BE2100 High accuracy DC source application note

a smart voltage sweep

This application note shows how to drive a Bilt BE2101 DC source together with a Keithley 2182 nano-voltmeter, while proceeding to a reliable, fast and accurate voltage monitoring.

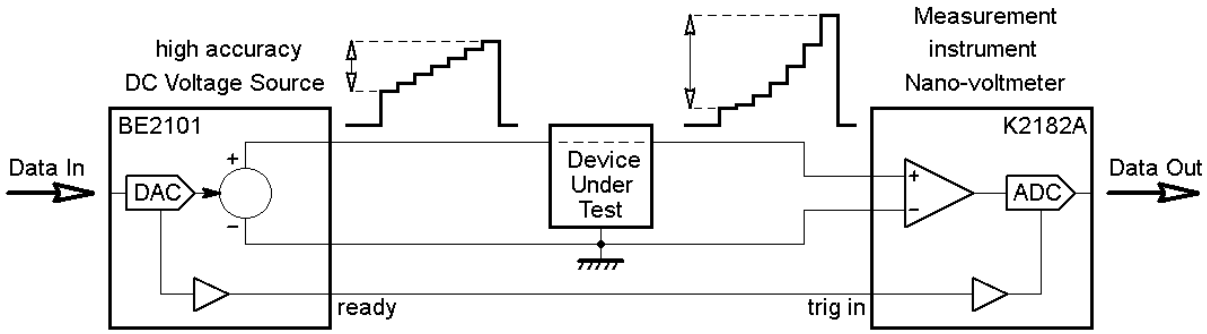
iTest supplies LabView drivers for Bilt system, including a demonstrator intended for BE2100 module control.

Review	*Date*	*Auteur*	*Modifications*
A	2012-03-22	hc	initial

Contents

1 Application description

According to the simplest characterization scheme, a device is biased using a voltage sweep input made of accurate micro-steps, while, synchronously, a measurement is performed onto the output signal.



In order to simplify this application note, the device under test has been removed and replaced by a strap, and thereby, the process will perform the characterization of the accuracy of the DC source itself, thanks to the higher accuracy of the Keithley 2182 nano-voltmeter.

- The PC computer controls both the DC source and the nano-voltmeter using GPIB interface.
- The logical output “Ready” of the BE2101 source is connected to the logical input trigger in of the K2182 voltmeter.
- A small board is used to connect within a single location the source output coaxial cable, the 2 source sense coaxial cables, and the shielded twisted pair voltmeter cable.

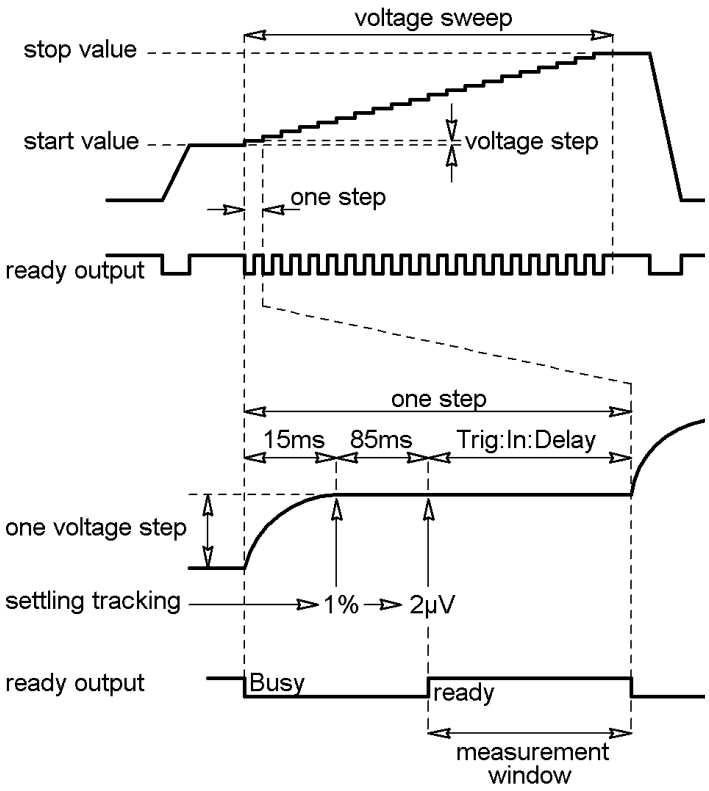
2 Auto synchronization

The latest innovation performed by the BE2100 sources is the auto synchronization mode. It allows to reduce the process duration to the minimum while ensuring maximum accuracy, whatever the settling time possibly increased by any random event.

