T5F0 DGUS II Application Guide Ver 6.5

Contents

1, Overview

The Dgus II development platform based on T5F0 ASIC CPU incorporates the following features:

(1) Based on T5F0 dual-core ASIC, The GUI and OS cores operate at the same main frequency (206.4384MHz).

(2) The T5F0 employs low-cost SPI flash for storing UI projects. The hardware may be designed according to the following configuration:

- Option 1: Use a single 8MB or 16MB SPI NOR Flash chip (it's mandatory to use the Chip Select 0 (CS0) signal for this chip.).
- Option 2: Use two 16MB SPI NOR Flash chips connected in parallel.
- Option 3: Use a combination of a 16MB SPI NOR Flash (CS0 required) + a 64MB or 128MB SPI NAND Flash (CS1 required).

(3) 512 Kbytes Nor-Flash for on-chip user database

(4) 128 Kbytes data variable space.

(5) Up to 255 display variables per page

(6) Supports standard T5 OS platform or 8051-based OS CPU core.

- Offers 24 I/O pins, 3 UARTs, 1 CAN interface, 4 PWM channels, 1 FSK interface, and multiple ADs.

(7) With a minimum DGUS cycle of 15ms, the user interface operation is exceptionally smooth.

(8) Display variables can be activated, deactivated, or modified within the application. Additionally, display priority can be customized to enable dynamic display functions.

(9) Touch commands can be activated, deactivated, or modified within the application to create complicated touch functions.

(10) Supports downloading and configuring files via SD card; support counting of download files and download verification; support encrypted downloading.

(11) Support online configuration of capacitive touchscreen parameters.

(12) As for data variables, the system automatically recognizes and displays grayscale encoded characters with sawtooth optimization, enabling the use of non-standard fonts (like nixie tube fonts) and full-width characters. The grayscale encoded fonts are generated using the DWIN tool.

(13) Support development mode of pre-configured module, significantly improving UI development speed and quality.

(14) support updating software and font online via UART 1, simplifying debugging process.

(15) Supports digital video playback encoded in MJPEG images.

(16) CPU main frequency can be fine-tuned.

(17) Compatible with 4-wire or 5-wire resistive touchscreens. Touchscreen precision and sensitivity can be adjusted.

(18) Support dynamic switching of icon files; Developing multi-language applications is extremely easy.

(19) Support overlaying of GUI pages for developing alert notification applications efficiently.

(20) Negative coordinates are supported for Icons and text display.

(21) The device's internal algorithm supports the use of two low-cost NTC resistors mounted inside the enclosure. This configuration allows for accurate measurement of the external air temperature, even within the enclosure, thus eliminating the need for an external temperature sensor, which is often necessary in other designs due to internal heat buildup.

(22) The T5F0 DGUS software comes from T5L0 DGUS II V6.5. A comparison of the two is provided in the table below.

DGUS II Caparison	T5F0	T5L0	Notes
Maximum Resolution	480×480	854×480	
Maximum size of a single JPEG image	124Kbytes	252Kbytes	
Data variable space	128Kbytes	256Kbytes	
Maximum external flash units	2	7	
Maximum external Flash size	16Mbytes+128Mbytes	48Mbytes+512Mbytes	The flash memory of the T5l0 is expanded by means of an external decoder
Number of serial ports	4（UART1/2/4/5）	5（UART1/2/3/4/5）	
Maximum AD channels available for user access	7（AD1-AD7）	8（AD0-AD7）	Direct reading of AD is enabled by the T5F0OS kernel
Maximum number of AD channels available to the user	4	2	Direct PWM operation is enabled in the T5F0 OS kernel.
ED4 Debugging Interface	Unavailable	Available	
OS core memory space	128Kbytes	96Kbytes	
GUI core program naming	T5F0_UI*.BIN	T5L_UI*.BIN	
OS core program Naming	T5F0_OS*.BIN	T5L_OS*.BIN	DWIN OS Core
	T5F0_51*.BIN	T5L51*.BIN	allows users to program and develop directly on the 8051 cores
Configuration file for TCON interface initialization	T5F0*.INI	T5L*.INI	
DGUS projects originally developed on T5L are highly compatible with T5F0 and can be executed directly on the platform, provided the above differences are addressed.			

2. DGUS Function

2.1 Display Variables

S/N	Code	Variable Name	Data Length (Word)	Description
01	0x00	Variable Icon	1	A linear relationship is established between the range of a data variable and a set of icons. As the variable value changes, the displayed icon updates accordingly. This is commonly used for creating precision dashboards and progress bars. Support background overlay and transparency settings. Background filtering intensity can be customized.
02	0x01	Animation Icon	2	A fixed value data variable is associated with 3 different icon states: hidden, static, or animated. This is typically used for variable alarm prompts. The variable occupies 2 words, and the (VP+1) position is reserved. The icon ID cannot exceed 255(0xFF). Support background overlay, transparency settings. and animation speed settings. Support single play mode. Background filtering intensity can be customized.
03	0x02	Slider Display	1	A data variable's range is correlated to different positions of an icon (slider), commonly used in liquid level, dial, and progress bar indicators. Support background overlay and transparency settings. Background filter intensity can be customized.
04	0x03	Artistic Variables	1/2/4	Use icons instead of font characters to display variable data. Support background overlay and transparency settings. Background filter intensity can be customized.
05	0x04	Image Animation	NONE	Play a set of full-screen images at a specified speed. This is often used for startup interface or screen saver. The storage space allocated for the image library can be customized.
06	0x05	Icon Rotation	1	A linear relationship is established between the range of a data variable and angular data. The icon is rotated based on the corresponding angle and displayed. Background filtering intensity can be customized.

				Mostly used for pointer dashboard display.
07	0x06	Bit Icon	3	The binary state (0/1) of each bit is mapped with two different options out of 8 display schemes and is visualized through icon or animation. Background filtering intensity can be set.
08	0x07	Icon Page Trans	4	JPEG images that exceed the screen resolution can be displayed by moving up, down, left, and right. Icons can be selected through a sliding gesture using the 0x0C touch variable. Background filtering intensity can be customized.
09	0x08	Icon Overlay	MAX 128KB	The JPEG icon from the variable buffer is overlaid and displayed in the specified area of the current page. The overlay's brightness and transparency can be customized. VP = 5AA5: activates the overlay display (Even number). VP+1 = Word length of JPEG data buffer (even number). VP+2 = JPEG data starts to be stored. Background filtering intensity can be customized.
10	0x09	Batch Var Icon	MAX 64KB	The icons are rapidly copied from the background or video memory and displayed to the specified location, as defined by the variable buffer.
11	0x10	Data Variables	1/2/4	Display a data variable in Arabic numerals with a specified format (integer, decimal, with or without unit), using a specified font and size. Support options of character spacing adjustment/ non-adjustment; support showing/hiding options of invalid zero in integer digit. Support 8-bit encoded grayscale fonts with anti-aliasing optimization.
12	0x11	Text Display	MAX 2K	Display text string in specified format (depending on the font) in a text box located a a designated area. Support 8-bit encoded grayscale fonts with anti-aliasing optimization.
13	0x12_00	RTC Display (Text)	NONE	Display RTC in user-defined text format. Support 8-bit encoded grayscale fonts with anti-aliasing

				optimization.
14	0x12_01	RTC Display (Watch)	NONE	Utilize “Icon Rotation” to display the Gregorian RTC (Real Time Clock) information in dial with moving hands.
15	0x13	HEX Data	MAX 8	Display variable data in byte-sized hexadecimal format, separated by a user-specified ASCII character. A common application is for timekeeping displays, for example, displaying the value 0x1234 as 12:34. Support 8-bit encoded grayscale fonts with anti-aliasing optimization. Allows for the conversion of hexadecimal data into binary-coded decimal (BCD) format for display purposes. For example, 0x0C can be converted to 0x12 and displayed as the decimal number 12.
16	0x14	Text Scroll	User-defined	Display the text stored in variable at the designated area of the screen.
17	0x15	Data Window	2	Display data variables in a designated display window and highlight the selected value. Data can be scrolled on the screen through touchscreen gestures or incremental adjustments. The scrolling speed is customizable via OS. Support 8-bit encoded grayscale fonts with anti-aliasing optimization. The variable occupies 2 words, and the (VP+1) position is reserved.
18	0x16	DGUSII Text	Max 2k	Display the text in the specified text box area based on the DGUS II font library. Font size is scalable.
19	0x17	Roll Character	4	Basic function is the same as data window.
20	0x18	GTF Icon	Max 128	Efficiently display icon character
21	0x20	Real- Time Curves	2K/Channel	Display real-time curves (trend charts) based on data from a curve buffer, with adjustable curve thickness. Users can specify the display area, center axis coordinates, display scale (zoom in/out), and the curve direction
22	0x21_1	Graphic_ Placement	User-defined	Place a point at the specified coordinates (x,y). The color and size of the point is customizable.
23	0x21_2	Graphic_ End Connection		Create a line segment that passes through the endpoints (color, (x0,y0), ..., (xn,yn)), The width of the line can be customized.

