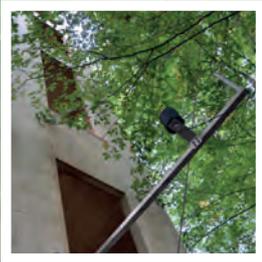


Catalog



Umwelt-Geräte-Technik GmbH



CERTIFICAT

CERTIFICADO

СЕРТИФИКАТ

認證證書

CERTIFICATE

ZERTIFIKAT



Management Service

CERTIFICATE

The Certification Body
of TÜV SÜD Management Service GmbH
certifies that



Umwelt-Geräte-Technik GmbH
Eberswalder Straße 58
15374 Müncheberg
Germany

has established and applies
a Quality Management System for

**Development, production, distribution and services
for measuring techniques and diagnostic instruments concerning
soil-water-air analysis, construction of scientific devices for
environmental technologies and environmental
monitoring and lysimeter technology.**

An audit was performed, Report No. **70754154**.
Proof has been furnished that the requirements according to

ISO 9001:2008

are fulfilled.

The certificate is valid from **2015-08-12** until **2018-08-11**.

Certificate Registration No.: **12 100 36542 TMS**.

M. Wegner

Product Compliance Management
Munich, 2015-07-16



MS101 07/2014

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TUV®



Dipl.-Ing. Bernd Fürst
Managing Director
and Company founder



Dr.rer.nat. Sascha Reth
Managing Director



Dr.-Ing. Manfred Seyfarth
Company founder and Associate

Dear Business Partners and Prospects,

we are pleased to present you an overview of our extensive equipment range in this product catalog. In this issue we have listed for you our latest developments of the past year, as well as already proven technology.

Our experience of more than 25 years in the field of environmental technology inures to the benefit of you as a customer. Close cooperation with leading research institutions and industrial partners is the key to innovative solutions in the field of environmental equipment technology. Through this our product portfolio could continuously grow qualitatively and quantitatively. For this we sincerely thank all our partners.

UGT stands for tailored and customized solutions. You don't find a suitable product or a solution in our catalog? Our interdisciplinary team of specialized staff, engineers, and scientists will develop a solution together with you.

Challenge us!

Dipl.-Ing. Bernd Fürst

Dr.rer.nat. Sascha Reth





UMWELT - GERÄTE - TECHNIK GmbH

Our roots - the Berlin / Brandenburg location

The research city of Müncheberg looks back on a long and significant tradition in the area of agricultural sciences and is well-known for its research institutes both nationally and internationally.

Established as the Kaiser-Wilhelm-Institut für Züchtungsforschung in 1928 under the management of Prof. Dr. Erwin Baur, the foundation stone was laid for intensive agricultural and agronomic research in Müncheberg, which was most successful particularly in plant cultivation up to the end of the 2nd World War.

The research activities were resumed on re-opening under the name of the Zentralforschungsanstalt für Pflanzenzucht (Erwin-Baur-Institut) on 1 October 1945, and the research institute continued in 1952 as the Institut für Acker- und Pflanzenbau of the German Academy of Agricultural Sciences in Berlin.

In 1970 the working area of the institute was extended as a research centre for soil fertility of the Academy of Agricultural Sciences of the GDR.

After the reunification of Germany on 2 January 1992, the research facility with an initial 8 institutes took up its work as Zentrum für Agrarlandschafts- und Landnutzungsforschung (ZALF) e.V. and has worked as member of the Leibniz Community since 2005 as Leibniz-Zentrum für Agrarlandschaftsforschung Müncheberg in research on ecosystems in agricultural landscapes and the development of ecologically and economically acceptable land use systems.

Foundation of UGT GmbH

On 2 May 1992, Umwelt-Geräte-Technik GmbH (UGT) took up operations as a spin-off from ZALF e.V. From the first hour, the

company founders and employees of Umwelt-Geräte-Technik GmbH worked for many years in different areas of the Forschungszentrum für Bodenfruchtbarkeit Müncheberg at a scientific and technical level.

Carried by the expertise of the shareholders, an interdisciplinary high-performance team of scientists, engineers and technicians is now available.

Our employees have worked for many years in a scientific capacity in the areas of hydrology, soil physics, geoecology and geography, biology and the construction of scientific apparatus and equipment. Solid expertise, coupled with extensive experimental experience in the laboratory and in the field form the foundation for developing and producing environmental instrument technology with high innovative character, high quality and highly usable products.

The production facility erected by the company in 1999 provides ultra-modern development workplaces for applied microelectronics and fine mechanics and a very well equipped production location with modern machine park and production technologies to satisfy the requirements placed on rational series production and customised equipment construction.

The hall extension building realised in 2001 provides additional production space for the production and assembly of large volume lysimeter container stations and for apparatus building so as to satisfy the growing demand for these test equipment set-ups.

The production location was supplemented in 2003 by an outdoor

test area with integrated 4-fold lysimeter station, a weather station and a soil hydrological measurement site.

One year later, a well equipped soil laboratory was inaugurated and an ongoing ground water observation point set up.

These facilities are used to conduct project work and to verify measurement methods and environmental measurement devices from the company's own development and production.

On 15 September 2008 the UGT GmbH south branch was founded in the Munich conurbation and premises rented in the innovation and founder centre of Freising-Weihenstephan. In addition to office space, the exhibition and conference areas enable UGT GmbH to show its complete performance range.

A new electronic laboratory was set up in 2009.

On 2 January 2010 the service center UGT GmbH - France, was opened in Homécourt (Lothringen) which is located on the grounds of the Industrial Association GISFI.

These grounds are at the same time a test location to conduct soil re-cultivation processes of a former site of the steel and coal industry. The basis for the tests is provided by a technically well equipped large-scale lysimeter installation which was erected by UGT GmbH in France.

UGT is committed to the long tradition of the research location Müncheberg and as an employer UGT serves to the people of our region. With the success on the national and international market there we secure and create new jobs. With the doubling of the production area in 2016 we achieved better working conditions and can manufacture large PE-HD lysimeter stations in-house. We dispose of specially equipped rooms for producing micro-electronics and micro-system technology. With the new production hall with a total area of 900m², UGT has in 2017 a productive area of 1800m². The course for the future of the company has been set, the team works continuously with the view to the future.



1992 Founding of the UGT GmbH



1999 Own production facility



2001 Hall extension 1



2003 Outdoor research area



2008 Opening of the UGT south branch



2010 Opening of the UGT branch France



2016 Hall extension 2



Training



Planning and installation of complete measurement stations

Our Services

Training

Our team of scientists and technicians provide training and induction for practical use under field and laboratory conditions for all products of UGT GmbH.

Training events range from service, calibration and measurement instruction through to plausibility checks and the interpretation of the data records obtained. Thanks to our cooperation partners, we are able to offer this training also internationally - in Brazil, Australia, China and Russia, for example. Specialised papers on new measurement methods and instrument developments are given in national and international workshops as well as ideas and experience exchanged.

Planning and installation

We offer scientifically based project advice for the erection of measurement stations and lysimeter installations. UGT GmbH is happy to assume the conception and design of the measurement project equipment, construction realisation, installation and test run as well as instruction or maintenance or to support you according to your requirements.

Lysimeter cutting

We can provide you with soil monoliths at a broad variety of locations for your lysimeter or column experiments.

