Dendrometer

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Diameter Dendrometer
Type DD-S

For measuring changes in diameter of plants

User Manual

Version 1.2

1. Introduction

Thank you for purchasing an Ecomatik Dendrometer type DD-S. This is a highly precise sensor for continuous measurements of diameter changes of plants under both indoor and outdoor conditions.

This manual is written to help you install and operate your dendrometer with least difficulty and for desirable results. Please read it carefully before installing the sensor, and refer to it if you should have any difficulty with the sensor in the future.

The dendrometer is the sensor part of a measuring system. This means that the dendrometer must be installed onto the experimental plant, and connected to a data logger for continuous data recording or to a simple voltmeter for discrete data display. The dendrometer is compatible with the most data logger types . At Ecomatik a low-cost, special for dendrometers developed dendrometer logger is available.

2. Product Description

As shown below, the DD-S dendrometer consists of:
1 Sensor with 2 m cable. The cable length is extendable to 100 m
1 Frame for fixing the sensor onto the stem/branch
1 Piece UV-resistant rubber band

Please contact your dealer should you miss any of these items

3. Safety Information

The sensor is protected from rain water, but it is not waterproof. Please do not immerse the sensor in water.

To reduce tension on the sensor, the cable component of the sensor is isolated. Please never pull the cable from the sensor and avoid any tension between the cable and sensor during handling and operation.

Pay attention to written instructions. Wrong connections will give wrong results.

4. Installation

4.1 Cable Extension

The standard version is delivered with 2 m cable. It can be extended up to 100 m. Cable type 4×0.25 mm^2 shielded is recommended for extensions.

4.2 Required tools for installation and for operation

Data logger: In addition to our low cost dendrometer logger the most popular data loggers are compatible to the dendrometers, e.g. CR800, CR1000, DL2e, DT80.

Required tools: Voltmeter, , spanner (M3), a pair of scissors.

4.3 Mounting

4.4.1 Detach the front frame of the dendrometer to allow you fix the stem/branch to be measured

4.4.2 Fix the hind plate and hind frame on the stem/branch using a rubber band so that the hind plate is firmly held on the stem/branch.

4.4.3 Replace the front part of the frame and fix it with screws.

4.4.4 Turn the screws slowly to achieve an electrical resistance between the yellow and green cable of approx. 5 kohm for installations before or in frost seasons and of approx. 2 kohm for installations in or before growth seasons.

4.4.5 Fix the cable onto the tree stem/branch so that the sensor is protected from any accidental pull/drag on the entire cable length. This can be done using a rope or cable straps. Ensure the suspension rope/strap is not so tight as to interfere with normal tree growth and expansion during the entire measurement period. Also, there should be no tension between the sensor and cable.

Ensure that no rain water can run along the cable into the sensor casing.
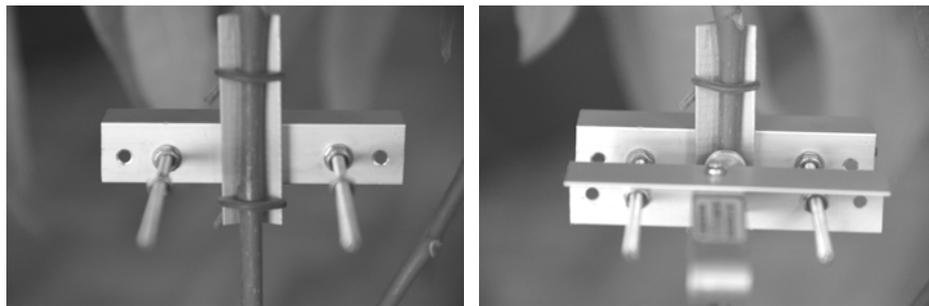
For very small plants the dendrometer can be hung or fixed to a wood stock.
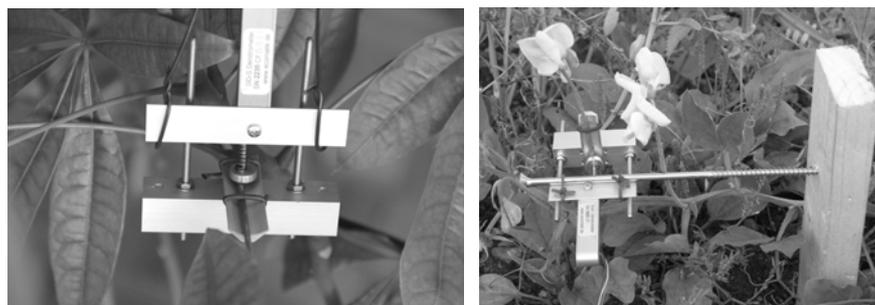
5 Wiring and Logger Configuration

There three measuring possibilities to record the dendrometer data:

One single-ended Channel for resistance (e.g. Dendrometer logger, Dl2e Logger).

Two single-ended Channels for resistance (e.g. Dendrometer logger, Dl2e Logger).

Full bridge measurement (e.g. Campbell CR800, CR1000, DT80).

The use of two resistance channels or full bridge is recommended as temperature influences can be compensated for and a higher precision can be achieved (see technical specification).

The dendrometer should be connected to the loggers as listen in the table.

Connecting to data loggers

Wire color		One single-ended channel	Two single-ended channels	Full bridge measurement
Green	Connect to	- Channel 1	- Channel 1	- Signal
Yellow		+ Channel 1	+ Channel 1	+ Signal
White		Not connected	- Channel 2	- Excitation
Brown			+ Channel 2	+ Excitation (<5 V)

An interval 0.5-hour for data collection can reveal the diurnal course of diameter changes very well.

6 Data Calculation

The changes of diameter are given:

If measuring with one channel:

Changes of diameter in µm = Values of Channel 1 in Ohm $\times$ CF-Value

The CF-Value is printed on the sensor.

If measuring with two channels:

$$\text{Changes of diameter in µm} = \frac{\text{Values of Channel 1 in Ohm}}{\text{Values of Channel 2 in Ohm}} \times 11\,000$$

If measuring with full bridge :

Changes of diameter in µm =-Output of Channel 1 x 11 000

7. Adjustment and maintenance

The measuring range of the sensor is up to 11 mm. Depending on the growth rate of the plants, the sensor should be reset after some months or years of measurements. **If the outputs of channel 1 (between green and yellow wires) exceed 18 kohm, a reset must be carried out. In case of full bridge measurement the reset should be carried out if the outputs exceed 0.95.**

For resetting the sensor relax the screws slowly to achieve an electrical resistance between the yellow and green cable of approx.5 kohm for resetting before or in frost seasons and of approx. 2 kohm for resetting in and before growth seasons.

Ensure that no falling branches, fruits or snow land on the sensor. The sensor is protected against water drops, but is not waterproof.

When the sensor is correctly installed, it will function under outdoor conditions without further maintenance.

8 Technical Specifications

Type:	Diameter dendrometer (DD-S)
Use area:	For measuring changes in diameter of plants
Diameter of plants:	0-5 cm (>5 cm on request)
Range of the senor:	11 mm
Accuracy of the sensor:	±2 µm (measurement with two channels)
Temperature coefficient of the sensor:	Measurement with two channels<0.1 µm/K
	Measurement with one channel <0.04 %/K of the values measured
linearity:	‹1%
Environment:	Outdoor condition: -30 to 40°C air temperature, 0 to 100% relative air humidity
Weight of the sensor:	13 g without cable
Output:	Analog output, 0-20 kohm
Power supply:	No power consumption
Material:	Stainless steel and Aluminum
Cable length:	2 m, extendable up to 100 m