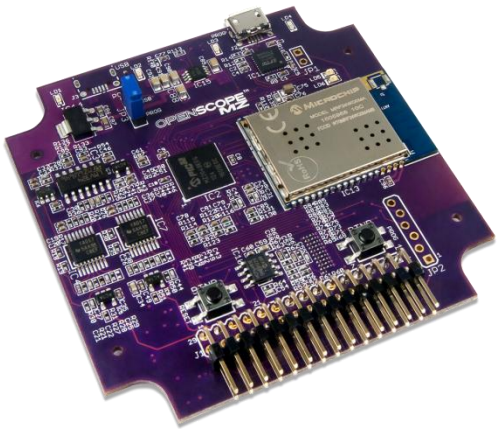
Digilent also has an un-enclosed circuit board (it does have rubber feet though) that offers open source test equipment with some of the capability of the Analog Discovery 2 in its OpenScope MZ (SKU: 471-0231).



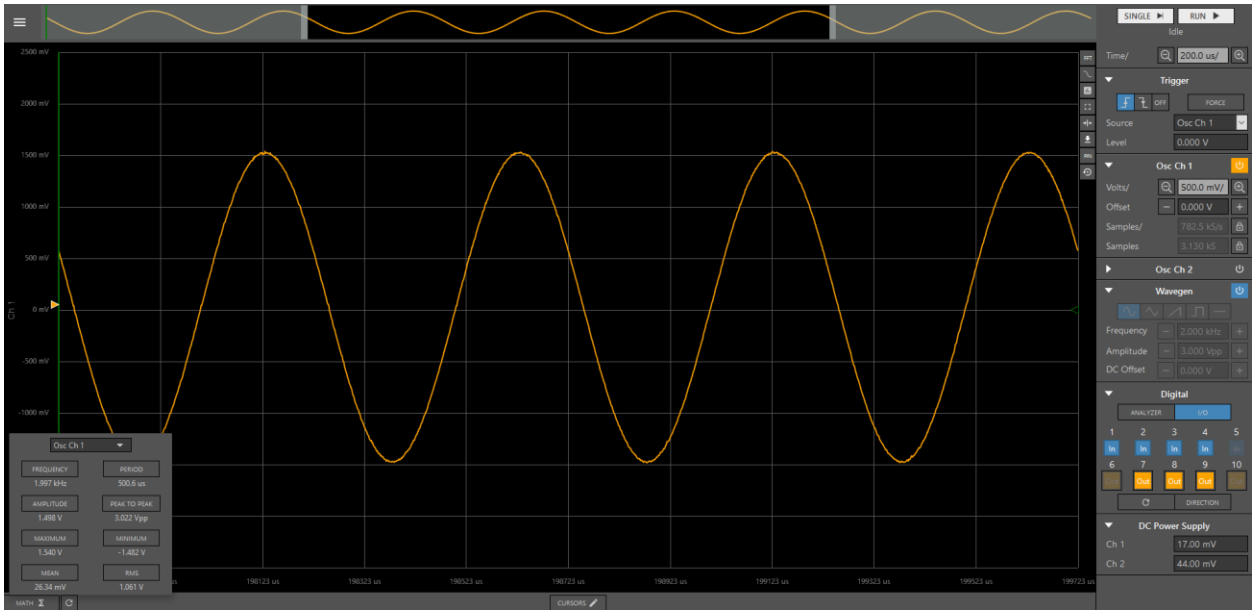
This device is powered by USB and includes two adjustable 0 to +/-5V power supply outputs at up to 50mA, a two-channel , 2MHz oscilloscope w/ FFT display, a simple waveform generator, and 8-bit digital I/O or logic analyzer (w/o protocol decoding). This unit costs $149. (A laser cut acrylic case is available for an additional $15.[1]) This includes the unit and a 30 wire cable to connect the outputs/inputs to a breadboard. You will need to add male-to-male headers to go into the breadboard. It includes WiFi so you can connect to it remotely (although it still requires USB power to run.) The software runs in a web browser connected via USB or WiFi, so it should run on almost any hardware. I believe this is the unit that students in ES-50 were given to complete the spring 2020 semester.

I tested the OpenScope MZ and it works pretty well as an oscilloscope. It is fairly straightforward to use and includes a number of built-in measurements including frequency, peak-to-peak amplitude, mean (DC offset), RMS, max and min. It also has cursors to make both time and amplitude measurements.

