Universal Auxiliary Switch 230 V

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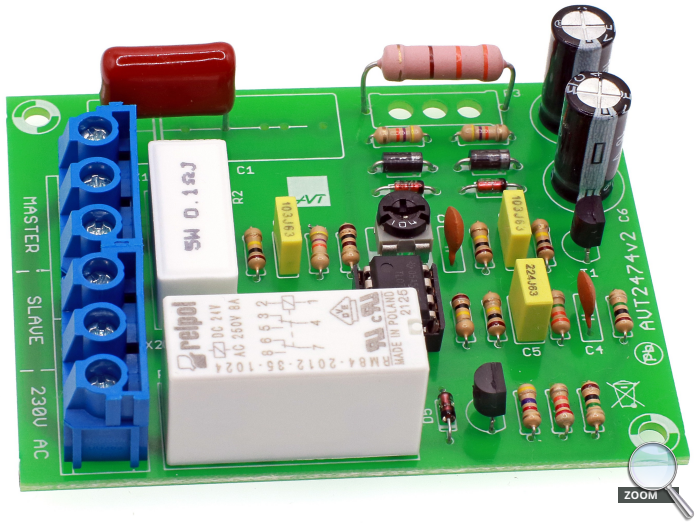
AVT 2474



ASSEMBLY DIFFICULTY

This circuit performs very useful functions and solves a problem faced by many users of electrical and electronic equipment. One of them is situation when the shutdown of the main device will not switch off its auxiliary device. An example would be a set of drill - vacuum cleaner. With the presented module, switching on the drill automatically starts the vacuum, and when the drill is switched off, with a small delay the vacuum will be switched off as well.

Characteristics

- adjustable sensitivity
- works with loads such as vacuum cleaners, power tools, etc.
- power supply: 230 VAC
- load without reinforcing tracks: 2000 W
- load with reinforced tracks: 3500 W
- PCB size: 61×78 mm

Circuit description

The design is an uncomplicated attachment with a current sensor and relay. Its principle of operation is shown in Figure 1. If there is a current in the main circuit (the main unit will be switched on), then the relay is activated and it will switch on the remaining auxiliary units. Schematic diagram of the circuit is shown in Figure 2. The electronic circuit receives voltage from the transformer less power supply, realised with components C1, R3, R1, R4, D1, D6, C2, C6, D2, D7. This power supply provides the ±12 V needed for the operational amplifier to operate and 24 V relay.
The current sensor is a resistor R2 of negligible value 0.1 Ω. Even with a 1000 W power load, i.e. at the current of 4.5 A, the voltage drop will not exceed 0.5 V, and the loss power of this sensor will be at most 2 W. At small currents drawn by the main unit, a voltage drop occurs in this resistor, measured in millivolts. This small AC voltage is boosted by the operational amplifier U1A.

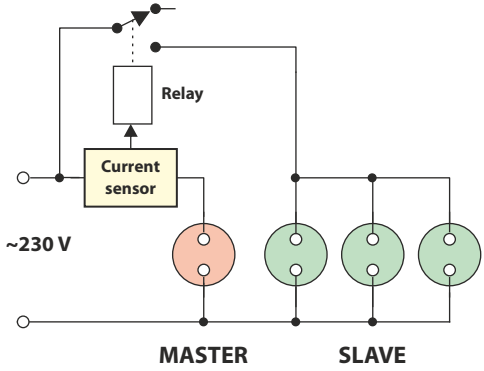


Fig. 1

Components R5, D3, D4 protect the amplifier from too high voltage that could appear on R2 in the mergency situations. The R6 C7 circuit acts as a filter, not allowing pulse interference to the amplifier. Amplifier gain is determined by the ratio PR1/R15. They can be regulated in wide range to adjust sensitivity of the circuit operation as required. Enhanced changing waveform passes through capacitor C3. Circuit R8 C8 additionally filters the signal. As a result, the transistor T1 is opened with the positive halves of the sine wave. Any positive half results in a rapid charging of capacitor C4, followed by a slow discharge through R10. Thus, even a small current flowing through resistor R2 changes the voltage on collector T1 from +12 V to approximately 0V. This change in voltage causes slow charging of capacitor C5 through resistor R11. At some point, a comparator built on an operational amplifier U1B will operate - the voltage of its output will increase from about -12 V to about +10 V. This will cause transistor T2 to open and relay S1 to trip. The trip threshold of comparator U1B is determined by resistors R12, R13. A feedback circuit was added to avoid interference. Resistor R14 provides the appropriate hysteresis so that the relay will switch reliablyMount the circuit on a board shown in Figure 3. The mounting is classic.

