External Power Controller
DBS-DV-N04C-24040-4
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	DBS-DV-N04C-2404 0-4		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.

Contents

1. Product Introduction

1.1 Product Features

- Supports RS232/485 communication
- External 24V power supply
- Low trigger response time
- Supports external trigger mode
- Supports millisecond-level stroboscope and microsecond-level stroboscope
- Manual adjustment of brightness and mode
- 5~24V bidirectional trigger, adaptable to high and low-level trigger modes
- Small size, easy installation, screw installation or C45 DIN rail installation

1.2 Product Selection

Model	Built-in Power Capacity	Maximum Current per Channel
DBS-DV-N04C-24040-4	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
Operating Mode	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	0~99	Unit: ms (millisecond)
Microsecond-level Stroboscope Time	0~99	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≦X≦255	Adjust brightness
Operating Mode	H. X	X=0 Constant OFF Mode	The light source turns on when the trigger signal is valid
		X=1 Constant ON Mode	The light source turns off when the trigger signal is valid
		X=2 Millisecond-level Stroboscope Mode (E1. X, 0≦X≦99, Unit: ms)	The light source flashes once for a millisecond when the trigger signal is valid
		X=3 Microsecond-level Stroboscope Mode (E1. X, 0≦X≦99, Unit: us)	The light source flashes once for a microsecond when the trigger signal is valid
Station Num	A. X	1≦X≦255	X is the address value

2. User Instructions

2.1 Panel Description

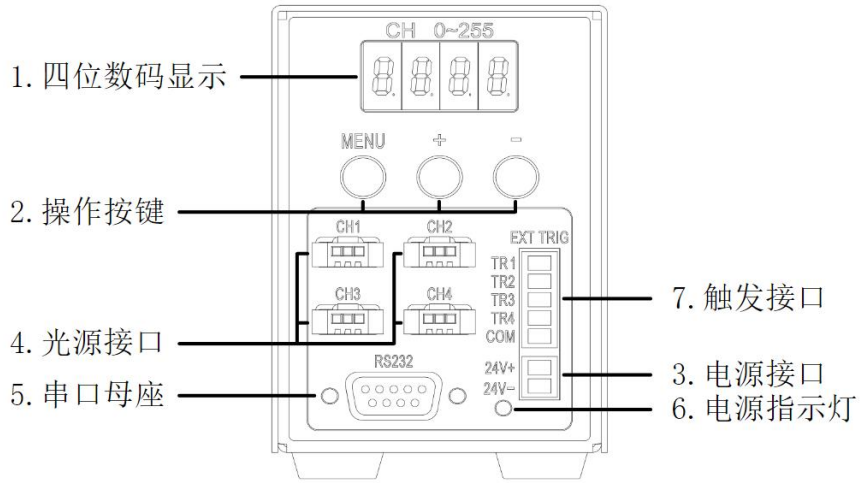


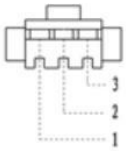
Figure 1 Front Panel

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 interface definition of the serial female connector is shown in Figure 2.

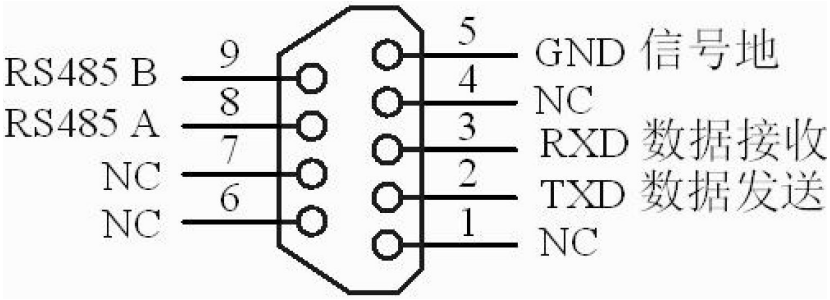


Figure 2 Serial Female Connector Interface Definition

Table 5 Light Source Interface Definition Table

Pin No.	Name	Description
1	NC	Not connected
2	TXD	Controller RS232 data transmission
3	RXD	Controller RS232 data reception
4	NC	Not connected
5	GND	RS232 signal ground
6	NC	Not connected
7	NC	Not connected
8	RS485 A	RS485 A terminal
9	RS485 B	RS485 B terminal

2.4 Trigger Description

2.4.1 Trigger Interface

The external trigger input interface is shown in Figure 3:

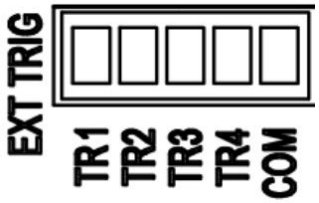


Figure 3 External Trigger Input Interface

There are 2 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 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:

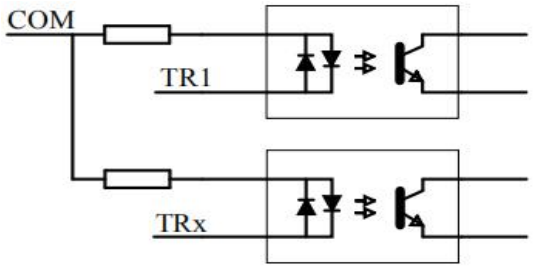


Figure 4 Internal Electrical Diagram of External Trigger

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:

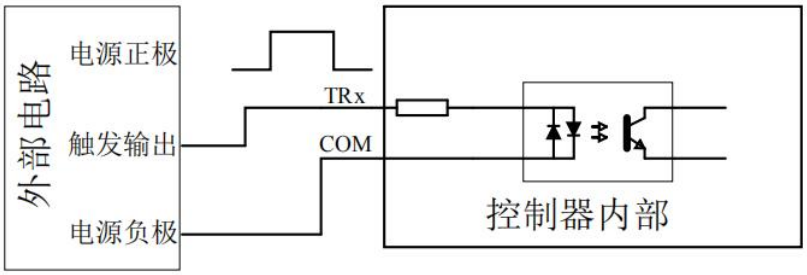


Figure 5 Wiring Example for Rising Edge or High-Level Active

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:

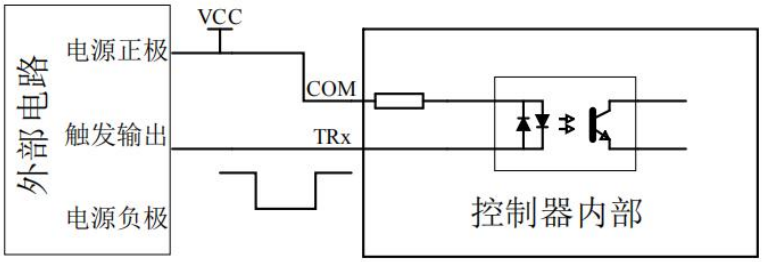


Figure 6 Wiring Example for Falling Edge or Low-Level Active

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 Diagram

Constant OFF Mode: When the controller's trigger input signal is a valid signal, the light source turns on. Taking high-level active as an example, the timing relationship is shown in Figure 7:

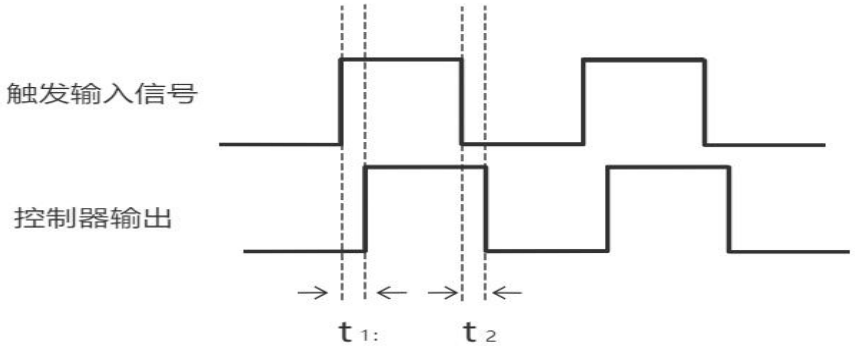


Figure 7　Constant OFF Mode Timing Diagram

Parameter	Time
t_1	≦25us
t_2	≦150us

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

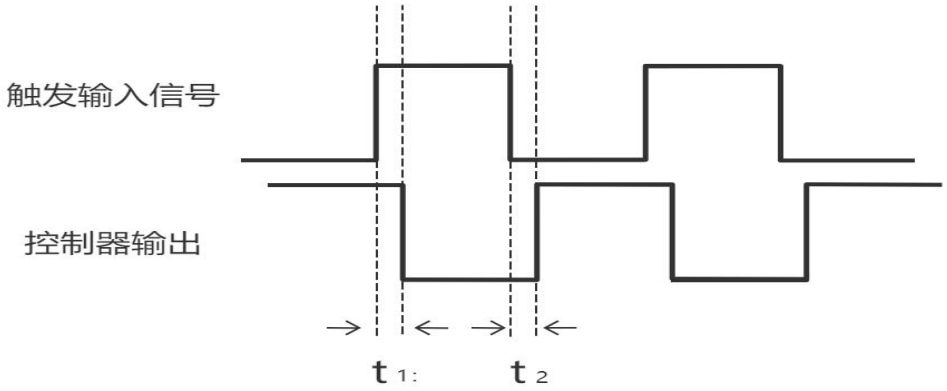


Figure 8 Constant ON Mode Timing Diagram

Parameter	Time
t_1	≦25us
t_2	≦150us

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

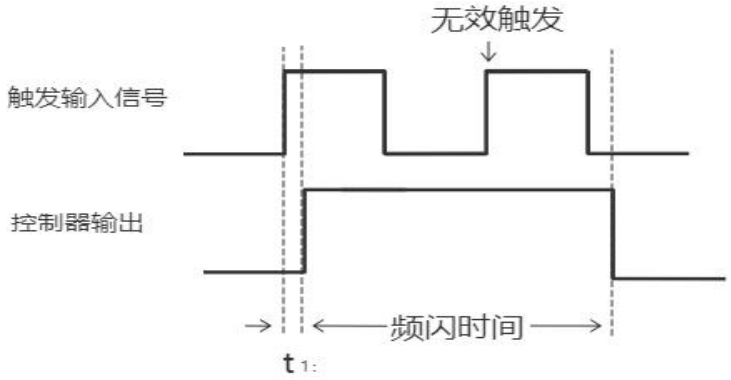


Figure 9 Stroboscope Mode Timing Diagram

Parameter	Time
t_1	≦25us

2.5 Manual Settings

2.5.1 Brightness Setting

After turning on the controller, the 4-digit nixie tube displays 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, it will display 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.

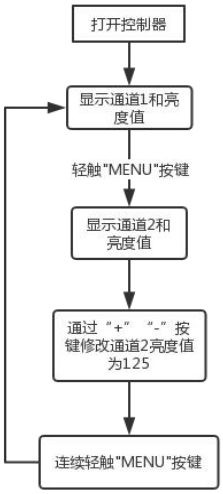


Figure 10 Brightness Setting Flow Chart

2.5.2 RS485 Interface Protocol Address Setting

When multiple controllers are connected to the RS485 bus, each controller's address needs to be set separately to distinguish them. The address can be set manually (as shown in Figure 11) or through communication (refer to the Communication Protocol chapter).

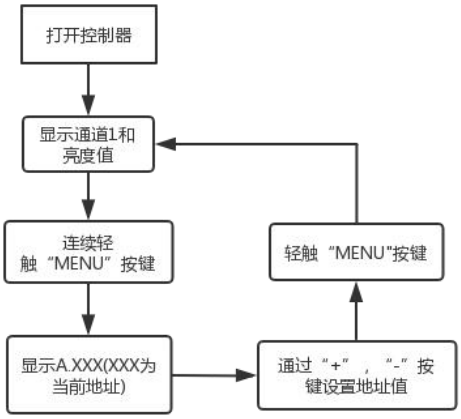


Figure 11 Address Setting Flow Chart

2.5.3 Operating Mode Setting

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

The mode of each channel can be set separately. The following takes setting the mode of Channel 2 as an example; the setting methods for other channels are similar.

2.5.4 Constant OFF Mode Setting

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

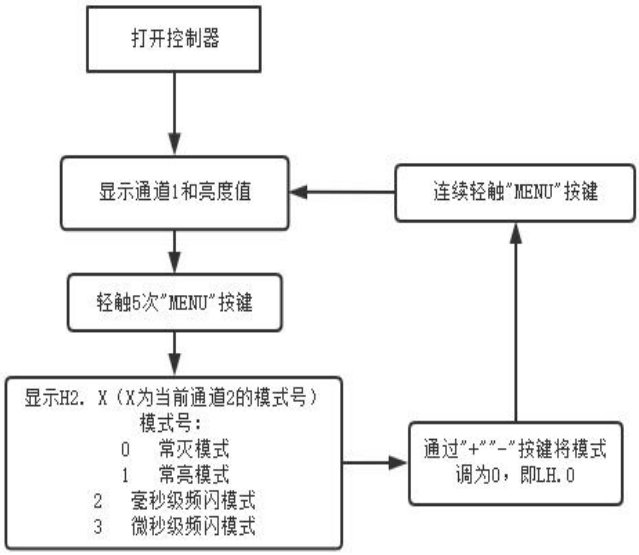


Figure 12 Constant OFF Mode Setting Flow Chart

2.5.5 Constant ON Mode Setting

The flow chart for setting Channel 2 to Constant ON Mode is shown in Figure 13.

