



## Up-and-Down Programming DUT Power Supplies

There seems to be some confusion on what the current limits are when using the DUT supplies in the Agilent 3070 system. While this article is not meant to be an exhaustive treatise on the subject, a little clarification might help. This article covers only the Agilent 6621A, Agilent 6624A, Agilent 6634A, and Agilent 6642A, since these are the only supplies currently supported on the Agilent 3070. For more information on these or other power supplies, consult the applicable manual. **STEADY STATE**

The only potential confusion here are the maximum and minimum programmable current limit levels. The high and low limits are listed below. Note that it is possible to program for a lower level than shown below. When that is done the supply automatically sets itself to its minimum, and **NO ERROR OR WARNING OCCURS!**

	<<<< SUPPLY MODEL >>>>				
RANGE	6621A	6624A	6624A	6634A	6642A
0 - 7 V	10 A	5 A	na	na	na
0 - 20 V	4 A	2 A	2 A	na	10 A
0 - 50 V	na	na	.8 A	na	na
0 - 100 V	na	na	na	1 A	na
MINIMUM CURRENT	130 mA	80 mA	50 mA	4 mA	0 mA

### UP-PROGRAMMING

This apparently straightforward action is not as simple as it seems. When a supply is sitting at 0 volts, and is programmed to say 10 volts and 1 amp, the output current can go to as much as 150% of the rated output (potentially 15 amps on the Agilent 6621A) for a few milliseconds (100 useconds on the Agilent 6642A). This overshoot may, of course, be limited by the applied load. After that time the output goes into either current or voltage limit depending on the user programmed values and the load. While this action is normally desirable, for example when charging the capacitors on the supply input of a board under test, it may be undesirable in other applications. If the overshoot is intolerable in your application, a work around which should minimize the overshoot is as follows.

- Program a small voltage and a small current so that the supply goes into current limit.
- Next program the desired voltage level (supply stays in current limit at low value).
- Finally program the desired current limit.

On the Agilent 3070 Series II there is a new 'optimize' option on the sps command. This option has no effect on either up-programming or down-programming current limits. The function of the 'optimize' option is to increase Agilent 3070 throughput (see Appendix).

--- CAUTION --- Direct programming of the Agilent 3070 DUT power supplies is not supported. Mistakes could cause damage to the system and or the board under test.

The following method is not recommended.

When using the Agilent 6621A or Agilent 6624A there is another potential solution, but it requires the use of direct GPIB programming of the DUT power supplies, a non-supported Agilent 3070 action. If direct programming is used, despite being unsupported, it is recommended that Agilent 3070 supply commands NOT BE INTERMIXED with direct commands. Control of the supplies should always be done using one method or the other, NOT both. Newer model supplies have an upgraded EPROM to help solve the up-programming overshoot problem. This new EPROM is retrofitable into older serial numbers (see Service Notes 6621A-09 and/or 6624A-09). To determine if your unit has the newer EPROM, run the following program.

```
assign @Supply3 to "/dev/ps3"
!** Check your /dev file. You will need to modify
!** the device name for each supply tested.
```

```
output @Supply3; "DCPON 3"
output @Supply3; "ERR?"
enter @Supply3; Error
if Error <> 0 then
print "This unit has an old EPROM."
else
print "This unit has the new EPROM."
end if
```

On Agilent 6621As and Agilent 6624As with the new EPROMs, overshoot is easily prevented. First you need to program DCPON to 3 (this may be done by running the program above). Once this variable is set, it should never need to be reset, much like the GPIB Address. From this point on you set the power supply voltage and current limits as normal, with one exception; anytime you want to set the supply to zero volts, turn the output off instead.

First you need to make sure the supplies output is set to off. This is easily done by;

```
output @Supply3; "OUT 2, 0"
!** Turn off second internal supply inside ps3
Next you must set up the desired current and voltage limits. For example:
output @Supply3; "VSET 2, 5"
!** Set supply 2 to 5 volts
output @Supply3; "ISET 2, .5"
!** Set supply 2 for .5 amps From this point on, unless changing limits, just turn the supplies
output on and off.
output @Supply3; "OUT 2, 0"
!** turn off second internal supply inside ps3 To turn the supply back on to its former
programmed value send:
output @Supply3; "OUT 2, 1"
!** turn on second internal supply inside ps3
```

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The previous method is not recommended. DOWN-PROGRAMMING It is also necessary to consider what happens when one of these supplies is reset to zero volts (programmed down). Again the Agilent 6621A and Agilent 6624A supplies operate differently than the Agilent 6634A and the Agilent 6642A.

