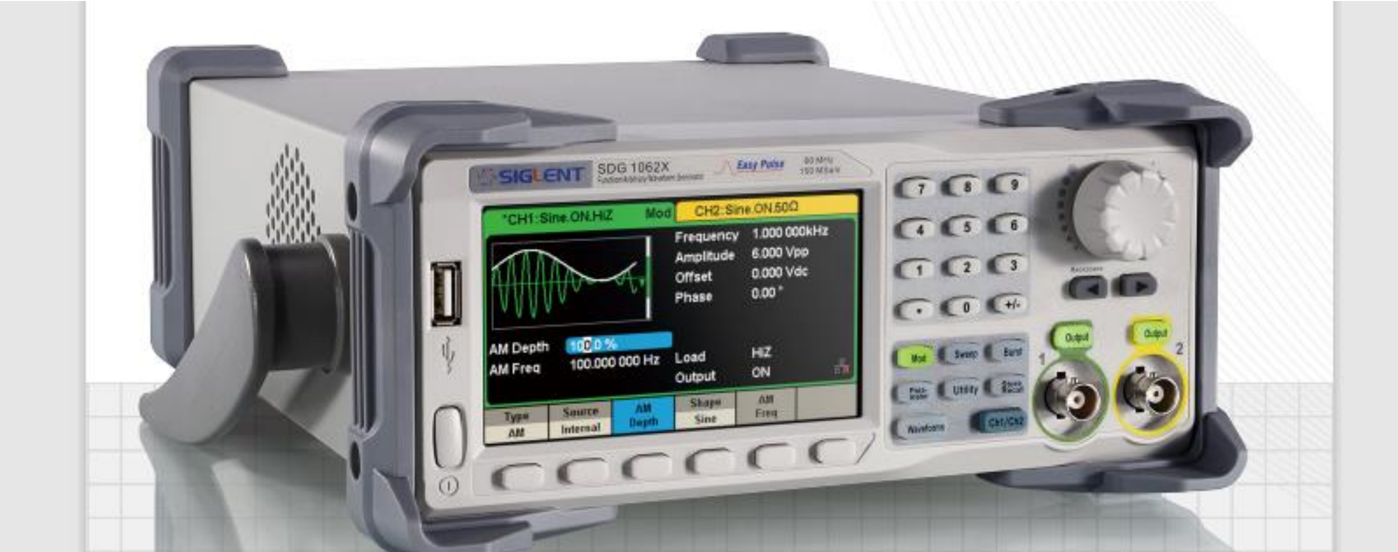
Reviewing the Siglent SDG 1032X



Presentation by
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October 19th Meeting

Cascades Amateur Radio Society (7PM EST)

Featured in October QST

- Reviewed by Phil Salas, AD5X
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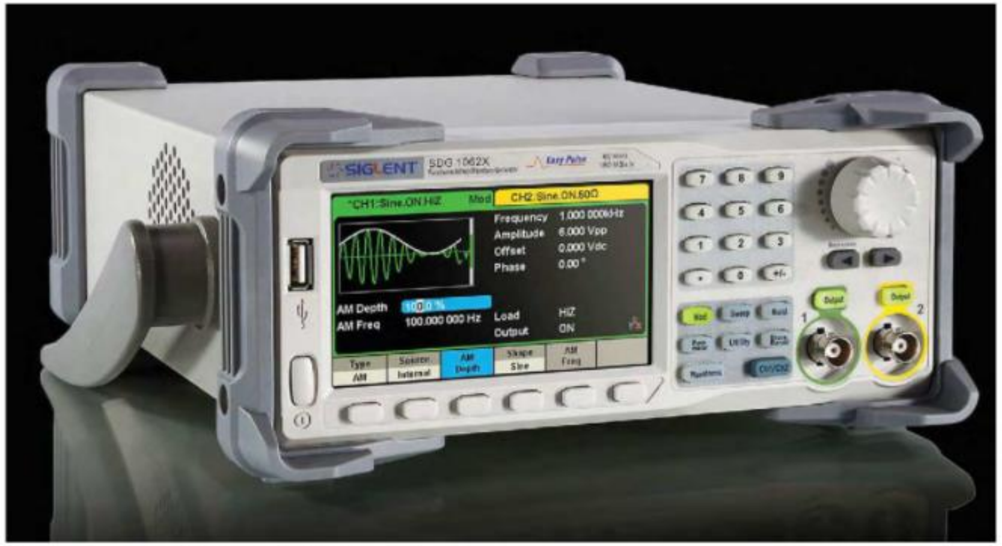
SIGLENT SDG1062X Waveform Signal Generator



(Photo courtesy of SIGLENT Technologies North America)

Reviewed by Phil Salas, AD5X
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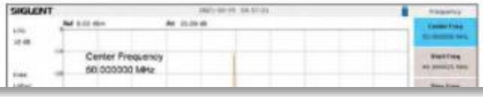
When it comes to test equipment in my home lab, I've always skimped on a good waveform generator. However, as I've been spending more time making receiver and transmitter tests, I thought the time was right to purchase a quality signal generator and invested in a SIGLENT SDG1062X.