We have the technology to provide you with monoliths with diameters of 100 mm to 500 mm in lengths of up to 1.0 m as well as large volume soil monoliths with cross section areas of 0.5, 1.0 and 2.0 m² and lengths of up to 3 m. We will also be happy to advise you on the selection of the suitable monoliths for your research.

More detailed information on our patented methods as well as the possible dimensions of the soil columns may be found in the "Lysimeter technology" chapter starting on page 193.

Lysimeter retrieval

After completion of the lysimeter experiments we are happy to retrieve the lysimeters for you. Using a special lysimeter retrieval technique, the soil monolith is cut into different thicknesses whilst maintaining the full cross sectional area. The use of high speed diamond cable sawing technology enables the original structure

of the monoliths to be essentially maintained.

Additional tests on soil development in the lysimeters as well as chemical and biological analyses of the soil cores are facilitated here. After securing these additional results, the lysimeter vessels are available for the production of new soil monoliths. The PE-HD container lysimeter stations we offer can also be used again after retrieval. They may be repositioned as required and equipped with new lysimeter vessels.

Lysimeter experiments

In our own lysimeter station, which essentially serves to verify new measurement methods and components, we offer the possibility of conducting special lysimeter experiments for you. Test runs with different objectives can be made simultaneously on four Lysimeters with a cross-section area of 1.0 m² and a height of 2.0 m. Due to the direct proximity to the lysimeter, our employees are in an ideal position to accompany the project. We can conduct data collection and the complete analysis of the experiment for you or together with you.



Determination of hydrological soil parameters



Care and maintenance of apparatus and equipment

Determining hydrological soil ratios

In our soil laboratory, we determine the following hydrological soil ratios using lysimeter samples:

- Saturated hydraulic conductivity
- Unsaturated hydraulic conductivity
- Water retention function

For this purpose we will also be happy to provide you with a soil sample ring set. You can take the samples or our UGT staff can do this for you. Particle analyses according to KÖHN are also possible with the Sedimat 4-12 for every soil sample of adequate volume on request.

Data acquisition and analysis

In addition to planning your test setups we can also assist you in analysing the data acquired. With the assistance of remote data transmission we will prepare your data, compile them in diagrams or tables and will produce a comprehensive analysis. For large installations we offer the preparation and establishment of data base systems as you require.

Maintenance and service

We offer maintenance and service for the test setups and instruments installed by us as well as inspections to guarantee long term perfect function. During this work, readjustments and calibration work is performed as well as function checks and in particular estimates made for the normal useful life of field installation. We are able to guarantee an optimum service due to our knowledge of the installations and our many years of experience with the measurement equipment. We offer plant specific maintenance contracts for monitoring stations.

Warranty and repair

The statutory warranty applies to all UGT products and the commercial products we sell. Our production offers you a high quality standard. If a product is nevertheless defective, UGT GmbH will take care of the repair or will provide you with a new product. Our skilled staff will be happy to repair the measurement equipment also outside the warranty period.

Project support

We can support you in your project in the development of measurement equipment and procedures or in the design of new measurement stations or networks. From development through production to installation and test run, UGT GmbH offers the support of the individual steps and of the entire project with its combined know-how and innovation.

We are there for you!



- Your UGT Team -



Pump for the automated sampling of printer ink



Obtaining water samples in a gas-tight bag

Our customisations

In order to do justice to the varied requirements placed on environmental measurement technology and to provide you with the most suitable equipment for your research, we also produce customised special solutions, not only in the area of environmental measurement technology. We are also happy to provide our technical know how for the development and production of new instruments and apparatus.

For example, in accordance with the suction probe method we have developed a pump for the automated taking of printer ink samples for the company Vistaprint. The vacuum unit consists of 5 independent pump units, the ON period of which and vacuum may be set individually for each of the 5 units. The samples are filled in boro-silicate glass flasks with drain taps. In cooperation with the Landeskontrollverband Brandenburg e.V. a sampler has been developed to take silage samples in order to monitor their quality. Unlike the usual samplers, the silage sampler from UGT can be driven into the silage using little force and retrieved again.

A special plate tensiometer has been developed for experiments

on the influence of wind erosion on fields at the Institute of Plants and Nutrition and Soil Science of the Christian-Albrechts University of Kiel. Instead of using a ceramic cup, the tension is transferred via a ceramic plate. This enables the tension of the above soil layer to be recorded. This tensiometer was installed in a wind tunnel in order to determine the correlation between soil moisture tension

GICON
Firmengruppe



and soil erosion.

We also convert new technologies into handy measurement instruments. For example, the procedure developed by the BGD Boden- und Grundwasserlabor GmbH Dresden to obtain representative seep water samples using suction cups and a gas-tight bag from UGT has been converted to a sampling system.

The suction cups with a P80 ceramic cell remain permanently installed in the soil. Instead of a collection volume, they have an open shaft into which a cartridge is inserted for sampling which docks onto the suction cup. There

is a gas-tight sampling bag in the cartridge which is connected with the ceramic cup when docked. Applying a vacuum to the pressure-tight cartridge outside the sampling bag causes water with all the dissolved gases and volatile substances in the water to be drawn from the suction cup into the sampling bag. The gas-tight bag is the sample transport vessel from which the samples are taken in the laboratory for the individual analyses. For repeated sampling the bag in the cartridge can be changed and substances for the conditioning of the seep water sample provided.

A further advantage of the system is that the volatile gas elements of the water sample can be collected in the gas-tight bag and analysed in the laboratory. The seep water collector with gas-tight bag has already been successfully used for the seep water forecast and landfill monitoring and will soon supplement our constantly growing product range.

Please consult us for specific inquiries on customisations and for innovative ideas.



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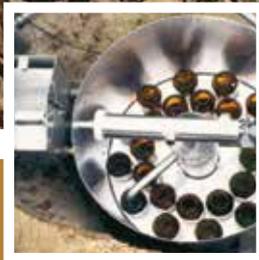
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SOIL SCIENCE







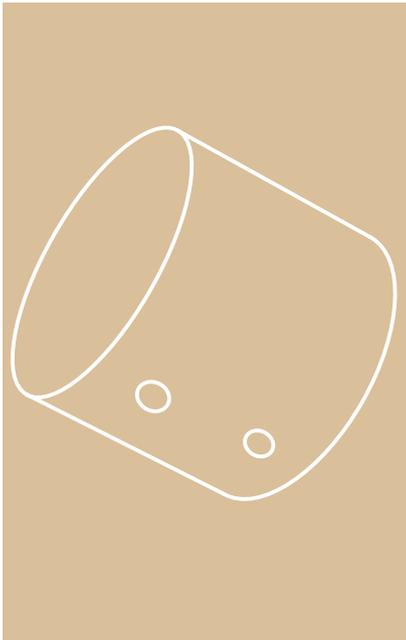
SOIL DRILLING AND SAMPLING

Soil drilling and sampling permits an insight into the structure of the soil. The horizontalisation of the soil, which already provides information on internal soil processes such as substance relocation, can be determined directly by visual means. Using soil samples the physical and chemical soil parameters to determine properties such as pore volume or hydraulic conductivity can be obtained in laboratory tests. A large number of different drilling devices and soil sample rings have been developed to cater to the different soils and the specific requirements placed on the samples. Corresponding accessories make the hard work of sampling easier and improve the quality of the samples.