24	0x21_3	Graphic_ Rectangle		Display rectangle, with adjustable position and size.
25	0x21_4	Graphic_ Rectangle Fill		Fill the specified rectangular area, with adjustable color, position and size.
26	0x21_5	Graphic_ Circle Display		Display a circle with specified center point and radius. The color and thickness of the circle can be customized.
27	0x21_6	Graphic_ Picture Copy		Copy a region from a specified image and paste it onto the current display page.
28	0x21_7	Graphic_ ICON Display		Display icon. Icon library can be selected.
29	0x21_8	Graphic_ Enclosed Area Fill		Select a seed point and fill the enclosed solid-colored region with a specified color.
30	0x21_9	Plot_ Spectrum Display		Plot a spectrum as vertical lines using variable data, with customizable line color and position.
31	0x21_A	Drawing_Connection		Connect data points based on variables, with adjustable line thickness.
32	0x21_B	Drawing_Arc Display		Display an arc segment with the specified center, radius, start angle, end angle, and customizable thickness.
33	0x21_11	Drawing_Elliptical Arc Display		Display an elliptical arc based on the ellipse's center, major axis, minor axis, and color.
34	0x21_0D	Drawing_Rectangular XOR		Perform an XOR operation on the bitmap data of a specified rectangular region using a designated color, commonly used to create a highlighting effect.
35	0x21_0E	Drawing_ Dual Color Bitmap Display		Each pixel is represented by a single bit, allowing for the rapid display of two-color bitmap in a designated region.
36	0x21_12	Drawing_ four- color bitmap Display		Each pixel is represented by 2 bits, allowing for the rapid display of a 4-color bitmap within a designated area. Support multiple four-color bitmap layers, enabling the creation of images with a richer color palette.
37	0x23	Process Bar	1	Display process bar is a specified location of the screen.
38	0x24	Area Scrolling	1	Perform a circular shift on the contents of a specified area. Direction of the shift is customable. Used for easy creation of dynamic elements like flowcharts and progress bars on the screen. Some

				variables are reserved for system use and should not be modified by the user.
39	0x25	QR Code	Max 259	Display a QR code graphic on the screen according to the specified content. The size can be set to 73x73 pixels.
40	0x26	Brightness	1	Adjust the display brightness of the specified display area to highlight or dim the background.
41	0x30	Data Transit	Max 11	After the page is switched, the predefined data is transferred to the variable or serial port once.
42	0x31	Video	6	Encode the video into MJPEG format, generate corresponding ICL and WAE files, and play these files simultaneously to create a digital video. VP and VP+1 position (user-controlled interface, double word) D3: 0x5A enables digital video playback. Any other value disables it. D2: Playback status control, DGUS will clear its value after processing. 0x01 stops the playback and freezes the video at the first frame. 0x02 pause/resume. 0x03 starts playback from a specific position (determined by the values in D1 and D0). D1:D0: the starting point of playback, measured in seconds. This value is only applicable when the value in D2 is set to 0x03. Locations VP+2 to VP+5 (status feedback interface, two double words, read-only for users). D7: Current playback status feedback, 0x00= Stop, 0x01= Playing. D6:D4: Undefined. D3:D2 Total video duration, 0x0000-0xFFFF, measured in seconds. D1: D0 Current playback video position, 0 x0000 - 0xFFFF, measured in seconds.

Notes:

- For more specific functions, please refer to “DGUS II System File Description”.
- VP refers to the storage location (pointer) of the user variable storage space.
- When developing PC configuration software, a variable description pointer is configured to store display variable configuration information within a user-defined variable space. This information can be accessed by the application through either a serial port or DWIN OS, allowing for dynamic manipulation (on/off/modification) of the variable configuration and thus enabling complex display variable combinations.

2.2 Touch Variables

S/N	Touch Control Code	Functions	User Variable Length (Word)	Description
01	00	Variable Data Input	1/2/4	Input various numerical data types (integers, fixed-point decimals, etc.) into specified variable storage space. Pop- up keyboard transparency can be customized. Support touch configuration control.
02	01	Pop-up Menu	1	A pop-up menu is displayed upon a touch, and the key code of the menu item is returned. The transparency of the pop-up menu can be customized.
03	02	Incremental Adjustment	1	Touch the button to perform + / - (incremental or decremental) operation on the specified Variable. By configuring a continuous cyclic adjustment between 0 and 1, the functionality of column checkboxes can be enabled.
04	03	Drag Adjustment	1	Drag the slider to input variable data, scale range can be customized.
05	05	Return Key Code	1	Upon a touch on the button, the button's value is immediately returned and stored in a variable, with bitwise operations supported. Press duration threshold can be set.
06	06	ASCII Text Input	Max 127	Input text characters in ASCII or GBK Chinese characters. Cursor movement and editing are supported. The input status and length can be stored at location (VP-1). The transparency of the pop-up keyboard for ASCII input can be customized. The pop-up keyboard can be switched dynamically.
07	08	Synchrodata Return	User-defined	A touch event on the screen triggers the return of data to the designated variable based on predefined rules.

				While direct serial mode return is currently unavailable, auto-upload configuration can be employed to simulate this functionality. The "Synchrodata return control" can integrate with any functions within "system variable interface" to achieve flexible touchscreen operations, like data reading and data saving.
08	09	Rotation Adjustment	1	Arc type drag adjustment.
09	0A	Sliding Adjustment	2	Slide on the touch screen along the X or Y axis of the specified area and return the relative adjustment value in real time. By coordinating with "data window display" control, the function of dynamic rolling text can be enabled. VP is reserved and the returned data is located at (VP+1).
10	0B	Page Sliding	none	Slide on the touch screen along the X or Y axis of the specified area to dynamically scroll the page. The target page and scrolling area can be customized. The current page variable display will dynamically update as you drag. When there are other touch buttons on the page and you want the entire page, including draggable elements, to be scrollable, the "page sliding" control shall be prioritized over other controls. Post-gesture animation actions are supported.
11	0C	Slide Icon Sel	4	Enable slide-to-select function for icon pages utilizing the 0x07 display variable (Icon Page Trans).
12	0D	Bit Icon	1	Touch the button to adjust a specific bit within a designated variable.

Notes:

For specific functions, please refer to "DGUS II System File Description".

Touch configuration file （13*.BIN）can't exceed 256kbytes.

By accessing the touch command interface defined in the 0x00B0 variable space via serial port or the OS, users can dynamically enable, disable, or modify specific touch commands to create complicated and integrated touch functions.

2.3 Serial Communication Protocol

During system debugging, the serial port UART2 mode is fixed at 8N1. The baud rate is configurable. Each data frame is composed of 5 data blocks.

