# Remote-Controlled 4-Channel Switch

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AVT 5599


ASSEMBLY DIFFICULTY

The device allows four devices to be remotely switched on/off using typical IR remote controls from common equipment. Its undoubted advantage is that it can be used with virtually any infrared remote control, and the procedure for learning remote control codes is reduced to a few easy steps.

## Features

- ATmega8 microcontroller.
- PCB with dimensions 74 mm×145 mm fitted to Z4 enclosure.
- Supply 230 VAC.
- Independent on/off switching of 4 relays using an infrared transmitter from the RTV equipment.

## Circuit description

Schematic diagram of the switch is shown in Figure 1. The device is powered from the 230 VAC mains via the TS1 transformer. After passing through a rectifier (M1) and a filter (C1, C3, C5, C6), the voltage goes to the US4 stabiliser, which provides +5 V. The component that controls the operation of the entire device is a microcontroller (US1) ATmega8, and the software contained therein is responsible for analysing and decoding infrared broadcast signals. The microcontroller is clocked by an 8 MHz quartz resonator (Q1). The receiver of the infrared radiation from the pilots is a specialised US3 chip of the TSOP4836 type, which contains all the components necessary to receive infrared signals. To increase the sensitivity of the receiver, it is fed through a filter that is made of resistor R11 and capacitor C4. As output stages for the individual switch channels the device uses the circuit (US2) type ULN2003A, which contains 7 stages of transistor amplifiers with protection diodes allowing direct control of the relays. The essential task that the microcontroller program performs is to receive the signal from the infrared receiver and distinguishing frames in this signal, i.e. codes sent from the IR remote control. Such a frame usually contains from a dozen to several dozen pulses, whose durations and pause times generally range from 0.2 ms to 3 ms. Software allows measuring pulses of up to 8 ms. If the signal input remains unchanged for 8 ms, this is an indication that the transmission of one frame has been completed and the next pulse will be the start of a new frame. When a signal appears, the program measures the pulse times and the interval times between them and stores the results in an array until the next 8-millisecond interval or until 64 measurements have been obtained. Thus, the only limitations on the

remote control (more precisely, the code it generates) that the device can 'learn' are the duration of each individual pulse and the pause, which must be within the limits mentioned above, and the maximum length of the code - 32 pulses (and 32 pauses). An important factor in the device's ability to remember the code is the frequency of the IR signal modulation - each remote control transmits codes on a fixed carrier frequency. The most popular, most common one is 36 kHz. If needed, the receiver can be replaced by a similar one with a different carrier frequency. These can be, for example, TSOP4833 - 33 kHz, TSOP4838 - 38 kHz, TSOP4840 - 40 kHz.
This switch features pushbuttons that allow direct switching of the relays without the need to use a remote control. Shortly press the button to change the state of the relay. Diodes LED1-LED4 indicate which relay is currently switched on, while LED5 acts as a signalling device, indicating operation of the device, the receipt of a commands from the remote control, as well as entering programming mode.
Remote control code programming mode is opened by holding down the selected button for approximately 5 seconds. Once this is done, the LED corresponding to the programmed channel will start slow flashing. This means that the circuit is waiting for a command from the remote control to be given and acknowledged, which will be responsible for switching the relay. Correct reception by the device of the remote control code results in the LED lighting up for a longer period of time, after which it flashes again, indicating that the system is expecting acknowledgement of a previously received command. Then, press the same button on the remote control again. Once a valid command has been received, the programming procedure is finished and the device will return to normal operation. Entering the programming mode is possible at any time during operation of the device and is performed independently for each of the four channels.