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SOIL SAMPLE RINGS

Soil sample rings are used to take soil samples which are as undisturbed as possible for laboratory research such as to determine the pore volume, the hydraulic or pneumatic conductivity or water content. The hollow rings made of stainless steel have a cutting edge on one side. With this cutting edge facing down, they are pressed or hammered into the ground. The soil volume in the inside of the soil sample ring is removed with the soil sample ring and remains in it until investigated in the laboratory. The soil sample ring itself as well as lid on the top and bottom sides enclose the sample completely. This enables it to be transported practically and without disturbances. The soil samples with soil sample ring are removed quickly, easily and the samples obtained in this manner are essentially undisturbed. A further advantage is that a uniform volume is always taken from the soil with the same type of soil sample ring.

Undisturbed sampling with sample ring

Based on the patented UGT sampling method for large soil monoliths, UGT GmbH has developed this sampling device for soil samples with a sample ring size of 120 mm diameter and 120 mm height. Equivalent to the excavation technology for large soil monoliths the soil is pre-cut to minimise the forces impacting on the soil. The sample ring is firmly positioned in a stainless steel cutting sleeve studded with cutters. This cutting sleeve is driven by an electrical motor via a planetary gear so that the sample ring inside remains perfectly still while the cutting sleeve rotates to pre-cut the soil sample. The sample ring can then be taken in the detached soil sample accurately to shape.

The cutter unit and drive are mounted on a portable tripod which is vertically aligned and fixed in the ground at the sampling point. The large pneumatic tyres on the tripod permit a high degree of mobility in the field and therefore simple access to the sample points.

An external power supply is required to operate the electrical motor. Appropriate generating units can be procured from UGT if required.

Both stainless steel and plexiglass sample rings with the corresponding size can be used with this sampling device. Plexiglass sample rings enable subsequent computer tomographic examination and provide a visual impression



of the soil. For plexiglass cylinders a stainless steel cutting ring is put on to support the cutting effect.

Technical data

- | | |
|-----------------------------------|------------------------|
| • Dimensions of overall assembly: | 120 x 100 x 120 cm |
| • Weight of overall assembly: | 38 kg |
| • Sample height/diameter (inner): | 120 mm / 110 mm |
| • Sample volume: | ~ 1140 cm ³ |

Advantages

- Minimal influence of bedding
- Sample excavation irrespective of soil condition

Taking undisturbed samples from sample ring samples

With this sampling device, undisturbed samples with $\varnothing = 30$ mm can be excavated from 120 mm sample rings for higher resolution soil examinations in the lab. Amongst others, this enables examinations of the mesopores and the root distribution. Up to three 30 mm samples can be obtained simultaneously from one layer of the sample ring.

The Plexiglass sample rings are placed in stainless steel cutting sleeves which pre-cut the soil before it is taken in the sample rings. The position of the cutting sleeves on their support is ad-

justable. Therefore the sampling point can be freely chosen on the surface of the 120 mm sample ring. The cutting sleeves are manually pressed in using a crank handle. In the cutting process, the sample is pressed out of the large sample ring from below by a die and pressed into the small sample rings. Thus the soil outside the small sample ring can expand and distortions caused by pressure on the small samples are prevented.



Technical data

- Dimensions/weight of overall assembly: 30 x 30 x 60 cm / 12 kg
- Sample height/diameter (inner): 30 mm / 30 mm
- Sample volume: 21 cm³

Advantages

- Undisturbed soil structure
- Examinations in the μm range possible

Hammering head for soil sample rings

The hammering head is an attachment used to hammer soil sample rings into harder soils with a hammer. The impact is distributed evenly over the complete edge of the soil sample ring. The hitting edge is also somewhat deeper and there are pressure compensation bore holes in the base plate of the hammering head. This per-

mits disturbances to the soil sample taken to be minimised. The hammering head is available for UGT soil sample rings with a volume of 100 cm³ and 250 cm³. A polyamide impact hammer is also available.



Soil sampler

Using the soil sampler, soil sample rings can be pressed into soft or medium hard soils without a hammer. It consists of a handle piece which is connected tightly with a ring holder using a bayonet connection. The soil samples may be taken both vertically from the soil surface and horizontally to a soil profile.



The soil sampler is suitable for UGT soil sample rings with a volume of 100 cm³ and 250 cm³.

Soil sample rings removal set

**Soil sample ring set, model A,
for soft soils to a depth of up to 2 m**

The sample sets with the suffix A are used to fill the soil sample rings in soft soil above the ground water table. The samples can be taken on the surface, in drilled holes or in profile pits. The open ring holder in this set is fitted with a bayonet connection and is driven into the soil manually.

The set among other items contains: an open ring holder, an

Edelmann and a Riverside auger, a handle and extension rods, a plastic case with soil sample rings, various accessories and a carry bag.

The sample sets with the suffix A can be obtained for soil sample rings with a diameter of 53 and 60 mm.



**Soil sample ring set, model C,
for all soils to a depth of up to 2 m and soil sample ring set, model E**

The sample sets with suffix C and E, for very hard soils, can be used to take samples in virtually all soils. The samples can be taken on the surface, in drilled holes or in profile pits both above and below the ground water table. The closed ring holder in this set is fitted with a conical thread connection which means that the ring holder may also be hammered into the soil with an impact absorbing hammer. The set among other items contains: a closed ring holder, a handle with beating head, an Edelmann and a Riverside auger, extension rods, a hammering head with a guide cylinder, a plastic case with soil sample rings and various accessories.

The sample sets with the suffix C can be obtained for soil sample rings with a diameter of 53, 60 and 84 mm. The most used diameter (standard) is 53 mm (E only available in Ø 53 mm). Soil sample rings are stainless steel rings made of seamless tubes, smooth inside and out. The bottom of the ring has a cutting edge. The dimensions, and thus the volume content of soil sample rings are exactly known which makes them highly suitable for laboratory research.



Soil sample rings

Soil sample ring 100 cm³

The soil sample ring with an inner volume of 100 cm³ has an internal diameter of 57 mm and is 40.5 mm high. The cutting edge on the lower side makes it easier to push the ring into the soil and reduces the disturbing effects.

It is made of rust free stainless steel, is tough and durable. The soil sample rings are not numbered as standard. At customer request a continuous or customised numbering can be attached.



Soil sample ring 250 cm³

Using these soil sample rings undisturbed samples may be obtained with a volume of 250 cm³ which are suitable for laboratory research. The inner diameter is 72 mm, and the height is 61 mm. A cutting edge on the bottom side facilitates pressing into the soil and reduces the disturbing effects. It is made of rust free stainless steel, is tough and durable.

These soil sample rings are closed or come with two side holes so that they may be inserted directly into the ku-pF apparatus in order to determine the unsaturated hydraulic conductivity as dependent on water content. The soil sample rings are not numbered as standard. At customer request a continuous or customised numbering can be attached.



Soil sample ring 1140 cm³

These sample rings allow an extremely large sampling volume. The inner diameter of the sample is 110 mm. At the sample rings V2A stainless steel is the outer diameter 114 mm and sample height are each 120 mm and at the plexiglass sample rings is the outer diameter 120 mm and sample height are each 120 mm.