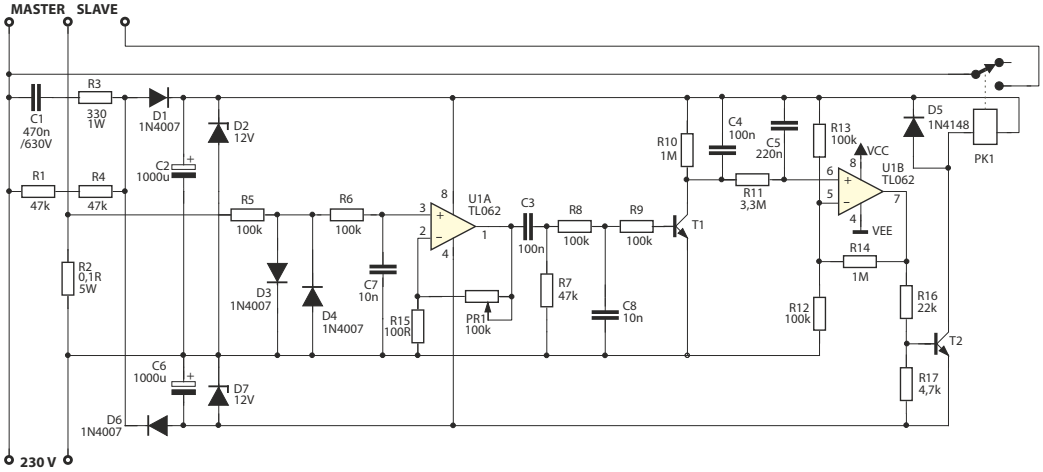


Fig. 1. Schematic diagram

Mounting and start-up

First, solder the smallest components, then the bigger ones. The complete board can be placed in a large plug-in enclosure and attached to the socket strip.

Circuit assembled correctly from efficient components will work straight away.

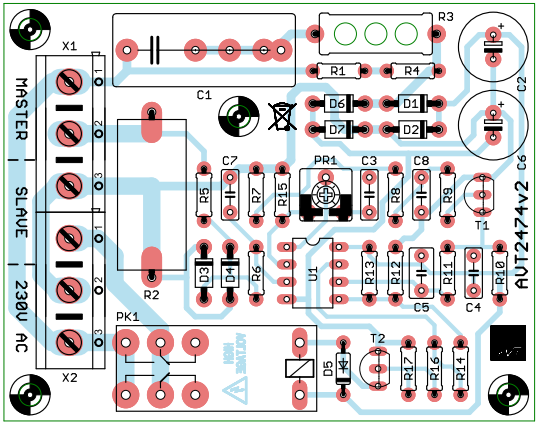


Fig. 2. Arrangement of components on the PCB.

If the main device or auxiliary equipment were to consume more than 2000 W, pay particular attention to wire connections. Circuits where more than 1 A current will flow must be made with thicker wire (1.5 mm^2 or more), and all screw connections must be tight. For load powers above 2,000 W, the exposed tracks must be reinforced by soldering pieces of copper wire to them.

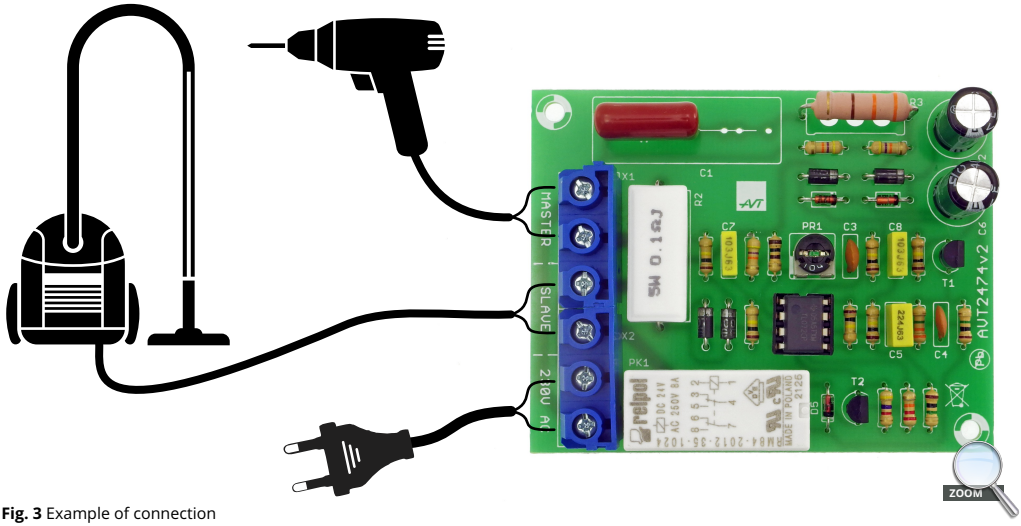


Fig. 3 Example of connection

List of components

Resistors:

R1, R4, R7.....47 kΩ
R3:.....330 Ω / 1 W
R2:.....0,1 Ω / 5 W
R5, R6, R8, R9, R12, R13:.....100 kΩ
R10, R14:.....1 MΩ
R11:.....3,3 MΩ
R15:.....100 Ω
R16:.....22 kΩ
R17:.....4,7 kΩ
PR1.....mounting potentiometer 100 kΩ

Capacitors:

C1:.....470 nF / 400 V (MKT, MKSE, MKP)
C2, C6:.....1000 µF
C3, C4:.....100nF (may be designated 104)
C5.....220nF (may be designated 224)
C7, C8:.....10 nF (may be designated 103)

Semiconductors:

D1, D3, D4, D6:.....1N4007
D2, D7:.....Zener diode 12 V
D5:.....1N4148
T1, T2:.....BC547 (BC548)
U1:.....TL062 (TL072, TL082)

Other:

PK1:.....relay 24 V (1×16 A or 2×8 A)
X1, X2:.....screw connectors

Components received in the kit, may differ in appearance from those shown in the photographs. Despite this, they have the same parameters and their appearance will not affect their operation in the circuit.

Start mounting from soldering the components onto the board in order of size from smallest to largest. Photographs of the mounted kit may be helpful. To access the high-resolution images as links, download the PDF.

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NOTE!
During mounting and start up, take care to ensure safe operating conditions, the circuit is not isolated from the mains and some components are directly connected to the mains phase wire.

Notes

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This symbol means do not dispose of your product with your other household waste. Instead, you should protect human health and the environment by handing over your waste equipment to a designated collection point for the recycling of waste electrical and electronic equipment.

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