MD01C Built-in Power Controller
DBS-XXX-MD01C-240XX-XX
User Manual

Thank you for choosing our company's product. Please read this user manual carefully before use.

Revised in April 2025, Version 1.3

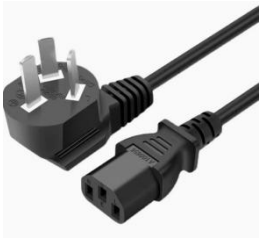
Precautions：

⚠Warnings	
	This product requires an external power supply for power. Ensure the power switch of the controller is in the OFF position when plugging in or unplugging the power supply to prevent electric shock.
	Before using this product, please read this manual in detail; when using this product, follow the operations specified in this manual.
	In case of abnormal conditions, please contact our company. Do not disassemble or assemble the product by yourself.
	Ensure the product is properly grounded to prevent electric shock.
	When using the matching light source, do not look directly at the light emitted by the light source to avoid eye damage.

Document Version Description:

Version No.	Revision Date	Revision Description
V1.1	2024.Jun	New version release
V1.2	2024.Nov	1. Added precautions and document version description 2. Fixed known issues
V1.3	2025.Mar	Updated content and version format

Standard Shipping List

Product Name	Model	Type	Quantity
Light Source Controller	MD01C Built-in Power See 1.2 for model selection		1
Serial Cable	1.5M Male-to-Female		1
Terminal Block	3.81-8P		1
Power Cable	1.5M		1

Note: If you have other requirements for the shipping configuration, please contact the salesperson or distributor in a timely manner.

Contents

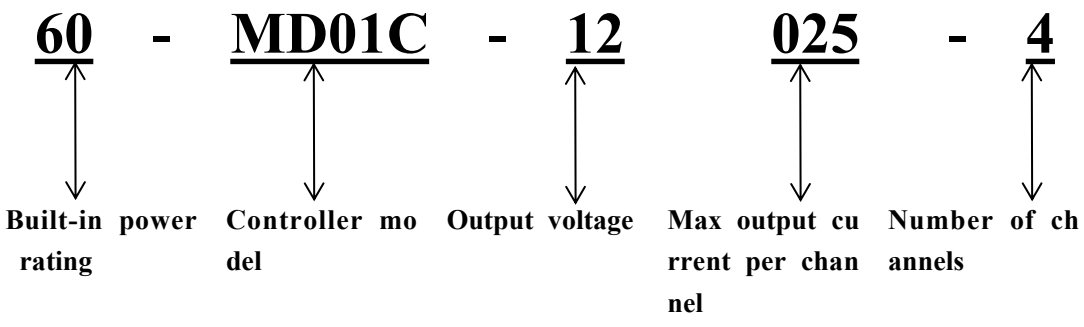
1. Product Introduction

1.1 Product Features

- Supports RS232 communication
- Low trigger response time
- Supports external trigger mode
- Supports millisecond-level and microsecond-level strobing
- Manual adjustment of brightness and mode
- 5~24V one-way trigger, adaptable to high/low-level trigger modes
- Equipped with overheating protection and output short-circuit protection
- Compact size, easy installation (screw mounting or C45 DIN rail mounting)

1.2 Product Model Selection

Model	Built-in Power Rating	Max Current per Channel
(24V Output)		
DBS-60-MD01C-24025-2	60W	2.5A
DBS-115-MD01C-24030-2	115W	3A
DBS-60-MD01C-24025-4	60W	2.5A
DBS-115-MD01C-24025-4	115W	2.5A



1.3 Main Parameters

Table 1: Main Parameters

Item	Parameter	Description
Input Voltage	AC220V	For built-in switching power supply
Output Voltage	24V/12V (selected by model)	Voltage of built-in switching power supply
Output Current	2.5A/3A per channel	Max total current: 2.5A/5A/8A
Overheating Protection	Available	Triggered when temperature exceeds 90℃
Output Short-Circuit Protection	Available	
Operating Modes	4 types	0: Constant off; 1: Constant on; 2: Millisecond strobing; 3: Microsecond strobing
Dimming Method	PWM	100kHz
Light Emitting Modes	Constant on/constant off/strobing	External trigger available in constant off and strobing modes
Trigger Method	Edge + Level Trigger	Edge trigger for strobing mode; Level trigger for constant on/off modes
Constant On Brightness Level	255	255-level brightness adjustment
Millisecond Strobing Time	1~999	Unit: ms (millisecond)
Microsecond Strobing Time	1~999	Unit: μs (microsecond)
Communication Baud Rate	9600bps(default)	Optional: 9600/19200/57600/115200bps
Compatible Light Source Type	-	10mA~2.5A/3A, 24V/12V (selected by model) light sources
Operating Ambient Temperature	-5~50℃	
Dimensions	See Appendix for details	

1.4 Function Modes

Table 2: Function Modes Table

(Take Channel 1 as an example)

Function	Nixie Tube Display Mode		Description
Brightness Setting	1. X	0≦X≦255	Adjusts brightness
Operating Mode	H1. X	X=0 Constant Off Mode	Light turns on when the trigger signal is valid
		X=1 Constant On Mode	Light turns off when the trigger signal is valid
		X=2 Millisecond-Level Strobing Mode	Light flashes once (in milliseconds) when the trigger signal is valid Display: P. X (1≦X≦999, Unit: ms)
		X=3 Microsecond-Level Strobing Mode	Light flashes once (in microseconds) when the trigger signal is valid Display: P. X (1≦X≦999, Unit: μs)
Long press the MENU button at "H1. X" to enter the following parameter editing modes			
Level Trigger Mode	LL. X	X=0 Low-Level Valid	Trigger signal is valid at low level
		X=1 High-Level Valid	Trigger signal is valid at high level
Trigger Mode	Lo. X	X=0	Edge Trigger
		X=1	Level Trigger
Debounce Time Parameter	dt. X	0≦X≦99	X = Debounce time, Unit: μs
Long press the MENU button at "dt. X" to enter the controller's short-circuit protection parameter settings			
Short-Circuit Protection Setting	PE.X	X=0	Short-circuit protection disabled
		X=1	Short-circuit protection enabled
Controller Internal Temperature Display	tp.X		Unit: ℃ (Celsius)
Long press the MENU button at "tp.X" to enter the controller's cooling fan activation temperature settings			
Controller Cooling Fan Activation Temperature Setting	FS.X	20≦X≦60Unit: ℃ (Celsius)	Displays the controller's internal temperature via a temperature sensor and sets the cooling fan activation temperature (default: 55℃)
Linkage Mode	LH. X	X=0	No Linkage
		X=1	IO Linkage
		X=2	Sequence Linkage
Long press the MENU button at "H2. X" to enter the following parameter editing modes			
Initial Brightness Setting	C1.X	0≦X≦99	Adjusts the initial brightness of the light source

