Python Scripts for SDG

NOTICE

1. All scripts can only be used for calibrating SDG products.
2. Updating SDG's firmware to the newest version is strongly recommended.
3. Before being calibrated, all devices should have been operating continuously for more than 30 minutes within specified operating temperature range (18℃ ~ 28℃)
4. Make sure all devices are well connected as section 1.3 shows.
5. Don't open Microsoft Office Excel when running scripts.

1. Test Environment

1.1 Calibrating Process

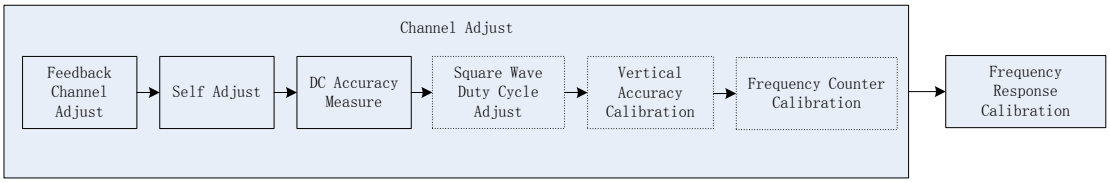


Figure 1. Calibrating Process

There are some differences between all products, as Table 1 shows:

Product	Square Wave Duty Cycle Adjust	Vertical Accuracy Calibration	Frequency Counter Calibration
SDG800	×	×	×
SDG1000	√	×	×
SDG5000	×	PCB version of channel board is E or higher	×
SDG2000X	×	√	√
SDG1000X	√	√	×

Table 1. Differences of Calibrating Process

1.2 Software Environment

1.2.1 Python

Make sure you have installed Python 2.7 in your computer. The following modules of Python are required as well: PyVisa, PyQt4 and PyWin32.

1.2.2 Microsoft Office

As test reports are saved as '.xls', it is necessary that you are working with MS Office 2003 or higher.

1.2.3 NI VISA

The Python module, PyVisa, is based on VISA I/O library which can be derived from NI VISA.

1.3 Hardware Environment

1.3.1 Channel Adjust

TEST EQUIPMENT: Digital Multimeter & Digital Storage Oscilloscope

RECOMMENDED: Agilent 34461A or Agilent 34401A & Siglent SDS1000X

(1) Feedback Channel Adjust

TEST EQUIPMENT: Digital Multimeter

RECOMMENDED: Agilent 34461A or Agilent 34401A

ITEM ADJUSTED: Feedback Channel

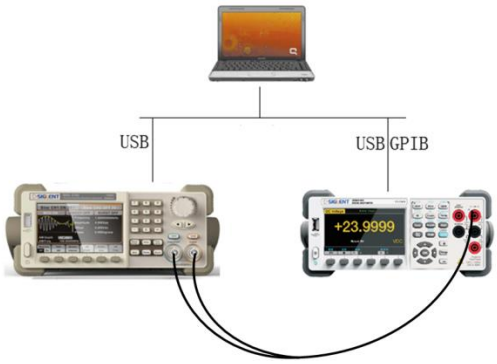


Figure 2. Old Method

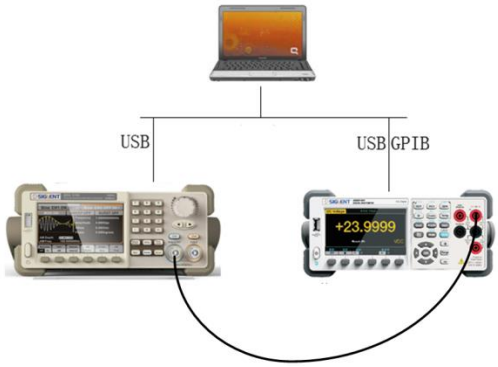


Figure 3. New Method

Table 2 shows differences of test methods between all products.

