

Kit 137. TOUCH SWITCH

You can turn on almost any electrical device with this switch, and the switch automatically turns off a short time later. As you will see you can determine how much later – less than a second to over one minute – just by changing the value of one resistor.

The kit uses a 12V relay to do the switching. It is rated at 250V/12A. The Dinkle brand 3 pole terminal block is also rated and approved for this voltage and current. So the switch can be used for switching AC as well as DC. It is best to use a 9V – 12VDC regulated or unregulated plugpack for the power supply. Do not go over 15VDC input.

Assembly. Solder the lowest height components first. Make sure to get the electrolytic capacitor and the IC the right way around. If you want a relay delay about 1 second use R1 1K resistor. If you want a delay of about 5 seconds use the 10K resistor for R1. See below.

How it Works. the circuit is based around a nmos 555 timer IC. This is usually marked NE555 or LM555. The 555 IC can have many uses which is why it has survived long after it was predicted to disappear. This time we use the high sensitivity of its trigger input. You can download the data sheet for the LM555 from national.com the website of National Semiconductor.

The 555 is connected as a pulse generator, monostable multivibrator. The ‘mono’ gives a clue as to how it works – it produces just one pulse when it is triggered. If you bought our Kit 9 you would have already been introduced to this type of oscillator.

When the power is first switched on current flows through R1 and charges C1 until the voltage across C1 equals one third of the supply voltage. In this circuit if the supply voltage is 12V the capacitor is charged to 4V. Pins 1 and 7 are shorted together by an internal resistor in the 555 so current flows through R1 to ground. Nothing more happens until the IC is triggered. This is done by putting a low voltage input on pin 2, the trigger input.

When this happens an internal resistor turns off and the current flow from pin 7 to pin 1 is stopped. This causes C1 to charge. At the same time the voltage at the output of pin 3 which had been at zero rises quickly to 9V. This is the beginning of the output pulse. Charging of C2 continues until it reaches two-thirds of the supply voltage, 8V. As soon as it reaches 8V two things happen: The output voltage on pin 3 drops almost instantly to zero ending the pulse. Secondly, the internal transistor turns back on and the path between pins 1 and 7 opens up again. C1 is rapidly discharged back to one third of the supply voltage. Then the internal transistor turns off and the timer is ready to be triggered again.

The trigger input, pin 2, is normally held at the positive voltage input by the internal circuit in the 555. It is connected to the input of a very sensitive comparator which triggers the timer when its voltage is brought below one-third of the supply voltage. Pin 2 can be a metal wire or plate located several yards away from the Kit.

Touching the plate/pin with a finger is enough to cause the timer to be triggered. Now when this happens and pin 3 goes high the transistor Q1 is turned on. Current flows through Q1 and causes current to flow through the relay. So by choosing between the appropriate pair of relay outputs, common (C), normally open (NO) or normally closed (NC) an external device can be turned on or turned off temporarily.

Pin 2 is very sensitive so to reduce its sensitivity to electromagnetic interference C2 has been connected between it and the positive rail. If there is not a lot of EMI around you (no motors, neon lights, etc.) then C2 can be omitted. Make your own touch plate out of metal typically an inch square. We have tested this circuit with the touch plate over 5 yards away and it works with no problems.

Timing. The output pulse is on as C1 is charging from one-third to two-thirds the supply voltage. This time depends only on the values of C1 and R1 (and not, surprisingly, on the value of the supply voltage itself.) This is one of the reasons the 555 is so popular as a timer. The equation for the time of the output pulse is $t=1.1RC$.

So for our circuit as provided R is 10,000 ohms (10K) and C is 0.00047uF, so t is about 5.2 seconds. Remember the components typically have 5% tolerance for resistors and 20% tolerance for electrolytic capacitors. The maximum practical value for resistance is 20M (connect 2 x 10M resistors in series.) With R of 3M3 and a 1mF electrolytic capacitor over an hours delay can be achieved in theory. You can get LL (low leakage) capacitors for more accurate timing around the one hour period. We supply a LL ecap in Kit 85_2 for just this reason.)

See our other timer kits: kits 54, 85_2, 85_3, 152.

COMPONENTS

Resistors, 5%, 1/4W carbon		
10K brown black orange	R1	1
1K brown black red	alternate R1	
18K brown grey orange	R2	1
100pF ceramic cap	C2	1
470uF/16V ecap	C1	1
1N4004 diode	D1	1
LM/NE555 IC	IC1	1
8 pin IC socket		1
BC548 transistor	Q1	1
12V relay		1
3 pole terminal block		1
K137 PCB		1

This circuit has no doubt been published many times over the last 20 years but I took it from *Electronics Australia*, august, 2000.

See our website at

<http://kitsrus.com>

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