



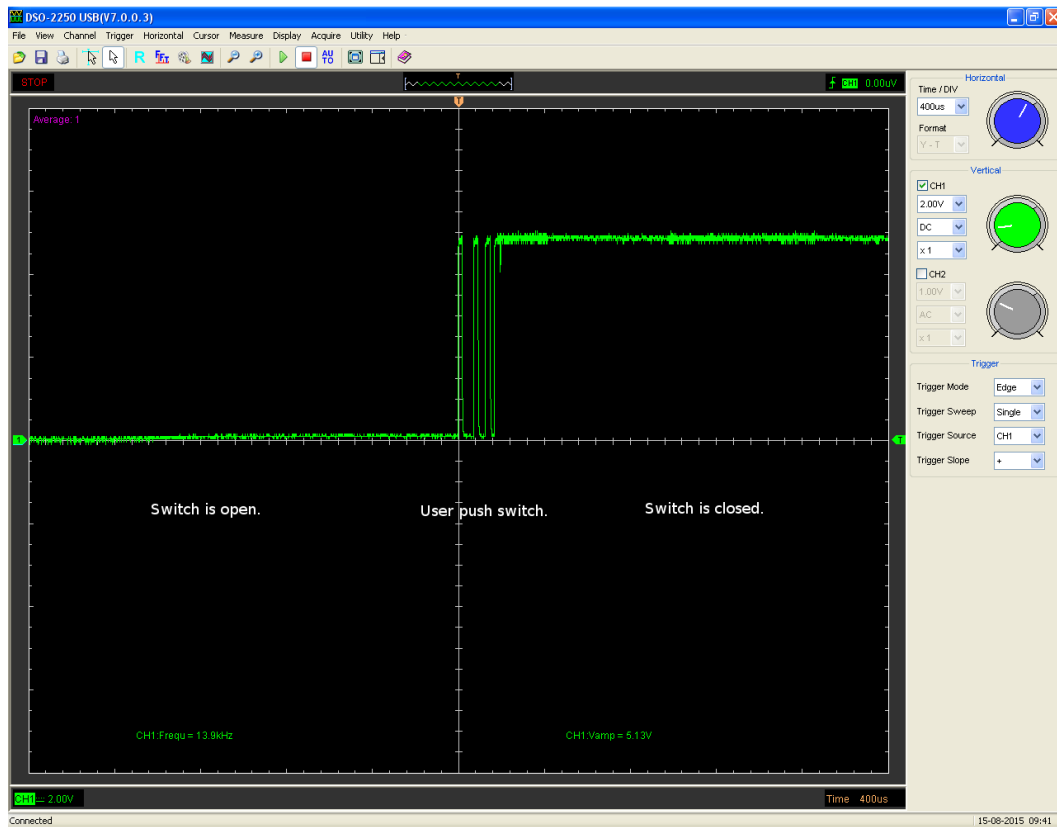
# Bouncing

Not a ball but a “switch”.

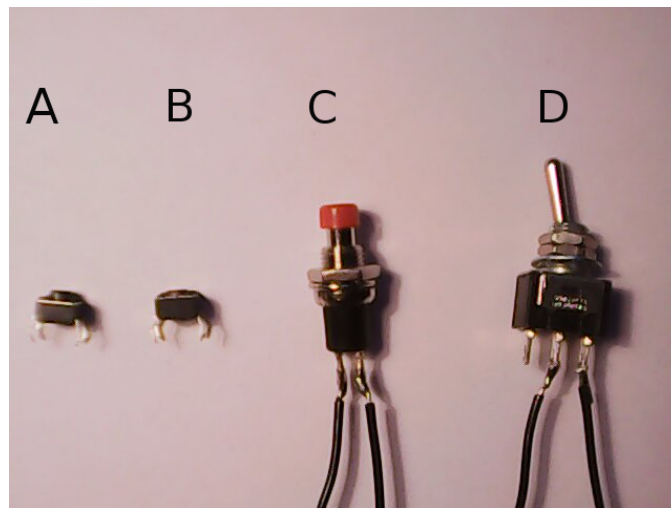
## What is a Switch Bounce?

When you push a button, press a micro switch, or flip a toggle switch, two metal parts come together. For the user, it might seem that the contact is made instantly. However, that is not quite correct. Inside the switch, there are moving parts. When you push the switch, it initially makes brief contact with the other metal part for just a split microsecond. Then it makes contact for a little longer, and again for a little longer. Eventually, the switch is fully closed. During this process, the switch bounces between making contact and not making contact.

