IV. Oscilloscopes, ADVANCED FEATURES

Recommendations:

1. Before you start working with an oscilloscope, perform „Default Setup“. Thus you cancel any special settings that might remain after a preceding user.
2. Save acquired waveforms on a FLASH drive (Save / Recall> Storage> 8, 24 Bitmap, or PNG; External).

Exercises:

1. Run Task 1 (noisy harmonic signal). The program generates noisy harmonic signal on one channel, and a clean square wave at the second channel.
a) Try to view and to synchronize the oscilloscope from the channel 1, where the noisy harmonic signal is connected. Use various functions of internal synchronization of the measured waveform. Does the setting help to stabilize signal on screen? Estimate the amplitude of the harmonic signal. Try averaging the measured signal (Aquire > acquistion > average), with several averaging settings (number of waveforms to be averaged). Will noise supression and precise amplitude measurement be possible?
b) Connect DSO channel 2 to generated rectangular signal. Use this signal for synchronization – set trigger source to channel 2. Now you can disable displaying channel 2 waveform and only display the noisy sine, cca. 2 periods. Use averaging again, will noise supression and precise amplitude measurement be possible?
c) Repeat 1b) with external synchronization instead of internal on channel 2. How is external synchronization different and when do we use it?

2. Run Task 2 (digital waveform with glitches). This program generates a burst of digital impulses with random glitches.
a) Capture one burst of impulses. Bursts are generated with random delay, which complicates proper capturing of the waveform. Try synchronizing in normal sweep mode, edge triggering and a suitable hold-off time. What hold-off time assures proper synchronization and why?
b) After synchronizing, use zoom function for displaying a selected impulse and measure rise and fall time. Use both cursors and measure function and compare the results.
c) Generated signal contains two sorts of glitches. For their detection use mask test – display captured waveform at the entire screen and justify to the left. Turn on the mask test (utility>Mask Test>Enable test>On). Now set the mask: Utility>Mask Test>Mask Settings> now stop the acquisition, waveform that stays on the screen must be without glitches>set Xmask and Ymask close to waveform>Create Mask. In Mask Test select Operate. The DSO is now running in test mode and triggers once the signal gets out of the mask. When that happens, note the type of glitch and run mask test again (Operate). Repeat until you find both types of glitches. What are they? Browse also other mask settings.
d) Certain types of glitches may be also found other way. Use normal sweep mode and “Pulse” triggering mode (Trigger menu>mode>pulse). When (condition) set to narrower

than … (->||<-) 350uS, which should be the shortest valid impulse. The DSO will now trigger on any impulse narrower than 350uS. Slowly decrease this time, DSO will stop triggering at a certain point – leave this setting and wait. Once an invalid (too short) impulse appears, DSO will trigger and display it.

3. Run Task 3 (phase shift). Program generates a fixed 1kHz sine wave on one channel. On the second channel there is also a sine, but with adjustable frequency and phase shift (use mouse or keys Home, End, PgUp and PgDn).
a) Set frequency to 1kHz and capture both waveforms on DSO. Set trigger source to channel 1. Change the phase shift on second channel to 90°. Notice the change on the display, which waveform has moved? Measure phase shift using cursors. Does it correspond to set value? Change trigger source to channel 2 and vary the phase shift. Which waveform is moving on DSO screen and why?
b) Change the frequency of signal 2. Is it possible to measure the phase shift between waveforms? Why?
c) Change display mode to X-Y and center the image. Change phase shift and frequency and observe displayed Lissajous curve. Note the shape at ratio of frequencies 2:1, 1:2, 1:3, 1:4 and noninteger.
4. Run task 4 (eye diagram). Program generates digital data on channel 1 and synchronization pulses on channel 2.
Connect data to DSO channel 1 and clock to channel 2, set trigger source to channel 2 and edge mode. Display channel 1 at entire screen, don't display channel 2. Set display persistance (Display>persist>infinite). Set timebase so you only see one period of data signal on the screen (with persistance it resembles an eye).

Manual:
Oscilloscope Agilent DS 1004A