2. User Instructions

2.1 Panel Description

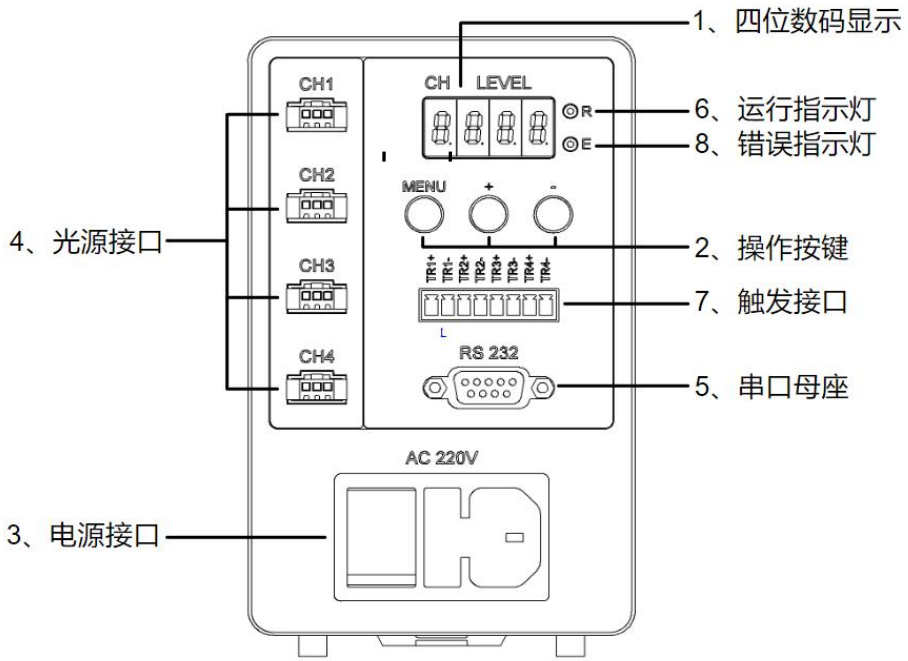


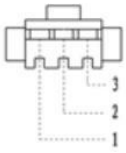
Figure 1: Front Panel

Table 3: Panel Interface Definition Table

No.	Name	Description
1	4-digit Nixie Tube Display	The first digit (from the left) is the current operating channel; the last three digits are the corresponding value of the current channel
2	Operation Buttons	MENU = Function switch button; "+" = Increase value; "-" = Decrease value
3	Power Interface	AC220V interface
4	Light Source Interface	Connects to 10mA~2.5A/3A, 24V/12V (model-selected) light sources
5	Serial Female Connector	Connects to devices with an RS232 interface
6	Running Indicator	Flashes when the controller is running
7	Trigger Interface	Connects to external signals for trigger switch operation
8	Error Indicator	Lights up when the controller malfunctions

2.2 Light Source Interface Definition

Table 4: Light Source Interface Definition Table

	Position	Definition	Description
	1	Light+	Positive pole of the light source output
	2	Empty	No function
	3	Light-	Negative pole of the light source output

2.3 Serial Female Connector Interface Definition

The interface definition of the serial female connector is shown in Figure 2. It is connected to the 9-pin serial port of a computer using a straight cable.

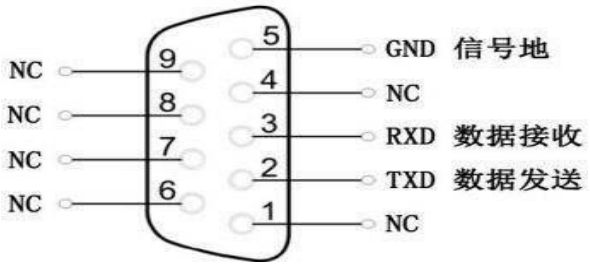


Figure 2: Serial Female Connector Interface Definition

Table 5: Serial Female Connector Interface Definition Table

No.	Name	Description
1	NC	Not connected
2	TXD	Controller RS232 data transmission (RS232 level)
3	RXD	Controller RS232 data reception (RS232 level)
4	NC	Not connected
5	GND	RS232 signal ground
6	NC	Not connected
7	NC	Not connected
8	NC	Not connected
9	NC	Not connected

2.4 Trigger Description

2.4.1 Trigger Interface

The external trigger input interface is shown in Figure 3：

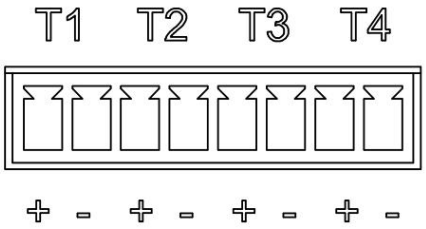


Figure 3: External Trigger Input Interface

There are 4 channels of external trigger input interfaces, and each channel has two input terminals ("+" and "-", where "X" represents the channel number). An

internal one-way optocoupler is integrated, and its electrical diagram is shown in Figure 4.

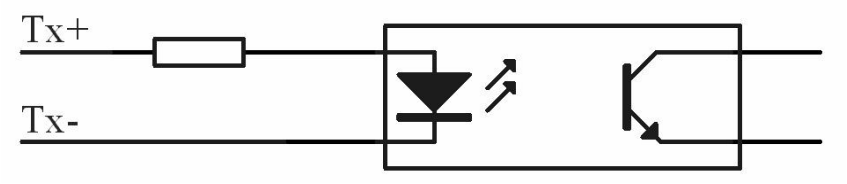


Figure 4: Internal Electrical Diagram of External Trigger

2.4.2 Trigger Interface Wiring Examples

When the valid trigger signal is a rising edge or high level: The wiring is shown in Figure 5.

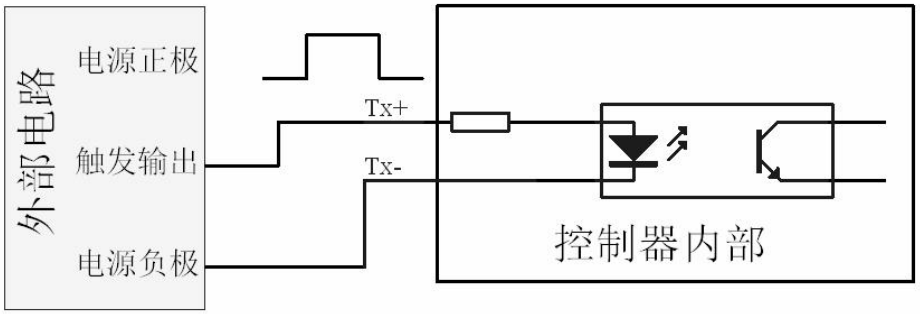


Figure 5: Wiring Example for Rising Edge or High-Level Valid Trigger

Connect the trigger output of the external control circuit to Tx+, and the negative pole of the power supply to Tx-. The controller controls the output when a rising edge or high level is present at the trigger output terminal.

When the valid trigger signal is a falling edge or active low, its wiring is shown in Figure 6:

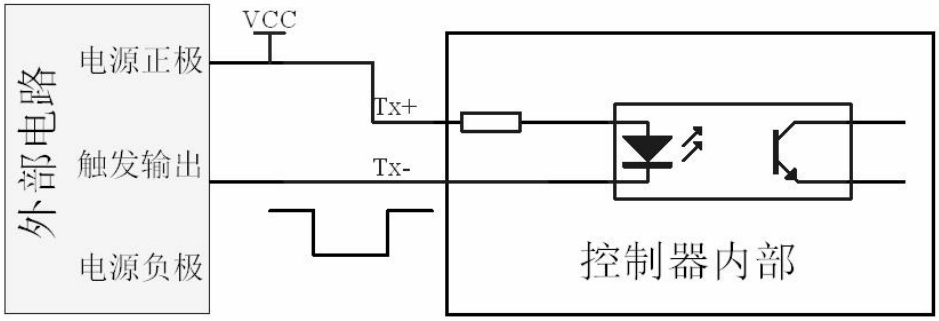


Figure 6: Wiring Example for Falling Edge or Low-Level Valid Trigger

The trigger output of the external control circuit is connected to Tx-, and the positive pole of the power supply is connected to Tx. When there is a falling edge or low level at the trigger output terminal, the controller controls the output.

2.4.3 Trigger Timing Diagrams

Constant Off Mode: When the controller's trigger input signal is valid, the light turns on. The timing relationship is illustrated with a high-level valid signal as an example (see Figure 7).