Data Block	1	2	3	4	5
Definition	Frame Header	Data Length	Command	Data	CRC Verification (Optional)
Data Length	2	1	1	N	2
Description	0x5AA5	Including command, data and verification	0x80/0x81/0x82/0x83		
Example (Without Verification)	5A A5	04	83	00 10 04	
Example (With Verification)	5A A5	06	83	00 10 04	25 A3

CRC verification is a 16-bit Modbus CRC checksum value for commands and data. The on/off status is controlled by 0x05.6 in the configuration file downloaded via SD card. The UART2 debug interface commands are as follows:

Command	Data	Description
0x80	Transit: Register page (0x00 - 0x08) + register address (0x00 - 0xFF) + the written data	Write the data string to the register, starting at the designated address.
	Receive: 0x4F 0x4B.	Write a response command
0x81	Transit: Register page (0x00-0x08) + register address (0x00- 0xFF) + byte length of the read data (0 x01-0xFB)	Read data starting from the designated register.
	Receive: Register page (0x00-0x08) + register address (0x00- 0xFF) + data length + data	Data Response
0x82	Transit: Variable space start address (0x0000-	Write data string (word data) to variable space starting from the specified address.

	0xFFFF) + the written data	Avoid writing the system-reserved space.
	Receive: 0x4F 0x4B.	Write command response
0x83	Transit: Variable space start address (0x0000-0xFFFF) +word length of the read data(0x01-0x7D)	Read a specified number of words of data starting from the designated address in the variable memory.
	Receive: Variable space start address + word length of the variable data + the read variable data	Data Response
0x84	Transit CH_Mode（Byte）+DATA0Word) +…+DATAn	Write curve buffer data CH_Mode determines the channel order of subsequent data. ➢ Each bit in CH_Mode represents a channel. CH_Mode.0 represents channel 0, and CH_Mode.7 represents channel 7. A bit value of 1 indicates the presence of data for that channel, while a bit value of 0 indicates the absence of data. ➢ Data is ordered from lowest to highest channel number. For instance, when CH_Mode is set to 0x83 (10000011B), the subsequent data format is: (Channel 0 + Channel 1 + Channel 7) + ... + Channel 0 + Channel 1 + Channel 7). The curve buffer is allocated from memory address 0x1000 to 0x4FFF, with each curve using 2KWords.
	Receive: 0x4F 0x4B	
0x86	Transit: Doubleword start address of the variable space (0x000000-0x007FFF) + the written data.	Data will be written to the variable memory region starting from the specified doubleword address. The total writable variable memory is 128. System reserved memory areas must not be overwritten.
	Receive: 0x4F 0x4B	Write command response

0x87	Transit: Doubleword start address of the variable space（0x000000-0x007FFF）+ doubleword length of the read data (0x01-0x3d)	Read a specified number of double-word values starting from a designated address. The total accessible variable memory is 128KB.
	Receive: Start address of the variable space + doubleword length of the variable data + the read variable data	Response Data

The register pages are defined as follows:

Register Page ID	Definition	Description
0x00-0x07	Data Register	256 per group, R0-R255
0x08	Interface Register	DR0-DR255. For more details, please refer to section 3.4 "Interface Register Definition" in the "OS Development Guide Based on T5”.

3 System Variable Interface

(System variable address range: 0x0000-0x0FFF)

VP	Definition	Length (Word)	Description
0x00	Reserved	4	Undefined
0x04	System_ Reset	2	Writing 0x55AA 5AA5 will reset the T5F CPU once.
0x06	OS_ Update_ CMD	2	D3: Setting D3 to 0x5A triggers a one-time operation to update the OS program, which is written to the on-chip flash memory. Once the CPU completes the update, it resets to 0. D2: File type 0x10: OS code starting from 0x1000, updating 28kb each time. 0xA5: 8051 code, updating 64KB each time. D1: 0: Start address of SRAM to save/update program. It must be even. If a power outage occurs during the update, causing the update to fail, the software will automatically restore to the previous version upon power-on.
0x08	NOR_ FLASH_ RW_ CMD	4	D7: Operating mode: 0x5A=read 0xA5=write; cleared after operation. D6:4: Start address of the on-chip Nor Flash. It must be an even number. 0x000000-0x03: FFFE, 256 KWords. D3:2: Start address of data variable space. It must be an even number. D1:0: Length of the read/written data, must be an even number.
0x0C	UART2 configuration	2	D3: Write 0x5A to configure the UART2 baud rate once; change it to 0xA5 after OS core processing. D2: serial port mode, bit définition. .7 CRC check, 1 = on, 0 = off. .6-.0 Reserved, write 0. D1:D0: Baud rate configuration value, D1:D0 = CPU main frequency / (64*the set baud rate).
0x0E	Ver	2	Application software version. D3 = 0x00, D2 = CTP driver software version, D1 means GUI software version, D0 means OS software version.

0x10	RTC	4	D7 = Year (0-0x63),
			D6 = Month (0-0x0C),
			D5 = Day (0-0x1F),
			D4 = Week(0-0x6),
			D3 = Hour (0-0x17),
			D2 = Minute (0-0x3B),
			D1 = Second(0-0x3B),
			D0 Undefined.
			All data is in hexadecimal format.
			The RTC requires hardware support. In the absence of such hardware support, the RTC data must be manually input by the user.

0x14	PIC_ Now	1	ID of the currently displayed page
0x15	GUI_ Status	1	The GUI operation status feedback: 0x0000 = idle, 0x0001 = currently processing variable files 13 and 14.
0x16	TP_ Status	4	D7: 0x5A = touch panel data is updated. D6: Touch status. 0x00: The touchscreen is not being pressed. 0x01: First press. 0x02: Finger lifted from the touchscreen after a press. 0x03: The touchscreen is currently being pressed. D5: D4 = X coordinate, D3:D2 = Y coordinate, D1:D0 = 0x0000.

0x1A	TP_KEY_status	1	Capacitive touch key data return (requires hardware support).
			D1 = 0x5A: Key detected → needs manual clear.
			D0 = key value

0x1A-0x30	Reserved	23	Undefined
0x31	LED_ Now	1	D1: 0x5A: backlight brightness value, AD0-AD7 instant value is updated. D0: current backlight brightness value, 0x00-0x64.
0x32	AD0- AD7 Instantaneous value	8	Instantaneous values of channels AD0 to AD7, one word per channel, with resolution set by the CFG file at address 0x06.2. 12bit mode: voltage = AD value*3300/4095mV.

			16bit mode: voltage = AD value*3300/65520mV. Real-time interrupt-based AD value reading is also supported by the OS core, with each channel having an AD sampling rate of 8KHz.
0x3A		4	
0x3E	Dual NTC temperature measurements	2	D3:D2: The external (outer shell wall boundary) temperature calculated by the algorithm, integer, unit 0.1℃. D1:D0: The temperature measured by the internal NTC within the housing, integer, unit 0.1℃. Instead of using an external temperature sensor, two NTC resistors (B=3950) are installed within the housing (typically a wall-mounted 86-type thermostat box) to measure and calculate the external air temperature, thereby mitigating the impact of internal heat on temperature readings NTCs, biased by a 10K 0.5% resistor via VREF, are connected to AD6 and AD7, complying with the following requirements: The NTC on AD6 is positioned at the enclosure center, while the NTC on AD7 is at the edge; each NTC has a 104 capacitor in parallel. Hardware support is required for this functionality. AD channels can be used for other purposes when not in use.
0x40-0x79	Reserved	58	Undefined.
0x7A	LCD_ HOR	1	Horizontal resolution of the screen
0x7B	LCD_ VER	1	Vertical resolution of the screen
0x7C-0x7F	Reserved	4	Undefined.
0x80	System_Config	2	D3: 0x5A = enable the parameter configuration once, cleared after operation. D2: touch panel sensitivity configuration value, read only. D1: touch panel mode configuration value, read only. D0: system status setting. .7: Serial port CRC check, 0 = off, 1 = on, read only. .6: Buzzer or music playback selection, 0 = buzzer, 1 = music playback. .5: Load the 22 file upon power-up to initialize the variable space. 1 = load, 0 = not to load, read only. .4: Variable automatic upload setting, 1= on, 0= off, read and

