

External Power Controller

DBS-DV-N02C-24030-8

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-24020-8		1
Serial Cable	1.5M Male-to-Female		1
Terminal Block	3.81mm-8P		2
Terminal Block	3.81mm-4P		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
1.1 Product Features	1
1.2 Main Parameters	1
1.3 Function Modes	2
2. User Instructions	3
2.1 Panel Description	3
2.2 Light Source Interface Definition	3
2.3 Serial Port Interface Definition	4
2.4 Trigger Description	4
2.4.1 Trigger Interface	4
2.4.2 Trigger Interface Wiring Example	5
2.4.3 Trigger Timing Diagram	5
2.5 Manual Settings	7
2.5.1 Brightness Setting	7
2.5.2 Operating Mode Setting	7
2.5.3 Constant Off Mode Setting	7
2.5.4 Constant On Mode Setting	8
2.5.5 Millisecond-Level Strobe Mode Setting	8
2.5.6 Debounce Time Parameter Setting	9
2.5.7 High-Level Trigger Mode Setting	10
2.5.8 Edge Trigger Mode Setting	10
3. Communication Protocol	12
3.1 Programming Flow	12
3.2 Communication Settings	12
3.3 Frame Format Description	12
3.3 Communication Examples	13
4. Prompt Command Index	16
5. Accessories	17

1. Product Introduction

1.1 Product Features

- Supports RS232 communication
- Compatible with external power supplies up to 24V
- Low trigger response time
- Supports external trigger mode
- Supports millisecond-level strobe function
- Allows manual adjustment of brightness and operating mode
- 5~24V bidirectional trigger, adaptable to both high-level and low-level trigger modes
- Compact size for easy installation (supports 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 matches the input voltage
Output Current	3A	Maximum current per channel
Overcurrent Protection	None	-
Overvoltage Protection	None	-
Operating Modes	4 Types	0: Constant OFF; 1: Constant ON; 2: Millisecond-level Strobe
Light-Emitting Mode	Constant ON / Constant OFF / Strobe	External trigger is available in Constant Off and Strobe modes
Trigger Mode	Edge + Level Trigger	Edge trigger for Strobe mode; Level trigger for Constant On/Off modes
Constant On Brightness Level	255	255-level brightness adjustment
Millisecond-level Strobe Time	1~999	Unit: ms (millisecond)
Communication Baud Rate	9600bps	-
Built-in Power Supply	None	-
Number of Channels	8	-
Connected Light Source Type	24V Light Source	10mA~3A 24V light source
Operating Ambient Temperature	-5~50°C	-
Dimensions	See appendix for details	

1.3 Function Modes

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

Function	Nixie Tube Display Mode		Description
Brightness Setting	1. X	$0 \leq X \leq 255$	Adjusts the brightness of the light source
Operating Mode	H. X	X=0 Constant Off Mode	Light source turns on when the trigger signal is valid
		X=1 Constant On Mode	Light source turns off when the trigger signal is valid
		X=2 Millisecond-level Strobe Mode	Light source flashes once (in milliseconds) when the trigger signal is valid (Display: P. X, $1 \leq X \leq 999$, Unit: ms)
		X=3 Single Channel Operating Mode Editing	Edits the operating mode of each channel individually
Debounce Time Parameter	dt. X	$0 \leq X \leq 99$	X represents the debounce time; Unit: μ s (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
Trigger Mode	Lo. X	X=0	Edge Trigger
		X=1	Level Trigger
Long-press the MENU button when the display shows "H. 1" to enter the initial brightness editing mode.			
Initial Brightness Editing Mode	CX. Y	$1 \leq X \leq 8$ Channel Number	Press MENU to switch channels
		$0 \leq Y \leq 99$	Press "-" or "+" to adjust initial brightness

