

External Power Controller LD-NP24DC-4T5A 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	LD-NP24DC-4T5A		1
Serial Cable	1.5M Male-to-Female		1
Terminal Block	3.81-5P		1
Terminal Block	3.81-2P		1

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

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1. Product Introduction

1.1 Product Features

- Support RS232 communication
- External 24V power supply
- Low trigger response time
- Support external trigger mode
- Support millisecond-level strobe and microsecond-level strobe
- Brightness and mode can be set manually
- 5~24V bidirectional triggering, which can adapt to high and low level trigger modes
- Small size, easy to install, screw mounting or C45 snap rail mounting

1.2 Product Selection

Model	Built-in Power Capacity	Maximum Current per Channel
LD-NP24DC-4T5A	None	4A

1.3 Main Parameters

Table 1 Main Parameters Table

Item	Parameter	Description
Input Voltage	24V	The maximum voltage must not exceed 24V
Output Voltage	24V	Output voltage is consistent with input voltage
Output Current	4A	Maximum current per channel
Overcurrent Protection	None	-
Overvoltage Protection	None	-
Operating Modes	4 Types	0: Constant OFF; 1: Constant ON; 2: Millisecond-level stroboscope; 3: Microsecond-level stroboscope
Lighting Mode	Constant ON / Constant OFF / Stroboscope	External trigger is available in constant OFF and stroboscope modes
Trigger Mode	Edge + Level Trigger	Edge trigger in stroboscope mode; Level trigger in constant ON and constant OFF modes
Constant ON Brightness Level	255	255-level brightness adjustment
Millisecond-level Stroboscope Time	1~999	Unit: ms (millisecond)
Microsecond-level Stroboscope Time	1~999	Unit: us (microsecond)
Communication Baud Rate	9600bps	-
Built-in Power Supply	None	-
Number of Channels	4	-
Connected Light Source Type	24V Light Source	10mA~4A 24V Light Source
Operating Ambient Temperature	-5~50℃	-
Dimensions	See appendix for details	

1.4 Function Modes

Table 2 Function Modes Table (Taking Channel 1 as an Example)

Function	Nixie Tube Display Mode		Description
Brightness Setting	1. X	$0 \leq X \leq 255$	Adjust brightness
Operating Mode	H1. X	X=0 Constant Off Mode	Light source turns on when trigger signal is valid
		X=1 Constant On Mode	Light source turns off when trigger signal is valid
		X=2 Millisecond-level Strobe Mode	Light source flashes once (in milliseconds) when trigger signal is valid; P. X ($1 \leq X \leq 999$, Unit: ms)
		X=3 Microsecond-level Strobe Mode	Light source flashes once (in microseconds) when trigger signal is valid; P. X ($1 \leq X \leq 999$, 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 Active	Trigger signal is valid at low level
		X=1 High-level Active	Trigger signal is valid at high level
Trigger Mode	Lo. X	X=0	Edge Trigger
		X=1	Level Trigger
Debounce Time Parameter	dt. X	$0 \leq X \leq 99$	X:debounce time, Unit: μs
Linkage Mode	LH. X	X=0	No Linkage
		X=1	IO Linkage
		X=2	Sequence Linkage

2. User Instructions

2.1 Panel Description

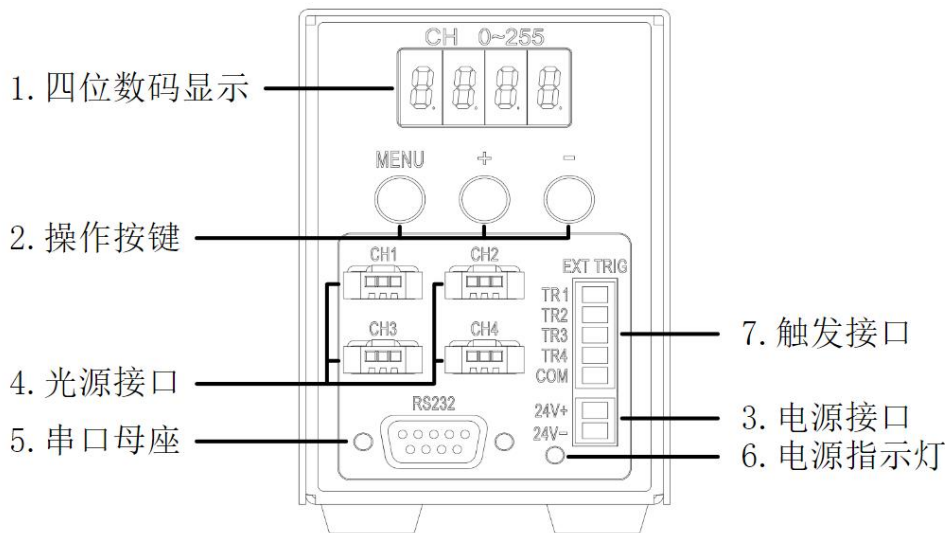


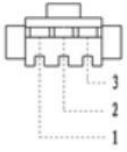
Figure 1 Front Panel

Table 3 Panel Interface Definition Table

No.	Name	Description
1	4-digit Nixie Tube Display	The first digit from the left is the current operation channel, and the last three digits are the corresponding values of the current operation channel
2	Operation Buttons	MENU: Function switching button; "+": Increase value; "-": Decrease value
3	Power Interface	DC 24V input interface
4	Light Source Interface	Connect to 10mA~4A 24V light source
5	Serial Female Connector	Connect to devices with RS232 interface
6	Power Indicator Light	The indicator light is on when there is power input
7	Trigger Interface	Connect to external signals for trigger switch operation