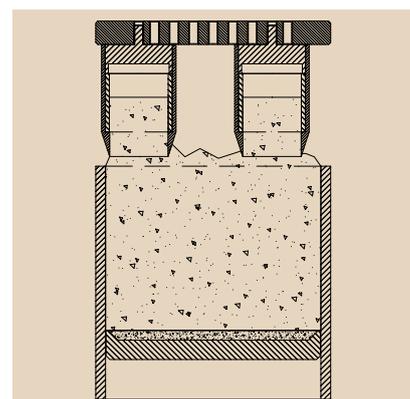
They are suitable for use with sampling equipment for the excavation of undisturbed samples with a sample ring from UGT GmbH. When using plexiglass sample rings with the sampling equipment, a stainless steel cutting ring is put on the rings to support the cutting effect.



Soil sample ring 21 cm³

These miniature sample rings have been designed specifically for sampling larger sample rings and should be used with the sampling equipment for undisturbed sample ring testing from UGT GmbH. They are made of plexiglass, and the height and inner diameter of the sample ring each measure 30 mm.

Matching lids are also available.



HAND AUGER EQUIPMENT

Hand auger equipment is available in different sets and also as individually compiled components and are made of a specially hardened high quality steel. Deeper drillings may be made by extensions with a bayonet connection or with a conical screw thread. A drilling depth of around 8 to 10 m may be achieved using hand auger equipment. The maximum drilling depth will depend on several factors including soil structure and properties of the material to be drilled.

Almost every soil type places special requirements on the model of the auger to be used. This is why several models have been developed during the course of a year which have been ideally designed for the specific requirements.

Hand auger types

- Edelman auger (in different versions for clay, sand and coarse sand)
- Riverside auger (hard, stiff soils mixed with fine gravel)
- Stony soil augers (for soils with a high gravel content)
- Spiral augers (to drill through hard horizons/layers, e.g. local stone)
- Stone catchers (to remove loose stones from the auger hole)
- Augers for soft soil
- Piston samplers (for less cohesive, wet soil layers beneath the ground water)



Connections

Bayonet connection

The advantages of the bayonet connection are rapid assembly and low weight.

One disadvantage that only leads to problems for certain tasks is that the connection is without play. The bayonet connection is used as the standard connection.



Conical thread connection

The connection consists of an inner and outer thread and the parts to be connected. If the connection is tightened a strong join is made.



Ergonomic auger set

The ergonomic hand auger set for heterogenous soils is used to carry out manual drilling and sampling in a great variety of different soils in an ergonomically sound

manner. It is particularly suitable for general soil investigation (description of the layering, geology, mineralogy) and for environmental research.



Auger set for heterogenous soils

Drilling and sampling in homogeneous soils (soils with a uniform soil profile) can in almost all cases be executed with one type of auger. For drillings in heterogenous soils, several different auger types will be applied. With the standard set it is possible to execute manual drilling to a depth of 5 m without great physical effort. The standard set comprises different auger types, diameter 7 cm so that this set can be used successfully with all drillings in layered soil profiles. The set can be used for drilling above the water table in all soils, and below the water table in cohesive soils. The piston sampler is used for looser soils also below the ground water table.

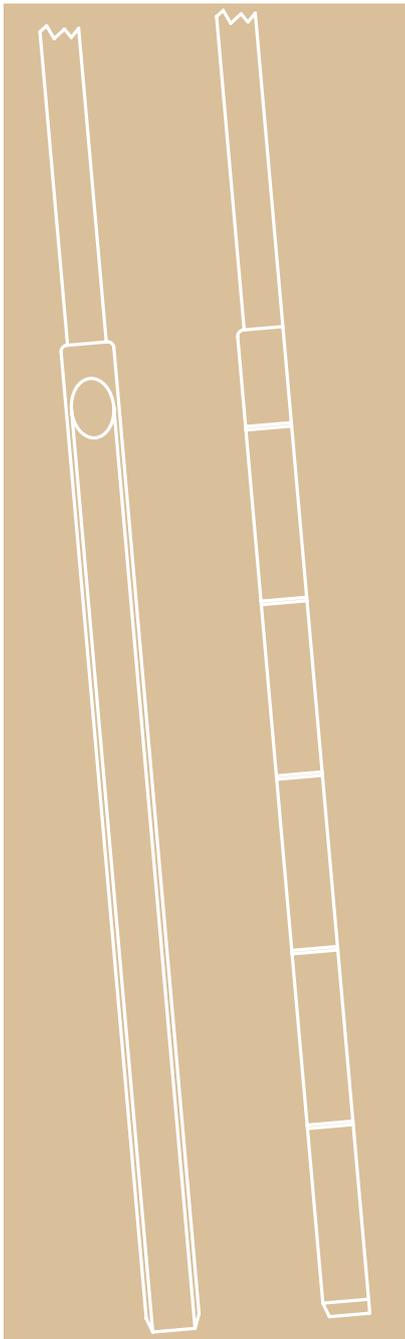
The auger set (with bayonet connection) comprises the following items among others: four types of Edelmann augers (clay, combination, sand, and coarse sand), a riverside auger, a stony soil auger, a spiral auger, a piston sampler and a gouge auger.

The set also includes the following:

Extensions, line search probe, submersible bell with tape measure, a pull and push piece, care material and a field map. This is all provided in an aluminium transport case.



This set is available both with bayonet connections or with conical screw thread connection!



GOUGE AUGERS

Hand operated equipment can be used for soil research up to a depth of 5 to 10 m. A number of augers are described in this section. Their common denominator is that they are all fitted with an almost half cylindrical operational part with parallel cutting edges running vertically, justifying the name gouge auger. The operational part may vary in length as well as diameter. The most suitable length depends on the penetration resistance, the substance of the soil and required drilling depth. The longer the operational part, the more vulnerable the auger is to torsion. The selection of the most suitable diameter will depend on the composition and the structure of the soil and on the purpose of the research. In general a smaller diameter is used in soils with a fine and/or dense structure than in soils with a loose structure (e.g. young swampy soils).

Advantages

The advantages of gouge augers compared to other hand auger equipment are as follows:

- A large profile overview per sample taken, due to the very long effective auger body.
- A large drilling area per hole so that large drilling depths can be quickly reached.

Areas of use

Due to the fact that the samples show very little disturbance, these gouge augers are frequently used for investigations for the following purposes:

- Mapping
- Soil suitability investigations
- Training
- Root investigations
- Fertiliser investigations
- Clay classification
- Palaeontological investigations

Groove auger

The groove auger is used to take soil samples and investigate the soil horizons. Under consideration of the different soil properties we offer this auger in two different versions.

The groove auger for heavy soil is particularly strong and torsion resistant. The core volume consists of a groove with a diameter of 12 mm which is laterally milled into the solid rod made of steel with special alloy.

The length of the groove is 1000 mm. The groove auger for light soils consists of a special steel tube with a diameter of 30 mm and wall thickness of 4 mm which is open at the sides. The groove of 1000 mm length has a diameter of 22 mm in this version.

The shaft can be extended up to 4 m using 1 m screw on pieces.

Advantages

- Favourably priced
- Tough
- Simple to use



Universal gouge auger - PÜRCKHAUER

Universal gauge augers particularly suitable for very hard and stony soils. A set with a gouge auger of the type PÜRCKHAUER with hammer and mechanical withdrawal system as well as accessories packaged in a strong carry case.



Bi-partite gouge augers

The bi-partite gouge auger set is a standard set for sampling in more or less soft soils to a depth of 5 metres. The set has a bayonet connection and contains gouge augers with various lengths and

diameters, an Edelman auger, extension accessories, push-/pull handle and a strong carrying bag for transport in the field.



