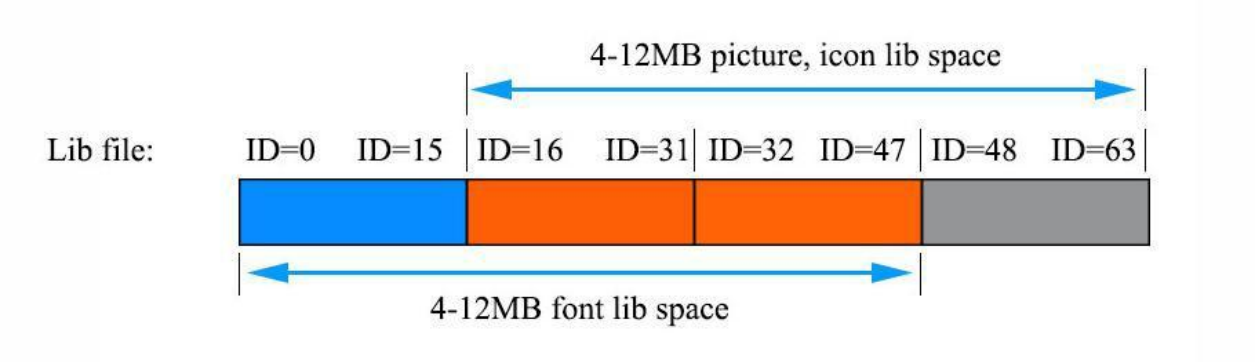
1) Low power consumption T5L dual core IC, main frequency of GUI and OS cores is 200MHz;
2) 24bit true color, support resolution of 1920*1080 at highest;
3) 16Mbytes low cost SPI Flash, support JPEG picture and icon compression storage;
4) Support SD/SDHC interface to download and upgrade;
5) Support basic drawing operation such as set-point, connection, and area filling;
6) Support basic UI display such as text, icon, picture, and QR code;
7) Images or icons can be designed as UI resolution, no need to match the fixed resolution of the screen. For example, the screen with a resolution of 800*480 can be set to rotate 90 degrees for vertical displaying and pictures with the resolution of 480*800 will match;
8) RTP screens support automatically touch bias check and dynamic calibration; extra calibration is optional;
9) OS core is open source to users for their customized development, including 4*UARTs, 20*IOs, 1*CAN, 2/6*12bit AD, 1*PWM, 64KbytesFlash, 320Kbytes RAM.

2.3 Flash Memory

16MB flash memory is divided into 64 fixed 256KB storage subspaces; profile ID ranges 0-63. Based on the contents of profiles, subspaces are defined into two parts:

4-12MB font lib space storing the font lib, icon lib, and configuration files;

4-12MB storage space for full screen background image file (ICL file).



Notice:

1) Background picture lib ID needs to be defined at 0x08 position in the system configuration profile, otherwise software will not read. Users shall use the DWIN ICL file generator to build icon libs and full screen background lib.
2) As for T5L1 platform, a single JPG picture of the ICL profile should not exceed 256Kbytes, while a single JPG picture of the ICL profile should not exceed 768Kbytes at T5L2 platform. Otherwise, picture will not show normally.
3) Original images exceeding this limitation will be compressed by DWIN ICL file generator, and this tool will warn users of images exceeding the limitation and users can lower the image quality to generate normally. Users can also view the attributes of the compressed images in the file naming icl***_derived_JPG.
4) After the screen is powered on, the picture 0 will be displayed by default, so the picture naming sequence starts from 0.

2.4 Download Files

SD/SDHC interface of T5L serial instruction set screen supports downloading and upgrading files as table shown below:

File types	Naming rule	Description		
Program	T5L_UI*.BIN T5L_OS*.BIN	The underlying kernel firmware application program. Users update selectively. As the software is constantly being upgraded, the kernel version may be different by time purchase, the higher is compatible with the lower.		
Font file(4-12MB)	Font ID+(optional) file name.bin/dzk.hzk(Font ID 0-47)	Example	Example description(The green part of the font library comes with the factory, and the user can also replace the factory pre-installed font library space for personal use.)	Memory
		0_DWIN_ASC.HZK	Factory pre-installed font library (Song typeface); ASCII font library uses DGUS 0#font library.	3011KB
		12*.BIN	Factory pre-installed font lib for QR code displaying.	173KB
		13*.BIN	Touch controls file	<256KB
		15_GB2312_32_song typeface.hzk	Factory pre-installed font library; used for 0x55 or 0x98 command to display 32*32 GB2312 character string.	1105KB
		20_GBK_12_songti.hzk	Factory pre-installed font library; used for 0x6E or 0x98 command to display 12*12 GBK character string.	562KB
		23_GBK_16_songti.hzk	Factory pre-installed font library; used for 0x54 or 0x98 command to display 16*16 GBK character string.	749KB
		26_GB2312_24_songti.hzk	Factory pre-installed font library; used for 0x6F or 0x98 command to display 24*24 GB2312 character string.	622KB
		29~47.BIN/DZK/HZK/ICL	If the factory pre-installed font is needed for other use, font position can be selected from 29~47.	
		16-48.ICL	Must be JPEG ICO file	

JEPG image, icon file (8-12MB)	Font ID+(optional) file name.ICL		format in DGUS III format. The 16-48 file is used to save the background image and must be defined in the .CFG configuration file.	Max:12 MB
		17-63	Borrow the font library space to store the icon library, and the size and name should not occupy the background image location.	
Hardware configuration file	T5LCFG*.CFG	Configure CRC check, modify baud rate, text back color restoration control, touch upload mode, display direction and etc.		

T5LCFG*.CFG hardware configuration file adopts binary-data format and can be edited using Ultra Edit and other software. The descriptions are shown in the table below:

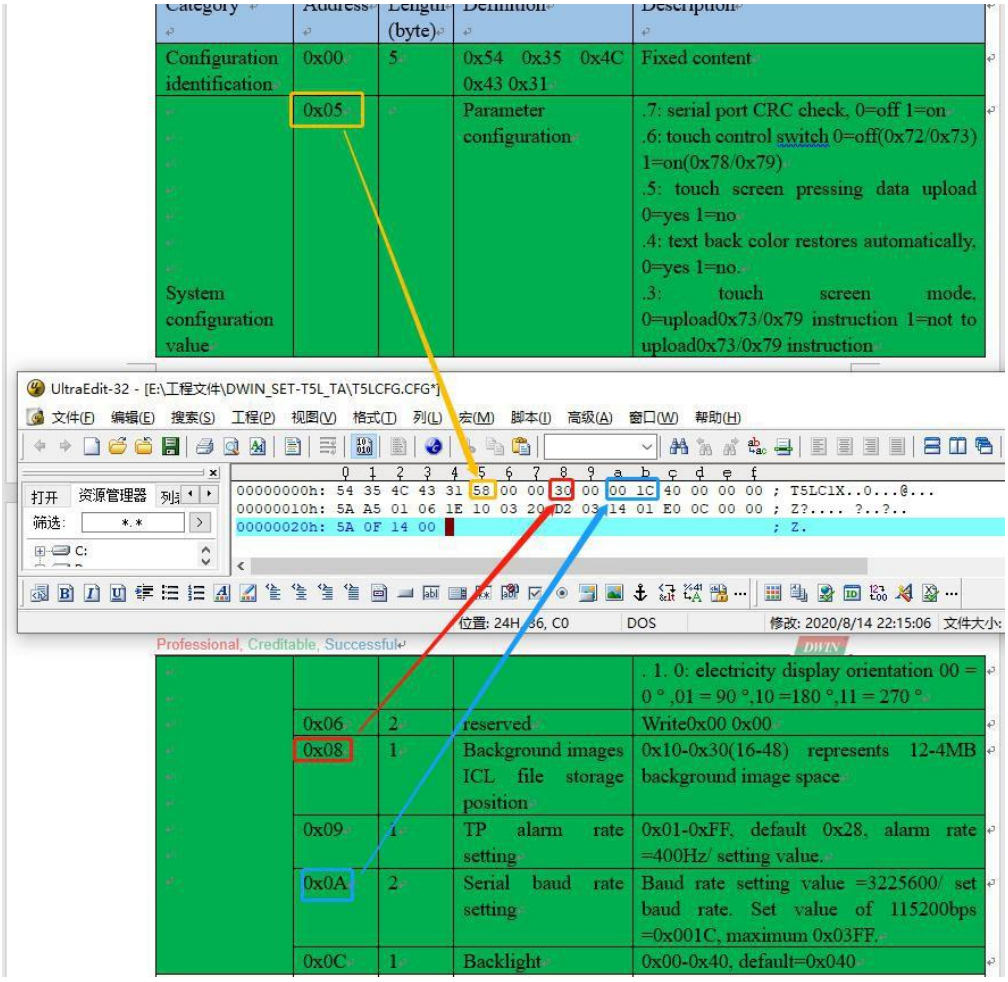
Category	Address	Length(byte)	Definition	Description
Configuration identification	0x00	5	0x54 0x35 0x4C 0x43 0x31	Fixed content
System configuration value	0x05	1	Parameter configuration	.7: UART CRC check 0=off 1=on; .6: Touch switch 0=off (0x72/0x73) 1=on (0x78/0x79); .5: touch screen pressing data upload 0=upload 1=no upload; . 4: background color recovery control for text display 1=automatic recovery 0=no automatic recovery; .3 touch screen mode selection 0=upload 73/79 instruction 1=not upload 73/79 instruction; .2 touch sound 0=on 1=off; .1-.0: display direction 00=0° 01=90°
	0x06	2	Parameter configuration2	.7: When parameter configuration 1.4=1 0=background image 1=color. .6-.0: undefined, write 0.
	0x08	1	Background images ICL file storage position	0x10-0x30(16-48) represents 12-4MB background image space
	0x09	1	TP alarm rate setting	0x01-0xFF, default 0x28, alarm rate =400Hz/ setting value.
	0x0A	2	Serial baud rate setting	Baud rate setting value =3225600/ set baud rate. Set value of 115200bps =0x001C, maximum 0x03FF.

