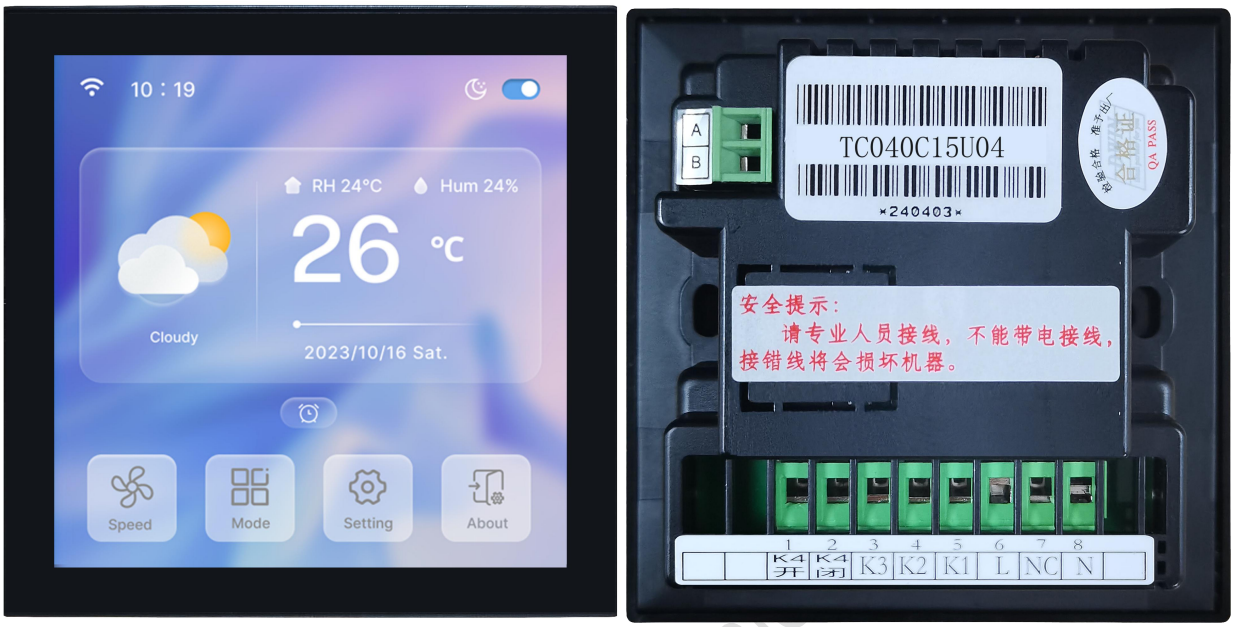
TC040C15U04



Features:

(1) Based on the T5L0 ASIC CPU, running the DGUS II human-machine interaction software platform, ultra-slim thermostat.

(2) 4.0-inch, 480*480 pixels resolution, 262K colors, IPS-TFT-LCD, wide viewing angle.

(3) OCA bonded capacitive touch screen.

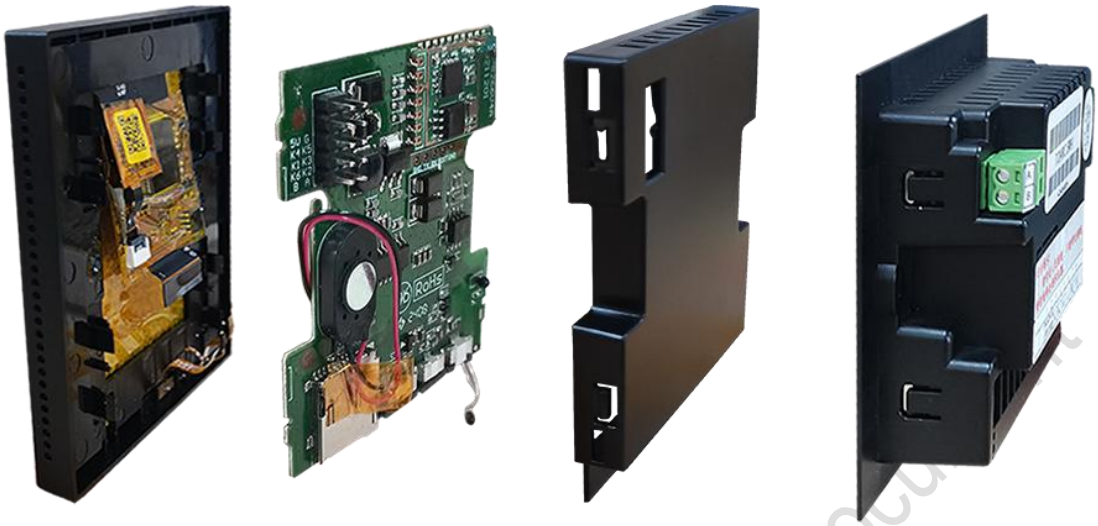
(4) With speaker and RTC.

