Automatic turn-off switch

After leaving on my soldering iron overnight numerous times, I needed a switch so that it would turn off automatically. The circuit shown does this, and can also control anything else of a similar nature. It turns off the device after about 18 minutes, and a LED (LD1) gives a warning flash for 4 minutes before it turns the device off.

When power is applied, pushbutton PB1 needs to be pushed to reset IC3 (4040), a 12-stage binary ripple counter — otherwise IC3 could be anywhere in its counting cycle.

PB1 activates the 'master reset' of IC3, via the 10uF capacitor and 100k resistor, by sending its pin 11 high. This resets all outputs Q0-Q11 low — and, while PB1 remains pressed (keeping pin 11 high), they remain low irrespective of the state of the active low clock- pulse input (pin 10).

Several of these IC3 outputs are connected to IC4 (4032), a triple 3-input NAND gate. The low outputs on Q1, Q8 and Q9 send the output of IC4a high, which keeps LD1 off via the BC558 transistor Q1; while the low on Q10 has two effects. Via pin 1 of IC4b, it sends pin 9 high, which prevents the 555 timer (IC2) from being reset; and via transistor Q2, it switches on the triac optocoupler U1 (MOC3021), which controls the 240V power to the main circuit via triac TR1 (MAC320A8FP).

As shown in the schematic, the 555 (IC2) is set up to operate in its astable mode, with a period of approximately 1s. The low-to-high pulse from its output at pin 3 is used to clock pin 10 of IC3.

Once IC3 has reached a count of 769 (about 13 minutes), its outputs Q1, Q8 and Q9 are all high. These three highs cause IC4a to go low and turn on the warning LED. As the count continues, output Q1 changes its state every 2s, so Q1 and LD1 are turned on and off.

This flashing continues until a count of 1024 is reached (about 17 minutes), when output Q10 goes high and turns off transistor Q2, optotriac U1, triac TR1 and the device under control. The high also causes IC4b to go low, which is applied to pin 4 of IC2 to stop the timer counting.

The device can be turned on again, or kept on by simply pushing PB1 to restart the cycle.

The low power is derived from transformer T1 (2851), the bridge rectifier D1-D4 (1N4002) and a 7812 3-terminal regulator. The mains power is directed through U1 and TR1 to the load socket. The usual care needs to be taken with the potentially lethal 240V.

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