

# Dendrometer

## Fruit Dendrometer (Type DF3)

For measuring changes in diameter of fruits and vegetables



## User Manual

## 1. Introduction

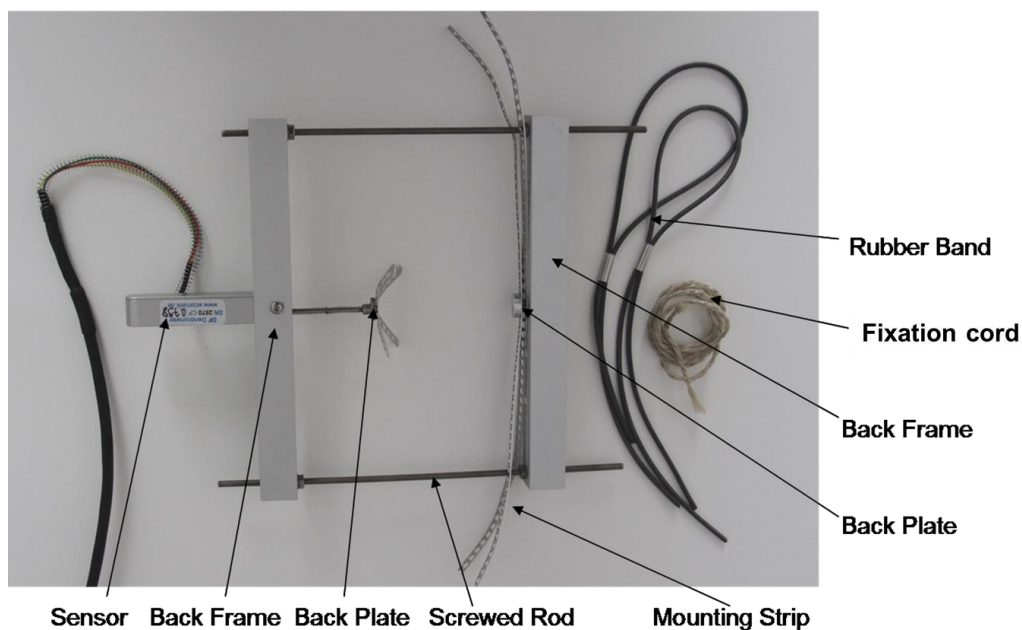
Thank you for purchasing an Ecomatik Dendrometer type DF3. This is a highly precise sensor for continuous measurements of diameter changes of fruits and vegetables under both indoor and outdoor conditions.

This manual is written to help you install and operate your DF3 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 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

The picture below shows the contents of delivery. Please contact us should you miss anything of these items.



**DF3 Fruit 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

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

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

**Tools:** Cable strap, spanner (M3), screw driver, and cord.

Depending on the size and shape of the fruit, there are 3 kinds of installation: **small fruits**, **big fruits** and **elongated fruits**. The photos below show how the dendrometer is installed at the fruits.



In case of hanging fruits (here: e.g. grapes, apple), please use the delivered cord to tie the dendrometer frame to the same branch as the instrumented fruit. Place the dendrometer such that the stalk of the fruit does not bare additional weight from the dendrometer.

### **Generally, it must be ensured:**

Tighten all screws firmly and the frame is stable.

The dendrometer bears the weight of fruit.

The cable does not pull on the sensor.

No rain water flows into the sensor.

The sensor rod is slightly pushed in by 2-3 mm.

## 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 <sup>st</sup> dendrometer	Yellow	1H
	Green	Ground
	Brown	Vx1
	White	Ground
2 <sup>nd</sup> dendrometer	Yellow	1L
	Green	Ground
	Brown	Vx1
	White	Ground
<b>Program Syntax</b> <i>ExciteV (Vx1,2500,0)</i> <i>VoltSe(SEVolt(),2,mV2500,1,True,0,_50Hz,Mult(),Offs())</i> If Multiplier=20.32, Offset=0, the results are measured in microns.		

