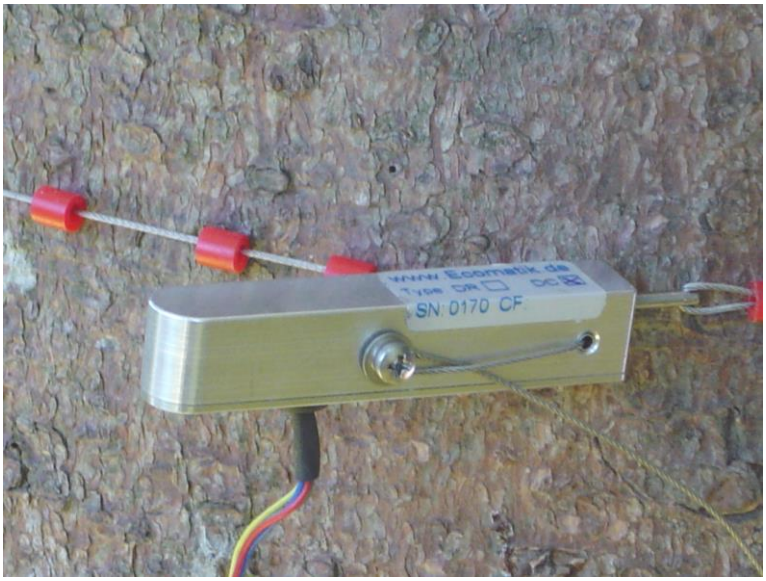
Dendrometer

ECOMATIK GmbH
Muenchner Str. 23
D-85221 Dachau/Germany
Tel.: +49 8131 260 738
Fax: +49 8131 260 736
e-mail: info@ecomatik.de
website: www.ecomatik.de

Circumference Dendrometer (Type DC1)

For measuring changes in circumference of plant stems and fruits



User Manual

Version 2.0

1. Introduction

Thank you for purchasing an Ecomatik Dendrometer type DC1. This is a highly precise sensor for continuous measurements of circumference changes of trees under both indoor and outdoor conditions.

This manual is written to help you install and operate your DC1 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 should be connected to a data logger for continuous data recording. The dendrometer is compatible with the most data logger types. At Ecomatik a low-cost, special for dendrometers developed DL18 logger is available

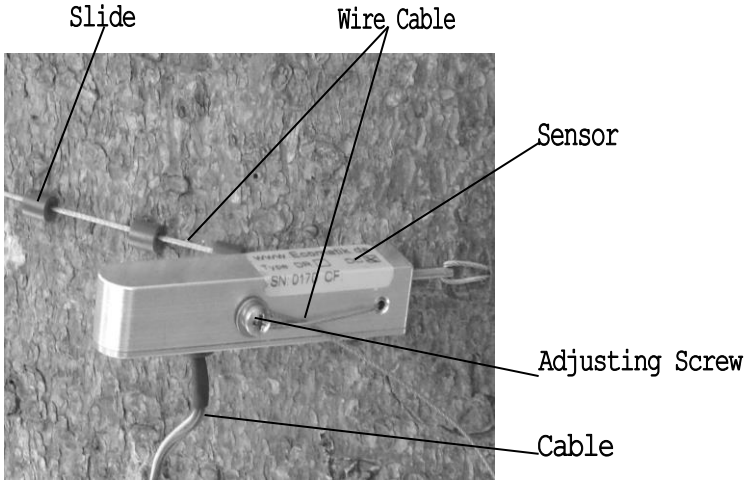
2. Product Description

As shown blow, the DC1 dendrometer consists of:

1 Sensor with 5 m cable. The cable length is extendable to 100 m

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

1 bag of plastic slides for reducing the friction between the steel wire and the measured plant stem.



DC1 Dendrometer

Please contact us should you miss anything of these items.

The standard cable length is 5 m. if you ordered cable extension, the cable length is the ordered extension + 5 m.

To meet the requirements of different loggers, there are 2 different types of cables: **cable with plug** and **cable without plug**. Cable with plug can only be connected to Dendrometer Logger DL18. Cable without plug can be connected to other loggers.