	0x0C	1	Backlight brightness	0x00-0x40, default=0x040
System reserved	0x0D	3	Reserved	Write 0x00
Display configuration	0x10	2	Display_Config_En	0x5AA5=display configuration is valid, factory configured, ,extra configuration is not needed.
	0x12	1	PCLK_PHS	Data latching phase setting: 0x00=PCLK descending edge 0x01=PCLK ascending edge.
	0x13	1	PCLK_DIV	Pixel clock PCLK frequency setting, PCLK frequency (MHz) =206.4/PCLK_DIV.
	0x14	1	H_W	Horizontal (X direction) resolution
	0x15	1	H_S	
	0x16	2	H_D	
	0x18	1	H_E	
	0x19	1	H_W	
	0x1A	1	V_S	Vertical (Y direction) resolution
	0x1B	2	V_D	
	0x1D	1	V_E	
	0x1E	1	TCON_SEL	0x00=no need to configure TCON
TP configuration	0x1F	1	Reserved	Write 0x00
	0x20	1	TP_SET_EN	0x5A= display configuration is valid, factory configured, extra configuration is not needed.
	0x21	1	TP_MODE	TP mode configuration. .7-.4(high 4bit), Select the TP type: 0x0*=Resistance Touch 0x1*=GT911, GT9271, GT9110 drive IC capacitive TP 0x2*=ILI9881H In-cell CTP .3 RTP test: 0= off 1= on, enabled only when SD is downloaded. .2-.0 (low 4bit), select TP mode: .2 X axis data selection: 0=0 to Xmax 1=Xmax to 0; .1 Y axis data selection: 0=0 to Ymax 1=Ymax to 0; .0 XY swap: 0=XY 1=YX. (7-inch RTP is 0x07; 8-inch RTP is 0x05; RTP is 0x03)
	0x22	1	TP_Sense	TP sensitivity setting: 0x00-0x1F, 0x00 lowest, 0x1F highest. Default: 0x14, with high sensitivity.(ILI9881

				is 0x01-0x06). Set to 0xFF will not configure touch (use hardware initial value).
	0x23	1	TP_Freq	Frequency range selection, ILI9881H applicable, 0x01-0x14 is fixed frequency, 0x00 frequency hopping.
	0x24	1	CKO_Set_En	0x5A indicates that this configuration is valid.
RTC configuration	0x25	1	CKO_En	Set 0x5A to enable the CKO(P3.0) clock output function, otherwise it is off.
	0x26	1	CKO_DIV	CKO output clock setting, output clock frequency = 825.7536/CKO_DIV MHz.

Note that the parameters in the green background section must be configured, picture below is an example of CFG file based on model DMG80480L070_01W:

(.6 touch control switch set 1; touch panel mode set 1; text back color restoration set 1; baud rate set 115200bps); (0x10h line and 0x20h line was already set, users write 0x00 on these two lines and system will work as well.)



2.5 Display Configuration Reference

Size_resolution	T5L_SET.CFG display configuration value(HEX format）													
	0x12	**0x13**	**0x14**	**0x15**	**0x16**	**0x17**	**0x18**	**0x19**	**0x1A**	**0x1B**	**0x1C**	**0x1D**	**0x1E**	**0x1F**
2.0_240*320 IPS	01	26	0A	14	00	F0	0A	02	02	01	40	02	11	00
2.4_240*320（IPS）	01	26	0A	14	00	F0	0A	02	02	01	40	02	0D	00
2.4_240*320	01	26	0A	14	00	F0	0A	02	02	01	40	02	05	00
2.8_240*320A	01	26	0A	14	00	F0	0A	02	02	01	40	02	03	00
2.8_240*320B	01	20	10	20	00	F0	20	02	0E	01	40	08	01	00
3.5_320*240	01	1C	1E	14	01	40	40	03	0F	00	F0	10	02	00
3.5_320*480	01	14	0A	04	01	40	0A	02	02	01	E0	02	04	00
3.5_320*480（IPS）	01	14	0A	04	01	40	0A	02	02	01	E0	02	06	00
3.5_480*640	01	0A	10	20	01	E0	20	02	03	02	80	02	07	00
4.0_480*480（IPS）	00	0E	08	08	01	E0	08	02	0C	01	E0	06	08	00
4.0_480*800（IPS）	00	08	08	08	01	E0	08	04	0A	03	20	0A	09	00
4.0_720*720（IPS In-cell）	00	03	70	B4	02	D0	B4	02	14	02	D0	DC	0A	00
5.0_720*1280（IPS In-cell）	00	03	04	14	02	D0	14	02	12	05	00	C8	0A	00
5.0_480*854（IPS）	00	08	08	08	01	E0	08	02	0C	03	56	06	0C	00
4.3_480*800 IPS	00	08	04	0C	01	E0	08	04	13	03	20	08	0E	00
3.0_360*640 IPS	00	0A	20	3C	01	68	20	06	36	02	80	08	0F	00
1920*1080eDP	01	03	20	20	05	54	62	06	08	03	00	08	10	00
1920*1080eDP	00	02	32	48	08	80	A0	06	03	04	38	28	12	00
480*272	01	16	29	02	01	E0	02	0A	02	01	10	02	00	00
640*480	01	08	1E	72	02	58	10	03	20	01	E0	0A	00	00
800*480	01	06	1E	10	03	20	D2	03	14	01	E0	0C	00	00
800*600	01	05	1E	10	03	20	D2	03	14	02	58	0C	00	00
1024*600	01	04	A0	88	04	00	18	06	1D	02	58	03	00	00
1024*768	01	04	10	40	04	00	20	04	08	03	00	04	00	00
1280*720	01	03	10	40	05	00	20	08	20	02	D0	20	00	00
1280*800	01	03	10	1C	05	00	10	08	10	03	20	10	00	00
1366*768	01	03	10	20	05	54	20	06	10	03	00	08	00	00
1024*768 VGA	00	03	88	A0	04	00	18	06	1D	03	00	03	00	00
1280*800 VGA	00	03	80	C8	05	00	48	06	16	03	20	03	00	00
1280*960 VGA	00	02	A0	E0	05	00	40	03	2F	03	C0	01	00	00
1600*900 VGA	00	02	20	50	06	40	30	05	12	03	84	03	00	00

3 Hardware Interface Definition

3.1 Communication/Power Interface

			Socket type		
			CN1 PIN	CN2 PIN	CN3 PIN
VCC	P	Power Supply Input	1, 2	1, 2, 3	1
TX4	O	Serial 4 Output	3	4	2
TX2		Serial 2 Output	4	5	3
RX2	I	Serial 2 Input	5	6	4
RX4	I	Serial 4	6	7	5
GND	P	Input	7, 8	8, 9, 10	6

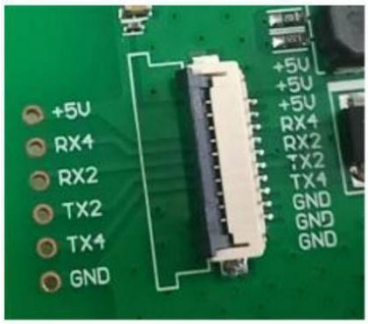
Remarks:

1. I: Input, O: Output, P: Power
2. PCB pins of the same defined pins have been connected in parallel

   CN1: 8Pin_2.0mm spacing SMT socket

   CN2: 10Pin_1.0mm spacing SMT FPC socket

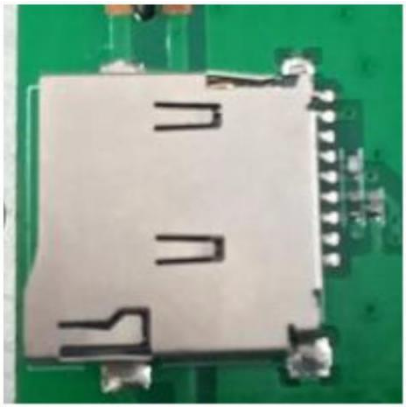
   CN3: Some models retain 8Pin 2.54mm spacing SMT through-hole pads
3. Some models adopt TTL/RS232 compatible interface, users can use 0 -ohm resistance or solder to directly short circuit, RS232=0(short circuit): TTL level input; RS232=1(disconnected): RS232 level.
4. TX4, RX4 serial instruction set mode is not temporarily open for users.



3.2 SD/TF Card Interface

Use 10PIN PUSH-PUSH self-elastic Micro SD (TF) card socket.

Copying the underlying kernel firmware, icons, fonts, music files, etc. from the SD card to the FLASH inside the serial screen terminal is supported.



3.3 Audio Interface

2Pin 2.0mm spacing socket. It is recommended that users can choose a speaker with a power of 8Ω 5W, and the socket does not need to distinguish between positive and negative poles.

4 Quick Start

4.1 Development Process

1. Function planning and interface designing: According to the demand, artists make exquisite pictures; use drawing software to make interfaces, icons, fonts, button formats, etc. Ensure that the display effect on the screen is consistent with the design effect.
2. Touch controls configuration (screens without touch panel, users can ignore this step): Users can use PC developing software to set the parameter of touch controls on the pages and generate the touch control file.
3. Testing and modifying: Download via SD card, put the pictures, ICL icon files, font files, etc. on the SD card to download to the screen for debugging and modifying.
4. Finalizing: after debugging and modifying, users need to download configuration files, pictures, fonts, icon libraries and related files to an SD card or U disk for mass production.

4.2 Software Installation

This section explains how to install the operating environment of the PC software DWToolBox.exe.

The PC software program needs .NET Framework support (that is, the .NET runtime library). If users unzip the "DW Toolbox (support T5L instruction set).rar." file package, double-click to open the "DWToolBox.exe" and the program cannot open normally, then users need to install .NET Framework. If users can open "DWToolBox.exe" normally, there is no need to install the operating environment.

4.2.1 Installation Environment

Operating system: Windows XP/ Windows Vista/Windows 7/Windows 8/Windows 10

Systems of 32-bit and 64-bit require different drive programs for running DWToolBox.exe. Users can download the drive program on DWIN' s website according to the system edition: x64 OS install DotNetFx2.0(0x64).exe; 0x32 OS install DotNetFx2.0(0x86).exe.

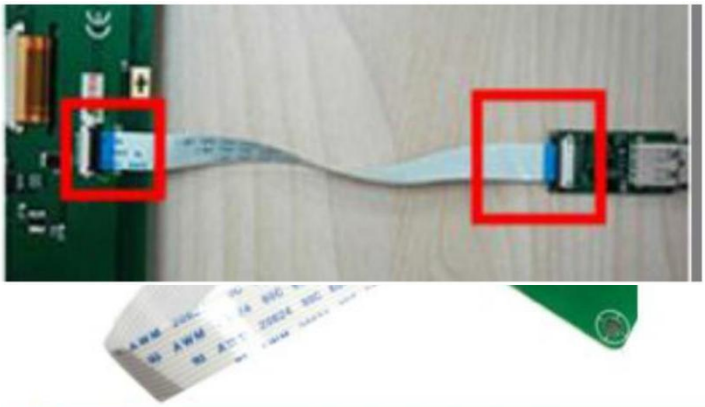
After completing installation of drive, users can unzip DW Toolbox or Terminal Assistant v6.*.exe(support T5L instruction set).rar and double click to run the DWToolBox.exe or Terminal Assistant v6.*.exe.

