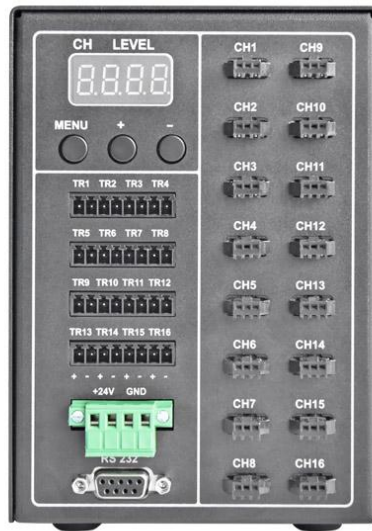


External Power Controller DBS-DV-N02C-24020-16 User Manual



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
Controller	DBS-DV-N02C-24020-16		1
Serial Cable	1.5M Male-to-Female		1
Terminal Block	3.81mm-8P		4
Terminal Block	5.08mm-4P		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

- Supports RS232 communication
- External power supply up to 24V
- Low trigger response time
- Supports external trigger mode
- Supports millisecond-level and microsecond-level strobe
- Manual brightness and mode adjustment
- 5~24V bidirectional trigger, adaptable to high and low-level trigger modes
- Compact size, easy installation (screw mounting or C45 DIN rail mounting)

1.2 Main Parameters

Table 1 Main Parameters Table

Item	Parameter	Description
Input Voltage	24V	Do not exceed the maximum voltage; otherwise, permanent damage may occur
Output Voltage	24V	Output voltage is consistent with input voltage
Output Current	2A	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
Light-Emitting Mode	Constant ON / Constant OFF / Stroboscope	External trigger is available in Constant Off and Strobe modes
Trigger Mode	Edge + Level Trigger	Edge trigger in Strobe mode; Level trigger in Constant On/Off modes
Constant On Brightness Level	255	255-level brightness adjustment
Millisecond-level Strobe Time	1~999	Unit: ms (millisecond)
Microsecond-level Strobe Time	1~999	Unit: us (microsecond)
Communication Baud Rate	9600bps	-
Built-in Power Supply	None	-
Number of Channels	16	-
Connected Light Source Type	24V Light Source	10mA~2A 24V light source
Operating Ambient Temperature	-5~50°C	-
Dimensions	See appendix for details	

1.3Function Modes

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

Function	数码管显示方式		说明
Brightness Setting	1. X	$0 \leq X \leq 255$	Adjust brightness
Operating Mode	H. 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: μ s)
		X=4 Single Channel Operating Mode Editing	Edit the operating mode of each channel individually
Debounce Time Parameter	dt. X	$0 \leq X \leq 99$	X represents debounce time; Unit: us (microsecond)
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
Long-press the MENU button at "H. 1" to enter the initial brightness editing mode.			
Initial Brightness Editing Mode	CX. Y	$1 \leq X \leq 16$ (Channel Number)	Adjust the channel number by pressing MENU
		$0 \leq Y \leq 99$	Adjust the initial brightness by pressing "-" and "+"

Note: Channels 10 to 16 are represented by letters (A to G) since Channel 9.

