

# Dendrometer



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## Radius Dendrometer (Type DR)

For measuring changes in radius of plant stems



## User Manual

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## 1. Introduction

Thank you for purchasing an Ecomatik Dendrometer type DR. This is a highly precise sensor for continuous measurements of changes in radius of plant stems 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 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

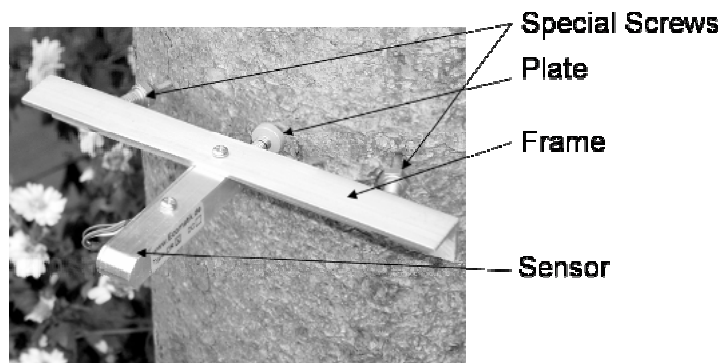
As shown below, the radius dendrometer consists of:

1 Sensor with 2 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 your dealer should you miss any of these items



*Radius Dendrometer*

## 3. Safety Information

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

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 results.

## 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<sup>2</sup> is recommended for extensions.

#### 4.2 Required tools for installation and for operation

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

**Required tools for installation:** A hand-held drill with 4 mm drill bit, natural resin, cable straps, 2 spanners for M6 screw nut (10mm), voltmeter.

#### 4.3 Mounting

Remove the dead bark from the region/section on which the sensor is to be installed. Ensure no injury/damage to the living tissues below the dead bark. 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 natural 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 slowly to achieve an electrical resistance between the yellow and green cable of 10 kohm for installation before or in frost seasons and of 2 kohm for installation in and before growth seasons.

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

## Radius Dendrometer

The changes of Radius are given:

If measuring with two channels:

$$\text{Changes of Radius in } \mu\text{m} = \frac{\text{Values of Channel 1 in Ohm}}{\text{Values of Channel 2 in Ohm}} \times 11\,000$$

If measuring with one channel:

$$\text{Changes of Radius in } \mu\text{m} = \text{Values of Channel 1 in Ohm} \times \text{CF-Value}$$

The CF-Value is printed on the sensor.

## 7 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 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 of approx. 10 kohm for resetting before or in frost seasons and of approx. 2 kohm for resetting in and before growth seasons.

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.

## 8 Technical Specification

<b>Type:</b>	Radius Dendrometer (DR)
<b>Use area:</b>	For measuring changes in Radius of plant stems
<b>Diameter of stem:</b>	>8 cm
<b>Range of the sensor:</b>	11 mm
<b>Accuracy of the sensor:</b>	±2 μm (measurement with two channels)
<b>Temperature coefficient of the sensor:</b>	Measurement with two channels <0.1 μm/K Measurement with one channel <0.04 %/K of the values measured
<b>Environment:</b>	Outdoor condition: -30 to 40°C air temperature, 0 to 100% relative air humidity
<b>Weight of the sensor:</b>	13 g without cable
<b>Output:</b>	Analog output, 0-50 kohm
<b>Power supply:</b>	No power consumption
<b>Material:</b>	Stainless steel and Aluminum
<b>Cable length:</b>	2 m, extendable up to 100 m