Feedback Channel Adjust		
Product	Old Method (DMM is connected to both channels)	New Method (DMM is connected to channel 1)
SDG800	×	√
SDG1000	√	×
SDG5000	D or former PCB version of channel board	PCB version of channel board is E or higher
SDG2000X	×	√
SDG1000X	×	√

Table 2. Different test mothods

Many DMMs require banana jack cables for connection to the measurement inputs, like DCV connections on the front panel. Generators typically use BNC connectors. For these processes, you may need to use adapters or make your own cables. Some of which are shown in the following figures below.

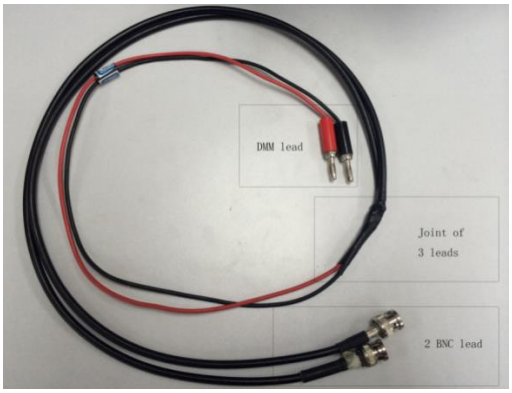


Figure 4. Banana-to-dual BNC.

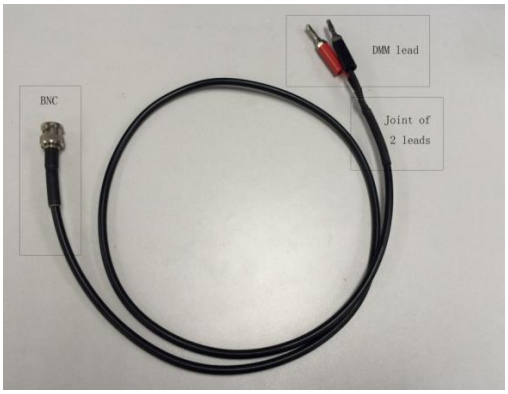


Figure 5. Banana-to-single BNC.

(2) Self Adjust

TEST EQUIPMENT: NONE

RECOMMENDED: NONE

ITEM ADJUSTED: DC Accuracy, AC Accuracy

You have to do this manually: I. for SDG800/1000/5000: *Utility→Test/Cal→SelfAdjust*, II. for SDG1000X/SDG2000X: *Utility→System→System Info→*Enter Password "123654" *→SelfCal*. And then wait until the interior adjustment is completed.

(3) DC Accuracy Measure

TEST EQUIPMENT: Digital Multimeter

RECOMMENDED: Agilent 34461A or Agilent 34401A

ITEM ADJUSTED: NONE (Only check DC accuracy)

Connect your DMM to the channel which is under test, as figure 3 shows.

(4) Square Wave Duty Cycle Adjust

TEST EQUIPMENT: Digital Storage Oscilloscope

RECOMMENDED: Siglent SDS1000X

ITEM ADJUSTED: Square wave duty cycle accuracy

Notice that only SDG1000 and SDG1000X are obliged to perform this procedure, and use channel 1 of SDS1000X to measure square wave duty cycle during this procedure.

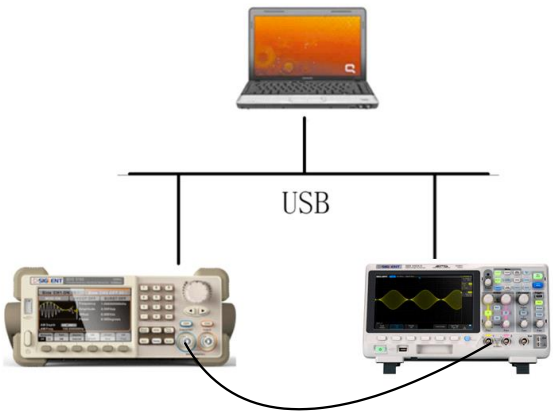


Figure 6. Square Wave Duty Cycle Adjust

(5) Vertical Accuracy Calibration

TEST EQUIPMENT: Digital Multimeter

RECOMMENDED: Agilent 34461A or Agilent 34401A

ITEM ADJUSTED: AC accuracy in low frequency

Notice that only SDG1000X, SDG2000X and SDG5000 with channel board "E" & main board "D" is supported for this procedure. Generally, the hardware version "05-xx-xx-xx-xx" of SDG5000 means that its channel board version is "E" and main board version is "D".

