

Firmware 2.06.3 bug list:

Current firmware bold border marked.

Colors : red - bug, light red – minor bug, orange - sill something to fix but progress, yellow – almost there ..., green – fixed

Bug number	2.06.3 120224.0	2.06.3 120423.0	2.06.3 120507.0	2.06.3 120625.0	2.06.3 120808.0	2.06.3 121027.0	
1	Only on B models	Only on B models	Only on B models	fixed	fixed	fixed	
2	see description	see description	see description	see description	see description	see description	
3	see description	see description	see description	see description	see description	see description	
4	BUG	BUG	BUG	Some progress, but function disabled in this fw version	Some progress, but function disabled in this fw version	Some progress, but function disabled in this fw version	
5	BUG	Partially fixed -GPL released, SDK some documentation shared	Partially fixed -GPL released, SDK some documentation shared	Partially fixed -GPL released, SDK some documentation shared	Partially fixed -GPL released, SDK some documentation shared	Partially fixed -GPL released, SDK some documentation shared	
6	see description	see description	see description	see description	see description	see description	
7	BUG	BUG	BUG	BUG	BUG	Removed from to-do	
8	BUG	BUG	BUG	BUG	BUG	Fixed	
9	BUG	see description	see description	Fixed	Fixed	Fixed	
10	BUG	see description	see description	Fixed	Fixed	Fixed	
11	BUG	BUG	BUG	Like fixed – new scale looks better	Fixed	Fixed	
12	BUG	BUG	BUG	Fixed	Fixed	Fixed	

Bug number	2.06.3 120224.0	2.06.3 120423.0	2.06.3 120507.0	2.06.3 120625.0	2.06.3 120808.0	2.06.3 121027.0	
13	BUG	BUG	BUG	BUG	BUG	BUG	
14	BUG	BUG	BUG	fixed	fixed	fixed	
15	BUG	BUG	BUG	BUG	See description	See description	
16	BUG	Fixed, /dso/app/dsod as WD checking profile and dso.exe state	Fixed, /dso/app/dsod as WD checking profile and dso.exe state	Fixed, /dso/app/dsod as WD checking profile and dso.exe state	Fixed, /dso/app/dsod as WD checking profile and dso.exe state	Fixed, /dso/app/dsod as WD checking profile and dso.exe state	
17	BUG	Partially fixed, see description	Partially fixed, see description	Fixed	Fixed	Fixed	
18	BUG	BUG	BUG	BUG	BUG	BUG	
19	BUG	BUG	BUG	BUG	BUG	BUG	
20	BUG	BUG	BUG	BUG	BUG	BUG	
21	BUG	BUG	BUG	BUG	BUG	BUG	
22	BUG	BUG	BUG	BUG	BUG	BUG	
23	BUG	BUG	New bug or fix in progress???, function disabled in this fw version	function disabled in this fw version	function disabled in this fw version	function disabled in this fw version	
24	BUG	BUG	BUG	BUG	See description	See description	
25	BUG	BUG	BUG	BUG	BUG	almost fixed, see description	
26	Not exist in this version	Not exist in this version	Not exist in this version	See description	See description	Fixed	
27	Not exist in this version	Not exist in this version	Not exist in this version	Not exist in this version	BUG	BUG	
28	BUG	BUG	BUG	BUG	BUG	Fixed?	

Bug number	2.06.3 120224.0	2.06.3 120423.0	2.06.3 120507.0	2.06.3 120625.0	2.06.3 120808.0	2.06.3 121027.0	
29	BUG	BUG	BUG	BUG	BUG	BUG	
30	BUG	BUG	BUG	BUG	BUG	BUG	
31	BUG	BUG	BUG	BUG	BUG	BUG	
32	Not exist in this version	Not exist in this version	Not exist in this version	Not exist in this version	Not exist in this version	Not exist in this version	
33	OK	BAD	BAD	BAD	BAD	BAD	

List of bugs/improvement requests

1. Select any of the new functions like "Printer Cfg", "Option, Wave" (any many others), push HELP button on the front panel and the DSO is crashing and not responding anymore.
2. Apply test signal, do auto setup to trigger properly. Set time base to 4ns/DIV, change Acquisition mode from "Real Time" to "Equ Time", hide menu by pushing F0, turn time base knob from 4ns/DIV to 2ns/DIV and DSO is crashing and not responding anymore. **This bug seems to exist only on DSOs where the factory calibration (not self-calibration!) is somehow invalid. After user-executed factory calibration bug disappeared. Is there something in "chk1kb_091023" which can be changed to fix that? (User-executed factory calibration is not an option).**
3. Apply test signal, do auto setup to trigger properly. Set time base to 4ns/DIV, change Acquisition mode from "Real Time" to "Equ Time", hide menu by pushing F0. When menu hidden you can see artifacts on the right side of the screen. They don't need to be there. **This bug seems to exist only on DSOs where the factory calibration (not self-calibration!) is somehow invalid. After user-executed factory calibration bug disappeared. Is there something in "chk1kb_091023" which can be changed to fix that? (User-executed factory calibration is not an option).**
4. Digital Filters to be implemented.
5. SDK to be released
6. Update FPGA design to match ADC skew/timings in 125MHz/1GSs mode (this is already known issue and listed in old "issue list", posting once again in this list as reminder)
FPGA design revision 83E8 sample rate 1GS/s clocks skew (must be always 1000ps):
 - Clock 8->Clock 1: 1010ps
 - Clock 1->Clock 7: 1250ps
 - Clock 7->Clock 2: 550ps
 - Clock 2->Clock 6: 1230ps
 - Clock 6->Clock 3: 1000ps
 - Clock 3->Clock 5: 1280ps
 - Clock 5->Clock 4: 500ps
 - Clock 4->Clock 8: 1250psFPGA design revision 83E8 sample rate <= 800MS/s clocks skew (must be always 1250ps):
 - Clock 8->Clock 1 1250ps

Clock 1->Clock 7 1260ps
Clock 7->Clock 2 1280ps
Clock 2->Clock 6 1230ps
Clock 6->Clock 3 1260ps
Clock 3->Clock 5 1280ps
Clock 5->Clock 4 1230ps
Clock 4->Clock 8 1260ps

FPGA design revision 83E9:

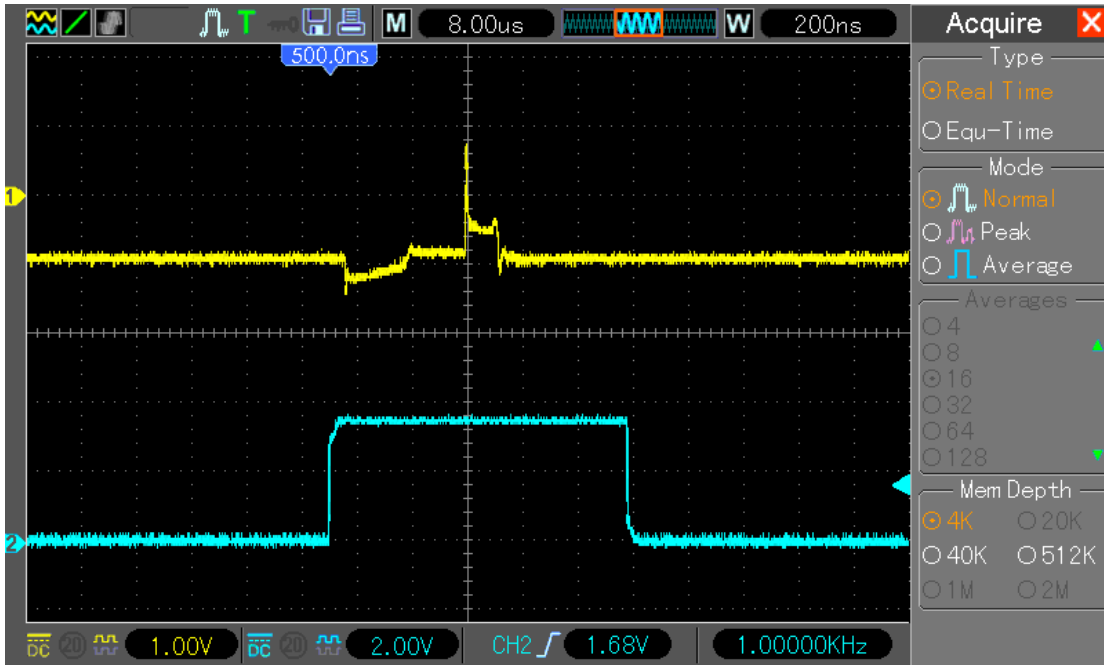
not yet measured, but Hantek statement *"It's impossible for us to achieve it now"*
is not really optimistic.

~~7. add 20ksamples/16ksamples/8ksamples (whatever possible, if possible) to memory depth,
preferred with highest possible sample rate. This is in principle what already published as
"available" in the user manual or on Tekway and Hantek websites.~~

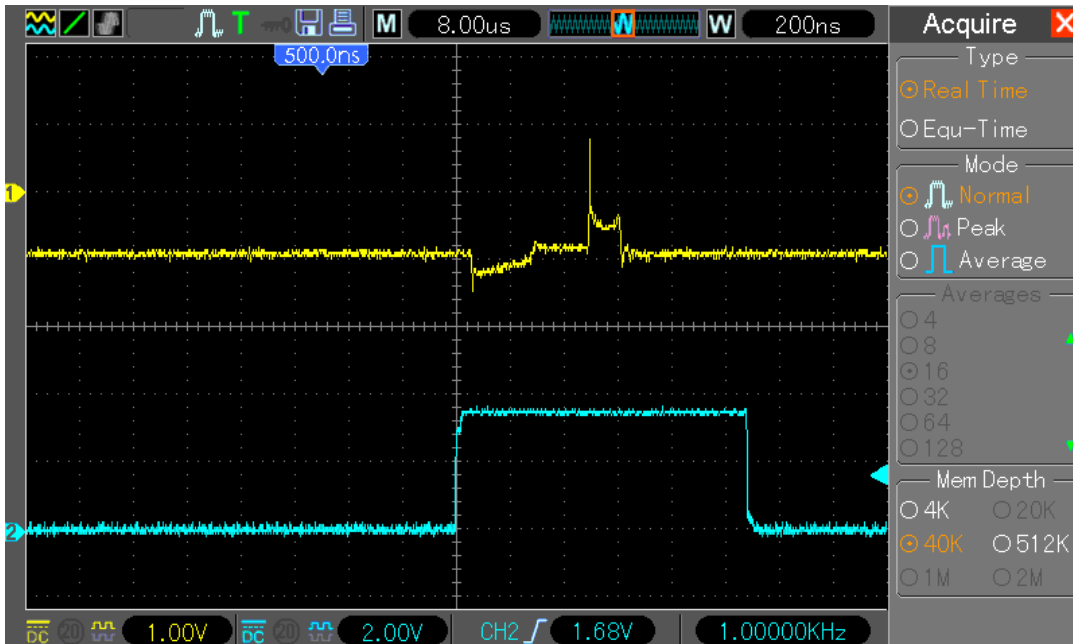
This was only proposal, it has been removed from to-do as "not important". I'm fine with that as
long other bugs would get fixed!