2. User Instructions

2.1 Panel Description

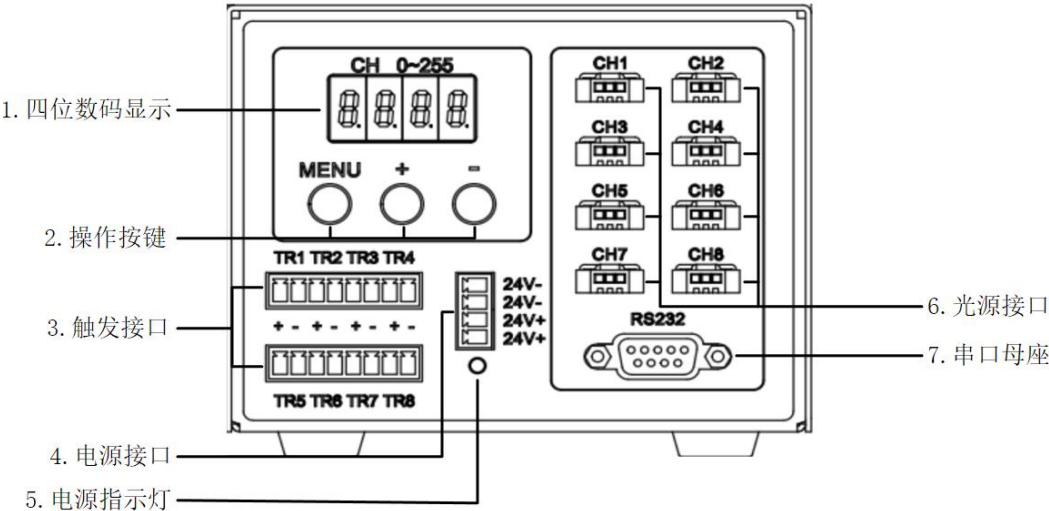


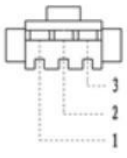
Figure 1 Front Panel

Table 3 Panel Interface Definition Table

No.	Name	Description
1	4-digit Nixie Tube Display	The first digit from the left represents the current operating channel, and the following three digits represent its corresponding value.
2	Operation Buttons	MENU: Function switching button; "+": Increases value; "-": Decreases value
3	Trigger Interface	Connects to external signals to trigger the light source's on/off operation
4	Power Interface	Accepts 12~24V DC power input
5	Power Indicator Light	Lights up when power is input
6	Light Source Interface	Connects to 10mA~3A 24V light sources
7	Serial Female Connector	Connects to devices with an RS232 interface

2.2 Light Source Interface Definition

Table 4 Light Source Interface Definition Table

	Empty	Definition	Description
	1	Light+	Positive terminal of light source output
	2	Empty	No function
	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.

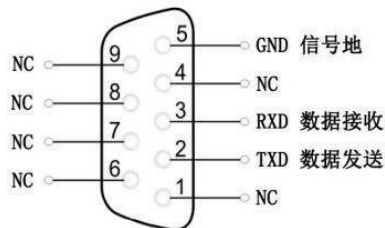


Figure 2 Serial Female Connector Interface Definition

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

There are 8 external trigger input channels, as shown in Figure 3:

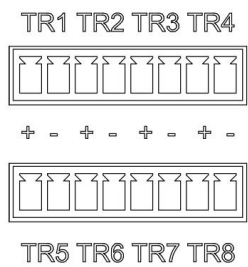


Figure 3 External Trigger Input Interface

Each channel has two input terminals marked "+" and "-" (where "x" represents the channel number). The internal structure includes a bidirectional optocoupler, and its electrical diagram is shown in Figure 4:

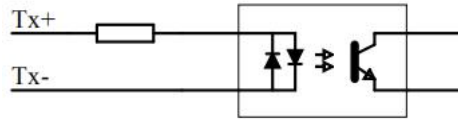


Figure 4 Internal Electrical Diagram of External Trigger

2.4.2 Trigger Interface Wiring Example

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

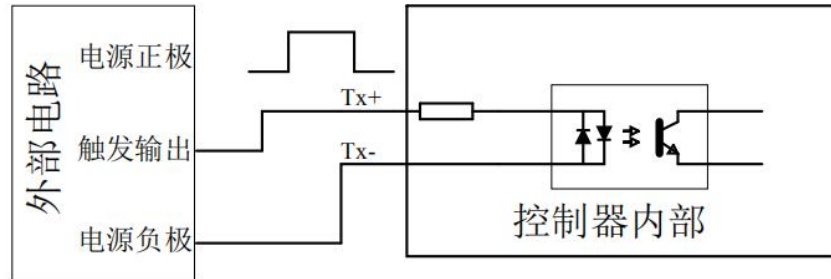


Figure 5 Wiring Example for Rising Edge or High-Level Active

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:

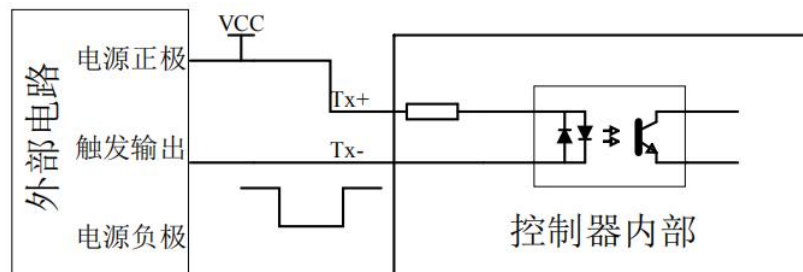


Figure 6 Wiring Example for Falling Edge or Low-Level Active

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 Diagram

Constant Off Mode: When the controller receives a valid trigger signal, the light source turns on. The timing relationship (taking high-level active as an example) is shown in Figure 7:

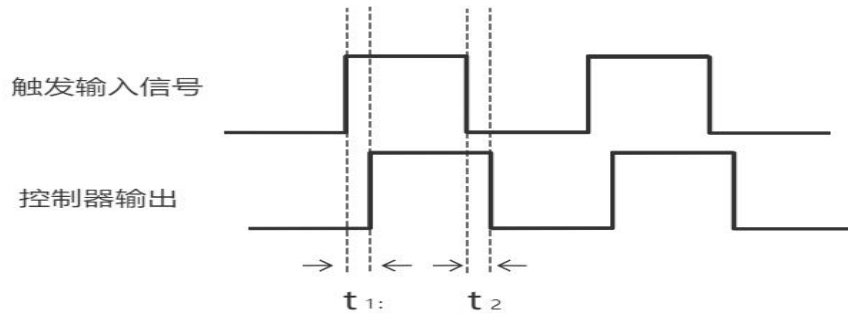


Figure 7 Timing Diagram for Constant Off Mode

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

Constant On Mode: When the controller receives a valid trigger signal, the light source turns off. The timing relationship (taking high-level active as an example) is shown in Figure 8:

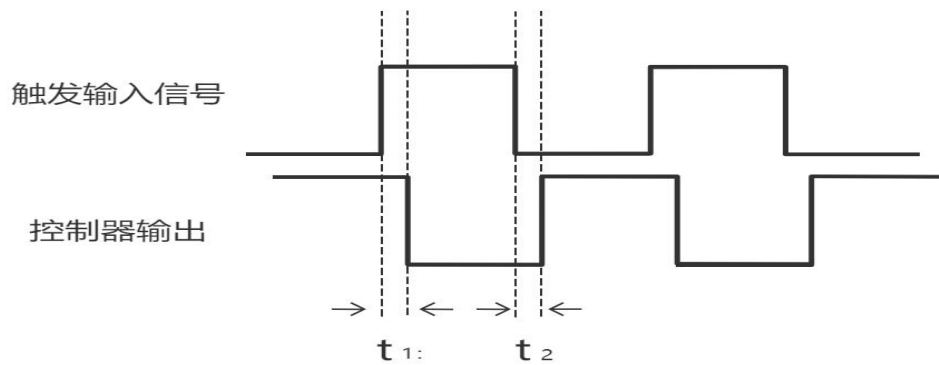


Figure 8 Timing Diagram for Constant On Mode

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, the light source turns on when a valid trigger signal is received. The timing relationship (taking high-level active as an example) is shown in Figure 9:

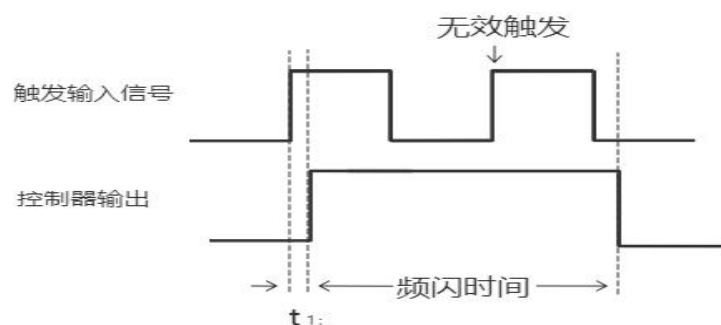


Figure 9 Timing Diagram for Strobe Mode

Parameter	Time
t_1	$\leq 25\mu s$

2.5 Manual Settings

2.5.1 Brightness Setting

When the controller is powered on, the 4-digit nixie tube displays "Channel Number + Brightness Value". Initially, it shows Channel 1 and its brightness value. For example, if the last set brightness of Channel 1 was 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 flow chart):

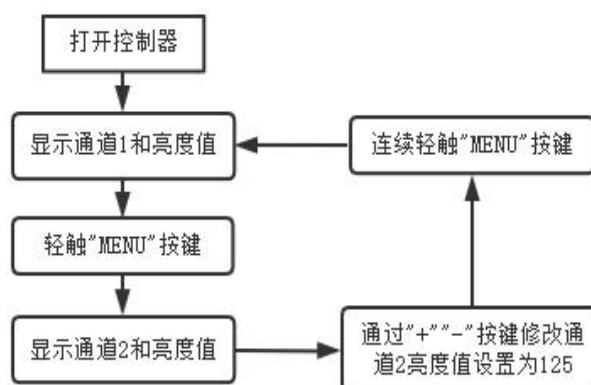


Figure 10 Brightness Setting Flow Chart

2.5.2 Operating Mode Setting

This controller model has five operating modes, which can be set via manual buttons or communication (see Table 2 for mode details).

Each channel's mode can be set independently. The following example describes how to set the mode for Channel 2; the 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:

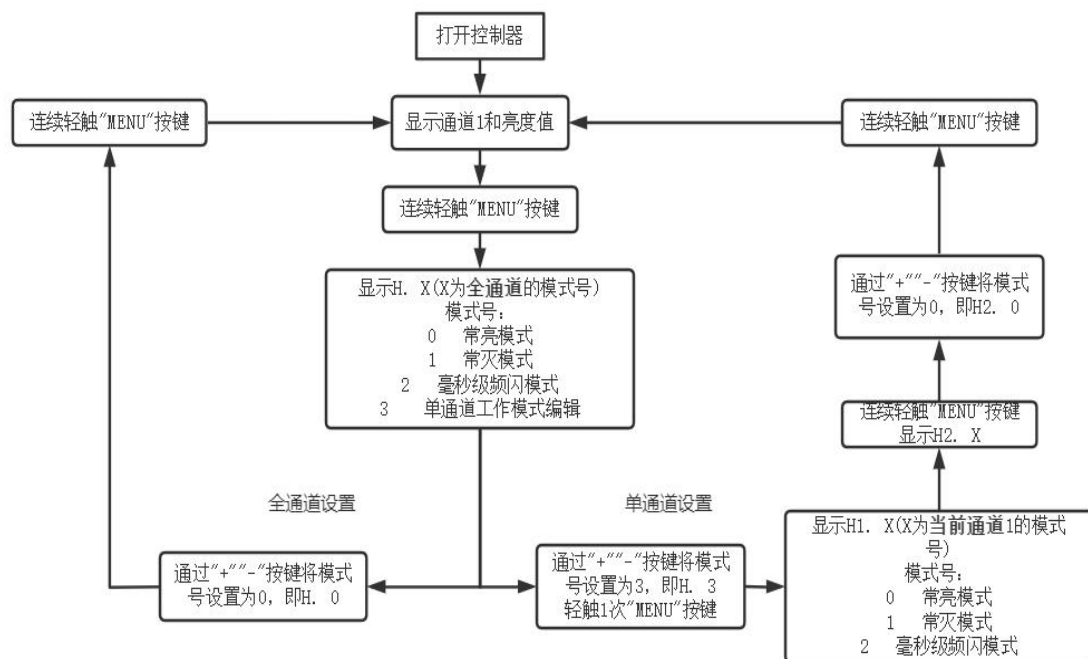


Figure 11 Flow Chart for Setting Constant Off Mode (Channel 2)