2. User Instructions

2.1 Panel Description

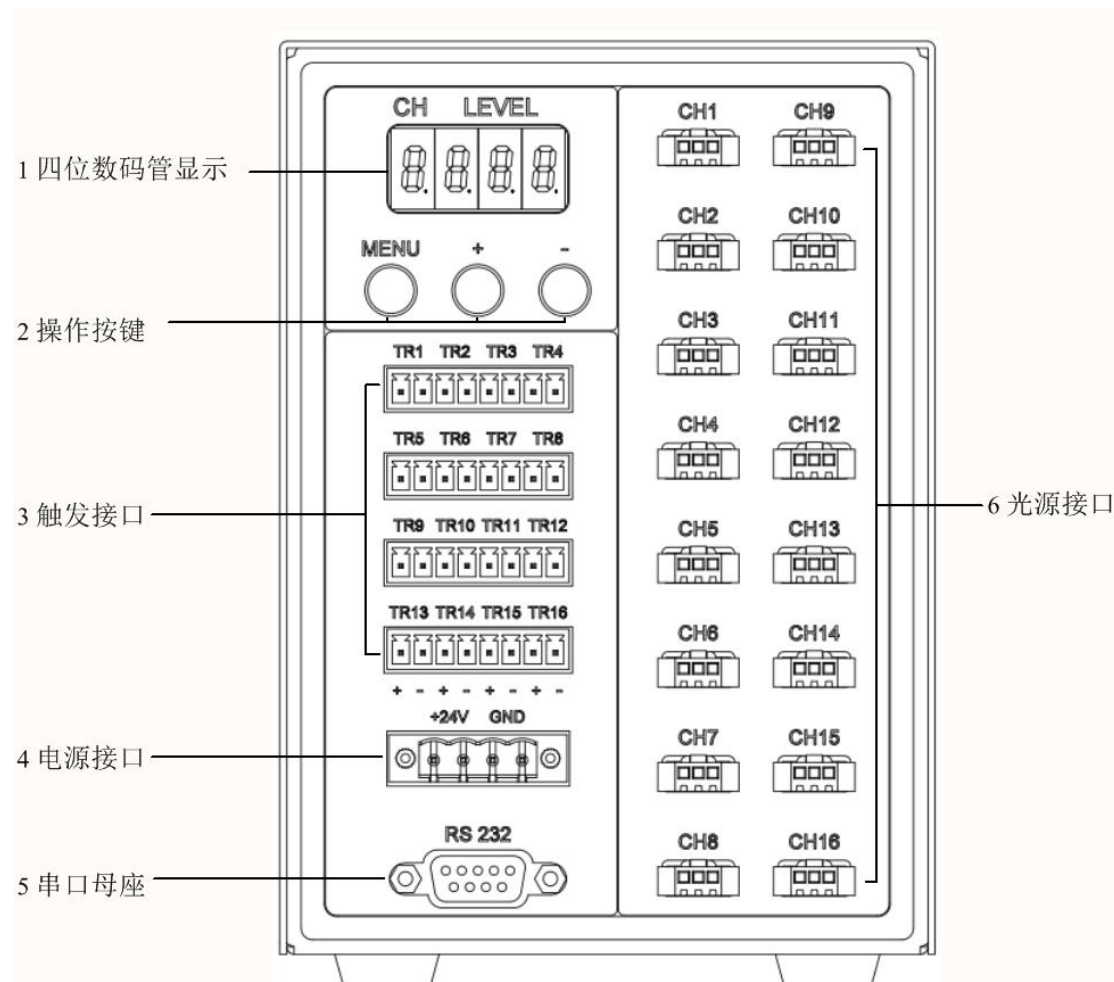


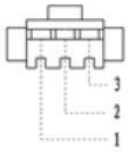
Figure 1 Front Panel

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; 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	Trigger Interface	Connect to external signals to trigger on/off operation
4	Power Interface	Accepts 12~24V DC power input
5	Serial Female Connector	Connects to devices with an RS232 interface
6	Light Source Interface	Connects to 10 mA~2 A 24V light sources

2.2 Light Source Interface Definition

Table 4 Light Source Interface Definition Table

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

2.3 Serial Port Interface Definition

The pin definition of the serial female connector is shown in Figure 2. Connect it to the 9-pin serial port of a computer using a straight-through cable.

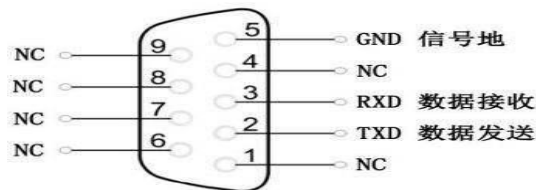


Figure 2 Serial Female Connector Interface Definition

Table 5 Serial Female Connector 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 16 external trigger input interfaces. Each interface has two input terminals, namely “+” and “-” (where x represents the channel number). Inside, there is a bidirectional optocoupler. The electrical diagram is shown in Figure 4:

