USB Relay

From Diustou Wiki

Product Overview

- This is an industrial-grade isolated USB relay developed based on GD32F103C8T6.It supports TTL UART input and outputs corresponding dry contact switch signals with two contact points.It can be powered either via USB or 5V pin power supply.The design adopts optocoupler isolation and overcurrent protection.The load terminal adopts a typical triode drive circuit with a freewheeling diode, capable of controlling resistive loads within the range of 10A 250VAC and 30VDC.
- It is not specially optimized for inductive loads. Therefore, external equipment is required when necessary to suppress inrush current and surge voltage.Designed to industrial-grade standards, it is applicable to a wide range of scenarios with a customized communication protocol that is simple and easy to operate.The upgraded version is equipped with a housing, as well as higher-grade chips and relays.

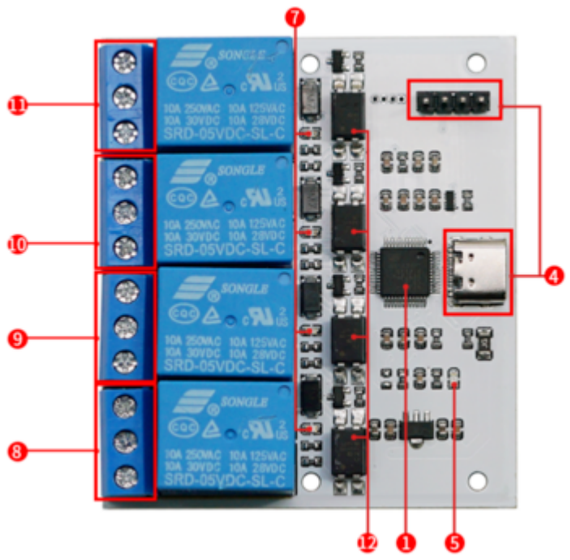
Product Specifications

Product model	DSTUR-T10 USB Relay (TC, 1, Opto)	DSTUR-T20 USB Relay (TC, 2, Opto)	DSTUR-T30 USB Relay (TC, 3, Opto)	DSTUR-T40 USB Relay (TC, 4, Opto)	DSTUR-T80 USB Relay (TC, 8, Opto)
Product appearance					
Relay channel	1	2	3	4	8
Power supply voltage	5V				
Power supply method	Type-C interface/pin header				
Control interface	Type-C interface/pin header				
USB chip	GD32F103C8T6				
Serial port baud rate	115200bps				
LED indicators	Power indicator and relay status indicator				
Circuit design	With overcurrent protection and optocoupler protection functions				
Output type	Relay common terminal, normally open terminal, normally closed terminal				
Load type	Power supply capable of handling loads up to 10A/30VDC, 10A/250VAC				
Product dimensions	63mm*19mm	58mm*32mm	58mm*48mm	58mm*63mm	101mm*73mm

Product Description

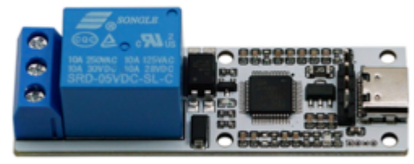
- Taking the 4-channel and 8-channel USB relays as examples:
- There is only a channel quantity difference between the 1-channel to 4-channel USB relays. The 8-channel model is newly added with a DC power port, supporting 5-32V power input.

USB Relay (TC, 4, Opto)

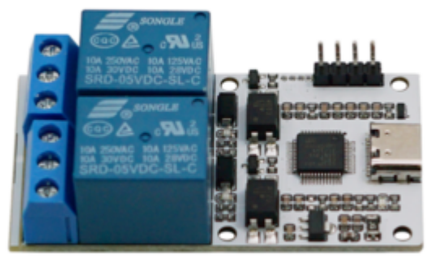


- 1.Microcontroller chip
- 2.Power supply mode selection terminal
- 3.Power Supply Options:
  - When using USB power supply, switch the toggle to the USB_P position.
  - When using external power supply (via DC jack), switch the toggle to the Ext_P position.
- 4.Control interface: used for 5V power supply and command control of relays
- 5.Power indicator light
- 6.DC power jack: used for external power supply
- 7.Relay switch indicator light
- 8-11.Relay one output terminal (NC1/COM1/NO1):
  - COM1: Common terminal;
  - NC1: Normally closed terminal, short-circuited to COM1 before the relay is energized and open after energization;
  - NO1: Normally open terminal, open before the relay is energized and short-circuited to COM1 after energization.