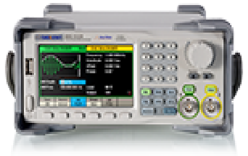
Overview

The SIGLENT SDG1062X is a dual-channel function/form) and very low total harmonic distortion (THD). It generates sine, square, pulse, ramp, noise, and arbitrary waveforms. A library of 196 waveforms is included in the SDG1062X's internal memory, or you can create and store your own arbitrary waveform. The SDG1062X will also sweep the selected waveform,

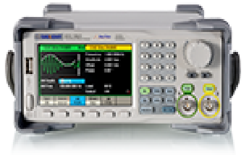


What’s the Diff?

- Primary specifications are mostly identical.
- Double the maximum frequency out.



$319



$459

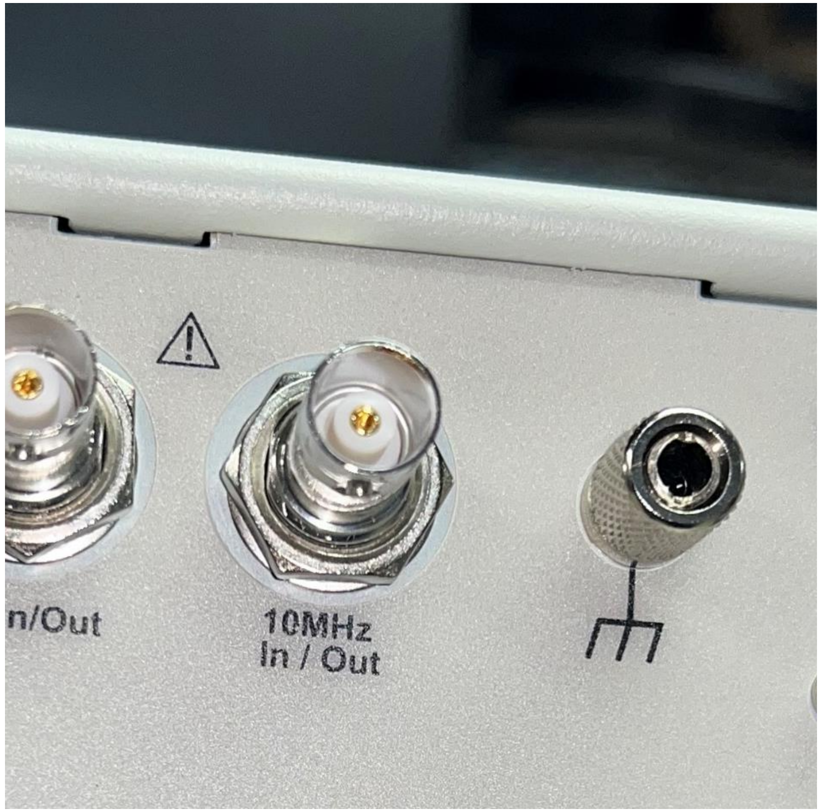
	Siglent Technologies SDG1032X Arbitrary Waveform - Function Generator	Siglent Technologies SDG1062X Function/Arbitrary Waveform generators
Max Output Frequency	30 MHz	60 MHz
Max Sampling Rate	150 MSa/s	150 MSa/s
Vertical Resolution	14-bit	14-bit
Waveform Length	16 kpts	16 kpts
Channels	2 CH	2 CH
Max. amplitude	±10 V	±10 V
Interface	Standard: USB Host, USB Device, LAN	Standard: USB Host, USB Device, LAN

14-Bits Precision Vertical Resolution

- $2^{14}-1 = 16,383$
- Maximum output voltage:
  - Feeding infinite load:
    - Less than 10 MHz out: 20 Volts pp.
    - More than 10 MHz: 10 Volts pp.
  - Feeding 50Ω load: 10 Volts pp.
- Suppose the instrument was programed to output/display 20 Volts.
- To what precision can that 20 Volts be read?
- Divide 20V by 16,383 = 1.2mV
- What is the significance of 1.2mV?
  - If your noise floor is 2mV then any more precision would be wasted.

