

Dendrometer

Rugged Radius Dendrometer (Type DR1W)

For measuring changes in radius of plant stems



User Manual

1. Introduction

Thank you for purchasing an Ecomatik Dendrometer type DR1W. This is a highly precise sensor for continuous measurements of radius changes of trees under extreme environmental conditions (in the soil, under water or snow, heavy exposure to dust, corrosive agents such as sea water, or volcanic ashes).

This manual is written to help you install and operate your DR1W 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

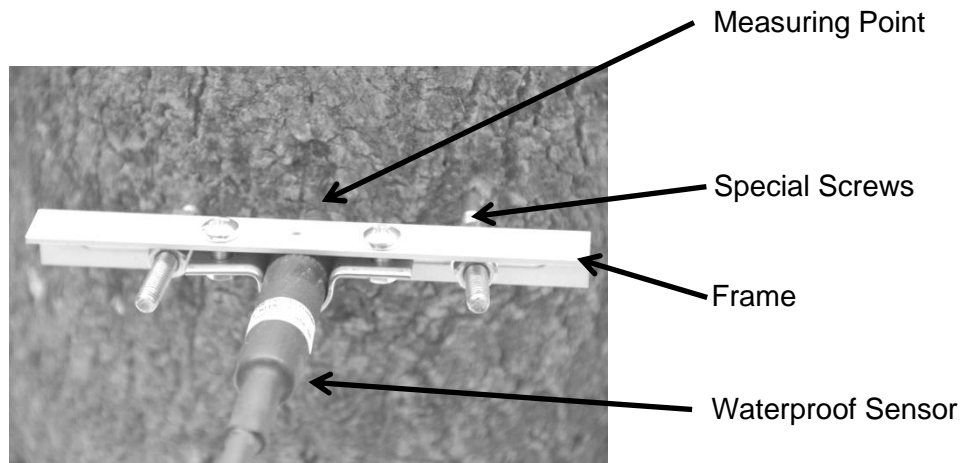
As shown below, the waterproof radius dendrometer consists of:

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

1 Aluminum frame

2 Special screws for fixing the frame onto the plant stem

Please contact us should you miss anything of these items.



Waterproof Radius 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

Handle carefully with rubber isolation of the sensor. Injuries to the rubber may impair the seal.

Avoid any tension between the cable and sensor during handling and operation. Tensions between sensor and cable can significantly distort the measured data.

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

Ensure that no falling branches, fruits or snow land on the sensor.

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 4x0.25 mm² 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).

4.3 Mounting

Drill two holes ($\phi=4$ mm, max. 6 cm deep) on the left and right side and max. 5.5 cm apart from the measuring point. Dip the screw top into the tree resin before screwing them into the trunk. Both screws are screwed 6 cm into the holes by using the countered two nuts. Fix the frame, with sensor attached, to the screws.

Turn the screws so that the sensor rod is pushed in by about 2-3 mm. 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.

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.

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 |
| 1 st dendrometer | Yellow | 1H |
| | Green | Ground |
| | Brown | Vx1 |
| | White | Ground |
| 2 nd dendrometer | Yellow | 1L |
| | Green | Ground |
| | Brown | Vx1 |
| | White | Ground |
| Program Syntax <i>ExciteV (Vx1,2500,0)</i> <i>VoltSe(SEVolt(),2,mV2500,1,True,0,_50Hz,Mult(),Offs())</i> If Multiplier=4.4, Offset=0, the results are measured in microns. | | |

Differential Voltage Mode (2 dendrometers)

| Connection | | |
|--|-------------|------------|
| | Cable Color | Input Port |
| 1 st dendrometer | Yellow | 1H |
| | Green | 1L |
| | Brown | Vx1 |
| | White | Ground |
| 2 nd dendrometer | Yellow | 2H |
| | Green | 2L |
| | Brown | Vx1 |
| | White | Ground |
| Program Syntax <i>ExciteV (Vx1,2500,0)</i> <i>VoltDiff(DiffVolt(),2,mV2500,1,True,0,_50Hz,Mult(),Offs())</i> 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

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 tree, the sensor should be reset after some months or years of measurements. When the output approaches 11 mm, the sensor needs to be reset.

Relax the screw slowly so that the sensor rod is pushed in by about 2-3 mm. When the reset 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 Specification

| | |
|--|--|
| Name of the Sensor | Rugged Radius dendrometer Type DR1W |
| Use area | For measuring radius growth of trees |
| 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 sensor | 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. $\pm 4.5\%$ of reading (stable offset) Dependent on the connected data logger, e.g.: CR1000: $\pm(0.04\%$ of reading + $4.4\mu\text{m}$) Dendrometer logger DL18: $\pm 0.1\%$ |
| Temperature coefficient of the sensor | $< 0.2 \mu\text{m} / ^\circ\text{C}$ in the whole range |
| Linearity | $< 1\%$ |
| Environment | In the air, in the soil, under water or snow condition: -25 to 70°C air temperature, 0 to 100% relative air humidity |
| Weight of the sensor | 17 g without cable |
| Power supply | Stabilized Vex 0.5 – 10 VDC, power consumption practically zero |
| Material | Stainless steel and Aluminium, rubber seal |
| Cable length | 5 m, extendable up to 100 m |