Göttinger gouge auger

The Göttinger gouge augers have been developed for taking soil samples up to 90 cm depth, and are primarily designed for soil sample removal with N-min tests. The sampling is done by hand without the use of tools such as hammers or hooks.

The drill groove is manufactured from specially hardened steel adapted to the strong load, so that it is as thin as possible while still being robust and elastic.

The sophisticated milled profile of the drill groove and the system

of three drills matched in diameter minimizes the frictional force for pressing into and pulling out of the soil.

This permits sampling using less force compared to conventional sampling equipment.

The Göttinger gouge auger set consist of three drilling rods (0-30cm, 30-60cm and 60-90cm).



Gouge auger set for stepwise sampling

The set consists of three bi-partite gouge augers with different diameters. By first taking a sample with the gouge with the largest diameter and subsequently the gouges having smaller diameters, cross contamination among the samples is avoided. The gouge augers can be pushed into the soil or

hammered (with an impact absorbing hammer).

Because of the short operational length and the diminishing diameters, the set is very suitable for profile research (nitro research) in soils with a somewhat higher penetration resistance.



Lifter S-9000 / S-9002

The tough lifter makes it easier to lift hand operated drilling equipment with a cross borehole in the head. The tough and compact ap-

paratus uses a ball clamp made of steel. It weighs 5.5 kg or 8.1 kg and facilitates a lift load of up to 500 kg and 1000 kg respectively.

Technical data

• Lifter:	S-9000	S-9002
• Lift load [kg]:	500	1000
• Throughput [mm]:	-	22
• Total weight [kg]:	5.5	8.1



Root sampler

The root sampler has been specially designed for forest soils. The sampler itself consists of two half shells with a smooth cutting ring and a clamp flange which guarantees a tight connection of the two halves during drilling. To insert the sampler into the soil and to retrieve it easily, a head with cross borehole is screwed on for the insertion of a lever or lifter. During drilling the sampler as a full tube is particularly stable and the facility to open up one side of the tube provides easy access to the drilled core.

tube with a window permitting a view of the profile of the sampled core.

The standard version of the root sampler is made of rust free V2A steel, is 600 mm long and has a diameter of 80 mm. At customer request, the geometric dimensions can be altered and adapted to the specific uses.

Advantages

- Suitable for forest soils rich in roots
- Very tough
- Large sample core volume
- Large access to sample core

Set consisting of:

- 1 drill head made of two half shells
- 1 impact head with lever



Soil column cylinders

The soil column cylinder has been developed to take undisturbed soil samples. This allows for a fast insight in the structure of the soil profile, the rooting potential, etc. Applying this system it is possible to take undisturbed samples with a length of 100 cm and a diameter of 93 mm, without digging a profile pit.

less steel soil column cylinder, a hand auger, an extraction system and 10 sample gutters.

The standard set comprises a gasoline driven mechanical hammer (electrically on request), a stain-

Advantages

- Big sample length and diameter
- undisturbed soil column
- Large window for sub sampling or soil identification
- Mobile yet very powerfull



Moor probe (according to ILLNER)

The moor probe according to ILLNER has been designed for the taking of semi-homogenous samples during soil investigations in bog, soft sediments, peat land and also sampling in powdery and grainy substances. This sampler is used particularly in environmental research but also to investigate filter beds or palaeontological research and pollen analyses. It consists of an auger head made of stainless steel followed by a semi-cylindrical sampling vessel. The sampling vessel has a cutting edge and is concluded by an angular metal around the auger axis. The metal sheet protrudes a little on one side and similarly has a cutting edge so as to be able to take samples which have been mixed as little as possible.

The solid tip with centering pushes the soil away when the probe is inserted into it. Turning the probe causes the sample to be cut from the substrate whilst at the same time the metal sheet closes the sampling vessel. After a half turn around the auger axis (180°) the sample vessel is full.

The metal plate remains in this position due to its own resistance and therefore completely closes the sampling vessel. This can now be pulled from the soil and the sample withdrawn.

The length of the sampling vessel is 500 mm, producing a sample volume of approx 0.5 l with an inner diameter of 60 mm. The overall length of the moor probe is 1000 mm. Either a turn handle or extensions can be attached directly to this. Grips and extensions with spring connectors are provided for fast assembly/dismantling. The standard set contains 10 extension pieces each of 1 m in length.

On request, sets may also be compiled with the customised number of extensions.



Advantages

- To obtain samples from flowing, powdery and fine grained substrates

Set consisting of:

- 1 auger head for the moor probe
- 1 handle
- 10 extensions at 1 m each

Sediment core sampler, type Beeker

The Beeker sampler is designed for taking undisturbed samples from submerged soils. The samples are taken in a transparent tube. The original stratification of the sampled material is maintained. This enables a clear profile description to be made.

The Sediment core sampler, type Beeker consists of: one transparent tube of 1 or 1.5 metres, piston and piston rod and battery powered pressure and vacuum pumps with extension hose, furthermore hammer and extension rods, non-stretch cord, sample

bucket and brush.

The standard set is suitable for use in water up to a maximum depth of 5 metres. In some cases, deeper sampling is possible using additional extension rods.

Advantages

- Takes samples fast and certain
- Not necessary to assemble and disassemble apparatus with every new sample



Taking samples from sample ring samples

237000	Sample ring extraction device for higher-resolution soil tests
237500	Excavation device for soil samples with sample ring size

Soil sample ring

230150	Soil sample ring 100 cm ³	Ø 60 mm
230052	Soil sample ring 250 cm ³	Ø 72 mm
230056	Soil sample ring 1357 cm ³ V2A stainless steel	Ø 114 mm
230059	Soil sample ring 1357 cm ³ acrylic	Ø 120 mm
230065	Soil sample ring 21 cm ³	Ø 30 mm

Soil sample ring-removal-set

235000	Soil sample ring removal set Model A for soft soils	Ø 53 mm
235002	Soil sample ring removal set Model C for all soils	Ø 53 mm
235003	Soil sample ring removal set Model C for all soils	Ø 60 mm
235004	Soil sample ring removal set Model C for all soils	Ø 84 mm
235005	Soil sample ring removal set Model E for hard soils	Ø 53 mm

Hammering head for soil sample rings

230060	Hammering head for soil sample rings	Ø 60 mm
230061	Hammering head for soil sample rings	Ø 72 mm

Ergonomic auger set

230040	Ergonomic auger set with bayonet connection
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Soil sampler

235100	Soil sampler 100 cm ³
235200	Soil sampler 250 cm ³

Auger set for heterogenous soils

230038	with bayonet connection
230039	with conical screw thread connection

Groove auger

231100	for heavy soils
231200	for light soils

Universal gouge auger - PÜRCKHAUER

230042	Universal gouge auger - PÜRCKHAUER
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Bi-partite gouge augers

230043	with conical screw thread connection
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Göttinger gouge auger

232310	Set of Göttinger gouge augers, consisting of: 1 gouge auger for each of the three sampling depths (0-30cm), (30-60cm) and (60-90cm)
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Gouge auger set for stepwise sampling

230041	with conical screw thread connection
--------	--------------------------------------