			write. .3: Touch panel sound control 1 = on, 0 = off, read and write. .2: Touch panel backlight standby control, 1 = on 0 = off, read and write. .1-.0: display direction 00 = 0 °, 01 = 90 °, 10 =180 ° ,11 = 270 °, read and write.
0x82	LED_Config	2	D3 = Turn on brightness, 0x00-0x64; When backlight standby control is off, D3 is the interface for brightness adjustment. D2 = Turn off brightness, 0x00-0x64. D1:0 = backlight-on time/10 ms.
0x84	PIC_Set	2	D3: 0x5A= enable page operation once, The CPU clears it after processing. This operation is invalid in multi-screen asynchronous display mode. D2: Processing Mode. 0x01 = page switch (Display the specified image from the image storage space to the current background page).
0x86	PWM0_Set	2	Unavailable: The OS core has 4 hardware PWM channels
0x88	PWM1_Set	2	Unavailable: The OS core has 4 hardware PWM channels
0x8A-0x91	Reserved	8	Undefined
0x92	PWM0_Out	1	Unavailable: The OS core has 4 hardware PWM channels
0x93	PWM1_Out	1	Unavailable: The OS core has 4 hardware PWM channels
0x94	Current Display of Multi-Screen Mode	1	D7:D6: Display page for LCD #1. A value of 0xFFFF indicates that LCD #1 is either not present or not displayed. D5:D4: Display page for LCD #2. A value of 0xFFFF indicates that LCD #2 is either not present or not displayed. D3:32: Display page for LCD #3. A value of 0xFFFF indicates that LCD #3 is either not present or not displayed. D1:D0: Display page for LCD #4. A value of 0xFFFF indicates that LCD #4 is either not present or not displayed. In order to maintain synchronization among display pages, data update shall be executed only when the DGUS is in an idle state, as reported by system variable 0x0015.
0x98-0x99	Reserved	4	Undefined

0x9A	CTP_Online config	2	D3: Write 0x5A to enable CTP configuration once, cleared after GUI core processing. D2: The ID of the location where the CTP configuration file (CTPCFG*.CFG) is stored within the LIB library D1:D0: Undefined, write 0x00.
0x9C	RTC_Set	4	D7:D6 = write 0x5AA5 to enable one-time setting of RTC. A hardware RTC must be installed to enable this setting.
0xA0	WAE Music_ Play_ Set	4	WAE music playback settings saved by the on-chip Flash: D7: ID of the segment played for this time, 0x00 -0xFF. The WAE file location is specified either by the CFG configuration file or D2: D1. D6: Number of segments played for this time, fixed at 0x01, cleared after DGUS processing. In buzzer mode, the playback segment duration is measured in units of 8 ms. D5: Playback volume, unit: 1/64; The initial power-on value is 0x40 (100%). D4: Playback status feedback, 0x00 = stop, 0x01 = pause, 0x02 = playing. D3: A value of 0x5A indicates that the location of the WAE file is specified by D2:D1. If the value is anything other than 0x5A, the location of the WAE file is determined by the CFG configuration file. D2: D1: WAE file location, only enabled when D3 = 0x5A. D0: undefined, write 0x00
0xA4	Reserved	6	Undefined
0xAA	External 16 Mbytes FLASH write operation	6	Update 16Mbytes of external memory content based on 32Kbyes blocks. D11: 0x5A = enable external memory operation; GUI clears it after execution. D10: Operation mode D10 = 0x10, read external 16 MB SPI NOR FLASH data D9: font library ID, 0x10-0x1F, 256Kbytes per font library, maximum 4Mbytes D8: D6: the start address of data in the font library is defined by word, 0x00 00 00-0x01 FF FF D5: D4: The first address of the read data variable space, which

			must be even. D3: D2: The length of the read data, defined by the Word, must be even. D1:D0: undefined, write 0x00. D10 = 0x02, write a 32 Kbytes data block into 16 MB external SPI NOR FLASH. D9: D8: 32Kybtes memory block address, 0x0000-0x01FF, correspond to 16 Mbytes memory. D7: D6: The first address of the update data stored in the data variable space must be even. D5:D0: Undefined, write 0x00. D10=0x03, font copy D9:D8: Source font ID, 0x0000-0x001F, 256 Kbytes per font library, max 4 Mbytes. D7:D6: Target font ID, 0x0000-0x003F. D5-D4: Number of fonts to copy, 0x0000-0x0010. D3:D0: Undefined, write 0x00. D10=0x04, write multiple 4KB data blocks to NAND FLASH (NAND Flash must be externally expanded). D9: D6: The starting address for writing to the NAND Flash must be 4KB-aligned (i.e., the low 12 bits must be 0). If the starting address of the low 18 bits are all 0, T5F0 will erase the entire 256KB block before writing any data. D5: D4: The starting address of the written data stored at the beginning of the data variable space, must be an even number. If D2 = 0x5A, then D1 is the 16-bit starting address of the variable space, allowing access to the entire 256KB variable space. D3: Number of 4KB blocks written, 0x01-0x10. D2: D1: Within the data variable space, the value at address D16 is interpreted as follows: 0x5A01 indicates that D16 is set to 1, while any other value implies that D16 is set to 0. D0: undefined, write 0x00. D10 = 0x05, A 32-bit CRC will be performed on the NAND Flash data. An external NAND Flash device is required for this operation. D9: D6: NAND source address, 0x0000:0000-0x1FFF:F000, the

			lower 12 bits are 0 (4 KB alignment). D5: D4: The number of 4KB data blocks to be checked, 0x0001-0x8000, the maximum is 128 Mbytes. D3: D0: 32-bit CRC check return value, The CRC polynomial is identical to the one employed during SD card downloading. D10=0x06, NAND Flash Copy (External NAND Flash Required). D9: D6: NAND source address, 0x0000:0000-0x1FFF:F000, the lower 12 bits are 0 (4KB alignment). D5:D4: Target font ID, 0x0000-0x00FF. 0x00-0xBF is SPI NOR Flash, the size of a single font is 256 Kbytes. 0x00C0-0xFF are SPI NAND Flash, and the size of a single font is 8 Mbytes. D3: D2: the number of fonts to be copied. D1: D0: undefined, write 0x00. In the event of an unexpected power outage during the copying process, the operation will automatically restart and continue from the point of interruption once power is restored.
0xB0	Touch instruction access interface	36	0xB0: 0x5AA5 = initiates a single touch command access, cleared by the CPU after operation. 0xB1: The page ID where the touch command to be accessed is located. 0xB2: The high byte of the code, which is configurable in the DGUS II software, serves as a unique identifier for the touch command to be executed. It can range from 0x00-0xFF. The low byte, on the other hand, specifies the exact operation or action to be performed by the touch command and can have values from 0x00-0x7F. 0xB3: Access mode 0xB4-0xD3: access the modified data of 0x02, 0x03. Mode 0x0000: turn off this touch control. Mode 0x0001: turn on this touch control. Mode 0x0002: Read this touch command and write it to the data area beginning at memory address 0xB4. Mode 0x0003: Replace the data of this touch instruction with data beginning at 0xB4, making sure the format and data length remain

			unchanged. only available for 13 files smaller than 32Kbytes
0xD4	TP operation simulation	4	0x5AA5 enables a simulated touch event. The CPU clears it upon completion. 0xD5: press mode. 0x0001=press down, 0x0002=release, 0x0003 = continuous press, 0x0004 = touch (press + release) 0xD6: X coordinate of press position. 0xD7: Y coordinate of press position. After simulating mode 0x0001 and 0x0003, must simulate 0x0002. Following a simulated press action of a short press (0x0001) or a long press (0x0003), a simulated release action (0x0002) must be executed to complete the input sequence. During the operation of the configuration touch function, if x = 0xAA: KH and y = 0xA5: KL, the system will immediately send the key values KH and KL as input to the configuration touch interface. For instance, when you are in configuration mode and entering a value for a variable, if you touch the screen at coordinates (0xAAF0, 0xA5F0), the input process will terminate instantly. In a touch file design that supports keycode functionality, if a touch event occurs at the X coordinate 0Xff: a specific keycode and the Y coordinate 0x0001, it will activate the associated keycode function.
0xD8	Pointer icon overlay display	4	0xD8_ H: 0x5A = enable the overlay display. 0xD8_ L: the position of ICL file which the pointer icon is saved at. 0xD9: the pointer icon ID. 0xDA: the X coordinates of pointer icon. 0xDB: the Y coordinates of pointer icon. The pointer icon is usually displayed in the background filtering mode. And the filtering intensity is consistently set to a value of 0x08.
0xDC	Music WAE file switch	2	D3: 0x5A indicates that the music WAE file switching is enabled. Upon first start up, this setting is initially disabled (0x00). D2: Undefined, write 0x00. D1:D0: music WAE file ID.
0xDE	Background ICL	2	D3: 0x5A indicates that the background picture ICL file switching is