8. In single window, sample memory $\geq 40k$, both channels (ch1, ch2) enabled and time base from 400ns/div up to 2ns/div the position change (fine and coarse) control is not working. Only scale is moving, but not the waveform. See attached picture to understand issue:

with 4k memory when changing position waveform is moving



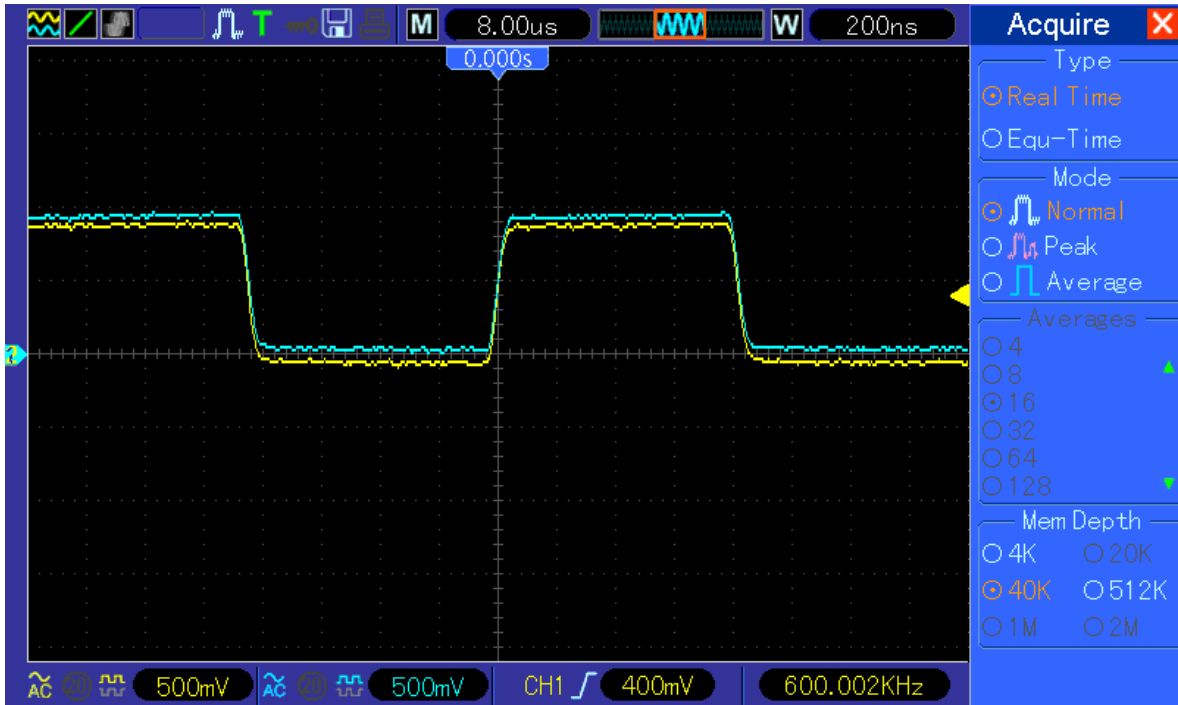
with 40k and above, when moving changing time base position waveform is NOT moving when in RUN mode (but works in STOP mode)



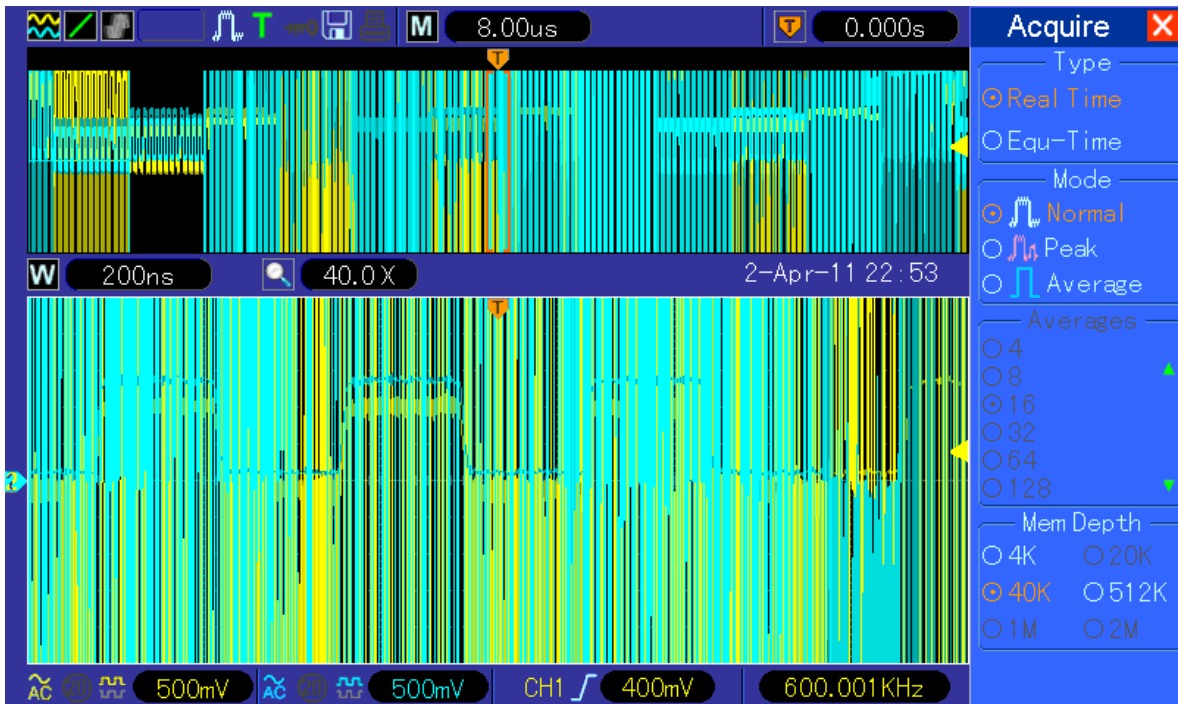
9. In single window mode, sample memory 40k, both channels (ch1, ch2) enabled – while switching to dual window mode artifacts on screen and DSO later crashing and not responding.

Artifacts disappear when changing timebase just after switch to dual window, so just an init error?

Set like on picture



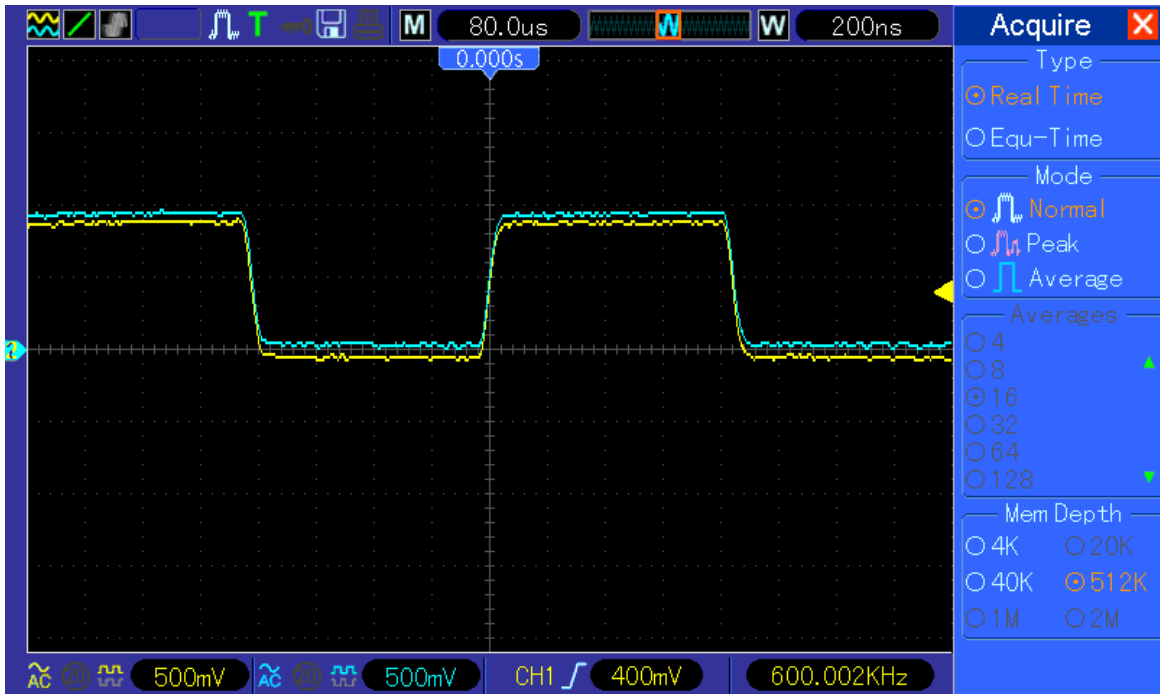
and switch dual window mode to see artifacts like this:



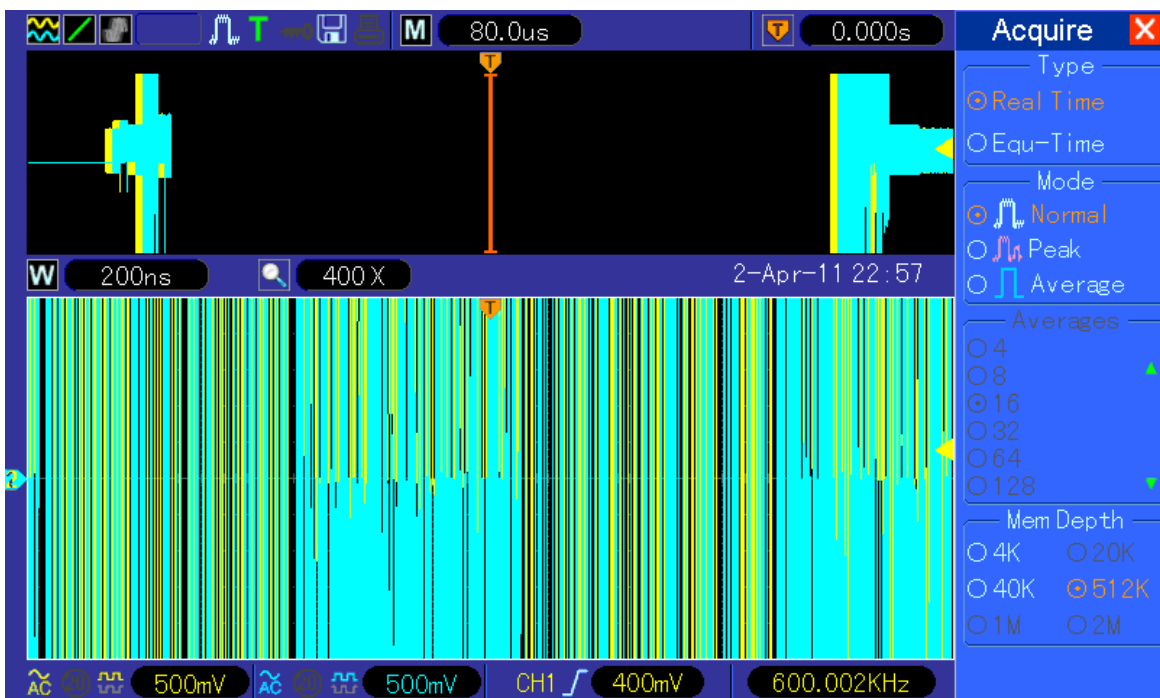
10. In single window mode, sample memory 512k, both channels (ch1, ch2) enabled – when switching to dual window mode artifacts on screen and DSO later crashing and not responding

Artifacts disappear when changing timebase just after switch to dual window, so just an init error?

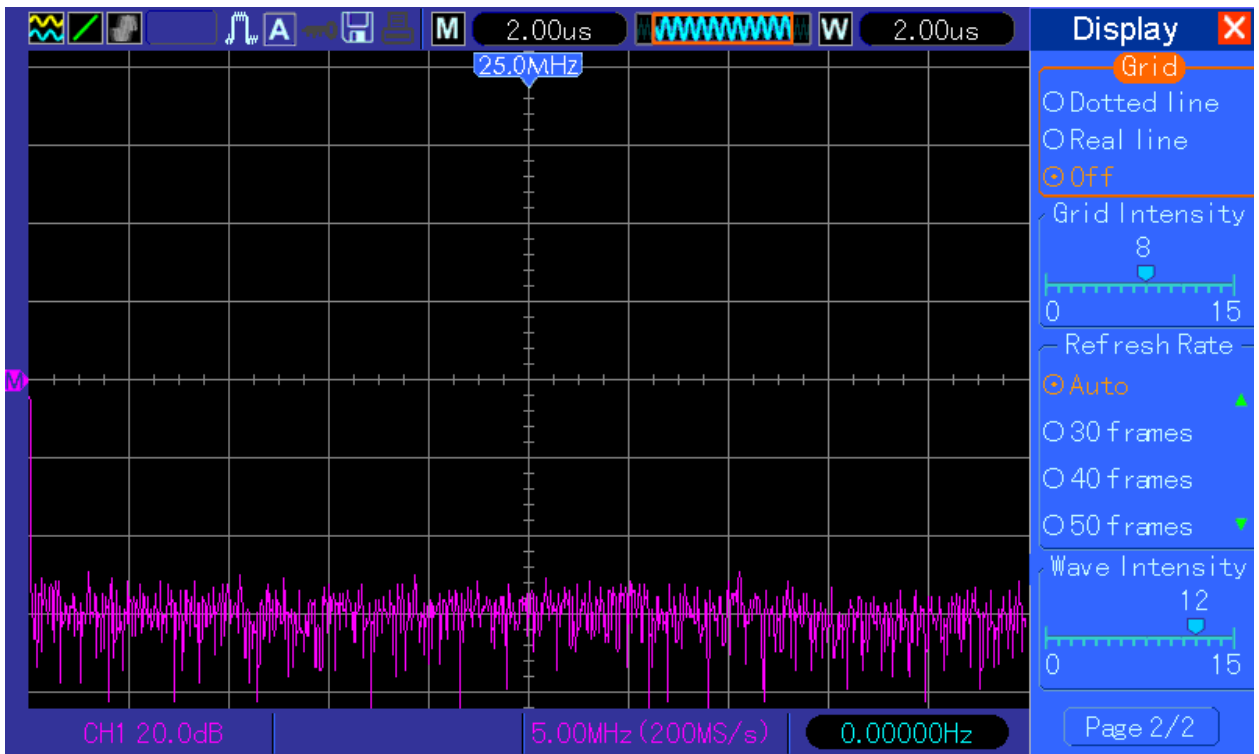
Set DSO like on picture



and switch dual window mode to see artifacts like this:

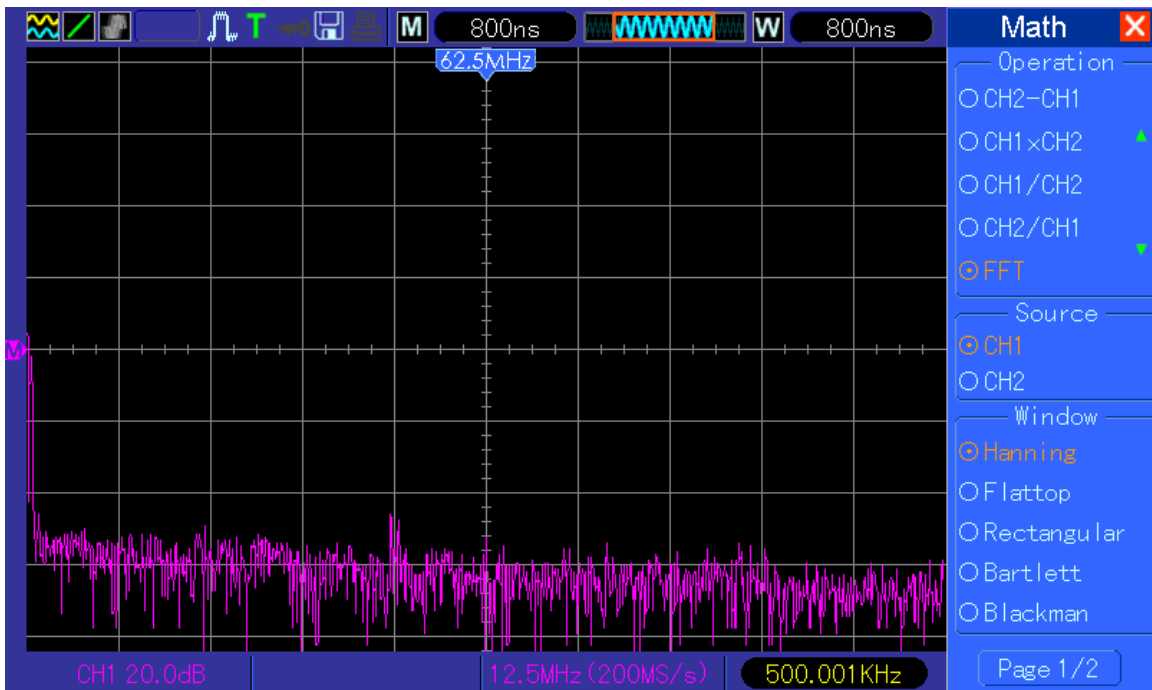


11. In FFT mode the Display -> Grid option is not changing the grid, it is always “real line” and not possible to change to “dotted line” or “off”.

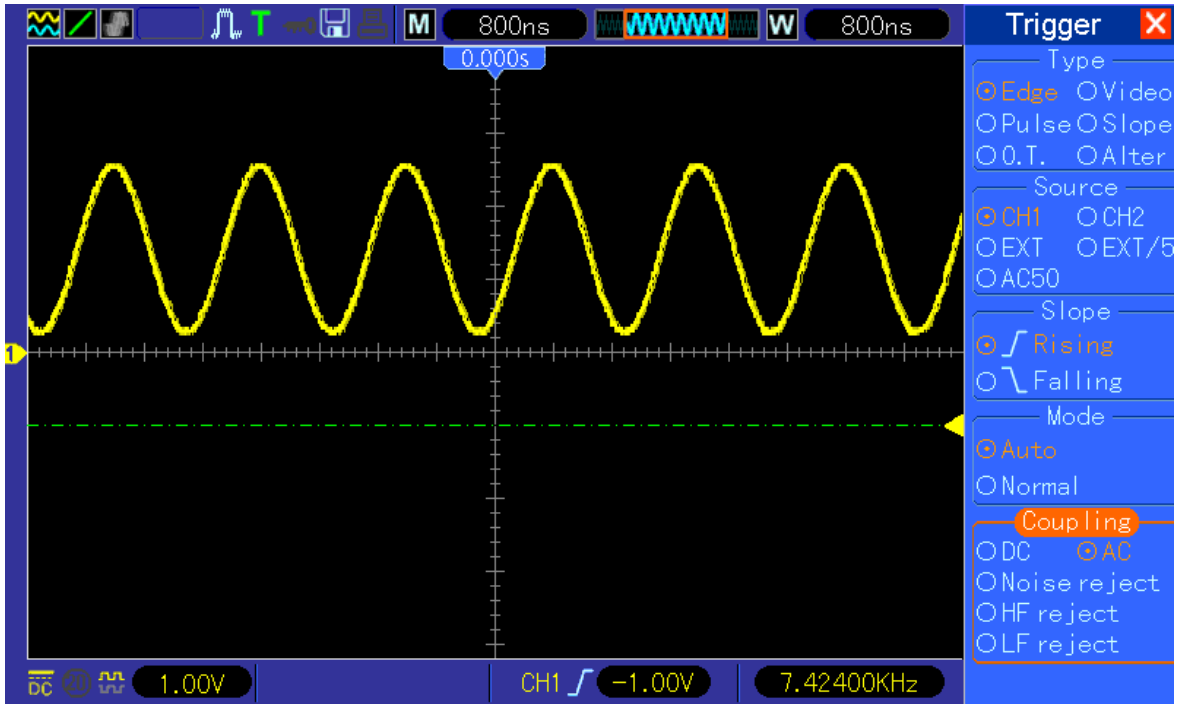


12. In FFT mode “Full span” is higher than Nyquist (sample rate / 2)

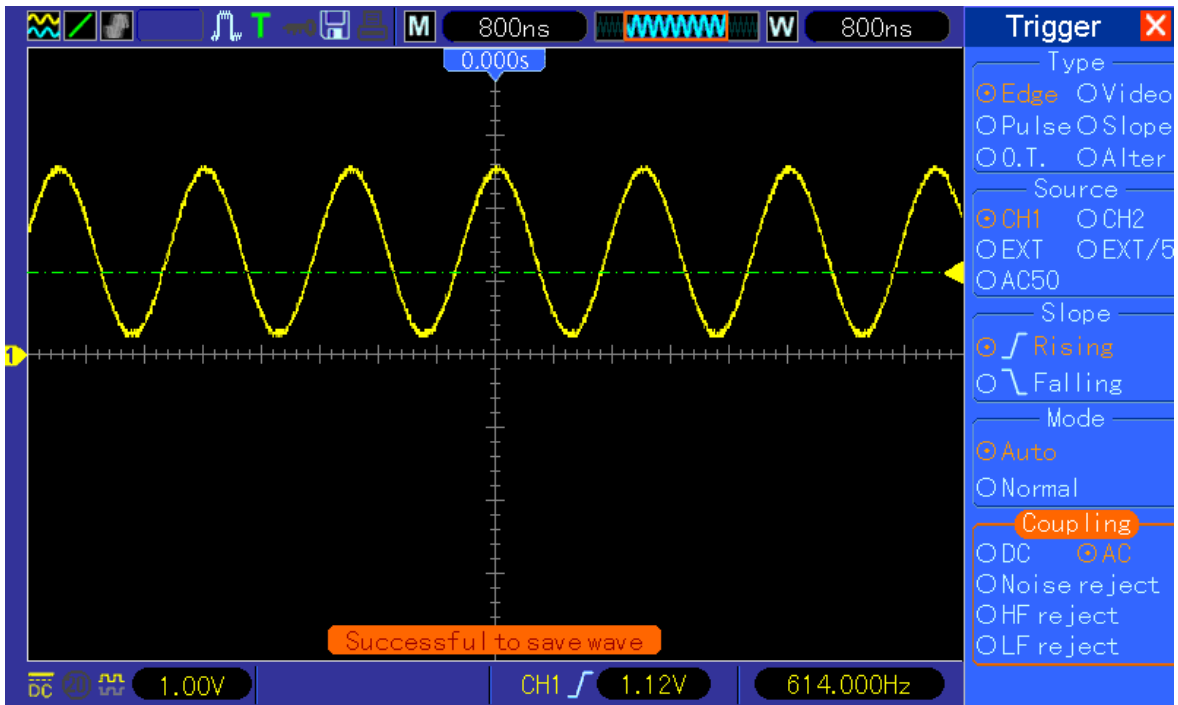
Example: 800ns/DIV, sample rate is 200MSs, full span 125MHz. Easy to fix by enabling from 800ns/DIV to 20ns/DIV 1GSs sampling (when 4k memory or FFT enabled)



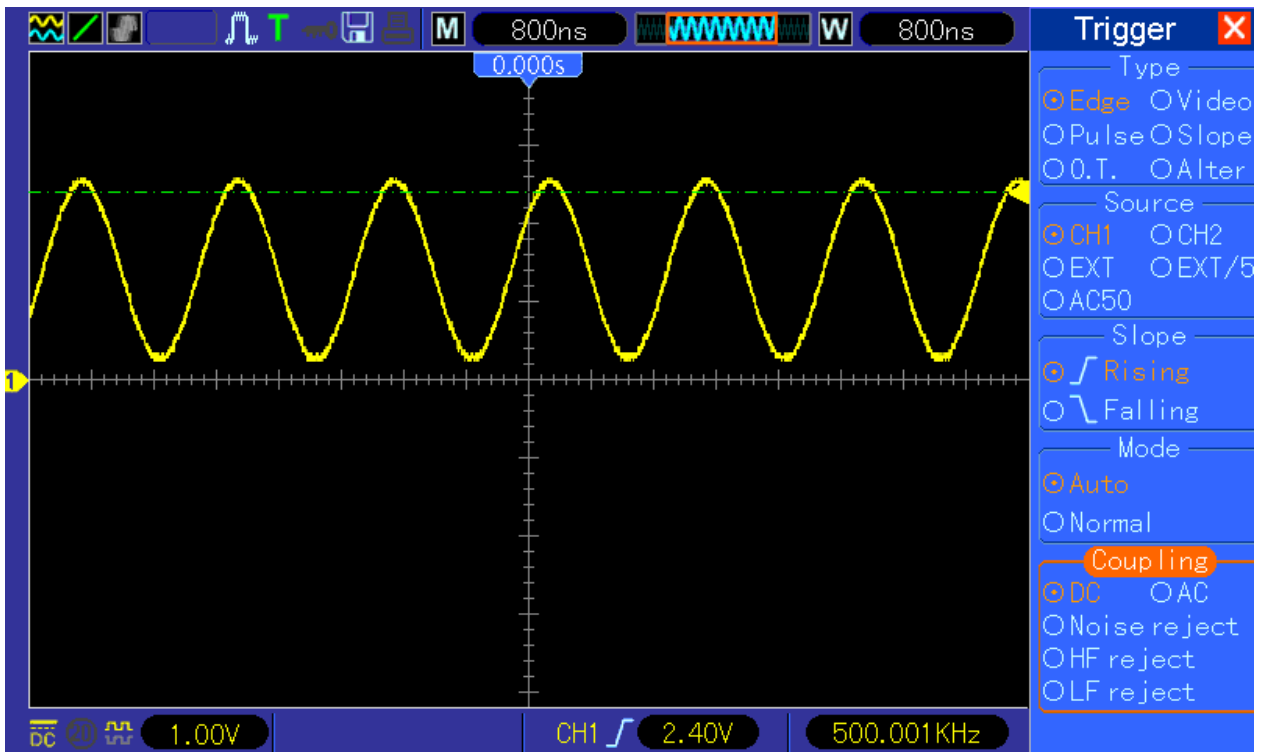
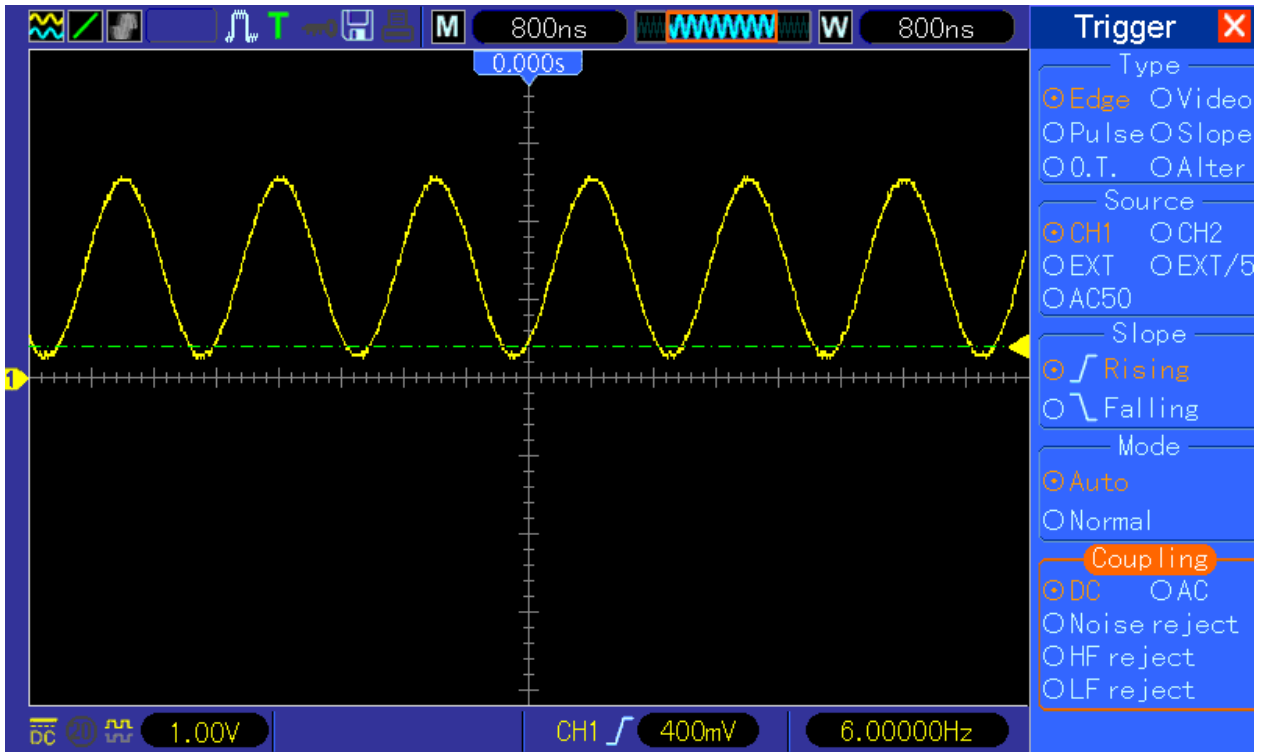
13. AC trigger indicator and line wrong. Set ch1, signal DC coupled, trigger AC coupled. The trigger lowest level below signal :