Connect your DMM to the channel which is under test, as figure 3 shows.

(6) Frequency Counter Calibration

TEST EQUIPMENT: NONE

RECOMMENDED: NONE

ITEM ADJUSTED: Trigger level of frequency counter

Figure 8. Frequency Counter Calibration

Notice that only SDG2000X is able to perform this procedure.

1.3.2 Frequency Response Calibration

TEST EQUIPMENT: USB Average Power Sensor

RECOMMENDED: Agilent U2004A

ITEM ADJUSTED: Flatness

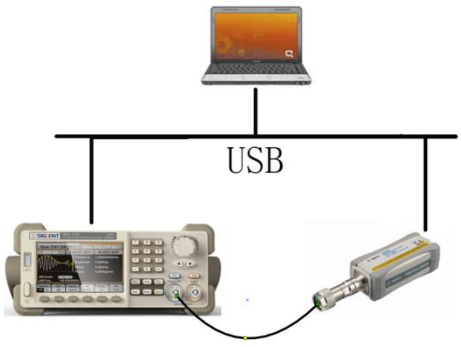


Figure 8. Frequency Response Calibration

2. Test Steps

2.1 Start test

(1)Set up the test environment of each procedure as section 1.3 recommended. Make sure all devices are well connected.

(2)Double-click the corresponding script. The test window is shown as follow:

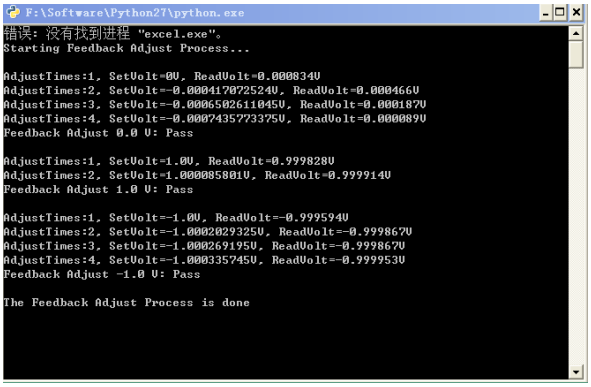


Figure 9. Test Window (e.g. Feedback Channel Adjust)

(3)Test result will be prompted after each procedure is done.

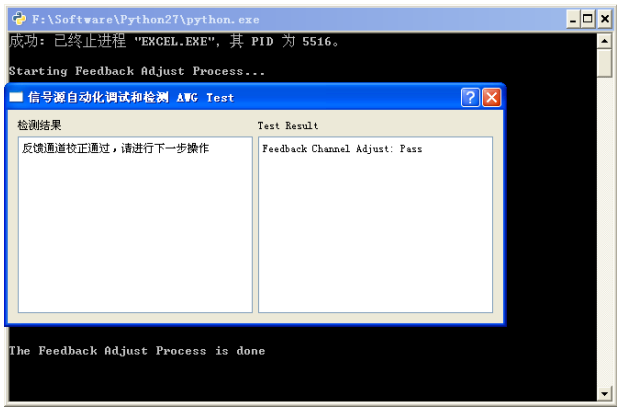
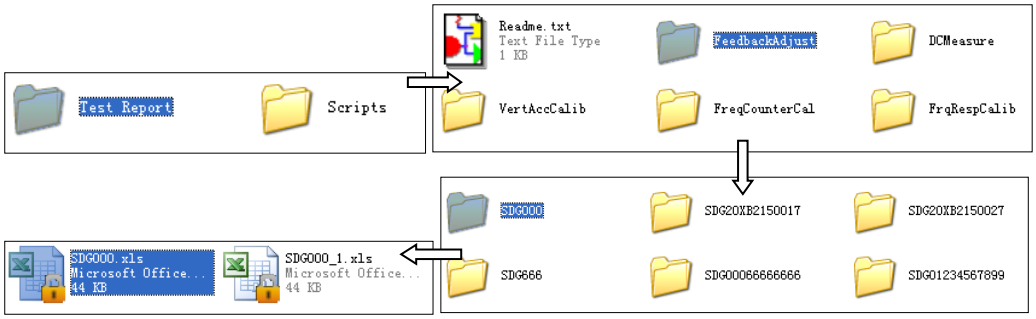


