Dendrometer

Vertical Dendrometer (Type DV)
For measuring bending of the tree trunk

User Manual

Version 2.0

1. Introduction

Thank you for purchasing an Ecomatik Dendrometer type DV. This is a highly precise sensor for continuous measurements of vertical changes of tree trunk under both indoor and outdoor conditions.

This manual is written to help you install and operate your DR 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 radius 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 vertical changes of tree stem to the sensor

2 Special screws, the upper one is for fixing the sensor while the lower one is for fixing the end of the wire.

1 Aluminum tube for fixing the ends of the wire.

Please contact us should you miss anything of these items.
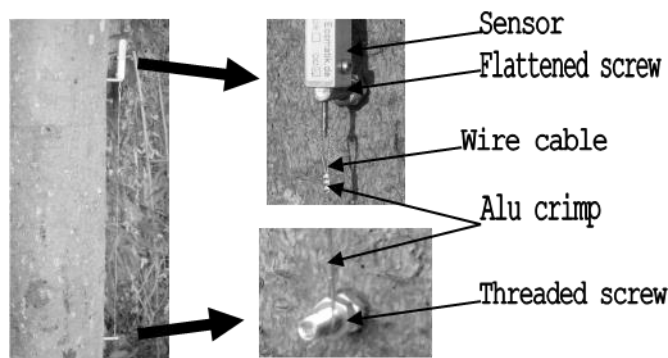
Vertical Dendrometer

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

Avoid any tension between the cable and sensor during handling 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

A hand-held drill with 4 mm drill bit, tree resin, cable straps, 2 spanners for M6 screw nut (10 mm), pliers.

4.3 Mounting

Drill two holes (Ø=4 mm, 6 cm deep), one above the other directly below, one meter apart in the trunk. Dip the screws into the tree resin before screwing them into the trunk. The flattened screw is screwed in the top hole. The second screw is screwed into the bottom hole leaving approx. 3 cm of the shaft visible. It is easier to turn the screws when the two screw nuts are countered on the screw rod.

The sensor is attached to the top screw with the wire drawn down through the hole in the second screw. Pass the wire-end though the small aluminum tube and fix it by pressing on the tube with pliers.
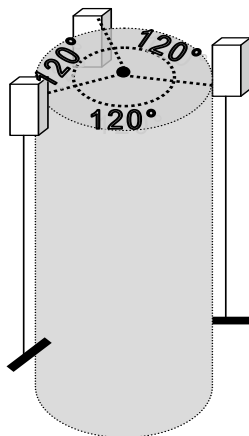
The second screw is turned slowly so that the sensor rod is pulled out by about 3-4 mm.

Fix the cable onto the tree stem 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 there is no tension between the sensor and cable.

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

If three vertical dendrometers are used, ensure that the three sensors are installed at the same height on the tree and have the same arc distance to each other (see fig. left)

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) and Delta-T Logger (DL2e). 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 drops, but is not waterproof.

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

7. Technical Specification

Name of the Sensor	Vertical Dendrometer (DV)
Use area	Measuring the vertical changes of tree trunk
Suitable for plant size	Diameter > 8 cm
Limitation	Tree trunk is injured by drilling (the damage can be minimized if using tree resin).
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
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 0.5 – 10 VDC, power consumption practically zero
Material	Stainless steel and Aluminium
Cable length	5 m, extendable up to 100 m