Dave, as always thanks so much to you and the community for always digging deep into instruments. Everyone here always does a great job with all of their testing!

Dave did a great job of documenting 3 different issues across a number of products.

1) 5 us jitter
2) AC trigger coupling
3) Rising & Falling trigger

The 5 us jitter issue I have described as:

Trigger jitter variance displayed at 5 us odd intervals of positive trigger offset. I.E. when the trigger is 5 us, 15 us, 25 us… before the center of the display some jitter appears that doesn't appear otherwise.

We tested 3 DS1000Z scopes here with different board revisions including the FW and HW used by Dave. Here are the results:

Scope 1: shows model and revisions as well as 5 us, 15 us, and 25 us offset.

Scope 2: shows model and revisions as well as 0 us, 5 us, and 25 us offset.

Scope 3: shows model and revisions as well as 0 us, 5 us, and 15 us offset.

Conclusions:

None of the scopes we have show any change in the jitter based on trigger delay as far as I can tell. All 3 units with different hardware running the latest FW were rock solid. I was actually hoping to find one that was a little off because I expect a proper warm up and self-cal may solve the issue. You can find the self-cal in the utility menu. Anyone seeing this issue should try a self-cal and if the problem still exists please contact Rigol. If the instrument is out of spec we will absolutely help you with that. We haven't had any report of this problem to date in the USA and a self-cal is a good first check. Certainly, if Mads from EcProjects scope doesn't improve when properly calibrated then it is a bad unit that needs repaired, but tests here indicate that it is not systemic and may be fixed with a self-cal. Dave, can you give yours a warm-up and self-cal and let us know if you see any change at 5 us intervals?

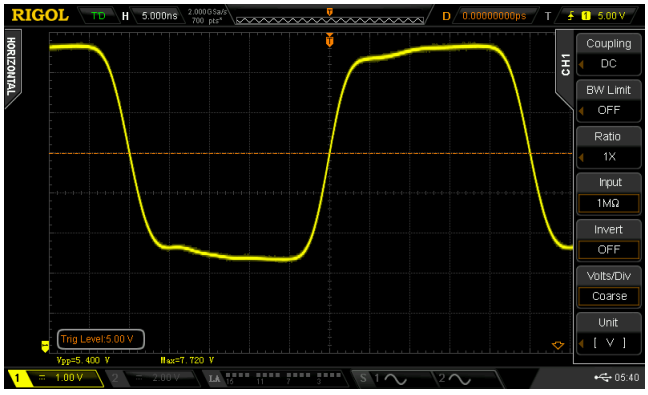
It is also worth noting that if this does continue in some scopes I'd expect a Firmware update solution. Most, if not all, of the DS1000Z triggering sub system is digital. It is handled by FPGAs predominantly. There is no real inherent jitter in those captured signals, so I'd expect a FW solution if there is a verified problem on some units after a self-cal.

AC trigger coupling

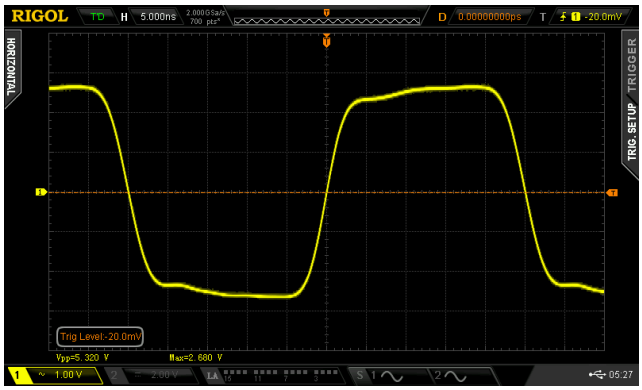
Definition: Setting the Edge trigger to AC coupling causes crazy trigger insanity.