3. Safety Information

The sensor is protected from water droplets, but it is not waterproof, therefore please do not immerse the sensor in water, or install the sensor below a longer lasting snow cover.

For a high degree of measurement accuracy, 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.).

Never pull the cable from the sensor and avoid any tension between the cable and sensor during handling, set up and operation.

Pay attention to connections to data logger. Wrong connections will provide wrong readings.

4. Installation

4.1 Cable Extension

The standard version is delivered with 5 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

A Voltmeter, a screw driver, cable straps.

4.3 Mounting

4.3.1 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 so that the rod is pulled out about 2-3 mm, and then fix it with the screw.



4.3.2 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.

4.3.3 Ensure that no rain water can run along the cable into the sensor casing.

5. Wiring and Logger Configuration

The dendrometer is compatible with most data loggers. In the following we describe the connection with Dendrometer Logger (DL18), Campbell Logger (CR1000). Please contact us if your logger is not described here.

Dendrometer Data Logger (DL18)

The DL18 is a battery powered, waterproof logger for connecting 4 dendrometers. It is a very effective data logger for dendrometer measurement under outdoor conditions. For details please see the user manual of the DL18.

Campbell Data Logger (CR1000)

The dendrometer can be measured both in single-ended voltage as well as differential voltage mode. Differential voltage mode provides better accuracy. But single-ended mode requires half as many channels as differential mode. One CR1000 can include 16 dendrometers in single-ended mode, but only 8 dendrometers in differential mode.

Single-ended Voltage Mode (2 dendrometers)

Connection		
Cable Color		Input Port
1st dendrometer	Yellow	1H
	Green	Ground
	Brown	Vx1
	White	Ground
2nd dendrometer	Yellow	1L
	Green	Ground
	Brown	Vx1
	White	Ground
Program Syntax *ExciteV (Vx1,2500,0)* *VoltSe(SEVolt(),2,mV2500,1,True,0,_50Hz,Mult(),Offs())* If Multiplier=4.4, Offset=0, the results are measured in microns.		

Differential Voltage Mode (2 dendrometers)

Connection		
Cable Color		Input Port
1st dendrometer	Yellow	1H
	Green	1L
	Brown	Vx1
	White	Ground
2nd dendrometer	Yellow	2H
	Green	2L
	Brown	Vx1
	White	Ground
Program Syntax *ExciteV (Vx1,2500,0)* *VoltDiff(DiffVolt(),2,mV2500,1,True,0,_50Hz,Mult(),Offs())* If Multiplier=4.4, Offset=0, the results are measured in microns.		

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

6. Adjustment and maintenance

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

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

The measuring range of the sensor is up to 11 mm. Depending on the growth rate of the tree, the sensor should be reset after some months or years of measurements. If the outputs are greater than 9000 µm a reset must be carried out.

For resetting the sensor relax the wire cable pull the wire slowly so that the rod is only pulled out about 2-3 mm, and then fix it with the screw.

7. Technical Specifications

Name of the Sensor	Circumference Dendrometer 1 Type DC1
Use area	For measuring circumference growth of trees
Suitable for plant size	Diameter: 5 -32 cm
Limitation	The mechanical pressure of the wire cable on the tree is dependent from the tree size. The smaller the tree, the higher the pressure. Therefore, the measuring data from trees with different diameters are usually not comparable
Range of the senor	11 mm
Resolution	The resolution of the sensor itself is infinite. The resolution of readings is determined by connected data logger, e.g. CR1000: 1.5 µm Dendrometer logger DL18: 0.2 µm
Accuracy	Dendrometer dependent: Max. ± 4.5% of reading (stable offset) Dependent on the connected data logger, e.g.: CR1000:±(0.04% of reading+4.4µm) Dendrometer logger DL18: ±0.1%
Temperature coefficient of the sensor	<0.2 µm / °C in the whole range
Temperature coefficient of the wire cable	$<1.4 \times 10^{-6}$/k
Linearity	<1%
Environment	Outdoor condition: -25 to 70°C air temperature, 0 to 100% relative air humidity
Weight of the sensor	13 g without cable
Power supply	Stabilized Vex of 0.5 – 10 VDC, power consumption practically zero
Material	Stainless steel and Aluminium
Cable length	5 m, extendable up to 100 m