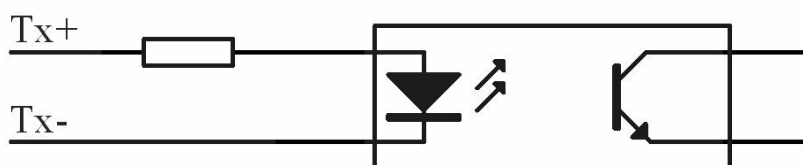


Figure 4 Internal Electrical Diagram of External Trigger

2.4.2 Trigger Interface Wiring Example

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

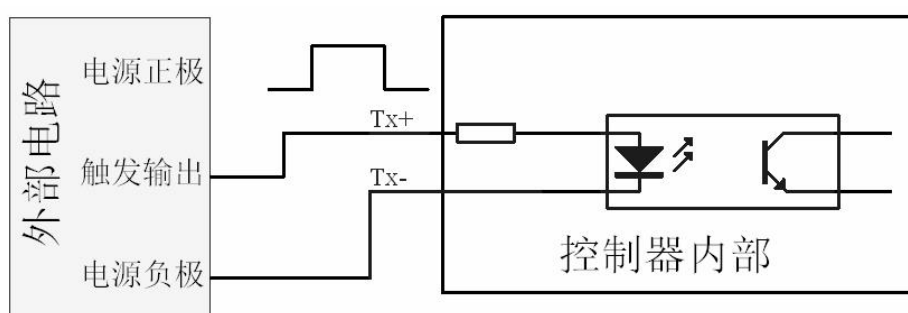


Figure 5 Wiring Example for Rising Edge or High-Level Active

Connect the trigger output of the external control circuit to Tx+, and the negative terminal of the power supply to Tx-. When a rising edge or high level is detected at the trigger output, the controller controls the light source output.

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

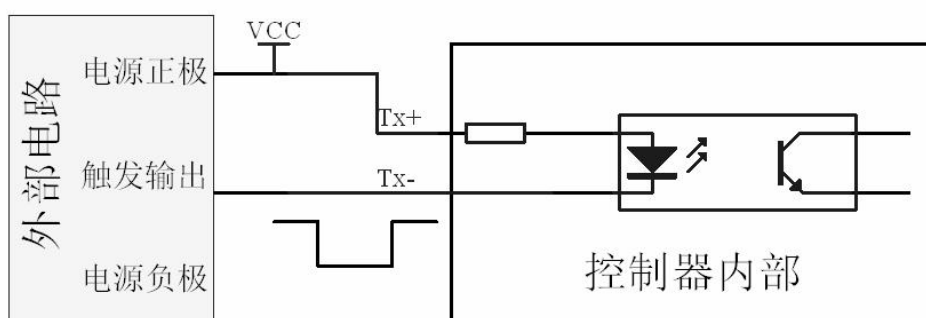


Figure 6 Wiring Example for Falling Edge or Low-Level Active

Connect the trigger output of the external control circuit to Tx-, and the positive terminal of the power supply to Tx+. When a falling edge or low level is detected at the trigger output, the controller controls the light source output.

2.4.3 Trigger Timing Diagrams

Constant Off Mode: When the trigger input signal of the controller is valid, the light source turns on. Taking high-level active as an example to explain the timing relationship, as shown in Figure 7:

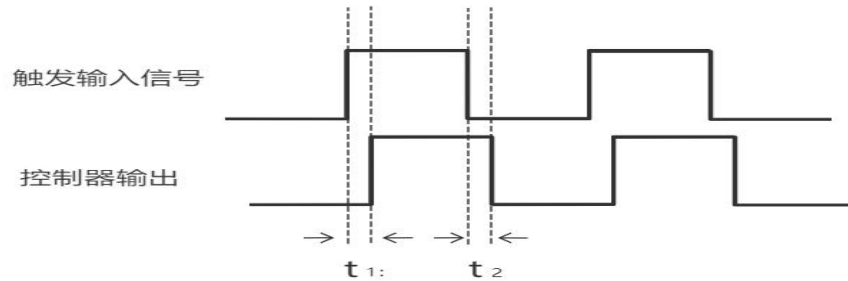


Figure 7 Timing Diagram for Constant Off Mode

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

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

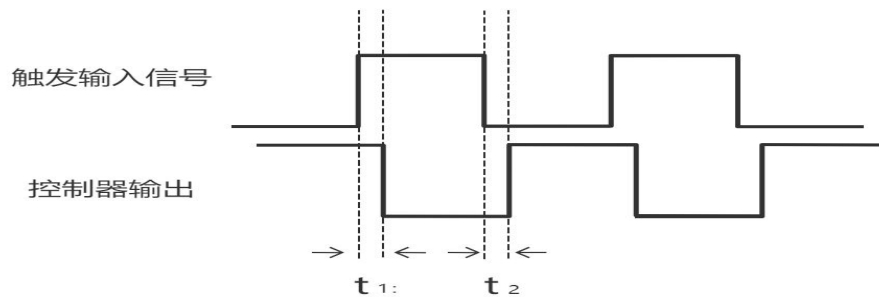


Figure 8 Timing Diagram for Constant On Mode

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 trigger input signal of the controller is valid. Taking high-level active as an example to explain the timing relationship, as shown in Figure 9:

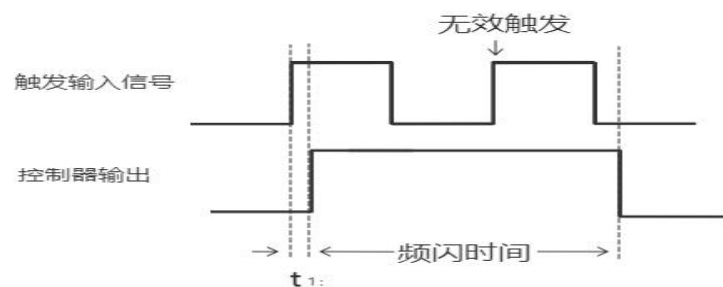


Figure 9 Timing Diagram for Strobe Mode

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 nixie tube displays "Channel Number + Brightness Value". Initially, it shows Channel 1 and its brightness value. For example, if the brightness value of Channel 1 set last time was 10, the display will show "1.010".

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

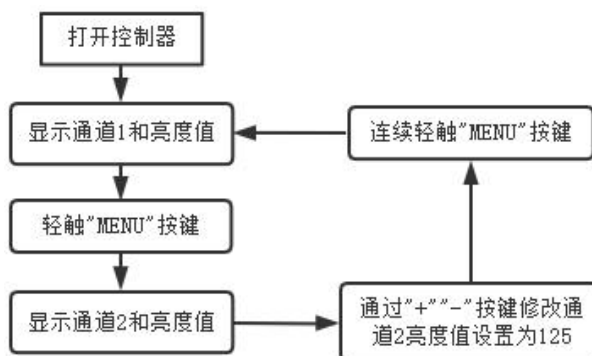


Figure 10 Brightness Setting Flow Chart

2.5.2 Operating Mode Setting

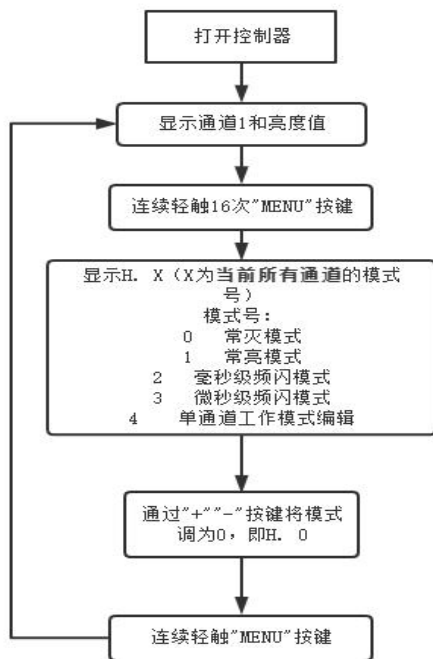
This model of controller has five operating modes, which can be set via manual buttons or communication. For details of the five modes, refer to Table 2.

The mode of each channel can be set independently. The following takes "setting the mode of Channel 2" as an example for explanation, and the setting method for other channels is the same.

2.5.3 Constant OFF Mode Setting

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

全通道设置



指定通道设置

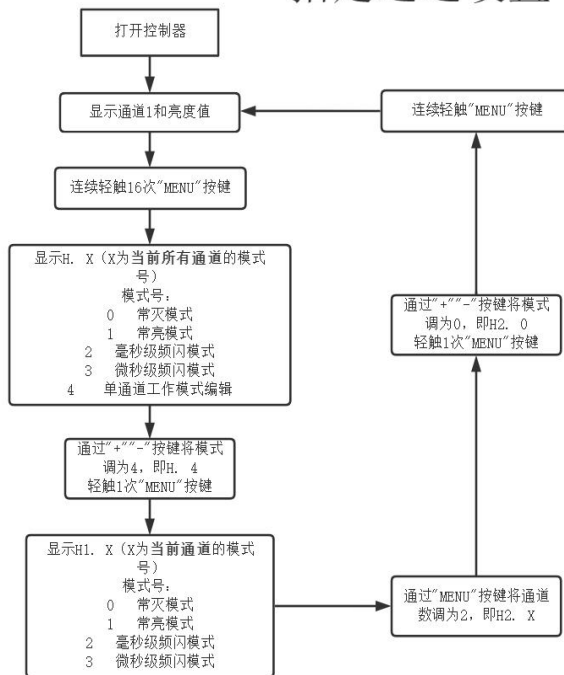
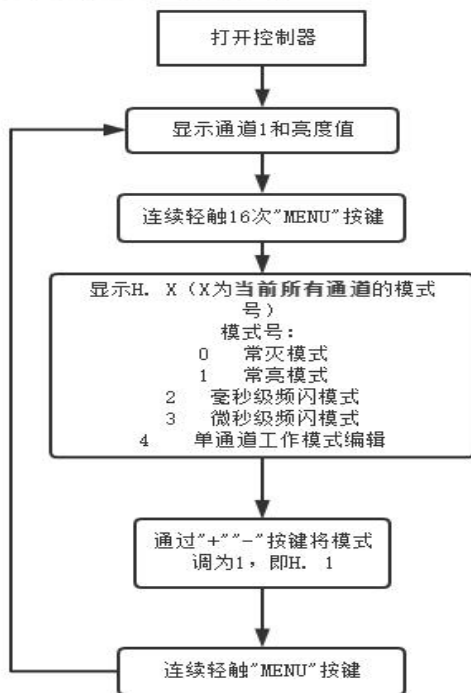


