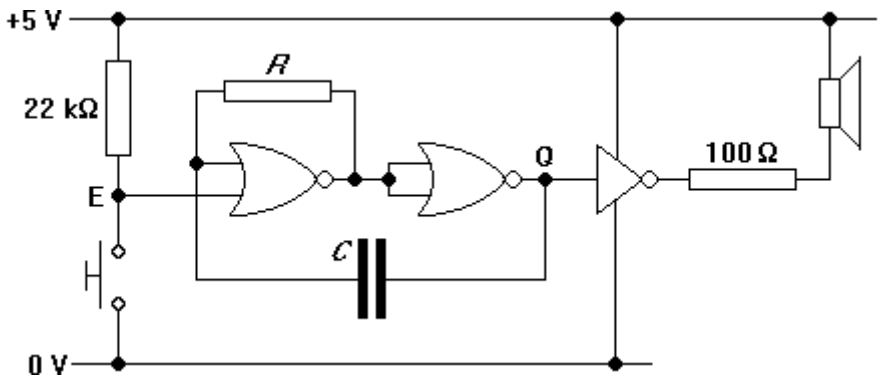
Enabled oscillators

Unlike most oscillators, the one shown below has an input which can be used to turn it on and off. You are going to make interesting noises by using one oscillator to turn another one on and off.



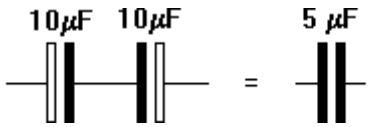
1. Assemble the circuit with a 4001 NOR gate i.c. and a 2004 driver i.c. Use one gate from the top half of the i.c. and another from the bottom half. Have C = 100 nF and R = 10 kΩ. If all is well, the speaker should make a noise whenever the switch is pressed.

2. Use a CRO to study the outputs and inputs of the NOR gates when the system is oscillating. Does the period T of the square wave at Q obey the formula $T = 1.6RC$?

3. Measure the period T for the values of R and C shown in the table. How well do they agree with the rule $T = 1.6RC$?

R/kΩ	C/nF	T/ms	1.6RC/ms
10	100		
22	100		
47	100		
47	10		
22	10		

4. Construct a second oscillator with a period of 1 s. You can make a high value unpolarised capacitor from polarised ones as shown below. Test its behaviour with a pull-down switch and the CRO.



5. Now use the output of the slow oscillator to turn the fast oscillator on and off. Speed up the frequency of the slow oscillator (by changing its component values) until the sound emitted by the speaker is interesting.