

PSY1 Stem Psychrometer

Product Overview

The PSY1 is a self contained, stand-alone instrument for the measurement of stem water potential. It can continuously log (at 10 minute temporal resolution) changes in the plant water status which directly reflect the energy required to access water or the stress the plant is under.

The PSY1 Stem Psychrometer is a very powerful tool integrating all the ambient environmental parameters acting upon the plant such as solar radiation, temperature, humidity, wind speed and water availability into a single continuously measurable variable.

When combined with the SFM1 Sap Flow Meter and the DBL60 Logging Dendrometer, the complete plant water relation and growth potential of the plant can be obtained, thus continuously monitoring ecophysiological change over time.



The PSY1 Stem Psychrometer consists of two welded chromel-constantan thermocouples connected in series within a chromium plated brass chamber that forms a large insulating thermal mass.

Inside the chamber, one thermocouple is in contact with the stem sample and the other simultaneously measures the chamber air temperature and subsequent to a Peltier cooling pulse, the wet bulb depression.

A third soldered copper-constantan thermocouple is located within the sample chamber body to measure the instrument temperature for the purpose of temperature compensation.

All temperature measurements (dT, wet bulb depression & chamber temperature) are then used in the determination of plant water potential.



Enabling better research outcomes in soil, plant & environmental monitoring www.icinternational.com sales@icinternational.com

INTERNATIONAL

Rua José de Carvalho, 294 - 04714-020
Ch. Santo Antonio - São Paulo - SP - Brasil
Tel/Fax: (11) 5181-1173
vendas@labcontrol.com.br
www.labcontrol.com.br

Representante

 **LABCONTROL**
Instrumentos Científicos

Principle of Measurement

Thermocouple hygrometers or psychrometers of various designs have been used successfully in plant science research since the early 1950's, most commonly used on a detached leaf sample. The PSY1 Stem Psychrometer developed by Professor Mike Dixon, University of Guelph, measures water potential in-situ and has been validated against Scholander-Hammel pressure bombs with excellent results and used in published research since 1984. *Dixon, M.A., & Tyree, M.T., 1984 A new stem hygrometer, corrected for temperature gradients and calibrated against the pressure bomb Plant, Cell and Environment 7, 693-697.*

The PSY1 Stem Psychrometer is attached to the stem using a clamp to hold it in position using moderate pressure. A thermocouple is lifted up from the sample chamber and placed in contact with an exposed section of sapwood while a second thermocouple remains within the sample chamber measuring the chamber air temperature.

A Peltier cooling current is then applied to the junction, the differential output of the two junctions is a measure of the temperature gradient between the sample and the dew point measuring junction. By measuring the psychrometric (wet bulb) depression and applying automatic temperature correction of the error induced by temperature gradients within the chamber, precise and repeatable measurements of plant water potential are accurately obtained.

The PSY1 Stem Psychrometer offers significant benefits over more common leaf psychrometers through the ease of attachment which minimizes energy balance disruptions and improves measurement accuracy.

Equilibration Half-Time

Equilibration half-time for thermocouple psychrometer is varied. The range can extend from several minutes to several hours depending upon the design of the psychrometer. Variability stems from how accurately the differential temperatures are measured, whether the initial measuring junction and sample temperatures are measured or assumed and finally, how well the psychrometer is insulated from thermal gradients.

The PSY1 Stem Psychrometer measures all temperatures and assumes nothing. With good insulation, equilibration half-times as short as 60 seconds can be achieved, making it a very rapid, repeatable and reliable instrument.

Data Analysis

Data can be manually processed using a spreadsheet such as Excel by opening the comma separated Values (CSV) file provided by the PSY1. The user can customise what values are logged in the data file choosing from all raw data parameters, processed stem Water Potential in MPa and the relevant calibration and correction factors used in the data processing. Regardless of the parameters chosen all are pre-processed into engineering units ready for interpretation and analysis.