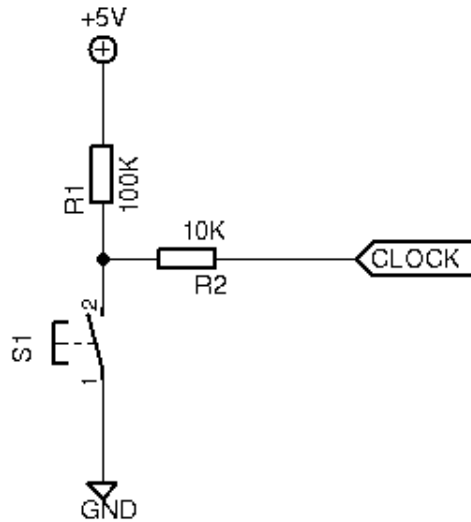
"When the switch is closed, the two contacts actually separate and reconnect, typically 10 to 100 times over a period of about 1ms" ("The Art of Electronics," Horowitz & Hill, Second Edition, pg. 506). Usually, the hardware operates faster than the bouncing, causing the hardware to register multiple presses. This hardware is often an integrated circuit. The following screenshots illustrate a typical switch bounce without any form of bounce control:



If I have following 4 switches how will they bounce?

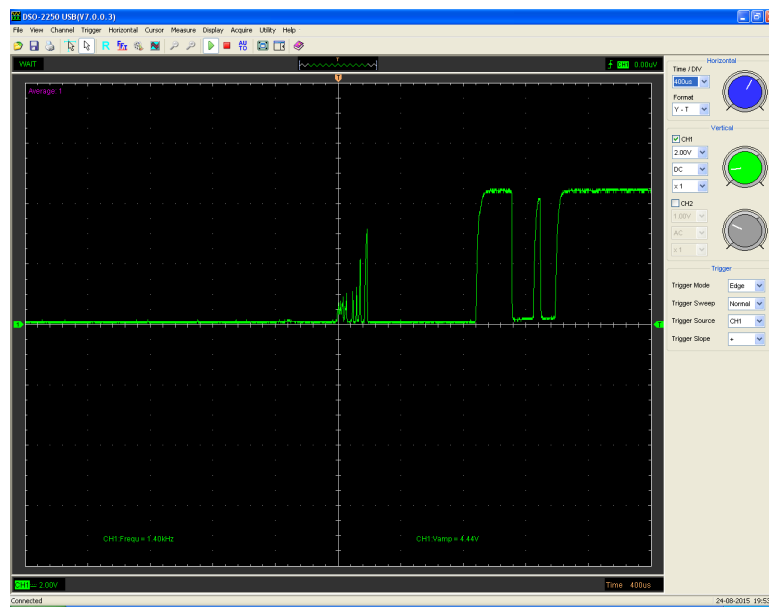


To find out this, let's take following simple circuit and check waveforms across them.

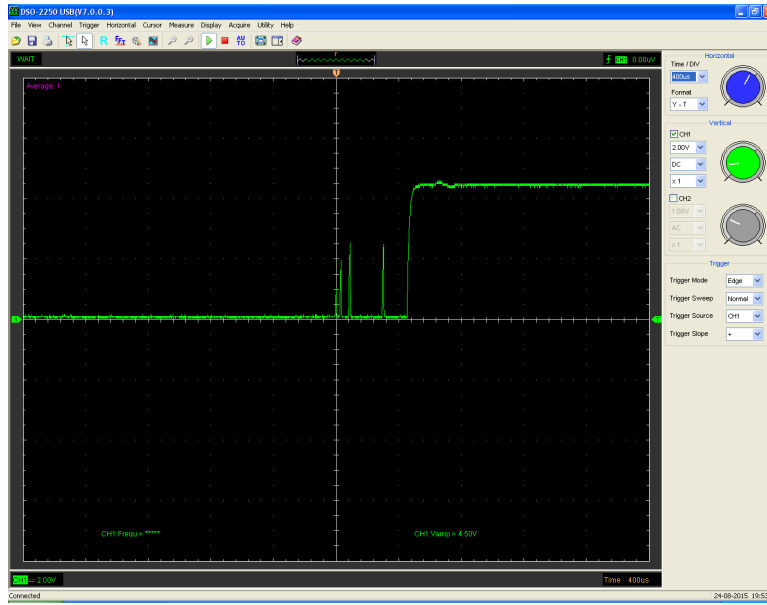


So, the waveforms observed are:

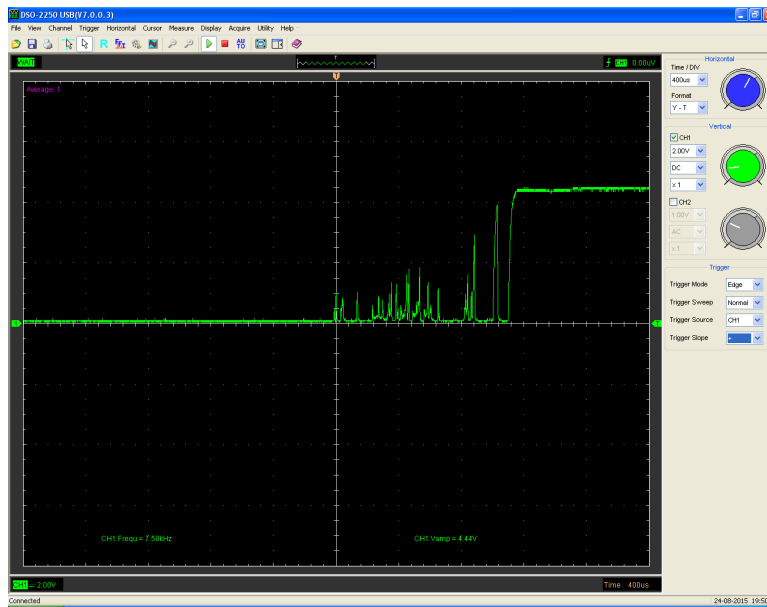
1. *Switch A:*



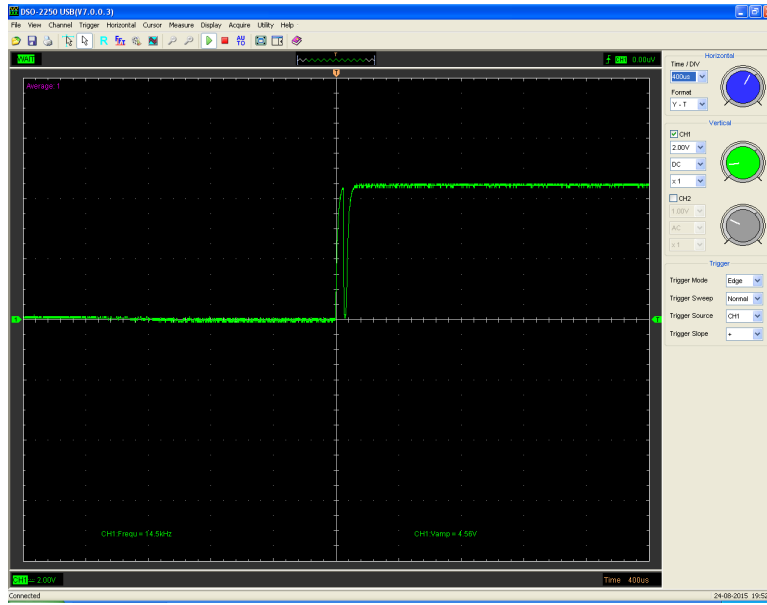
2. *Switch B:*



### 3. Switch C:

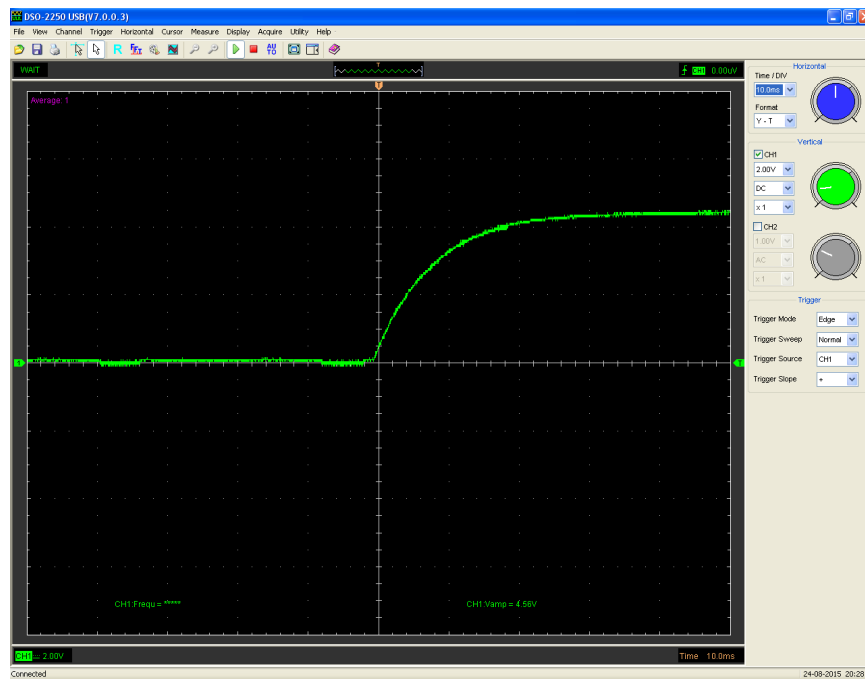


### 4. Switch D:



## How to reduce bouncing?

- **Adding Capacitor** : Capacitor acts like a filter, it smoothen out the waveforms. If we add a capacitor in above circuit the waveform for switch A is:



- **Software Debouncing** : When working with microcontrollers, we can deal with switch bounce in a different way that will save both hardware space and money. Some programmers do not care much about bouncing switches and just add a 50ms delay after the first bounce. This will force the microcontroller to wait 50ms for the bouncing to stop, and then continue with the program.

## Conclusion

This article was all about bouncing of switch, how it affects your system, and different ways to deal with it. The examples that are used are very simple, but they should give you a feeling of what is happening when you push a switch. You should always consider switch bounce when you are designing a system.