Lifter

230029	S-9000
230030	S-9002

ORDERING DETAILS

Root sampler

234100 Root sampler bi-partite

234200 Root sampler one part

Soil column cylinder auger

235010 Soil column cylinder auger, type Stiboka

Moor probe (according to ILLNER)

230200 Moor probe (according to ILLNER)

Sediment core sampler, type Beeker

235006 Sediment core sampler, type Beeker

Related Products	Usable for
Lifter S-9000 For the easier lifting of samples from the soil	<ul style="list-style-type: none"> • Hand augers with cross bore-hole in the hammer head
Lifter S-9002 For the easier lifting of samples from the soil	<ul style="list-style-type: none"> • Hand augers with cross bore-hole in the hammer head and probe rods with a max. diameter of 22 mm
Screw-on hammer head Ø 40 mm with cross bore hole for steel lever	<ul style="list-style-type: none"> • Groove auger
Steel lever Ø 16 mm Chromed, with PVC handle	<ul style="list-style-type: none"> • Groove auger
Chromed extension pieces For auger shaft 1000 mm	<ul style="list-style-type: none"> • Groove auger
Polyamide hammer 4 kg	
Polyamide hammer 5 kg	
Simplex hammer 3 kg	
Simplex hammer 5 kg	
Simplex hammer 7 kg	

ORDERING DETAILS





TENSIOMETERS

The soil moisture tension is the foundation for every water movement and therefore for every water balance analysis. The gradient of the soil moisture tension determines both the direction and the speed of the water movement.

The soil moisture tension can be recorded using tensiometers by water in the tensiometer being connected with the pore system of the soil via a porous ceramic cup. The pressure relationships are transferred to the pressure sensor inside the tensiometer. Thereby it must be pointed out that the soil moisture tension is defined as a negative pressure. According to this underpressure in the pores implies a positive soil moisture tension. Impounding causes negative tension values. A large variety of versions permits the use of tensiometers for a broad range of tasks.



This applies from the ring soil sample in the laboratory through to field use and from short term measurements through to long term monitoring.

All tensiometers are supplied filled and ready to use.



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Tensio 100

Mobile field tensiometer

The Tensio 100 is the root of the UGT-tensiometer technology and has been continuously developed further over more than 25 years. It is a cost-efficient tensiometer type that is especially designed for the easy and fast mobile measurement of the suction in the field. The Tensio 100-set comprises a V2A-insertion auger for quick installation, as well as a protective tube for transport, in which the tensiometer is kept permanently moist for immediate use and is protected from mechanical damage. In the tensiometer head made of transparent acrylic glass air inclusions are easily recognizable. The pre-tensioning screw enables an easy refilling even in the field. Additionally this screw allows to preset a tension to reduce the measurement time to less than

3 seconds per measurement (from installation to reading).

The measurement corpus itself is made of a V2A-standpipe (Ø 10 mm), a Ms support, a ceramic cell (SKA 100FF, 10x24 mm) and a V2A tip. Depending on the type of Tensio 100 the suction pressure is displayed on a mechanical precision vacuum meter (Ø 63 mm) or via an electronic pressure transducer on a handheld or a laptop.



Advantages

- Can be easily and safely transported in the protective tube
- Always ready to use
- Robust design
- Fast and simple measurement
- Short reaction time (<3s)



Technical data

	Tensio 100	Tensio 100 RFID	Tensio 100 RFIDplus
Pressure measurement:	Precision vacuumeter	Electronic pressure transducer	Electronic pressure transducer
Measurement range			
Tension:	0 ... +85 kPa	0 ... +85 kPa	0 ... +85 kPa
Output unit:	bar	bar	bar
Accuracy:	0,01 bar	±0,0045 bar	±0,0045 bar
Resolution:	0,01 bar	0,001 bar	0,001 bar
Dataoutput:	Manual reading	Display and storage on handheld device	Display and storage on Laptop/PC
Interface:	-	RFID/Handheld device	RFID/USB
Data memory:	-	-	Approx. 2048 pressure and temperature data sets with time stamp
Power supply:	-	External via RFID handheld	Integrated battery
Degree of protection:	IP54	IP67	IP67

General / Standpipe

Response time:	< 3 s (according to RICHARDS)
Operating temperature:	0 ... 40 °C
Length:	30 cm / 60 cm / 90 cm / customised on request
Diameter (outer):	10 mm
Material:	V2A stainless steel

Ceramic

Length:	24 mm
Diameter:	10 mm
Air entry point:	> -85 kPa
Hydraulic conductivity:	8.1x10 ⁻⁸ m/s

Tensio 120

Septum tensiometer

The Septum tensiometer permits several tensiometers to be read out using only one instrument and therefore offers a favourably priced alternative to the comprehensive determination of soil moisture tension with many measurement points. The top side of the tensiometer is sealed with a silicone septum so that

the hand meter can be attached quickly and simply with a needle. The septum recloses automatically when the meter is removed. It can be replaced simply because it is screwed on using a GL18 thread or used as a silicon plug depending on design. The ceramic cup (P80; 20 x 50 mm) is mounted on a transparent acrylic tube

(\varnothing 20 mm) with level scale. It is therefore easy to read the level of the tensiometer.

Advantages

- Simple to handle
- Favourably priced because only one measurement instrument is required
- Variable lengths in accordance with the measurement point

Technical data

- | | |
|--------------------------------|-------------------------------------|
| • Tension range: | 0 ... +85 kPa |
| • Working temperature range: | 0 ... +50 °C |
| • Accuracy: | \pm 0.3 kPa |
| • Available standpipe lengths: | Freely selectable up to max. 200 cm |



Tensio 130

Laboratory tensiometer for ku-pF-Apparatus

The laboratory tensiometer with acrylic glass head and highly sensitive pressure transducer offers all the benefits of a compact tensiometer. The ceramic cup with 6.5 mm diameter and a length of 20 mm provides highly accurate measurements with a minimum destruction of the soil. An auger set for installation and minimization of disturbing effects may be

obtained from UGT as accessories. Air bubbles are easy to recognise and eliminate through the acrylic head with bleed screw. The tensiometers can be installed in any position. They are ideally suited to determine the soil moisture tension in test setups in laboratory scale. A laboratory interface is also supplied for direct connection to a PC.

Advantages

- Little destruction of the soil
- Can be used in very small samples / soil sample rings
- Short reaction time

Technical data

- | | |
|--------------------------------|---|
| • Tension range: | -100 ... +85 kPa |
| • Working temperature range: | 0 ... +40 °C |
| • Accuracy: | \pm 0.3 kPa |
| • Power supply: | 5 V constant / 1 mA constant |
| • Available standpipe lengths: | 3.7 cm
customised lengths on request |



Tensio 140

Laboratory tensiometer

The Tensio 140 with ceramic cup of 6.5 mm in diameter and a length of 20 mm provides highly accurate measurements with a minimum destruction of the soil. An auger set for installation and minimization of disturbing effects may be obtained from UGT as accessories. Air bubbles are easy to

recognize and eliminate through the acrylic head with vent screw. The tensiometers can be installed in any position. They are ideally suited to determine the soil moisture tension in experimental setups in the laboratory. The Tensio 140 is characterized by its long and robust shaft.