	Switch		enabled. Upon first start up, this setting is initially disabled (0x00). D2: Undefined, write 0x00. D1:D0: ICL file ID of the background image.
0xE0	Memory CRC check	2	D3: write 0x5A to enable the CRC verification once, cleared after execution. D2: memory type selection 0x00= font space (16Mbytes memory) 0x02= OS code 0x03= Nor flash database (LIB file). D1:D0: data interface. ▶ Enable the CRC Font check mode: D1= starting ID of the font library (256 KB for each font); D0= the number of 4KB blocks to be verified, 0x00-0xFF. OS code verification mode: D1:D0 = starting at 0x1000, the length of the OS code to be verified in bytes, 0x0001-0x7000. Nor flash database mode: D1:D0 = Nor flash database ID, verifying a fixed 4KB data each time. ▶ After the CRC verification The returned CRC value.
0xE2	Export the monochrome bitmap of the specified area on the screen	6	Unavailable
0xE8	Page stacking switch	2	0xE8_H: 0x5A Enable page overlay function; other values to disable the function. 0xE8_L: Enable page overlay post-touch mode; 0x00 = Touch on overlay page is not responded 0x01 = only touch of the overlay page is responded. 0xE9: the ID of the page to be overlayed. Once page overlay is enabled, the display variables of the page overlay shall be displayed on the current page with the highest priority.
0xEA-0xEF	Reserved	6	Undefined

0xF0	Music streaming playback API	4	D7: 0x5A= enable the music playback operation, cleared after operation. D6: Playback mode, 0x00 = stop (clear the buffer), 0x01= suspend (reserve the buffer), 0x02=start. D5:D4: undefined, write 0x00. D3:D2: Variable memory address where music data is stored, even number. D1:D0: Music data word length, maximum 8KWords, even number; data is 16-bit integer format.
0xF4	Painting interface	8	Unavailable
0xFC	DGUS_STOP_EN	2	Writing 0x55 AA 5A A5 will stop the DGUS refresh, which is used to avoid the conflict of rewriting fonts when there is no backup area to upgrade. Writing 0x55 AA 5A AA to pause both the DGUS screen refresh and OS core running. This is done to ensure the integrity of the fixed variable buffer (0x8000-0xFFFF) during ED4 downloads. By freezing refresh and OS core running, you prevent any potential overwrites of the variables that could cause upgrade data errors. Writing 0x55 AA 5A 5A will stop the touch processing and no longer respond to touch screen operation (0x0016 variable coordinates normal update).
0xFE	UART1 high speed download	2	0x5AA5 = enable the high-speed download operation through UART1
0x100	FSK bus interface	512	Not supported. The OS kernel has a built-in FSK interface.
0x300	Dynamic curve interface	128	0x300- 0x30F: state feedback for 8 channel curve buffers (read only advised), 2 words per channel. High word is the storage pointer location (0x000-0x07FF) where curve data is stored, and low word is the effective data length of curve buffer Setting the valid data length to 0x0000 will hide the corresponding curve. 0x310- 0x311: start writing curve buffer data. (If you choose to use serial port command 0x84 to write to the curve buffer, you can skip using this operation interface.) D3: D2: 0x5AA5 enables a write operation to curve buffer data. Once the CPU completes the write, the buffer is cleared. D1: the number of data blocks, 0x01-0x08. D0: undefined, write 0x00. 0x312-0x37F: data block written to the curve buffer; Each data point within this region is a 16-bit unsigned integer.

			Each data block consists of data channel ID (0x00-0x07) + data word length (0x01-0x6E) + data. Once dynamic curve display is enabled, data buffers for each curve are created starting from address 0x1000, with 2K words allocated for each channel. The CH0 buffer is 0x1000-0x17FF, the CH1 buffer is 0x1800-0x1FFF, etc. The unused curve buffer zones can be used as user variables. Users can overwrite curve buffer data directly and modify storage pointer and data length at addresses 0x300-0x30F to ensure that curves are correctly displayed.
0x380	The first channel curve data automatic reading configuration	2	D3: 0x5A enables automatic reading of curve data from the variable space for the first channel. D2: Automatic reading interval, the unit is 10ms. D1:D0: variable space address.
0x382	Channel 2-8 configuration	14	The definition is the same as channel 1.
0x390	Reserved	112	Undefined, not available for user.
0x400-0x4FF	Network communication interface	256	Application control interface for WiFi and other Internet communication equipment.
0x500-0x5BF	Multi- Media interface	192	Multi-Media application interface, 0x500- 0x57F digital multi-Media interface, 0x580-0x5BF analog multi-Media interface.
0x5C0-0x5FF	External memory interface	64	External memory interface (such as U disk) read or write interface.
0x600-0xEFF	Reserved	2404	Undefined. Not available for users.

0x0F00	Variable change indication	2	After setting variables to change the automatic upload function, this function is enabled.
			D3 =5A means variable change,
			D2:D1= variable memory pointer,
			D0 = variable length (word).

0xF02-0xFFF	Reserved	254	Undefined. Not available for users.

The variable storage space between 0x1000 and 0xFFFF is available for unrestricted use.

3.1 Network Communication Interface

In the DGUS system, the address of the network part is defined in the region 0x400-0x4FF, as follows:

Definition	Address	Length (Word)	Recommended value (HEX)	Instructions
Network interface switch	0x400	1	5AA5	0x5AA5 indicates that the network communication interface is enabled.
RAM ALARM	0x401	3	0000 0000 0000	D5:D4: 0x5AA5 triggers an immediate upload of data from the designated RMA space to the server. This value is reset to zero after the upload is complete. D3-D2: Word address of the RMA variable memory to be uploaded. D1-D0: The word length of the RMA variable memory to be uploaded.
Reserve	0x404	12	All are 00	Reserve
Device description	0x410	1	5A45	High byte: 0x5A indicates that the device description is valid. Low byte: the encoding method and length of the device description text. .7-.6: encoding 0x00 = UNICODE, 0x01=GBK, GBK is recommended. .5-.0: describes the text length, 0x00-0x34.
	0x411	2	00000001	A 4-byte manufacturer ID assigned by DWIN. The range from 0xFFFF:0000 to 0xFFFF:FFFF is reserved for future use.
	0x413	1	0001	2-byte identifier assigned to manufacturers to classify their devices. This classification follows the DWIN standard but is determined independently by each manufacturer.
	0x414	2	User-defined	4-byte, unique device identifier within each device class, assigned by the manufacturer.
	0x416	26	DGUS2_T5UID1	Device description text, up to 52Bytes.
Device description (RMA mapping)	0x430	1	012C	RMA automatically refreshes the server interval 0x0000-0xFFFF in 0.1 seconds. 0x0000 indicates that no automatic refresh is required.