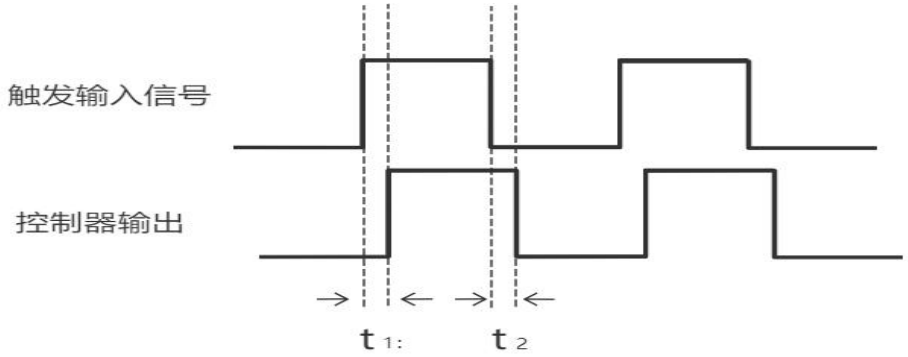


Figure 7: Timing Diagram for Constant Off Mode

Parameter	Time
t_1	≦25us
t_2	≦150us

Constant On Mode: When the controller's trigger input signal is valid, the light turns off. The timing relationship is illustrated with a high-level valid signal as an example (see Figure 8).

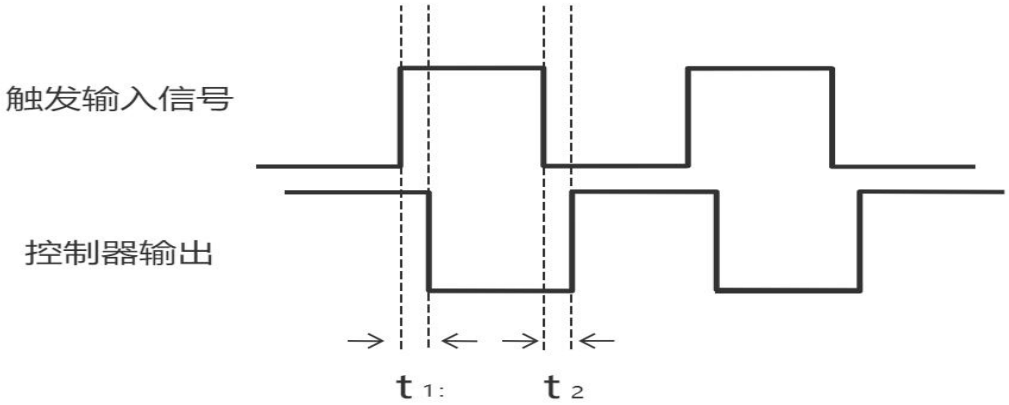


Figure 8: Timing Diagram for Constant On Mode

Parameter	Time
t_1	≦25us
t_2	≦150us

Strobing Mode: When the controller is set to millisecond-level or microsecond-level strobing, the light turns on when the trigger input signal is valid.

The timing relationship is illustrated with a high-level valid signal as an example (see Figure 9).

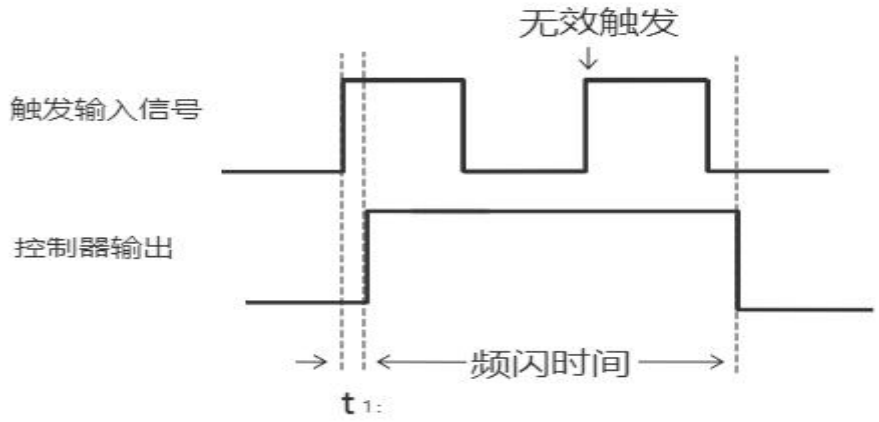


Figure 9: Timing Diagram for Strobing Mode

Parameter	Time
t_1	≤25us

2.5 Manual Settings

2.5.1 Brightness Setting

When the controller is turned on, the 4-digit 7-segment display shows channel number + brightness value. Initially, it displays Channel 1 and its brightness value. For example, if the last set brightness of Channel 1 is 10, the display will show "1.010".

The following example describes how to set the brightness of Channel 2 to 125 (see Figure 10 for the flowchart).

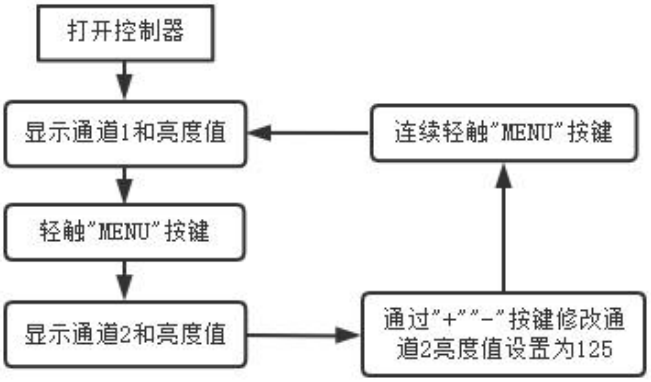


Figure 10: Brightness Setting Flowchart

2.5.2 Operating Mode Setting

This model of controller supports 4 operating modes, which can be set via manual buttons or communication (see Table 2 for the 4 modes). Each channel's mode can be set independently. The following example describes how to set the mode of Channel 2; the setting method for other channels is similar.

2.5.3 Constant Off Mode Setting

The flowchart for setting Channel 2 to Constant Off Mode is shown in Figure 11.

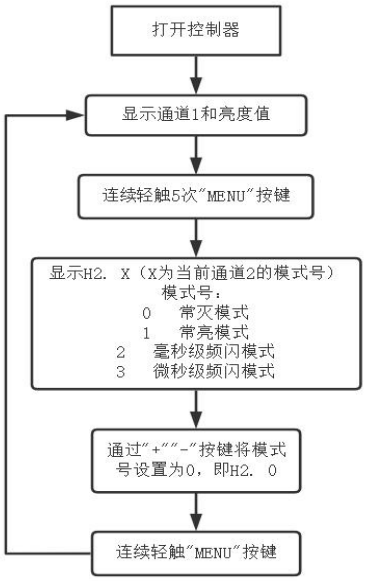


Figure 11: Flowchart for Constant Off Mode Setting (Channel 2)

2.5.4 Constant On Mode Setting

The flowchart for setting Channel 2 to Constant On Mode is shown in Figure 12.

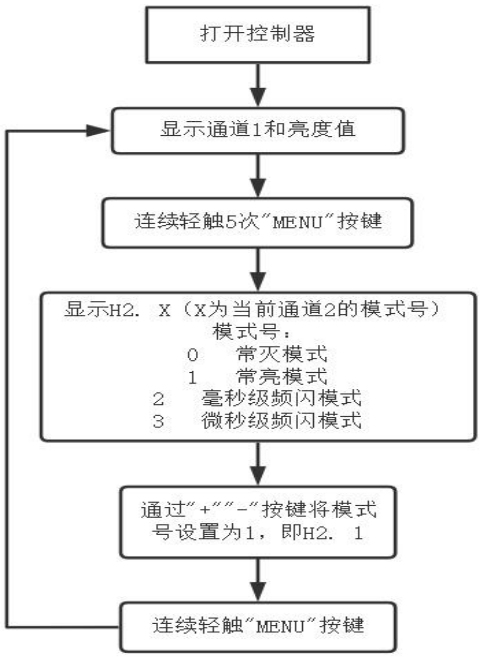


Figure 12: Flowchart for Constant On Mode Setting

2.5.5 Millisecond-Level Strobing Mode Setting

The flowchart for setting Channel 2 to Millisecond-Level Strobing Mode and adjusting its strobing time is shown in Figure 13.

