EDUCATIONAL ELECTRONIC KITS

Soft start for power tools

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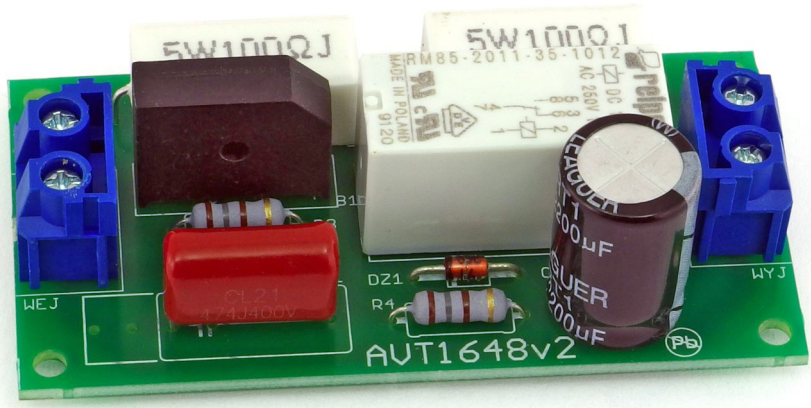
AVT 1648



ASSEMBLY DIFFICULTY

Devices connected to the power grid, such as power tools, motors, transformers with capacities higher than 1 kW and others, when powered up, cause a sudden current pulse that often exceeds the rated current by several times. One way to reduce the effects of this unfavorable phenomenon is to use a voltage regulator, but this is a complicated device and much more expensive than the presented circuit.

Characteristics

- dedicated to high-power devices generating high startup current
- universal application
- screw connectors for use with large cable cross sections
- 230 V AC power supply
- maximum load: 2 kW

Circuit description

Despite the uncomplicated design, it should be noted that the system is powered by the power grid and therefore the person making it should have the appropriate knowledge, skills, and experience. The schematic diagram of the current limiter is shown in Figure 1. The receiver, which can be, for example, an electric drill, should be connected to the output terminals, while the mains supply should be connected to the input terminals. The system should be switched on behind the mains switch. When the line voltage appears at the I/O connector, the current flowing to the load is limited by the R1 and R2 high-power resistors. The C2 capacitor charges through the C1 capacitance, the B1 rectifier bridge and the R4 resistor. The voltage on it after about 1 second reaches a high enough value to trigger the PK1 relay.

The relay switches and its contacts short the R1 and R2 resistors. From this point on, the line voltage is applied directly to the load.

The C1 capacitor sets the current capacity of the transformerless power supply and the C2 capacitor sets the relay trigger delay. A delay of the order of one second is sufficient to protect fuses from blowing when the transformer is switched on, since the current pulse usually does not last longer than 10 ms. In the case of a motor, the surge current depends on the load on its drive shaft, and if the time resulting from the values of C1 and C2 used is too short, you can try increasing the value of the C2 capacitor or the resistance of the R2 resistor.

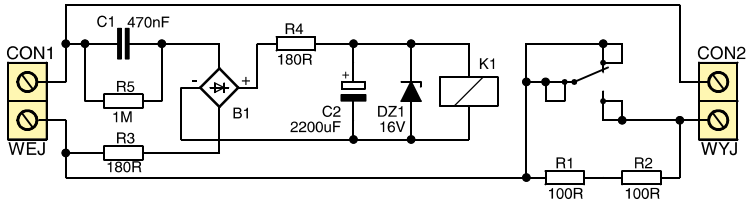


Fig. 1 Schematic diagram of the soft starter

Assembly and start-up

An assembly diagram of the system is shown in Figure 2. The whole thing was assembled on a single-sided printed circuit board measuring 39 × 75 mm. We start assembling the circuit by soldering small-sized components into the board, and finish by installing the bridge, electrolytic capacitor relay and screw connectors. The system, assembled from working components, does not require any adjustment and is immediately ready for operation.

Note: the C2 capacitor is connected in parallel with the relay, which maintains its operation for a short time after the mains voltage is disconnected. If it reconnects during this time, the system will not work, and a current surge may result, causing the fuses to trigger or blow.

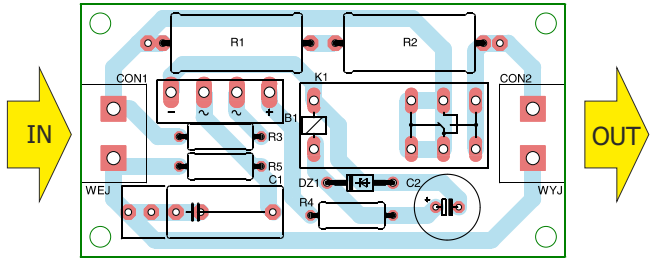


Fig. 2 Layout of the components on the circuit board

List of elements

Resistors:
R1, R2: ..... 100 Ω 5 W
R3, R4: ..... 180 Ω 1 W
R5: ..... 1 MΩ 1 W

Capacitors:
C1: ..... 470 nF / 400 V
C2: ..... 2200 uF / 16 V

Semiconductors:
B1: ..... bridge rectifier
DZ1: ..... 1.3 W / 16 V Zener diode

Other:
PK1: ..... 12 V Relay
IN, OUT: ARK2/750

Attention!
During assembly and startup, care should be taken to ensure safe operating conditions. The system is not separated from the power grid, and some components are directly connected to the power mains.

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