Agilent 6621A: If the output voltage is between 21.2 volts and 10 volts, and is reset to zero, the sink current will be limited to 4.4 amps. If the output voltage is between 10 and about 1 volts, then this current is limited to 11 amps. When the output voltage is below about 1 volt, the current decreases roughly linearly from 11 amps to zero amps at zero volts. These limits are NOT dependent on the settings of the supply, but are fixed at the levels given above. Note that a supply down programmed from say 15 volts to zero in one step will have a variable current sink (assuming there are no external current limiting devices). While the voltage is above 10 volts the current will be 4.4 amps, but as soon as the voltage drops below 10 volts the current will jump to 11 amps.

Agilent 6624A: Low Voltage; If the output voltage is between 21.2 volts and 10 volts, and is reset to zero, the sink current will be limited to 2.2 amps. If the output voltage is between 10 and about 1 volts, then this current is limited to 5.5 amps. When the output voltage is below about 1 volt, the current decreases roughly linearly from 5.5 amps to zero amps at zero volts. These limits are NOT dependent on the settings of the supply, but are fixed at the levels given above. Note that a supply down programmed from say 15 volts to zero in one step will have a variable current sink (assuming there are no external current limiting devices). While the voltage is above 10 volts the current will be 2.2 amps, but when the voltage drops below 10 volts the current will jump to 5.5 amps.

Agilent 6624A High Voltage: If the output voltage is between 51.5 volts and 24.1 volts, and is reset to zero, the sink current will be limited to .88 amps. If the output voltage is between 24.1 and about 1 volts, then this current is limited to 2.2 amps. When the output voltage is below about 1 volt, the current decreases roughly linearly from 2.2 amps to zero amps at zero volts. These limits are NOT dependent on the settings of the supply, but are fixed at the levels given above. Note that a supply down programmed from say 30 volts to zero in one step will have a variable current sink (assuming there are no external current limiting devices). While the voltage is above 24.1 volts the current will be .88 amps, but when the voltage drops below 24.1 volts the current will jump to 2.2 amps.

Agilent 6634A: This supply operates completely differently when down-programmed. No matter where the voltage is set, it will sink 50 milliamps PLUS the programmed current limit. Since the minimum current limit setting is 4 milliamps, it is easy to insure that a limit of 54 milliamps (or more if wanted) is not exceeded when setting the voltage to zero; just reset the current limit as desired before down-programming.

Agilent 6642A: This supply is different yet again. The sink current is limited to 1 amp during down-programming, no matter what supply settings are used. APPENDIX REFERENCE OPTIMIZEOPTION ON SERIES II SPS

\*\*\* New Syntax Reference Manual Entry under sps \*\*\*

Typically, power supply programming is "optimized", which improves board test throughput. If desired, you can

force a necessary power supply turn on sequence by removing the "optimize" keyword.

The optimize option uses the STORE/RECALL feature on the Agilent 6621A and Agilent 6624A supplies which allows a power supply state to be stored and then recalled later with a single command. On nrun=1, each output must be set to its current and voltage, and then the state must be stored. On subsequent runs, the previously stored state is recalled with a single command which is much faster than reprogramming each output individually. So, nrun=1 is slower than subsequent runs when using the optimize command, but the supplies are still brought up "simultaneously". They will probably NOT turn on in the same order as shown in the testplan.

When nrun is greater than one, the optimize keyword has its greatest effect. All supplies having the keyword "optimize" are turned on (actually enabled) at the same time. Any supplies not having the keyword "optimize" are turned on in the order they appear in the testplan. Note that you may mix and match optimized and non-optimized supplies. Also the default wait of 30 milliseconds still applies, but can be changed if desired.

EXAMPLES (nrun>1);

! \*\* Turn on supply 1, then wait 30 ms.

sps 1, 3

! \*\* Turn on supplies 2 & 6 at the same time,

! \*\* and then wait 30 ms.

sps 2, 12; optimize

sps 6, 12; optimize

! \*\* Turn on supply 4 and then wait 1 second.

sps 4, 6, wa 1

! \*\* Turn on supplies 3 & 9 at the same time,

! \*\* and then wait 50 ms.

sps 3, 5; optimize

sps 9, 5, wa 50m; optimize

! \*\* Set supply 3 to zero volts, then wait 30 ms.

sps 3, 0

! \*\* Set supply 9 to zero volts, then wait 30 ms.

sps 9, 0