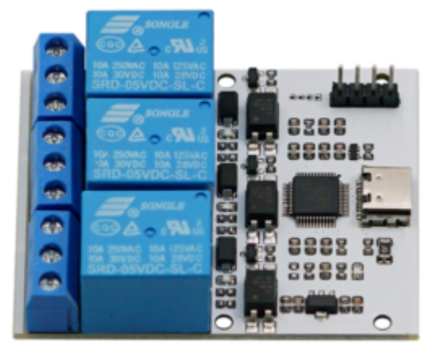
USB Relay



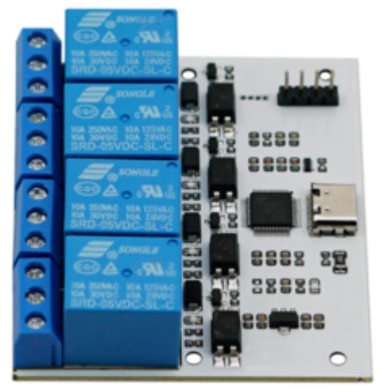
USB Relay (TC, 1, Opto)



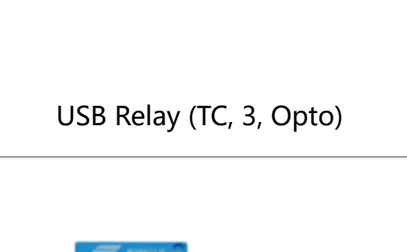
USB Relay (TC, 2, Opto)



USB Relay (TC, 3, Opto)



USB Relay (TC, 4, Opto)



USB Relay (TC, 8, Opto)

Information

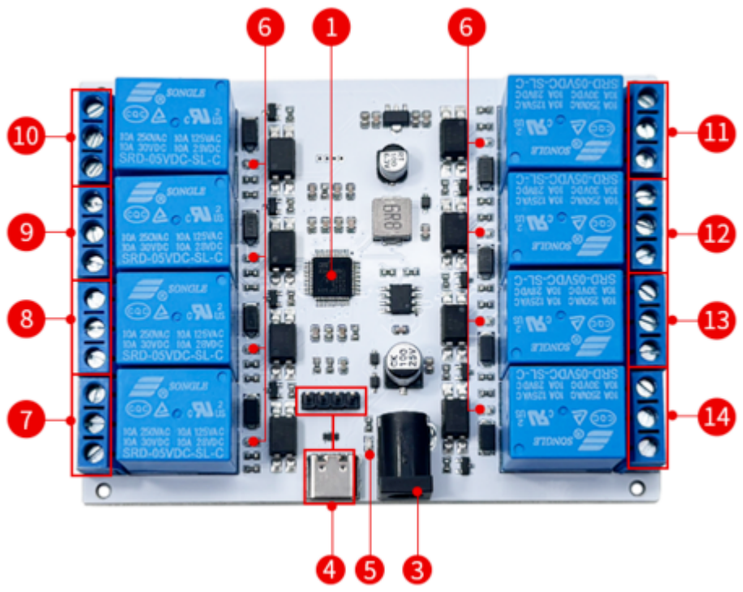
Categories: USB

Brand: Diustou

Description

- 12.Optocoupler protection circuit

USB Relay (TC, 8, Opto)

- 

- 1.Microcontroller chip
- 3.DC power jack: used for external power supply.
  - The output current of the USB interface is limited, so it is recommended to use external power supply when using multiple relays to ensure stable operation of the circuit.
- 4.Control interface: used for 5V power supply and command control of relays
- 5.Power indicator light
- 6.Relay switch indicator light
- 7-14.Relay one output terminal (NC1/COM1/NO1):
  - COM1: Common terminal;
  - NC1: Normally closed terminal, short-circuited to COM1 before the relay is energized and open after energization;
  - NO1: Normally open terminal, open before the relay is energized and short-circuited to COM1 after energization.
- Each channel is equipped with an independent optocoupler isolation protection circuit.