Serial Number:	PSY0A201										
APP Serial #:	3000008										
Head Serial #:	1212										
APP Ver:	R1-4-0										
COM Ver:	R1-3-0G										
Instrument Name:	ICT Stem Psychrometer										
Comment:	Demo Unit										
Date	Time	Chamber Temperature (°C)	dT (µV)	Wet Bulb Depression (µV)	Corrected Water Potential (MPa)	Intercept	Slope	Correction for dT (MPa)	Internal Battery Voltage (V)	External Power Supply Present	
29/07/2010	10:47:06	17.74	-0.88	14.92	-4.34	0.69	-4.23	-0.12	3.73	present	
29/07/2010	10:48:03	17.72	-0.41	15.32	-4.4	0.69	-4.23	-0.05	3.73	present	
29/07/2010	10:49:07	17.67	-0.16	15.23	-4.35	0.69	-4.23	-0.02	3.73	present	
29/07/2010	10:50:47	17.58	-0.27	14.94	-4.29	0.69	-4.23	-0.03	3.73	present	

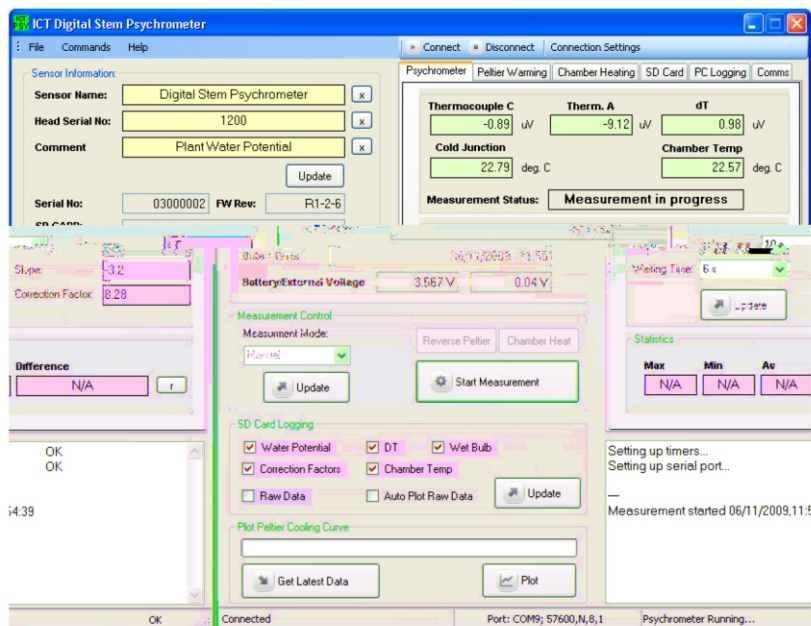
Example Data File



Eucalyptus



Instrument Configuration & Operation



All functions of the instrument's operation and calculations are controlled by the microprocessor which automatically converts the analogue microvolt signals to a calibrated output. Programming variables such as; Peltier cooling pulse, duration & wait time; reverse Peltier warming, duration & wait time; Chamber heating, duration & period; measurement frequency and data logging options, are all held resident in nonvolatile memory.

The PSY1 Stem Psychrometer displays information such as External Battery Status, Serial Number, Firmware Version, SD Card Status, Measurement Interval, Data File Logging Option, & Calibration Factors.

The utility software enables the instrument to be used in the manual mode. This provides the ability to perform lab based work with destructively sampled material, osmotic potential measurements or to evaluate the cleanliness or reliability of the chamber using the Plot Peltier Cooling Curve recording and plotting function.

Calibration Options

The PSY1 Stem Psychrometer requires calibration. Depending upon the level of accuracy required you can choose to utilise a generic batch calibration with coarse generalized accuracy or a specific chamber calibration. The specific chamber calibration can be requested from ICT International at the time of purchase and this calibration is at additional cost to the instrument. Alternatively, ICT international provides detailed calibration instructions and a calibration spreadsheet to enable the user to perform their own calibration at no extra cost.

