



Agilent 33120A and 33220A Programming comparison guide

This 33120A/33220A Comparison Programming guide will list those areas where 33120A users might find differences in operation when using a 33220A. These differences are few, but documented in order to make it easier to verify programs. This guide does not list all of the differences in performance where the 33220A is superior, such as the maximum frequency (20 MHz vs 15 MHz) or additional features (such as pulse or additional modulation capabilities).

The differences are grouped into the following categories:

- General
- Triangle
- Arbitrary Waveforms
- Modulation
- Burst
- Sweep
- Sync Signal
- Store/Recall States

General

Min/Max Values: The 33220A has different performance capabilities than the 33120A, and all instances of minimum and maximum values in a program should be verified to be certain the new performance is compatible with the application. One such example is the OUTPUT:LOAD command. The 33120A can recognize two termination settings: 50 Ohms and High-Z. The 33220A can be told to compute the voltage for a termination value between 1 Ohm and 10 kOhms (the default is 50 Ohms). Setting OUTPUT:LOAD MIN on the 33120A will give 50 Ohms, but will give 1 Ohm on the 33220A. Similarly, OUTPUT:LOAD MAX on the 33120A will give High-Z, but will give 10 kOhms on the 33220A. Similar differences in performance will be seen with other commands.

Output Enable: The 33220A powers on with the output disabled. The 33120A does not have the ability to turn off the output. From the 33220A front panel, Press the OUTPUT key to enable or disable the output. In all 33120A programs, the command OUTPUT ON will need to be added when using the Agilent 33220A.

Timing: The 33220A is a different instrument than the 33120A. Programs relying upon expected response times of the 33120A may need to be adjusted.

Calibration: The calibration of the 33220A is different than that for the 33120A. Automated calibration programs for the purposes of adjustment will not be compatible.

DIAG, PEEK, POKE: None of the diagnostic commands unique to the 33120A are supported on the 33220A.

Triangle

The 33220A does not have a separate triangle function, but rather a ramp waveform with variable symmetry. Although it is not documented in the 33220A manual, sending the 33120A command FUNCTION:SHAPE:TRIangle will be interpreted by the 33220A as a command to select the RAMP waveform with 50% symmetry (i.e. a triangle waveform).

If the triangle waveform is output, then ramp is selected, the 33120A will change to a ramp waveform with 100% symmetry. The 33220A has already selected the ramp waveform, and will output the ramp

with the previously selected symmetry; 50% in this example. Function queries, APPLY? and FUNCTION?, will not return "TRIANGLE" as the result on the 33220A.

Arbitrary Waveforms

The 33220A has a memory depth of 64K arb points and a sample rate of 50 MSa/sec. Depending upon the number of points downloaded, the number of arb points used is always 16K (when <16385 points are downloaded) or 64K (when >16384 points are downloaded). The downloaded points are expanded to fill the required memory. The 33120A has a 16,000 point memory depth and only uses those points downloaded into its memory.

The order of the built-in arbitrary waveforms is also different. The 33220A will return the following list: Exp_rise, Exp_fall, Neg_ramp, Sinc, Cardiac. The 33120A returns the list in this order: Sinc, Neg_ramp, Exp_rise, Exp_fall, Cardiac.

The output sync for arbitrary waveforms on the 33220A is a 50% duty cycle square wave, with the rising edge occurring at the beginning of the waveform. On the 33120A, it is a positive pulse at the beginning of the waveform.

From the front panel, there are two additional differences. First, when selecting the desired arb to be output, it is possible to select the arb at any time on the 33120A. With the 33220A, the arb must be turned on before a new arb waveform may be selected. To prevent the current arb from being output, disable the output. Second, when creating arbitrary waveforms from the front panel, the 33120A sets the number of points to determine the overall arb size. The 33220A uses the number of points to set the number of line segments. The actual number of points will be 16K unless 16385 or more segments are edited from the front panel.

Modulation

From the front panel, the 33220A requires that the current modulation be turned on before a new modulation can be selected or a modulation parameter can be adjusted. Disable the output or set up the modulation in advance, store it into one of the memory locations and recall that state if this presents any type of a problem.

The output sync for modulation on the 33220A is a 50% duty cycle square wave, with the rising edge occurring at the beginning of the modulation. On the 33120A, it is a positive pulse at the beginning of the modulation.

The 33120A external AM input is always enabled, so the choices for modulation source are External or Internal/External (AM:SOURce BOTH). The 33220A does not support the internal/external mode of operation. When the command AM:SOURce BOTH command is sent, it is accepted by the instrument and the modulation source is changed to INTERNAL. The response to the AM:SOURce? query on the 33120A is "BOTH" but is "INT" for the 33220A.

If the modulation is on and the carrier is changed to noise, or DC, the 33220A will generate an error (-221 from the bus) to warn of a conflict of settings and turn off modulation. When a valid carrier is selected, the modulation will remain off. The 33120A turns off the modulation without generating an error and resumes modulation when a valid carrier is again selected.

The External AM input is fixed on the 33120A so that 5 Vp is equal to 100% depth. The 33220A sets the 5 Vp limit equal to the value selected for modulation depth, which allows greater control of amplitude change over small ranges.

When using internal modulation, the 33220A always uses a 200 kHz Direct Digital Synthesis (DDS) engine with 8K point waveforms. The 33120A uses various clock speeds and waveform point counts depending upon the settings.

