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Zweifel Consulting

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Point Dendrometer *ZN11-T-WP*

The **ZN11-T-WP** is the further developed version of the former ZB06. The frame is made out of one piece of carbon fibre (CFK) and is consequently combined with stainless steel elements (rods and nuts). The electronic displacement-sensor (linear motion potentiometer) is the same as for the ZB06.
Size of carbon fibre frame: 190 x 92 x 8 mm
Weight (without thread rods): < 100 g
Frame: T-shaped carbon fibre frame, 3 stainless steel thread rods, 6 screw nuts, 6 washers, and 3 cap nuts.
Displacement transducer: Weatherproof but not sealed potentiometer for measuring in a μm resolution. Hub of the moving rod is 2 cm.
Power supply: 5V DC.
Output: 0-5V DC, single ended measurement.


Voltage-Sensitivity: 1 mV = 4.0 μm
Temperature-Sensitivity: < -0.28 μm °C^{-1}

What is detected?
Diurnal stem radius fluctuations are mainly influenced by changes of the thickness of living tissues of the bark (mainly phloem cells). The thickness changes depend on the hydration status of the bark. While water is withdrawn from the bark through transpiration during the daytime, at night the tissue is replenished. As a result of this cycle, the diameter decreases during the day and increases at night. Over a period of weeks and months, this diurnal rhythm is altered by growth. New layers of xylem cells irreversibly increase the radius, particularly during wet periods in the growing season. An additional but smaller contribution comes from tensions within the wood and the growth and death of the phloem cells. In winter, ice formations in the wood induce strong decreases of the stem radius.

Advantages in comparison to other products
- No disturbances by deformations of the dead outermost layer of the bark, induced by temperature and air-humidity (a general argument in favour of point dendrometers and against band dendrometers).
- Materials and electronic parts insensitive to temperature allow for more accurate measurements.
- The spot of measurement is not influenced by the thread rods because it is neither in the vertical nor in the horizontal line of the anchor points.
- The application to different stem expositions allows a spatial resolution of stem radius fluctuations.
- Compatibility to most logging systems and easy to power with a stable 5V DC supply.
- Easy to mount.
- Minor disturbance of the tree stem.
- Weatherproof materials.
- Constructed, produced and tested by experts in tree physiology. Made in Switzerland.

Mounting principle
The electronic part of the dendrometer is mounted on a carbon fibre frame which is fixed to the stem by three stainless steel thread rods implanted into the inactive heartwood. A sensing rod is pressed slightly against the tree stem by a spring. The combination of weatherproof materials and a solid anchorage in the stem make it possible to precisely detect changes in the stem radius with a resolution of less than 1μm.

Mounting instruction
1. Hold the dendrometer against the stem and mark the three spots to drill. Use the outermost rod holes in the carbon frame whenever possible. Ensure that the sensing rod is pointing towards the centre of the stem.
2. Drill holes approximately 5-8 cm into the stem (drill diameter 4 mm). Ensure that the direction of the drill holes is kept horizontal.
3. Put the cap nuts on the thread rods and screw the thread rods into the drill holes previously prepared.
4. Clear the spot on the bark on which the sensor head is placed from rough, dead parts of bark. Use a knife, a chisel or sandpaper but never cut into the living part of the bark.
5. Remove the cap nuts and mount a screw nut followed by a washer on each thread rod.
6. Mount the dendrometer on the thread rods and adjust the distance to the stem with the screw nuts.
7. Fix the dendrometer with a second washer and a screw nut.
8. Connect the **red** wire to a stabilised +5V DC power supply, the **black** wire to GND, and the **white** wire to the data logger.

Maintenance
Put a droplet of WD-40 on the moveable sensor rod twice a year.

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