Figure 11: Constant OFF Mode Setting Flowchart

2.5.4 Constant ON Mode Setting

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

全通道设置



指定通道设置

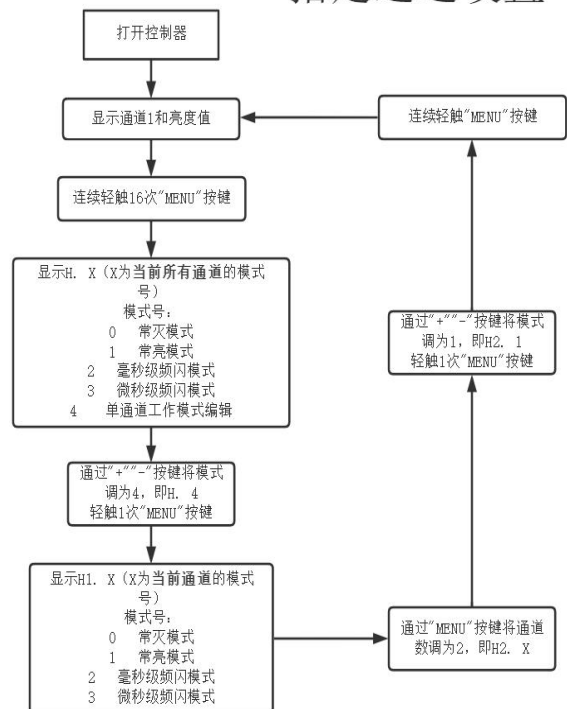


Figure 12: Constant ON Mode Setting Flowchart

2.5.5 Millisecond Strobe Mode Setting

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

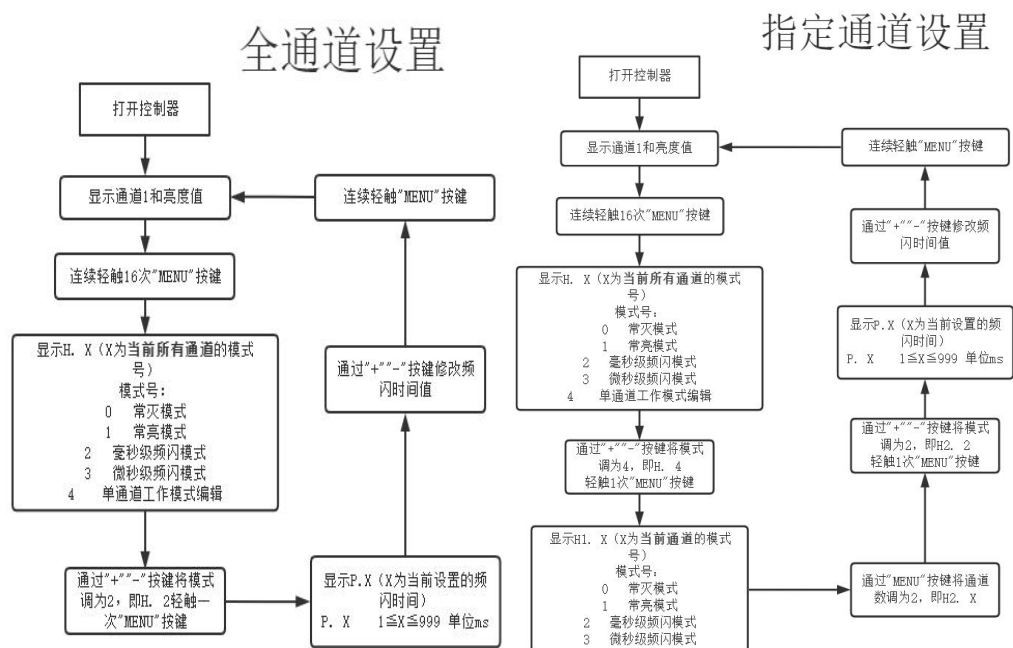


Figure 13: Millisecond Strobe Mode & Time Setting Flowchart