#### Differential Voltage Mode ( 2 dendrometers)

Connection		
	Cable Color	Input Port
1 <sup>st</sup> dendrometer	Yellow	1H
	Green	1L
	Brown	Vx1
	White	Ground
2 <sup>nd</sup> dendrometer	Yellow	2H
	Green	2L
	Brown	Vx1
	White	Ground
<b>Program Syntax</b> <i>ExciteV (Vx1,2500,0)</i> <i>VoltDiff(DiffVolt(),2,mV2500,1,True,0,_50Hz,Mult(),Offs())</i> If Multiplier=20.32, Offset=0, the results are measured in microns.		

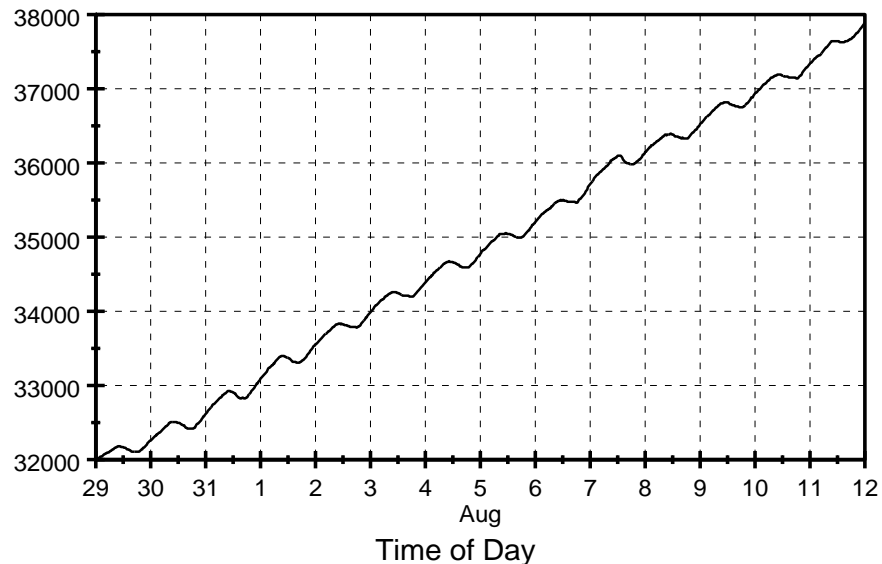
An interval 0.5-hour for data collection can reveal the diurnal course of diameter changes very well.

## 5. Adjustment and maintenance

Fruits usually grow very fast, the diameter can grow more than 0.5 mm per day. It is therefore very important to pay attention to adjust the sensor frame to reset of the sensor. When the output approaches 50 mm, the sensor needs to be reset. Relax the screws and let the sensor again at the position where the sensor is pushed in about 2-3 mm.

## 6. An Example of measured data

The figure shows the diameter changes of an apple measured with an Ecomatik fruit dendrometer.



## 7. Technical Specification

<b>Type:</b>	Fruit dendrometer DF3
<b>Use area:</b>	For measuring diameter changes of small/medium sized, fast-growing fruits
<b>Diameter of fruit:</b>	0-13 cm (frame sizes > 13 cm on request)
<b>Range of the sensor:</b>	50.8 mm
<b>Resolution:</b>	The resolution of the sensor itself is infinite. The resolution of readings is determined by connected data logger, e.g. CR1000: 3.3 µm Dendrometer logger DL18: 0.5 µm
<b>Accuracy:</b>	Dendrometer dependent: Max. ±0.98% of reading (stable offset)  Dependent on the connected data logger, e.g.: CR1000: ±(0.04% of reading+20µm) Dendrometer logger DL18: ±0.1%
<b>Temperature coefficient of the sensor:</b>	<0.2 µm / °C in the whole range
<b>Linearity:</b>	<0.5%
<b>Environment:</b>	Outdoor condition: -25 to 70°C air temperature, 0 to 100% relative air humidity
<b>Weight of the sensor:</b>	32 g without cable
<b>Power supply:</b>	Stabilized Vex of 0.5 – 10 VDC, power consumption practically zero
<b>Material:</b>	Stainless steel and Aluminum
<b>Cable length:</b>	5 m, extendable up to 100 m