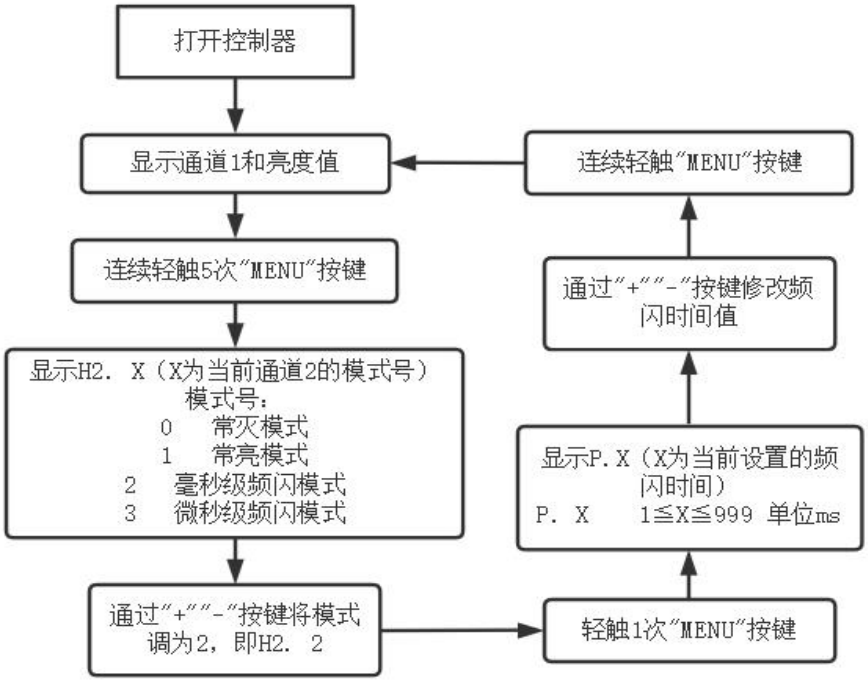


Figure 13: Flowchart for Millisecond-Level Strobing Mode & Time Setting

2.5.6 Microsecond-Level Strobing Mode Setting

The flowchart for setting Channel 2 to Microsecond-Level Strobing Mode and adjusting its strobing time is shown in Figure 14.

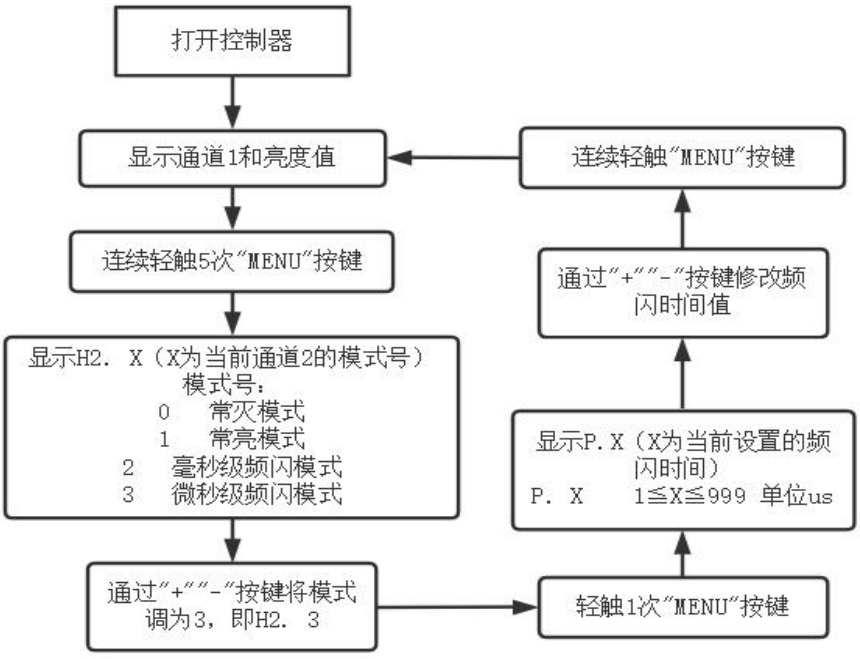


Figure 14: Flowchart for Microsecond-Level Strobing Mode & Time Setting

2.5.7 High-Level Trigger Mode Setting

The flowchart for setting all channels to High-Level Trigger Mode is shown in Figure 15.

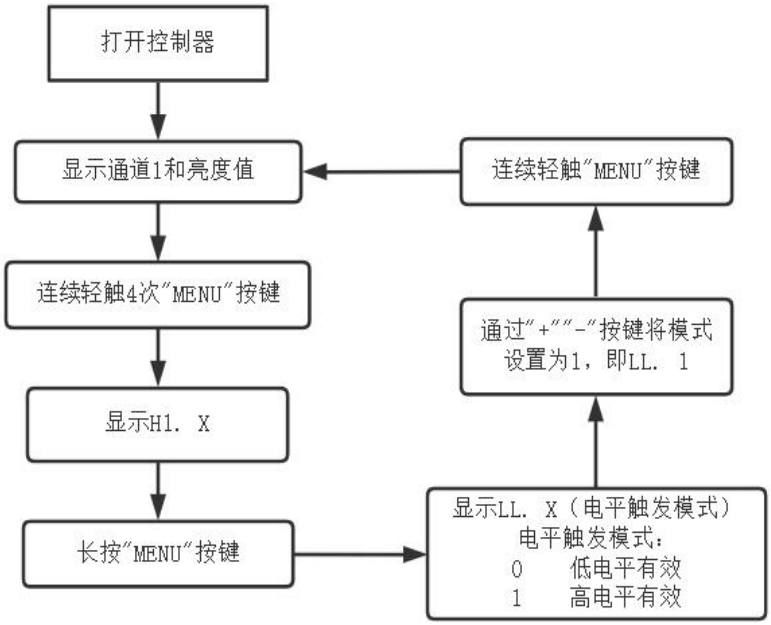


Figure 15: Flowchart for High-Level Trigger Mode Setting

2.5.8 Edge Trigger Mode Setting

The flowchart for setting all channels to Edge Trigger Mode is shown in Figure 16.

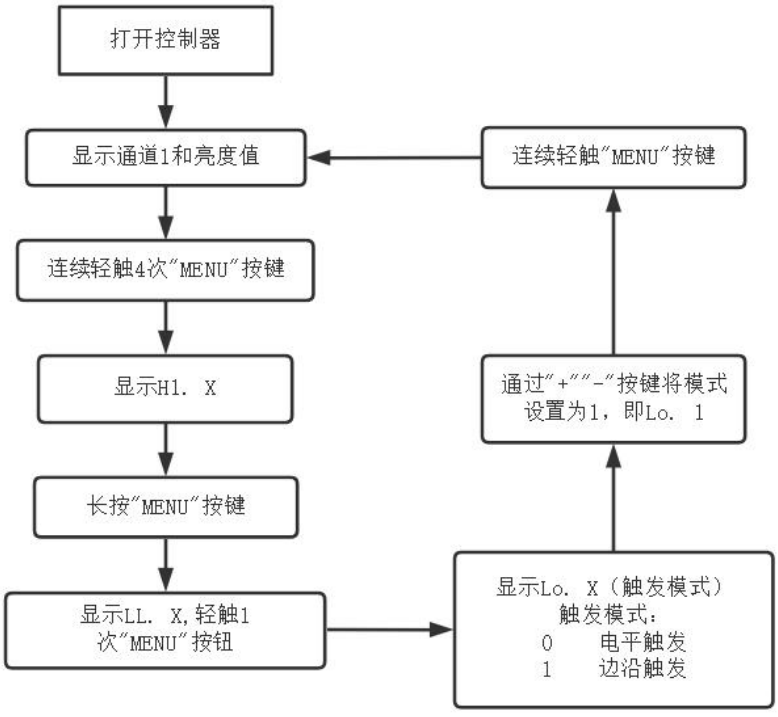


Figure 16: Flowchart for Edge Trigger Mode Setting

2.5.9 Debounce Time Parameter Setting

The flowchart for setting the debounce time parameter of all channels is shown in Figure 17.

