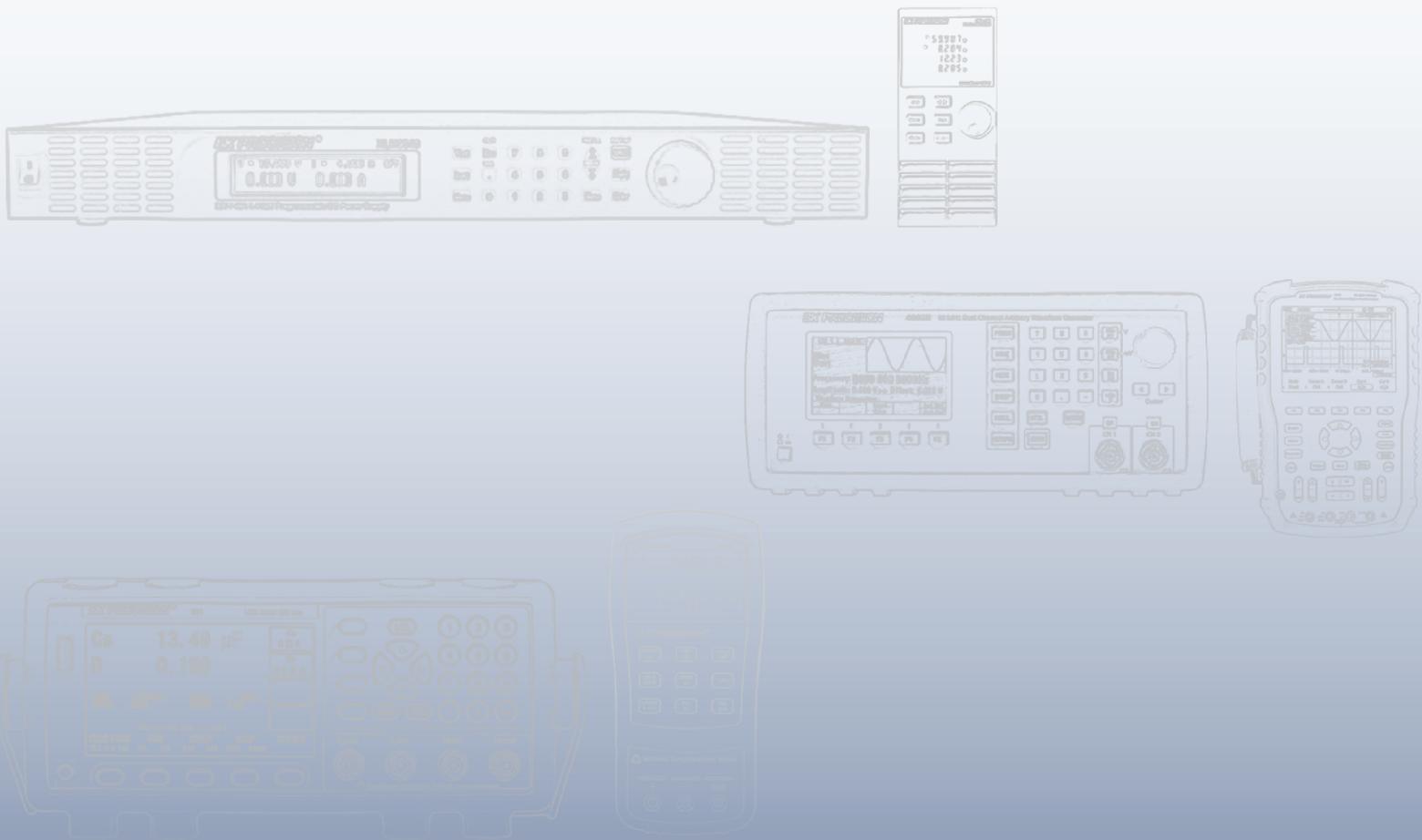


# Application Brief

## 894/895 - Sweeping Function



# Logging Results of Sweeping Function

## Background

*The sweeping function allows the user to analyze the performance of the components to be used in a circuit under specific conditions.*