2.2 Light Source Interface Definition

Table 4 Light Source Interface Definition Table

	Position	Definition	Description
	1	Light+	Positive pole of light source output
	2	Empty	Not connected
	3	Light-	Negative pole of light source output

2.3 Serial Female Connector Interface Definition

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

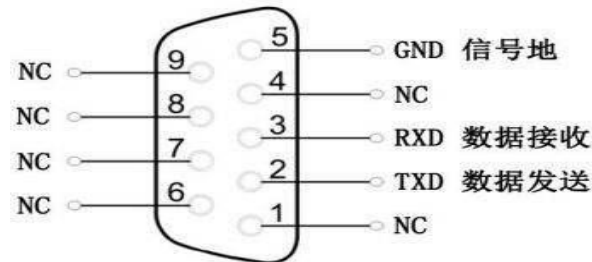


Figure 2 Serial Female Socket Interface Definition

Table 5 Serial Female Socket Interface Definition Table

Pin No.	Name	Description
1	NC	Not connected
2	TXD	Controller's RS232 data transmission (RS232 level)
3	RXD	Controller's 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. Each channel has a trigger port TRx (x represents the channel number), and COM is the common port, which can be connected to either the positive or negative pole of the power supply. The internal part is a bidirectional optocoupler, and its electrical diagram is shown in Figure 4:

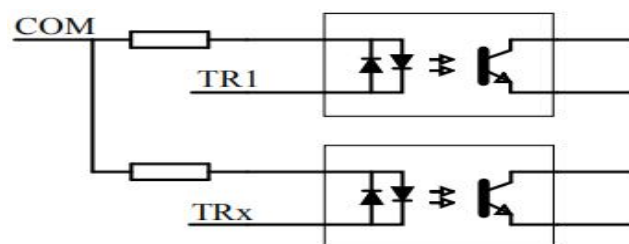


Figure 4 Internal Electrical Diagram of External Trigger

2.4.2 Trigger Interface Wiring Example

When the valid trigger signal is rising edge or high-level active, the wiring is shown in Figure 5:

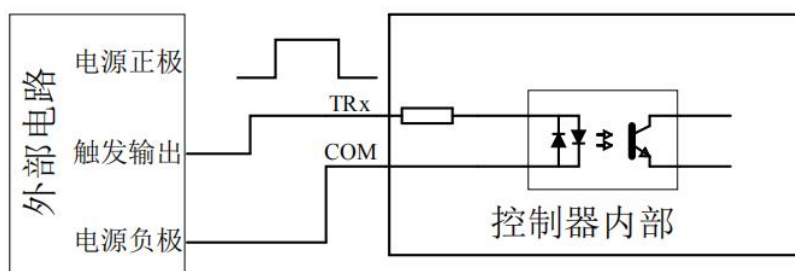


Figure 5 Wiring Example for Rising Edge or High-Level Active

The trigger output of the external control circuit is connected to TRx, and the negative pole of the power supply is connected to COM. When there is a rising edge or high level at the trigger output terminal, the controller controls the output.

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

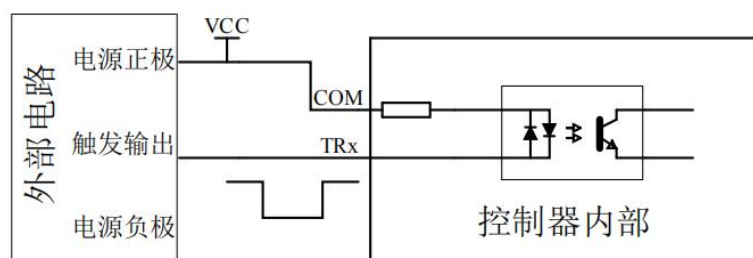


Figure 6 Wiring Example for Falling Edge or Low-Level Active

The trigger output of the external control circuit is connected to TRx, and the positive pole of the power supply is connected to COM. 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 source turns on. Taking high-level active as an example, the timing relationship is shown in Figure 7:

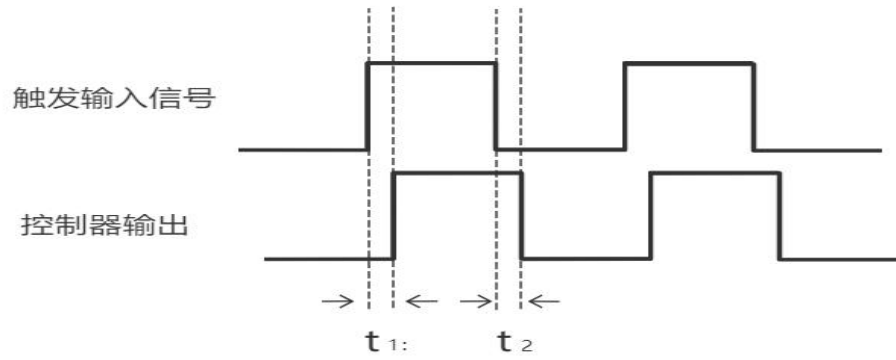


Figure 7 Timing Diagram of Constant Off Mode

Parameter	Time
t_1	$\leq 25\mu s$
t_2	$\leq 150\mu s$

Constant On Mode: When the controller's trigger input signal is valid, the light source turns off. Taking high-level active as an example, the timing relationship is shown in Figure 8:

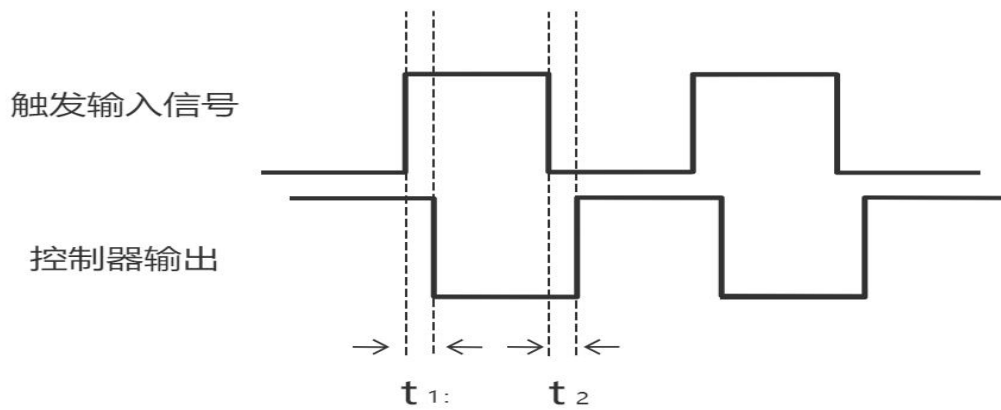


Figure 8 Timing Diagram of Constant On Mode

Parameter	Time
t_1	$\leq 25\mu s$
t_2	$\leq 150\mu s$

Strobe Mode: When the controller is set to millisecond-level strobe or microsecond-level strobe, the light source turns on when the controller's trigger input signal is valid. Taking high-level active as an example, the timing relationship is shown in Figure 9:

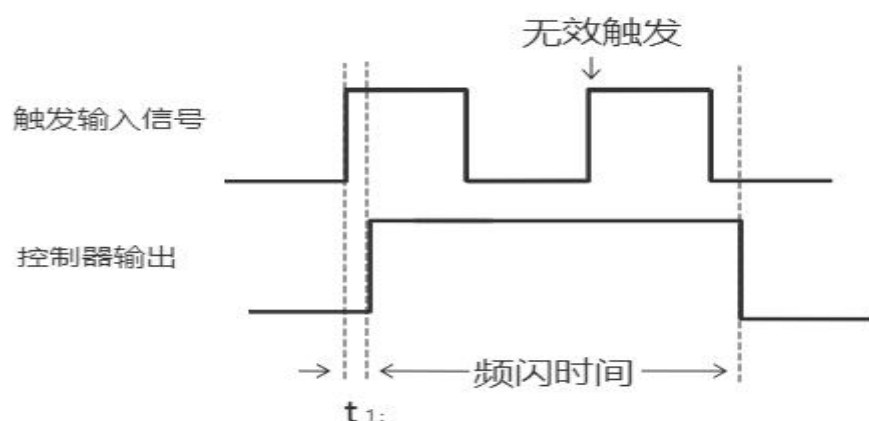


Figure 9 Timing Diagram of Strobe Mode

Parameter	Time
t_1	$\leq 25\mu s$

2.5 Manual Settings

2.5.1 Brightness Setting

After turning on the controller, the 4-digit LED display shows the channel number + brightness value. Initially, it displays Channel 1 and its brightness value. For example, if the brightness value of Channel 1 was set to 10 last time, the display will show "1.010".

The following takes setting the brightness of Channel 2 to 125 as an example, and its flow chart is shown in Figure 10.

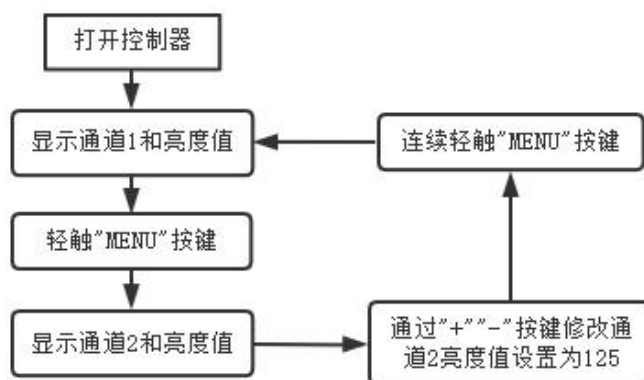


Figure 10 Brightness Setting Flow Chart

2.5.2 Operating Mode Setting

This model of controller has 4 operating modes, which can be set via manual buttons or communication. For the 4 modes, please refer to Table 2.

The mode of each channel can be set independently. The following takes setting the mode of Channel 2 as an example; the setting method for other channels is similar.

nnels is similar.

