33120A Function / Arbitrary Waveform Generator, 15 MHz [Agilent(=HP) - Discontinued]
FAQs

Is the Output connector on the 33120A <u>floating</u> or grounded?

Both the 'Output' connector and the 'Sync' connector are floating. Both connectors can be up to 42 volts (dc + peak ac) from earth ground. Note that there is also an earth ground screw terminal located on the rear panel of the instrument.
Revision 1.0; 03 May 99; dah

How do I replace the <u>output</u> protection <u>fuse</u>?

The output protection fuse is located inside the function generator. This fuse is a thru-hole soldered 500 mA part (Agilent part number 2110-0716C). The fuse is located near the output connector (J801) on the main PC board. You will need to disassemble the function generator to replace this fuse (use a TORX T-15 driver to remove the screws located on the rear panel). This part may be obtained from Agilent Parts Ordering at 877-447-7278.
Revision 1.0 13 DEC 99 jtm

How do I replace the <u>power-line</u> <u>fuse</u>?

The power-line fuse is located within the function generator's fuse-holder assembly on the rear panel. The function generator is shipped from the factory with a 500 mA slow-blow fuse installed (Agilent part number 2110-0458). This is the correct fuse for all line voltages.
This part may be obtained from Agilent Parts Ordering at
877-447-7278.
To replace the fuse:
1. Remove the power cord.
2. Remove the fuse-holder assembly from the rear. This assembly is adjacent to the power cord receptacle and has a small window that displays the line voltage setting.
3. Remove the blown fuse and install the new one.
4. Ensuring that the correct line voltage is still displayed in the window, replace the fuse-holder assembly.
Revision 1.0 13 DEC 99 jtm

How do I <u>clear</u> <u>memory</u> in the 33120A?

Calibration Constants:
The calibration constants cannot be cleared except during a calibration.
Calibration String:
The calibration string allows you to store customized calibration information about your function generator. To clear the calibration string, simply overwrite the old string by entering new information (or null string) using the **CALibration:STRing** command. For more information, refer to chapter 4 in the Agilent 33120A User's Guide.
Instrument States:
You can store up to four different instrument states (numbered 0,1,2, and 3) in non-volatile memory. To clear a previously stored instrument state, use the
MEMory:STATe:DELete{0|1|2|3} command. For more information, refer to chapter 4 in the Agilent 33120A User's Guide.
User-Defined Arbitrary Waveform Memory:
You can delete the waveform currently in volatile memory or any of the four user-defined waveforms in non-volatile memory. Note that you cannot delete the arbitrary waveform that is

currently being output nor can you delete any of the five built-in arbitrary waveforms. Use the **DATA:DELete** command to delete selected arbitrary waveforms or the **DATA:DELete:ALL** command to delete all user-defined arbitrary wavforms. For more information, refer to chapter 4 in the Agilent 33120A User's Guide.
Revision 1.0, 17 Dec 98 - dah

Can I disable the output without turning the 33120A off?

The 33120A does **not** have a simple ON/OFF switch for the output. **One possible method of producing zero output is to output 0 Volts dc**. The desired instrument state may be stored and then recalled when desired.
To set the 33120A to 0 Vdc from the front panel, hold down the "Offset" key for about two seconds. The dc offset voltage will then be output, which may be adjusted to 0 V. From the remote interface, issuing the SCPI command APPLy:DC DEFault, DEFault, 0 has the same effect.
For more information on generating a dc voltage, see How do I generate a dc voltage output from the Agilent 33120A?

How do I generate a dc voltage output from the 33120A?

The Agilent 33120A can output dc voltage in the range -5 Vdc to +5 Vdc (into a 50-ohm termination).
1. **Press the "Offset" key and hold it down for more than 2 seconds**. This activates the dc mode with the offset voltage as the output level (0 V default).
2. Enter the magnitude of the desired dc voltage using the knob or "Enter Number" key.
3. Set the units to the desired value by pressing the "Shift" key followed by the "V" (down arrow) key for millivolts or just press the "Enter" key for volts.
Revision 2.0, 05 Jun 02, cld

Adding a dc offset to the output of your function generator

Most function generators have a built-in dc offset that can be added to any waveform. The 33220A's built-in dc offset function can be used with any waveform to generate any combination of amplitude and offset within a -5Vdc to +5Vdc window into a 50-Ohm load. For applications which require a larger offset, you may be able to use an external power supply to generate the additional offset. In order to use an external supply to create the DC offset - follow these three steps:
1. The Function Generator needs to be isolated from ground, "floats". The 33220A can float up to 42 Volts (output plus dc offset) from earth ground. The maximum dc offset can be calculated by subtracting the peak output from 42 Volts.
2. The dc power supply needs to be connected in series. A BNC-T can NOT be used as this would connect the supply in parallel.
3. The voltage at the output of the function generator should be less than 42V. Connecting the power supply to ground makes it possible to calculate the voltage at the output of the function generator. The output voltage will be the dc supply voltage plus the peak voltage of the generator.
The diagram below shows a model of the 33220A, the connections to an external supply and the load.