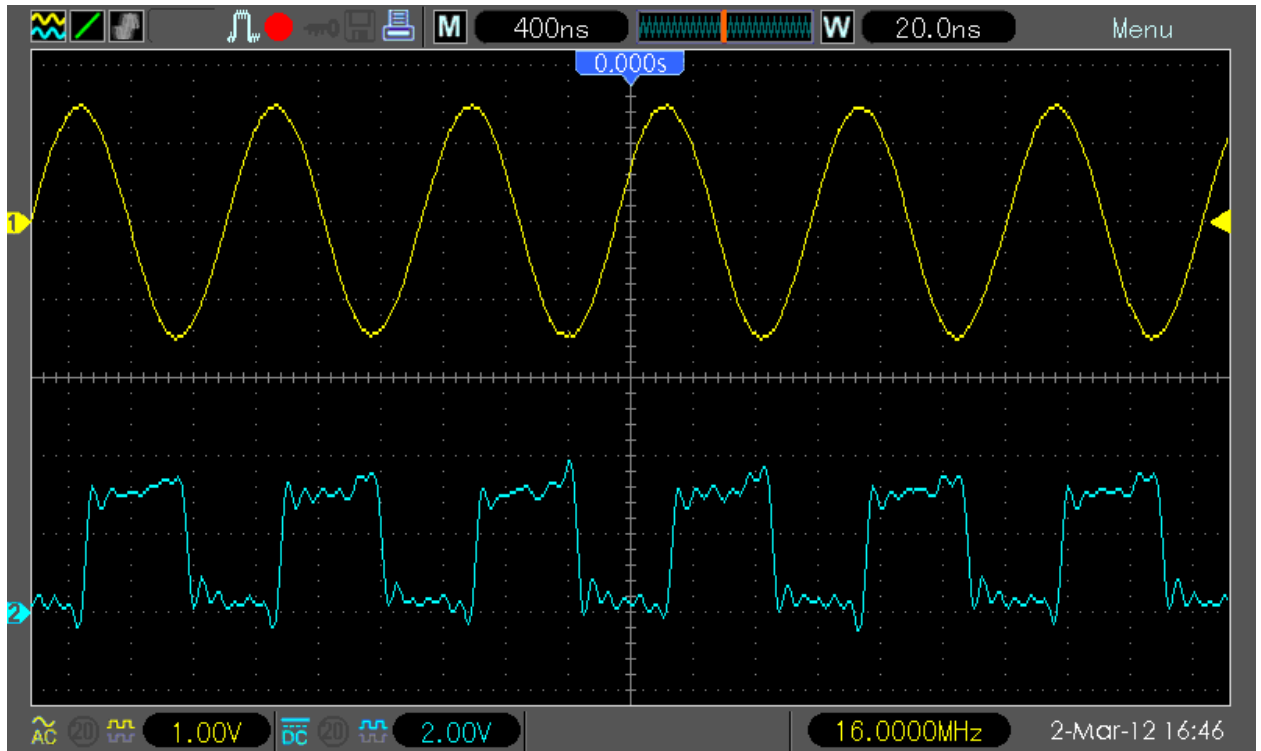
highest level only mid of signal



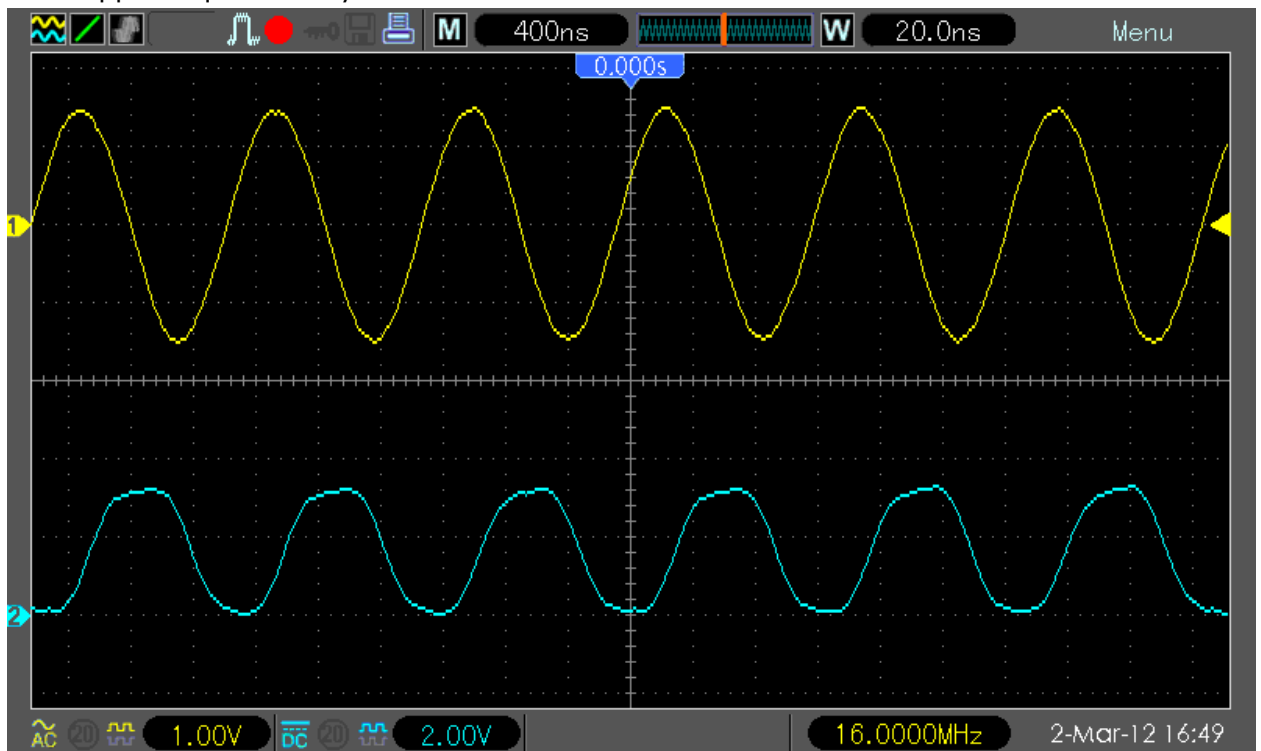
But both should look like when trigger coupled in DC mode:



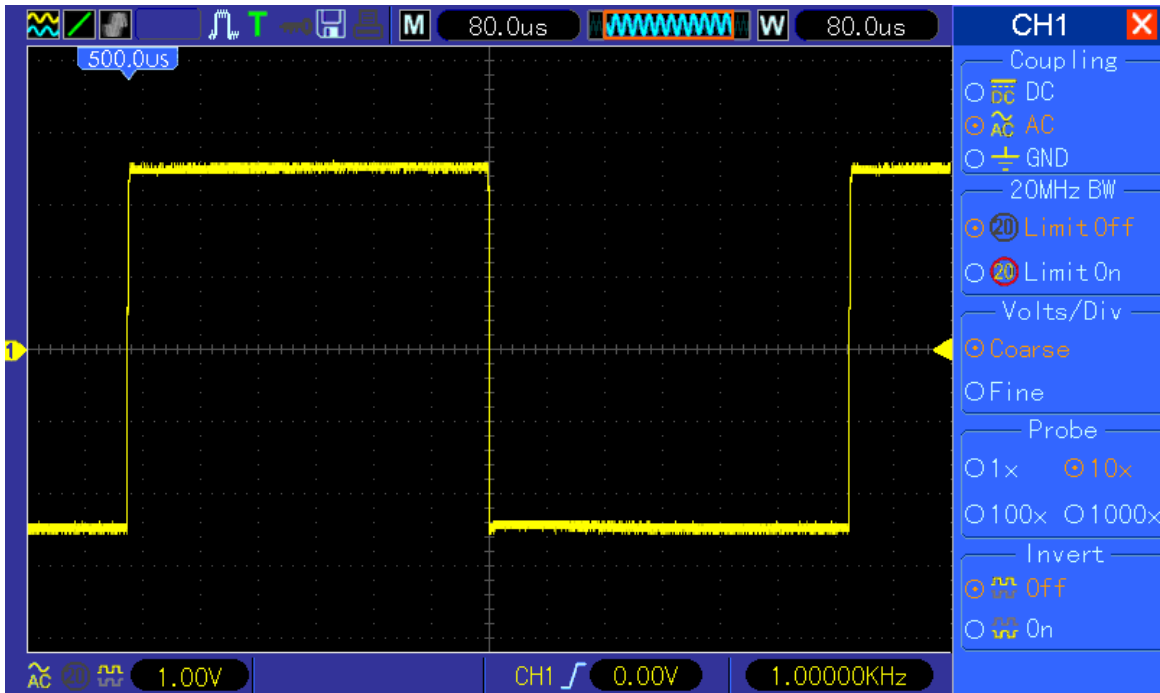
14. Dithering/interpolation filter of waveform too sharp. When enabling both channels (this also occurs in single channel mode and 1GSs, but test signal need to be higher to get same error) and applying for example 16MHz square wave the waveform is switching between proper square:



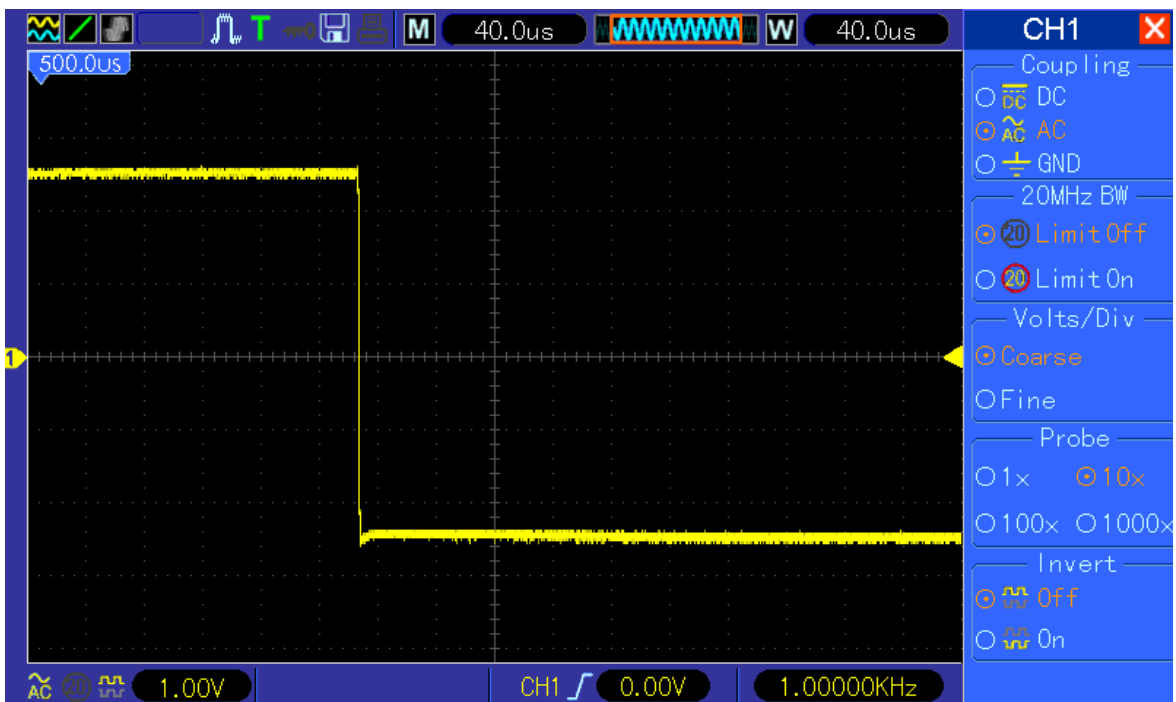
and crippled square every second:



15. Display / Time base scaling strange behavior. When you apply e.g. 1kHz signal, set time base to 80us/DIV and move the waveform to 500us/DIV (bug only in 4/40k memory depth, 512k/1M/2M works fine):



When you now change time base to 40uS/DIV the falling edge (which should be still in the middle of the screen) has been moved to 454uS position (but it should stay on 500uS). The same happens of course with 20uS/DIV.