User Manual

Communication Protocol for Switch Control

- Data 1 — Start Flag (Default: 0xA0)
- Data 2 — Switch Address Code (0x01 represents the first switch channel)
- Data 3 — Operation Data (0x00 indicates OFF, 0x01 indicates ON)
- Data 4 — Checksum (Calculated as Data1 + Data2 + Data3)
- Note: For USB Relay modules labeled from "USB Relay (TC, 1, Opto)" to "USB Relay (TC, 8, Opto)", the default serial communication baud rate is set to 115200 bps.

Command Instructions

USB Relay (TC, 4, Opto)

- **Switch Control Command Instructions** (sent in HEX format):
  - Open the first USB switch: A0 01 01 A2;
  - Close the first USB switch: A0 01 00 A1;
  - Open the second USB switch: A0 02 01 A3;
  - Close the second USB switch: A0 02 00 A2;
  - Open the third USB switch: A0 03 01 A4;
  - Close the third USB switch: A0 03 00 A3;
  - Open the fourth USB switch: A0 04 01 A5;
  - Close the fourth USB switch: A0 04 00 A4;
  - Open all USB switches: A0 0F 01 B0;
  - Close all USB switches: A0 0F 00 AF;
- **Query Switch Status** (sent in HEX format):
  - Status of the first channel: A0 01 02 A3;
  - Status of the second channel: A0 02 02 A4;
  - Status of the third channel: A0 03 02 A5;
  - Status of the fourth channel: A0 04 02 A6;
  - Query all relay statuses: A0 0F 02 B1;

USB Relay (TC, 8, Opto)

- **Switch Control Command Instructions** (sent in HEX format):
  - Open the first USB switch: A0 01 01 A2;
  - Close the first USB switch: A0 01 00 A1;
  - Open the second USB switch: A0 02 01 A3;
  - Close the second USB switch: A0 02 00 A2;
  - Open the third USB switch: A0 03 01 A4;
  - Close the third USB switch: A0 03 00 A3;
  - Open the fourth USB switch: A0 04 01 A5;
  - Close the fourth USB switch: A0 04 00 A4;
  - Open the fifth USB switch: A0 05 01 A6;
  - Close the fifth USB switch: A0 05 00 A5;
  - Open the sixth USB switch: A0 06 01 A7;
  - Close the sixth USB switch: A0 06 00 A6;
  - Open the seventh USB switch: A0 07 01 A8;
  - Close the seventh USB switch: A0 07 00 A7;
  - Open the eighth USB switch: A0 08 01 A9;

Features	▪ USB Relay
Interfaces	USB

Related products

- RS232 Modbus Relay
- RS232 Modbus Relay PRO
- RS485 Modbus Relay
- RS485 Modbus Relay PRO
- GPIO Relay
- GPIO Relay PRO
- USB Relay
- USB Relay PRO

    - Close the eighth USB switch: A0 08 00 A8;
    - Open all USB switches: A0 0F 01 B0;
    - Close all USB switches: A0 0F 00 AF;
- **Query Switch Status** (sent in HEX format):
    - Status of the first channel: A0 01 02 A3;
    - Status of the second channel: A0 02 02 A4;
    - Status of the third channel: A0 03 02 A5;
    - Status of the fourth channel: A0 04 02 A6;
    - Query all relay statuses: A0 0F 02 B1;

Usage Instructions

- USB Relay Control Program (Python)

