Siglent SAG1021 Review

SAG1021 AWG

The SAG1021 is an optional device and since it is just a little box with a couple connectors, it requires a software license for the SDS1004X-E on top, as that's the only way it can be operated. No software license is needed to utilize the SAG1021 as a signal source for the Bode plotter though.

The total price for the SAG1021 hardware plus license is certainly not low enough to make it a no-brainer, so we'd probably consider a SDG1032X at almost twice the price, but with significantly more performance, functionality and features. Yet if someone wants some ultra-portable signal generator that doesn't require an extra power supply and still provides decent signal quality, the SAG1021 would be worth a 2nd look.

Some important features and limitations of the SAG1021 are listed below:

- USB powered
- Output overvoltage protection
- External Sync signal up to 2MHz
- One channel only
- Maximum output amplitude 3Vpp into 50Ω, 6Vpp High-Z
- 25MHz max. sine frequency
- 24ns rise time for square and pulse
- 45 built-in arbitrary waveforms
- Signal polarity cannot be changed
- No modulation capabilities
- No sweep, burst, gate and trigger
- No external reference clock input

Even though this appears rather limiting and despite the lack of any bells and whistles, I can't help but really like this tiny little brick. It is just a solid performer that also has its little highlights, as will be discovered during this review.

Operation

The AWG user interface can be found in the Utility menu and the main operation hides behind the *Wave* soft menu button, which will be used throughout this review. Apart from that, there are several more menu items:

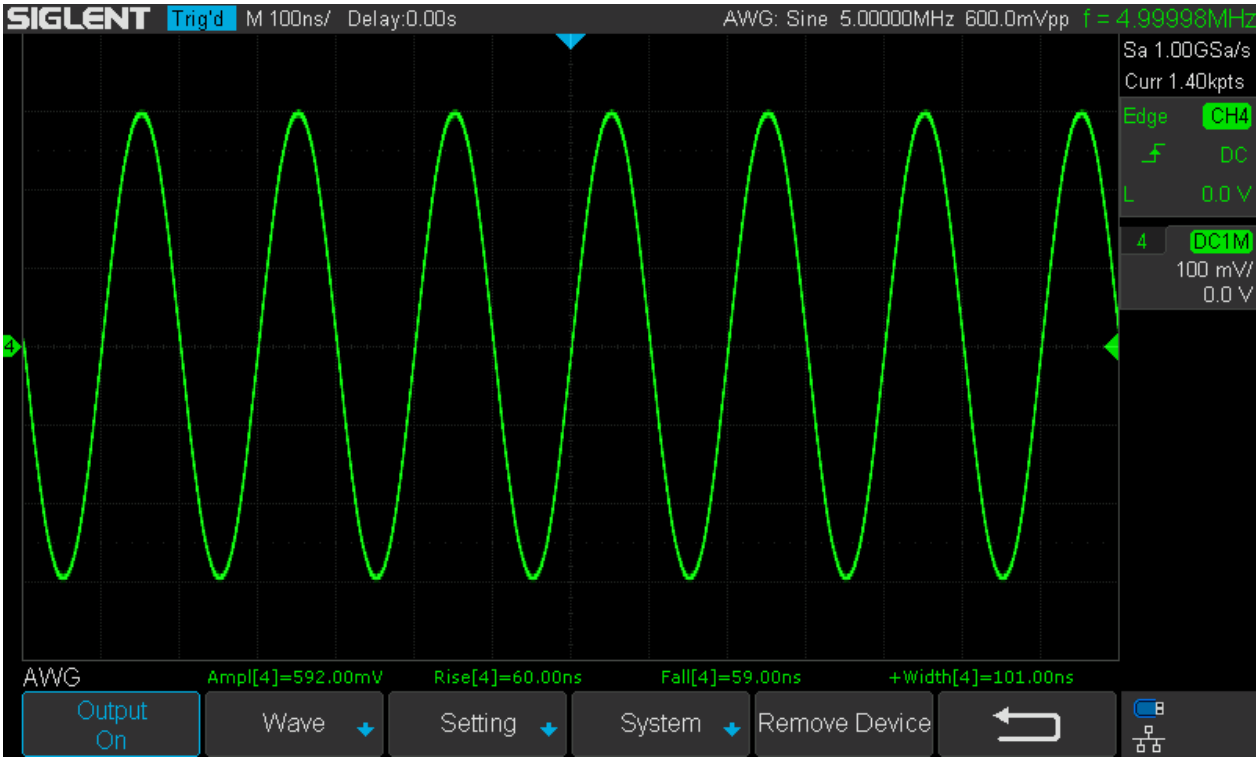
Output just turns the SAG1021 output on or off.