- Advantages**
- Little destruction of the soil
 - Can be used in very small samples / soil sample rings
 - Short reaction time



Technical data

- Tension Range -30 ... 100 kPa
- Operating Temperature 0 ... +40 °C
- Output Signal 0 ... 1 VDC
- Power Supply 9 ... 30 V DC < 3 mA
- Response Time < 1s

Tensio 141

Laboratory tensiometer

The laboratory tensiometer Tensio 141 with ceramic cup of 6.5 mm in diameter and a length of 20 mm provides highly accurate measurements with a minimum destruction of the soil. An auger set for installation and minimization of disturbing effects may be obtained from UGT as accessories. Air bubbles are easy to recognize and eliminate through the

acrylic head with vent screw. The tensiometers can be installed in any position. They are ideally suited to determine the soil moisture tension in experimental setups in the laboratory. The Tensio 141 is characterized by its sensor head, which is suitable for installation in soil column experiments.

- Advantages**
- Little destruction of the soil
 - Can be used in very small samples / soil sample rings
 - Short reaction time



Technical data

- Tension Range -30 ... 100 kPa
- Operating Temperature 0 ... +40 °C
- Output Signal 0 ... 1 VDC
- Power Supply 9 ... 30 V DC < 3 mA
- Response Time < 1s

Tensio 150

Pressure transducer tensiometer

The pressure transducer tensiometer offers an ideal combination of the simple handling of the mobile field tensiometer with electronic data acquisition. As for the Tensio 100 field tensiometers, the measurement system consists of a V2A standpipe (\varnothing 10 mm) and V2A insertion tool, an Ms support unit and a ceramic cell (SKA 100FF, 10x24 mm).

The soil moisture tension is measured using a highly sensitive pressure transducer in the light metal tensiometer head (IP65). A signal amplifier in the tensiometer head and sealed cable permit low interference transmission of data also over long distances. The standard length of the cable is 5 m.

Advantages

- Good long term stability
- Low maintenance operation
- Robust design

Technical data

• Tension range:	-20 ... +85 kPa
• Working temperature range:	0 ... +40 °C
• Accuracy:	\pm 0.3 kPa
• Available standpipe lengths:	30 cm / 60 cm / 90 cm
• Integrated SMD amplifier (signal output):	0 - 1 V DC
Possible on request:	0 - 5 V DC / 0 - 20 mA / 4 - 20 mA without signal amplifier



Tensio 152

Pressure transducer tensiometer (frost protected)

The Tensio 152 is especially developed for challenging applications. The used stainless steel membrane sensor is more durable and more resistant against aggressive media. The Tensio 152 is therefore particularly suitable for contaminated and extremely saline soils. When installed, the Tensio 152 is also frost protected because the pressure transducer is situated directly above the ceramic cup and the water tank is therefore exclusively at installation depth.

The plastic standpipe (PVC \varnothing = 25 mm) minimises temperature conduction from colder layers of soil. The Tensio 152 freezes with the ground when installed in soil layers near to the surface, but on thawing is immediately functional again and continues the measurement. This means that it can be used throughout the year and for long-term monitoring of the soil moisture tension. The ceramic cup and standpipe are connected to each other by a



transparent acrylic adapter which enables air bubbles to be easily detected. The integrated filling screw permits simple refilling of the tensiometer, which can be carried out by the customer himself.

Technical data

• Tension range:	-30 ... +100 kPa
• Working temperature range:	0 ... +50 °C
• Accuracy:	\pm 0.2 kPa
• Integrated SMD amplifier (signal output):	0 ... 1 V
• Available standpipe lengths:	Customised lengths on request
• Optional Integrated temperature sensor:	Pt 100, -30 ... +50 °C, 1/3 DIN

Advantages

- Resistant to aggressive media
- Frost-proof in installed state
- Measurement possible throughout the year
- Good long-term stability
- Low maintenance operation

Tensio 160

Lysimeter tensiometer

The Tensio 160 has been developed for the long term use in lysimeters and particularly designed for horizontal installation. The arrangement of the filling lines permits the filling and bleeding also in horizontal position so that the tensiometer need not be dismantled for this purpose. Combined with the corresponding optional control electronics the filling may be performed fully automatically in order to achieve a minimum of maintenance. The

pressure sensor with stainless steel diaphragm guarantees optimum function and long serviceable life. If required, the sensor may be replaced without dismantling the tensiometer.

Advantages

- Can be installed horizontally
- Can be filled in installed position
- Automatic filling possible



Tensio 160 with automatic filling

Technical data

• Tension range:	-20 ... +89 kPa
• Working temperature range:	-0 ... +40 °C
• Accuracy:	±0.3 kPa
• Available standpipe lengths:	30 cm (customised lengths on request to 100 cm)
• Integrated SMD amplifier (signal output):	0 - 1 V DC 4 - 20 mA

Watermark

Soil moisture sensor

The measurement principle of the Watermark sensors is similar to that of plaster blocks. However, the special sensor does not dissolve in the soil and has a more even distribution of pores so that more precise measurements are possible.

The sensors are permanently buried in the soil and have an average serviceable life of 3 to 5 years. They do not need any

service work during this time and are frost-proof. The Watermark sensors are available with temperature sensors whose values may be used for temperature compensation. This method of soil moisture tension measurement may be used as a substitute for tensiometers if it is to be expected that the tensiometer will frequently fall dry at the installation site. The sensors may be connected either to a data logger or to the speci-

fic hand instrument for recording and reading out the data.

Advantages

- No maintenance
- Winter-proof
- Good suitability for long term measurements
- Price efficient



Technical data

• Tension range:	0 ... 200 kPa
• Working temperature range:	1 ... +80 °C
• Ceramic body:	∅ 25 mm, length 70 mm
• Sensor lengths:	80 mm

Full Range Tensiometer

Polymer Tensiometer

The Full Range Tensiometer by UGT covers the complete range of water potentials relevant for plants, even up to 1500 kPa depending on the model. Unlike other systems with an according measurement range the Full Range Tensiometer doesn't determine the tension as an indirect measurement derived from another measured parameter but as a direct pressure measurement. Changes in tension are transmitted very fast. A range of 1000 kPa is passed through within some minutes. Even after complete drying and leaving the measurement range the measurement is automatically continued as soon as the soil moisture increases again. Refilling is not necessary. Another advantage compared with other instruments for the complete plant relevant tension range is the low energy consumption (20 mA in operational mode). Therefore the Full Range Tensiometer



is particularly suitable for remote measurement sites where regular maintenance and reliable supply of electricity cannot be ensured. The data transmission via RS485 allows communication even in environments with increased risk of electromagnetic interference and over greater distances.

The measurement is reliable also in difficult media. Saline sites, as may occur in aride climates, are no problem as a result of the direct pressure measurement. The temperature is recorded as an additional parameter.