2.5.3 Constant Off Mode Setting

The flow chart for setting Channel 2 to Constant Off Mode is shown in Figure 11:

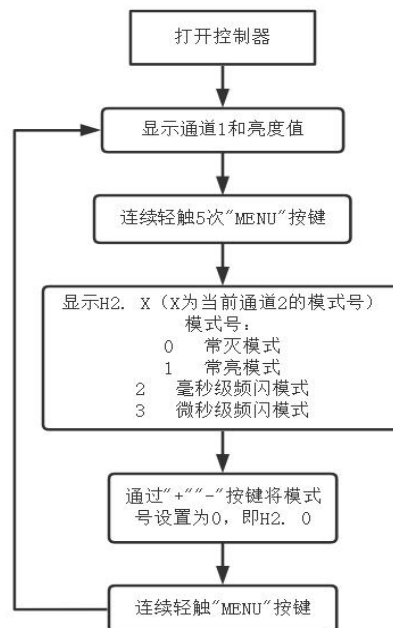


Figure 11 Flow Chart for Setting Constant Off Mode

2.5.4 Constant On Mode Setting

The flow chart for setting Channel 2 to Constant On Mode is shown in Figure 12:

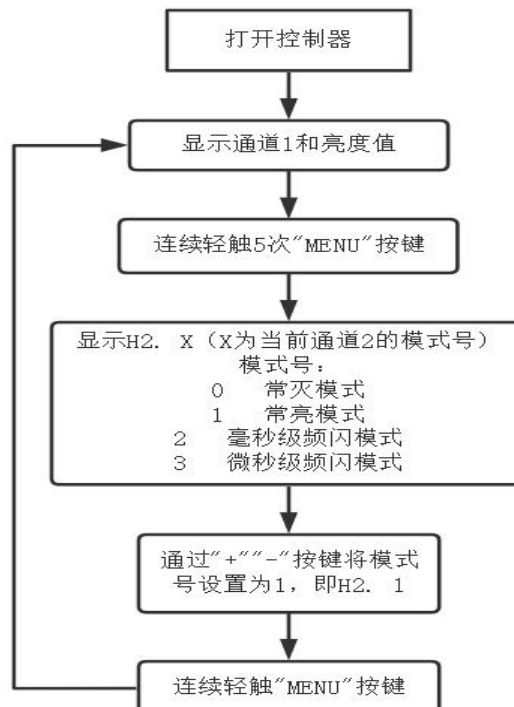


Figure 12 Flow Chart for Setting Constant On Mode

2.5.5 Millisecond-level Strobe Mode Setting

The flow chart for setting Channel 2 to Millisecond-level Strobe Mode and its strobe time is shown in Figure 13:

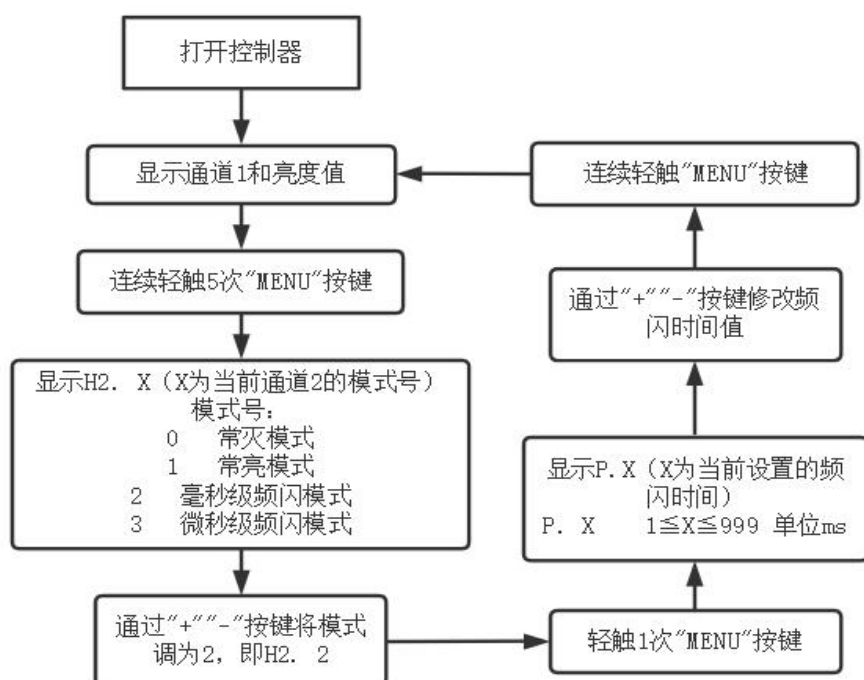


Figure 13 Flow Chart for Setting Millisecond-level Strobe Mode and Strobe Time

2.5.6 Microsecond-level Strobe Mode Setting

The flow chart for setting Channel 2 to Microsecond-level Strobe Mode and its strobe time is shown in Figure 14:

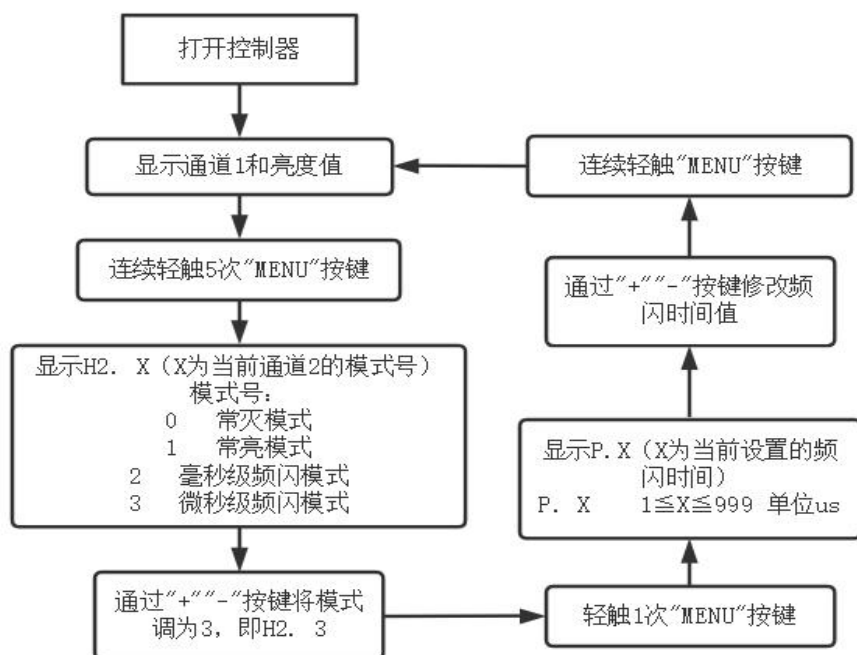


Figure 14 Flow Chart for Setting Microsecond-level Strobe Mode and Strobe Time

2.5.7 High-Level Trigger Mode Setting

The flow chart for setting all channels to High-Level Trigger Mode is shown in Figure 15:

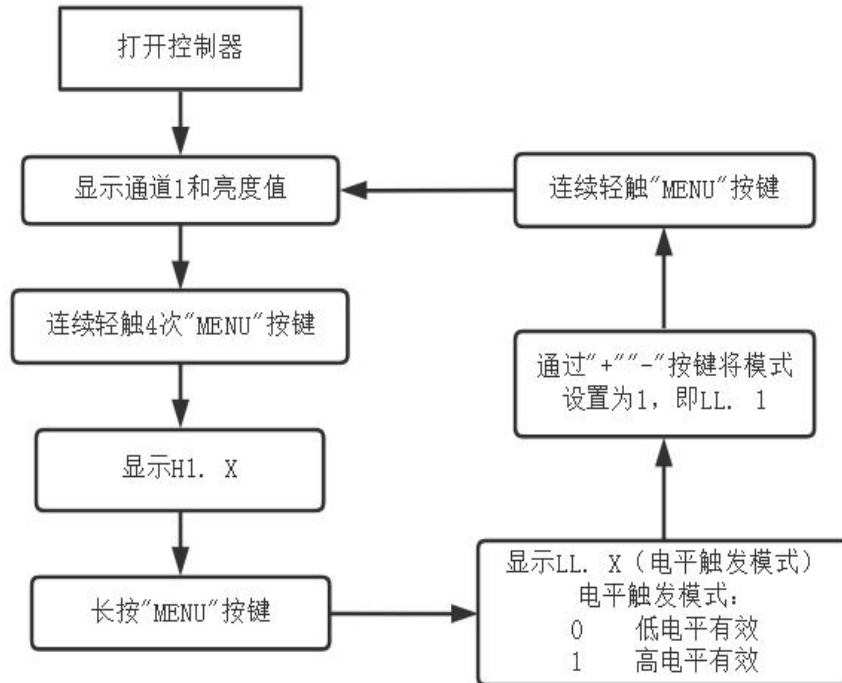


Figure 15 Flow Chart for Setting All Channels to High-Level Trigger Mode

2.5.8 Edge Trigger Mode Setting

The flow chart for setting all channels to Edge Trigger Mode is shown in Figure 16:

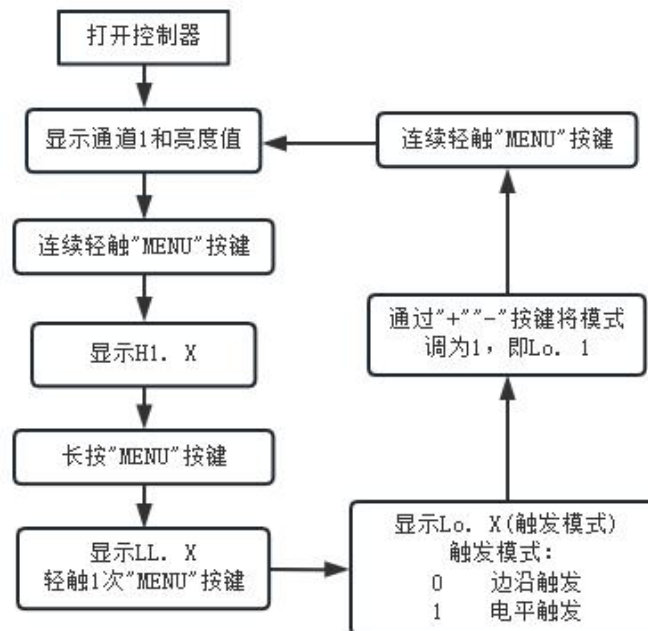


Figure 16 Flow Chart for Setting All Channels to Edge Trigger Mode

2.5.9 Debounce Time Parameter Setting

The flow chart for setting the debounce time parameter of all channels is shown in Figure 17:

