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Dimensions: 8.5 inch wide, 11 inch tall

Material: Paper, 92 Bright White or better, 75g/m² or heavier

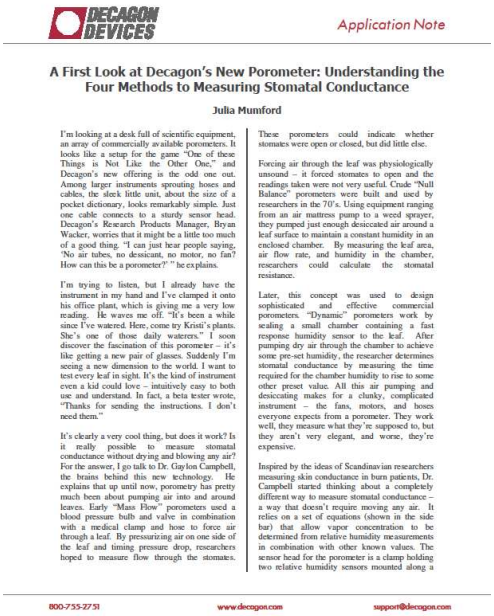
Colors: Color Print on White

Printer: HP Color LaserJet 8550-PS

Finish: None

Adhesive: None

Special Notes: Illustrations are Ref Only ** Not to Scale ** (Shown page 1 of 2)



DECAGON DEVICES Application Note

A First Look at Decagon's New Porometer: Understanding the Four Methods to Measuring Stomatal Conductance

Julia Mumford

I'm looking at a desk full of scientific equipment, an array of commercially available porometers. It looks like a setup for the game "One of these Things is Not Like the Other One," and Decagon's new offering is the odd one out. Among larger instruments sprouting hoses and cables, the sleek little unit, about the size of a pocket dictionary, looks remarkably simple. Just one cable connects to a sturdy sensor head. Decagon's Research Products Manager, Bryan Wacker, worries that it might be a little too much of a good thing. "I can just hear people saying, 'No air tubes, no dessicant, no motor, no fan? How can this be a porometer?' " he explains.

I'm trying to listen, but I already have the instrument in my hand and I've clamped it onto his office plant, which is giving me a very low reading. He waves me off. "It's been a while since I've watered. Here, come try Kristi's plants. She's one of those daily waterers." I soon discover the fascination of this porometer – it's like getting a new pair of glasses. Suddenly I'm seeing a new dimension to the world. I want to test every leaf in sight. It's the kind of instrument even a kid could love – intuitively easy to both use and understand. In fact, a beta tester wrote, "Thanks for sending the instructions. I don't need them."

It's clearly a very cool thing, but does it work? Is it really possible to measure stomatal conductance without drying and blowing any air? For the answer, I go talk to Dr. Gaylon Campbell, the brains behind this new technology. He explains that up until now, porometry has pretty much been about pumping air into and around leaves. Early "Mass Flow" porometers used a blood pressure bulb and valve in combination with a medical clamp and hose to force air through a leaf. By pressurizing air on one side of the leaf and timing pressure drop, researchers hoped to measure flow through the stomates. These porometers could indicate whether stomates were open or closed, but did little else.

Forcing air through the leaf was physiologically unsound – it forced stomates to open and the readings taken were not very useful. Crude "Null Balance" porometers were built and used by researchers in the 70's. Using equipment ranging from an air mattress pump to a weed sprayer, they pumped just enough desiccated air around a leaf surface to maintain a constant humidity in an enclosed chamber. By measuring the leaf area, air flow rate, and humidity in the chamber, researchers could calculate the stomatal resistance.

Later, this concept was used to design sophisticated and effective commercial porometers. "Dynamic" porometers work by sealing a small chamber containing a fast response humidity sensor to the leaf. After pumping dry air through the chamber to achieve some pre-set humidity, the researcher determines stomatal conductance by measuring the time required for the chamber humidity to rise to some other preset value. All this air pumping and desiccating makes for a clunky, complicated instrument – the fans, motors, and hoses everyone expects from a porometer. They work well, they measure what they're supposed to, but they aren't very elegant, and worse, they're expensive.

Inspired by the ideas of Scandinavian researchers measuring skin conductance in burn patients, Dr. Campbell started thinking about a completely different way to measure stomatal conductance – a way that doesn't require moving any air. It relies on a set of equations (shown in the side bar) that allow vapor concentration to be determined from relative humidity measurements in combination with other known values. The sensor head for the porometer is a clamp holding two relative humidity sensors mounted along a

800-755-2751 www.decagon.com support@decagon.com