High Pressure Flow Meter - HPFM

The complete HPFM-C system is field portable with detachable wheels and backpack.

Applications

- **Root conductance in the lab or field**
- **Conductance of shoots and petioles**
- **Root stress analysis on trees or crops**
- **Modeling root to shoot communication**
- **Transpiration models**
- **Hydraulic lift studies**
- **Root water status studies**
- **Absolute varietal statistics**
- **Mycorrhizae nutrient or water uptake enhancement**
- **Soil to root conductance statistics**
- **Crop conductance studies**
- **Root interconnection studies**

The High Pressure Flow Meter (HPFM) is designed to perform quantitative root and stem analysis without having to dig up roots or drag limbs back to the lab. In most cases, the analysis of a sample root or shoot is completed in as little as 10 minutes. You can quickly measure the major components of the hydraulic conductance in the soil-plant-atmosphere continuum (Tyree, 1994)[1]. The HPFM will help plant physiologists and agronomists look forward to those seasonal studies of root and shoot progression, water potential, or soil treatment effects.

The HPFM is easy

- **Excise the shoot**
- **Prep the root or shoot**
- **Connect the HPFM and select the flow range**
- **Turn on the system pressure**
- **Run analysis software on the portable PC**
- **Disconnect the HPFM**
- **Go to the next sample**

The HPFM is designed for two types of numerical analysis. The first analysis is an in-situ transient analysis of hydraulic conductance. This transient analysis measures the flow as the HPFM increases the pressure of the water flowing into the root or shoot. The software then intelligently calculates the slope of a graphical line of the increased flow and pressure. That slope is the hydraulic conductance. The second is a quasi-steady state, constant pressure and flow into the sample. This derives the flow/pressure, the conductance, in a steady state environment.

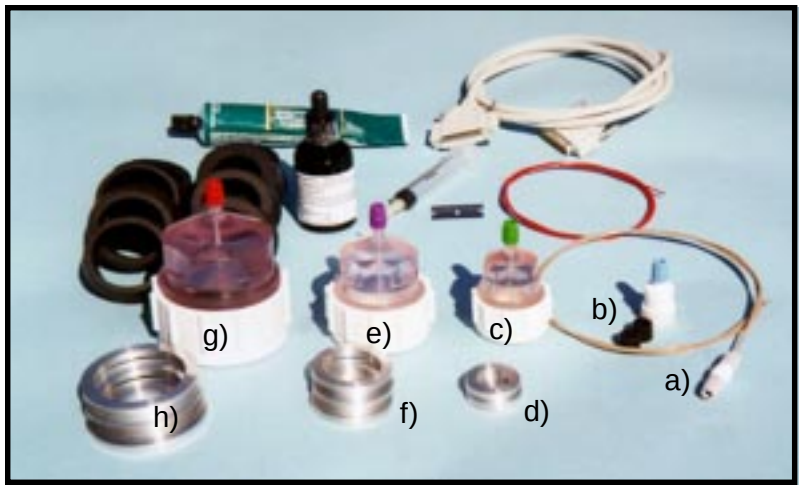
(1) Melvin T. Tyree, Sandra Patino, John Bennink and John Alexander; "Dynamic measurements of root hydraulic conductance using a high-pressure flowmeter in the laboratory and field", Journal of Experimental Botany, Vol. 46, No. 282, pp. 83-94.

Software

The HPFM comes with software that is easy to use and straightforward in it's approach with a menu driven system. Minimal requirements for a PC system are a parallel port, a VGA screen, and DOS version 2.2 or better. Data collected in the quasi-steady state real-time mode are: Flow Rate, Hydraulic Conductance, Pressure, Time of Day, and Absolute Pressure.

The HPFM software includes diagnostics and calibration modes to assure the user of correct readings. All data is saved to the PC hard drive for later analysis by your favorite spreadsheet and graphing packages.

HPFM Specifications



Dynamax includes all the fititngs and couplings you may require for analysis. These additional parts include high quality couplings machined out of Lexan for durability and easy viewing.

Compression couplings to plants

a) 1 - 4mm stem / HPLC Coupling, with O-Rings.
b) 4 - 10mm stem / HPLC Coupling, with O-Rings.
c) 10 - 20mm stem / HPLC Coupling, 6 Rubber seals with compression rings (d).
e) 19 - 36mm stem / HPLC Coupling, 9 Rubber seals with compression rings (f).
g) 36 - 55mm stem / HPLC Coupling, 9 Rubber seals with compression rings (h).

Components included with the system

- **Pressure bottle with 2000 psi (14 MPa) pressure regulator**
- **Pressure safety valve**
- **Digital pressure display gauge**
- **5 ft. (2m) high pressure hose with disconnects**
- **6 ft. of FEP hose, 5 ft. of HPLC hose with spare couplings**
- **8-way manifolds, two each**
- **Micron filter**
- **Portable degassed water refill kit with quick disconnects**
- **Algicide**
- **Cutting tools**
- **Coupling lubricant**
- **Bleeding Kit**
- **Manual**
- **Software 3.5" floppy**

Specifications

Stem Ranges
1mm to 55mm diameters

Flow Rates
0.01 to 1000 grams/hr in 6 overlapping ranges

Conductance
7.7E-08 to 6.4E-03 Kg s^{-1} MPa^{-1}

Electronic A/D
12 bit resolution dual Analog / Digital converters

Analog/Digital
One reading every two seconds

Data Interface
Standard Parallel Port (via 1.5 m cable)

Battery
12 VDC, 4 Amp hour

Charger
110-220 VAC, typical time - overnight

Dimensions
21" x 13" x 12" (54 x 33 x 30cm)

Weight
35 lb. (15.9 Kg)

Capacity
2.1 gal. (8 liter) Degassed Water

Maximum Pressure
85 psi (585 kPa)

Ordering information

HPFM-C
High Pressure Flow Meter - Complete Package

HPFM-P
High Pressure Flow Meter - Portable Package

HPFM-L
High Pressure Flow Meter - Laboratory Package

HPFM-WIN
Windows software upgrade. CD-ROM for HPFM, Manual