Dendrometer

Diameter Dendrometer
Type DD-S2

For measuring changes in diameter of plants

User Manual

Version 2019

1. Introduction

Thank you for purchasing an Ecomatik Dendrometer type DD-S2. This is a highly precise sensor for continuous measurements of diameter changes of small plants under both indoor and outdoor conditions. The DD-S2 is designed for a fast and toolless installation.

This manual is written to help you install and operate your DD-S2 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 below, the DD-S2 dendrometer consists of:

1x Sensor body with two knurled-head nuts to lock quick-mount frames, standard sensor cable length 5 m (extendable to 100 m)

2x Quick-mount frame for two different diameter ranges, 0 to 2.2 cm or 1.8 to 5 cm

2x Pieces UV-resistant perforated rubber belt to fix dendrometer at the stem/branch

4x Pieces UV-resistant rubber band (3x 20 cm, 1x 50cm, reusable) to fix the sensor cable at the branch/stem for strain relief.
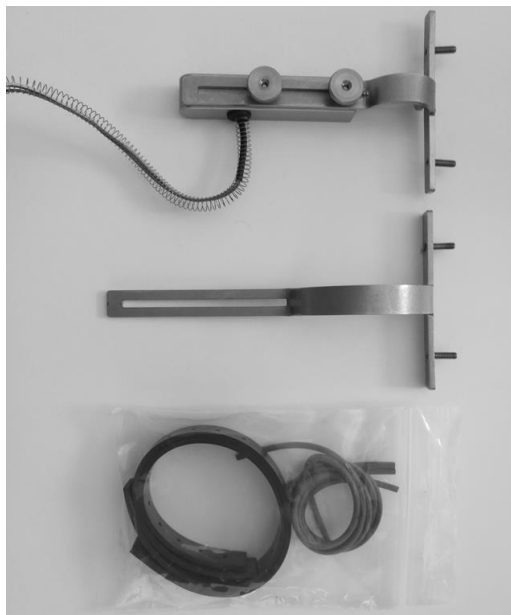
DD-S2 Dendrometer

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 rain water, but it is not waterproof. Please do not immerse the sensor in water, or install the sensor below a longer lasting snow cover.

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 and for operation

- none -

4.3 Mounting

4.3.1 Select the adequate quick-mount frame size, 0 to 2.2 cm or 1.8 to 5 cm, according to the stem/branch diameter.

4.3.2 Attach one end of each of the two perforated rubber belts to the fixation bolts at the back-side bar of the quick-mount frame.

4.3.3 Firmly fix the frame at the stem/branch, by tightly wrapping the rubber belts around the stem/branch and locking them again by slipping the desired hole of each belt on the corresponding bolt at the back-side bar.

4.3.4 Unscrew and remove the two knurled-head nuts from the dendrometer body, then insert the screws into the slide rail of the frame and loosely screw on the knurled-head nuts again.

4.3.5 Move the dendrometer body along the sliding rail, so that the sensor rod is pushed in by about 2-3 mm, then lock the dendrometer at the desired position by firmly tightening the two knurled-head nuts. When the installation is taking place shortly before frost period, the sensor rod should be pushed in by 5 mm. At frosts the stem diameter can shrink considerably.

4.3.6 **!! IMPORTANT !!** Fix the cable onto the tree stem/branch so that the sensor is protected from any accidental pull/ drag of the entire cable length. This can be done using a rope or cable straps. In addition, there should be no tension between the sensor and cable.

Ensure that no rain water can run along the cable, or the sensor rod and enter the sensor casing. Rod entrance, as well as wire outlet should hence always be inclined downwards.

5. Wiring and Logger Configuration

The dendrometer is compatible with most data loggers. In the following we exemplify the connection with Dendrometer Logger (DL18) and Campbell Logger (CR1000). Please contact us if your logger is not described here, or if you should need further assistance.

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.

Depending on the growth rate of the plant, the sensor should be reset after some months or years of measurements. When the output approaches 11 mm, the sensor needs to be reset.

To do so, relax the knurled-head screws and move the sensor body slowly along the slide rail, until the sensor rod is pushed out completely. Then slowly move the dendrometer body along the sliding rail in the opposite direction, until the sensor rod is pushed in again by about 2-3 mm and lock the dendrometer at the desired position by firmly tightening the two knurled-head nuts. When the installation is taking place shortly before frost period, the sensor rod should be pushed in by 5 mm. At frosts the stem diameter can shrink considerably.

7. Technical Specifications

Name of the Sensor	Diameter dendrometer small Type DD-S2, fast mounting frame for toolless installation
Use area	For measuring diameter growth of plants
Suitable for plant size	Diameter 0-5 cm (>5 cm on request) Suitable for small plants such as trees, wheat, corn.
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 (differential w/i): 1.5 µm Dendrometer logger DL18: 0.2 µm
Accuracy	Dendrometer dependent: Max. ±4.5% of reading (stable offset) Logger dependent, e.g.: CR1000: ± (0.04% of reading +4.4 µm) 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	15 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