Agilent 33220A
BNC Cable
50 Ω
A
V_{GEN}
B
V_{OUT}
R_L
1M Ω
45nF
DC Power Supply
V_{offset}

Point A Center conductor on output BNC
Point B Outside shield on Modulation In BNC
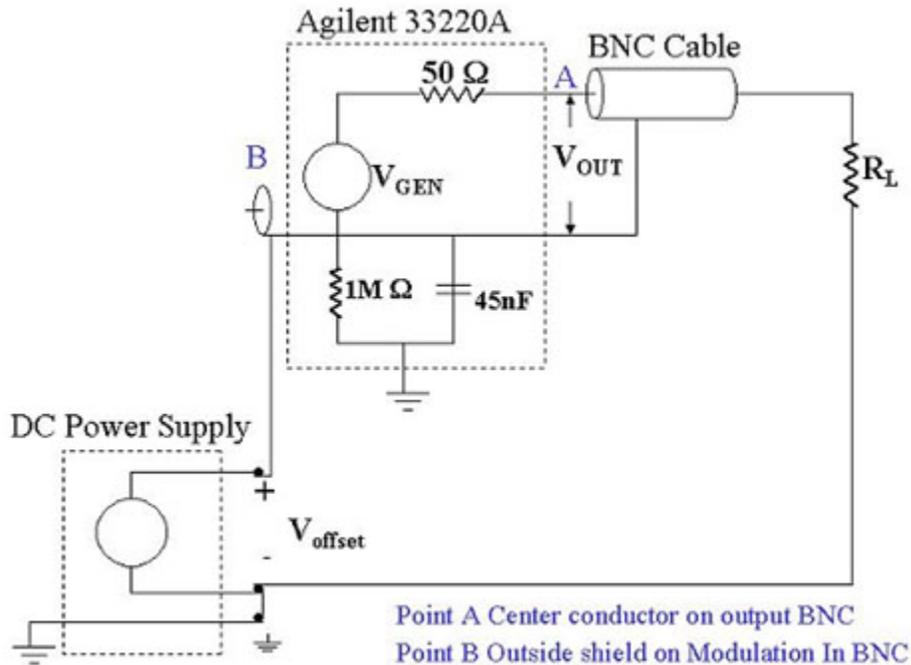
33220A, 33250A and 33120A Tip
An easy way to make these connections on the 33220A and 33250A is to access the floating ground through the Modulation In BNC, which is located on the rear panel. You can use a BNC connector minus the center conductor; connect this wire to the high of the power supply. Use just a wire to connect the signal output, center conductor of the output BNC of the function generator, to the high side of the load (do not use the shield of the Output BNC). The low side of the load is connected to the low of the power supply. Finally, the power supply low is connected to earth ground.

Can I control the power-on state of the 33120A?

When power is turned off, the 33120A automatically stores its state in memory location "0". You can configure the 33120A to automatically recall the power-down state when power is restored. The recall mode is disabled when the unit is shipped from the factory.
To enable the power-on state:
1. Enter the menu system by pressing the blue "Shift" key and then the "Enter" key.
2. Use the right arrow key until "D: SYS MENU" is displayed.
3. Press the down arrow key once to view the first of the available choices. You will see "1: OUT TERM".
4. Press the right arrow key once. You will see "2: POWER ON".
5. Press the down arrow key once. You should see "DEFAULT".
6. Press the right arrow key to change from "DEFAULT" to "LAST STATE".
7. Press the "Enter" key to exit the menu and save the changes. Your 33120A will now power up in the state in which it was powered down.

Can I turn off the audible beep on the 33120A?

The Agilent 33120A has three forms of audible feedback from the front panel:
- "*Tick*":
- "*Click*":
- "*Beep*":
The following commands allow you to make minor changes to the default sounds:

- **SYSTem:CLICk:VOLume {SOFT|NORMal}**
- When SOFT is selected, you will hear a "tick" when you press any front-panel key (normally, you would hear a slightly louder "click").
- **SYSTem:TICK:STATe {OFF|ON}**
- When OFF is selected, you will not hear any audible feedback when you rotate the knob (normally, you would hear a "tick").