Burst

When the internal burst rate is set to a value equal to or less than the carrier (1 kHz from the default state of the instrument) then the burst is turned on (BM:INTernal:RATE 1000 then BM:STATe ON), the 33220A will generate an error to warn that the settings conflict (-221 from the bus) and changes the burst rate to a value that will work. The 33120A “skips” those triggers that are received while the waveform is being output (an effective burst rate of 500 Hz in this example) without generating an error.

The gated burst on the 33220A always begins at a known phase and may be adjusted. When the external gate goes false, the 33220A completes the current cycle then stops to wait for the gate to go true. On the 33120A, the waveform begins immediately at an arbitrary phase with the high gate and stops immediately with the low.

Accordingly, the output sync is different with both instruments.

In gated burst, the 33120A output signal begins immediately with the high gate, and stops immediately with the low. Since the 33220A always completes the last cycle, the sync signal remains high until the last cycle is complete.

With counted burst, 33220A pulls the sync high while the output is active to keep it consistent with the operation of the gated burst. The 33120A uses the reverse polarity, outputting a low sync while the output is active and high during the wait state.

Sweep

With Marker Off, output sync for sweep on the 33220A is a 50% duty cycle square wave, with the rising edge occurring at the beginning of the sweep. With Marker On, the falling edge occurs at the key frequency. The 33120A sync outputs a falling edge at the start frequency and a rising edge at the stop frequency.

Sync Signal

Gated Burst: With the 33120A, the output signal begins immediately with the high gate, and stops immediately with the low. Since the 33220A always completes the last cycle, the sync signal will remain high until the last cycle is complete.

Counted Burst: The 33220A pulls the sync high while the output is active to keep it consistent with the operation of the gated burst. The 33120A uses the reverse polarity, outputting a low sync while the output is active and high during the wait state.

AM, FM, FSK: The output sync for modulation on the 33220A is a 50% duty cycle square wave, with the rising edge occurring at the beginning of the modulation. On the 33120A, it is a positive pulse at the beginning of the modulation.

Sweep: With Marker Off, output sync for sweep on the 33220A is a 50% duty cycle square wave, with the rising edge occurring at the beginning of the sweep. With Marker On, the falling edge occurs at the key frequency. The 33120A sync outputs a falling edge at the start frequency and a rising edge at the stop frequency.

Arbitrary Waveforms: The output sync for arbitrary waveforms on the 33220A is a 50% duty cycle square wave, with the rising edge occurring at the beginning of the waveform. On the 33120A, it is a positive pulse at the beginning of the waveform.

Store/Recall States

If State 3 is not defined, and either the command MEMory:STATe:DELeTe 3 or the command *RCL 3 is executed, error +010 is generated on the 33120A, specifying that no such state exists. No error is generated on the 33220A.

	33120A	33220A
APPLY? and FUNCTION?		Will not return "TRIANGLE"
Sending FUNC:SHAP TRI then FUNC:SHAP RAMP	Ramp	Triangle
OUTP:LOAD MAX	High-Z	10 kOhms
OUTP:LOAD MIN	50 Ohms	1 Ohm
Arb List Order (DATA:CAT?)	Sinc, neg_ramp, exp_rise, exp_fall, cardiac	Exp_rise, exp_fall, neg_ramp, sinc, cardiac
AM:SOUR BOTH	33120A has external or internal/external source	Does not support internal/external operation: Accepts the command and changes the source to internal
AM:SOUR?	Returns "BOTH"	Returns "INT"
MEM:STAT:DEL 3 (3 not defined)	Generates Error +010	
*RCL 3 (3 not defined)	Generates Error +010	
BM:INT:RATE 1000 then BM:STAT ON	Effective burst rate of 500 Hz	Generates Error -221 and changes burst rate
Gated Burst	Starts immediately with high gate, stops immediately with low	Always completes last cycle
Gated Burst Phase	Arbitrary—can not set	Always starts at known phase
Sync for Gated Burst	Follows external signal – high while output	High while output
Sync on arbs	Positive pulse at beginning of waveform.	50% square wave with rising edge at beginning of waveform.
Sync on AM, FM, FSK	Positive pulse at beginning of modulation	50% square wave with rising edge at beginning of modulation
Sync for Counted Burst	Low while output	High while output
Sync for Sweep	TTL low at start frequency, TTL high at stop frequency	Marker off: TTL high at start, 50% duty Marker on: TTL high at start, low at key frequency
Internal Modulation	Various clock speeds and waveform point counts	200 kHz DDS with 8K point waveforms
External AM	5 Vp is equal to 100% depth	5 Vp is equal to depth setting to be more equivalent with external FM
Change carrier to noise, pulse, or DC	Turns off Modulation	Generates Error -221 and turns off modulation
Change back to valid carrier	Returns to Modulation	Modulation remains off
Arb Points	Determined by user (16000 max.)	Always 16K or 64K (when >16384 points)
Front Panel Arb Creation	Set points and amplitude reference	Set key time and voltage pairs
Number of Points	Determines arb size	Determines number of segments
Front Panel Arb Select	Can select arb at any time	Can not select arb without turning on current arb
Front Panel Burst Rate, AM Shape, FM Shape, Sweep type, etc.	Can select and change at any time	Can not modify without turning on modulation, sweep, burst, etc.
Unique commands	MIN/MAX values, calibration, DIAG, PEEK, POKE, etc.	