Dendrometer

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Circumference Dendrometer (Type DC)

For measuring changes in circumference of plant stems and fruits

User Manual

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1. Introduction

Thank you for purchasing an Ecomatik Dendrometer type DC. This is a highly precise sensor for continuous measurements of changes in circumference of plant stems and fruits under both indoor and outdoor conditions.

This manual is written to help you install and operate your DC 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 tree, 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 ulogger is available.
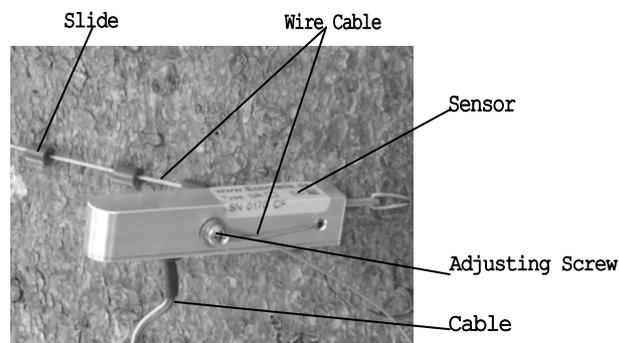
2. Product Description

As shown blow, the DC dendrometer consists of:

1 Sensor with 2 m cable. The cable length is extendable to 100 m

1 m special wire cable for transmitting the circumference changes to the sensor

About 20 plastic slides for reducing the friction between the wire cable und tree bark

Circumference Dendrometer

Should any of these items be missing, contact your dealer.

3. Safety Information

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

For high accuracy of measurement it is very important to keep the original shape of the wire cable. Please handle it with care and avoid any distortion (turning, bending etc.)

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 readings.

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 with shield is recommended for extensions.

4.2 Required tools for installation and for operation

Data logger: One Dendromerter requires one or two single-ended channel(s) that can measure resistance between 0 and 50 kohm range.

Required tools for installation: Voltmeter, screw driver, cable straps.

4.3 Mounting

Pass the wire around the tree trunk and insert its end through the sensor hole. Fix it by the adjusting screw. Move the plastic slides along the wire so that it does not touch the bark. Ensure that it is flat around the stem. Loosen the adjusting screw slightly and pull the wire slowly to achieve an electrical resistance between the yellow and green cable around 30 kohm for installation.

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.

5 Wiring and Logger Configuration

One dendrometer requires one or two single-ended channels that can measure resistance between 0 and 50 kohm. With two channels temperature influences can be compensated and a higher precision is achieved (see technical specification). If you use ulogger for data recording, only one channel measurement can be configured.

The dendrometer is connected to both channels for measuring resistance as follows:

Wire color		Data Logger One-channel measurement	Data Logger Two-channel measurement	Voltmeter
Green	Connect to	-	- Channel 1	-
Yellow		+	+ Channel 1	+
White		Not connected	- Channel 2	-
Brown			+ Channel 2	+

Configure both channels of data logger to measure resistance from 0 to 50 kohm (e.g. 0–100 kohm). An interval 0.5-hour for data collection can reveal the diurnal course of radius changes very well.

6 Data Calculation

The changes of circumference are given:

If measuring with two channels:

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

If measuring with one channel:

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

The CF-Value is printed on the sensor.

7 Maintenance

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.

The measuring range of the sensor is up to 11 mm. Depending on the growth rate of the tree in question, the sensor should be reset after some months or years of measurements. If the outputs of channel 1 (between green and yellow wires) exceed 45 kohm, a reset must be carried out.

For resetting the sensor relax the screws slowly to achieve an electrical resistance between the yellow and green cable around 10 kohm.

8 Technical Specification

Type:	Circumference Dendrometer (DC)
Use area:	For measuring changes in circumference of plant stems and fruits
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
Temperature coefficient of the wire cable:	<1.4 ×10^{-6}/k
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, 0-50 kohm
Power supply:	No power consumption
Material:	Stainless steel and Aluminum
Cable length:	2 m, extendable up to 100 m