

Agilent 33522A Function/Arbitrary Waveform Generator

and

Tektronix TDS 3012B Oscilloscope



Agilent 33522A Function Arbitrary Waveform Generator

The signal source for this lab is the Agilent 33522A Function Arbitrary Waveform Generator. It can produce basic waveforms to frequencies from a few Hertz to 30 MHz. In addition an arbitrary waveform can be inserted into the waveform RAM memory using software. It has two separate outputs when can be independent or ganged together and the amplitude and frequency varied. It also has a Synchron Output which is a TTL signal (0 – 5 V). The output connectors are female BNC. BNC means Bayonet N Connector which is a cylindrical conductor system.



Tektronix TDS 3012B Scope

The oscilloscope for this lab is the Tektronix TDS 3012B. It is a two channel 100 MHz instrument which means one or two signals may be displayed as functions of time. As long as the significant frequency content is below 100 MHz the waveforms will be undistorted. It also has an EXT TRIG input which is used for synchronization purposes. The input connectors are female BNC connectors.

Turn on the scope and FG with the on/off buttons located in the lower left. Wait for the instruments to boot. Obtain a male BNC to male BNC connector from the wall rack; this is a coaxial lead with a characteristic impedance of 50Ω . Connect Output on from the FG to CH1 input on the scope. Align the metal ridge with the metal slot and rotate clockwise until it clicks into place. Do not connect anything to the USB connectors on the FG; if you need to charge your toys use the USB connectors on the pc.

Press the 1 button above the Output 1 BNC connector on the FG. On the soft menu that appears under the display on the FG, switch the Output to On, Output Load to High Z (High Z means the FG is to expect a load other than 50Ω which is the characteristic impedance of the coaxial lead used for high frequency applications). On the buttons to the right of the display on the FG press Waveforms and select sine. Press Parameters, Frequency 1 kHz (use the numeric keyboard to the right of the display), and Amplitude 2 V pp (pp means peak-to-

peak, viz the difference between the top and bottom of the waveform is then 2 V peak to peak, this is only correct if High Z was set).

On the scope press the SAVE/RECALL button on the top row to the right of the display. On the soft menu that then appears below the display press Recall Factory Setup and then OK Confirm Factor Init to the right of the display. Then press AUTOSET under the ACQUIRE grouping of controls on the far right of the controls on the front of the scope.

Note that the display states which channel is active, the VOLTS/DIV for that channel (there are 8 major vertical divisions), the TIME/DIV (there are 10 major horizontal divisions), and the trigger setting indicating that the scope is being triggered by the waveform on CH1, the trigger slope is positive, and the trigger level. Press the MENU button under the VERTICAL grouping of controls. Note that the display now indicates the coupling for CH1 and that the scope is set for a 1X scope probe with an input impedance of 1 M Ω (don't change either).

On the FG press Waveforms and select square. Press the offset button and note and record the effect of varying the Duty Cycle by pressing Duty Cycle and then varying the rotary knob on the upper right of the FG. The duty cycle is the percentage of the time the waveform is at the upper level.

Press Waveforms and select Ramp. Press Symmetry and note the effect of varying the symmetry with the rotary knob on the right of the FG. What value of symmetry turns the ramp into a triangular wave?

Press symmetry and select 100 %. On the scope press MENU on the TRIGGER grouping of controls. Vary the level knob under TRIGGER and describe what happens to the display.

Press Set to 50% for the trigger level.

Press Waveforms on the FG, More, PRBS (Pseudo Random Binary Sequence). Press PRBS Data on the FG and select PN7. Press AUTOSET on the scope and then SINGLE SEQ (the button just above AUTOSET). Print this display. Do so by executing the Screen Capture program on the desktop or the class web page. Note the Bit Rate indicated on the screen of the FG.

Press Waveforms on the FG, select sine wave, Parameters, and set the frequency to 100 kHz. Press AUTOSET on the scope. Press Modulate on the FG (Make sure it is on.). Manually change the TIME/DIV on the scope by rotating the SCALE button under the HORIZONTAL group of controls to 2 ms/DIV. Press RUN/STOP on the scope. On the FG change the AM Depth to 50% with the numeric keyboard. Press RUN/STOP on the scope twice. Print the display.

Select the Modulation type as FM on the FG. Change the Frequency Deviation to 10 kHz and the FM Frequency to 1 kHz. Press AUTOSET on the scope. Print the display. Turn the modulation off.

Select Waveform on the FG and set to a sine wave with a frequency of 1 kHz and an amplitude of 2 V pp. Obtain another BNC to BNC lead from the wall rack and connect Output 2 of the FG to CH 2 on the scope. Press the 2 button above Output 2 on the FG and set it for ON, High Z, a frequency of 1 kHz, and an amplitude of 2 V pp. Press the blue CH 2 button on the scope and then AUTOSET. On the FG under CH 2 parameter, press the phase button and enter a phase shift of 90 degrees and Sync Internal. On the scope press DISPLAY, XY Display, and then Triggered XY. Print the display.

Change the frequency of the Output 2 to 2 kHz and Phase Synch Internal. Print the display.

Change the frequency of the Output 2 to 5 kHz and Phase Synch Internal. Manually change the VOLTS/DIV for CH1 and CH2 to get a display that occupies about half the screen of the scope. Note that one first presses the CH1 or CH2 button and then the SCALE is for that channel.

Print the display.

Set the frequency of the Output 1 to 900 Hz and Output 2 to 600 Hz and phase to Phase Synch Internal. Print the display.