16. Develop failsafe into rcS script.

Currently when firmware does have bug and DSO is crashing, or even with no bug but when user is powering off the DSO while the dso.exe is saving the profile/DSO settings into the

`/param/sav/run1kb_XXXX`

file it is possible that this file will get damaged. When this happens DSO is not starting up properly.

The failsafe can be separate executable loaded in rcS before dso.exe is loaded. This file will then check if “default button” is pressed. If so, this executable will purge settings/profiles and terminate itself. The dso.exe will then start up with default settings as no profiles saved.

17. The new function “Wave” is no working properly in some models. There is missing the directory `/param/sav/wave_sav` on 2.6.13 kernel loaded DSOs.

Additionally there is typo in ARM source code,

GetWaveAreaAndRight	text	0004
GetWaveAreaGridKind	text	0004
GetWaveDispMode	text	000C
GetWaveSaveFileName	text	000E
GetWaveSignType	text	0001
GetWaveSpecExtremeVal	text	000E
GetWinAreaBufDrawVStart	text	000E
GetWinAreaHeadTail	text	000E
GetWinTextId	text	000C
GetWindowDataYHeadTail	text	000A
GetWindowStopModeParamDisp	text	000E
GetWindowWaveParam	text	0003
GetWindowWaveParamFromAcq	text	0003
GetWindowWaveParamFromAcqBak	text	0003
GetWindowWaveParamFromAcqBak2	text	000E
GetWindowWaveParamFromAcqBak21	text	000E
GetWindowWaveParamFromAcqBak3	text	000E
GetWindowWaveParamFromDisp	text	0003
GetWindowZoom	text	0007
GetWindowZoomFact	text	0007
GetWindowZoomMax	text	0008
Get_AutoMeasureWave	text	0006
Get_CursorDelta	text	000C
Get_DotNumPerVerticLine	text	0006
Get_DotTypeNum	text	0007
Get_FFTPerCoPixelCnt	text	000E
Get_FixedWidthStLineYLen	text	0008
Get_HelpDBByAlias	text	0002
Get_HelpInfoZDisp	text	0002
Get_HelpPageContentByD	text	0002
Get_HelpPageContentInfo	text	0002
Get_HelpPageInfoKeyword	text	0002

```

.text:00059110 LDR R1, =aSDS ; "%s%d%s"
.text:00059114 LDR R2, =aParamSavWave_5 ; "/param/sav/wave_sav/"
.text:00059118 MOV R3, R12
.text:0005911C BL sprintf
.text:00059120 B loc_59154
;
.text:00059124 ; CODE XREF: GetWaveSaveFileName+4C7j
loc_59124:
.text:00059124 LDR R3, =p_dso_4
.text:00059128 LDR R2, [R3]
.text:0005912C MOV R3, 0x1198
.text:00059134 LDR R12, [R2,R3]
.text:00059138 LDR R3, =a_hsw ; ".hsw"
.text:0005913C STR R3, [SP,#0x14+var_14]
.text:00059140 LDR R0, [R11,#5] ; 5
.text:00059144 LDR R1, =aSDS ; "%s%d%s"
.text:00059148 LDR R2, =aHntSdWave_sav ; "/mnt/sd/wave_sav/"
.text:00059150 MOV R3, R12
.text:00059154 BL sprintf
;
.text:00059154 loc_59154 ; CODE XREF: GetWaveSaveFileName+507j
; GetWaveSaveFileName+847j
.text:00059154 SUB SP, R11, #4
.text:00059158 LDMFD SP!, {R11,LR}
.text:0005915C BX LR
; End of Function GetWaveSaveFileName
.text:0005915C
;
.text:0005915C
;
.text:00059160 off_59160 DCD p_dso_4 ; DATA XREF: GetWaveSaveFileName+207r
; GetWaveSaveFileName:loc_59160f ...
.text:00059164 off_59164 DCD a_hsw ; DATA XREF: GetWaveSaveFileName+687r
; GetWaveSaveFileName+9C7r
; ".hsw"
; char *off_59168
.text:00059168 off_59168 DCD aSDS ; DATA XREF: GetWaveSaveFileName+747r
; GetWaveSaveFileName+887r

```

`a_hws` `DCB ".hws",0`

once the file extension is `.hsw` and another time it is `.hws` – this is preventing the save/reload from USB to work properly and even sometimes crashing DSO.

From the file format I assume `.hws` is the proper file extension name

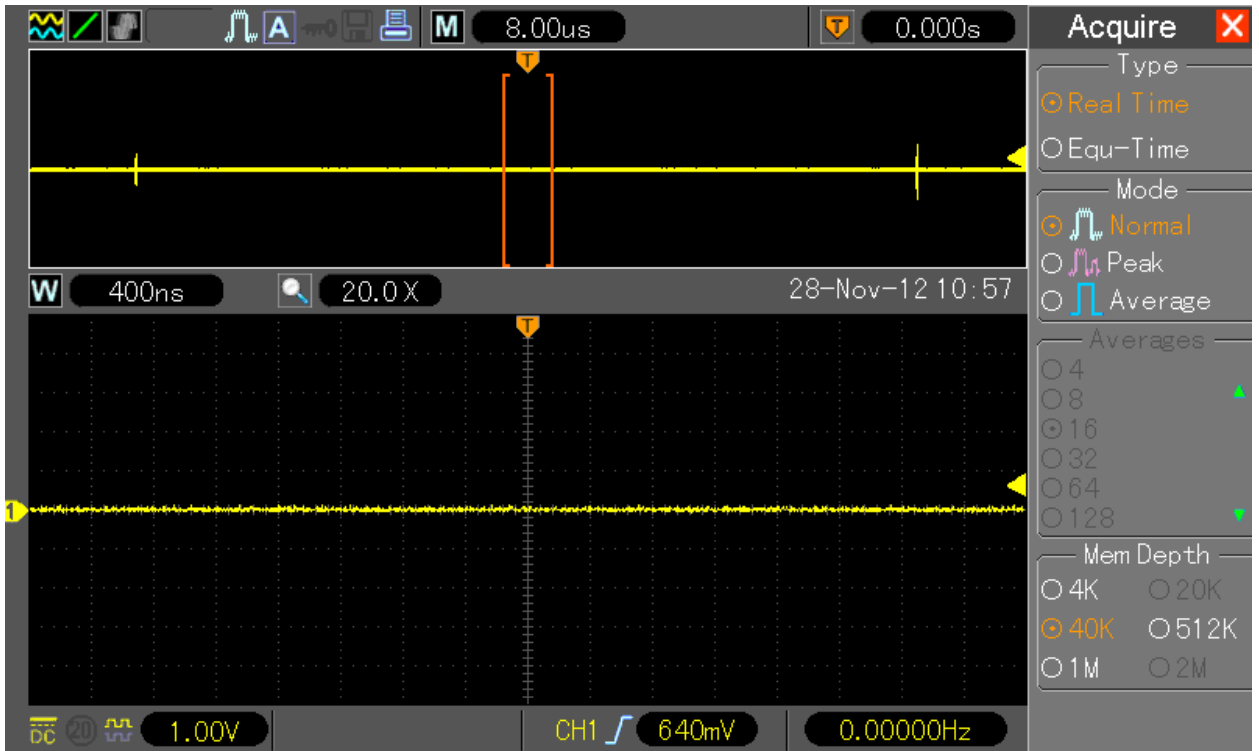
18. The protocol.inf file in every 2.06.03 firmware (DSO5xxxB, BV, BMV and DSO1xxxB) contains error in the definition of [TRIG-SWAP-CH1-PULSE-TIME]. It is defined as "1" byte long but it should be "8" byte. The firmware itself is using 8 byte, only the "protocol.inf" file is wrong.
19. The protocol.inf file in ever 2.06.3 firmware (DSO5xxxB, BV, BMV and DSO1xxxB) contains error in the definition of ALT trigger. The entries for ALT-O.T.CH1 and ALT.O.T.CH2 are missing :
 - [TRIG-SWAP-CH1-VPOS] 2
 - [TRIG-SWAP-CH1-OVERTIME-NEG] 1
 - [TRIG-SWAP-CH1-OVERTIME-TIME] 8
 - [TRIG-SWAP-CH2-VPOS] 2
 - [TRIG-SWAP-CH2-OVERTIME-NEG] 1
 - [TRIG-SWAP-CH2-OVERTIME-TIME] 8
20. Every 2.06.3 firmware (DSO5xxxB, BV, BMV and DSO1xxxB) contains error in the "Trans_DSIOeachData" and "Trans_PCeachData" functions. The "g_FFTWin" table is defined too small, due this SYSData FFT status is having only
 - 0x00 : hanning
 - 0x01 : flattop
 - 0x02 : rectangular
 Barlett and Blackman are missing (always sending 0x00 and 0x01 instead of 0x03 and 0x04)
21. In every 2.06.3 firmware (DSO5xxxB, BV, BMV and DSO1xxxB) in SYSData definition the field for FFT -> Vrms is missing, only dBrms available.
22. Every 2.06.3 firmware (DSO5xxxB, BV, BMV and DSO1xxxB) contains error in the "Trans_DSIOeachData" and "Trans_PCeachData" functions. The "g_MSItem" table is defined too small, is having only 0x0B size but since year there are 22 measurement's available.
23. Equivalent sampling not working properly.
24. ~~No real difference when changing Screen Refresh rate (Auto, 30, 40, 50). It looks like "30" is maximum what the current firmware is able to handle, when changing to "40" or "50" no visible difference. This seems to be the case in all firmware's since end of Nov 2011. This was one of the unique features and need to be changed back to what it was before!~~
~~Edit - a little bit better, Auto and 30 are ok, but 50 is still equal to 40 (but it should refresh faster)~~
 I got told that there is no room for improvement, the firmware is running with "full speed"
 Honestly I don't believe that, but for now I would say "fix other bugs first".
25. Waveforms in memory (in some combination of Timebase and memory depth), in display memory and exported data having at begin or/and end of the waveform random data. Also the buffer length seems to be not as it should be, e.g. 4100 instead of 4000 samples. This error seems to be in all firmwares since Mid-December 2011. UPDATE: Exported (csv checked, other formats not because they not documented nor open) data seems to be fine. Display data seems

to be fine for Normal and Peak sampling, in average probably still some issues (not sure if this is now related to bug nr. 27 or if still belongs to 25).