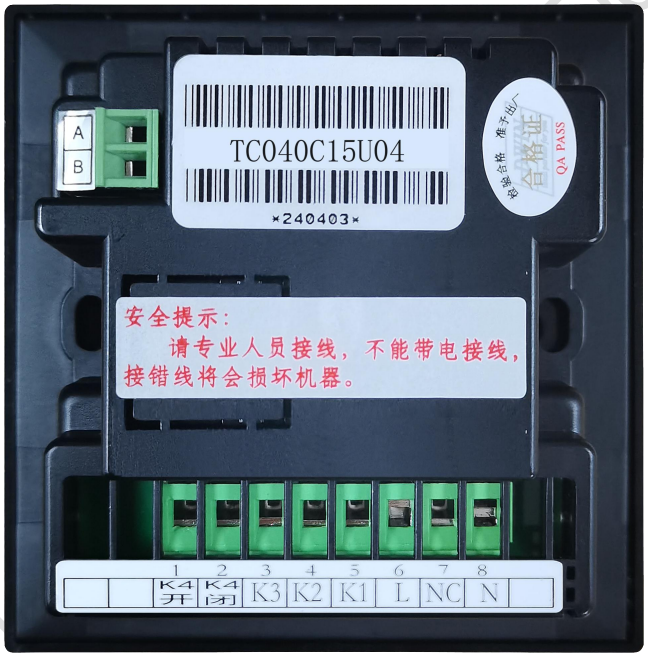
(5) With conformal coating.

(6) Feature temperature measurement using NTC and support expansion of infrared reception, real-time temperature and humidity display, proximity sensing, and offline voice capabilities.