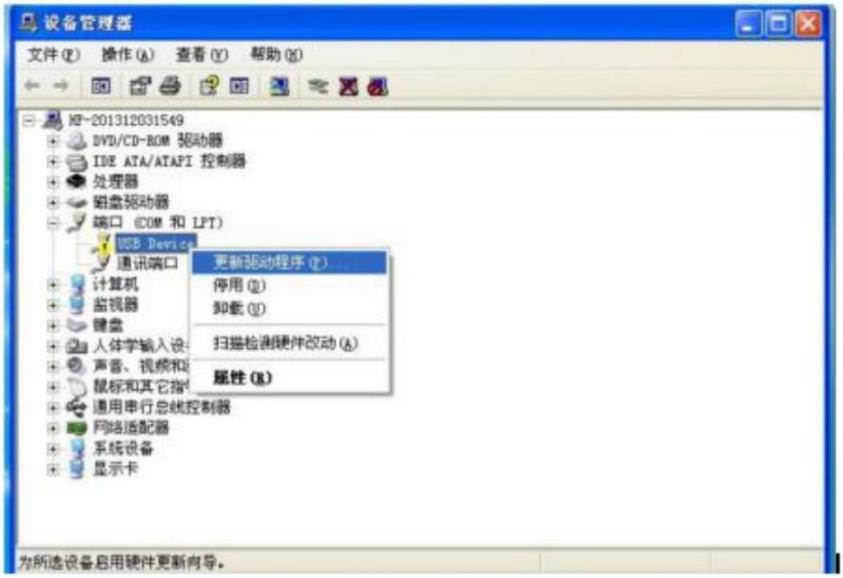
4.3 Hardware Interface and Debugging

4.3.1 Connect Screen to the Computer

A. 10 pin 1.0 mm FCC interface

Users need to connect one end of the FPC flexible cable to the terminal block of the serial screen, and the other end to the DWIN HLD662B adapter board (optional accessory), the XR21V1410XR1410 chip USB driver needs to be installed.





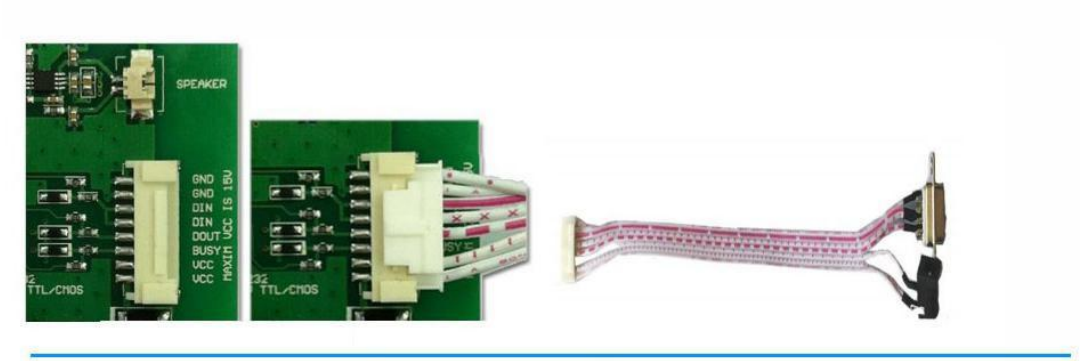
Run the Device Manager and right click the USB Device to update driver.

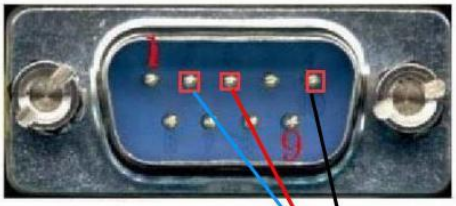
The HDL662B adapter board is a small board for USB to TTL communication and power supply. Please note that the blue end of the cable must be upward (as picture shown below); please short the PWR jumper cap on the USB adapter board. (If the screen is not lit, please check the power supply of the dual-male USB cable. For example, some USB cables may be too thin to supply power to the screen, causing a flickering or black screen.)

B. 8Pin_2.0mm spacing SMT socket

Users can select 8Pin_2.0mm cable(HDL65011) with DB9 and power interface, with length of20cm.

After powering on the screen, the other end performs RS232 communication with the DB9 head of the computer. In order to increase the baud rate and make it easier to connect to the PC for debugging, the screen of this interface is generally designed with a TTL/RS232 compatible interface, and the communication distance should not exceed 50cm.





Pin	Shorthand	Significance
Pin1	CD	Carrier detect
Pin2	RXD	Receive
Pin3	TXD	Transmit
Pin4	DTR	Data terminal preparation
Pin5	GND	Ground
Pin6	DSR	Data ready
Pin7	RTS	Request send
Pin8	CTS	Clear send
Pin9	RI	Ringing indication

RXD receive data: terminal to computer

TXD text data: computer to terminal

GND: ground

4.4 Software Operating

4.4.1 Software Version

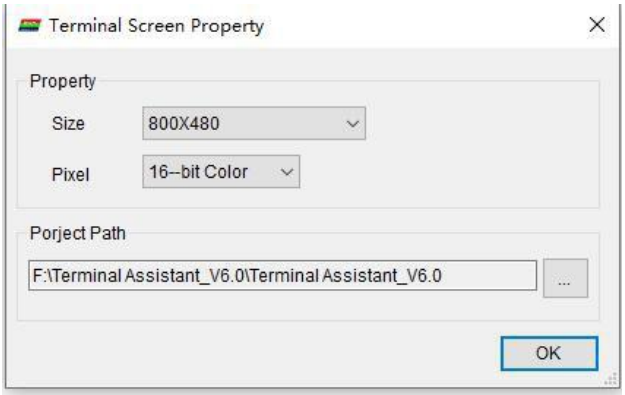
Some functions of this software, such as touch calibration, picture download, font download, SD configuration, configuration file download, etc. do not support on T5L_TA instruction set screen temporarily. This document main explain:

1. Configuration of 13.bin touch control file
2. Generation of ICL file

4.4.2 Run the Software

1. Double click to run DWToolBox.exe as picture shown below:

2. Click Terminal Assistant or download DWIN Terminal Assistant_v6.*.exe from DWIN' s website to run on. Window below will pop up:

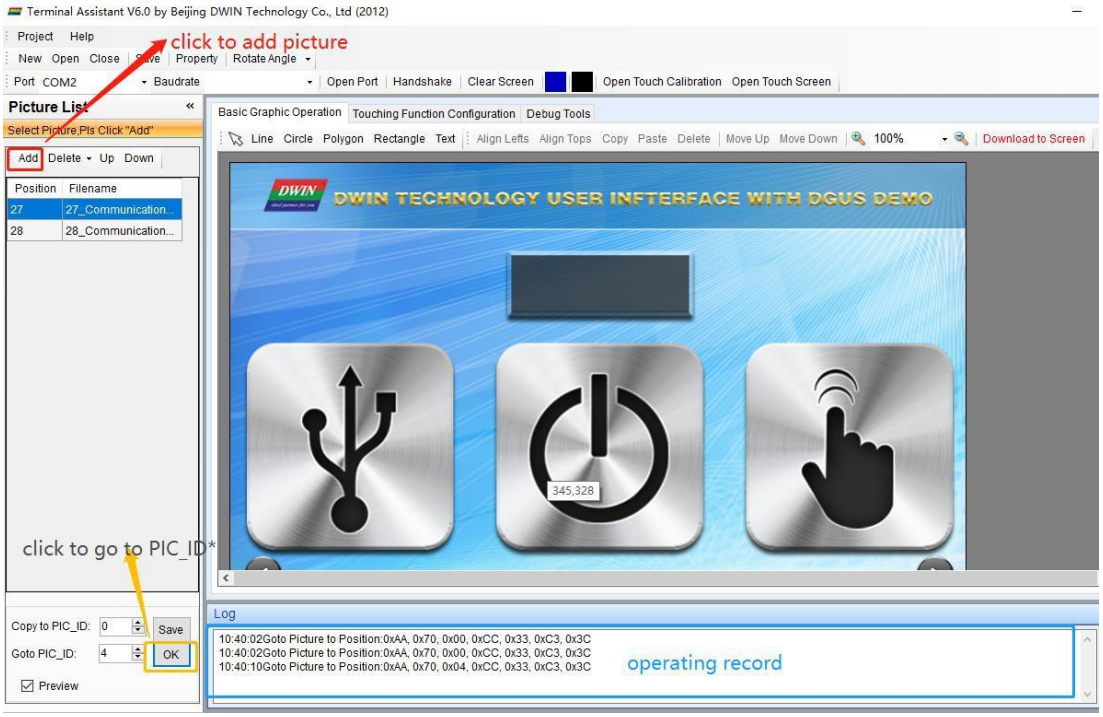


If the user cannot find the resolution of his model, he can open the Config folder in the software directory, open the Terminal.ini file in Notepad, and modify one of the resolutions under [Resolution], for example, R1=480X480.

3. After setting the storage path (for example, the new folder 2 shown on the desktop), click OK to enter the main interface. If there is a previously used project in the storage path, the system will automatically open the project file and read the size and pixels set in the project file for processing.

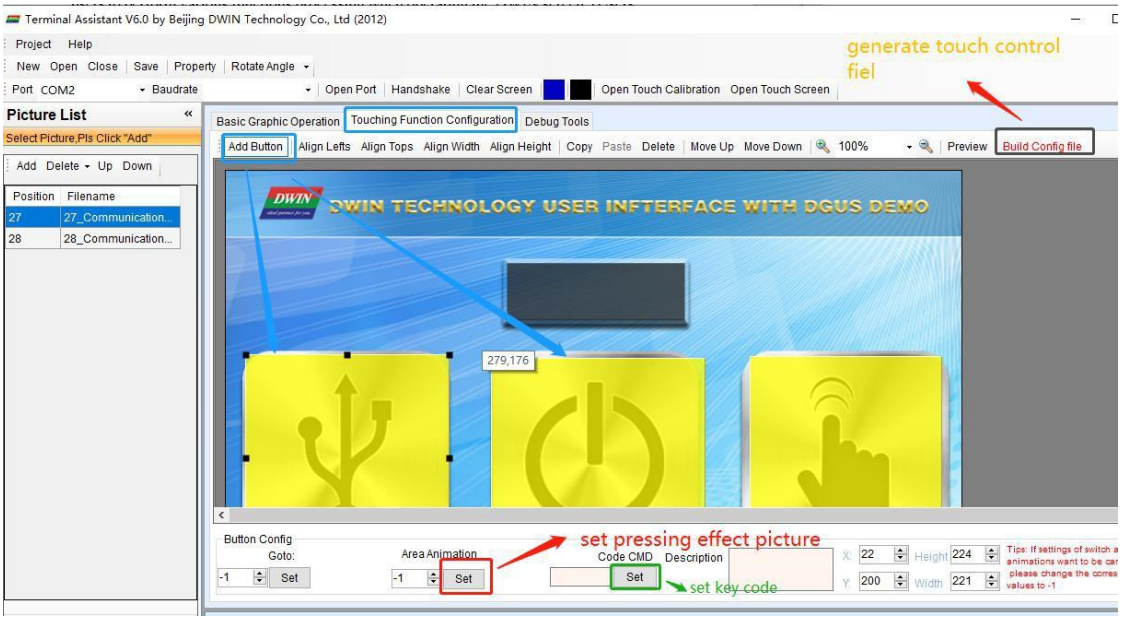
4.4.3 Add Pictures

Click the Add button to add the picture to the project. (When adding pictures, the software will copy the picture files to the \image folder in the project directory.)