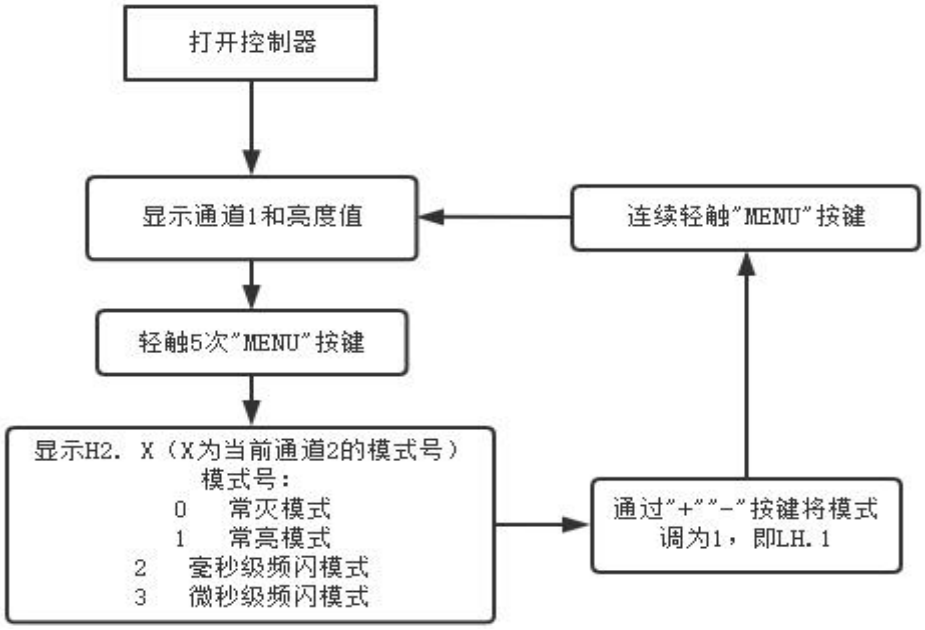


Figure 13 Constant ON Mode Setting Flow Chart

2.5.6 Millisecond-level Stroboscope Mode Setting

The flow chart for setting Channel 2 to Millisecond-level Stroboscope Mode and its stroboscope time is shown in Figure 14.

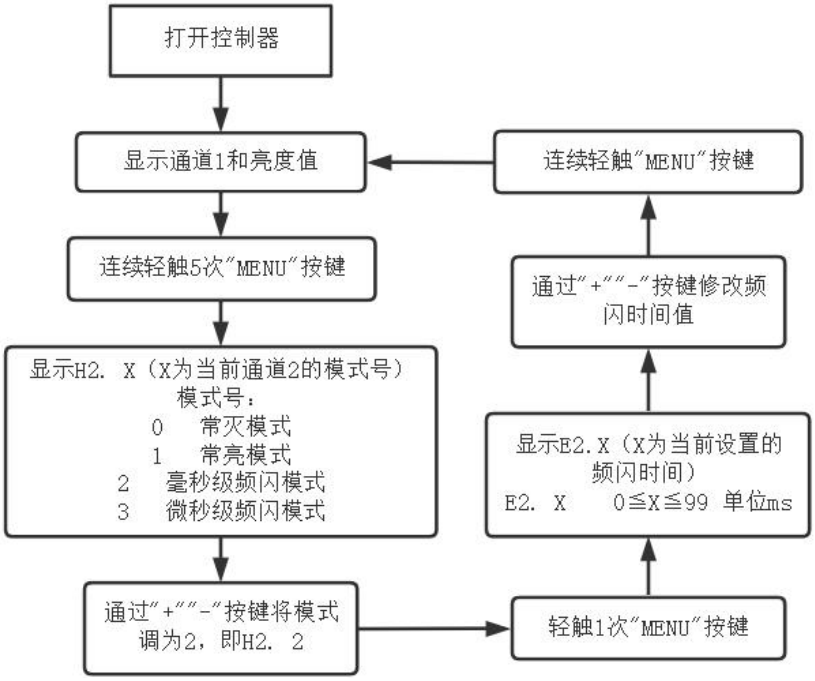


Figure 14 Millisecond-level Stroboscope Mode and Time Setting Flow Chart

2.5.7 Microsecond-level Stroboscope Mode Setting

The flow chart for setting Channel 2 to Microsecond-level Stroboscope Mode and its stroboscope time is shown in Figure 15.