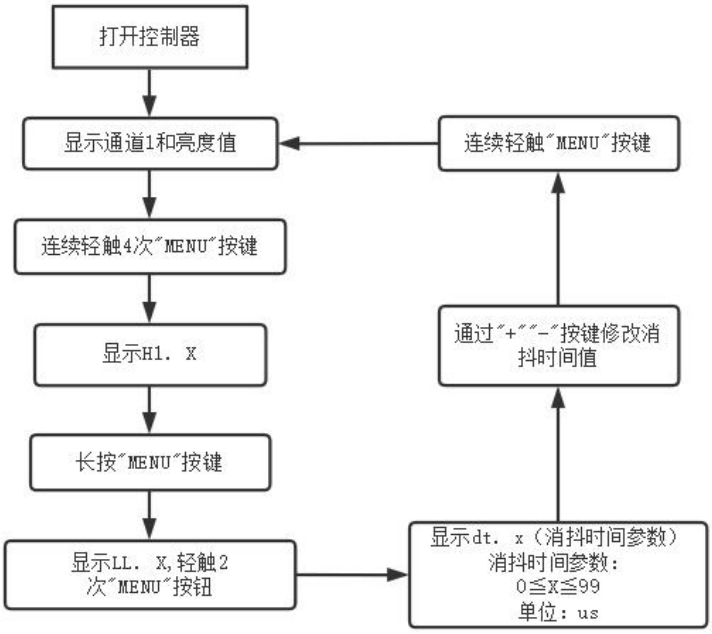


Figure 17: Flowchart for Debounce Time Parameter Setting

2.5.10 Short-Circuit Protection Setting

The flowchart for short-circuit protection setting is shown in Figure 18.

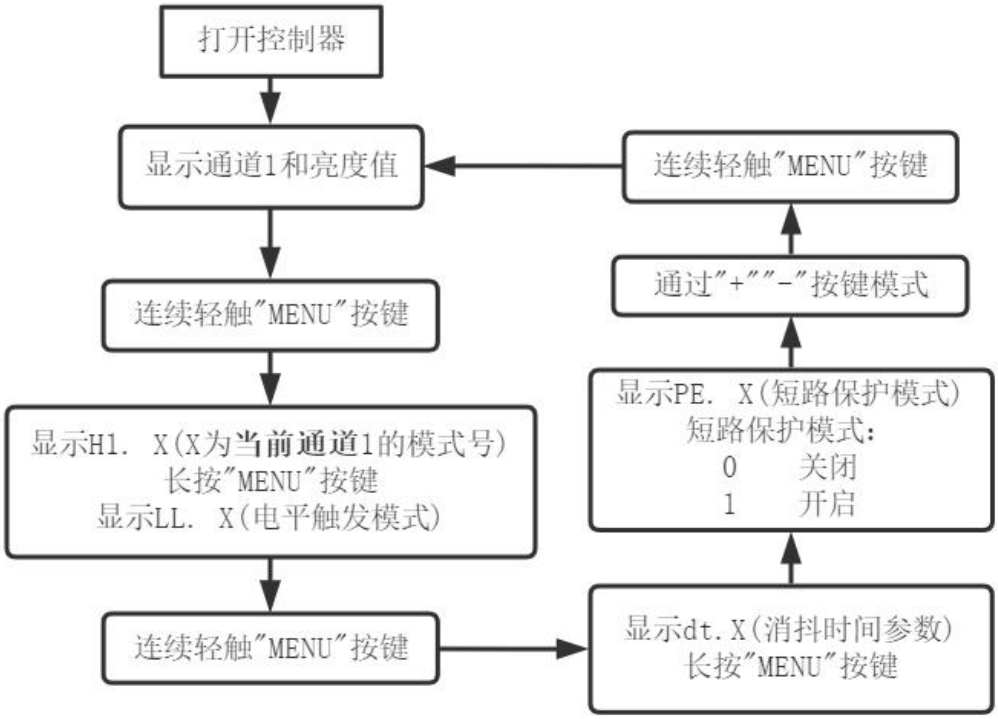


Figure 18: Flowchart for Short-Circuit Protection Setting

2.5.11 Fan Temperature Display & Setting

The flowchart for setting the cooling fan activation temperature is shown in Figure 19.

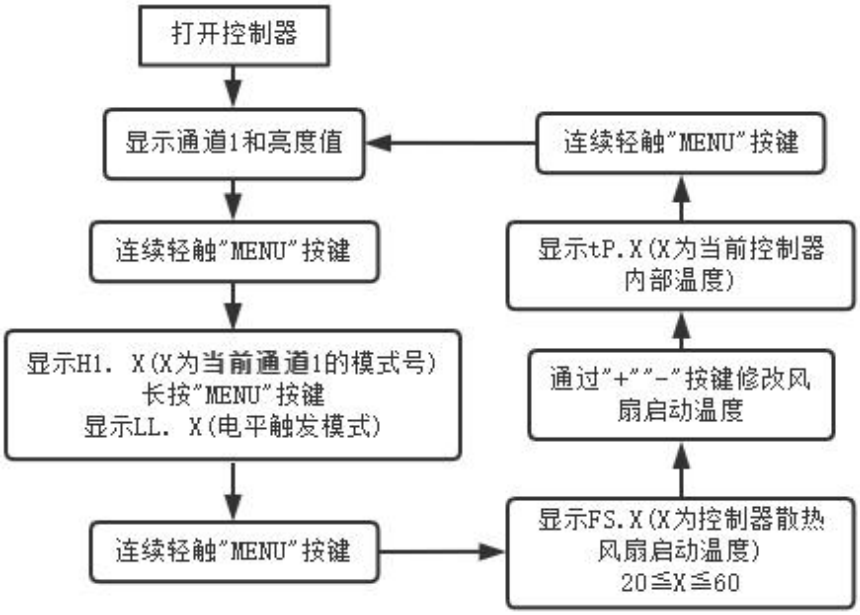


Figure 19: Flowchart for Cooling Fan Activation Temperature Setting

2.5.12 Initial Brightness Setting

The flowchart for setting the initial brightness of Channel 2 is shown in Figure 20.

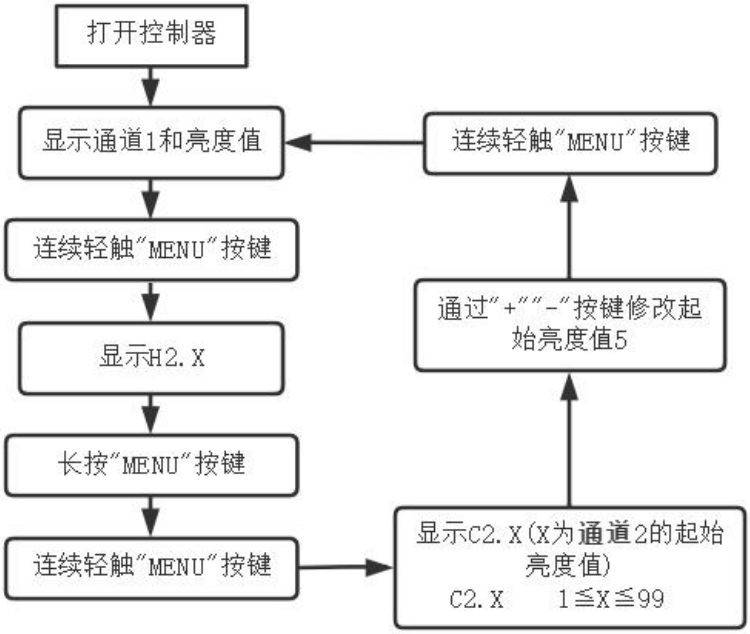


Figure 20: Flowchart for Initial Brightness Setting

2.5.13 Key Lock Setting

Long press the MENU button when the channel and brightness values are displayed to lock the buttons. After locking, you can switch between channel data but cannot modify it.