Relay Control

- Connect the USB relay module to your computer and install the driver for the CH340 USB-to-serial chip.
- Open serial port debugging software such as STC-ISP or SSCOM32, select a baud rate of 9600, and send commands in hexadecimal (hex) format to control the relays. For example, sending `A0 01 01 A2` will turn on the relay, while sending `A0 01 00 A1` will turn it off. You can choose between manual and automatic sending methods. The following examples are based on the SSCOM32 serial port debugging software:
- **Manual Sending**:
    - Set Parameters: Choose a baud rate of 115200 and check the "Hex Send" option.
    - Send Commands:
        - Enter the command `A0 01 01 A2` to turn on the relay.
        - Enter the command `A0 01 00 A1` to turn off the relay.
    - Execute: After entering the command, click "Send" to manually open or close the relay.

- **Automatic Sending**:
    - Set Parameters: Again, choose a baud rate of 115200, click on "Extend" in the SSCOM32 interface, input the commands `A0 01 01 A2` and `A0 01 00 A1`, and check the "Hex Send" option.
    - Configure Automatic Loop**: Input the interval time for automatic loop sending and check the "Automatic Loop Send" option to automatically cycle through opening and closing the relay.

Querying Relay Status

- For a three-channel relay module, assuming channels 1 and 2 are open while others are closed, querying the status of each channel will return the following responses:

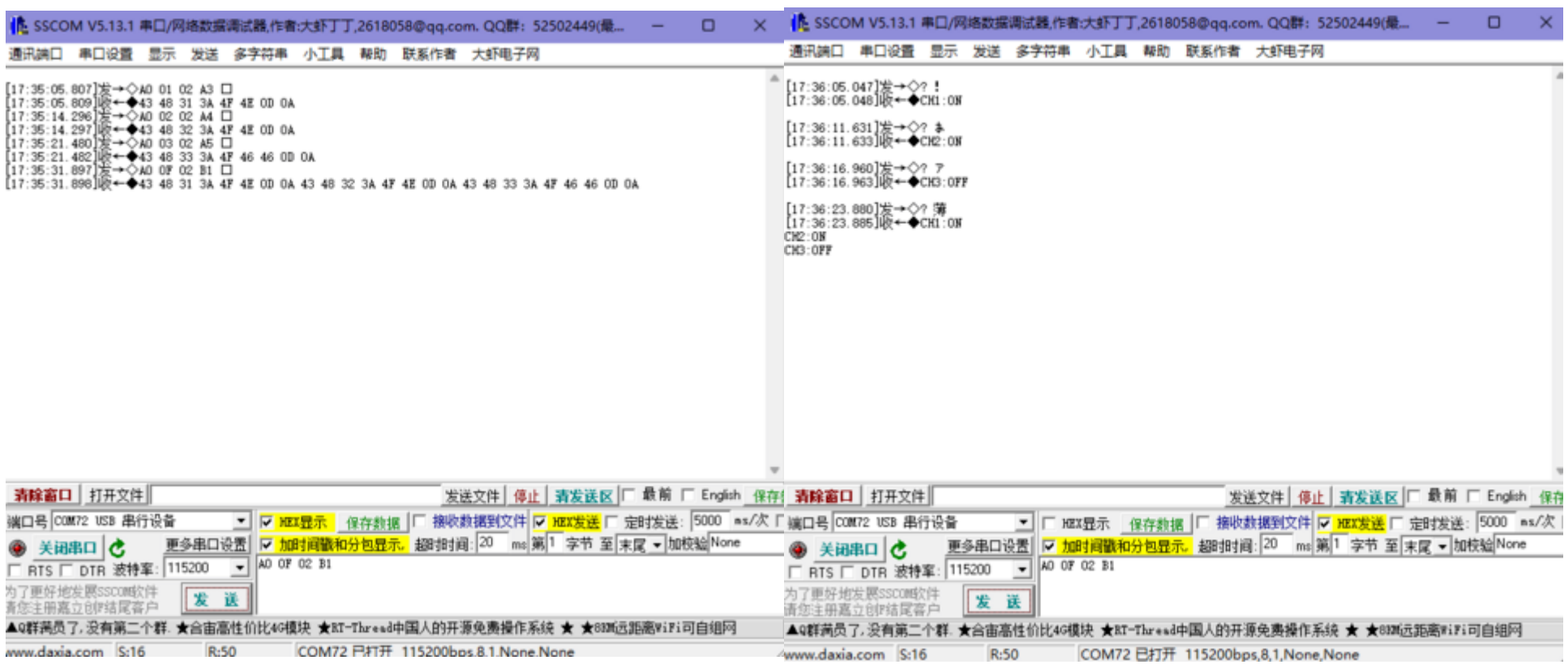
```
Query Channel 1
 Send (Hex): A0 01 02 A3
 Receive (ASCII): CH1:ON
 Receive (Hex): 43 48 31 3A 4F 4E 0D 0A
```

```
Query Channel 2
 Send (Hex): A0 02 02 A4
 Receive (ASCII): CH2:ON
 Receive (Hex): 43 48 32 3A 4F 4E 0D 0A
```

```
Query Channel 3
 Send (Hex): A0 03 02 A5
 Receive (ASCII): CH3:OFF
 Receive (Hex): 43 48 33 3A 4F 46 46 0D 0A
```

```
Query All Relays
 Send (Hex): A0 0F 02 B1
```

```
Receive (ASCII):
 CH1:ON
 CH2:ON
 CH3:OFF
Receive (Hex): 43 48 31 3A 4F 4E 0D 0A 43 48 32 3A 4F 4E 0D 0A 43 48 33 3A 4F 46 46 0D 0A
```