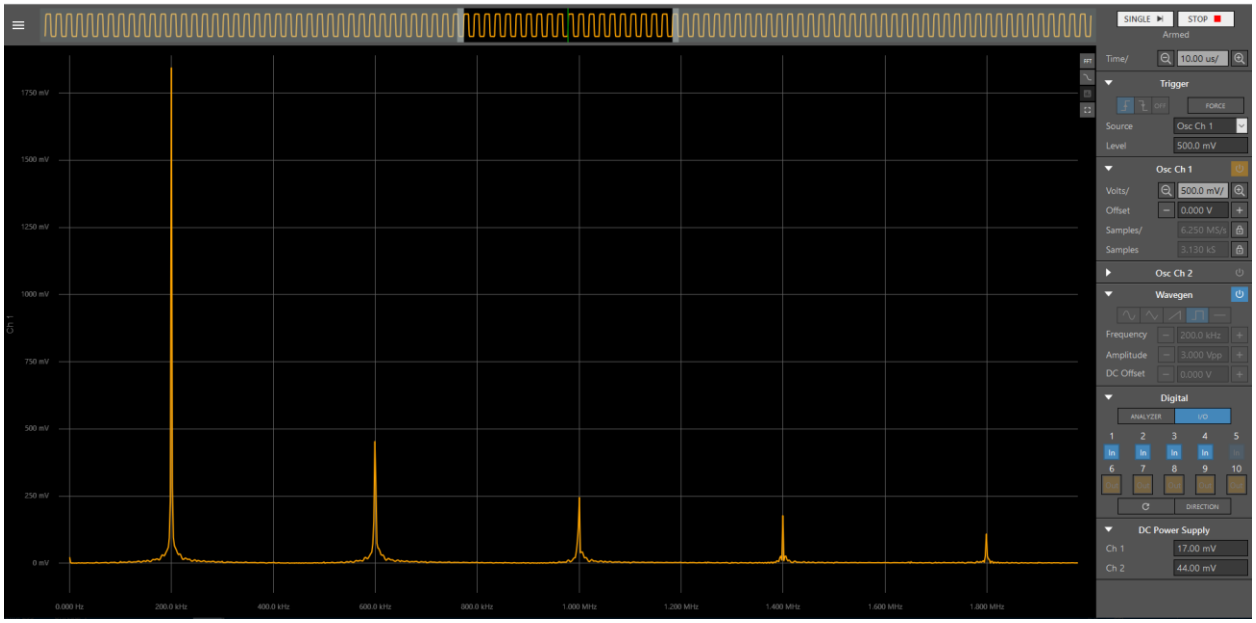
The function generator, however, is pretty limited. It only outputs a maximum of 3V peak-to peak but has a +/-1.5 adjustable offset so you can create a 3V pulse. All waveforms (sine, square and triangle) are adjustable from 1Hz to 1Mhz but limited to 50% duty cycle, although there is a sawtooth (falling edge vertical) available as well. The major limitation of the waveform generator is that you must stop it (by clicking the power button) in order to change shape, frequency, amplitude or offset, and then re-enable it. This makes experiments which adjust the function generator while watching the result tedious. The function generator can also be used as a +/-3V DC signal source (output impedance is unknown).

Similarly, the digital inputs must be manually sampled, they do not display changes until the “update” button is pressed, limiting their utility.[2] The digital inputs and outputs are 3.3V logic. When these same eight inputs are used as a logic analyzer ,they support reasonable complex triggering (either or both edges, multiple lines triggered) but no protocol triggering or analysis/display.

[1] The OpenScope MZ web page states that the case is included. It was not in the sample given me -- but that one had been passed through several other people.
[2] This also seems somewhat flakey. Several times it looked to me like the digital inputs did not update properly.



The FFT calculation works but is limited to a linear display of amplitude. Horizontal frequency scrolling is tedious when the horizontal scale is expanded. There is a Bode function but I could not figure out how it worked.



Overall, it looks to me like the picoscope 2400A is a better choice for slightly less money ($140). It comes in a case with actual scope probes, is slightly faster (10Mhz), has a much faster sampling rate (100Mhz vs 6.25MHz), has a much larger buffer, provides complex trigger modes (glitch, runt, etc), appears to include some serial protocol decoding and includes many more measurements. The FFT amplitude is in dBs and the AWG includes sweep (but does not appear to have duty cycle adjust either). However, the picoscope resolution is lower 8 bits vs 14, it does not have the rudimentary power supply outputs or the digital I/O – logic analyzer, and the function generator output is limited (+/-2V max) and 100KHz max, so it is not suitable as a digital clock source without a level shifter.

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