2.6 Linkage Mode Setting

This product provides two linkage modes: 1. IO Linkage; 2. Sequence Linkage. Users can select and set the mode according to actual needs.

2.6.1 IO Linkage Mode Setting

In IO Linkage Mode, when one of the trigger channels receives a trigger signal, the light sources of all four channels turn on simultaneously. The brightness of the light sources is determined by the group parameter settings (the brightness is the value displayed on the screen). The setting method for other trigger channels is similar.

Description of IO Linkage Mode:

When the display shows the "n. 0" interface, the number "0" will change to the number of the corresponding responding channel when a channel responds.

Example: When a trigger signal is sent to Channel 1, the light sources of all four channels turn on simultaneously. The brightness of Channel 1 is 100, Channel 2 is 50, Channel 3 is 150, and Channel 4 is 100.

The flowchart for IO Linkage Mode setting is shown in Figure 21.

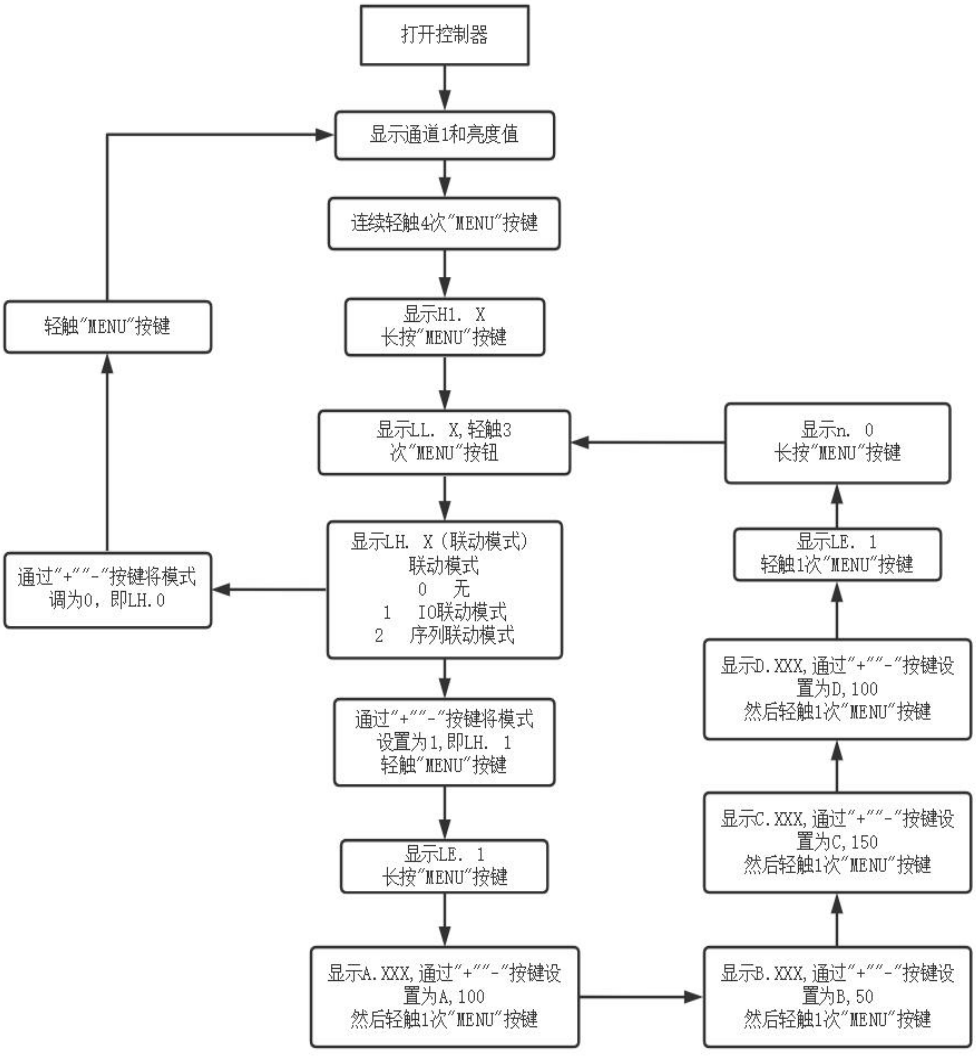


Figure 21: Flowchart for IO Linkage Mode Setting

2.6.2 Sequence Linkage Mode Setting

In Sequence Linkage Mode, take Channel 1 as the trigger channel. Each time a trigger signal is sent, Channel 1 turns on, and the sequence increments by 1. After incrementing to the last sequence, it automatically returns to the first sequence to cycle. The brightness of the light source each time it turns on is determined by the group parameters of the current sequence (a maximum of 8 groups of parameters can be preset). The setting method for other trigger channels is similar.

Example: When a trigger signal is sent to Channel 1, the brightness of the Channel 1 light source is 100, 125, 150, 175, 50, 75 in sequence. Each trigger causes an increment; after reaching the last sequence, it automatically returns to the first sequence to cycle.

The flowchart for Sequence Linkage Mode setting is shown in Figure 22.