This mode uses the output “Ready” signal to synchronize both source settling and measurement process:

- after each digital voltage update, a low level means “Busy”. The DC source analog settling time is in progress, up to the defined resolution. Depending on the internal filter (*Volt:filter parameter*), it takes approximatively 10ms or 100ms to settle within the guaranteed true resolution (19 or 21 bit). Note that this time/resolution goal can be modified by the user (*Ready amplitude parameter*), and that some external random events can delay the settling (Load modification, noise, capacitor effect...)

- once the settling completes within the requested resolution, a high level means “Ready”. The voltmeter is trigged for measurement within a duration defined by the user (Trig:In:Delay parameter). Then, after completion, the next step is internally initiated.



Following a simple setting and a single software start command, the DC source will output by itself the requested voltage sweep, without any PC software effort.

In addition, all along the sweep, the user software can read a completion parameter (volt:status? from 0 to 1) which indicates the remainder gap between the running voltage and the stop voltage at the end of the sweep.

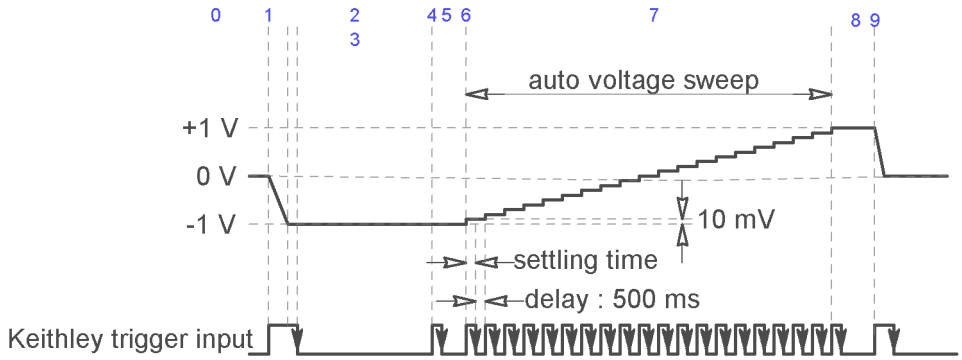
In case of some mismatch between setting parameters or with the external working conditions, the sweep will never complete, even the first step. Anyway, the computer can abort the process at any time, warned by the abnormal idle value given by the command "volt:status?"

3 Software process

3.1 Complete voltage sweep sequence

The process will perform the characterization of the accuracy of the DC source from -1V up to +1V using 200 steps of 10mV. For maximum accuracy, the step width will be about 600ms (maximum). The corresponding 201 points plot is shown at the end of this section.

0 - Set voltage = -1 V
1 - Set output ON
2 - Wait for stabilization (approx ~10 sec).
3 - Configure Keithley while waiting for stabilization :
    Set range
    Set PLC count
    Set recording points count to 201
    Enable external trigger input
4 - Set voltage = -1 V => trigger ready event => first measurement.
5 - Configure auto voltage sweep :
    Set voltage = +1 V
    Set trigger delay = 500ms
    Set voltage step amplitude = 10 mV
6 - Start sweep thanks to software trigger
7 - Wait for stair ending (Volt:status?)
8 - Add additional delay for Keithley to proceed to the last measurement.
9 - Set voltage = 0V



The output “Ready” signal of the BE2101 source is inverted and connected to the external trigger input of the Keithley K2182A nano-voltmeter : each falling edge initiates a new measurement, automatically stored in K2182A's internal buffer.

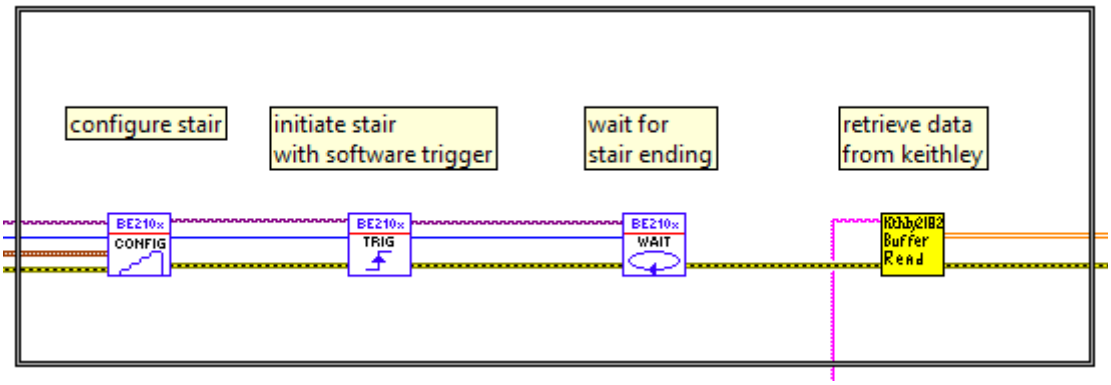
3.2 Instruments setup

BE2101 parameters	value
voltage range	1.2V
filter / settling speed	slow (100ms)
trigger in mode	AUTO
start voltage	-1 V
stop voltage	+1 V
voltage step amplitude	10mV
Ready amplitude	1.2µV
trigger delay	120ms
trigger polarity	inverted