Figure 10. Test Result (e.g. Feedback Channel Adjust)

2.2 Check reports

If you need more test information, you can check the reports in the folder “Test Report”. The detailed directory is “…\\Test Report\\[test procedure](such as ‘FeedbackAdjust’, ‘DCMeasure’, and so on)\\[serial number](like ‘SDG00000000000’)”.

The test reports are saved as ‘.xls’ in the corresponding folders, in the way new report will never overwrite former ones with the maximum number up to 100. The naming format of all reports is “[Serial Number]_[saved times]. xls". For example, the 1st report is saved as “SDG00000000000.xls”, then the 2nd report is saved as “SDG00000000000_1.xls”, the 3rd is “SDG00000000000_2.xls”…



3. Summary

All important information of SDG calibrating process can be summarized into Table 3

Steps	Process	Adjusting Items	Scripts	Products	Recommended Equipments
1	Feedback Channel Adjust	Feedback Channel	FeedbackAdjust.py	SDG800 SDG1000 SDG5000 SDG2000X SDG1000X	Agilent 34461A Agilent 34401A
2	Self Adjust	DC Accuracy, AC Accuracy	×		
3	DC Accuracy Measure	×	DCMeasure.py		
4	Square Wave Duty Cycle Adjust	Square wave duty-cycle accuracy	DutyCalib.py DutyCalib_x.py	SDG1000 SDG1000X	
5	Vertical Accuracy Calibration	AC accuracy in low frequency	VertAccCalib.py	SDG5000 SDG2000X SDG1000X	Siglent SDS1000X
6	Frequency Counter Calibration	Trigger level of frequency counter	FreqCounterCal.py	SDG2000X	×
7	Frequency Response Calibration	Flatness	FrqRespCalib.py	SDG800 SDG1000 SDG5000 SDG2000X SDG1000X	Agilent U2004A

Table 3. Summary

Considering the convenience, “ChannelAdjust.py” provides a choice that you can run just one script to perform test step 1~6 by combining “FeedbackAdjust.py”, “DCMeasure.py”, “DutyCalib.py / DutyCalib_x.py”, “VertAccCalib.py” and “FreqCounterCal.py”. Under this condition, two test equipments are necessary (DMM & DSO) and manual operations are still needed to perform self-adjust procedure (except SDG2000X & SDG1000X).

Messages of all manual operations are shown in the prompts when running the scripts.

4. Troubleshooting

4-1. When performing vertical accuracy calibration using DMM or frequency response calibration using power sensor, there may occasionally come a problem: it prompts out a message saying that the value read by DMM or power sensor is out of range.

Figure 11. Problem 4-1 (e.g. no output)

Explanation: In these two conditions (vertical accuracy or frequency response calibration), there will be a step for checking whether the test equipment is operating well. Sometimes the value is too large or too small because of some interior errors in the test equipment. For example, the LED indicator of Agilent U2004A power sensor will get RED if some errors are detected.

Solution: Check your test equipment manually to fix it. If you find nothing wrong, it means that there may be some unexpected errors in the output.

4-2. When performing frequency response calibration using power sensor, sometimes it will prompt out a message saying that the reference value of flatness is out of range.

Figure 12. Problem 4-2 (e.g. no output)

Explanation: Flatness test will begin once the calibration is done. The reference value of output flatness is the measured value in a particular reference frequency (e.g. 10 kHz). Examples of error cause: (1) Not calibrated (2) Unstable condition inside

Solution: Make sure the output is OK, and then try it again. If the problem is still unsolved, you should check the output setting the reference frequency.