	0x431	1	1000	RMA (mapped to the server's variable memory) read space start address, word address, out of bounds cannot be read. (Since we are running out of space, now we have no limit on reading space)
	0x432	1	0004	RMA read space size in 128 Words with a maximum size of 64KWords and 0x0000 indicates forbidden reading.
	0x433	1	2000	The starting address for writing to the RMA space can overlap with the starting address for reading from the RMA space. However, writing beyond the boundaries of the allocated RMA space is not permitted.
	0x434	1	0004	RMA write space size in 128 Words, Max 64 KWords, 0x0000 indicates write forbidden.
	0x435	3	All are 00	Reserve
Device description (remote upgrade)	0x438	1	5AA5	The remote upgrade interface is enabled. 0x5AA5 indicates that the device is enabled with the remote upgrade interface. The system will automatically detect the Buffer.
	0x439	1	0064	Remote upgrade packet timeout timer configuration in 0.1 second.
	0x43A	4	5A 0001 0000 0000F0	Definition of the first remote upgrade space on the device (which corresponds to 1MB of Flash memory on T5F0, aligned to 4KB blocks): D7: 0x5A indicates that the remote upgrade space is enabled. D6-D3: 32-bit start address of the upgradeable space (lower 12 bit is 0), up to 4 GB. D2-D0: The size of the upgradeable space, in 4KB, up to 4GB.
	0x43E	4	5A00 0000 0000 8000	The second remote upgradeable space definition for the device, associated with 16MB-64MB of storage for images and fonts.
	0x442	4	All are 00	The third remote upgradeable space definition for the device, currently not in use
	0x446	4	All are 00	The fourth remote upgrade space definition for the device, currently not in use

	0x44A	2	5A 00 08 B0 00	Remote upgrade Buffer interface definition: D7: 0x5A indicates that the remote upgrade Buffer is valid. D6 = update mode 0x00 = the communication end is responsible for performing the CRC checksum on the data. If an error frame is detected, the communication end will notify the host to resend the data. D5: the number of buffers that can be used for remote firmware upgrades. This value can range from 0x01 to 0x10, with a maximum of 16 buffers. D4: the high byte of the starting address (word address) for Buffer0. The lower 8 bits of this address are always 0x00. Each buffer is assigned a fixed address space of 2304 words (0x900), allocated contiguously. Definition of a single buffer (the first 512 bytes are used for the control interface, with the subsequent 4KB dedicated to data): D0: 0x5A = initiates a remote upgrade process for the associated buffer. The CPU will reset this value to zero after completing the upgrade. D1: one of the four remote upgrade spaces (0x00 to 0x03) for the purpose of a 4KB block write operation. D2-D5: write the target address for the remote upgrade space. The lower 12 bits of this address are always 0. D6-D7: Data byte length, 0x0001-0x1000. D8-D9: Data CRC checksum D10-D511: Reserve D512: the start of the data, up to 4096 bytes in length.

	0x44C	4	All are 00	Reserve
Device description QR code	0x450	48	All are 00	QR_Code device QR code.
Communication device description	0x480	16	User-defined	D31: 0x5A indicates that the communication device description data is valid. D30: The encoding method and length of the device description text. .7-.6 Edit: Code mode 0x00=UNICODE 0x01=GBK, GBK is recommended. .5- .0 Description: The length of the text is 0x00-0x14. D29: Communication device category 0x01=WIFI . D28: Communication device status, bit definition .7 Equipment working status 0=Configuration 1=Normal; .6-.3 undefined, write 0; .2- .0 signal quality, 0x00-0x07 A total of 8 files, 0x00 means the worst, 0x07 means the best. D27-D20: 8Bytes communication device MAC address, low (D20) alignment. D19-D0: Description of the communication device in text format, up to 20Bytes. Use hexadecimal to describe the information as the corresponding ASCII character.
Communication device	0x490	8	User-defined	Communication device customization, such as WIFI username, password.

Device description information is set according to the relevant data in the 22-initialization file at location 0x0800-0x09FF, regardless of whether the variable buffer initialization function for the 22 file is active.

4 SD Card

Upgrading via SD card without power cycle is not supported. To upgrade, you need to power off the screen, insert SD card, and power on again for downloading.

The following types of files can be updated and downloaded through the SD/SDHC interface of the T5F0 serial screens.

Filetype	Naming Rule	Description
Program file	T5F0_UI*.BIN T5F0_OS*.BIN TPS04*.BIN	Underlying kernel firmware program
OS program	DWINOS*.BIN	OS program, the code must start from 0x1000.
OS CPU 8051 program	T5F0_51*.BIN	A user-developed program in the OS-based 8051 platform. You can choose to encrypt or not to encrypt when downloading.
Program configuration or initialization	T5F0_*.INI	TCON configuration or initialization program of LCD screen.
NOR Flash data base	ID + (optional) file name. LIB	Each ID is associated with a 2KB memory block. IDs range from 0 to 127. The database, which is 256KB in size, is stored in the on-chip NOR Flash and can be used to store either user data or the OS program library files.
Font file	Font ID + (optional) file name.BIN/ DZK/HZK/GTF	Font ID: 00-31; ASCII fonts utilize the DGUS 0# font library
DGUS input method file	12*.BIN	Permanently stored in 12 font location
DGUS touch control file	13*.BIN	Permanently stored in 13 font location. Size limit: 32 KB
DGUS display control file	14*.BIN	Permanently stored in 14 font location. Size limit: 256 KB, in DGUS II format.
DGUS variables initialization file	22*.BIN	Permanently stored in 22 font location. The content from memory addresses 0x2000 to 0x3FFFF is loaded to initialize the variable space from 0x0:1000 to 0x1:FFFF.
JPEG image and icon file	Font ID + (optional) filename.ICL	Must be an ICL file in DGUSIII format. For multi-FLASH expansion, make sure that the data for each image must be contained within the boundaries of a single Flash. For product kernel of DGUS2 V4.0 and above, you must use

		DGUS software V7.623 and above to generate ICL files.
Music file	Font ID + (optional) filename.WAE	The file format must be in DGUS2 format, generated exclusively by specified development tool.
UI configuration file	Configuration module ID + (optional) filename. UIC	The configuration module ID is from 0x0000 to 0xFFFF, and each ID corresponds to 32 KB memory space. For multi-FLASH expansion, the data for each module must be contained within the boundaries of a single flash.
Hardware configuration file	T5LCFG*.CFG	Configure CRC status, baud rate modification, touch panel sound, touch upload mode, display direction, and other settings. Avoid downloading incompatible CFG files that may cause screen malfunction. Users can contact customer service for the necessary the CFG files.
CTP configuration file	CTPCFG*. CFG	Firmware file for configuring the capacitive touchscreen, which is directly flashed into the CTP IC.
CRC check file	T5*. CRC	Perform CRC32 check after SD card download.

The size of a single JPEG image must not exceed 124KB.

When using NAND Flash for expansion, it must be soldered to the Flash expansion slot 1 (0-1, 2 positions in total). The associated font library IDs range from 0xC0 to 0xFF, with each library occupying 8MB. The maximum capacity of a single expandable SPI NAND Flash is 128Mbytes.

The downloaded file must be placed in the folder as specified by DGUS software at the root directory of a 4KB-sector, FAT32 formatted SD or SDHC card.

4.1 T5LCFG*.CFG File Format

Type	Address	Length	Definition	Description
System Configuration Value	0x00	5	0x54 0x35 0x4C 0x43 0x31	Fixed Content
	0x05	1	Configure Parameters	.7: Serial CRC verification, 1 = off 2 = on .6: Buzzer/music playback selection, 0 = buzzer 1 = music playback .5: Load 22 file to initialize the variables when powered on, 1 = load 0 = not to load .4: Touch variable automatic upload, 1 = on, 0 = off .3: Touchscreen auditory feedback control, 0=off 1 = on. .2: Screen Standby backlight control, 1 = on, 0 = off. .1-.0: Display direction, 00 = 0° 01 = 90° 10 = 180° 11 = 270°.
	0x06	1	Configure Parameter 1	.7: 0 = External LED driver, PWMO output 25KHz dimming signal. 1 = the system uses T5F0's closed-loop control with both PWM0 and ADC4 to drive the LED. .6: Expand SPI NAND Flash. 0 = not expanded 1 = expanded. .5: Setting the value to 1 to start NAND FLASH formatting (Data will be cleared) .4: Undefined .3: Set the value to 1 to erase all internal flash data. .2: AD return value resolution selection. 0 = 12 bit; 1=16 bit .1: Encryption setting for downloading OS 8051 program: 0 = unencrypted; 1 = encrypted. If encryption is selected, users must encrypt 8051 programs with the specified tool before downloading.