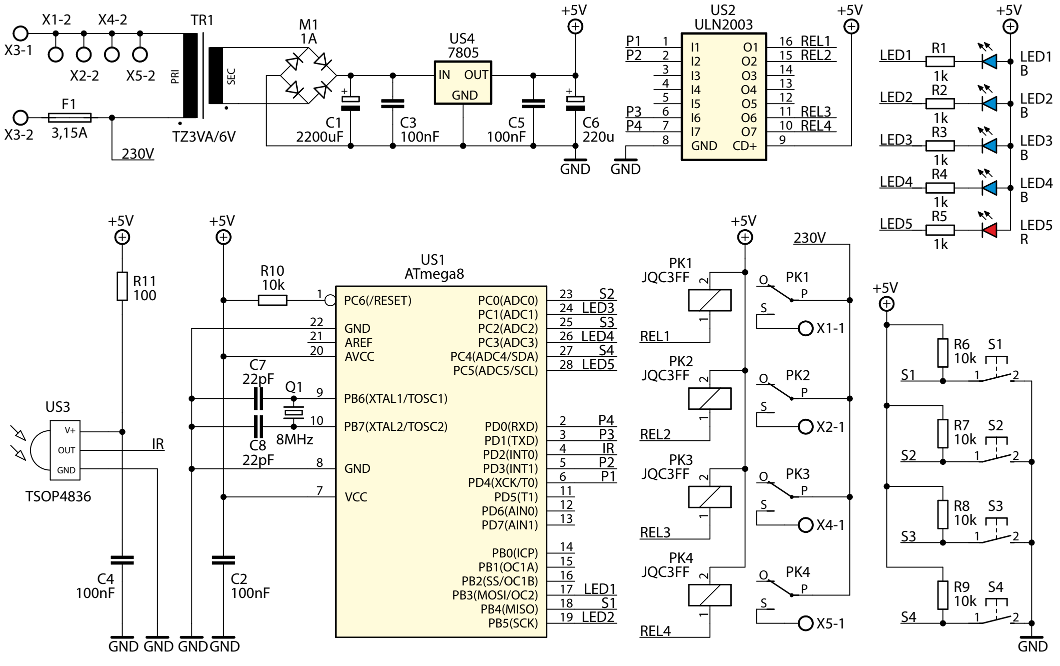


**Figure 1.** Schematic diagram of a 4-channel switch

## Mounting and start-up

The PCB mounting diagram is shown in Figure 2. In the additional material you can find PCB samples that can be used as front and back panels. Installation details are shown in the enclosed photographs. The board fits into the Z4 housing - its dimensions are 74 mm×145 mm. The assembly of the main PCB is typical and requires no additional detailed description. Only the LED leads need to be bent so that they are above the angled microswitches and can be fed through the front panel. It is a good idea to connect the two solder fields on the main board with the fields on the front panel. This will allow the boards to be installed securely in the housing. In addition, the main board has mounting holes fitted to the uprights in the housing for screwing on. The rear panel is preferably fitted with 4 sockets type GS-035.

They are mounted with a single screw. Connect the main board (X1, X2, X4, X5) to the above-mentioned sockets using wires min. 1.5 $mm^2$. These are ungrounded sockets and allow the connection of a device with wires terminated with a flat plug. The rear panel also has space for the on/off switch and an opening for the power cable. The switch must be inserted into the circuit of the power cable and the free ends into screw socket X3. Its fuse is located inside the device and before any replacement, remember to disconnect the unit from the mains. The load of a single channel/socket is up to 150 W.

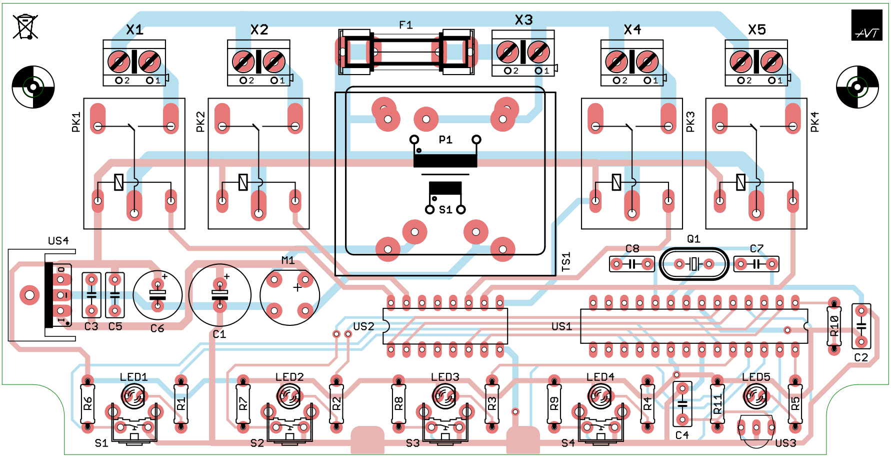


**Figure 2.** Mounting diagram of a 4-channel switch

## List of components

**Resistors:**
R1-R5:.......................................1 kΩ
R6-R10:.....................................10 kΩ
R11: ..........................................100 Ω
**Capacitors:**
C1:.............................................2200 uF
C2-C5:.......................................100 nF
C6:.............................................220 uF
C7, C8: ......................................22 pF
**Semiconductors:**
LED1-LED4: ..............................LED 3 mm (blue)
LED5:........................................LED 3 mm (red)
M1:............................................rectifier bridge 1 A
US1: ..........................................ATmega8
US2: ..........................................ULN2003
US3: ..........................................TSOP4836
US4: ..........................................7805