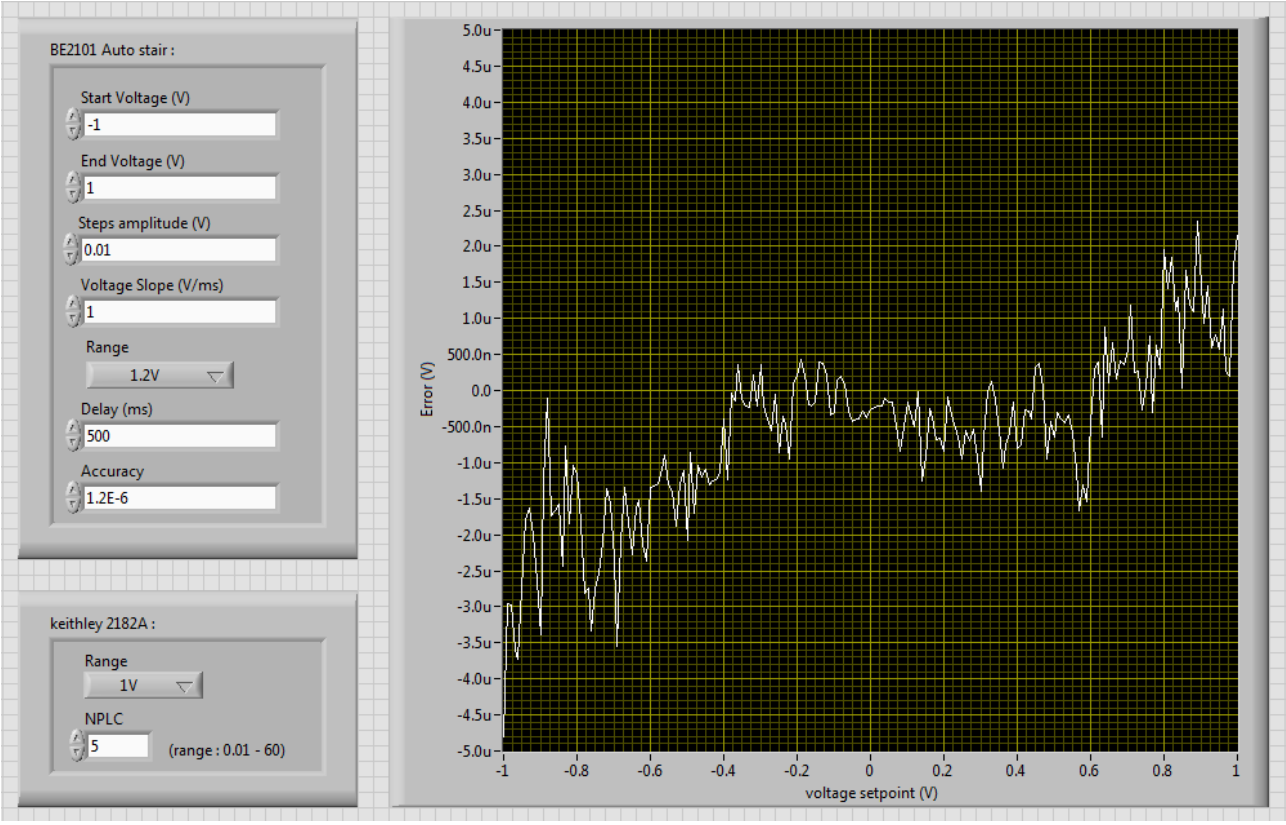
K2182A parameters	value
voltage range	1V
Integration time	100ms
trigger mode	external
Measurement	DC buffered mode
trigger delay	1 ms (min value)

3.3 LabView diagram

As a result of the BE2101 source auto synchronization feature, the programing sequence is reduced to its simplest form :



3.4 Output data : BE2100 accuracy and linearity results



4 Obtaining more with other setups

Using this synchronized voltage sweep setup, it is also possible to trim accuracy, speed, range...

- fast initial characterization plot using 10ms fast filter value, in order to perform 20ms steps with lower accuracy.
- using 12V range

Synchronized voltage sweeps can be performed using different ways:

- fastest speed: the voltmeter trigger out signal is connected to the DC source trigger in to start each further step. Then measurement window performs minimum latency. The 2 instruments are working together within a synchronizing loop. Anyway the first step has to be initiated by the software. Then the further steps are chained by the trigger loop. The DC source “trigger in mode” value will be “step”.
- The voltage sweep can be controlled step by step by the computer itself, within a slower control loop performing for each step:
    - updating DC source value
    - reading and waiting for the status “Ready”
    - asking for measurement
    - waiting for complete measurement and logging new data

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