*This LCR meter has the capacity of sweeping not only frequency, which is the most common feature found in other meters, but also: voltage, current, bias voltage and bias current. The 894/895 series allows the user to sweep up to 201 points while it compares the results to either the primary or secondary parameters and a range of that selected parameter.*

*We will focus our attention on the Voltage Bias Sweeping Function applied to a multi-layer (ML) ceramic capacitor because it is common to have ML ceramic capacitors in circuits where there is a DC bias voltage.*

## How is a DC Bias Voltage useful?

It is important to understand the relationship between capacitance and DC Bias, there is a decrease in the capacitance of a ML ceramic capacitor when there is a DC Bias Voltage applied. An LCR meter comes in handy in this situation because different DC Bias voltage situations can be simulated to determine the behavior of a capacitor in a circuit.

## Decrease in capacitance: How does this happens?

In a ML ceramic capacitor, when there is no DC Bias Voltage applied, there is no electric field present and the dipoles will arrange themselves randomly, this is sometimes called "spontaneous polarization". This type of polarization, the dielectric constant is high and as a result the capacitance is high and this is the value that tends to be the nominal value.

When DC Bias Voltage is applied to the ML ceramic capacitor, there is an electric field created and it starts affecting the dipoles, these dipoles start aligning parallel to the electric field created in the dielectric material

## Issue

If the sweep needs to be done remotely, there are no available commands for the 894/895 to read the results of said sweep. There are no buffer readings which prevent the unit from providing the customer with all the results of the sweep.

## Solution

Through programming a workaround can be found that, with some limitations, can be implemented to have a virtual sweep function. A benefit of doing this type of sweep is that there is no limitation in the amount of steps. A limitation is the increase in timing because the sweep will be run from the computer, command by command. The preferred language of the Test and Measurement industry is Python, therefore, a detailed example was created and shown below.

```
76 *Untitled*
File Edit Format Run Options Windows Help
import visa
from datetime import datetime

try:
    rm = visa.ResourceManager()
    rm.list_resources()

    meter = rm.open_resource('ASRL18::INSTR')
    meter.timeout = 5000

    print(meter.query('*IDN?'))
    meter.write('FREQ 20000')
    meter.write('FUNC:IMP CPD')
    meter.write('FUNC:IMP:RANG:AUTO ON')
    meter.write('APERTURE FAST')

    meter.write('TRIGger:SOUR BUS')
    print(meter.query('TRIGger:SOUR?'))

    meter.write('DISP:PAGE LSETUP')
    meter.write('LIST:CLEAR:ALL')
    meter.write('LIST:MODE STEP')
    meter.write('BIAS:STAT 1')
    meter.write('LIST:BIAS:VOLT -5, -3, 0, 1, 3, 5')
    meter.write('LIST:BAND1 A,4.90000e-12,5.5e-12')
    meter.write('LIST:BAND2 A,4.90000e-12,5.5e-12')
    meter.write('LIST:BAND3 A,4.90000e-12,5.5e-12')
    meter.write('LIST:BAND4 A,4.880000e-12,4.98e-12')
    meter.write('LIST:BAND5 A,4.7700000e-12,4.88-9')
    meter.write('LIST:BAND6 A,4.6900000e-9,4.76e-9')
    meter.write('DISP:PAGE LIST')

    count = 0
    #voltage = -5
    while (count <201):

        print (count)
        print(str(datetime.now()))
        print('Reading: 1st Parameter, 2nd Parameter, Status, Compare Status, Sweep Index')
        print(meter.query('*TRG:FETC?'))
        print('Frequency= '+ meter.query('FREQ?'))

        count = count + 1
        # voltage = voltage + 0.04
        print('-----')
    print('close instrument connection')

finally:
    # meter.close()
    #perforesourceM clean up operations
    print('complete')
```