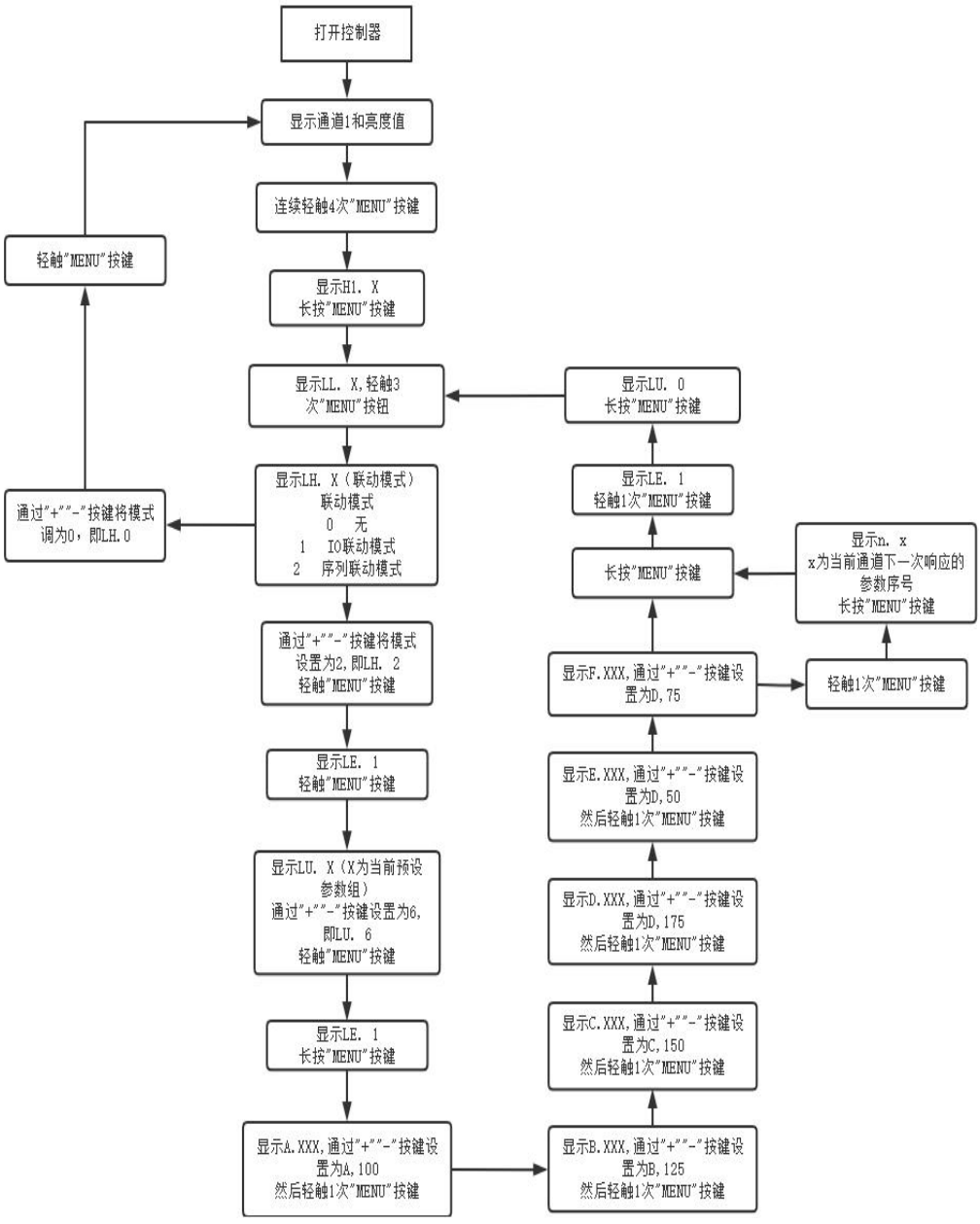


Figure 22: Flowchart for Sequence Linkage Mode Setting

3. Communication Protocol

3.1 Programming Flow

The communication programming flowchart for controlling the light source controller via serial port is shown in Figure 23.

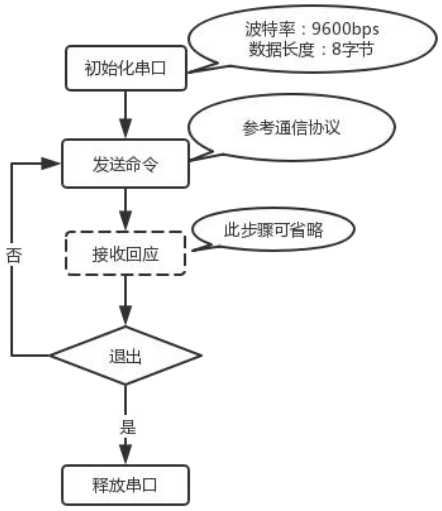


Figure 23: Communication Programming Flowchart

3.2 Communication Settings

The serial port communication format settings are shown in Table 6.

Table 6: Serial Port Settings Table

Baud Rate	Parity	Data Bits	Stop Bits
9600	None	8	1

3.3 Frame Format Description

The communication frame format is shown in Table 7.

Table 7 Frame Format

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Feature Character	Command Character	Channel Character	Data 1	Data 2	Data 3	XOR Check Character 1	XOR Check Character 2

1、All communication bytes use ASCII code.

2、Feature Character: $

3、Command Characters are shown in Table 8.

4、When the Command Character is "1", "2", "3", "7", "8", or "9": If the controller receives the command successfully, it returns the feature character "$"; if it fails to receive the command, it returns "&".

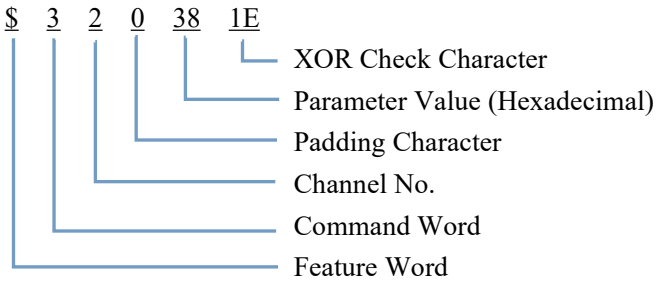
5、When the Command Character is "4": If the controller receives the command successfully, it returns the brightness setting parameter of the corresponding channel (the return format is the same as the sending format); if it fails to receive the command, it returns "&".
6、Channel Characters: "1", "2", "3", "4" (representing 4 channels respectively).
7、Data = 0XX (XX is any value between 00 and FF), which corresponds to the setting parameter of the channel. The high byte comes first, and the low byte comes after.
8、XOR Checksum = XOR checksum of all bytes except the checksum bytes (including Feature Character, Command Character, Channel Character, and Data). The ASCII code of the high 4 bits of the checksum comes first, and the ASCII code of the low 4 bits comes after.

Table 8: Command Character Function Table

Character	Function	Description
“1”	Turn on the corresponding channel	The corresponding channel is determined by the Channel Character
“2”	Turn off the corresponding channel	The corresponding channel is determined by the Channel Character
“3”	Set the brightness parameter of the corresponding channel	The corresponding channel is determined by the Channel Character; the brightness parameter is Data 1~Data 3
“4”	Read the brightness parameter of the corresponding channel	The corresponding channel is determined by the Channel Character; the return format is the same as the sending format
“7”	Trigger strobing of the corresponding channel	The corresponding channel is determined by the Channel Character; this function is invalid in non-strobing modes
“8”	Set the mode of the corresponding channel	The corresponding channel is determined by the Channel Character
“9”	Set the strobing time of the corresponding channel	The corresponding channel is determined by the Channel Character; this function is invalid in non-strobing modes

3.4 Communication Examples

To set the brightness of Channel 2 to 56, write the ASCII code "$320381E" as follows:



	String	ASCII Code	ASCII Code (Hexadecimal)	Represent High 4 Bits and Low 4 Bits with 8421 Code Respectively
Feature Word	$	36	24	0010 0100
Command Word	3	51	33	0011 0011
Channel Word	2	50	32	0011 0010
Data	0	48	30	0011 0000
	3	51	33	0011 0011
	8	56	38	0011 1000
XOR Sum				0001 1110
XOR Checksum Word				1 E

Note: During the calculation of the XOR checksum for the three functions (turning on the corresponding channel, turning off the corresponding channel, and reading the parameters of the corresponding channel), the values of the 3 data bytes have no impact on the XOR result. It is only necessary to ensure the format is 0XX (where XX is any value from 00 to FF).

The following are several groups of command data:

Turn off Channel 2: $220381F

	String	ASCII Code	ASCII Code (Hexadecimal)	Represent High 4 Bits and Low 4 Bits with 8421 Code Respectively
Feature Word	$	36	24	0010 0100
Command Word	2	50	32	0011 0010
Channel Word	2	50	32	0011 0010
Data	0	48	30	0011 0000
	3	51	33	0011 0011
	8	56	38	0011 1000
XOR Sum				0001 1111
XOR Checksum Word				1 F

Turn on Channel 2: $120381C

	String	ASCII Code	ASCII Code (Hexadecimal)	Represent High 4 Bits and Low 4 Bits with 8421 Code Respectively
Feature Word	$	36	24	0010 0100
Command Word	1	49	31	0011 0001
Channel Word	2	50	32	0011 0010
Data	0	48	30	0011 0000
	3	51	33	0011 0011
	8	56	38	0011 1000
XOR Sum				0001 1100
XOR Checksum Word				1 C

Read data from Channel 2: $4200012

	String	ASCII Code	ASCII Code (Hexadecimal)	Represent High 4 Bits and Low 4 Bits with 8421 Code Respectively
Feature Word	$	36	24	0010 0100
Command Word	4	52	34	0011 0100
Channel Word	2	50	32	0011 0010
Data	0	48	30	0011 0000
	0	48	30	0011 0000
	0	48	30	0011 0000
XOR Sum				0001 0010
XOR Checksum Word				1 0