				.0: Choose whether to run OS core when downloading data with SD card, 0 = not to run 1 = to run.
	0x07	1	Music WAE file Storage Location	0x00-0x3F（00-63）。
	0x08	1	Storage location of background images and ICL file	0x10-0xFF.
	0x09	1	Set reporting point of touch panel	0x01-0xFF. The factory default value is 0x28. Reporting point rate = 400 Hz / The set value
	0x0A	2	Set serial baud rate	Baud rate setting value = 3225600 / the set baud rate For 115200bps, the setting value is 0x001C, and the maximum setting value is 0x03FF.
Standby backlight configuration	0x0C	1	Normal operation and start-up brightness	0x00-0x64, Unit 1%
	0x0D	1	Standby brightness	0x00-0x64; Unit: 1%
	0x0E	2	Time to resume from standby and turn on display	0x0001-0XFFFF; Unit: 10mS
Display configuration	0x10	2	Display_Config_En	0x5AA5 = Enable the configuration. Pre-configured at the factory. Users do not need to configure it.
	0x12	1	PCLK_ PHS	Data latch phase setting: 0x00 = falling edge 0x01 = rising edge.
	0x13	1	PCLK_ DIV	Pixel clock (PCLK) frequency configuration: PCLK frequency (MHz) = 206.4 / PCLK_DIV.
	0x14	1	H_W	
	0x15	1	H_S	
	0x16	2	H_D	Screen resolution in the horizontal direction (X axis).
	0x18	1	H_E	

	0x19	1	V_W	
	0x1A	1	W_S	
	0x1B	2	V_D	Screen resolution in the vertical direction. (Y axis).
	0x1D	1	V_E	
	0x1E	1	TCON_SEL	0x00 = unnecessary to configure TCON
	0x1F	1	Reserved	Write 0x00
Touch panel settings	0x20	1	TP_Set_En	0x5A = Enable the configuration. It has been preconfigured at the factory, and no further configuration by the user is required.
	0x21	1	TP_Mode	Touch panel mode configuration .7-.4 (high 4bit). Select touch panel type: 0x0* = 4-wire resistive touch panel 0x1* = Capacitive touch panel driven by GT911, GT9271 or GT9110 ICs 0x2* = ILI9881H Incell CTP 0x3* = Capacitive touch panel driven by ILI ICs, such as the ILI2117 and ILI2118. 0x4* = Capacitive touch panel driven by ILI IC, such as ILI2130 0x5* = Capacitive touch panel driven by Betterlife IC, such as BL8825 0x6* = Capacitive touch panel driven by Sili micro-IC, such as GSL1680. 0x7* = Capacitive touch panel driven by Hynitron IC, such as CST340 0x8* = Capacitive touch panel driven by ILI driver IC, such as ILI231*/251* 0x9* = Capacitive touch panel driven by TPS04 IC. 0xF* = 5-wire resistive touch panel .3 Resistive touch panel calibration: 0= off; 1 = on; only enabled when downloading from an SD card. During resistive touchscreen calibration, the display cannot be configured to rotate 180°

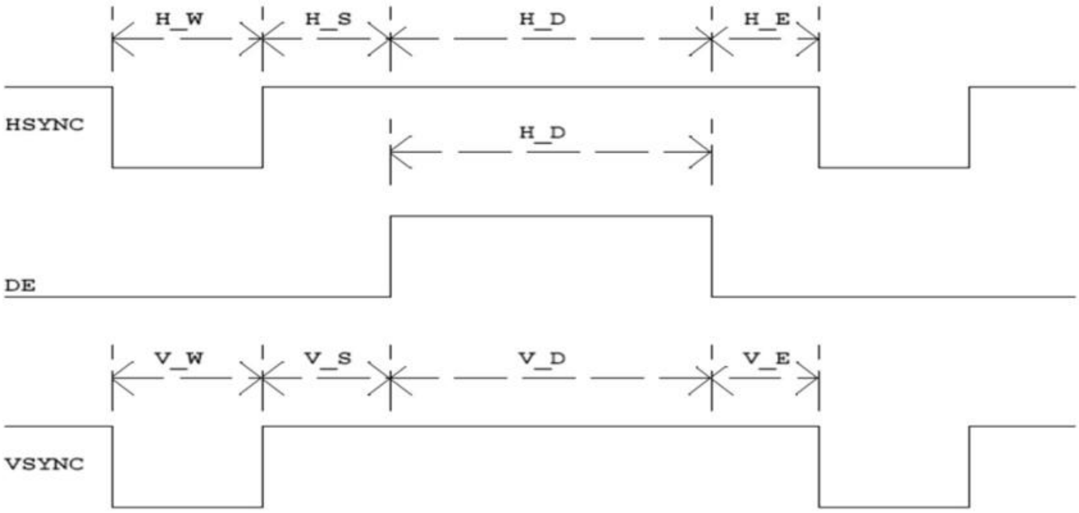
				or 270°. .2-.0 (low 3bit) Touch panel mode: (Only valid for capacitive touch panel) .2 X coordinate selection: 0 = from 0 to Xmax; 1 = from Xmax to 0. .1 Y coordinate selection: 0 = from 0 to Y max; 1 = from Y max to 0. .0 X, Y exchange: 0 = XY; 1 = YX.
	0x22	1	TP_Sense	For capacitive touchscreens, the touchscreen sensitivity can be adjusted between 0x00 and 0x1F, with 0x00 being the lowest and 0x1F being the highest. The factory default setting is 0x14, which offers relatively high sensitivity. (For ILI9881 displays, the range is 0x01-0x06). Setting the value to 0xFF will disable touch configuration (using the hardware initial value). For resistive touchscreens, the touch accuracy can be set between 0x10 and 0xFF. A lower value results in higher accuracy but slower response times, while a higher value results in lower accuracy but faster response times. The factory default setting is 0x40.
	0x23	1	TP_Freq	Frequency band selection for ILI9881H. 0x01 to 0x14: fixed frequency bands. 0x00: frequency hopping mode.
Clock output configuration	0x24	1	CKO_Set_En	Unavailable, not defined
	0x25	1	CKO_En	
	0x26	1	CKO_DIV	
Buzzer configuration	0x27	1	BUZZ_Set_En	0x5A = Enable the configuration.
	0x28	1	BUZZ_Freq_DIV1	Buzzer frequency = 825753.6/(BUZZ_Freq_DIV1*BUZZ_Freq_DIV1) KHz Factory settings: DIV1 = 0x6E, DIV2 = 0x0BB8, corresponding to the 2.5 KHz frequency.
	0x29	2	BUZZ_Freq_DIV2	
	0x2B	2	BUZZ_Freq_Duty	Buzzer duty ratio settings: High level duty ratio = BUZZ_Freq_Duty/

<table>
<tr><td rowspan="2"></td><td></td><td></td><td></td><td>BUZZ_Freq_DIV2.
Factory setting: 0x00F0 corresponds to 8% high level duty ratio.</td></tr>
<tr><td>0x2D</td><td>1</td><td>BUZZ_Time</td><td>Buzzer beep duration after touch; unit: 10mS; Factory setting: 0x0A.</td></tr>
<tr><td rowspan="2">Power- on initialization file ID configuration</td><td>0x2E</td><td>1</td><td>Init_File_Set_En</td><td>0x5A = Start configuring power-on initialization variable file ID.</td></tr>
<tr><td>0x2F</td><td>1</td><td>Init_File_ID</td><td>The configured power-on initialization variable file ID, Default: 0x16.</td></tr>
<tr><td rowspan="2">System clock
adjustment</td><td>0x30</td><td>1</td><td>Sysclk_Set_EN</td><td>0x5A= Enable the configuration.</td></tr>
<tr><td>0x31</td><td>1</td><td>Sysclk_Adj_Set</td><td>System clock adjustment, -2 (0xFE) to +2 (0x02), the unit is 1/224.
The factory configuration value is 0x00.
Different configuration values correspond to different PLL main frequencies, CPU main frequencies, and baud rates, as shown in the following table:
<table>
<tr><th>Setting Value</th><th>PLL Main Frequency (MHz)</th><th>CPU Main Frequency（MHz）</th><th>Baud Rate Constant（bps）</th></tr>
<tr><td>0xFE</td><td>818.3808</td><td>204.5952</td><td>6393600</td></tr>
<tr><td>0xFF</td><td>822.0672</td><td>205.5168</td><td>6422400</td></tr>
<tr><td>0x00</td><td>825.7536</td><td>206.4384</td><td>6451200</td></tr>
<tr><td>0x01</td><td>829.4400</td><td>207.3600</td><td>6480000</td></tr>
<tr><td>0x02</td><td>833.1264</td><td>208.2816</td><td>6508800</td></tr>
</table>
The factory value is 0x00</td></tr>
<tr><td rowspan="2">Picture Replace
Configuration</td><td>0x32</td><td>1</td><td>Picture_Replace_En</td><td>0x5A enables picture replacement.
After the picture placement is enabled, the system will search the specified ICL file for a replacement image when executing commands related to image display. If the desired image is found, it will be displayed; If not found, the system will display the image in the ICL file specified at 0x08 location in the CFG file.</td></tr>
<tr><td>0x33</td><td>1</td><td>ICL_ID</td><td>The ID of the ICL file that saves the replaced picture, 0x00 means no replacement</td></tr>
</table>