Has a 10 MHz Reference Signal Out

- The SDG1000X provides an internal 10MHz clock source. It also can accept external clock source form the [10 MHz In/Out] connector at the rear panel.
- It can also output the clock source from the [10 MHz In/Out] connector for other devices.



Harmonics

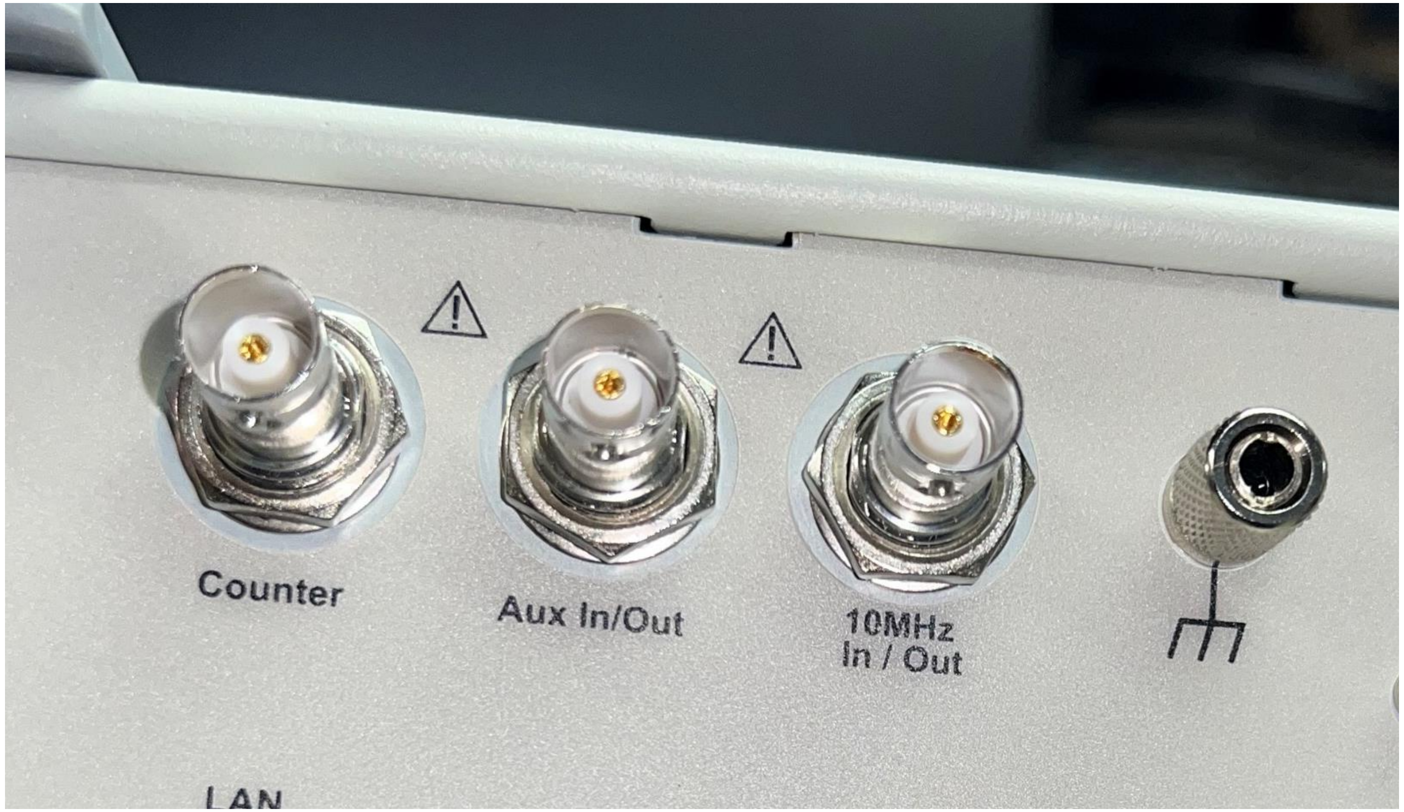
- Can add harmonics to signal.
- But what is a square wave?
  - How can you synthesize a square wave?
- Knowing this…
  - Why is a function generator so dramatically limited in its upper signal capabilities relative to a plain signal generator?
- Has a special circuit for generating square waves.
  - Why a special circuit?