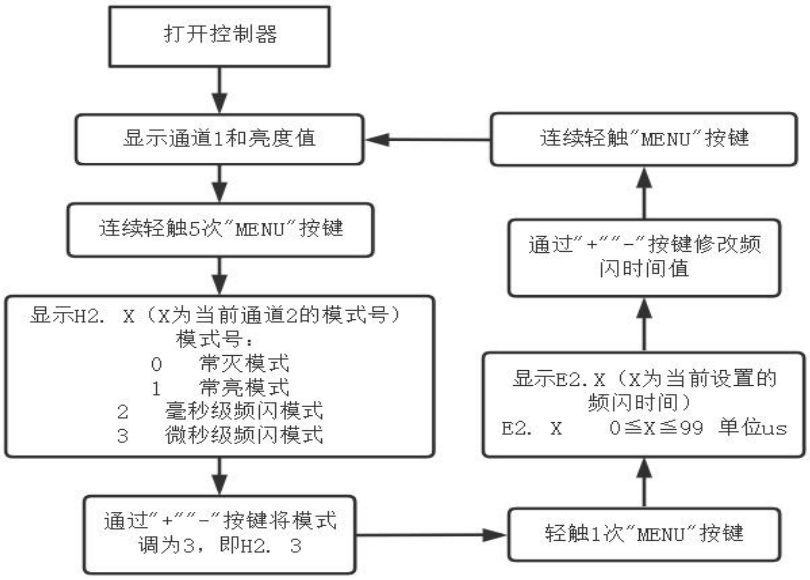


Figure 15 Microsecond-Level Strobe Mode and Its Time Setting Flowchart

3. RS232 Communication Protocol

3.1 Programming Flow

The communication programming flow when controlling the light source controller via serial port is shown in Figure 16:

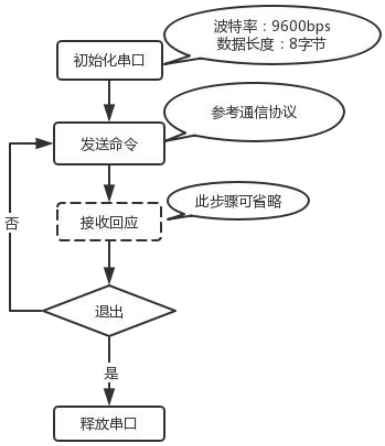


Figure 16 Communication Programming Flow Chart

3.2 Communication Settings

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

Table 6 Serial Port Setting 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 adopt ASCII code.

2.Feature character: $.

3.Command characters are as shown in Table 7.

4.When the command character is "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 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.Channel characters: "1", "2", "3", "4", representing 4 channels respectively.

7.Data = 0XX (XX is any value between 00 and FF), which is the setting parameter of the corresponding channel, with the high byte first and the low byte last.

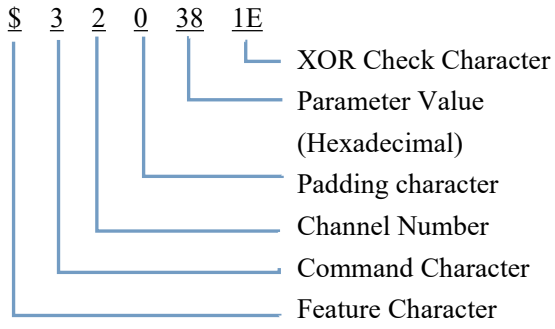
8.XOR check character = XOR check sum of bytes except the check characters (including: feature character, command character, channel character and data). The high 4-bit ASCII code of the check sum comes first, and the low 4-bit ASCII code comes last.

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.RS485 Interface Communication Protocol

This controller supports two types of RS485 interface communication protocols: custom communication protocol and Modbus RTU communication protocol. The protocol can be set according to requirements before delivery.

4.1 Custom Communication Protocol

4.1.1 Communication Settings

The RS485 communication format settings are shown in the following table:：

Baud Rate	Parity Bit	Data Bit	Stop Bit
9600	None	8bits	1bit

4.1.2 Communication Protocol

The frame format for address setting is as follows:

Frame Header	Function Code	Address Code	Reserved	Frame Trailer	Response
S	WD	00-99	AAAA	C#	RS485 OK

The following is an example of setting the address to 02. After successful reception, it will return the character "RS485 OK".