Software

- sscom32
- USB Relay Control Program (Python)

Appendix A: USB Relay Control Program (Python)

```python
#!/usr/bin/env python3
"""
USB Relay (TC, 8, Opto) Test Program - Based on ASCII Multi-line Response
USB 继电器（TC，8路，光耦隔离）测试程序
Command Format: A0 [Address] [Operation] [Checksum] (Binary)
命令格式: A0 [地址] [操作] [校验和] (二进制)
Response Example:
响应示例:
  Single Channel: "CH1:ON" or "CH1:OFF"
  单通道: "CH1:ON" 或 "CH1:OFF"
  All Channels: 8 lines "CHx:ON/OFF"
  全部通道: 8行 "CHx:ON/OFF"
"""

import serial
import serial.tools.list_ports
import sys
import time
import re

class USBRelay:
    def __init__(self, port=None, baudrate=115200, timeout=1):
        self.baudrate = baudrate
        self.timeout = timeout
        self.ser = None
        self._connect(port)

    def _connect(self, port):
        if port is None:
            ports = list(serial.tools.list_ports.comports())
            if not ports:
                raise RuntimeError("No serial ports detected / 未检测到任何串口设备")
            for p in ports:
                desc = p.description.lower()
                if any(k in desc for k in ["usb", "ch340", "cp210", "ftdi", "serial"]):
                    port = p.device
                    break
            if port is None:
                port = ports[0].device
            print(f"Auto Selected Port: {port} / 自动选择串口: {port}")
        try:
            self.ser = serial.Serial(port, self.baudrate, timeout=self.timeout)
            print(f"Connected to {port} @ {self.baudrate} bps / 已连接 {port} @ {self.baudrate} bps")
        except Exception as e:
            raise RuntimeError(f"Failed to open port {port}: {e} / 无法打开串口 {port}: {e}")

    def _calc_checksum(self, d1, d2, d3):
        return (d1 + d2 + d3) & 0xFF

    def _send_command(self, addr, op):
        """Send command, return ASCII string for query, None for switch command
        发送命令，查询命令返回 ASCII 字符串，开关命令返回 None"""
        data1, data2, data3 = 0xA0, addr, op
        checksum = self._calc_checksum(data1, data2, data3)
        cmd = bytes([data1, data2, data3, checksum])
        print(f"Command Sent: {' '.join(f'{b:02X}' for b in cmd)} / 发送命令: {' '.join(f'{b:02X}' for b in cmd)}")
        self.ser.write(cmd)

        if op == 0x02:      # Query Command / 查询命令
            # Wait for response (max 200ms)
            # 等待设备响应（最多200ms）
            time.sleep(0.2)
            # Read all available data until timeout
            # 读取所有可用数据，直到超时
            raw_data = b''
            while True:
                chunk = self.ser.read(64)
                if not chunk:
                    break
                raw_data += chunk
                time.sleep(0.05)
                if self.ser.in_waiting == 0:
                    break

            if raw_data:
                ascii_str = raw_data.decode('ascii', errors='replace').strip()
                print(f"ASCII Response Received:\n{ascii_str} / 收到 ASCII 响应:\n{ascii_str}")
                return ascii_str
            else:
                print("Warning: No response received / 警告: 未收到任何响应数据")
                return None
        else:
            time.sleep(0.05)
            return None

    def _parse_single_line(self, line):
        """Parse single line e.g. 'CH1:ON' → (channel, state)
        解析单行字符串，如 'CH1:ON' → (通道号, 状态)"""