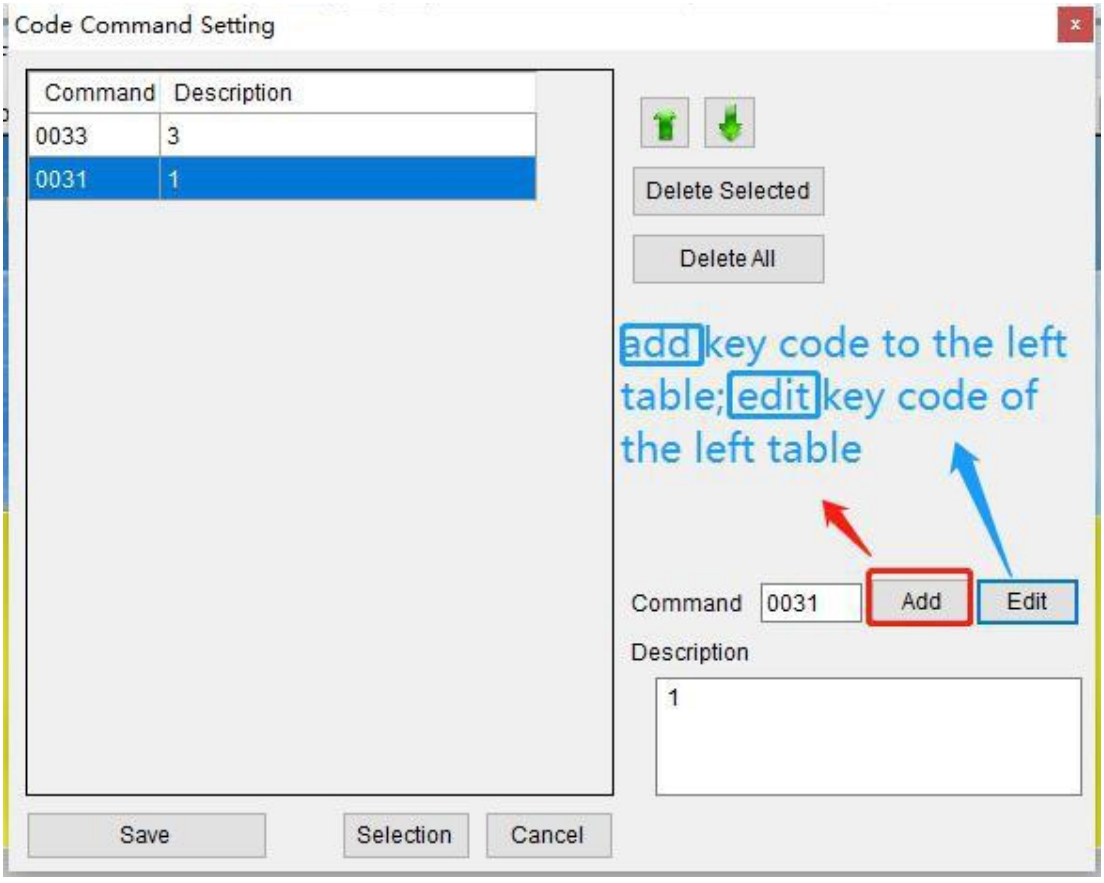
4.4.4 Touch Control File

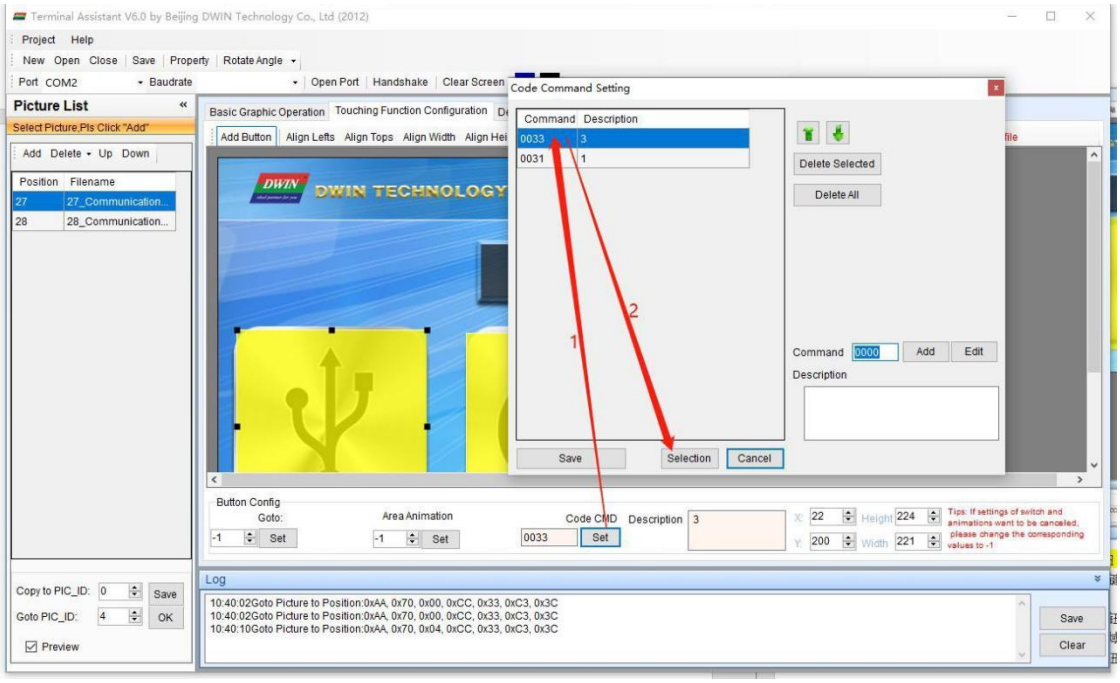
The touch area can be set for the touch button of the picture, which is convenient for users to perform various functions processing when operating the DWIN screen. (Users can switch to the touch adding window by clicking the "touch configuration" button shown in the figure below after opening the debugging assistant.)



4.4.5 Operation Overview and Precautions

1. Designing touch controls: After dragging an area, users can click the right mouse button to cancel the touch control, and after selecting the touch with the left button, users can click Delete on the keyboard to delete.

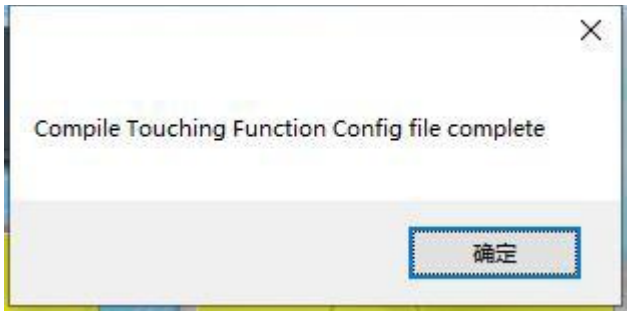


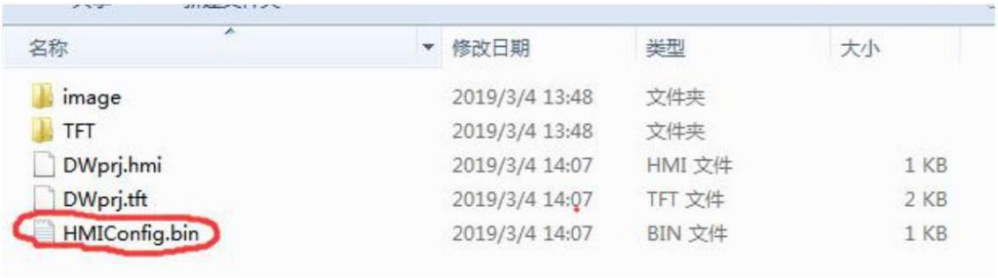


2. Users must select the software button "Specify" to define the key code uploaded while touching. In the code command setting, add it before saving. After finishing the touch control design, if users want to check the defined key code of the touch control, users need to move the mouse down to refresh and view, some computers may be delayed while refreshing.