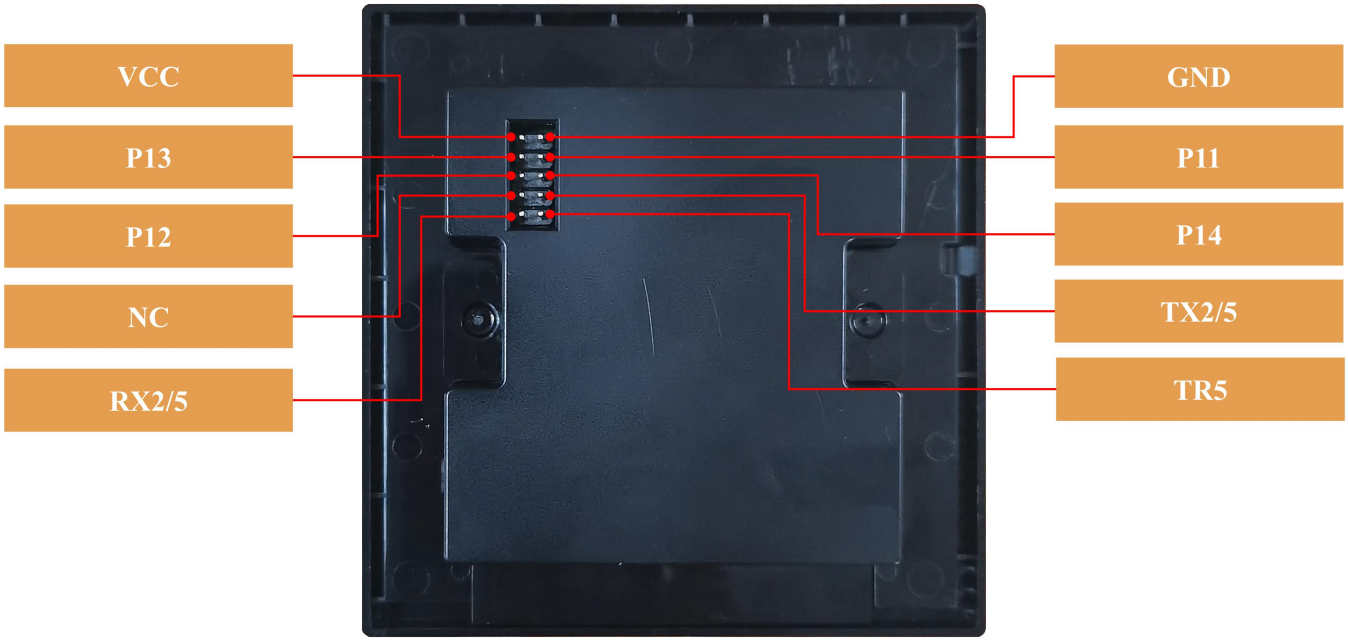
1、Hardware and Interface

1.1 Hardware Interface





Item	Parameter	Corresponding internal pin
A	IO	485+
B		485-
K4 Open	O	P1.3 electric relay1 valve(IO3)
K4 Close		
K3	O	P1.1 electric relay 2 low(IO1)
K2	O	P1.4 electric relay 3 middle(IO4)
K1	O	P1.2 electric relay 4 high(IO2)
L	P	Live line
NC	—	Undefined
N	P	Neutral line



Item	Parameter	Description
1	VCC	Power input, 5V.
2	GND	GND
3	P13	P1.3 electric relay1 valve (IO3)
4	P11	P1.1 electric relay 2 low (IO1)
5	P12	P1.2 electric relay 4 high (IO2)
6	P14	P1.4 electric relay 3 middle (IO4)
7	NC	Undefined
8	TX2/5	UART2 and UART5 transmit data. (TX2 and TX5, logic AND)
9	RX2/5	UART2 and UART5 receive data. (RX2 and RX5 shorted)
10	TR5	Output for RS485 transmit/receive switching (TR5 and UART 2 self-transmit/receive control pin, logic OR)

1.2 Hardware and Interface Description

No.	Name	Description
1	T5L0 ASIC	DWIN independently developed, mass production in 2020; patented encryption technology ensures code and data security; low power consumption, strong anti-interference capability, easily passes EMC/EMI tests with dual-sided PCB design.
2	User interface	8Pin_5.08mm and 2Pin_3.81mm horizontal terminal blocks for power supply, serial communication and electric relay control. Download rate(typical value): 12KByte/s.
3	Flash	16MBytes NOR Flash, can be used to store user UI files such as fonts, images, music, etc., with erase/write cycles >100,000 times.
4	Speaker	Built-in Speaker, 8Ω1W
5	RTC	Super-capacitor supplies power to RTC, accuracy: ±20ppm @25℃. Can maintain normal operation for 7 days after power-off.
6	SD card slot	Supports downloading of all files (user UI files, CFG files, underlying kernel firmware), displays download statistics on the screen, download rate: 4 Mb/s. When downloading files, the SD card needs to be formatted in FAT32 format, with a recommended allocation unit size of 4096.
7	PGT05 interface	Used for reprogramming the underlying DGUS firmware.

2、Specification Parameters

2.1 Display Parameters

LCD Type	IPS process TFT display screen.
Viewing Angle	Wide viewing angle (typical values are 85°/85°/85°/85°), high contrast, and good color reproduction.
Resolution	480*480 pixels (0°/90°/180°/270°)
Color	262K color(18-bit 6R6G6B)
Active Area (A.A.)	71.86mm (W)*70.18mm (H)
Backlight Mode	LED
Backlight Service Life	>20000 hours (Time of the brightness decaying to 50% on the condition of continuous working with the maximum brightness)
Brightness	250nit
Brightness Control	0~100 grade (When the brightness is adjusted to 1%~30% of the maximum brightness, flickering may occur and is not recommended to use in this range)
Note: You can use dynamic screen saver wallpapers to avoid afterimages caused by fixed page display for a long time.	