Note: You cannot turn off the "beep" that is heard when an error is generated from the remote interface.

Can I transfer <u>waveform data</u> from the 33120A's arbitrary waveform memory <u>into a PC</u>?

It is **not** possible to directly transfer waveform data from the 33120A to a PC. While the 33120A is capable of accepting waveform data from a PC, **it is not capable of the reverse**.

One possible workaround involves the use of an oscilloscope. If you have a scope like the Agilent Infiinium or 546XX oscilloscopes, you can use the Agilent Intuilink Waveform Generator software to facilitate this. The process is relatively easy.
On the 33120A, select the desired waveform and connect this signal to your scope's input. Adjust the scope's trigger and horizontal and vertical scaling factors so that it displays a good picture of the waveform. Then use the IntuiLink Waveform Generator software to transfer the waveform data from your scope to your PC's Excel worksheet. Now you can view and edit the waveform data.
IntuiLink Waveform Generator software is free and is now shipped with the 33120A. It also can be ordered (no charge) from IntuiLink Connectivity Software

How do I <u>delete</u> a user-defined <u>arbitrary waveform</u> from memory?

From the remote interface, you can use the commands DATA:DELete <arb name> specifying the name of the arbitrary waveform you wish to delete or DATA:DELete:ALL to delete all of the user-defined arbitrary waveforms.
1. Enter the menu system by pressing the blue "Shift" key and then the "Enter" key.
2. Use the right arrow key until "C: EDIT MENU" is displayed.
3. Press the down arrow key to access the settings under the Edit menu.
4. Press the right arrow key until "7: DELETE" is displayed.
5. Press the down arrow key to view the waveforms in memory.
6. Press the left or right arrow keys to display the name of the waveform to be deleted.
7. Press the "Enter" key. "DELETED" appears on the display, confirming deletion.

Note: **You can also delete waveforms with Agilent IntuiLink Waveform Editor software**. It can be downloaded from the IntuiLink product page. After establishing communications with the instrument, select **Communications | Send Waveform** and then select the **Manage Waveforms** tab. You can then select the waveform to activate or delete.
IntuiLink Connectivity Software

What are the mean time between failure (MTBF) and mean time to repair (MTTR) estimates for the 33120A?

Mean time between failure (MTBF) is 40,000 hours. Mean time to repair (MTTR) is 1.2 hours.

What is the frequency <u>accuracy</u> of the 33120A?

The Agilent 33120A has the following specifications:
Accuracy: 10 ppm in 90 days, 20 ppm in 1 year, 18-28 degrees C
Temperature Coefficient: less than 2 ppm/degree C
Aging: less than 10 ppm/yr
Let's assume that you wish to determine the accuracy specification for your 1 MHz sine wave and your 33120A has been calibrated within the last year and is in a 22 degrees C environment.
The frequency accuracy is specified as 20 ppm (parts per million) within one year of the last calibration. Converting 20 ppm to a decimal value we get $20/10^6 = 0.00002$. Now multiply this value by the frequency to get (0.00002)(1.0E6) = 20 Hz. Your output frequency is therefore specified to be 1 MHz ± 20 Hz.
If your 33120A had been calibrated 2 months ago and was in a 30 degree C environment, the accuracy would be:
Frequency accuracy as 10 ppm (calibration was done within 90 days) plus 4 ppm (2 ppm per degree C outside of the 18-28 degree C temperature range) for a total of 14 ppm. (0.000010 + 0.000004)(1.0E6) = 14 Hz.

What does the <u>error message</u> number displayed on the front of my 33120A waveform generator mean?

Full descriptions of error codes may be found in Chapter 5 of the 33120A User's Guide or Chapter 6 of the 33120A Service Guide. 33120A Function Generator User's Guide
Error codes used on the 33120A fall into four general categories.

- **Execution Errors** - refers to error codes -101 through -440, 501 through -580, and 800 and 810. These errors are produced by software commands or communication errors. Commands that, for example, contain a syntax error or make an attempt to place the instrument into a state that is excluded, generally fall into the range -101 to -440. Error codes 501 through 550, 800 and 810 refer to communications errors. Error code 580 is specific to the external clock reference option (OPT 001).
- **Self test errors** with codes in the range of 590 - 626 occur either during the power-on self test (errors 601, 625 and 626) or during a complete self test. They indicate there may be a problem with the operation of the 33120A.
- **Calibration errors** fall in the range of 701 to 760, 800, 810 and 850 to 858. Calibration procedures outlined in Chapter 4 of the 33120A Service Guide may result in codes of this type.
- **Arbitrary Waveform errors** - codes 780 through 790, 800 and 810. These errors can occur when a attempt is made to create, modify or delete an arbitrary waveform in a way that is excluded by the instrument.
- **Colisted Errors** - 800 and 810. These two error codes can occur during several operations and are therefore listed in the sections "Execution Errors", "Calibration Errors" and "Arbitrary Waveform Errors". In general, these error codes are related to programming syntax or procedural errors.