2.5.6 Microsecond-level Stroboscope Mode Setting

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

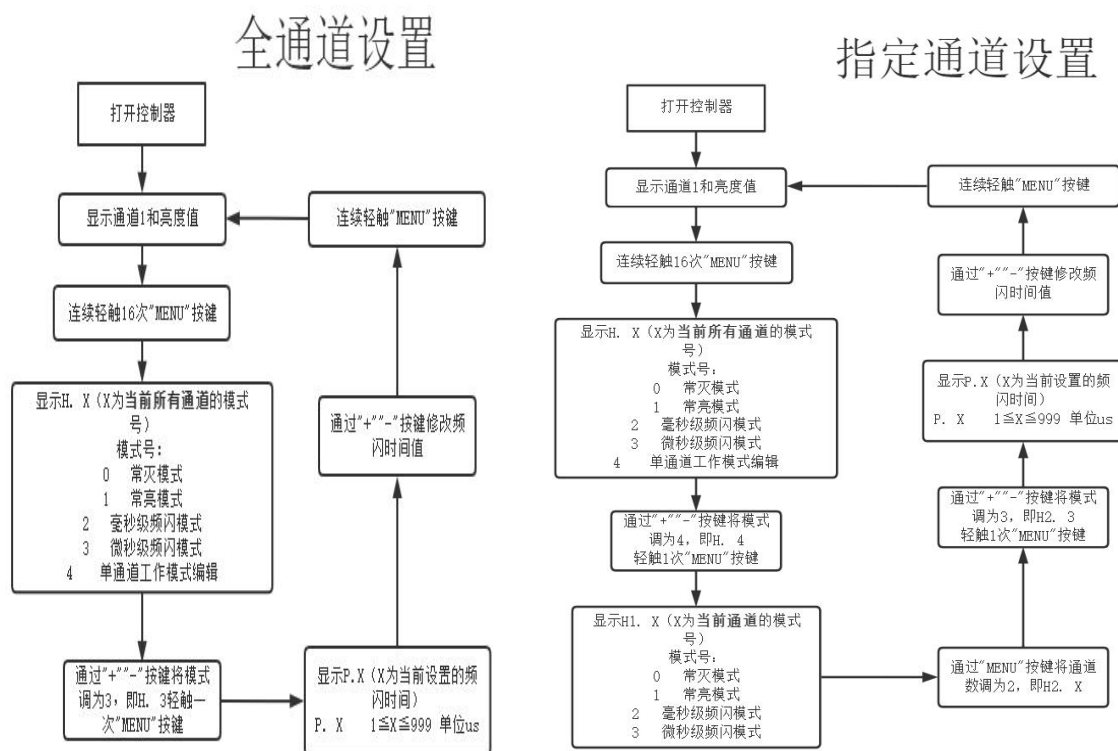


Figure 14: Microsecond Strobe Mode & Time Setting Flowchart

2.5.7 Debounce Time Parameter Setting

In applications with severe signal interference, set the debounce time parameter to filter out interference signals. The flow chart for setting the debounce time for all channels is shown in Figure 15:

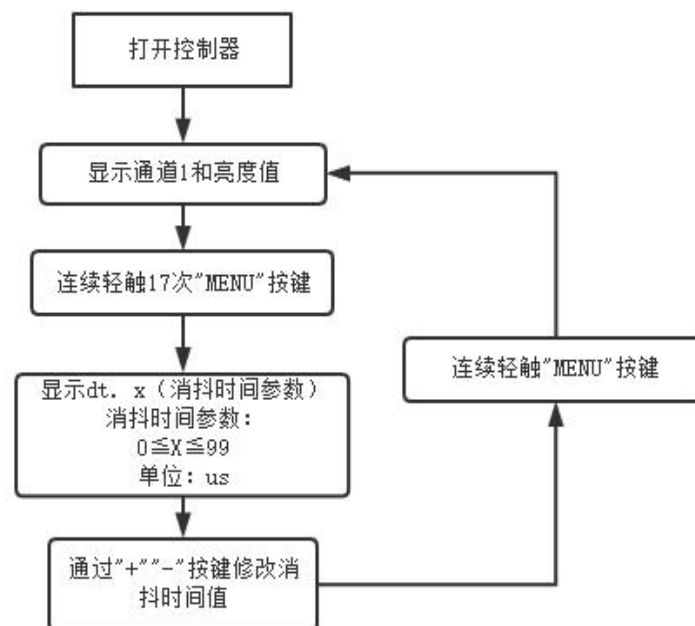


Figure 15 Complete channel debounce time parameter setting process

2.5.8 High-Level Trigger Mode Setting

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

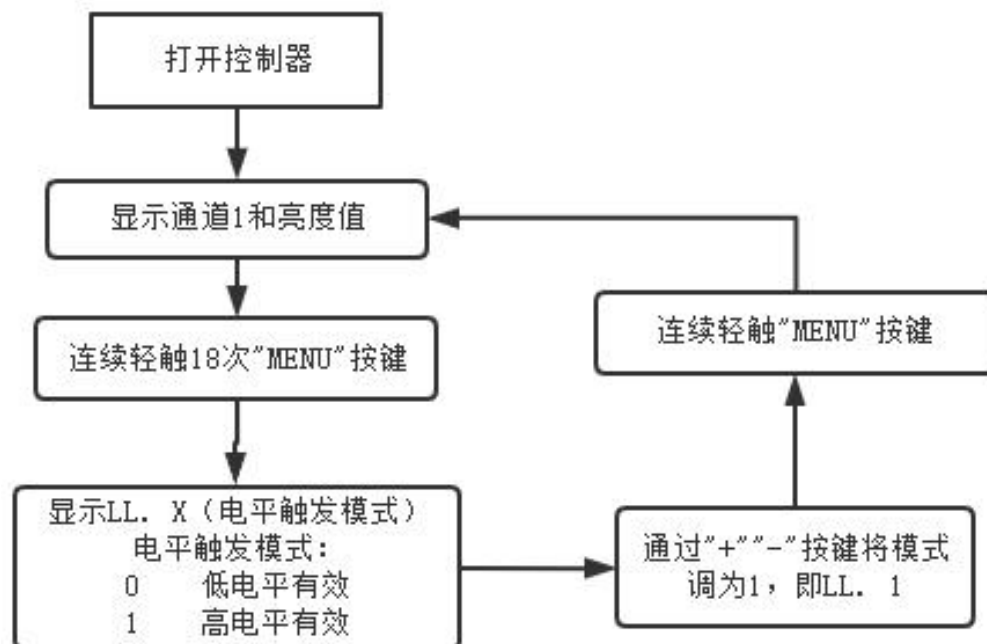


Figure 16 Flow Chart for Setting High-Level Trigger Mode (All Channels)

2.5.9 Initial Brightness Editing Mode Setting

The flow chart for setting the initial brightness of Channel 2 is shown in Figure 17:

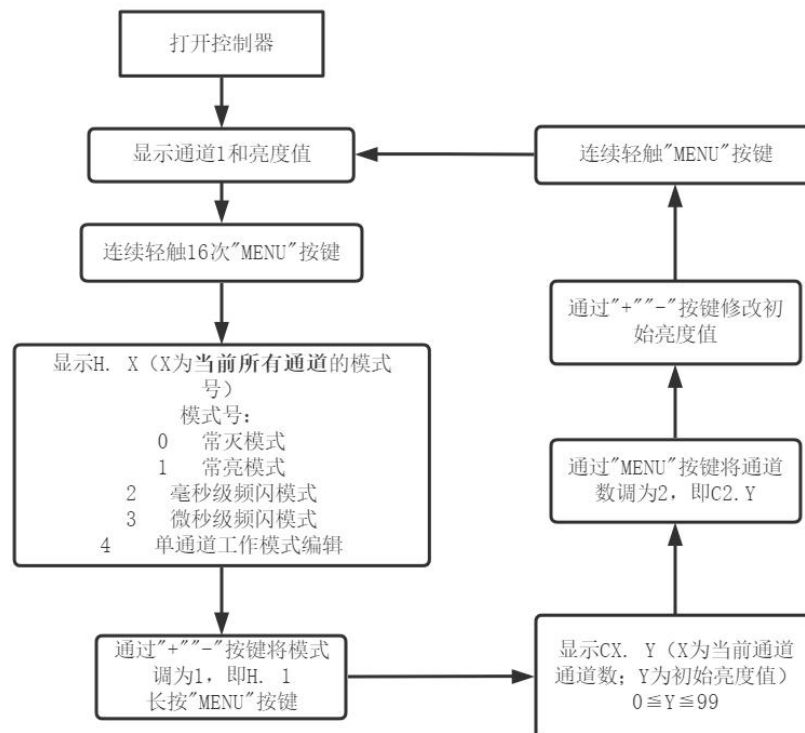


Figure 17 Flow Chart for Setting Initial Brightness (Channel 2)