The calibration function automatically records raw wet bulb depressions, chamber temperatures and corrected wet bulb depression values for plotting against known solute potentials. The plot function includes each individual data point, r^2 regression analysis and line, slope & intercept of the calibration curve. You can also choose to plot the current calibration against a historical calibration evaluating and comparing r^2 , slope and offsets of each. The calibration function is a very powerful and time saving feature. Multiple calibration files for a Psychrometer or calibration files for multiple Psychrometer chambers can be stored on the Micro SD card of the PSY1 and recalled for use with the specific chamber.

PSY1 Stem Psychrometer requires calibration. It is recommended that a full 6 point calibration (0.1, 0.2, 0.3, 0.4, 0.5 and 1.0 Molal NaCl solutions) be performed every 6 to 12 months or immediately following a serious contamination and cleaning of the chamber. The need for a full calibration and or change of calibration can then be determined using the integrated calibration function of the utility software. Calibrations should be performed both within the range of expected water potentials and at a range of expected temperatures. An extreme environment calibration range (1.2 to 2.0 Molal equivalent to -6 to -10 MPa) is included to facilitate this.



Rua José de Carvalho, 294 - 04714-020
Ch. Santo Antonio - São Paulo - SP - Brasil
Tel/Fax: (11) 5181-1173
vendas@labcontrol.com.br
www.labcontrol.com.br

Representante



PSY1 Specifications

Measurement

Units	MPa
Range	-0.1 to 10 MPa (1 to 100 Bars)
Resolution	0.01 MPa (0.1 Bar)
Accuracy	±0.1 MPa (1 Bar)
Response Time	A. Measurement mode 51 seconds B. Live mode 1 second
Sampling rate	10 Hz

Data

Computer Interface	USB, Wireless RF 2.4 GHz
Data Storage	Micro SD Card
Memory Capacity	Up to 16GB, 4GB microSD card included.

Operating Conditions

Temperature Range	-10 to 50°C
R/H Range	0-99%

Power

Power supply	960mAh Lithium Polymer battery
Battery Life	A. 3 days at hourly logging interval without chamber heating. B. 1 day with chamber heating. C. Unlimited with optional 11W Solar panel
Charging Voltage	8-30V DC
Power Consumption	190mA maximum

Dimensions

Chamber	Length: 170mm Width: 80mm Depth: 35mm
Weight	400 g

Features

Power Management

- Internal Lithium-Polymer Battery
- Power On/Off Switch
- Internal Voltage Regulation
- Optical Isolation Lightning Protection

Logging

- Stand-alone logging
- MicroSD Expandable Memory
- USB Connectivity
- Wireless Data Transfer
- IP65 Rated Water Proof Enclosure
- Free Windows Utility Configuration Software

Applications

- In-Situ Stem Water Potential
- Osmotic Potential
- Pressure Volume Curves
- Measure Stomatal Closure & Cavitation
- Setting Refill Points & Permanent Wilting Pressures
- Stem Sizes > 5mm
- Crop & Forest Plant Water Relations
- Arid Ecosystems & Drought

Accessories

- PSY-SC Small Clamp
- PSY-LC Large Clamp
- PSY-IK Installation Kit
- PSY-CAL Optional Factory Calibration
- MCC- Multiconverter Wireless Communication Hub
- 11W Solar Panel
- SPBP11 Solar Panel Battery Pack



INTERNATIONAL

Rua José de Carvalho, 294 - 04714-020
Ch. Santo Antonio - São Paulo - SP - Brasil
Tel/Fax: (11) 5181-1173
vendas@labcontrol.com.br
www.labcontrol.com.br

Representante



Enabling better research outcomes in soil, plant & environmental monitoring www.icinternational.com sales@icinternational.com