Bio Instruments S.R.L.

SENSORS AND SYSTEMS
FOR MONITORING GROWING PLANTS

DE-1T-VS
Dendrometer

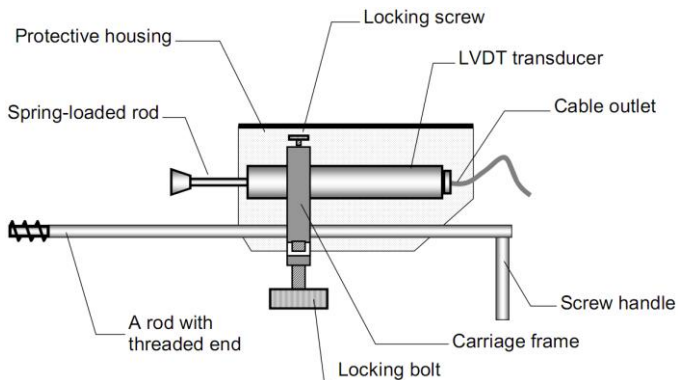## *Introduction*

The DE-1T-VS Dendrometer is a highly precise incremental LVDT-based sensor for monitoring micro-variations of trunk radius in micron range.

The sensor includes a linear displacement transducer (LVDT) mounted on a special rod with threaded end. When the rod is anchored inside the trunk, the LVDT rod follows movement of the trunk surface. The output signal follows the variation of distance between trunk surface and the anchored end of the rod.

The probe is connected by a standard 0.5-meter cable to the waterproof tube with the signal conditioner inside. A signal conditioner provides excitation of the LVDT and production of standard linear output signal.

Signal conditioner
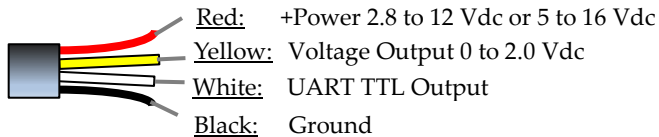
0.5 m cable

3.5-m cable with pigtail ends
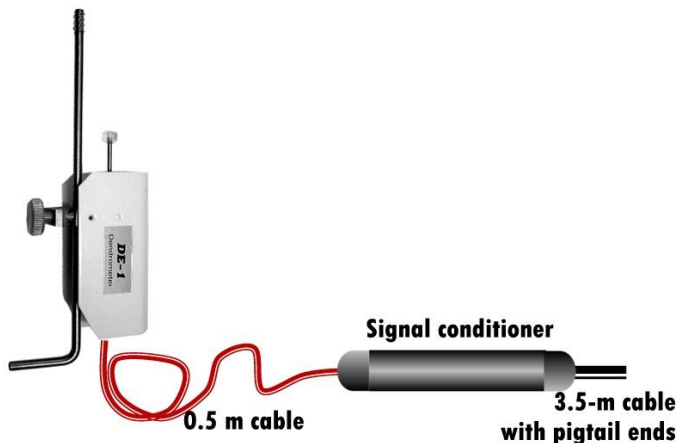
Installation

- In trees with rough bark over the cambium, rasp it away and pare down carefully an area of about $6 L \times 5 W$ cm². In caulis and species with smooth bark, no preparation may be needed.

- Drill the hole with the $3.3 - 3.5$ mm bits. It is recommended to drill slowly using a wood drill set to a low torque to prevent excessive tearing of wood fibers along the length of hole. The depth of hole must be 3 cm min. and 9 cm max.

- Free the locking bolt and remove the rod

from the carriage frame.

- Carefully screw the rod into the tree.
  If there is difficulty in insertion, clear the hole
  carefully with the drill bit.

- Once the rod is implanted, set the sensor on the rod
  and adjust its position until the butt of spring-
  loaded rod touches the trunk.

- Readjust the sensor when its readings become close
  to 0 or 10 mm.

Connection
The connection diagram is shown below.

Red: +Power 2.8 to 12 Vdc or 5 to 16 Vdc
Yellow: Voltage Output 0 to 2.0 Vdc
White: UART TTL Output
Black: Ground

Data reading
Digital outputs have data format: UART TTL,
Baud Rate = 9600, 8N1.
Decimal data format: XX.XXX (mm).
In a basic version, the UART-TTL operates as following:

1. After power is on, the sensor takes the first
measurement within 300 ms approximately, and, then,

sends the measured value in ASCII code. For instance, if the measured value is 5.453 mm, the string looks like **5.453<CR><LF>**. Where

<CR> - Carriage Return

<LF> - Line Feed

2. Then the sensor takes new measurement and sends the new reading every 5 second while power is on. Upon customer's request, the factory basic protocol can be modified with another (a) the string content (to add header, CRC, etc.), (b) Baud rate, (c) sampling time (any value from 1 s and more).

Calibrations table (for Voltage Output)

V	mm
0,000	0,000
2,000	10,000

Calibrations equations

$$\Delta R = 5 \times U$$

Where ΔR – trunk radius variations in mm

U – output voltage in Volts

Response time is 0.3 s (after applying the power).

Power

The DE-1T-VS sensors are to be powered from an external regulated power supply with 2.8 to 12 Vdc output voltage (VS1 modification) or 5 to 16 Vdc (VS2 modification).

Specifications

Measurement linear range (LVDT stroke)	0 to 10 mm
Trunk diameter range	Above 6 cm
Analog linear output Serial (TTL) output	0 to 2.0 Vdc
Resolution	0.005 mm (w/filter)
Operating temperature	0 to 50 °C
Temperature effect	< 0.02% total stroke / °C
Supply voltage	VS1: 2.8 to 12 Vdc @ 15 mA max.
	VS2: 5 to 16 Vdc @ 15 mA max.
Output auto update time	5 s
Excitation time	0.3s
Overall dimensions, mm	90 W × 60 H × 23 D
Carrying rod, mm	160 L × 4 ∅
Threaded end, mm	10 L × 5 ∅
Cable length between probe and signal conditioner	Customized (4 m total length standard)

Customer Support

If you ever need assistance with your sensor, or if you just have questions or feedback, please e-mail at **support@phyto-sensor.com.** Please include as part of your message your name, address, phone, and fax number along with a description of your problem.

Phyto-Sensor Group

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