

Measurement and control technology

In order to exploit the full potential of our lysimeters for comprehensive and precise data acquisition, we have also developed the requisite measurement and control technology.

The foundation for the water balance analysis is provided by weighing the lysimeter. This is done using the precision weighing system from UGT with weighing monitor. Even the smallest water increases such as dew or frost on vegetation can be recorded using this system. The quantity of the water flowing off on the lysimeter bottom, and the quantity of the water samples obtained using the suction cups is determined using the tipping counters attuned to the throughput to be expected. Water samples can be taken from any depth in a time- and tension-controlled manner using our suction probe systems.

UGT has a broad repertoire of high performance sensory technology comprehensively presented in the chapters "Tensiometers", "Soil moisture meters" and "Temperature sensors" of this catalogue for the measurement of soil moisture, soil moisture tension and temperature at any depth.

The UGT data logger (see chapter "Data acquisition and power supply" are designed such that this high bandwidth of sensors can be simply connected and managed even in large unit numbers.

Furthermore, after cutting the soil monolith, the objective of natural conditions which are as undisturbed as possible is met.

The peripheral conditions of the



DryLabLysimeter with mobile roof

monoliths cut from the soil must be controlled in accordance with the surroundings or alternatively with the aspired to scenarios.

This will usually relate to the temperature and the tension on the bottom side of the lysimeter primarily so that the surface is subjected to the same climatic conditions as the surrounding area. One exception here is the control in accordance with selective scenarios for example in drought stress tests, or comparative measurements.

UGT offers a heat exchanger for the temperature control on the lysimeter bottom which transfers the temperature of the surrounding soil directly to the lysimeter bottom. With a heating or cooling system the temperature can be controlled also independently of the surrounding soil temperature such as for climate experiments.

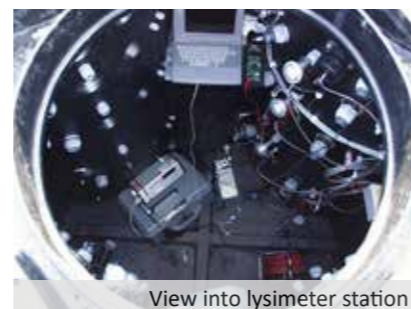
The soil moisture tension of the surrounding soil is recorded with tensiometers and then transferred to the lower edge of the soil monolith by means of a pump system via ceramic cups. Here, too, the possibility exists to conduct the control process in accordance with the scenario irrespective of the ambient conditions.

PE-HD lysimeter stations can also stand in ground water due to the fact that they are water tight. For this special case the surrounding water level can be transferred directly into the lysimeter vessel via

a pressure compensation system with filter. If the ground water in a lysimeter distant from the ground water is to be simulated, this can also be artificially dammed - on request also in accordance with the values of the distant ground water level which can be transferred to the control unit in the lysimeter via a radio modem.

We also offer special solutions for the control of the water input on the top edge.

The uncontrolled water input as a result of rain can be prevented by a mobile roof which automatically moves over the lysimeters when it rains. Since the roof only covers the lysimeters when it rains, the influence of the roofing on the vegetation is very low. Rain systems can be installed for selective fully automatic watering. In the special case of a sloped lysimeter, it is also possible to record the surface run off. This is captured in a collar, recorded in a tipping counter and filled into collecting flasks as required for later investigation or as an adequate sample.



View into lysimeter station



EcoUnit

An EcoUnit is a measuring system to investigate ecosystem functions in the soil-plant-atmosphere system under defined boundary conditions.

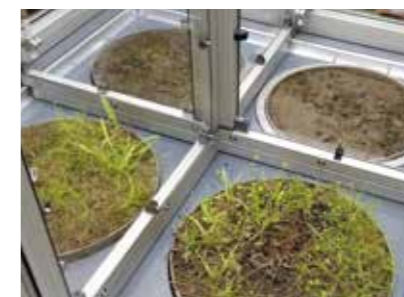
The EcoUnits have been developed for the iDiv Ecotron facility in a collaboration between scientists and technicians of the German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig and the Helmholtz Centre for Environmental Research – UFZ together with UGT GmbH and Emc GmbH.

Ecotrons are used to investigate processes within the soil-plant-atmosphere system as well as the interactions between the compartments. Ecotrons are lysimeter applications beyond the investigation of only soil processes and thus the generic term for lysimeter applications of all kinds.

An EcoUnit consists of three units. The lower unit contains the soil, which can either be inserted directly into the container or in extra stainless steel cylinders (lysimeters). The latter allows the investigation of undisturbed soil monoliths. Up to four lysimeters can be installed in one EcoUnit. Several soil sensors can be installed in the lower unit to collect soil temperature, soil moisture and soil tension data. To investigate root systems and root growth rhizotrons can be installed as well. The lower unit is equipped with a system to collect seepage water and a system to control the temperature conditions at the lower boundary of the soil. On top of the lower unit a second unit is attached, which isolates the environment above the soil surface from the surrounding. The size of the isolated habitat is big enough for growing of medium shrubs.



iDiv-Ecotron with 24 EcoUnits at the UFZ research station Bad Lauchstädt



graphic: © emc GmbH

The second unit can be equipped with additional walls to divide the EcoUnit in four self contained sub units. On top of the second unit the upper unit is located, which contains equipment for irrigation, lighting and ventilation. The upper unit can also be equipped with sensors to collect data of temperature and humidity as well as with a gas analyzer.

The lower and upper units are equipped with a control cabinet containing the required power supply and signal transformation as well as the measurement and control technology. The EcoUnit comes with a touch panel to visualize collected data and to control the EcoUnit.

The equipment and design of the EcoUnits are always optimized for the customer-specific research goal.