Remove Device - not quite sure why this is required as we cannot store any data on the SAG1021, apart from temporarily loading an arbitrary waveform into its sample memory. We don't have a comparable functionality for a USB memory stick that is used for data storage exclusively and certainly going to be (un)plugged much more frequently than the signal generator.

Setting is for the basic settings, like load impedance, sync output, over voltage protection, reset to default parameters and zero offset adjust.

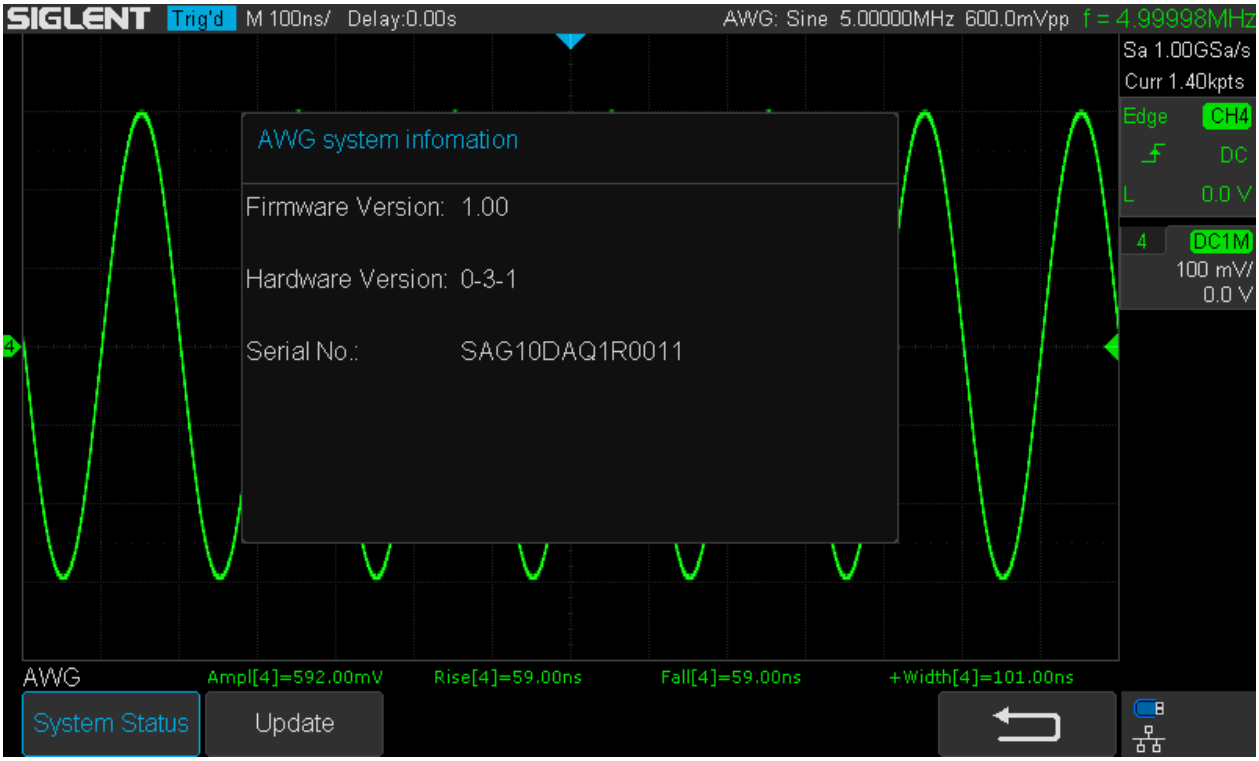
System offers a display of the AWG system status (which is just serial number, hardware- and software version) and also the menu item for a firmware update.