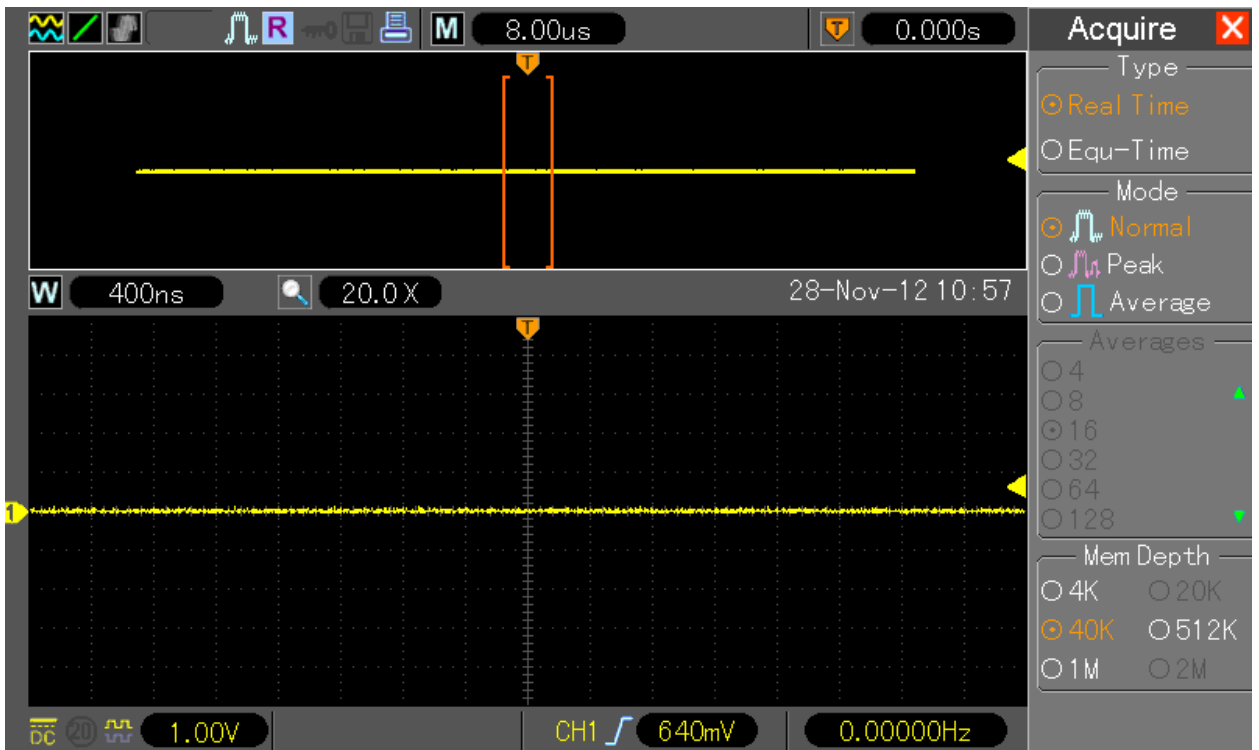
- 26. Main TB not always updating right after dual window enabled. No stability issue at all, scale changing immediately after any control changed. For an interim fw something we can accept as “minor bug”
- 27. While switching from single into dual window mode the main timebase is changing with a wrong factor, e.g. from 200ns/DIV in single into 400ns/DIV in dual window mode. Similar issue in 40k/512k and 1M – in dual window the MTB is twice that high as before in single window mode. Due incorrect timebase the display buffer is showing artifacts on both right and left side of the waveform (end of buffer). Example: CH1 enabled, 40k memory, single window and windows timebase smaller than main timebase, here 400ns/DIV (Main TB is 4us/DIV for 40k)

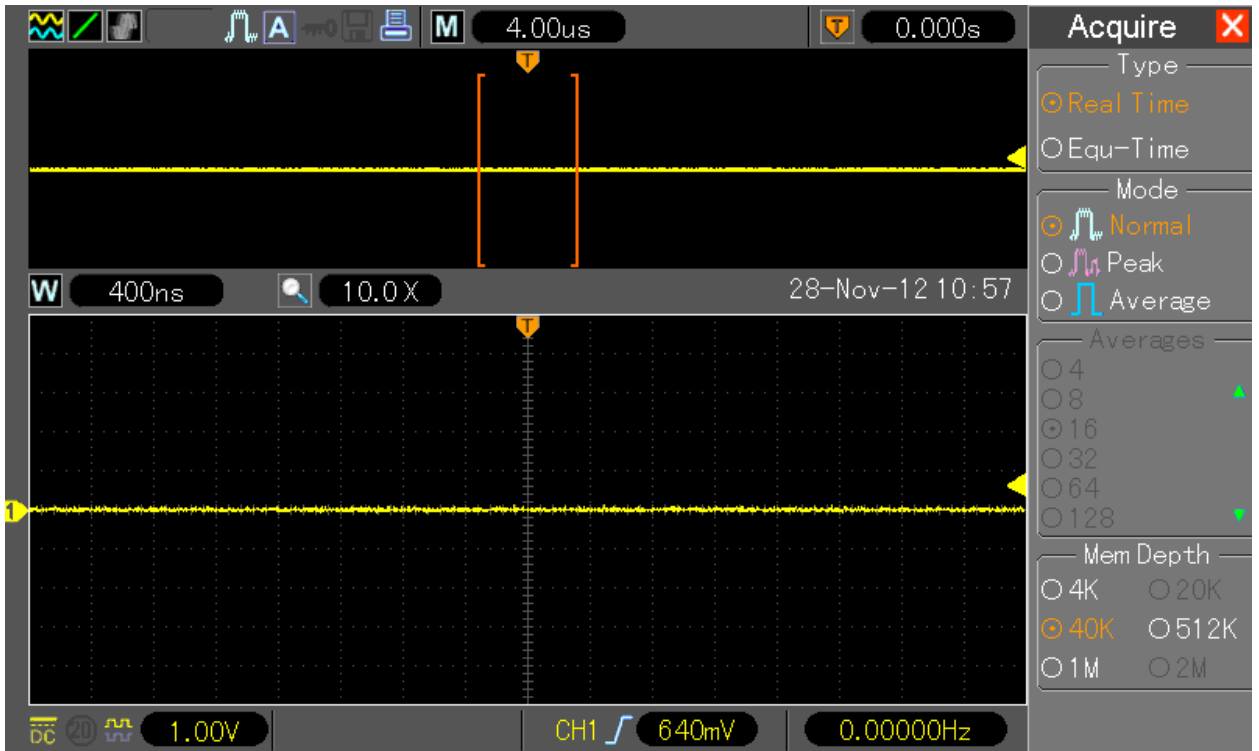


Now when switching to dual window the Main TB is changing to wrong value (here from 4us/DIV to 8us/DIV – actually it will be always doubled in length) and artifacts from “ned of buffer” right and left in top window are shown:

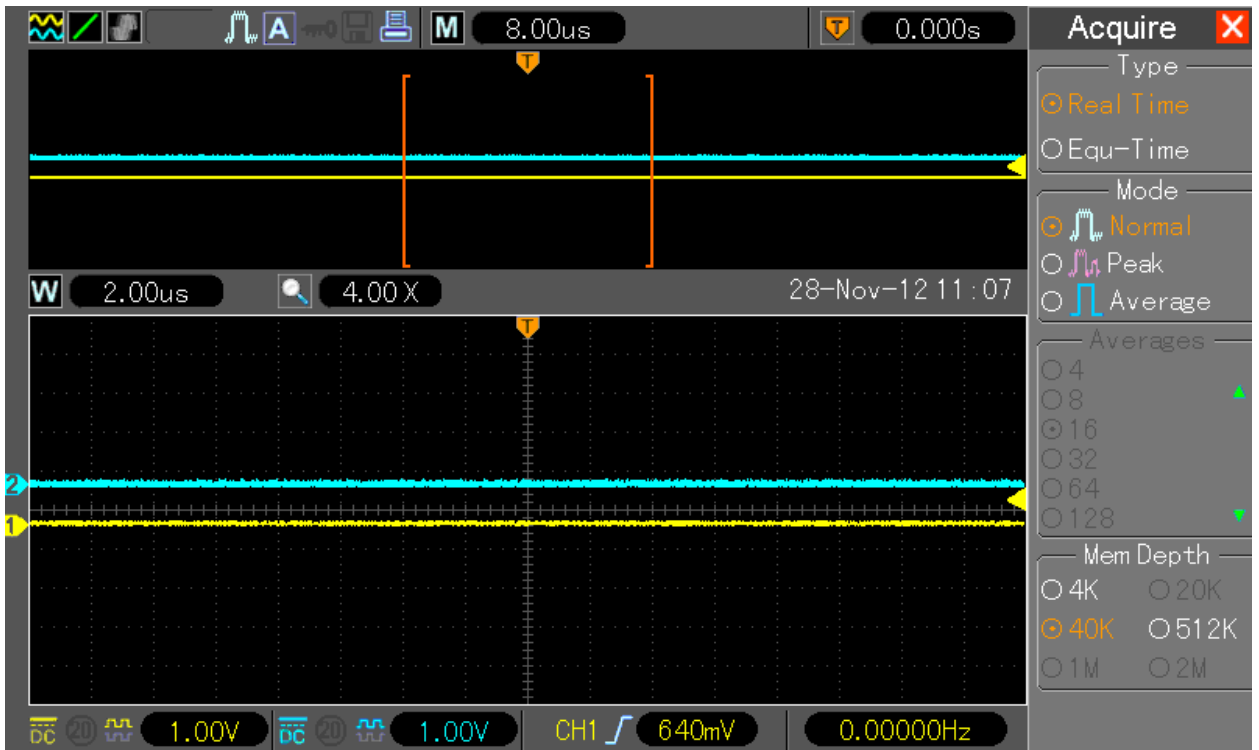


When the Acquisition could be stopped and restarted or Timebase changed one position forth and back (while Main window is focused) the Main TB and displayed data will be fixed to proper length; no artifacts shown anymore:





With 2 channels enabled this bug **DOES NOT EXIST**, this is because the doubled Main TB value is exactly what it should be for dual channel view:



28. Someone told me that there was “problem in csv exported data, no timestamp inside. This seems to be fixed in 2.06.3_121027.0”. Honestly, I see timestamp in scientific format but no idea if this is really fixed; for me it’s a bit strange when multiple data points are on same stamp, e.g. (steps are here in ns valued but then cut in format):

1.58E-03,0.000

1.59E-03,0.080

1.59E-03,0.080

1.59E-03,0.080

If the smallest step is e.g. 40ns then timestamp for every point should be always in ns and not increasing:

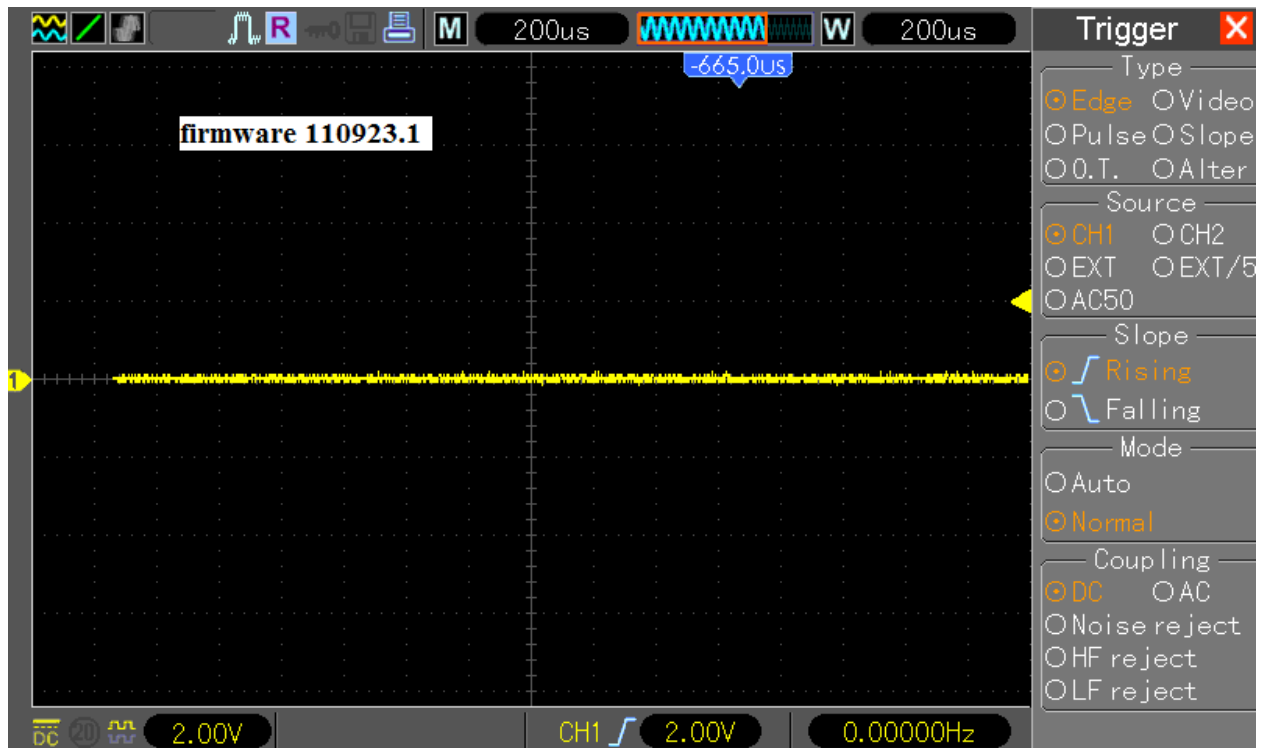
4.00E-07,0.002

8.00E-07,0.000

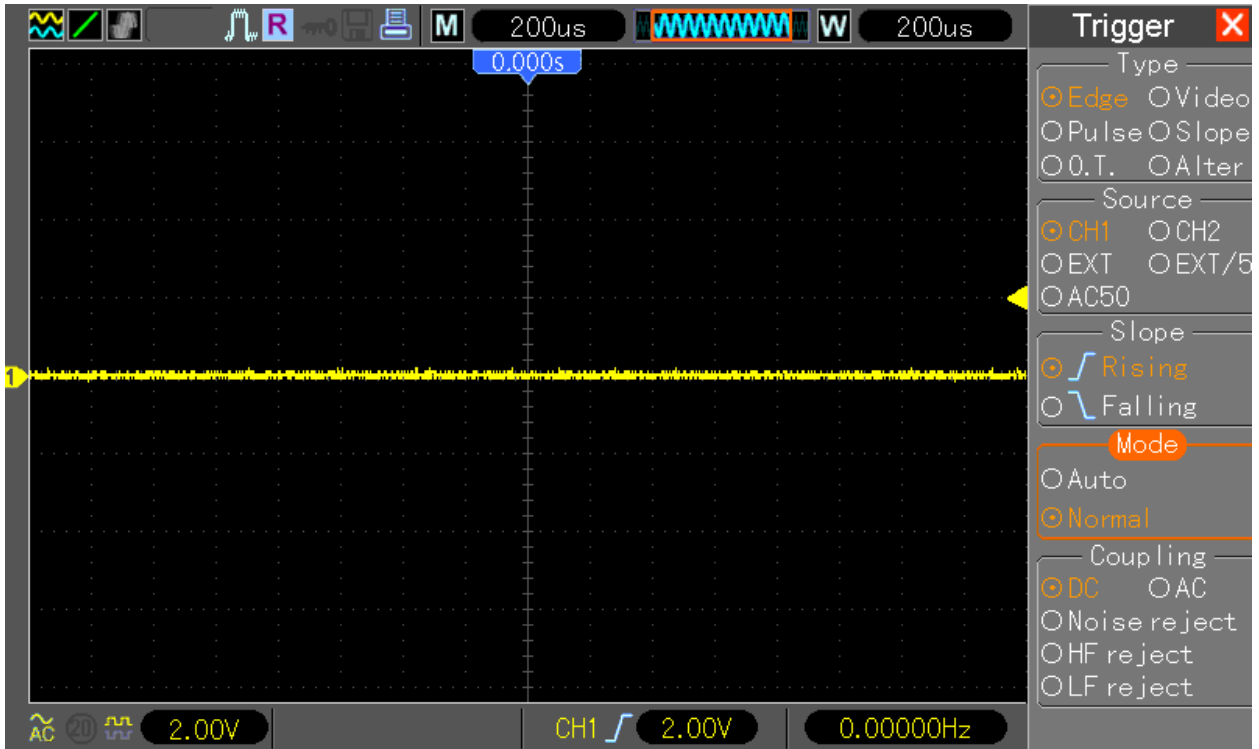
12.00E-07,0.002

16.00E-07,0.000

29. Horizontal Position knob not moving display data. Set Trigger to “Normal” – when DSO not triggered the waveform/horizontal screen position cannot be changed. Once triggered it changing rapidly. Another example – set trigger to Single Seq and Auto , while trigger in “R” (ready) mode waveform/horizontal screen position cannot be moved. Again, once triggered it change rapidly. **In firmware 110923.1 this was working! :**



but since few firmware version not anymore working (same condition, Horizontal position knob already turned few times but no move on screen):



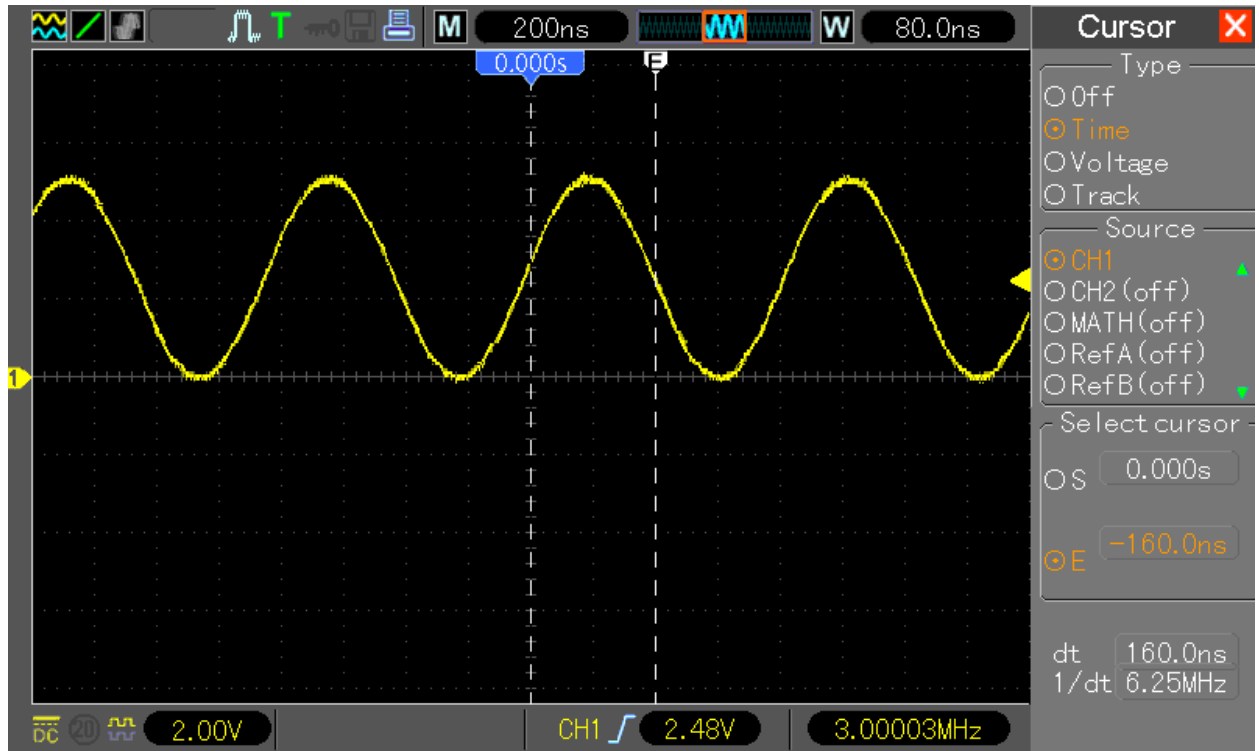
30. Cursor cannot be moved smoothly anymore. Every firmware update is slowing down more and more the V0 knob response. In firmware 110923.1 every kind of cursor was easy movable, in latest firmware (121027.0) is crazy slow, stumbling while changing V0 knob position.

Generally, bug 29 and 30 have something to do (in my opinion) with the fact that screen data is dependent on trigger. You can easily see the difference e.g. in cursor, while moving them with no trigger (e.g. normal mode, trigger level above signal level) the cursor is working just fine.

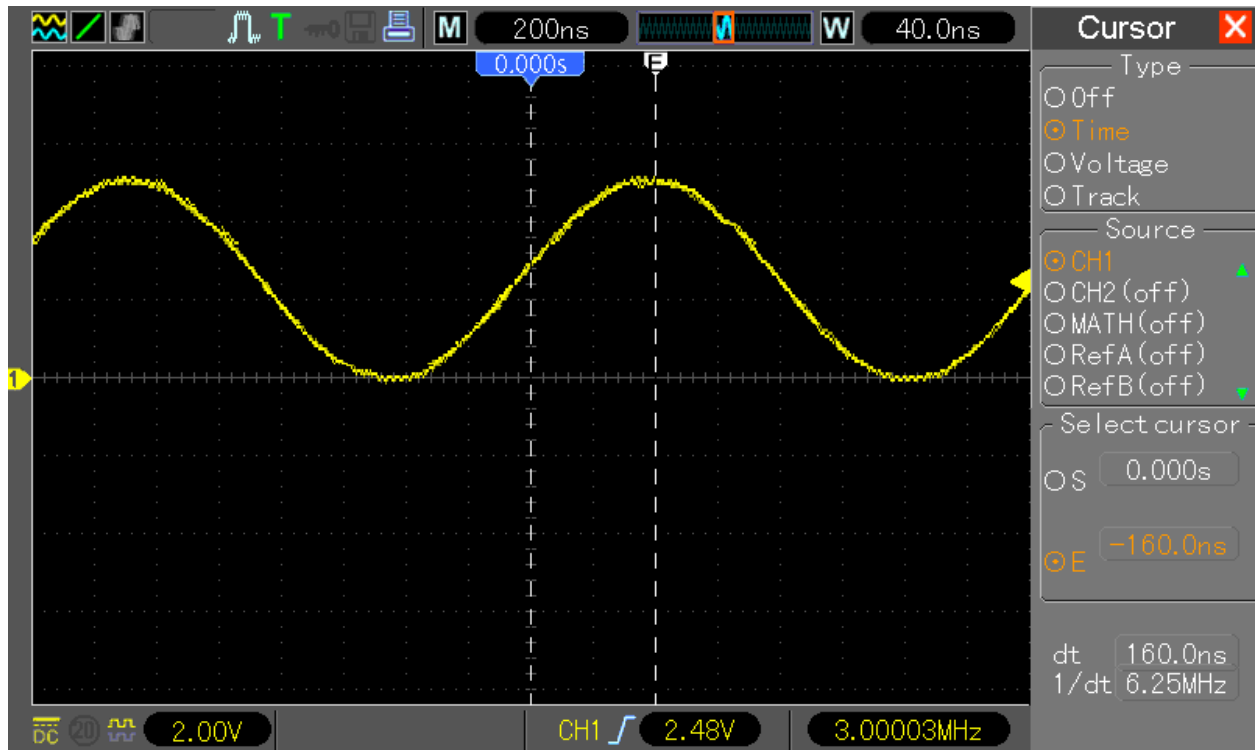
Maybe it would be good idea to remove the trigger event link from screen refresh (why is this linked together anyway? It cannot be necessary for the firmware because older versions never had this bug).

31. In RUN and STOP mode, while changing Timebase the Time Cursor values S and E not refreshing automatically. Any changes to Menu (hide/show with F0), other Knobs (like V0) position or any Buttons (e.g. push Measure button and again Cursor button) is refreshing the S and E values in Menu.

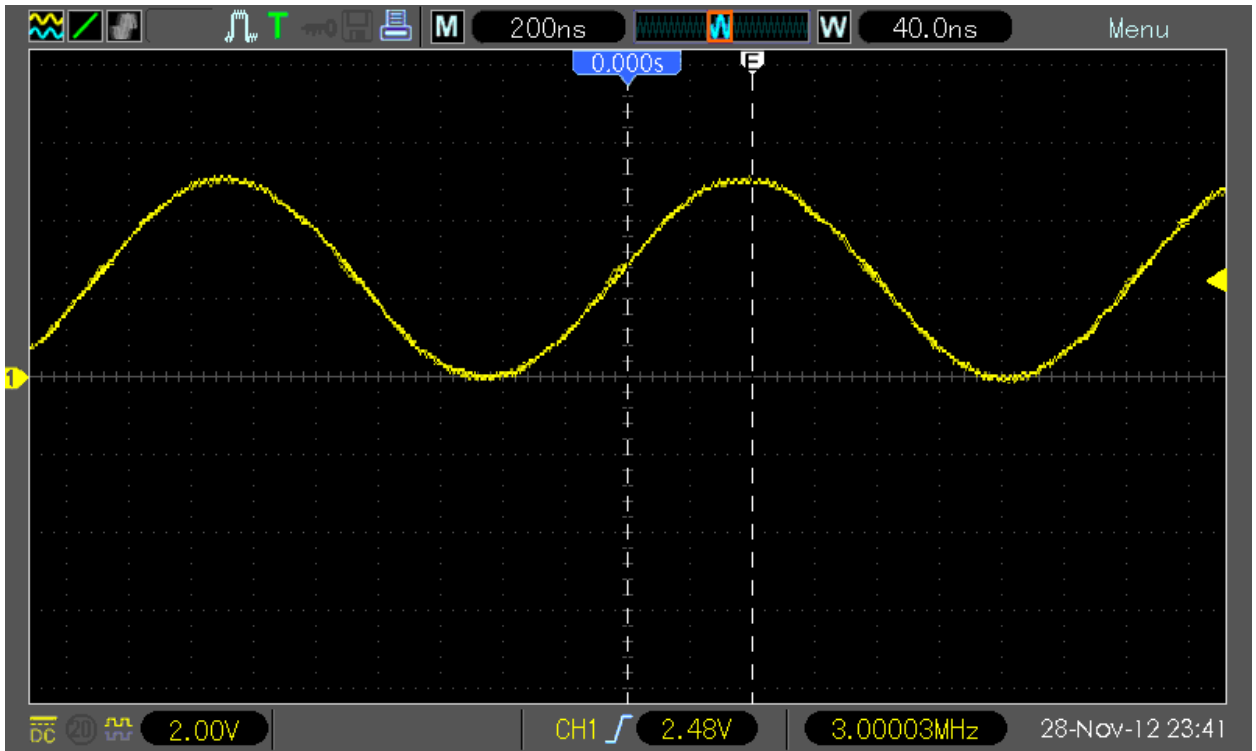
Here example, TB set to 80ns/DIV, cursor S to 0.0ns and E to -160ns:



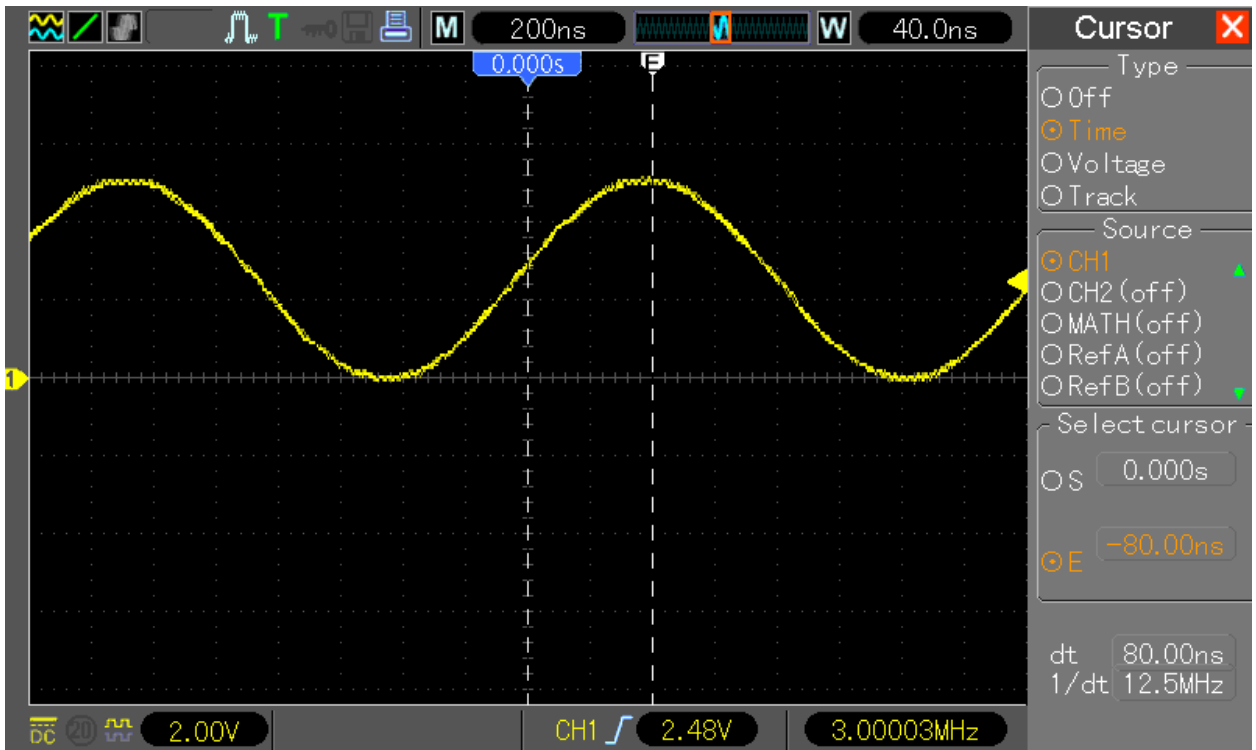
Then TB changed to 40ns/DIV, but displayed value for E still -160ns:



Now disabling Menu with F0:



and enabling Menu again with F0. The E cursor value is now having proper value (-80ns):



This was working properly the last time in firmware 110923.1

32. Request – add Edge Trigger on both falling and rising edges simultaneously.
33. **Debug symbols (.stab and .stabstr sections) removed (stripped) since 120423.0 from dso.exe file. Why that? It seems that you guys don't want to spend money for Quality Control or Firmware Testing in-house, there was not a SINGLE ONE firmware update in last 3 years without new bugs, "small mistakes", typos, etc. I can't believe that your engineer don't see all these things, but probably in hurry not checking everything. Fine (actually not really fine, but based on the small revenue I can understand this), we can do the QC and Testing for you (and continue to update this Bug List), but without debug symbols you slowing down us, and our time costs money as well! You can as well release each time two versions – one with and one without debug symbols, there is not a real work effort for you.**

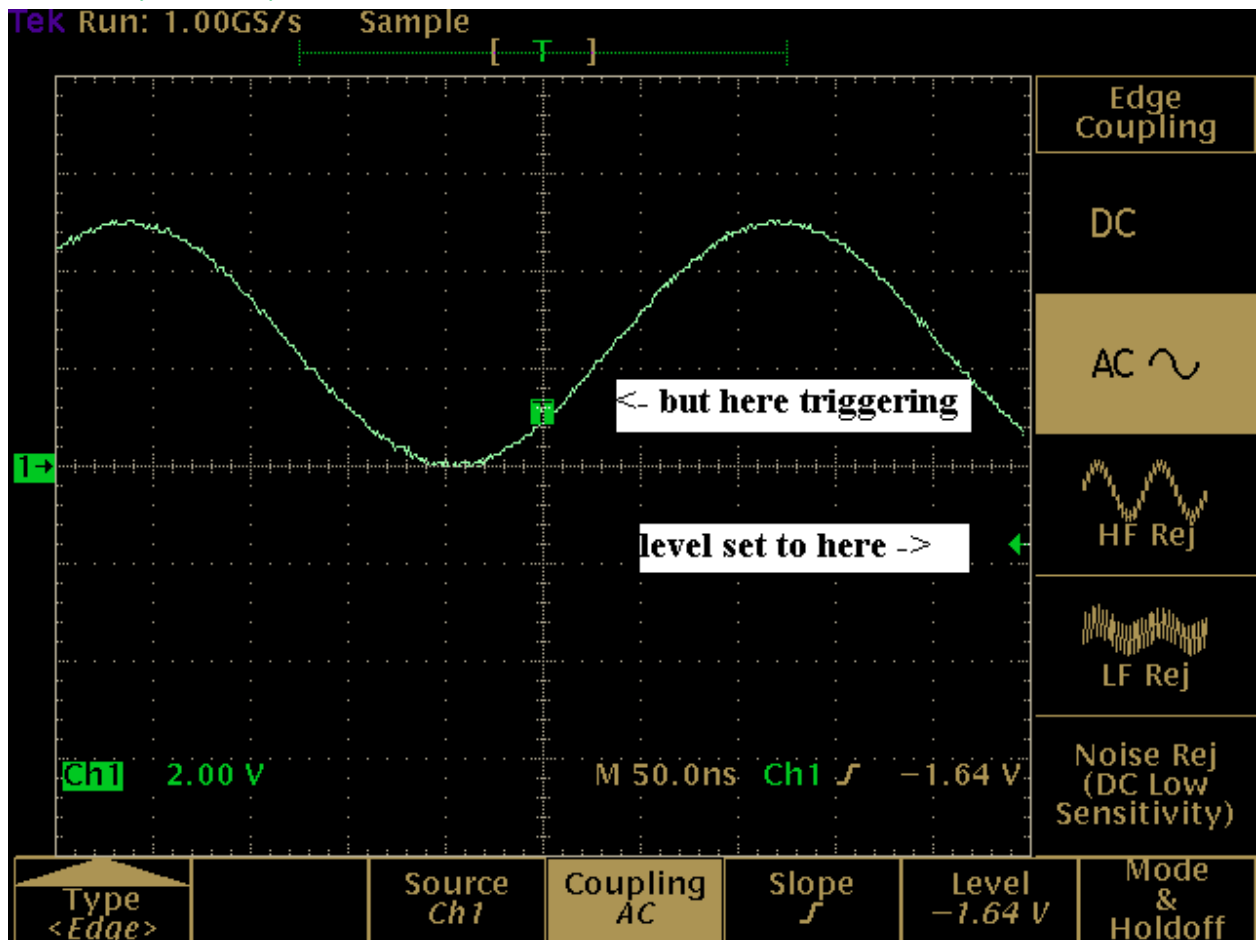
List of workarounds – by bug number

I've marked all workarounds with colors: red – bad one, yellow – sill bug, but workaround exists, green – not a bug or I don't care about. Note – these colors represents what I think and feel.

Update: Some of them already fixed

- ~~1. Don't use help~~
2. Run factory-calibration (only Edge calibration) and after that self-calibration. This bug seems to be only valid for hacked models, it does not exist on real 200MHz models (on which the factory calibration was executed after 2ns/DIV and other 200MHz features has been enabled).
3. Run factory-calibration (only Edge calibration) and after that self-calibration. This bug seems to be only valid for hacked models, it does not exist on real 200MHz models (on which the factory calibration was executed after 2ns/DIV and other 200MHz features has been enabled).
4. **No Workaround available.**
5. Well, you can build your own SDK/LabView/what so ever support based on the already published information's:
http://www.mikrocontroller.net/articles/Hantek_Protokoll
http://elinux.org/Das_Oszi_Protocol
6. There is no affordable workaround for now. Changes to hardware are possible but expensive. I've tested Silicon Labs jitter cleaner, Murata LDHxxx delay lines and a combination of other solutions. I was more than satisfied with achieved results, expect the costs.
For now we have to use what available, both manufacturers developed within last 2 years few FPGA design versions, the best is from upcoming Tekway MST DSOs and Hantek Handhelds – however they not allowing dual channel 500MS/s sampling in long memory; Hantek's bench DSO hw1007 83E9 design allows such faster sampling but the skew is still far from perfect. I did publish all these FPGA designs, you can play with them to which is best for you. **But note – do not do this when you own hw1005 DSO, they can't be modified!**
For those of you who don't know what this bug means – Google for waveform/interleave distortion and/or Agilent 5989-5732EN.
7. This is improvement proposal and not a bug. It has been removed from to-do as “not important”.
8. This is a very unfortunate bug; possible workaround is to use dual window mode or less memory depth (both with disadvantages)
9. ~~Workaround is to change Timebase (just one step forward and back) right after dual window enabled. Note – the main window (top) need to be activated, the bug have something to do with main TB buffer initialization.~~

10. Workaround is to change Timebase (just one step forward and back) right after dual window enabled. Note — the main window (top) need to be activated, the bug have something to do with main TB buffer initialization.
11. This is improvement proposal and not a bug.
12. Use my firmware (2.06.3_120507.6), I removed that bug.
13. Use DC trigger coupling or “add offset” when you set trigger point. On some other good known DSOs (e.g. Tektronix TDS7xxx) there is exact the same DC-signal/AC-trigger “dependency” (bug) and nobody ever complained about.



14. For sure a stupid bug, but since you can see when the signal is “wobbling” you can quick change (when necessary) to single channel to observe the waveform with better resolution and without wobble.
15. Funny bug, but easy to omit since we know it (remember, with higher sample depth there is no issues)
16. This is already fixed, the /dsod (or /dso/app/dsod — this depends on fw/DSO model version) binary is working perfectly as watch dog monitoring potential profile issues.

17. ~~Not a big deal~~
18. Not a big deal, you can update the protocol.inf file.
19. (yellow as this is a bug only when accessing remotely) - need to be implemented properly in the firmware; a pure protocol.inf change is not enough.
20. (yellow as this is a bug only when accessing remotely) - need to be implemented properly in the firmware.
21. (yellow as this is a bug only when accessing remotely) - need to be implemented properly in the firmware.
22. (yellow as this is a bug only when accessing remotely) - need to be implemented properly in the firmware.
23. No workaround, it was never properly implemented, now even completely disabled.
24. ~~Workaround could be to switch back to firmware from Mid-2011, but honestly this is really annoying bug. I can't understand why there is no QC?~~ See bug description
25. ~~No workaround, it looks just crap. Sure, when we know that there is crap on begin and end we can think the crap away, but what when there is a real spike?~~ UPDATE: see description in bug section above.
26. Just ignore it for now; it is interim fw version – for testing only.
27. Switch once focus from minor (bottom window) to major (top window) window by pushing timebase knob down, turn then timebase one position fort and back to get rid of waveform artifacts on left and right side of the waveform.
28. ~~Nothing to say here.~~
29. ~~Nothing to say here.~~
30. ~~Nothing to say here.~~
31. ~~Nothing to say here.~~
32. ~~Nothing to say here.~~
33. ~~Nothing to say here.~~