Use Function Generator as a Transmitter

- Antenna: a length of coax 324cm.
  - Let 2.98m = ¼ wave
  - Let the function generator serve as the counterpoise
  - Assume 0.8 velocity factor
  - F_{res} = 300*0.8/(3.24*4) = 18.1 MHz
  - AM modulation at 2 kHz 100%
  - Actual realized F_{res} = 18.1013 MHz
  - Velocity factor is therefore 0.782
- Guess what… 18.10 MHz is allocated for amateurs using RTTY and Data. We caused nobody no harm, no-how.
- Modulation source can be either internal or external.

Built-in Frequency Counter

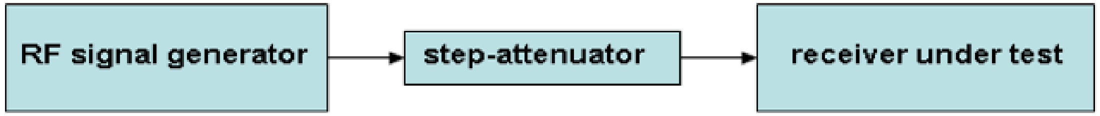
- 0.100 Hz <= Counts <= 200 MHz



Special Connectivity with Siglent Instruments

- Connect to O-scope via USB

Calibrate Your S-Meter

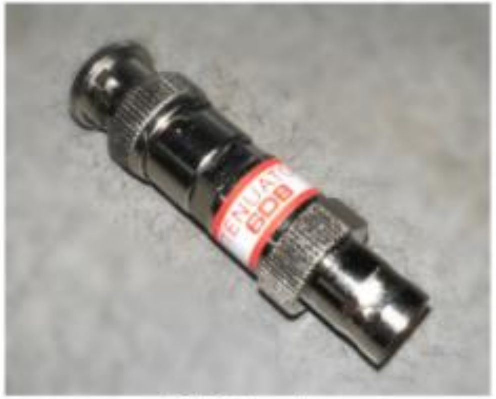


- Most non-SDR S-meters are not calibrated.
- What is an S-reading
  - It is a measure above 1μV
  - One S-reading step is 6dB
  - Example:
    - $Gain(dB) = 20\log_{10}\left({}^{V_{out}}/_{V_{in}}\right)$
    - $S0: 0(dB) = 20\log_{10}\left({}^{1\mu V}/_{1\mu V}\right)$ $(no\ gain)$
    - $S9: 34(dB) = 20\log_{10}\left({}^{50.2\mu V}/_{1\mu V}\right)$
- 50μV sine wave needed at receiver input.
- Must use an attenuator, generators don't go as low as 50μV.

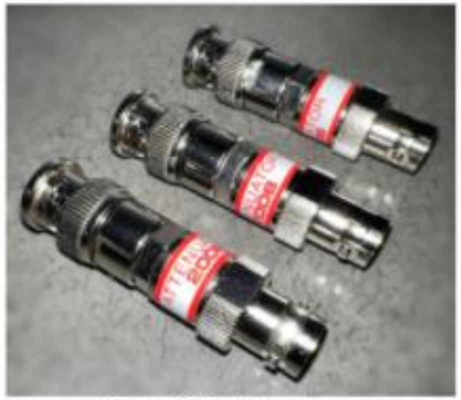
S-reading	HF		Signal Generator emf
	µV (rms, Relative to 50Ω)	dBm	dB above 1uV
S9+10dB	160.0	-63	44
S9	50.2	-73	34
S8	25.1	-79	28
S7	12.6	-85	22
S6	6.3	-91	16
S5	3.2	-97	10
S4	1.6	-103	4
S3	0.8	-109	-2
S2	0.4	-115	-8
S1	0.2	-121	-14

S-Meter Procedure

- S9 means there is 50µV RF signal at the antenna input.
- Obtain a signal generator capable of frequencies in the HF range.
- Obtain an attenuation capability.
  - In this example we are using -66dB
- Solve for the precise attenuation: In this case it was -65.10dB
- Place 89.9mV at the attenuation input.
  - Match characteristic impedances
  - $V_{in} = {}^{50\mu V}\!/\!_{10^{-65.10/20}} = 0.0899V$
- Place output of attenuator at transceiver antenna input. (Match impedances)
- Read S9 on the S-meter.
- TEST QUESTION: What V_{in} would be required if we added another 20dB attenuation?



A 6dB attenuator.



Three 20dB attenuators.