The following screenshots give an overview of these utility functions.



SAG1021_Main

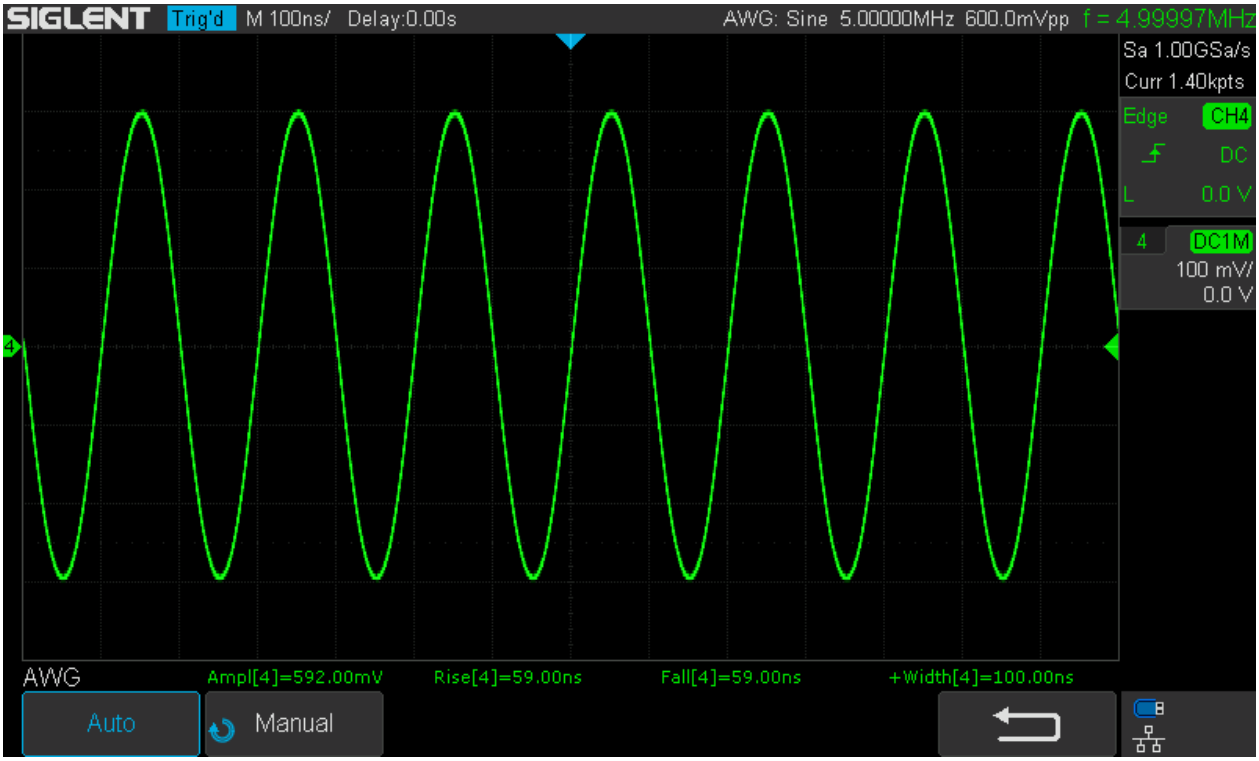
SAG1021_Settings



SAG1021_System

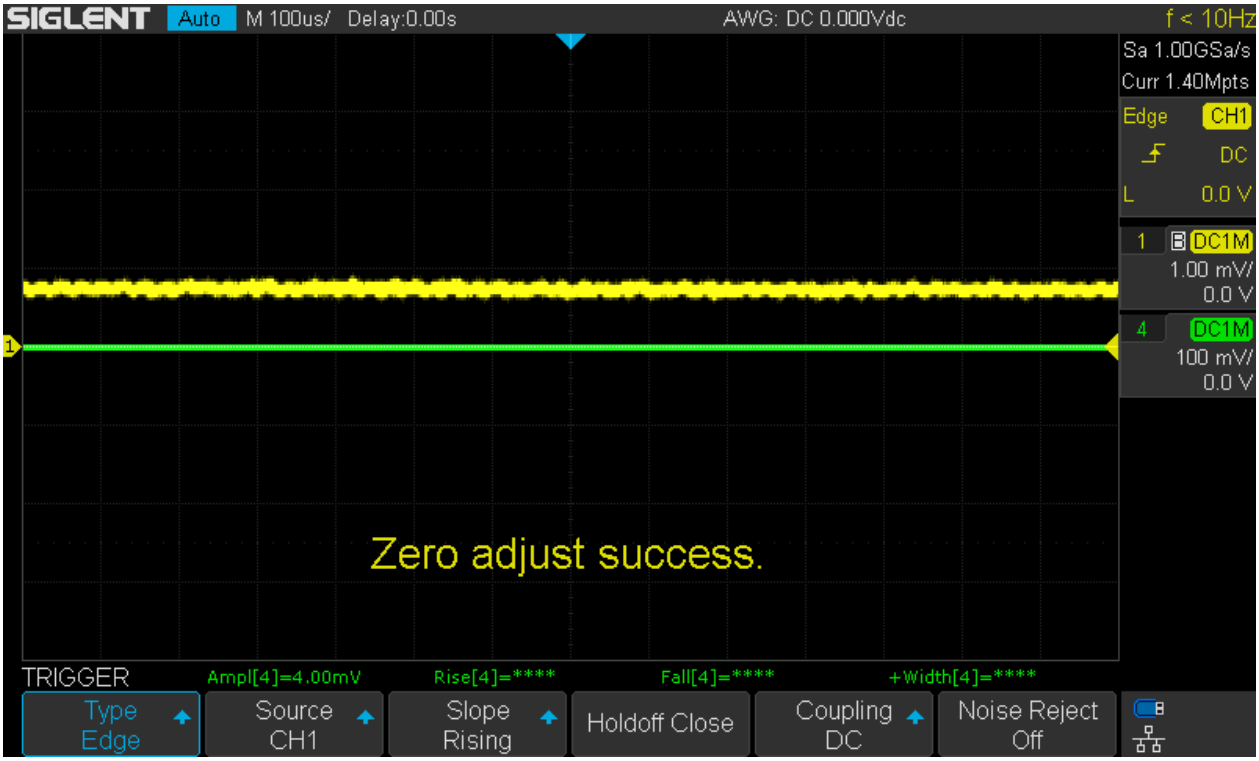
Zero Adjust

This function allows the adjustment of the DC offset so that it is close to zero. This can be done either automatically or manually – let's examine the automatic offset adjustment first.



SAG1021_Zero

In fact this is semi automatic only, as we still need to connect the signal output of the SAG1021 to the Ch.1 input of the scope (it will not work with any other channel). Then, after pressing the *Auto* soft button, the software takes over and sets the SAG1021 to DC output 0V and the scope Ch.1 to 1mV/div with 20MHz bandwidth limit and also sets the trigger to Ch.1, auto, rising slope with a level of 0V. After a while, it reports success with the generator output close to zero, but still with a considerable error. The screenshot below shows that situation, where the output has actually been adjusted to an offset level of 1mV, but sometimes it can be more. What is even worse, it does not restore the original settings after the adjustments. Consequently, the SAG1021 remains in DC output mode and the scope Ch.1 and trigger settings remain changed, messing up the previous setup.