2.5.4 Constant On Mode Setting

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

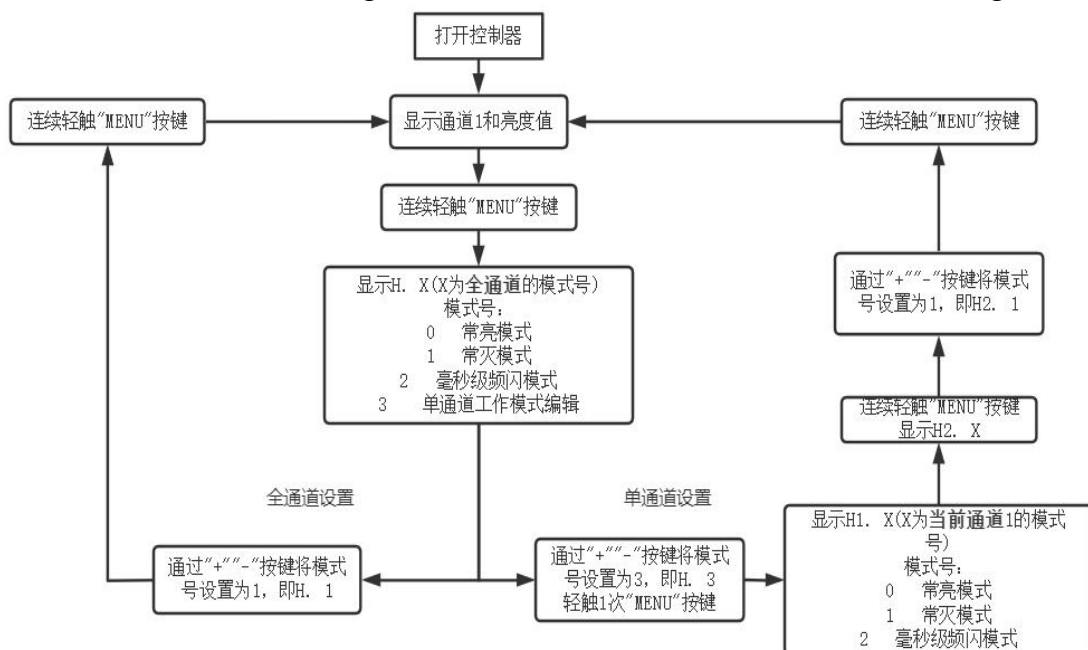


Figure 12 Flow Chart for Setting Constant On Mode (Channel 2)