2.2 Touch Parameters

Type	Capacitive touch panel.
Structure	G+G structure with surface cover of tempered glass.
Touch Mode	Support point touch and drag.
Surface Hardness	≥6H
Light Transmittance	>90%
Life	>10,000H

2.3 Serial Interface Parameters

Mode	RS485				
Voltage Level	Test Condition	Min	Typ	Max	Unit
	Output 1, Iout = 1mA	2.5	5.0	-	V
	Output 0, Iout = -1mA	-	-5.0	-2.5	V
	Input 1, Iin = 1mA	0	2.5	-	V
	Input 0, Iin = -1mA	-	-2.5	-0.2	V
Baud Rate	3150~921600bps, typical value of 115200bps.				
Data Format	N81				
Interface Cable	2Pin_3.81mm				

2.4 Electrical Specifications

Rated Power	<5W	
Operating Voltage	110~230V, typical value of 220V.	
Operating Current	25mA	VCC=220V, max backlight.
	18mA	VCC=220V, backlight off.
Recommended power supply: AC 220V 50Hz.		

2.5 Operating Environment

Operating Temperature	-20℃~70℃ (220V @ 60% RH)
Storage Temperature	-30℃~80℃
Anti-UV	Yes
Conformal Coating	Yes
Operating Humidity	10%~90%RH, typical value of 60% RH.

3、Reliability Test

3.1 Electrostatic Discharge Test

Test temperature: 25°C. Test humidity: 50%RH.

Test process: Place the product on the testing fixture of the test bench (fixture height approximately 15cm), and conduct contact discharge and air discharge tests on the smart screen, during the experimental process, it was observed whether the screen is dead, black, white, splash, or reboot. According to the experiment results, the performance is in line with the criteria GB/T 17626.2 B level and above.

■ Test standard : ☐EN 61000-4-2:2009 ☑IEC 61000-4-2:2008 ☐GB/T 17626.2-2018
☐Other:

Table 1： Electrostatic Discharge Immunity (Air Discharge)

Test Points Locations	Test Levels							
	-2kV	+2kV	-4kV	+4kV	-8kV -6kV Jo	+8kV +6kV Jo	-15kV	+15kV
屏幕 (Screen)					A	A		
/	/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/	/

Table 2： Electrostatic Discharge Immunity (Direct Contact)

Test Points Locations	Test Levels							
	-2kV	+2kV	-4kV	+4kV	-6kV	+6kV	-8kV	+8kV
边框(Frame) Jo	/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/	/

3.2 EFT Test

Test temperature: 25°C. Test humidity: 50%RH.

Test process: the product was placed on the test bench to perform contact and the smart screen is energized by the power supply coupled with a EFT generator. During the experimental process, it was observed whether abnormal reset, display or touch phenomena occurs. According to the experiment results, the performance is in line with the criteria GB/T 17626.4 B level and above.

■ Test standard : ☐EN 61000-4-4:2012 ☑IEC 61000-4-4:2012 ☐GB/T 17626.4-2018
☐Other:

Test Points		Test Levels(kV)							
		-0.5	+0.5	-1.0	+1.0	-2.0	+2.0	-4.0	+4.0
DC Power ports	L					A	A		
	N					A	A		
	Earth	/	/	/	/	/	/	/	/
	L+N					A	A		
	L + Earth	/	/	/	/	/	/	/	/
	N + Earth	/	/	/	/	/	/	/	/
	L+N+Earth	/	/	/	/	/	/	/	/
Signal ports	____/__	/	/	/	/	/	/	/	/

3.3 Surge Immunity Test

Test temperature: 25°C. Test humidity: 50%RH.