3. Communication Protocol

3.1 Programming Flow

When controlling the light source controller via serial port, the communication programming flow is shown in Figure 18:

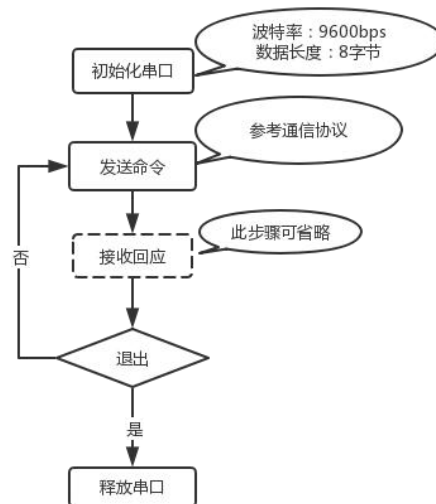


Figure 18 Communication Programming Flow

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	Data Bits	Stop Bits
9600	None	8	1

3.3 Frame Format Description

The frame format of communication 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 codes.
- 2、The feature character is: \$.
- 3、The command characters are as shown in Table 7.
- 4、When the command characters are "1", "2", "3", "7", "8", "9": if the controller receives the command successfully, it returns the feature character \$; if the controller

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 parameters 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 characters are "1", "2", "3", "4", "5", "6", "7", "8", "9", "A", "b", "C", "d", "E", "F", "G", representing 16 channels respectively.

7、 Data = 0XX (XX is any value from 00 to FF), corresponding to the setting parameters of the channel, with the high byte first and the low byte last.

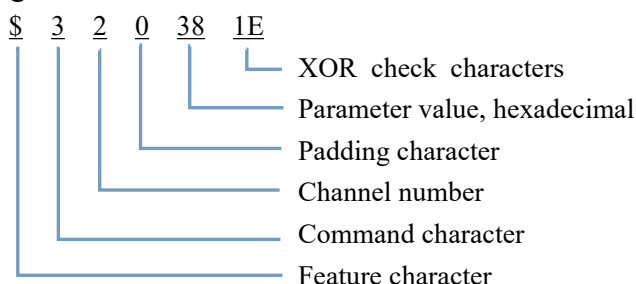
8、 XOR check characters = XOR check of bytes except check characters (including: feature character, command character, channel character and data). The high 4 bits ASCII code of the checksum comes first, and the low 4 bits ASCII code comes after.

Table 7 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 brightness parameters of the corresponding channel	The corresponding channel is determined by the channel character, and the brightness parameters are Data 1 to Data 3
"4"	Read brightness parameters of the corresponding channel	The corresponding channel is determined by the channel character, and the return format is the same as the sending format
"7"	Trigger strobe of the corresponding channel	he corresponding channel is determined by the channel character, and this function is invalid in non-strobe mode
"8"	Set mode of the corresponding channel	The corresponding channel is determined by the channel character
"9"	Set strobe time of the corresponding channel	The corresponding channel is determined by the channel character, and this function is invalid in non-strobe mode

3.3 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 in 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: In the calculation process of XOR checksum characters for the three functions of turning on the corresponding channel, turning off the corresponding channel and reading parameters of the corresponding channel, the values of the 3 bytes of data have no impact on the XOR result. It is only necessary to ensure the format is 0XX (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 in 8421 code respectively
Feature character	\$	36	24	0010 0100
Command character	2	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

Turn on channel 2: \$120381C

	String	ASCII Code	ASCII Code (Hexadecimal)	Represent high 4 bits and low 4 bits in 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

Read data of channel 2: \$4200012

	String	ASCII Code	ASCII Code (Hexadecimal)	Represent high 4 bits and low 4 bits in 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 command table below:

Command	Description	Troubleshooting Solution for Prompt Command
F.1	Unregistered	Re-register
F.2	Storage chip damaged	Need to return to 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 (for some models)	Excessively high temperature; check the controller's operating environment
Loc	Button lock	Unlock via DIP switch or long-press the "MENU" button

5. Accessories