2.5.5 Millisecond-Level 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:

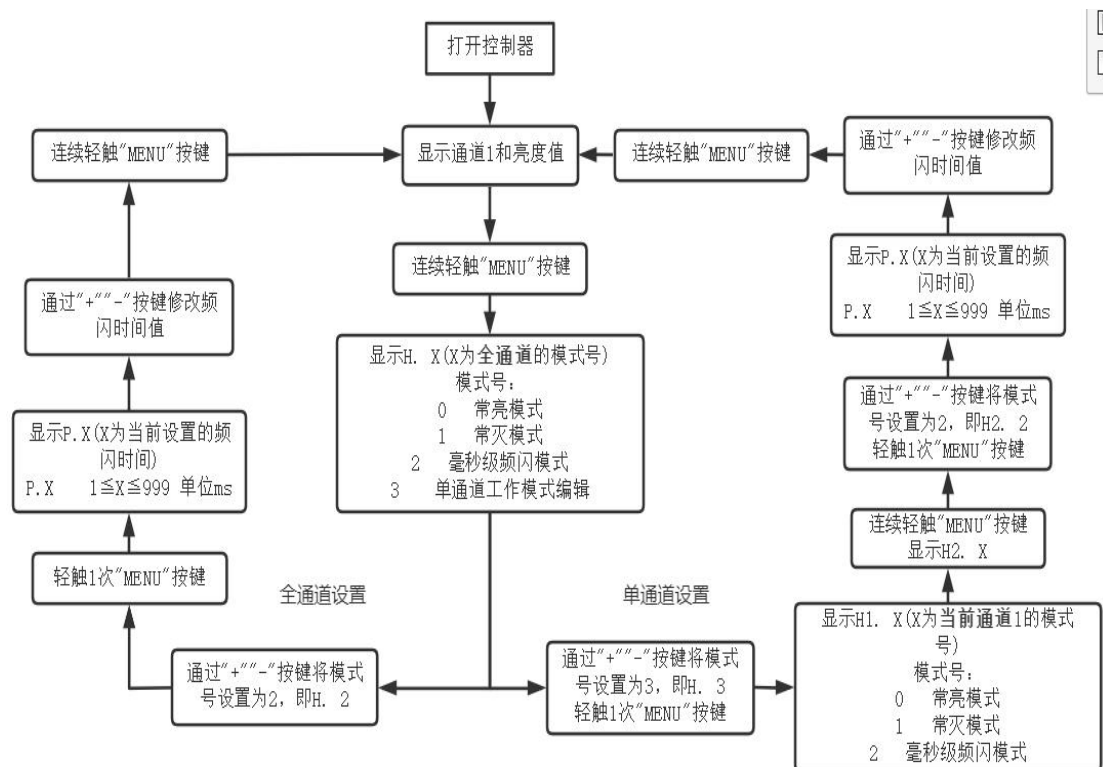


Figure 13 Flow Chart for Setting Millisecond-Level Strobe Mode and Strobe Time (Channel 2)

2.5.6 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 14:

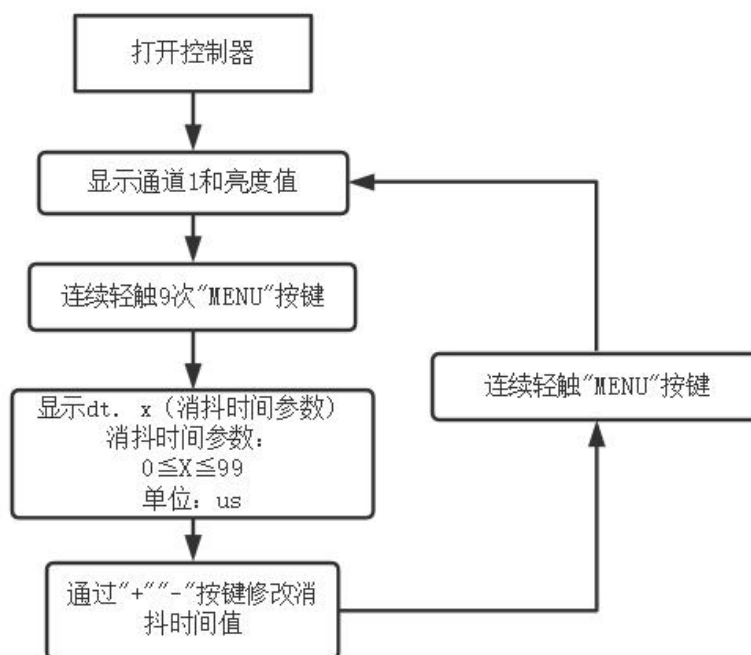


Figure 14 Flow Chart for Setting Debounce Time (All Channels)

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:

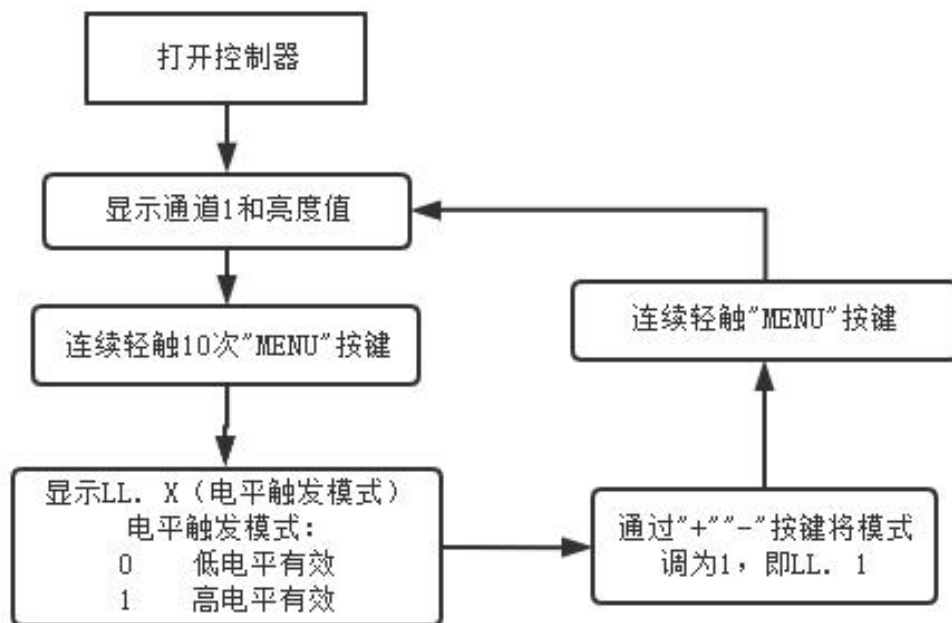


Figure 15 Flow Chart for Setting High-Level Trigger Mode (All Channels)

2.5.8 Edge Trigger Mode Setting

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

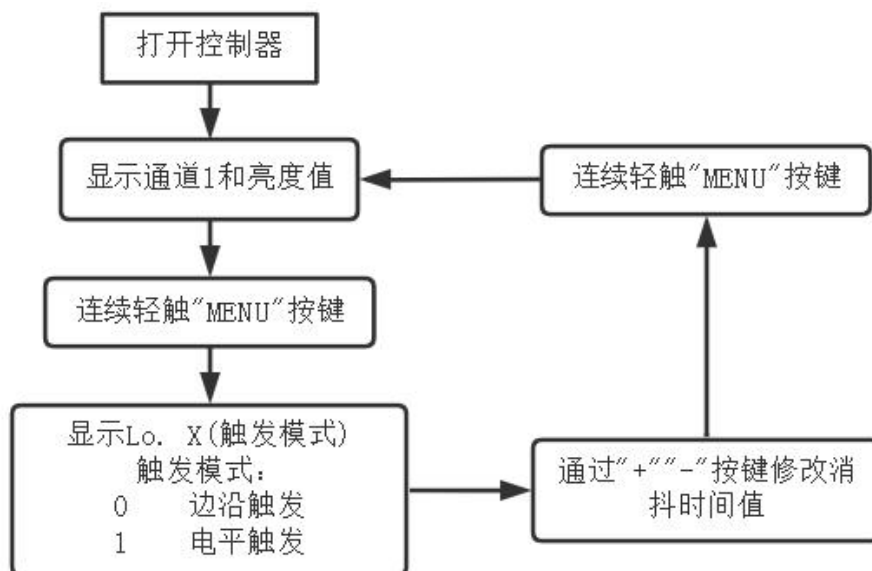


Figure 16 Flow Chart for Setting Edge Trigger Mode (All Channels)

2.5.9 Initial Brightness Editing Mode Setting

The flow chart for setting the initial brightness of Channel 1 is shown in Figure 17:

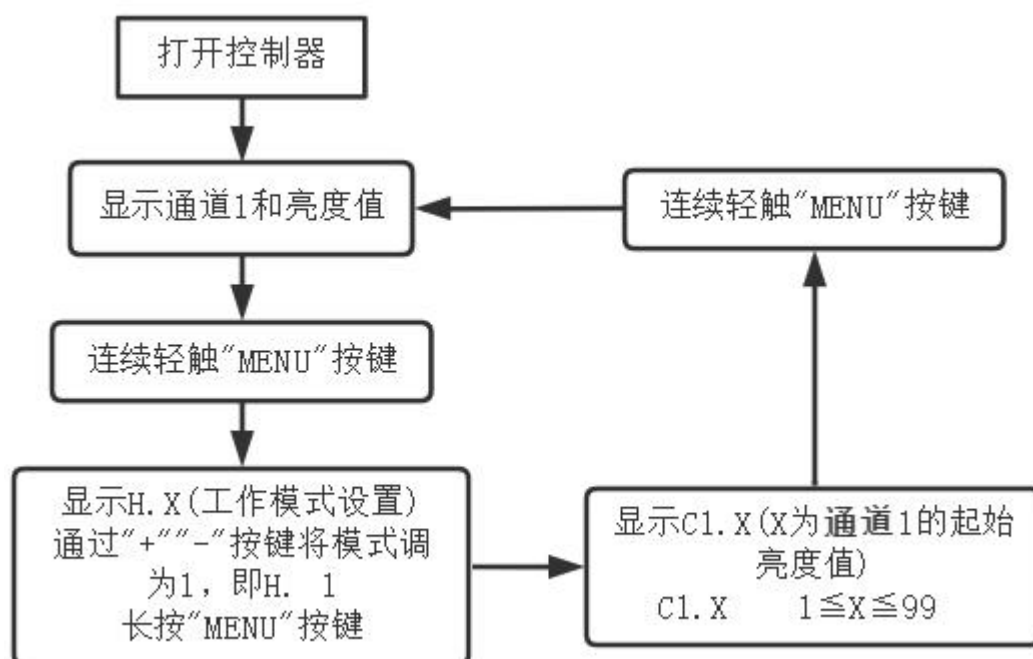


Figure 17 Flow Chart for Setting Initial Brightness (Channel 1)

3. Communication Protocol

3.1 Programming Flow

When controlling the light source controller via the serial port, follow the communication programming flow shown in Figure 17:

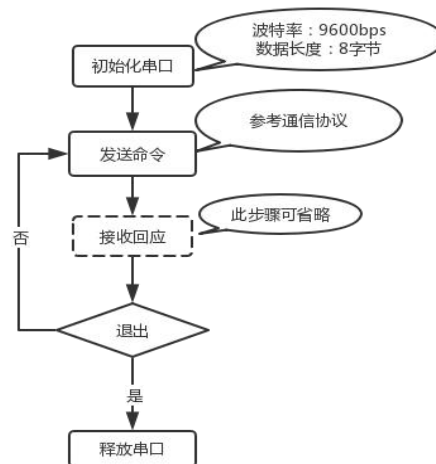


Figure 17 Communication Programming Flow Chart

3.2 Communication Settings

The serial port communication format is set as shown in 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 Frame Format:

Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
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 &.

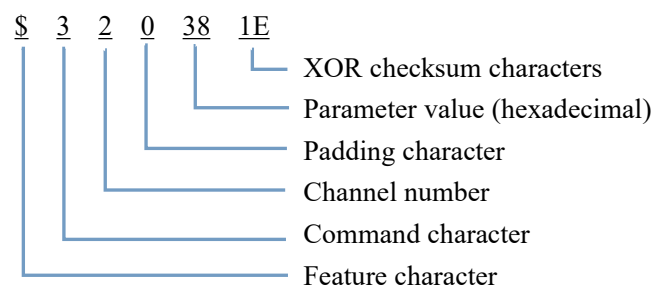
- 5、When the command character is "4": if the controller receives the command successfully, it returns the brightness setting parameters of the corresponding channel (the return format is the same as the sending format); if the controller fails to receive the command, it returns &.
- 6、The channel characters are "1", "2", "3", "4", "5", "6", "7", "8", representing 8 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 checksum characters = XOR checksum of bytes except checksum 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; 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; the return format is the same as the sending format
"7"	Trigger strobe of the corresponding channel	The corresponding channel is determined by the channel character; 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; 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 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/off the corresponding channel and reading 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 (XX = any value from 00 to FF).

The following are several sets 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 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 checksum character				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 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 checksum character				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 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 checksum 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:

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

