# QUASAR PROJECT KIT # 3137 - 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 relay output rated to switch resistive loads of up to 240Vac or 28Vdc @ 2A maximum. The relay terminal block is also rated to handle this voltage and current. So the output can be used for switching AC as well as DC. It is best to use a 9V – 12Vdc regulated mains adapter or battery for the power supply. Do not go over 15Vdc input. The relay will not switch with a supply under 9V.

**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 3009 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 coltage 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 comparitor 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 3085_2 for just this reason.)

See our other timer kits: 3054, 3085_2, 3085_3, 3152.

**COMPONENTS**

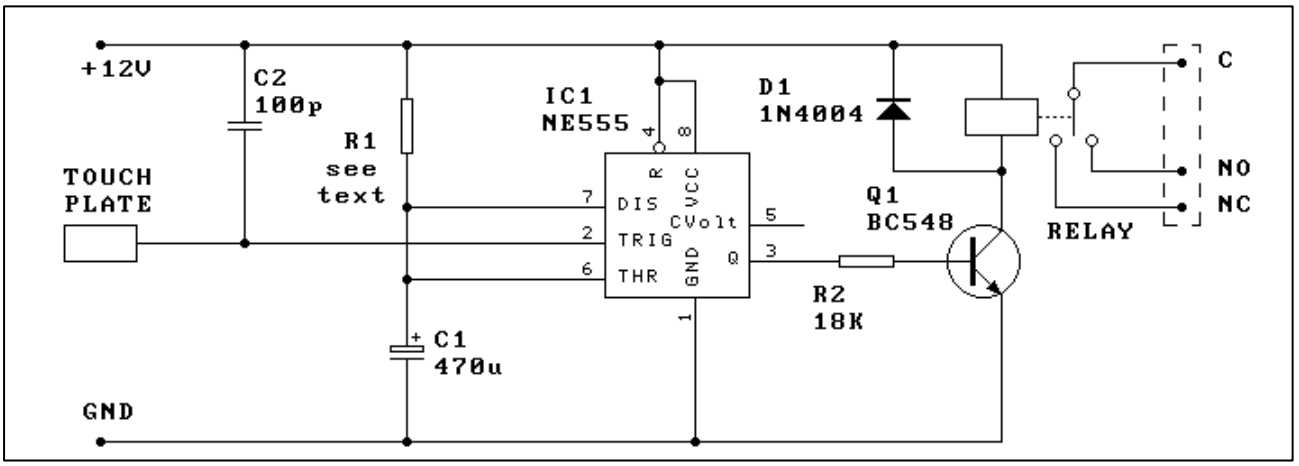
| | | |
|---|---|---|
| Resistors, 5%, 1/4W carbon | | |
| 10K brown black orange | R1 | 1 |
| 1K brown black red | alternate R1 | |
| 18K brown grey orange | R2 | 1 |
| | | |
| 100pF ceramic cap | C2 | 1 |
| 470uF/16V ecap | C1 | 1 |
| 1N4004 diode | D1 | 1 |
| LM/NE555 IC | IC1 | 1 |
| 8 pin IC socket | | 1 |
| BC548 transistor | Q1 | 1 |
| 12V relay | | 1 |
| 3 pole terminal block | | 1 |
| 3137 PCB | | 1 |

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

See our website at

**http://www.quasarelectronics.com/3137.htm**

# QUASAR PROJECT KIT # 3137 - TOUCH SWITCH



# GENERAL RELAY INFORMATION

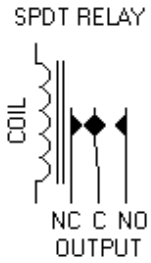
**Warning! Risk of Electric Shock!**
Some kits and modules have 110-240Vac mains rated relay outputs (as specified in the Product Documentation). Controlling mains equipment using these relay outputs must be treated with extreme caution. Electric shocks can cause severe and permanent injury or even death. Construction, installation, testing and commissioning should only be attempted by suitably qualified persons, or under the supervision of a suitably qualified person. These products are not suitable for children.
Before connecting mains powered equipment to the relay outputs please check with the relevant authorities in order to ensure compliance with all current local safety requirements.
Many areas of the assembly may operate at mains voltage. A suitable isolating enclosure must be used. Exposed screw terminal blocks on some products must be insulated to prevent contact with exposed metallic parts at mains potential. Connected equipment should be suitably fused.

You will find relay outputs on many of the kits and modules that we sell. A relay is simply an electrically operated on/off switch. It is important that you observe the relay voltage and current limitations specified in the Product Documentation (**not all products are rated to switch mains power even though the relays supplied may state higher voltage and current limits!)**

## Relay Terminals

Most boards have SPDT (Single Pole Double Throw) style relays. These have three outputs:

**C** = Common
**NO** = Normally-Open contacts connect the circuit when the relay is activated; the circuit is disconnected when the relay is inactive. It is also called a Form A contact or "make" contact.
**NC** = Normally-Closed contacts disconnect the circuit when the relay is activated; the circuit is connected when the relay is inactive. It is also called a Form B contact or "break" contact.

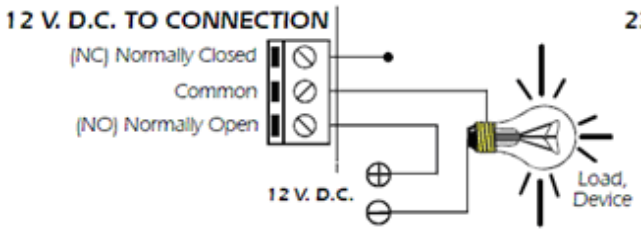


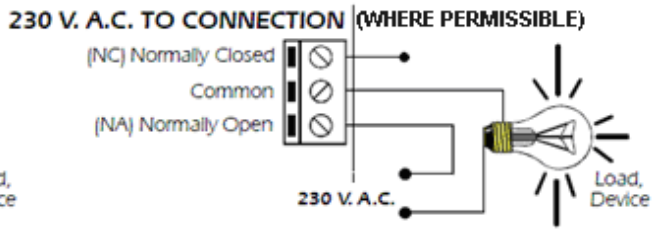

## Connecting the Device you want to Control

You must provide an external power source to the device you want to control. No voltage is present at the relay terminals (remember it is just a switch). The relay is normally connected in *series* with the positive (+) power wire of the device you want to control.

In this case, the positive wire from the power source should be connected to Common. Then either the NO or NC terminal (as appropriate for your purpose) is connected to the positive (+) wire going to the device you want to control. The negative (-) wire does not connect to the relay at all. It goes directly from the power source negative output to the device negative (-) terminal.

## Typical SPDT Relay Connection Diagrams




## Anti-Spark SPDT Relay Connection Diagram

Sometimes the connected equipment can cause arcing across the relay contacts. This must be corrected by installing a resistor and capacitor (not supplied) between the two contacts of the relay as shown below. Component values are for 230Vac mains.