

Pump Protector

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This circuit has been developed to limit the running time of a sump pump, since the pump can be damaged if it runs too long when the sump is dry. The circuit detects how long the pump has been switched on, and if this time exceeds a previously set limit (30 minutes in this case), the supply voltage to the pump is interrupted.

The protector circuit is connected in series with the pump's mains supply cable. The 230-V input is on the left-hand side of the schematic diagram, and the output is on the right. The schematic diagram consists of three main elements: the power supply, the timing circuit and the in-use detector.

The supply voltage is taken from the mains connection to the pump via transformer Tr1. Since voltage stabilisation is not necessary, the power supply can be limited to the standard combination of a transformer, a bridge rectifier and a smoothing capacitor. LED D5 acts as an on/off indicator.

A 4060 (IC1) is used for the timing function. LED D10 (Count) blinks as long as power is supplied to the load. Output Q14 of IC1 goes High after 30 minutes. Alternatively, the Test jumper position can be used to select output Q6. This output interrupts the power to the pump after 6 seconds for testing purposes.

Two diodes connected anti-parallel (D6–D7) are placed in series with one of the supply leads to detect whether the

pump is running. When the pump switches on, the voltage drop across these diodes is sufficient to cause T1 and T2 to conduct. These transistors pull down the Reset input of IC1, so the timing circuit starts to count. Diodes D8 and D9 provide a return path to ground from the Reset pin; a direct connection at this point would short out the detection diodes, which is not what we want! These diodes cause the Reset level to lie at around 0.8 V. Capacitor C2 suppresses the crossover spikes from the ac signal, which could otherwise cause the circuit to malfunction.

If the pump is still running when the time interval has expired, T3 energises the 12-V relay Re1, which in turn drives a 220-V relay with two changeover contacts. One of these contacts interrupts the supply voltage to the pump, while the other one is used to activate the Reset LED (D11). The pump can be started again by pressing the Restart button.

We can conclude with some practical remarks. First, a Eurocard relay relay may be used for Re1, and second, the Reset pushbutton switch must naturally be a normally-closed 230-V type. Finally, since the entire circuit is connected to the mains network, full consideration must be given to electrical safety in its construction, and a well-insulated enclosure is mandatory.

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