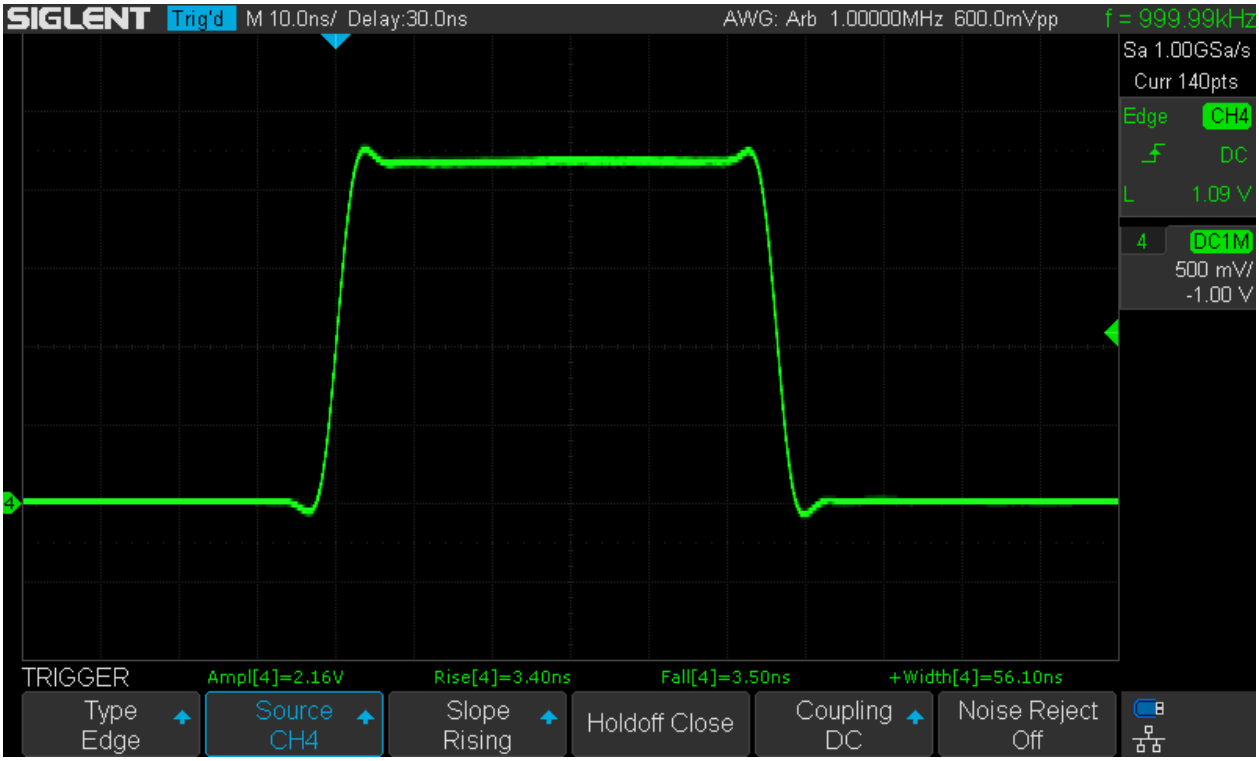
SAG1021_Zero_Auto

So the semi-automatic offset adjustment is far from perfect, but then again it is not really needed either. Manual offset calibration is straight forward and can be performed with any DSO channel. This still sets the SAG1021 to DC output mode and doesn't restore its previous settings, but at least the scope settings are left untouched. Of course we now need to set the channel gain to 1mV/div manually, but it can be done with any channel and we usually need not change the trigger settings, other than making sure it is in auto mode.

Sync Output

There are situations where it would be difficult for the scope to trigger on the output waveform directly, especially with arbitrary waveforms. Consequently, the SAG1021 offers a sync output that can be used as a reliable trigger source – and it turned out that it can be useful for more than just that. In fact its output is a nice pulse, 50ns wide with fairly fast transitions. So this is perfectly suited as a pulse source for e.g. rise time measurements and high frequency probe compensation adjustments. This should ease the pain caused by the slow transitions of the regular square and pulse waveforms.

The screenshot below show the sync pulse at 1MHz repetition rate on the 110MHz SDS1104X-E and it is perfectly suited for measuring its rise time of 3.5ns.