**Other:**
F1: .............................................fuse 3,15A
PK1-PK4:..................................relay JQC3FF 5V
S1-S4: ......................................angle microswitch 9 mm
TS1:...........................................transformer TZ3VA/6V
Q1:.............................................8MHz
X1-X5:.......................................connector ARK2/5
Mains sockets GS-035
Z4AP enclosure
Power line
Connecting wires 1.5 $mm^2$
Heat sink RAD DY-CN 20 mm
Switch MRS101

Start mounting from soldering the components onto the board in order of size from smallest to largest. When mounting components marked with an exclamation mark, pay attention to their polarity. Wiring diagrams and symbols of the components on the PCB and photographs of the assembled kit may be helpful.

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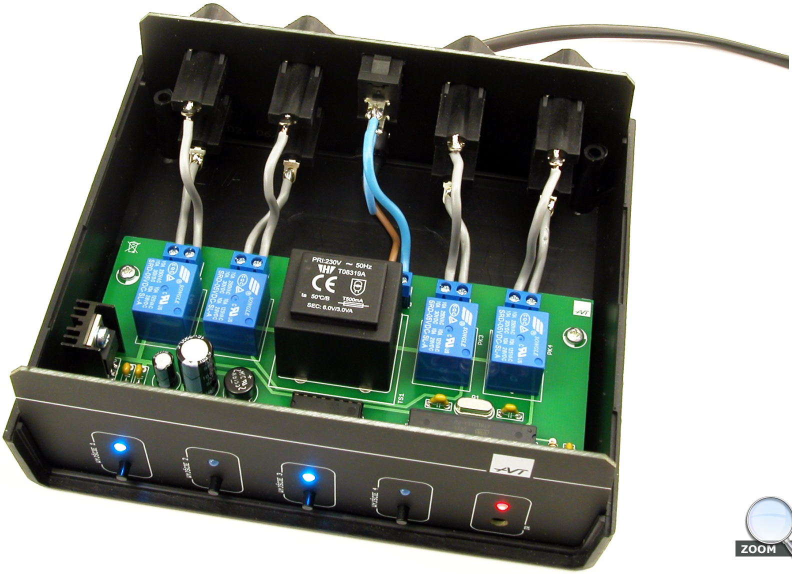

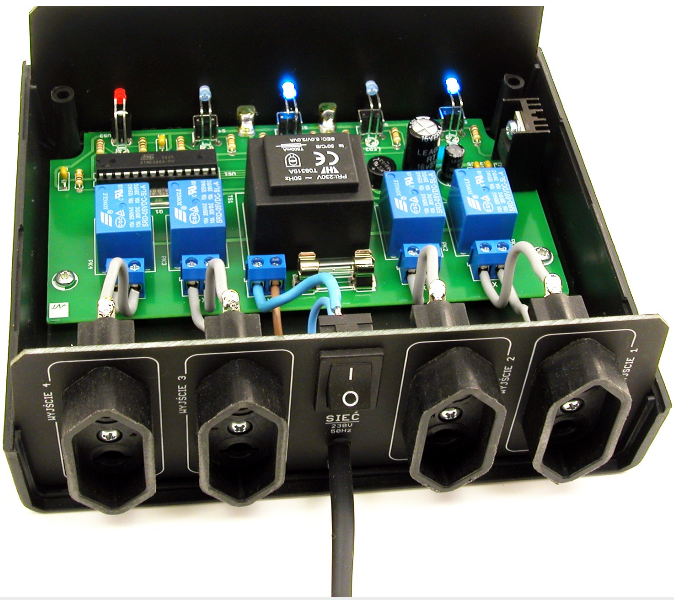


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