Why do I get a syntax error (error -102) when I try to transfer a waveform from Agilent BenchLink Arb to the Agilent 33120A?

You probably need to upgrade to the latest version of Agilent BenchLink Arb (Version 1.41). Go to: BenchLink Arb Software

Why do I get error 580 when I power the unit on?

Error 580 means that your 33120A has <u>lost</u> the external clock. This is helpful when you wish to be notified that the function generator is no longer referenced to your system. *(If you're not sure what the power-on error is, you can determine this by checking the error queue. From the front panel, press the "Shift" and "Recall Menu" key (left arrow) so that "3: ERROR" is displayed. Press the down arrow key to view the number of the error. From the remote interface, issue the "SYST:ERR?" query.)*

If the 33120A has error 580 enabled, it will beep and the "Error" annunciator will light whenever a 10 MHz reference is not present. This error is often observed for the first time when the user is finished with a setup in which the generator was locked to an external timebase and subsequently powers the unit on without the external 10 MHz clock. To allow for error-free independent operation, you will need to disable the error as follows:

1. Enter the menu system by pressing "Shift" and then "Enter".
2. Use the right arrow key to move to the "G: PHASE MENU" (This menu is not present in units without the option 001).
3. Press the down arrow key once to view the menu selections. "1: ADJUST" should be displayed.
4. Press the right or left arrow keys until "4: UNLOCK ERR" is displayed.
5. Press the down arrow key once.
6. Press the right or left arrow keys until "DISABLE" is displayed.
7. Press "Enter" to save your changes and exit the menu system.

Why is the <u>output</u> voltage from the 33120A <u>twice</u> the value I set?

The Agilent 33120A has a fixed output impedance of 50Ω on the OUTPUT terminal and the 33120A factory defaults set the display to show the output voltage when connected to a 50Ω load. When the output of the 33120A is connected to a device of different impedance, like the high impedance of a multimeter or most oscilloscopes, the default display setting of the 33120A does not match the voltage received at the device. In fact, the measured voltage will be twice the value displayed.

Vout = (2 x Vin x RL) / (RL + 50)

Where

- Vout is the actual voltage generated by the 33120A
- Vin is the output voltage entered on the 33120A display while the instrument is operating in 50Ω mode
- RL is the output load impedance
- 50 is the Agilent 33120A's output impedance

The Agilent 33120A's output impedance is fixed at 50Ω, and cannot be changed.

The following steps show how to configure the 33120A to display the correct voltage into a load:

- **Enter the front-panel menu by pressing "Shift-Enter**
- **Move across to the D: SYS MENU by pressing the right arrow key**
- **Press the down arrow to enter the menu so that 1: OUT TERM is displayed**
- **Press down arrow again to view the setting for the output termination (load impedance).**

Press the right arrow until the desired impedance of the load is displayed, either 50 OHM or HIGH Z.

- **Press "Enter" to save the change and exit the menu.**

The Agilent 33120A is now configured to display the actual output voltage into a high impedance load.

Why your function generator outputs <u>twice</u> the programmed voltage

The default setting for Agilent function generators is to display the desired voltage as though terminated into a 50 Ohm load. When a high impedance device, such as an oscilloscope is used to measure the output of the function generator, the waveform appears to be twice the voltage set on the display of the function generator.

Some oscilloscopes can change their input impedance from standard high impedance to a 50 Ohm termination. Another solution is to add a 50 Ohm feed through (Agilent part number: 0960-0301) to the end of the BNC cable.

$$V_{measured} = \tfrac{1}{2}V = \tfrac{1}{2}\,(2*\text{display})$$
$$V_{measured} = \text{display}$$