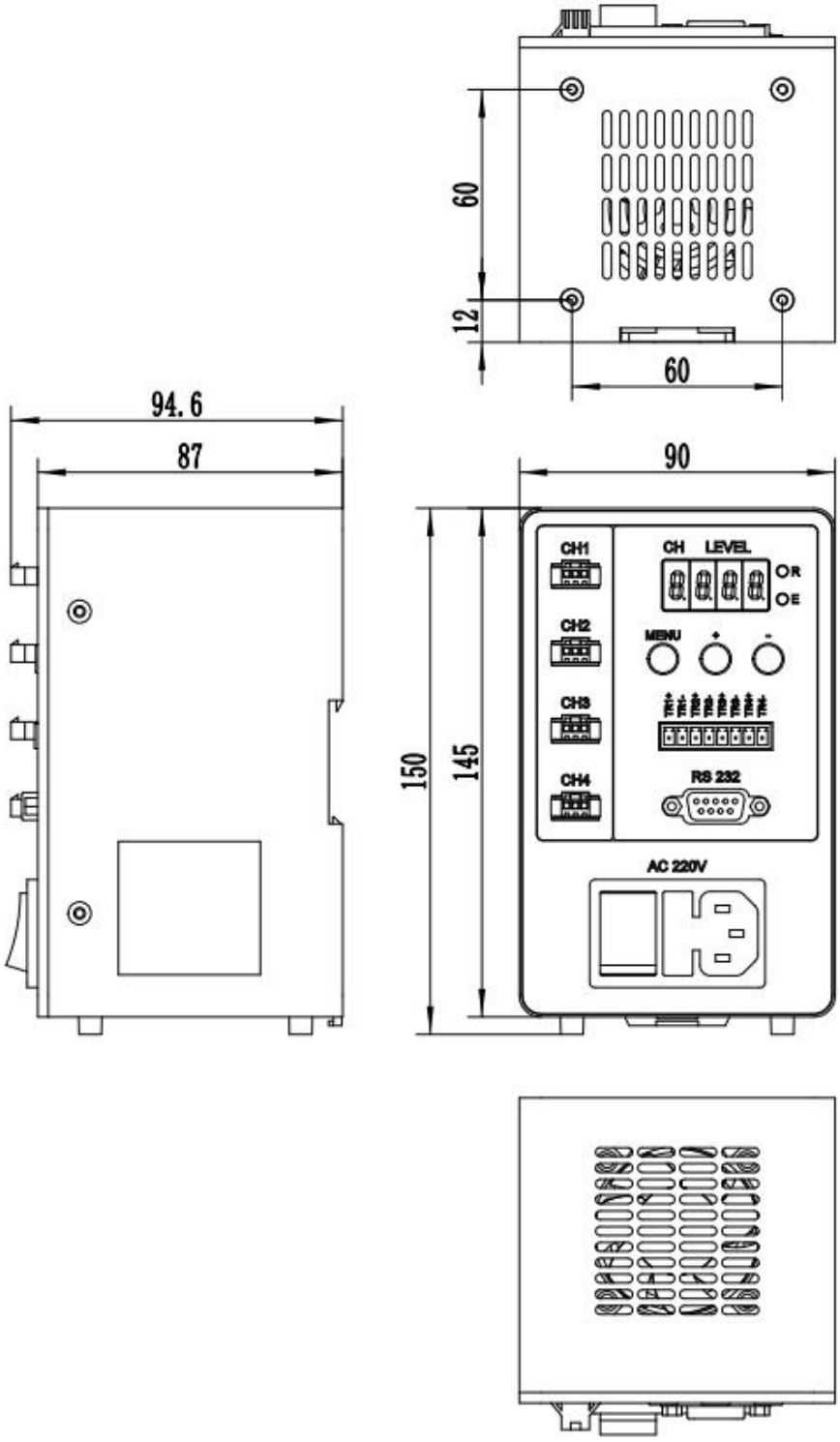
4. Prompt Command Index

If the controller's nixie tube displays a non-functional prompt command, troubleshoot according to the following command table:

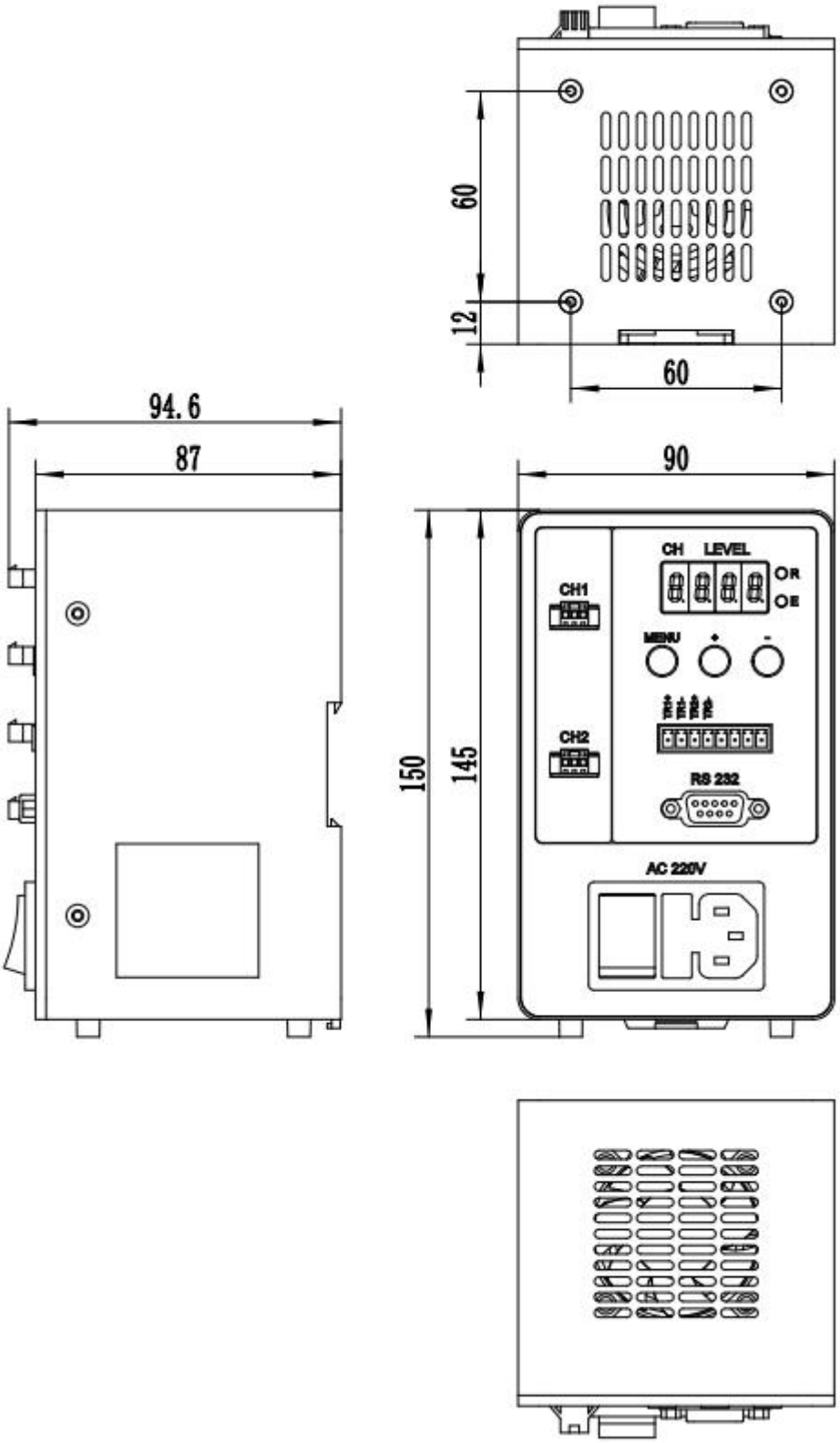
Command	Description	Troubleshooting Solution for Prompt Command
F.1	Unregistered	Re-register
F.2	Storage Chip Damaged	Need to return to the factory for repair
F.3	Exceeding Light Source Power, Short Circuit, Signal Interference	Check the light source power, whether the light source is short-circuited, and whether there is signal interference
F.6	Over-Temperature Alarm (Available for Some Models)	Excessively high temperature; check the controller's operating environment
Loc	Key Lock	Unlock via DIP switch or long-press the "MENU" button

5. Accessories

4-Channels：



2-Channels：


60
12
60
94.6
87
90
CH
LEVEL
OR
OE
CH1
MENU
CH2
RS 232
150
145
AC 220V