3. Button effect description: Click on a touch button on the screen, and it will change color when pressed, and there will be a pressing effect. The principle of the button effect of DWIN screen is to load another picture with other effect but the same of size and contents to the picture, and users can directly set this page to be shown as a button effect on the software. Although the touch buttons set are all square areas, the design of the background picture is free, and the buttons can have various effects in different styles. Example of the button effect shown below as a reference:

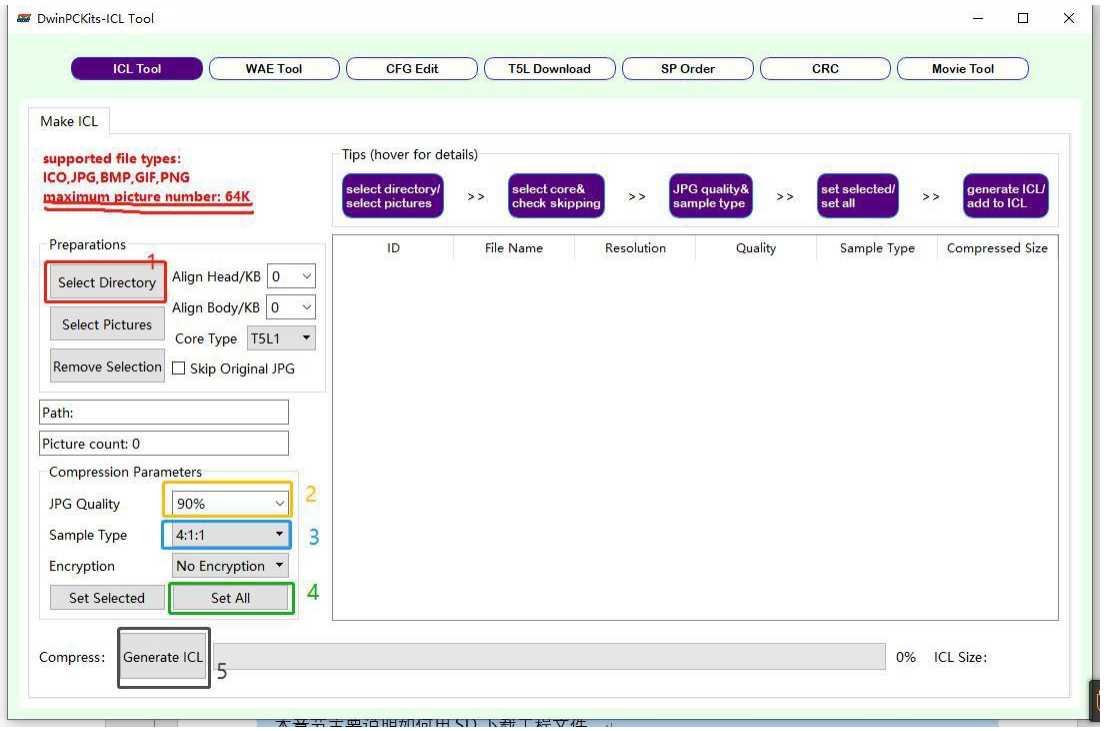
4. After finishing touch control design, click the “build config file” to generate.

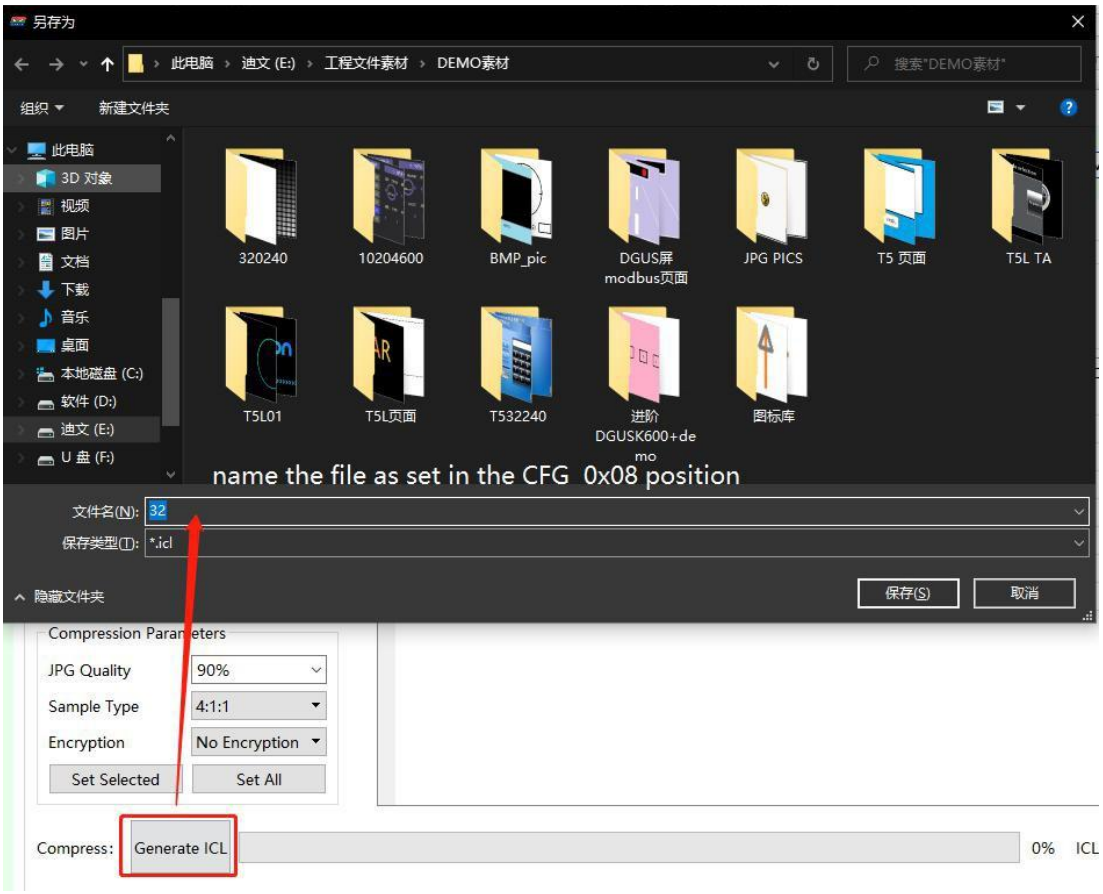




5. Find the HMIConfig.bin file and rename as 13.bin file.

4.4.6 Generate the ICL File





5 Download

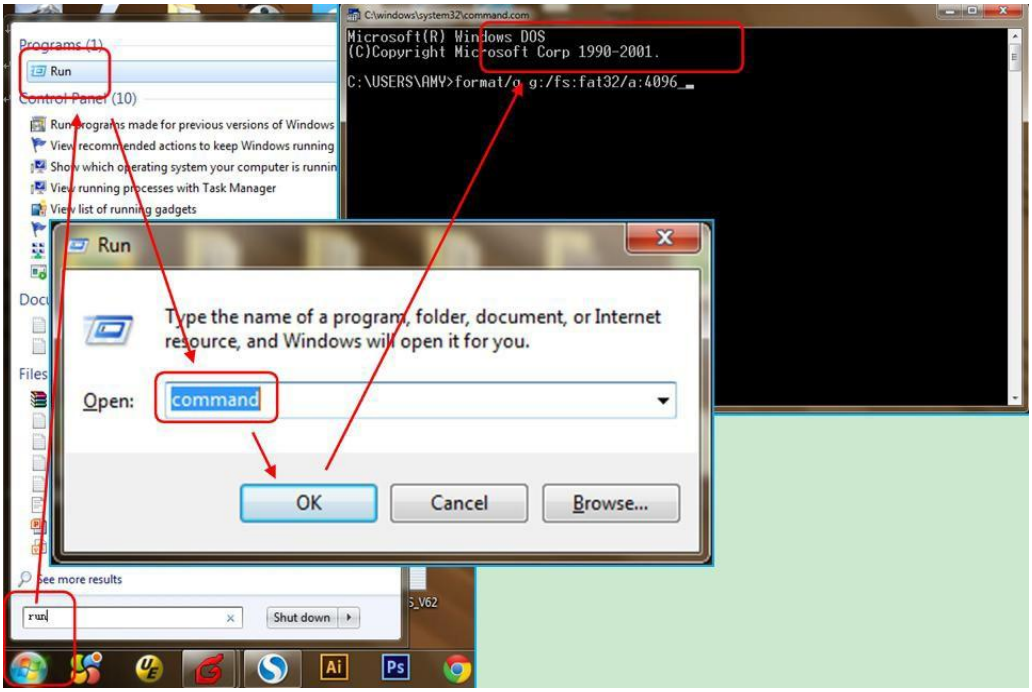
5.1 Micro SD(TF) Card Download Requirements

1. All hardware parameter settings and data of T5L display terminal can be downloaded through SD / TF card interface on the screen, and the file must be in FAT32 format.
2. SD cards sold by non DWIN factories often have to be formatted under DOS system. Otherwise, the download phenomenon is usually just that the number of downloaded files is 0 after the blue screen, or the display terminal fails to recognize that the card and cannot enter the download interface normally. Format as follows:

   Step 1: start> run >enter command (enter CMD for win7 system) to enter DOS system;

   Step 2: input the command: format/q g:/fs:fat32/a:4096 (Note: q is followed by a space). Click enter after input.

   The "g" is the disk number of SD card displayed on the user' s computer, and the corresponding disk number of different users is not fixed. (for example, h, i can be replaced)
3. Note: the format operation after right clicking SD card cannot be completely formatted into FAT32 format. Generally, only SD card with size range of 1-16G is supported.

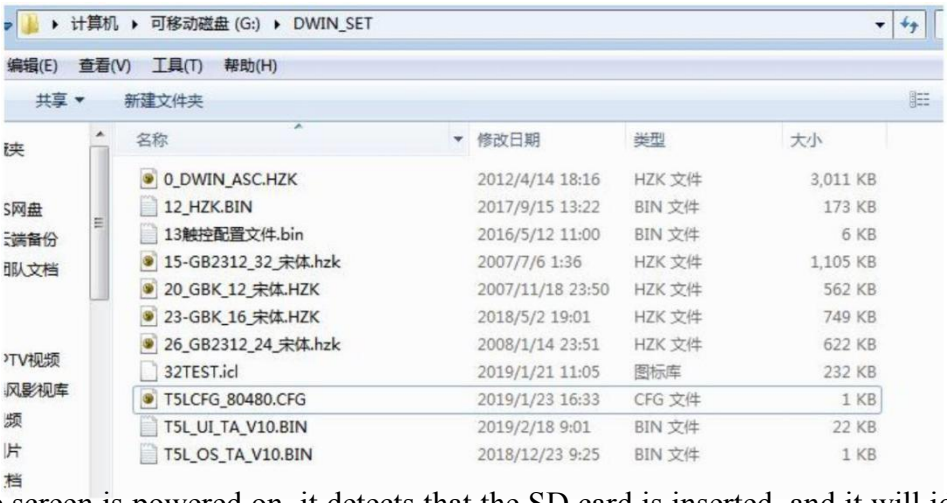


5.2 SD Card Interface Download

The SD card upgrade does not support online hot-swappable update. To prevent hot-swapping from affecting the Flash operation, users must strictly follow the instructions to power off the screen first, insert the SD card, and then power on to download. During the downloading process, please be sure to maintain the normal power supply. Power failure in the middle may cause an abnormal black screen.

STEPS:

1. Create the DWIN_SET folder in the root directory of TF card.
2. Put the ICL files, fonts, configuration files, etc. that need to be downloaded in the DWIN_SET folder as picture shown below:



3. When the screen is powered on, it detects that the SD card is inserted, and it will identify whether there is a file named DWIN_SET in the root directory of the SD card. If the file name exists in the SD card, the screen will copy and download the relevant file content in the file that meets the format requirements to the FLASH.
4. When the blue screen download list prompts that the download is complete, power off the screen, remove the SD card, and then power on again to enter the normal working mode.

