

SmartPath® Technology Explained

Technical Note 126

Introduction

Small volume spectrophotometers such as the DeNovix® DS-11 enable quantitative measurements using volumes as small as 0.5 to 1 µL. To make a measurement, the sample of interest forms a liquid bridge between the upper and lower sampling surfaces. The accuracy of the results is dependent on the accuracy of a calibrated distance between the two measurement surfaces. This note will explain how the DeNovix DS-11 SmartPath® Technology ensures that the measurement distance (pathlength) stays within specification resulting in accurate, reproducible results.

Pathlength and Sample Concentration

The DS-11 software uses the Beer-Lambert equation when calculating sample concentrations. This equation correlates the absorbance to both the concentration as well as the pathlength the light travels through a sample [3] and is generally written as:

$$A = \epsilon \cdot b \cdot c$$

A: absorbance value

ε: absorptivity coefficient with units of L /mol*cm

b: pathlength of the sample expressed in terms of cm.

c: concentration of the sample in solution, expressed in mol/L.

Higher concentration samples require shorter pathlengths. The DS-11 microvolume mode uses real-time absorbance data to determine the optimal pathlength for each sample. The software will automatically move the arm down as needed to ensure that the measurement is made using the optimal pathlength.

The DS-11 microvolume mode uses pathlengths ranging from 0.5 mm down to 0.02 mm.

Exquisite Pathlength Control

The DS-11 spectrophotometer utilizes opto-mechanical components and proprietary algorithms that together provide accurate pathlength control and deliver performance unmatched by any microvolume spectrophotometer.

The DS-11 uses an 80 thread/inch precision optical adjustment screw along with a high motor gear ratio and a high resolution encoder to control the pathlength to within 1 micron. This translates to +/- 0.2% at 500 microns and, and +/- 3% for the ultra short 30 micron path length.



No Recalibration Required

The DS-11 makes use of a “home” position (set at factory during calibration.) Each time the instrument is turned on, the motor is returned to “home” position. A calculation is then used to determine how many motor rotations are necessary to move to the 500 micron start position. Shorter path lengths are easily achieved since the rotation to pathlength relationship is well characterized.

During typical use, the DS-11 monitors the pathlength accuracy using proprietary software algorithms and performs the necessary adjustments as required.

The DeNovix DS-11 in conjunction with SmartPath Technology provides precise pathlength control and delivers performance unmatched by any microvolume spectrophotometer.