■ Test standard : ☐EN 61000-4-5:2014+A1:2017 ☑IEC 61000-4-5:2014+A1:2017 ☐GB/T 17626.5-2019
☐Other:

Table 1: AC mains power input port

Level	Voltage	Polarity	Path	Result
1	0.5kV	±	/	/
2	1kV	±	/	/
3	2kV	±	L-N	A
4	4kV	±	/	/

Table 2: _____ I/O Circuit and Lines

Level	Voltage	Polarity	Path	Result
1	0.5kV	±	Line-Ground	/
2	1kV	±	Line-Ground	/
3	2kV	±	Line-Ground	/
4	4kV	±	Line-Ground	/

Performance Criterion:

A. Normal performance within limits specified by the manufacturer, requester or purchaser;

B. Temporary loss of function or degradation of performance which ceases after the disturbance ceases, and from which the equipment under test recovers its normal performance, without operator intervention;

C. Temporary loss of function or degradation of performance, the correction of which requires operator intervention;

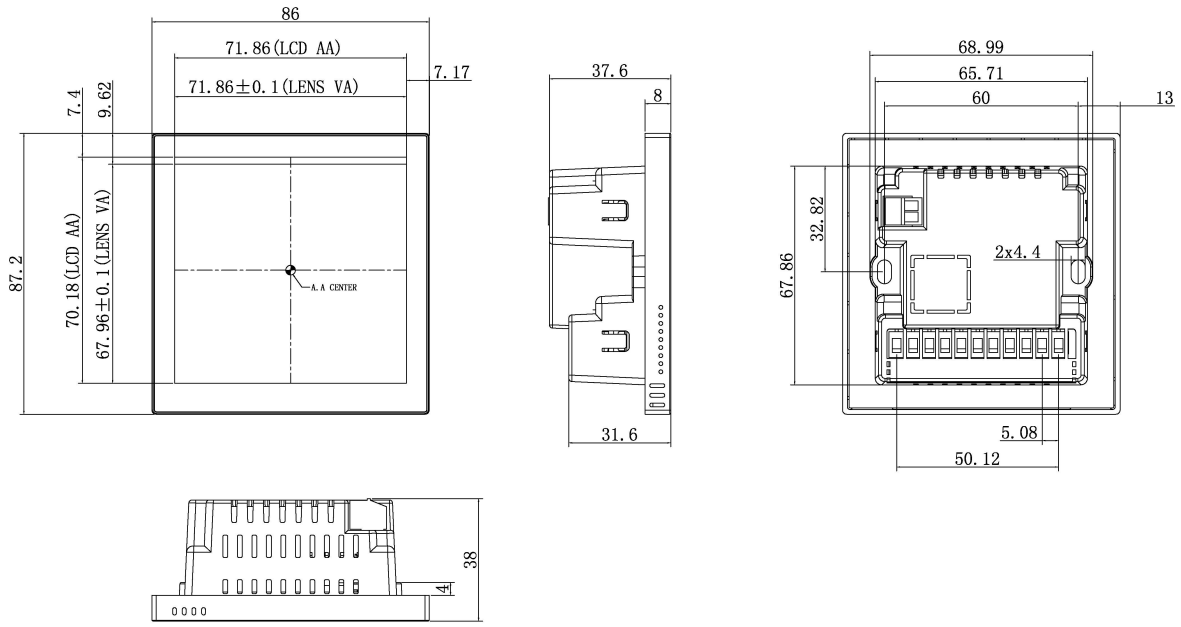
D. Loss of function or degradation of performance which is not recoverable, due to damage to hardware or software, or loss of data.

4、Packaging & Dimensions

Form Factor	86mm (W)*87.2mm (H)*38mm (T)
Net Weight	170g

Packaging Standards

Model	Size	Layer	Quantity/Layer	Quantity(Pcs)
Carton1:	220mm(L)*160mm(W)*47mm (H)	-	-	-
Carton2:	250mm(L)*200mm(W)*80mm (H)	1	2	2
Carton3:	320mm(L)*270mm(W)*80mm (H)	1	4	4
Carton4:	450mm(L)*350mm(W)*300mm(H)	-	-	-
Carton5:	600mm(L)*450mm(W)*300mm(H)	1	40	40



Definition	Pin#	IO	Description
A	1	IO	485+
B	2	IO	485-
Definition	Pin#	IO	Description
K4 Open	1	O	P1.3 electric relay valve(IO3)
K4 Close	2	O	P1.3 electric relay valve(IO3)
K3	3	O	P1.1 electric relay 2 low(IO1)
K2	4	O	P1.4 electric relay 3 middle(IO4)
K1	5	O	P1.2 electric relay 4 high(IO2)
L	6	P	Live wire
NC	7	-	Undefined
N	8	P	Neutral wire