Note that: if the DWIN standard screen will only recognized the folder named DWIN_SET. Other named folders will not be recognized. The user can also name the folder he wants to back up as other names, the download will not be affected. (as picture shown below)


计算机 ▸ 可移动磁盘 (G:) ▸
文件(F) 编辑(E) 查看(V) 工具(T) 帮助(H)
组织 共享 新建文件夹
收藏夹
桌面
最近访问的位置
库
视频
图片
文档
音乐
名称
修改日期
9.7 2017/3/27 13:22
32856 2017/8/7 17:36
DWIN_SET 2017/8/14 10:47
DWIN_SET11 2017/5/12 13:39
DWIN_SET45 2016/6/15 14:12
DWIN_SET222 2017/5/5 22:53
DWIN_SET333 2017/7/4 14:52
DWIN_SET345 2017/8/5 16:16
DWIN_SET567 2017/6/5 16:28
DWIN_SET1212 2017/6/15 16:31

6. Serial Instruction Set

6.1 Working Mode

T5L_TA HMI products adopt asynchronous full duplex serial port(UART), and the serial port mode is 8n1, that is, each data transfer uses 10 bits: 1 start bit, 8 data bits (lower bit before transmission, LSB), and 1 stop bit. The factory default baud rate is 115200bps, and the user can modify the baud rate required for system .CFG file configuration.

6.2 Data Frame

The serial data frame consists of 4 data:

Data block	1	2	3	4(when the CRC check code is turned on)	5
Example	0xAA	0x70	0x01	0xB5,0xE0	0xCC 0x33 0xC3 0x3C
Description	Frame header	Instruction (1 byte)	Data (up to 248 bytes)	CRC16 check code (2 bytes)	0xCC 0x33 0xC3 0x3C

Modify the .cfg system configuration file. 0x05 Location.7=1 Enable CRC check.

The CRC check value: the header (0xAA) + command + data check value, and placed before the end of frame, such as:

AA 70 00 74 20 (CRC checksum is the CRC checksum calculated by AA 70 00) CC 33 C3 3C

When the CRC check is enabled, the touch response command also enables the CRC check. For example: AA 73 00 C8 00 3B DD F7 CC 33 C3 3C.

6.3 Byte Transmission

The instructions or data are in hexadecimal (HEX) format. For font (2 bytes) data, always use high byte first to transmit (MSB) mode. For example, the x coordinate is 100, its HEX format data is 0x0064, and when it is transferred to the HMI, the transfer order is 0x00 0x64.

6.4 Coordinate System

As shown in the figure below, the first point in the upper left corner of the screen has a default coordinate of 0 (0,0), and the coordinates of the lower right corner are based on the resolution of the user's screen, for example, DMT80600T080_42WTC, the coordinates of the last point in the lower right corner of 800x600 are (799,599).

Num.	Instruction	Data	Function	Instruction running time
01	0x00	None	Handshake Tx	NA
	0x00	"OK_V1.0" 0x00 0x00 System_Config PIC_ID	Handshake Rx; System_Config is the SD/SDHC interface configuration value, PIC_ID is current showing image number.	NA
02	0x40	FC, BC	Set the palette FC is the foreground color, the default value is white; BC is the background color, the default value is blue. 16bit or 24bit are supported	NA
03	0x41	D_X, D_Y	Set the character spacing, D_X for X direction, D_Y for Y direction	0.5 uS/dot
04	0x42	(x, y)	Color pick to the background color palette	0.5 uS/dot
05	0x43	(x, y)	Color pick to the foreground color palette	0.5 uS/dot
06	0x44	<Cursor_EN>, (x,y), <Width>, <Height>	Cursor on/off. <Cursor_EN>: 0x01=cursor on 0x00=cursor off.	NA
07	0x54	(x, y); strings codes	Display 16*16 GBK char. strings, 23#font lib.	0.66 uS/dot
08	0x55	(x, y); strings codes	Display 32*32 GB2312 char. strings, 15#font lib	0.66 uS/dot
09	0x6E	(x, y); strings codes	Display 12*12 GBK char. strings, 20#font lib	0.66 uS/dot
10	0x6F	(x, y); strings codes	Display 24*24 GB2312 char. strings, 26#font lib	0.66 uS/dot

11	0x98	(x, y); lib id; mode; dots; FC; BC; strings	Specify format strings displaying: Lib id: 0x00-0x1F font ID Mode: .7: not defined .6: 1= BC displayed, 0= BC not displayed .5: not defined .4: 1=character width automatically adjusted 0=fixed character width .3-.0 encoding mode 0= 8bit, 1= GB2312, 2=GBK, 3=BIG5, 4=SJIS, 5=UNICODE Dots: strings pixels As for mode 0, 5: 00= 8*8 01= 6*12 02=8*16 03= 12*24 04= 16*32 05=20*40 06=24*48 07=28*56 08=32*64 09 dots of mode 0 and 5 starts at 00 of mode 1-4: 09(00)=12*12, 0A(01)=16*16 0B(02)=24*24 0C(03)=32*32, 0D(04)=40*40 0E(05)=48*48 0F(06)=56*56 10(07)=64*64 11(08)=40*80 12(09)=48*96 13(0A)=56*112 14(0B)=64*128 15(0C)=80*80 16(0D)=96*96 17(0E)=112*112 18(0F)=128*128 19(10)=6*8 1A(11)=8*10 1B(12)=8*12 1C(13)=100*200 1D(14)=200*200 1E(15)=48*64 FC: text color, 2bytes, 5R6G5B BC: background color of text, 2bytes, 5R6G5B	0.66 uS/dot
12	0x50	(x, y)0……..(x, y)n	Place a dot in background color	0.5 uS/dot
13	0x51	(x, y)0……..(x, y)n	Place a dot in foreground color	0.5 uS/dot
14	0x56	(x, y)0……..(x, y)n	Foreground endpoint connection	0.5 uS/dot
15	0x5D	(x, y)0……..(x, y)n	Background endpoint connection	0.5 uS/dot
16	0x52	None	Clear screen in background color	1.2 nS/dot

17	0x57	(Type,x,y,R)0……(Type,x,y,R)n	Type, display mode. 0x01=foreground color shows hollow circle. 0x03=foreground color shows solid circle. (x, y) are the coordinates of the circle center, R is the radius (0x01-0xFF)	0.5uS/dot
18	0x59	(Xs,Ys,Xe,Ye) 0…… (Xs,Ys,Xe,Ye)n	Draw a rectangle in foreground color	0.5 uS/dot
19	0x69	(Xs,Ys,Xe,Ye) 0…… (Xs,Ys,Xe,Ye)n	Draw a rectangle in background color	0.5 uS/dot
20	0x5A	(Xs,Ys,Xe,Ye) 0…… (Xs,Ys,Xe,Ye)n	Fill the rectangle in background color	1.2 nS/dot
21	0x5B	(Xs,Ys,Xe,Ye) 0…… (Xs,Ys,Xe,Ye)n	Fill the rectangle in foreground color	1.2 nS/dot
22	0x5C	(Xs,Ys,Xe,Ye) 0…… (Xs,Ys,Xe,Ye)n	Reverse color specified area	2.5 nS/dot
23	0x70	PIC_ID	Full screen image display	8 nS/dot
24	0x71	PIC_ID, (Xs Ys, Xe Ye), (x, y)	Copy and paste picture area	8 nS/dot
25	0x7D	Mode, PIC_ID	Fancy picture switching, Mode=0x00-0x08	0.5 s
26	0x96	(X, Y), QR_Pixel, Data	(x, y): coordinate position of the QR code display QR_Pixel: QR code occupies pixel size 0x01-0x0F for each point DATA: Display data within 155 bytes with 45*45 pixel QR; display data over 155 bytes 73*73 pixel	4.5mS/15mS
27	0x97	(X, Y), lib_ID, Mode, ICON_ID0-ICON_IDn	Lib_ID: ICON lib ID Mode: background color selection, 00=filter background (filters the color of the whole small icon image that matches the first pixel in the upper left corner), other = display background ICON_ID0 … … ICON_IDn: The index ID of the small icon to be displayed in the file, two bytes per ID, 0x0000-0xFFFF	8 nS/dot

28	0x79	BZ_Time	Buzzing time: BZ_Time*10mS	NA
29	0x5E	None	Backlight off	NA
30	0x5F	PWN_T	Backlight adjustment	NA
31	0x9B	0x5A 0x5A YY:MM:DD WEK HH:MM:SS	RTC read and Tx RTC read and Rx, the RTC data is BCD code.	NA
		0x00	RTC overlay display is off.	
		0xFF,RTC_Mode,Text_Mode,Color,（x,y）	RTC overlay display is on. RTC_Mode, clock display mode. 0x00: HH:MM:SS 0x01: 20YY-MM-DD HH:MM:SS Text_Mode, the font of the clock display. 0x00: 8*8 0x01: 6*12 0x02: 8*16 0x03: 12*24 0x04: 16*32 0x05: 20*40 0x06: 24*48 0x07: 28*56 Color, the clock display font color. (x, y) Clock display position.	
32	0xE7	0x55 0xAA 0x5A 0xA5 YY:MM:DD HH:MM:SS	RTC configuration, the RTC data is BCD code.	NA
33	0xC0	ADRH: L(0x0000-0x7FFF)+DATA	Write RAM, RAM storage: 32KWords	NA
34	0xC1	0x08+ADR_H:L+Parameter_N	Use the RAM to display multiple parameters.	NA
		0x0E+LIB_ADR_H:M:L+RD_LEN Rx: 0x0E+LIB_ADR_H:M:L+RD_LEN+Datas	Read the 16#-31# word library data, corresponding to addresses 0x40:0000-0x7F:FFFF, up to 240 bytes at a time.	NA
		0x0F+0x55 AA 5A A5+LIB_POS	Write 64Kbytes RAM into specified font lib, LIB_POS' high byte is the font lib ID(0x00-0x3F), each lib occupies 256Kbytes; LIB_POS's low byte is the 64KB data in the font lib.	NA
		Rx: 0x0F 0x4B+LIB_POS		

		0x12+（x,y）+Mode+ADR	Show a JPEG icon stored at the ADR address of the RAM. Show it. (x, y): icon display position. Mode: 0x00 = background display, otherwise = background filtering intensity. ADR: the starting address of the RAM where JPEG data is stored, must be is even, JPEG data cannot exceed 64KB buffer size.	NA
35	0xC2	ADR H:L(0x0000-0x7FFF)+Len(0x0001-0x0078) Rx: Read_Data	Read Len(word) length data from the RAM, Len=0x0001-0x0078.	
36	0x84	ID+0x00+DATA0.....DATAn	Write the specified ID (0x00-0x07) curve data (16bit unsigned number). Each time the data is written, it is automatically plotted once. Display position: X1=X0+Dis_X Y=Y0-DATA*K_Y/256 .	
		ID+0xFF+(Xs,Ys)+(Xe,Ye)+Color+Line_Dot +Dis_X+Y0+KY	Configures the curve display for the specified ID (0x00-0x07) and clear the curve display position. (Xs, Ys) (Xe, Ye): curve display area. Color: curve display color, 24bit color. Line_Dot: curve display pixel thickness, 0x01-0x07. Dis_X: curve display X-coordinate step, 0x01-0x0F. Y0: the Y-coordinate position corresponding to the curve data 0x0000. KY: curve data scale, 0x0001-0x0100, unit is 1/256.	