$$V_{measured} = V = 2*\text{display}$$
$$V_{measured} \neq \text{display}$$
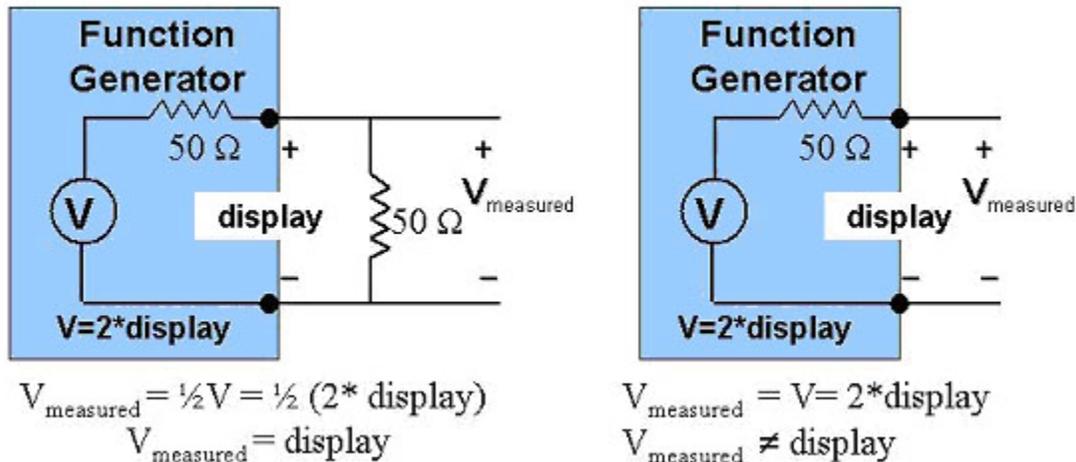
Other common impedances are: 25, **75**, 93, 135, 150, and **600** Ohms -Video systems are most often 75 Ohms and many audio systems use a balanced 600 Ohm termination. If not terminating the output of the function generator into a 50 Ohm load, it may be necessary to adjust the output voltage to compensate for the different impedance. For a 50 Ohm source the desired voltage $V_{measured}$ into an impedance R can be calculated as $V_{measured}=V(R/(R+50))$, where **V**=2*display or $V_{measured}=\text{display}(2R/(R+50))$

The Agilent 33220A and 33250A function generators have the ability to do this calculation for you and directly display the desired voltage. They include a feature that allows the output termination to be set to any impedance from 1 to 10 k Ohm, or infinite. For example if the output termination is set to 75 Ohms and then generator is connected to an oscilloscope with a 75 Ohm termination (or 75 Ohm feed through). The function generator display will match what is displayed on the scope.

To what EMC standards does the 33120A comply?

The 33120A complies to CISPR 11:1990/EN55011 (1991): Group 1, Class A. IEC801-2:1991/EN50082- 1(1992):4kV CD, 8kV AD. IEC 801-3:1984/EN50082-1 (1992): 3V/m. IEC 801-4:1988/EN50082-1 (1992): 1kV Power Lines, 0.5kV signal lines.
The 33120A does not meet the performance requirements of MIL-461C characterization. However, performance test data is available upon request.
Revision 1.0 16 DEC 99 MER

What is the <u>maxi</u>mum 33120A <u>output current</u>?

Output current is **not** a specified parameter, however, a single unit was characterized to determine its performance. <u>The maximum output current was 139mA RMS, with the 33120A configured for a 10Vp-p, 1 kHz sine wave.</u> The 33120A output was fed directly into the current inputs (approx 0.5 ohm) of a 34401A DMM. The output current reading decreased linearly to 14mA RMS as the output voltage setting was decreased to 1Vp-p.
The 33120A is designed for a 50 Ohm load, **and includes a 50 Ohm matching resistor in series with the final output stage**. A portion of the output voltage is dropped across this internal resistance. This voltage drop increases as the load resistance decreases. <u>When the 33120A output is set to 10 Vp-p, 139mA RMS was delivered to the low load resistance of the meter.</u> The majority of the output voltage was dropped across the 50 Ohm resistor internal to the 33120A, with only a small portion appearing across the load. No attempt was made to measure distortion that might be caused by the impedance mismatch.
Revision 1.1 18 JAN 00 gfe

Is the <u>noise</u> function of the 33120A "white" noise or "pink" noise?

The noise function of the Agilent 33120A is a 10 MHz Gaussian distribution, which is also called **"white"** noise. "Pink" noise has a -10 dB slope/decade.
Revision 1.0; 24 Nov 98; dah.

33120A Function / Arbitrary Waveform Generator, 15 MHz

Discontinued. Supported until: 30 May 2008.

The 33120A function generator has a proven legacy, 15 MHz bandwidth, arbitrary waveforms & modulation capability. **DDS technology** provides precise adjustment and frequency stability.

- 15 MHz **sine & square** waveforms
- Ramp, triangle, noise & DC waveforms
- **12-bit, 40 MSa/s, 16,000 points arbitrary waveforms**
- AM (int/ext), FM (int), FSK (internal/external), burst (int/extl)
- Linear & logarithmic sweeps and burst operation
- **IntuiLink software** plus GPIB & RS-232 interfaces included
- Option 001 provides improved stability & a multiple-unit link