We tested this on 4 different scopes (The previous 3 as well as a DS2000A). Using the scope the way Dave does I verified what he sees. That is an issue that we will immediately address. However, the reason no one has noticed it until now is that isn't really the normal way to look at AC Coupled signals in these scopes. We look at AC coupled signals all the time for a variety of tests without issue. The best reason to do this is often to test a signal with DC offset and keep it centered on the display and not have to get knob cramp by having to always adjust channel and trigger levels as the DC offset changes. The way I do it is to go into the channel menu and set the coupling on the channel to AC and leave the trigger coupling at the default settings. Here is a good example:

The input signal is a 20 MHz square wave (unterminated, like Dave's) except I've added a 5 V offset. So, this signal actually goes from 7.5 V – 2.5 V. Shown here DC coupled:



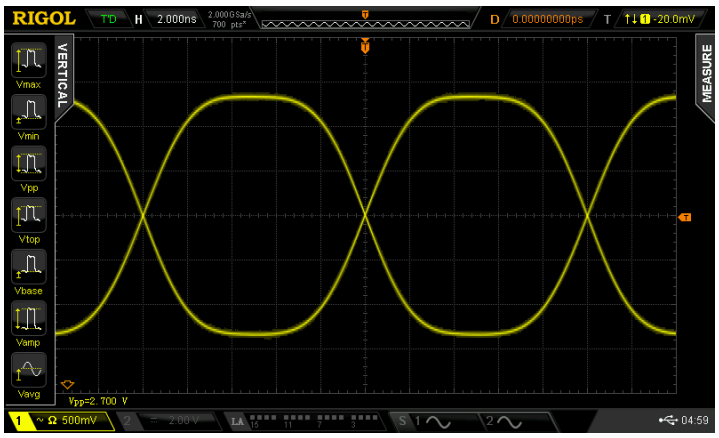
By changing to AC Coupled in the Channel menu it centers around 0 V as expected here:



Now notice the trigger line almost right at 0 V. The trigger system is being fed the AC coupled signal from the channel allowing you to trigger with the signal as it is shown on the screen. This is the common and normal way to use AC Coupling on a channel. As you can see this works great! AC coupling just the trigger and not the channel is pretty confusing because it either does nothing if the signal is centered around 0 V or you would then have to trigger at a level close to 0 V at a different point on the display than where the signal appears. So, you could no longer set the trigger level visually. Because of that confusion I'd never use the coupling in the trigger menu and would always use the coupling in the channel. That's not to say that it shouldn't work, but I can't think of any reason why I'd want to use that setting since any signal I put into it I want to have coupled AC on the display as well. So, I think there is a much better way to use the scope, but it is still something we will fast track a firmware version to improve.

Problem 3: Rising/Falling Trigger issue

Checking this on our DS2000A here I believe what Dave sees is a combination of trigger holdoff and the AC coupling issue above. When I measure on an AC coupled channel leaving the Trigger settings alone except for setting it to Rising and Falling it looks great on this scope:



With rising and falling you have to be careful with these repeating square waves. Especially, it turns out at 20 MHz. A 20 MHz square wave takes 50 ns and the default trigger holdoff on the DS2000 is 100 ns so you are always catching one side of the wave because of the holdoff. If you really want to catch both

sides of the wave make sure your trigger holdoff doesn't force you to repeat triggers on one side of the wave consistently.

In summary, great detective work, as always, by Dave and Rigol users worldwide! Keep using your scopes to capture all types of waves including AC coupled waves. We are allocating resources to make sure even the corner cases we have found here exceed expectations. As the instruments are clearly capable of triggering and measuring all signals within their domain whether DC coupled, AC coupled, rising and falling, or with a specified trigger offset I don't see any hardware issues across any of the released versions. Improvement in guiding users on how to make measurements and when to use settings is and needs to be a continuous process.

I can't think of any use cases on this scope where you would want to AC couple the triggering of a DC coupled channel. It doesn't work for me. If anyone is willing to share insight with us please follow this link to help us improve the interface.

http://beyondmeasure.rigoltech.com/acton/form/1579/0019:d-0001/1/index.htm

Here is a summary of the questions after the link in case you want a sneak peak:

- How often do you use AC coupling on your scope?
- When you use AC coupling on a channel, why do you do it?
- When you trigger on a AC coupled signal how often do you want to view that signal DC coupled on the display? If you do, please explain the use case.
- If you do this, how do you want the trigger level shown on the display since it is now decoupled from the signal visualization on the display?

Lastly, if anyone has questions or concerns they want to discuss with us, we are always here. Contact your local Rigol office or distribution partner. Our USA number is 877-4-RIGOL-1. Every DS1000Z bought in the USA is under our 3 year warranty program and Rigol quality is important to us all over the world.

Thanks,

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