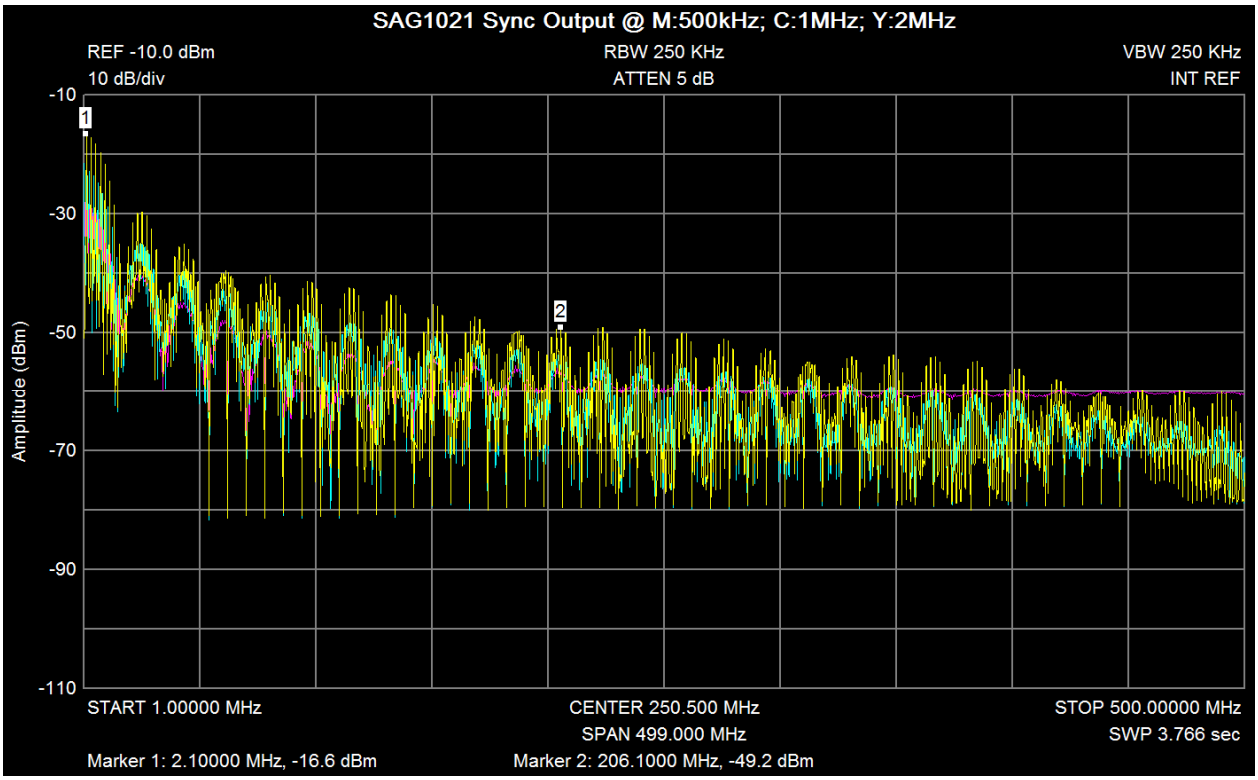


SAG1021_Sync_SDS1104X-E

On the 350MHz SDS2304X (1ns rise time) shown below we can estimate the rise time of the sync pulse to be close to 1ns.

SAG1021_Sync_SDS2304X

Just for fun, here's the spectrum of the sync pulse up to 500MHz for repetition rates of 500kHz (magenta), 1MHz (cyan) and 2MHz (yellow):



SAG1021_Sync_500kHz_1MHz_2MHz

Frequency Accuracy

The frequency accuracy is specified as ±50ppm which marks about the bottom of the barrel for all synthesized function generators. Fortunately, the actual accuracy appears to be much better than that.

For a 10MHz output, I got a measurement stable to 7 digits that was 9.999997MHz, hence a frequency error of <0.3ppm. The 7 digits mean that the short term stability is better than 1Hz or 0.1ppm. Of course this test cannot be representative for all devices, but it still indicates that the SAG1021 is likely to use a decent TCXO and the ±50ppm specification is just a copy & paste error. In fact, frequency accuracy of my SAG1021 is considerably better than that of the SDS1104X-E!

Waveforms

There are 5 standard waveforms (sine, square, ramp, pulse, noise) available, plus DC and arbitrary. This covers the majority of applications, but we don't get swept, gated and/or triggered waveforms and there is also no modulation capability.

We can adjust the frequency from 1µHz up to 25MHz for sine waves (10MHz for square and pulse, 300kHz for ramp) and the amplitude from 1mVpp to 3Vpp into a 50Ω load (or 2mVpp to 6Vpp into high-Z). We can also have a DC offset within this range and get an additional parameter for some waveforms, like symmetry for ramp, duty cycle for square and pulse width for pulse.

The available waveforms will be closely examined in the following sections.