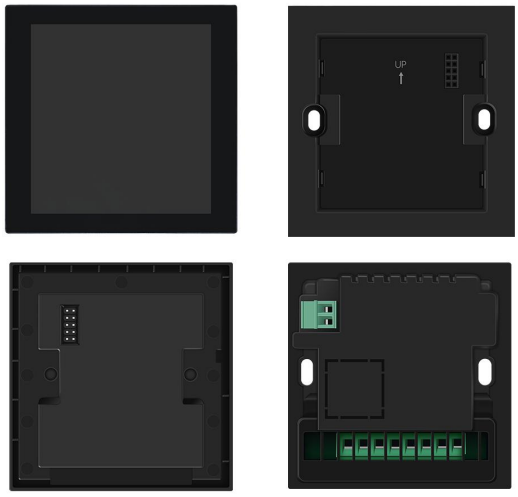
1. Location hole is used as position reference.
2. Unmarked Tolerance is +/-0.3mm

   Active area is marked in Dash lines

Model	TC040C15U04					DWIN Technology				
Drawing	A4	Drawn	DWIN	Date	2024.04.17					
Scale	1:1	Review		Date						
Unit	MM	Approval		Date						

TC040C15U04

Installation Schematic



Thermostat front screen

Thermostat back plate

1

Cut a hole according to the size of the junction box used.

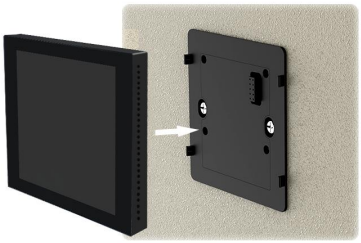
Install the junction box at the opening on the wall

2

Put the thermostat back plate into the junction box

Tighten 2 screws clockwise to fix the thermostat back plate on the junction box

3



Align the interface and four fasteners between the front screen and the back plate of the thermostat. Fasten them as shown in the figure, and fix the front screen on the back plate

Installation completed

5、T5L Series IC Features

(1) Mature and stable 8051 core which is the most widely used with the maximum operating frequency of T5L is up to 250MHz, 1T(single instruction cycle)high speed operation.

(2) Separate GUI CPU Core running DGUS II System:

- High-speed display memory, 2.4GB/S bandwidth.
- 2D hardware acceleration, the decompression speed of JPEG is up to 200fps@1280*800 and the UI with animation and icons as its main feature is extremely cool and smooth.
- Images and icons stored in JPEG format. Adopt Low-cost 16Mbytes SPI Flash.
- Support CTP or RTP with adjustable sensitivity and maximum 400 Hz touch frequency.
- 1-way 15bit 32Ksps PWM digital power amplifier driver loudspeaker, save power amplifier cost and achieve high signal-to-noise ratio and sound quality restoration.
- 128Kbytes variable storage space for exchanging data with OS CPU Core and memory.
- Support DGUS development and simulation on PC. Support background remote upgrade.

(3) Separate CPU (OS CPU) core runs user 8051 code or DWIN OS system and user CPU is omitted in practical application:

- Standard 8051 architecture and instruction set, 64Kbytes code space, 32Kbytes on-chip RAM.
- 64 bit integer mathematical operation unit (MDU), including 64 bit MAC and 64 bit divider.
- 28 IOs, 4-channel UARTs, 1-channel CAN, up to 8-channel 12-bit A/Ds and 2-channle 16-bit PWM of adjustable resolution.
- Support IAP on-line simulation and debugging with unlimited number of breakpoints.

  .
- Upgrade code online through DGUS system.

(4)1Mbytes on-chip Flash with DWIN patent encryption technology ensure code and data security.

(5)Operating temperature ranges from -40℃ to +85℃(IC operating temperature customizable from -55℃ to 105℃).

DWIN encourages users to design your own customized product based on T5L.

6、Revision Records

Rev	Revise Date	Content	Editor
00	2024-06-011	First Edition	YML
01	2024-07-04	Add support for temperature measurement using NTC	YML
02	2024-08-06	Modified operating current	YML

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DWIN Developer Forum: https://forums.dwin-global.com/index.php/forums

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