				(disenabled).
Extended Parameter Configuration	0x34	1	Enable extended configuration	0x5A enables configuration of the extended parameters.
	0x35	1	Enable extended parameters	0x5A enables configuration of extended parameters. Other values are invalid and disables it.
	0x36	1	Extended parameter configuration 1	.7, Configuration of DGUS refresh cycle; 0 = 1T (default), 1=2T. T represents refresh cycle of LCD, typically 16.7Ms. (60Hz) .6, UART1 CRC Verification 0 = off 1 = on. Verification mode is identical to that of UART 2. .5-.0, reserved, write 0
	0x37	9	Reserved	Write 0x00
SD download file folder name setting	0x40	2	SD_Encrypt_En	0x5A5A indicates setting the download folder name (SD download without encryption). 0x5AA5 indicates setting the download folder name for one time and enabling SD download encryption. 0x5AAA indicates canceling SD download encryption and restoring the SD download directory. Encryption settings will be saved in the screen's Flash memory and will not be lost after power off.
	0x42	1	Character length of download folder name	0x01-0x08.
	0x43	8	Folder name	The setting is limited to a maximum of 8 ASCII characters (0-9, a-z, A-Z, - and _ only). Invalid characters will be replaced with the default value. The setting will not be effective until the device is powered off and then on again.
	0x4B	5	Reserved	Write 0x00
	0x50	32	Decryption key	requires only a one-time setup.
Power-on backlight delay lighting	0x70	1	Enable configuration	Initiates a one-time configuration of the backlight delay time at power-up.
	0x71	1	Delay Setting	The power-on backlight delay time, measured in

configuration				units of 10 mS, set to 0x0A by default at the factory.
Undefined	0x72	16	Reserved	Write 0x00

Display Configuration Reference



Resolution	T5LCFG*.CFG Display Configuration Value (HEX Format)													
	0x12	0x13	0x14	0x15	0x16	0x17	0x18	0x19	0x1A	0x1B	0x1C	0x1D	0x1E	0x1F
	PHS	DIV	H_W	H_S	H_DH	H_DL	H_E	V_W	V_S	V_DH	V_DL	V_E	TCON	
2.0_240*320IPS	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 （ST7796）	01	26	0A	14	00	F0	0A	02	02	01	40	02	05	00
2.4_240*320 （ST7789）	01	26	0A	14	00	F0	0A	02	02	01	40	02	1A	00
2.8_240*320 (ST7789)	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 (ST7796S)	01	14	0A	04	01	40	0A	02	02	01	E0	02	06	00

3.5_320*480 IPS (IL9488)	01	14	0A	04	01	40	0A	02	02	01	E0	02	13	00
4.0_480*480 IPS (ST7701S)	00	0E	08	08	01	E0	08	02	0C	01	E0	06	08	00
3.0_360*640 IPS	00	0A	20	3C	01	68	20	06	36	02	80	08	0F	00
1.6_400*400 IPS （ST77903 Circular Scree）	00	1C	08	08	01	90	08	01	08	01	90	08	00	00
2.1_480*480 IPS (ST7701S Circular Screen)													18	
1.3_240*240 IPS (GC9A01A Circular Screen)													1B	
480*272	01	16	29	02	01	E0	02	0A	02	01	10	02	00	00

4.2 T5* CRC File Format

Category	Address	Length	Definition
File identification	0x0000	4	Fixed to 0x43 0x52 0x43 0x10.
CRC result	0x0004	4	The ultimate result of the CRC32 checksum calculation is obtained by processing the data at the designated locations in a sequential order.
Reserve	0x0008	7	Write 0x00.
OS core code verification	0x000F	1	Write 5AA5 to enable CRC checksum verification for the OS kernel code. Any other value will skip the checksum process. If OS kernel code checksum is selected, the downloaded OS kernel code must be 64KB in size. The remaining space should be padded with 0xFF.
LIB file check	0x0010	2	0x10 = ID of LIB file to be checked; 0x11= Number of files to be checked starting from this ID. 0x00 = the end of LIB file verification process.

			If LIB file checksum is selected, the downloaded OS kernel code must be 4KB in size. The remaining space should be padded with 0xFF.
	0x0012	62	The remaining 31 defined positions.
Font file verification	0x0050	2	0x50 = the ID of the font file to be checked. 0x51 = The number of files to be verified starting from this ID, 0x00 means the end of the font file check. For external NOR Flash, the font size is 256KB. For external NAND Flash, the font file size is 8 MB; However, due to the potential presence of bad blocks in NAND Flash, the last file should not be used or verified. If font file verification is enabled, the downloaded font file must be aligned to a size of 256KB for NOR flash or 8MB for NAND flash. Any remaining space should be padded with 0xFF.
	0x0052	254	The 127 remaining defined positions.
Reserve	0x0150	176	Write 0x00.

The CRC32 calculation uses the polynomial.

X32+X26+X23+X22+X16+X12+X11+X10+X8+X7+X5+X4+X2+X+1

4.3 Flashing File Format for CTPCFG*.CFG Capacitive touch Screen Configuration

Category	Address	Length	Definition
File Recognition	0x0000	4	Fixed as 0x43 0x54 0x50 0x53
CTP IC	0x0004	2	0x0001-GT911/GT9110H
PACK_NUM	0x0006	1	Configure the number of packets, 0x01-0x08
PACK_Delay	0x0007	1	Configure the delay time after 1 packet (then configure the next packet), 0x01-0xFF, the unit is 1ms
Reserved	0x0008	24	Reserved, write 0x00
Configuration package 1 definition	0x0020	2	The number of registers that need to be configured in this package
	0x0022	2	The start register address configured by this package
	0x0024	476	Register data
Configuration package 2 definition	0x0200	2	The number of registers that need to be configured in this package
	0x0202	2	The start register address for this configuration package
	0x0204	508	Register data
……			
Configuration package 8 definition	0x0E00	2	The number of registers that need to be configured in this package
	0x0E02	2	The start register address for this configuration package
	0x0E04	508	Register data

Appendix 1: Revision Record

Date	Revision Content	Program Version
September 25, 2024	Ported T5L DGUS II V6.5, first release.	V6.5
May 30, 2025	1) In the CFG configuration file, address 0x06.7 included a backlight driver mode selection: 0 = External LED backlight driver IC, 1 = T5F0 drives the LED backlight. 2) A 32KB block copy mode has been added to the 0x00AA system variable interface for SPI NOR Flash font library transfers. 3) A grouping display function has been added to the variable icon display for multi-language applications. 4) Added capacitive button status feedback to the 0x001A system variable interface (requires hardware support). 5) The 0x0094 system variable interface included the ability to display different pages on different screens when using multi-screen heterogeneous display.	V6.5

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Thank you all for your continuous support of DWIN, and your approval is the driving force of our progress!