Touch screen upload command

01	0x72	(x, y)	The coordinate position raised by the touch screen is actively uploaded.
02	0x73	(x, y)	The coordinate position in the touch screen pressing is actively uploaded.
03	0x78	<Touch_Code>	The touch key code raised by the touch screen is actively uploaded, 13.BIN configuration file.
04	0x79	<Touch_Code>	The touch key code in the touch screen is actively uploaded, 13.BIN configuration file.

6.5 Instruction Quick Look

Remarks: actual displaying time= instruction running time*the pixel size, for example:

Character strings displaying time is 0.66uS/dot, as for 32*32 pixel Chinese characters, a single character display running time is 0.66*32*32=0.68mS;

Image display running time is 8nS/dot, as for 800*600 resolution image, a single image displaying time is 8*800*600=3.84mS

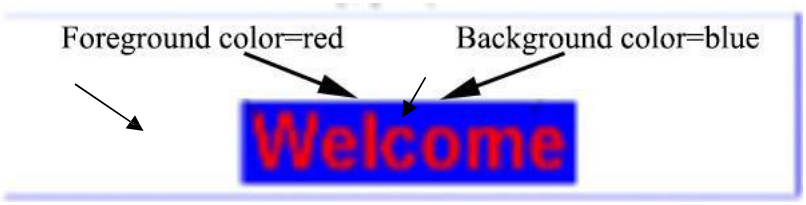
6.6 Examples and Applications

6.6.1 Handshake 0x00

Instruction	AA 00 CC 33 C3 3C
Parameter	AA 00 27 4F 4B 5F 56 36 2E 30 27 68 68 66 00 CC 33 C3 3C
Example	
Application	(1). When using the display terminal, as the control system and the display terminal start time are inconsistent (depending on the user's power supply capacity and power-on rate), in order to ensure that the data display terminal sent by the control system can correctly receive and execute the corresponding the function and command, so it is necessary to confirm whether the display terminal is in normal operation state, and the user can confirm by handshake command; (2). In the process of debugging, you need to know whether the version and configuration of the system are correct. You can also send a handshake command to read. (3). The sending and replying of the handshake command is also used to verify that the communication between the serial port and the serial screen of the computer is normal.

6.6.2 Set the Palette 0x40

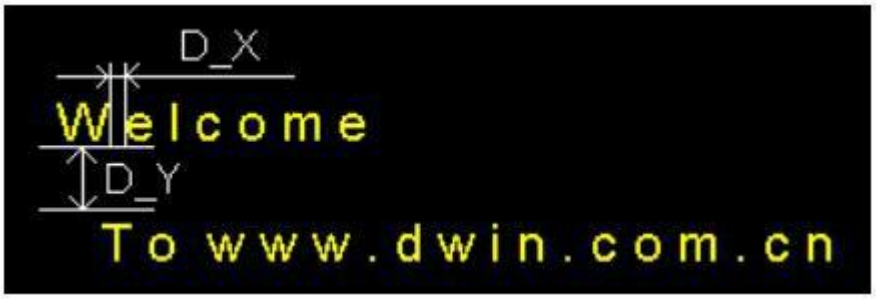
Instruction	AA 40 <FC> <BC> CC 33 C3 3C	
Example	AA 40 F800 001F CC 33 C3 3C or AA 40 FF0000 0000FF CC 33 C3 3C	
Answer		
Parameter	FC is the foreground color, the default value is white.	Can be 16bit or 24bit, for example 24-bit RGB red is represented as FF0000, 16-bit RGB red is

	BC is the background color, the default value is blue.	represented as F800
		
Application	This instruction applies to the 43, 54, 55, 6E, and 6F instructions for directly calling the fixed position Chinese character font display. At the same time, you need to configure the .cfg configuration file 05 address. 4=0, The background color of the text display is not automatically restored. Once fixed, it will be saved until it is reset, the default hardware value is restored after the terminal hardware reset. If text display needs to be displayed with the background color, the MCU can send the initial instruction packet to set the 40 instruction content.	

6.6.3 Clear Screen in Background Color 0x52

Instruction	AA 52 CC 33 C3 3C
Example	AA 52 CC 33 C3 3C
Answer	
Application	Clear background to solid color. The different colors of the clear screen instruction can be used to detect whether the screen has abnormal dead pixels and other liquid crystal display abnormalities.

6.6.4 Set the Character Spacing 0x41

Instruction	AA 41 <D_X> <D_Y> CC 33 C3 3C
Example	AA 41 10 10 CC 33 C3 3C
Answer	
Parameter	<D_X> is the character spacing in the x direction, the value range is from 0x00 to 0x7F, and the default value is 00.
	<D_Y> is the character spacing in the x direction, the value range is from to 0x00-0x7F, and the default value is 00.
	
Application	This instruction applies to the 43, 54, 55, 6E, 6F, and 98 instructions ,for directly calling

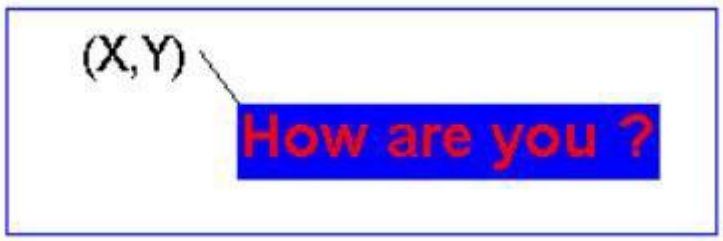
	character to display. It is used to adjust the display character spacing. Once set, it will be saved until it is reset. The default value is restored after the terminal hardware reset is displayed.

6.6.5 Take the Specified Color 0x42, 0x43

Instruction	AA <CMD> <X> <Y> CC 33 C3 3C	
Example	AA 42 0064 0064 CC 33 C3 3C Take the coordinate point (100, 100) to the background color palette; AA 43 0064 0064 CC 33 C3 3C Take coordinate points (100, 100) to the foreground color palette.	
Answer		
Parameter	<CMD> 42 is to take the specified position color to the background color palette; 43 is to take the specified position color to the foreground color palette. <X> is the coordinate point in the x direction; <Y> is the coordinate point in the y direction;	Can be 16bit or 24bit, for example 24-bit RGB red is represented as FF0000, 16-bit RGB red is represented as F800.
Application	Same as 40 setting the current palette command application.	

6.6.6 Factory Pre-installed Standard Font Display 0x54, 0x55, 0x6E, 0x6F

Instruction	AA <CMD> <X> <Y> <String> CC 33 C3 3C
Example	AA 55 0080 0030 48 6F 77 20 61 72 65 20 79 6F 75 20 3F CC 33 C3 3C
Answer	
Parameter	<CMD>: 54 displays 16*16 GBK string, 23# font. 55 displays 32*32 GB2312 string, 15# font. 6E displays 12*12 GBK string, 20# font. 6F displays 24*24 GB2312 string, 26# font.
	<X> <Y> The starting position of the character string (the upper left coordinate position of the first character) is displayed. The example shows the display from the (128, 48) position.
	<String> The character string to be displayed, the Chinese character uses GB2312 (55, 6F instruction) internal code; or GBK (54, 6e instruction) internal code extension coding, the color can be set by 40 command, and the display character spacing is set by 41 command. When the line ends, it will automatically wrap, 0x0D, 0x0A is processed into the carriage return and line feed.



6.6.7 Specify Content Display String 0x98

Instruction	AA 98 <x，y> <Lib_ID> <Mode> <Dots> <FC> <BC> <Strings> 0002 CC 33 C3 3C		
Example	AA 98 00 64 00 64 1A 41 02 F8 00 00 1F 31 32 B1 B1 CC 33 C3 3C displays 26# font, 24*24 dot matrix, GB2312, foreground red, background color blue, “12bei” at (100, 100) position .		
Answer			
Parameter	PIC_ID: The background picture stored in the HMI Flash stores the picture serial number. If the page display without the serial number is displayed, the operation will not be switched.		
	<x,y> displays the starting position of the string (the upper left coordinate position of the first character)		
	<Lib_ID> font selection, value range 0x00-0x3f		
	<Mode> selects the text display mode and encoding mode as shown in the following table.		
	bit	.7~.4 high bits	.3~.0 low bits
	definition	Whether the display mode configuration displays the background color (this mode is valid only when the CFG configuration 05 address.4=0 does not automatically restore the setting, otherwise the background color is automatically restored by default)	Character encoding
	Description	.7=Undefined. .6 =1 background color display; =0 background color is not displayed. .5-.4 Undefined.	0=8bit 1=GB2312 2=GBK 3=BIG5 4=SJIS 5=UNICODE
	<Dots> character dot matrix size, for mode 0, mode 5:	Patterns 0 and 5 after 09 are consistent with pattern 1 - 4 00 starting lattice:	
	00=8*8 01=6*12 02=8*16 03=12*24 04=16*32 05=20*40 06=24*48 07=28*56 08=32*64	09(00)=12*12 0A(01)=16*16 0B(02)=24*24 0C(03)=32*32 0D(04)=40*40 0E(05)=48*48 0F(06)=56*56 10(07)=64*64 11(08)=40*80	14(0B)=64*128 15(0C)=80*80 16(0D)=96*96 17(0E)=112*112 18(0F)=128*128 19(10)=6*8 1A(11)=8*10 1B(12)=8*12 1C(13)=100*200

		12(09)=48*96 13(0A)=56*112	1D(14)=200*200 1E(15)=48*64
	<FC>: Display the color of the text, 2Bytes, 5R6G5B mode.		
	<BC>: The background color of the text, 2Bytes, 5R6G5B mode.		
Application	The 98 command is usually used in conjunction with the 71 cut command. In addition to calling the factory pre-loaded font display, it is generally used to call user-defined fonts, and is often used to display Unicode font codes for multi-language character display. AA 98 00 64 00 64 32 45 07 F8 00 00 1F 00 31 00 32 00 77 CC 33 C3 3C For example, display the (100, 100)position ,50 font encoding method is Unicode 28*56 dot matrix character "12w".		

