# K85_1. 555 TIMER KIT

Timer kits are an ever popular item with the hobbyist. Two of the main methods used are a 555 IC and the discharging of an electrolytic capacitor. In this Kit we have presented a 555 timer kit. There is nothing original in this circuit. Similar circuits have been presented in text books and electronics magazines for literally decades. The 555 had its own cult following back in the 1970's after it came out. Whole books of circuit designs were published using it. In the 1990's it has become a favorite chip for some people to look down on (see Don Lancasters comments about it in his columns in the American electronics magazines.) But despite this it is simple to use and popular because it is so cheap and readily available.

The kit is constructed on a single-sided, routed, FR4 fibre glass printed circuit board (PCB) with a printed overlay and bottom solder mask. Protel Autotrax and Schematic were used to produce them.

**ASSEMBLY INSTRUCTIONS**

Check off the components against the Component listing. It is generally easiest to solder the lowest height components first - the resistors, diodes and IC sockets. There is one link to add. Use a length of wire cutoff from a resistor leg. Make sure you get the diodes and lectrolytic capacitors around the correct way according to the overlay.

**CIRCUIT DESCRIPTION**

555 Differences. First a general comment about the 555 IC. It is generally stated in the text books and assumed in the magazine articles about it that all 555's are the same. And in many applications they are. But in many other applications they definitely are not, especially when you are designing near the specification limits of the IC. On top of this we have also found that there are differences between the same type of 555 (whether nmos, or the lower power cmos version) made by different manufacturers. These problems must be kept in mind when you design using the 555. You must always prototype & test exhaustively and do not change IC brands nor nmos/cmos types without comprehensive testing. These comments also apply to the 556 IC (two 555 in the same package.) This problem of differences has not been widely reported although it is frequently alluded to in recent electronics magazine articles. (One senses the frustration reviewers have had when using different brands of 555.)

We have not attempted to review the operation of the 555 IC here. Most electronic magazines review it in detail once every few years. And it is a standard feature in most intoductory electronic text books. Some magazine references are given at the end of this documentation.

**Circuit Descripion.** The circuit consists of 3 parts: an oscillator, a ripple counter and a switching transistor. The 555 is configured in the standard astable oscillator circuit designed to give a square wave oscillation at a period of around 1 cycle/sec. A potentiometer is included in the design so the period can be set to exactly 1 second by timing the LED turning on/off. A separate jumper connection has been provided so the LED can be turned off completely if it is not required. The output pulse is fed to a 14-stage binary ripple counter.

The 14020 ripple counter advances its count on each negative transistion of the clock pulse from the 555. So for each output cycle of low-high-low-high the count is advanced by two. It can be set to an zero state (all outputs low) by a logic high applied to pin 11. In this circuit C3, R4 and D1 are arranged as a power-on reset. When power is applied to the circuit C3 is in a discharged state so pin 11 will be pulled high. C3 will quickly charge via R4 and the level at pin 11 falls thus enabling the counter. The 14020 then counts clock pulses until the selected counter output goes high. This output turns Q1 on which in turn activates the relay. Note that the reset pin of the 555 is connected to the collector of Q1. This enables the 555 during the counting period but as soon as Q1 is turned on the 555 is disabled as the collector of Q1 is pulled low.

The counter output required is set by a jumper. Eleven outputs are available: 8 16 32 64 128 256 512 1024 4096 and 8192. If the 555 is set to oscillate at exactly 1.0Hz by the on-board trimpot then the maximum timer interval which can be set is 8192 seconds. You can experiment with changing the components values of R1 and C1 to set the frequency at 10 seconds or a minute so timing periods of 81,920 seconds & 491,520 second can be reached easily. (You can work out how many days & hours this is.)

The relay will remain activated until the power is turned off at the switch by the user. D1 provides a discharge path for C3 once the power is disconnected.

**Mains Switching.** These on-board relays on these kits should not be used to switch the mains power directly even though they are rated to do it. To control mains power use our Kit 84 as an interface between the timer kit and the mains power supply. Kit 84 is designed to take a zero to 12V signal, or a 12V to zero signal and switch the mains power on or off.

**Long Duration Timers.** Combining the 20 minute period for the 555 demonstrated in our kit 85_2 the ripple counter of k85_1 shows that timing periods of 8192*20 minutes (about 110 days) are possible. In this case plug power pack operation would be required. Batteries would be quite unreliable. But accuracy could be a problem since the electrolyte capacitor could not be relied upon to maintain constant internal electrolytic characteristics over this duration. It would be operating at the limits of its specifications.

But there is another way to get a long duration timer, with more accuracy, and without pushing the limits of any of the components. We could just add a second ripple counter to the circuit of kit 85_1. A 555 oscillating with a period of 1 second and two ripple counters in series set to the maximum of 8192 pulses each, then a timing period of 8192*8192 seconds is possible. This is just over two years. The timing period can be set quite accurately. And we would be operating well inside the specifications for

# K85_1. 555 TIMER KIT

electrolytic capacitors. Setting the period to 10 Hz would give a timing period of over 21 years. Long enough for most purposes we think.

What to do if they do not work. Poor soldering is the most likely reason that any of the kits do not work. Check all solder joints carefully under a good light. Next check that all components are in their correct position on the PCB especially the diodes. Are the IC's in the correct way around. Did you put the link in kit 85_1.

See our kit range at

**http://www.kitsrus.com**

## Components Kit 85_1

| | |
|---|---|
| Resistors 5%, 1/4W carbon: | |
| 390K R1 orange white yellow | 1 |
| 470K R2 yellow violet yellow | 1 |
| 1K R3 brown black red | 1 |
| 39K R5 orange white orange | 1 |
| 100K R4 brown black yellow | 1 |
| 100K 104 Koa trimpot | 1 |
| | |
| Capacitors: | |
| 1uF E. cap C1 C3 | 2 |
| 470uF E. cap C5 | 1 |
| 10nF mylar C2 | 1 |
| 100nF 104 monoblok C4 | 1 |
| NE/LM555 nmos IC | 1 |
| 8 pin IC socket | 1 |
| 14020 IC | 1 |
| 16 pin IC socket | 1 |
| BC338 Q1 | 1 |
| 5mm LED | 1 |
| 1N4004 diode D1 D2 D3 | 3 |
| 2 pole header strip - 1 position | 1 |
| 2 pole header strip - 4 position | 1 |
| 2 pole header strip - 7 position | 1 |
| Jumper | 2 |
| 3 pole terminal block | 1 |
| 2 pole terminal block | 1 |
| Relay | 1 |
| SPDT switch | 1 |
| Kit 85_1 PCB | 1 |