        match = re.match(r'CH(\d+):(ON|OFF)', line.strip(), re.IGNORECASE)
        if match:
            ch = int(match.group(1))
            state = (match.group(2).upper() == 'ON')
            return ch, state
        return None, None

    def _parse_response(self, ascii_str, expected_channel=None):
        """Parse multi-line response, return dict or single state
        解析多行响应，返回字典或单个状态"""
        if ascii_str is None:
            return None

        lines = ascii_str.splitlines()
        if not lines:
            return None

        status_dict = {}
        for line in lines:
            ch, state = self._parse_single_line(line)
            if ch is not None:
```

```
            status_dict[ch] = state

    if expected_channel is not None:
        return status_dict.get(expected_channel, None)
    else:
        if len(status_dict) == 8:
            return status_dict
        else:
            print(f"Warning: Parsed channels {len(status_dict)} ≠ 8, Data: {status_dict} / 警告: 解析通道数 {len(status_dict)} ≠ 8，实际数据: {status_dict}")
            return status_dict

def open(self, channel):
    if not 1 <= channel <= 8:
        raise ValueError("Channel must be 1~8 / 通道号必须在1~8之间")
    self._send_command(channel, 0x01)

def close(self, channel):
    if not 1 <= channel <= 8:
        raise ValueError("Channel must be 1~8 / 通道号必须在1~8之间")
    self._send_command(channel, 0x00)

def open_all(self):
    self._send_command(0x0F, 0x01)

def close_all(self):
    self._send_command(0x0F, 0x00)

def query_channel(self, channel):
    """Query single channel, return True=ON False=OFF
    查询单个通道，返回 True=开 False=关"""
    if not 1 <= channel <= 8:
        raise ValueError("Channel must be 1~8 / 通道号必须在1~8之间")
    resp_str = self._send_command(channel, 0x02)
    return self._parse_response(resp_str, expected_channel=channel)

def query_all(self):
    """Query all channels, return dict {1:bool...}
    查询所有通道，返回状态字典"""
    resp_str = self._send_command(0x0F, 0x02)
    return self._parse_response(resp_str, expected_channel=None)

def disconnect(self):
    if self.ser and self.ser.is_open:
        self.ser.close()
        print("Port closed / 串口已关闭")


def print_help():
    print("""
╔═══════════════════════════════════════════════════════╗
║  USB Relay Test Program (ASCII Multi-Line)            ║
║  USB 继电器测试程序 (ASCII 多行版)                    ║
║  Response: CHx:ON / CHx:OFF                           ║
║  响应格式: CHx:ON / CHx:OFF                           ║
╚═══════════════════════════════════════════════════════╝

Commands / 命令:
  open <n>         Turn ON channel n (1-8)      打开通道 n (1-8)
  close <n>        Turn OFF channel n (1-8)     关闭通道 n (1-8)
  open_all         Turn ON all channels         打开所有通道
  close_all        Turn OFF all channels        关闭所有通道
  query <n>        Check channel n status       查询通道 n 状态
  query_all        Check all channels status    查询所有通道状态
  test             Auto test sequence           自动化测试
  help             Show this help               查看帮助
  exit             Exit program                 退出程序
""")


def auto_test(relay):
    print("\n========== Auto Test Started ==========")
    print("========== 自动化测试 开始 ==========\n")
    for ch in range(1, 9):
        print(f"--- Channel {ch} / 通道 {ch} ---")