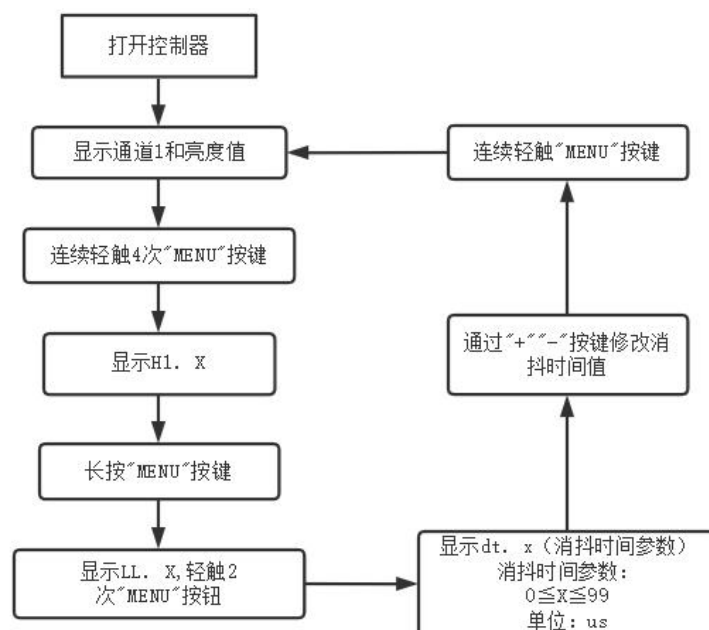


Figure 17 Flow Chart for Setting Debounce Time Parameter of All Channels

2.5.10 Key Lock Setting

Long press the MENU button when the channel and brightness value are displayed to lock the buttons. You can switch the data of each channel but cannot modify it.

2.6 Linkage Mode Settings

This product provides two linkage modes: 1. IO Linkage; 2. Sequence Linkage. Users can select and set 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:

On the interface displaying "n. 0", when a corresponding channel responds, the number "0" will change to the number of the responding channel.

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

The flow chart for setting IO Linkage Mode is shown in Figure 18:

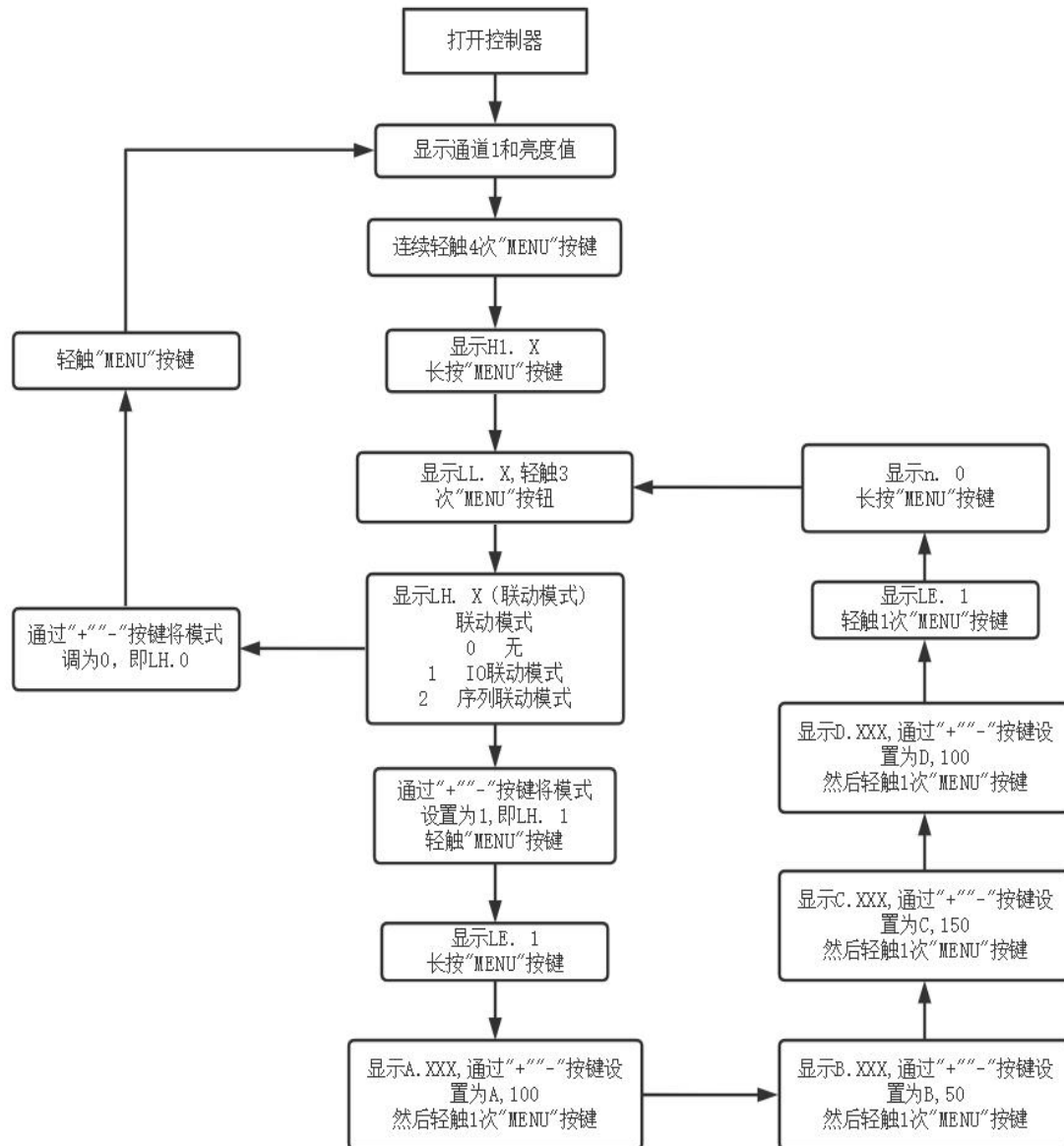


Figure 18 Flow Chart for Setting IO Linkage Mode

2.6.2 Sequence Linkage Mode Setting

In Sequence Linkage Mode, Channel 1 is used as the trigger channel. Each time a trigger signal is applied, Channel 1 turns on, and the sequence increments by 1 at the same time. After incrementing to the last sequence, it automatically returns to the first sequence to cycle. The brightness of each turn-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 applied to Channel 1, the brightness of Channel 1's light source is 100, 125, 150, 175, 50, 75 in sequence.

Each trigger causes an increment; after incrementing to the last sequence, it automatically returns to the first sequence to cycle.

The flow chart for setting Sequence Linkage Mode is shown in Figure 19:

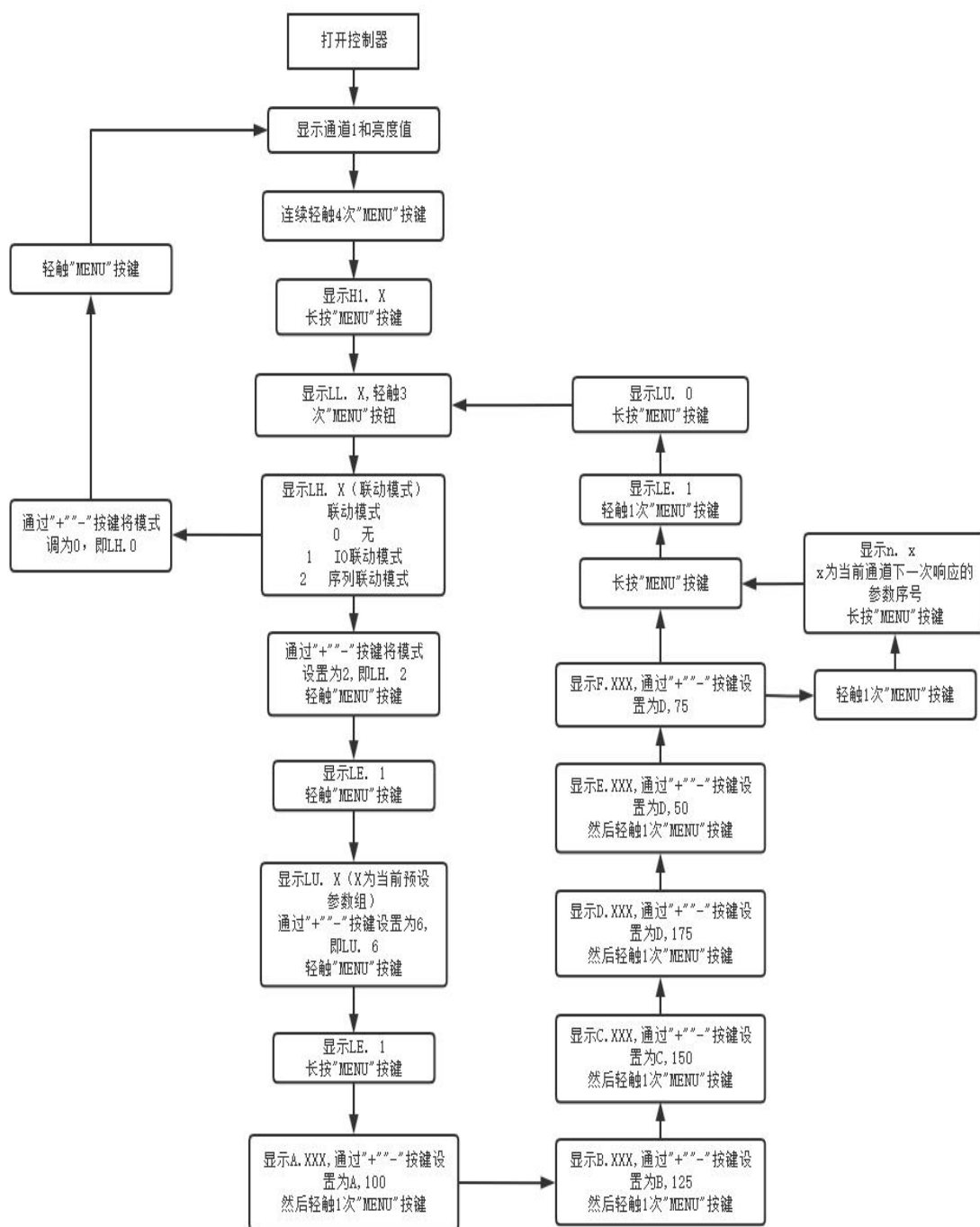


Figure 19 Flow Chart for Setting Sequence Linkage Mode

3. Communication Protocol

3.1 Programming Flow

When controlling the light source controller via serial port, the communication programming flow is shown in Figure 20:

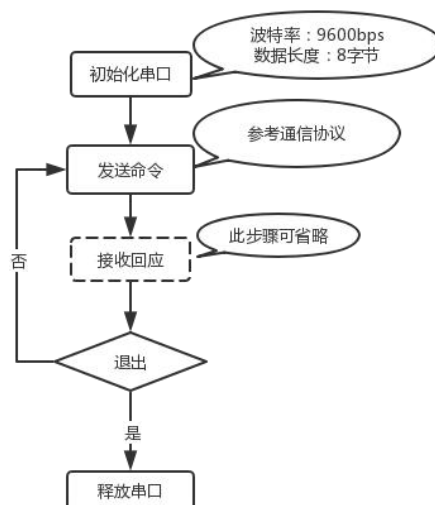


Figure 20 Communication Programming Flow Chart

3.2 Communication Settings

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

Table 6 Serial Port Settings Table

Baud Rate	Parity Bit	Data Bit	Stop Bit
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、 The feature word is: \$.
- 3、 The command words are as shown in Table 7.
- 4、 When the command word is "1", "2", "3", "7", "8", or "9": if the controller receives the command successfully, it returns the feature word "\$"; if the controller fails to receive the command, it returns "&".
- 5、 When the command word 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 the controller fails to receive the command, it returns "&".
- 6、 The channel words are "1", "2", "3", and "4", representing 4 channels respectively.
- 7、 Data = 0XX (XX is any value from 00 to FF), which corresponds to the setting

parameter of the channel. The high byte comes first, and the low byte comes after.

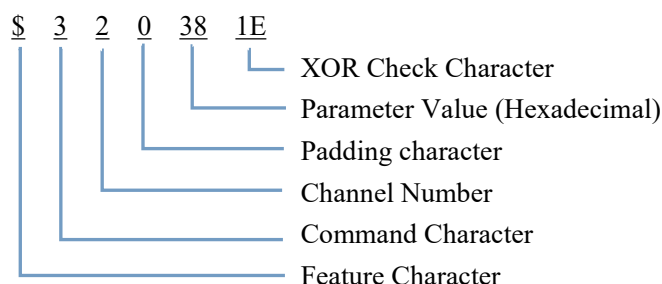
8、XOR checksum word = XOR checksum of bytes excluding the checksum words (including: feature word, command word, channel word, and data). The ASCII code of the high 4 bits of the checksum comes first, and the ASCII code of the low 4 bits comes after.

Table 8 Command Character Function Table

Character	Function	Description
"1"	Turn on target channel	Target channel is specified by the channel identifier.
"2"	Turn off target channel	Target channel is specified by the channel identifier.
"3"	Set channel brightness	Target channel is specified by the channel identifier; brightness = Data 1 to Data 3.
"4"	Read channel brightness	Target channel is specified by the channel identifier; return format matches command format.
"7"	Trigger channel strobe	Target channel is specified by the channel identifier; disabled in non-strobe mode.
"8"	Set channel mode	Target channel is specified by the channel identifier.
"9"	Set strobe duration	Target channel is specified by the channel identifier; disabled in non-strobe mode.

3.4 Communication Examples

To set the brightness of Channel 2 to 56, write "\$320381E" in ASCII code.



	String	ASCII Code	ASCII Code (Hexadecimal)	Represent High 4 Bits and Low 4 Bits with 8421 Code Respectively
Feature Character	\$	36	24	0010 0100
Command Character	3	51	33	0011 0011
Channel Character	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 Check Character				1 E

Note: For the three functions of 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 during the calculation of the XOR check character. It is only necessary to ensure the format is 0XX (where XX is any value ranging from 00 to FF).

The following are several sets of command data:

Turning off Channel 2: \$220381F

	String	ASCII Code	ASCII Code (Hexadecimal)	Represent High 4 Bits and Low 4 Bits with 8421 Code Respectively
Feature Character	\$	36	24	0010 0100
Command Character	3	50	32	0011 0010
Channel Character	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 Check Character				1 F

Turning on Channel 2: \$120381C

	String	ASCII Code	ASCII Code (Hexadecimal)	Represent High 4 Bits and Low 4 Bits with 8421 Code Respectively
Feature Character	\$	36	24	0010 0100
Command Character	1	49	31	0011 0001
Channel Character	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 Check Character				1 C

Reading Data from Channel 2: \$4200012

	String	ASCII Code	ASCII Code (Hexadecimal)	Represent High 4 Bits and Low 4 Bits with 8421 Code Respectively
Feature Character	\$	36	24	0010 0100
Command Character	4	52	34	0011 0100
Channel Character	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 Check Character				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:

指令	说明	提示指令相应解决办法
F.1	未注册	重新注册
F.2	存储芯片损坏	需返厂维修
F.3	超光源功率,短路,信号干扰	检查光源功率,光源是否短路,是否有信号干扰
F.6	过温报警(部分型号有)	温度过高,检查控制器工作环境
Loc	按键锁	拨码解锁或长按”MENU”按键解锁

5. Accessories