6.6.8 Full Screen Image Display 0x70

Instruction	AA <Mode> <PIC_ID> CC 33 C3 3C
Example	AA 70 00 CC 33 C3 3C Display the 0th picture saved in the HMI
Answer	
Parameter	PIC_ID: The background picture stored in the HMI Flash stores the picture serial number. If the page display without the serial number is displayed, the operation will not be switched.

6.6.9 Cut Icon Display 0x71

Instruction	AA 71 <PIC_ID> <Xs> <Ys> <Xe> <Ye> <X> <Y> CC 33 C3 3C
Example	AA 71 08 01 90 00 00 03 1F 01 90 00 C8 00 14 CC 33 C3 3C Cut the area of the 8th picture (400,0) (799,400) and display it to the current screen (200, 20) position.
Answer	
Parameter	<PIC_ID>: The background picture stored in the HMI Flash stores the picture serial number, and the page display operation without the serial number is not executed.
	<Xs> <Ys> <Xe> <Ye> The area of the front cut area, the upper left corner coordinate and the lower right corner coordinate
	<X> <Y>The cut picture is displayed on the current screen.
Application	Copy and paste the background image library files in the image area. It is often used to cut small areas of the current page, refreshing the text display of the current position area, that is, the 71+98 command is used together.

6.6.10 Icon Display 0x97

Instruction	AA 97 <X,Y> <Lib_ID> <Mode> <ICON_ID0……ICON_IDn> CC 33 C3 3C
Example	AA 97 00 64 00 64 32 00 00 01 00 02 CC 33 C3 3C Call the no.1 and no.2 icons in the 50.icl icon lib to show at the position (100,100) after background color filtered.
Answer	

Parameter	<X, Y> The coordinate position of the first icon is displayed. The subsequent icons will automatically calculate the coordinates. The interval between the icons is determined by the Dis_X set by the 41 command, that is, the second icon position = X + icon width + Dis_X.
	<Lib_ID> :the position where the icon file is saved
	<Mode> background color selection, 00=filter background (filters the color of the whole small icon image that matches the first pixel in the upper left corner), other = display background
	<ICON_ID0……ICON_IDn> The index ID of the small icon to be displayed in the file, two bytes per ID, 0x0000-0xFFFF
Application	It is mainly used to solve the problem that the 71 command cuts a small picture area on the picture, and needs manual alignment and cannot filter the background color. When making the icon library, the material format must be JPG format and the size should not exceed 1023*1023 resolution.

6.6.11 Fancy Picture Switching 0x7D

Instruction	AA 7D <Mode> <PIC_ID> CC 33 C3 3C
Example	AA 7D 01 0002 CC 33 C3 3C
Answer	
Parameter	<Mode>: 0x00-0x08, 9 kinds of fancy, from the center → two sides, diagonal → diagonal, up → down, left → right, etc.
	<PIC_ID>: The picture ID number (double byte) to be switched, cannot be used for refresh display of the current page.
Application	This instruction shows a time of 0.5S, and the refresh is extremely smooth. It is a new instruction compared with the old version of the instruction set. It can bring a cool visual experience to the user's terminal display.

6.6.12 Buzzer Control 0x79

Instruction	AA 79 <BZ_Time> <PIC_ID> CC 33 C3 3C
Example	AA 79 64 0002 CC 33 C3 3C
Answer	
Parameter	<BZ_Time>: 0x01-0xFF buzzing time, unit: 10 ms
	<PIC_ID>: The picture ID number (double byte) to be switched, cannot be used for refresh display of the current page.
Application	The buzzer sound "Dii" can be used for warning. For example, it can be used for the last step of completing power-on initialization.

6.6.13 Backlight Control 0x5E, 0x5F

Instruction	AA <CMD> <PIC_ID> CC 33 C3 3C
Example	AA 5E 0002 CC 33 C3 3C ； AA 5F 0002 CC 33 C3 3C
Answer	
Parameter	<CMD>5E:Backlight off
	<CMD>5F:Backlight on
Application	In order to extend the life of the LCD, the backlight can be turned off when the touch

6.6.14 Backlight Brightness Adjustment 0x5F

Instruction	AA 5F <PWM_T> CC 33 C3 3C
Example	AA 5F 20 CC 33 C3 3C
Answer	
Parameter	<PWM_T>： Backlight brightness adjustment, range 0x00-0x40.
Application	The backlight can be adjusted directly to the lowest backlight with the 5F command. AA 5F 00 CC 33 C3 3C

6.6.15 Display QR code 0x96

Instruction	AA 96 <x,y> <QR_Pixel> <DATA> CC 33 C3 3C
Example	AA 96 00 64 00 64 04 68 74 74 70 3A 2F 2F 77 77 77 2E 64 77 69 6E 2E 63 6F 6D 2E 63 6E 2F CC 33 C3 3C
Answer	
Parameter	<x, y>: coordinate position of the QR code display (100, 100)
	<QR_Pixel>: QR code occupies pixel size 0x01-0x0F for each point;
	<DATA>: Display data within 155 bytes with 45*45 points QR http://www.dwin.com.cn/
	
Application	The display of the dynamic QR code, bid farewell to the old version of the instruction set can only be displayed in a fixed picture. The instructions that the user needs to send only need to send coordinates, size, ASCII code and Chinese character code.

6.6.16 Draw a Point and Endpoint Connection

Instruction	AA <CMD> (x,y) 0 ……(x,y) n CC 33 C3 3C	
Example	AA 51 0000 0000 0003 0006 0005 0020 CC 33 C3 3C Display point (set point) with foreground color	
Answer		
Parameter	<CMD>	50 draw a dot in background color 51 draw a dot in foreground color 56 foreground color endpoint connection 5D background color endpoint connection
	（x,y）0 …… （x,y）n	The point coordinates to be displayed, a serial port data shows up to 62 points.
Application	56 instruction also used to draw polygons	

6.6.17 Draw a Rectangle

Instruction	AA <CMD> (Xs,Ys,Xe,Ye)0……(Xs,Ys,Xe,Ye)n CC 33 C3 3C	
Example	AA 59 00 01 00 02 00 65 00 66 CC 33 C3 3C Draw a rectangle in the coordinate area (1, 2) ~ (101, 102)	
Answer		
Parameter	<CMD>	59 draw a rectangle in foreground color 69 draw a rectangle in background color 5A fill the rectangular in background color 5B fill the rectangular in foreground color 5C specified area in reverse color
	(Xs,Ys,Xe,Ye)0…… (Xs,Ys,Xe,Ye)n	The upper left corner coordinate and the lower right corner coordinate of the rectangular area can perform the same type of instruction operation on a plurality of different areas in sequence by one instruction.
Application	Rectangular fill instructions are often used to display rectangular progress bars.	

7. OS Core Secondary Development Interface

TA instruction set application. The T5L OS core is mainly used to process serial data and exchange data with the GUI core through variable memory, defined as follows.

Double-word address	Double-word length	Definition	Description
0x00:0000	1	D3=0x5A D2 .7=1 CRC on D1:D0=CFG file baud rate setting value.	Serial port configuration, CRC is handled by the OS core.
0x00:0026	2	D7:D0=0x5A:YY:MM:DD WW:HH:MM:SS	RTC values that need to be displayed by the GUI core, BCD code.
0x00:0027	3	D11: 0x5A= RTC overlay display enable. D10: 0x00= off 0xFF= on. D9: RTC mode. D8: Text mode. D7:D6: Color. D5:D2: (x, y). D1:D0: Write 0x00.	RTC overlay display interface.
0x00:0x2B	1	D3: 0x5A indicates that 1 RTC overlay display has been executed. D2:D0: undefined.	RTC overlay display execution completion feedback.
0x00:1000	64	0x5A+DATA LEN+0x00+DATA	The serial port received data transmitted to the GUI core. For example, the display image instruction is AA 70 0001 CC 33 C3 3C, and then the variable data written by the OS core will be 5A 08 00 AA 70 00 01 CC 33 C3 3C
0x00:2000	64	0x5A+DATA LEN+0x0000+DATA	The data to be sent to the serial port by the GUI core. For example, uploading the touch screen coordinate information is AA 73 0000 0000 CC 33 C3 3C, and then variable data written by the GUI core will be 5A 0A 0000 AA 73 00 00 00 00 CC 33 C3 3C
0x00:3000	52K	Undefined	Available for OS core.
0x01:0000	64K	GUI reserved	Not available for OS core.

8. Transplant Old Version to T5L_TA platform

8.1 Replacement Steps

1. Save the background images as a new file, run the DGUS II Tool software to generate the ICL file of these images (maximum storage: 12MB; ICL_ID: 16-48). Users can lower the picture quality rate when generating a number of images of ICL file. Background image font (. ICL) ID needs to be set in the system configuration file at 0x08 position. For example, 0x08=20, ICL file=32*.icl.
2. Download the required font library (if the ASCII font library only uses 16*32 pixel strings, then 0# font library only uses the first 2 font space), the font number should be careful not to conflict with the space occupied by the background file, especially the factory font ID and the old version whose naming sequence number is different, besides 0x98 instruction codes should be modified accordingly.
3. Compress the icon file into an ICL file with the DGUS II tool software, and place the number 00-63 in the free place. Pay attention to modify the codes of the 0x97 instruction accordingly.
4. Set the CFG file.
5. Download these files to the screen with SD card.

9. Reversion Records

Ver	Date	Description
V1	2019.05.10	First edition
V2	2022.08.12	UART instruction update: 0X44 cursor on/off instruction, 0X57 circular field display instruction, 0XE7RTC interface instruction, 0X9BRTC overlay display off/on function, 0XC108 multi-parameter display instruction 0XC10E font data read instruction, 0XC10E font data read instruction, 0XC112JPEG icon display instruction, 0x84 curve display instruction, 0x84 curve display instruction; Updated CFG 0x05 address description; Add 0x98 instruction support for character width auto-adjustment function; Add chapter 7 OS core secondary development interface Add CFG 0x06 location, adding the choice of using picture or solid color overlay when the background is automatically restored; Add 2.0_240*320 IPS, 2.4_240*320 IPS, 4.3_480*800 IPS, 3.0_360*640 IPS, 1364*768eDP, 1920*1080eDP to the display configuration; Add CFG configuration 0x24\0x25\0x26 LOCATION; Overall non-uniform formatting adjustments; Footer replaced with English version official website URL; Add revision records.