        relay.open(ch)
        time.sleep(0.3)
        status = relay.query_channel(ch)
        print(f"  State: {'ON' if status else 'OFF'} / 状态: {'开' if status else '关'}")
        relay.close(ch)
        time.sleep(0.3)
        status = relay.query_channel(ch)
        print(f"  State: {'ON' if status else 'OFF'} / 状态: {'开' if status else '关'}\n")

    print("--- All Channels Test / 全部通道测试 ---")
    relay.open_all()
    time.sleep(0.3)
    all_st = relay.query_all()
    if all_st:
        print("All ON Status / 全部打开后状态:", ', '.join(f"CH{i}:{'ON' if v else 'OFF'}" for i, v in all_st.items()))
    relay.close_all()
    time.sleep(0.3)
    all_st = relay.query_all()
    if all_st:
        print("All OFF Status / 全部关闭后状态:", ', '.join(f"CH{i}:{'ON' if v else 'OFF'}" for i, v in all_st.items()))
    print("\n========== Auto Test Finished ==========")
    print("========== 测试完成 ==========\n")


def main():
    port = sys.argv[1] if len(sys.argv) > 1 else None
    baud = int(sys.argv[2]) if len(sys.argv) > 2 else 115200
    try:
        relay = USBRelay(port, baud)
    except Exception as e:
        print(f"Initialization failed: {e} / 初始化失败: {e}")
        sys.exit(1)

    print_help()
    while True:
        try:
            cmd_line = input("> ").strip().lower()
            if not cmd_line:
                continue
            parts = cmd_line.split()
            cmd = parts[0]

            if cmd in ("exit", "quit"):
                break
            elif cmd == "help":
                print_help()
            elif cmd == "open" and len(parts) == 2:
                relay.open(int(parts[1]))
            elif cmd == "close" and len(parts) == 2:
                relay.close(int(parts[1]))
            elif cmd == "open_all":
                relay.open_all()
            elif cmd == "close_all":
                relay.close_all()
            elif cmd == "query" and len(parts) == 2:
                ch = int(parts[1])
                st = relay.query_channel(ch)
                if st is not None:
                    print(f"Channel {ch} State: {'ON' if st else 'OFF'} / 通道 {ch} 状态: {'开' if st else '关'}")
                else:
                    print("Query Failed / 查询失败")
            elif cmd == "query_all":
                st = relay.query_all()
                if st:
                    print("All Channels Status / 所有通道状态:")
                    for i in range(1, 9):
                        state = st.get(i, None)
                        if state is None:
                            print(f"  Channel {i}: Unknown / 通道 {i}: 未知")
                        else:
                            print(f"  Channel {i}: {'ON' if state else 'OFF'} / 通道 {i}: {'开' if state else '关'}")
                else:
                    print("Query Failed / 查询失败")
            elif cmd == "test":
                auto_test(relay)
            else:
                print("Unknown command, type 'help' for usage / 未知命令，输入 help 查看帮助")
        except KeyboardInterrupt:
            print("\nExiting / 退出")
            break
        except Exception as e:
            print(f"Error: {e} / 错误: {e}")

relay.disconnect()
```

```
if __name__ == "__main__":
    main()
```

FAQ

Contact **Diustou**

Our working hours are: 09:00-18:00 (**UTC+8** Monday to Saturday)