	String	ASCII Code	ASCII Code (Hexadecimal)	Represent the High Nibble and Low Nibble with 8421 Code Respectively
Feature Character	S	83	53	0101 0011
Function Code	W	87	57	0101 0111
	D	68	44	0100 0100
Data	0	48	30	0011 0000
	2	50	32	0011 0010
Reserved	A	65	41	0100 0001
	A	65	41	0100 0001
	A	65	41	0100 0001
	A	65	41	0100 0001
Frame Trailer	C	67	43	0100 0011
	#	35	23	0010 0011

The frame format for light source control is as follows:

Frame Header	Address Code	Channel 1 Brightness	Channel 1 Status	Channel 2 Brightness	Channel 2 Status
S	00-99	000-255	T/F	000-255	T/F
Channel 3 Brightness	Channel 3 Status	Channel 4 Brightness	Channel 4 Status	Frame Trailer	Response
000-255	T/F	000-255	T/F	C#	OK/ON

Note: In channel status, T = On, F = Off.

The following is an example of light source control. Set the brightness of each channel to 56. It will return "OK" if successful, and "NO" if failed.

	String	ASCII Code	ASCII Code (Hexadecimal)	Represent High 4 Bits and Low 4 Bits with 8421 Code Respectively
Feature Character	S	83	53	0101 0011
Address Code	0	32	20	0010 0000
	2	34	22	0010 0010
Channel 1 Brightness	5	37	25	0010 0101
	6	38	26	0010 0110
Channel 1 Status	T	84	54	0101 0100
Channel 2 Brightness	5	37	25	0010 0101
	6	38	26	0010 0110
Channel 2 Status	F	70	46	0100 0110
Channel 3 Brightness	5	37	25	0010 0101
	6	38	26	0010 0110
Channel 3 Status	T	84	54	0101 0100
Channel 4 Brightness	5	37	25	0010 0101
	6	38	26	0010 0110
Channel 4 Status	F	70	46	0100 0110
Frame Trailer	C	67	43	0100 0011
	#	35	23	0010 0011

4.2 Modbus Communication Protocol

Modbus is a serial communication protocol developed by Modicon (now Schneider Electric) in 1979 for communication with Programmable Logic Controllers (PLCs). Modbus has become a de facto industry standard for communication protocols in the industrial field and is now a commonly used connection method between industrial electronic devices.

This product supports the Modbus RTU format. For detailed instruction generation and parsing methods, please refer to the register table in this document and the Chinese Version of MODBUS Protocol.

Coil Register Address Table:

Register Name	Register Address		Description
Channel 1 Control			
Channel Brightness	Holding Register 0x03, 0x06, 0x10	0x0000	Brightness data of Channel 1
Channel Trigger Mode		0x0001	Trigger mode data of Channel 1
Stroboscope Time		0x0002	Millisecond-level/microsecond-level stroboscope data of Channel 1
Channel 2 Control			
Channel Brightness	Holding Register (Function Codes: 0x03, 0x06, 0x10)	0x000A	Brightness data of Channel 2
Channel Trigger Mode		0x000B	Trigger mode data of Channel 2
Stroboscope Time		0x000C	Millisecond-level/microsecond-level stroboscope data of Channel 2
Channel 3 Control			
Channel Brightness	Holding Register (Function Codes: 0x03, 0x06, 0x10)	0x0014	Brightness data of Channel 3
Channel Trigger Mode		0x0015	Trigger mode data of Channel 3
Stroboscope Time		0x0016	Millisecond-level/microsecond-level stroboscope data of Channel 3
Channel 4 Control			
Channel Brightness	Holding Register (Function Codes: 0x03, 0x06, 0x10)	0x001E	Brightness data of Channel 4
Channel Trigger Mode		0x001F	Trigger mode data of Channel 4
Stroboscope Time		0x0020	Millisecond-level/microsecond-level stroboscope data of Channel 4
User Configuration			
RS485 Communication Baud Rate	Holding Register (Function Code: 0x03, 0x06, 0x10)	0x0069	See the Baud Rate Value Correspondence Table below. The default value is 0, supporting 0-3. This register determines the RS485 communication baud rate
Station Number		0x006D	Range:1-255

Baud Rate Value Correspondence Table:

Value	Baud Rate
0	9600bps
1	19200bps
2	57600bps
3	115200bps

5. 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

6. Accessories