Experiment B-20
Soil Moisture

Biology

Objectives

- To learn about the mechanism of the soil moisture sensor (tensiometer).
- To monitor the soil moisture of a plant indoors or outdoors.
- To understand the effect of temperature on the moisture of the soil.

Modules and Sensors

- PC + NeuLog application
- USB-200 module
- NUL-229 Soil moisture logger sensor

Equipment and Accessories

▪	Plastic container
▪	Plant in a pot

- The plastic container is included in the NeuLog Utility accessories, UTL-KIT.

Introduction

Soil is composed of different particles; most of them originate from the degradation of rocks (mineral particles). Others come from plant or animal residues (organic particles). Soil can also contain living materials (bugs, roots etc.)

The particles have small spaces between them called pores. When the pores are filled mostly with air, the soil is "dry". When they are filled with water then the soil is "moist".

The NeuLog soil moisture sensor can be used to know when to irrigate becuase the plant does not have enough water. The sensor is called a tensiometer, which is used to measure the energy status (or potential) of soil water. The measurement is directly related to the ability of plants to extract water from the soil.

The sensor consists of a ceramic porous cone which is filled with water. Water can move through it to equilibrate with the soil water. A partial vacuum is created as water leaves the cone through the pores (when the soil is dry); the sensor detects the vacuum indicating the energy that would need to be exerted by the plant to extract water from the soil.

The following table shows the typical interpretation of soil moisture readings:

Soil Moisture (cbar)	Condition of the Soil
0-10	Saturated soil. Present one or two days after irrigation.
10-20	The soil has the right amount of water (except very sandy soils which become dry in this range)
30-60	Typical range for irrigating or adding water (except in soils with too much clay)
60-100	Usual range for irrigation of clay
100-200	Soil is getting dry which is dangerous for the adequate growing of plants

Procedure

<u>Experiment setup</u>

1. Irrigate the plant (make sure there are holes for draining of water).

2. Remove the green cap from the soil moisture sensor.

3. Fill the container with water and immerse the ceramic cone for about 15 minutes.

4. Fill the cone with water until it is almost full.

5. Press the green cap back on the ceramic cone.

6. Insert the whole ceramic cone in the soil. Make sure there is good contact with the soil.

Sensor setup

7. Connect the USB-200 module to the PC.

8. Check that the soil moisture sensor is connected to the USB-200 module.

> Note:
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> The following software functions are explained in short. It is recommended to practice the NeuLog application functions (as described in the user manual) beforehand.

9. Run the NeuLog application and check that the soil moisture sensor is identified.

Settings

10. Click on the **On-line Experiment** icon in the NeuLog main icon bar.

11. Click on the **Experiment Setup** icon and set the:

    Experiment duration to 3 days
    Sampling rate to 60 per hour

- The experiment could also be conducted for fourteen hours.

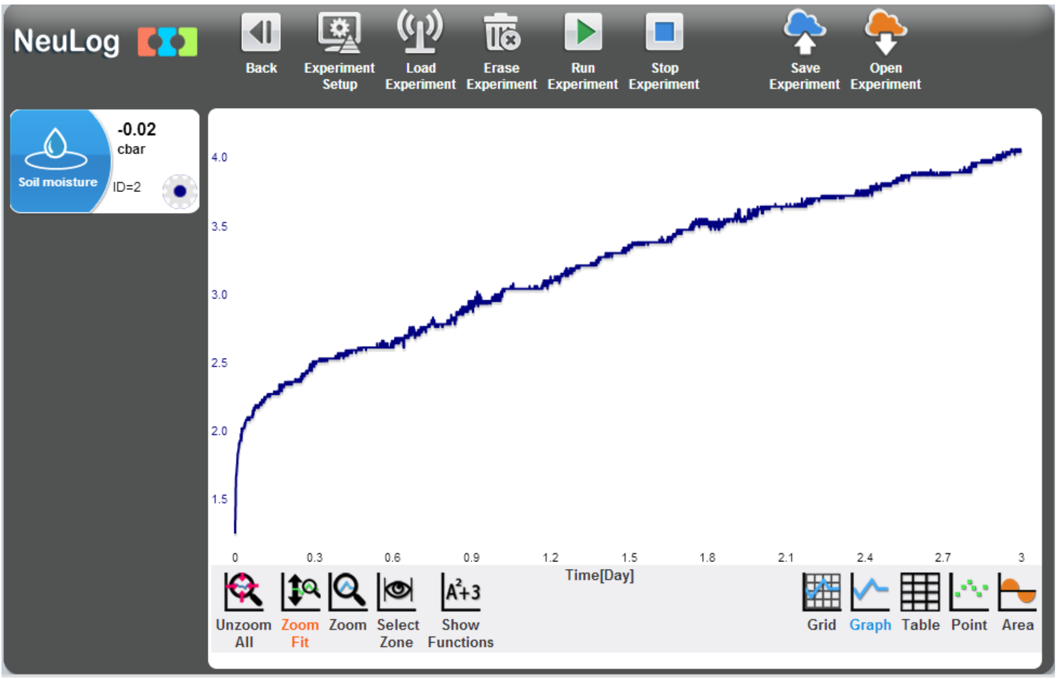
- The experiment could be conducted outdoors with a battery module.

Testing and measurements

12. Click on the **Run Experiment** icon to start the measurement. It is recommended to check the graph at least one time each day.

13. In order to focus on the desired range, click on the **Zoom** icon , locate the mouse cursor at a point above the graph and press its left button; keep it pressed and create a rectangle that includes the whole range.

14. Your graph should be similar to the following:



15. Save your graph.

Challenge research

16. Repeat the experiment after exposing the plant to more or less sunlight.

Summary questions

1. Did you get an incline or a decline on your graph? Explain.
2. What will you see on the graph after irrigation? Explain.
3. How did the change in exposure to sunlight affect the results?
4. What happens to plants when they do not get enough water? What happens when they get too much water?