Technical data

• Measurement range:	according to type
Tensiometer Full Range FRT 5D/5A	-100 ... +500 kPa (pF 3,7)
Tensiometer Full Range FRT 15D/15A	-100 ... +1500 kPa (pF 4,2)
• Operating temperature:	0 ... +40°C
• Temperature range:	-40 ... +60 °C
• Power supply:	5-20 V, 20 mA
• Interface:	RS485
• Dimension:	∅ 25 mm, Length 150 mm

Advantages

- Extended measurement range
- Fast response
- Maintenance free
- Low power consumption

Tensio 100**Mobile field tensiometer**

101100	Standpipe length 30 cm
101200	Standpipe length 60 cm
101300	Standpipe length 90 cm

Tensio 120**Septum tensiometer**

102100	Standpipe length max. 100 cm GL 18 with glass thread / silicone septum
102101	Standpipe length max. 100 cm with silicone plug
102200	Standpipe length max. 200 cm GL 18 with glass thread / silicone septum
102201	Standpipe length max. 200 cm with silicone plug

Tensio 130**Laboratory tensiometer for ku-pF-apparatur**

103100	Laboratory tensiometer
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Tensio 140**Laboratory tensiometer**

104000	with acrylic head, integrated pressure transducer and filling device, ceramic cup
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Tensio 141**Laboratory tensiometer**

104010	with acrylic head, integrated pressure transducer and filling device, ceramic cup
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Tensio 150**Pressure transducer tensiometer**

104100	Standpipe length 30 cm
104200	Standpipe length 60 cm
104300	Standpipe length 90 cm

Tensio 152**Pressure transducer tensiometer (frost protected)**

105700	Standpipe length 100 cm
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Customised lengths on request!	
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Tensio 160**Lysimeter tensiometer**

107100	Lysimeter tensiometer
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Customised lengths on request!	
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Full Range Tensiometer

108000	Tensiometer Full Range FRT 5D (digital) -100 ... +500 kPa (pF 3.7)
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108031	Tensiometer Full Range FRT 5A (analog) -100 ... +500 kPa (pF 3.7)
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108015	Tensiometer Full Range FRT 15D (digital) -100 ... +1500 kPa (pF 4.2)
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108032	Tensiometer Full Range FRT 15A (analog) -100 ... +1500 kPa (pF 4.2)
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Watermark**Soil moisture sensors**

112100	With temperature compensation	
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114501	Without temperature compensation	without rod
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114502	Without temperature compensation	rod length 75 cm
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114503	Without temperature compensation	rod length 120 cm
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ORDERING DETAILS

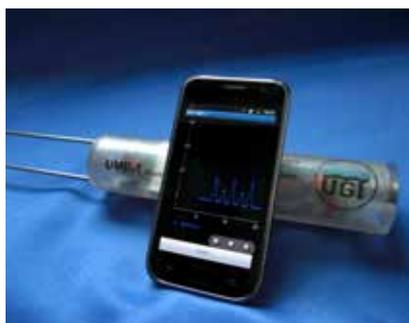
ORDERING DETAILS

Related Products	Usable for
Protective cap To protect the ceramic cup from drying out and mechanical damage.	<ul style="list-style-type: none"> • Tensio 100 • Tensio 150 • Tensio 160
Protective cap To protect the ceramic cup from drying out and mechanical damage.	<ul style="list-style-type: none"> • Tensio 120 • Tensio 152
Protective cap To protect the septum from environmental influences on the installed septum tensiometers; prevents the formation of algae	<ul style="list-style-type: none"> • Tensio 120
Rubber sleeve Prevents flow processes between tensiometer wall and soil	<ul style="list-style-type: none"> • Tensio 120 • Tensio 152
V2A insertion auger Non-destructive and simple installation of the tensiometers; optimum connection to the pore system of the soil	<ul style="list-style-type: none"> • Tensio 100 • Tensio 150 • Tensio 160
Insertion auger Non-destructive and simple installation of the tensiometers	<ul style="list-style-type: none"> • Tensio 120 • Tensio 152
Locking handle steel	
Auger set for laboratory tensiometers Non-destructive and simple installation of the tensiometers; optimum connection to the pore system of the soil	<ul style="list-style-type: none"> • Tensio 130 • Tensio 140 • Tensio 141
Extension for insertion auger Optimum installation of the tensiometers in greater depths	<ul style="list-style-type: none"> • V2A insertion auger • Insertion auger
Sledgehammer	
Lifter Simple and careful de-installation of the tensiometers	<ul style="list-style-type: none"> • All tensiometers

Related Products	Usable for
Ceramic cups P 80 Ø 20 mm, length 50 mm	<ul style="list-style-type: none"> • Tensio 120 • Tensio 152
Ceramic cups SKA 100 FF Ø 10 mm, length 24 mm	<ul style="list-style-type: none"> • Tensio 100 • Tensio 150 • Tensio 160
Ceramic cups P 80 Ø 6,5 mm, length 20 mm	<ul style="list-style-type: none"> • Tensio 130 • Tensio 140 • Tensio 141
Septum	<ul style="list-style-type: none"> • Tensio 120
Refill kit	<ul style="list-style-type: none"> • Tensio 130 • Tensio 140 • Tensio 141 • Tensio 152
Penetration hand meter	<ul style="list-style-type: none"> • Tensio 120

ORDERING DETAILS





SOIL MOISTURE METERS

Soil moisture is a determining factor for plant growth. It is therefore of great significance from the point of view both of agriculture and environmental protection. It influences chemical processes in the soil and therefore the formation of soil itself as well as the spread of pollution and contaminants.

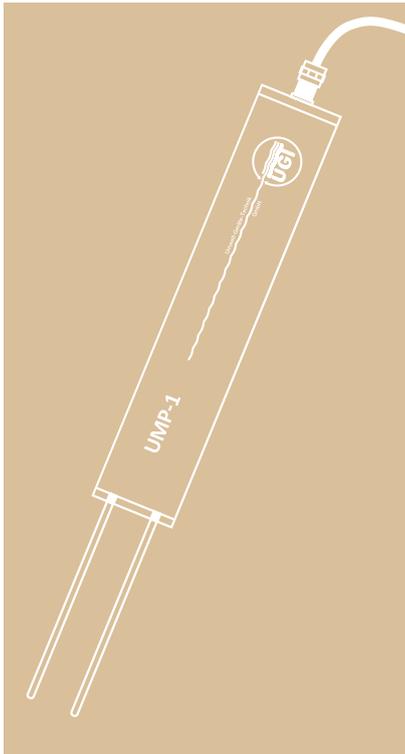
The measurement of soil moisture permits the determination of favourable and unfavourable plant locations, the recognition of changes in the ecological systems and statements to be made about important soil and water balance processes. The control of soil moisture, for example for agricultural irrigation, can be optimised and automated by way of permanently monitoring soil moisture.

The easy-to-install field meters determine the soil moisture indirectly via relating soil properties. From this relating properties subsequently the meter calculates the soil moisture. These sensors facilitate permanent monitoring and the electronic recording of measurement values by a logger.



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UMP-1 COMBINED SOIL MOISTURE, CONDUCTIVITY AND TEMPERATURE SENSOR

The UMP-1 series provides a range of combined sensors that offer high quality measurements with minimum effort.

Combining the three measurement variables of volumetric water content, electrical conductivity and temperature in a single sensor means that these combination sensors save money spent on acquisition and save time spent on installation and servicing. Disruption to the soil is also minimised because only one sensor needs to be inserted.

Various possibilities for data storage and transmission are available depending on the planned measuring arrangement.

The measurement principle of measuring the water content is closed to the FDR procedure, because the sensor operates with a continuous signal at constant frequency (60 MHz). The signal propagates into the medium and is partially reflected. Compared with the original the phase shifting of the reflected signal is considered. The size of the shift is a measure for the permittivity ϵ_r and the water content of the soil.

UMP-1

The standard version of the UMP-1 sensor is designed for connection to a data logger via cable.

Data are stored on the data logger, and are read out via an interface cable on a laptop or via data transmission.

This design is especially suitable for measurement stations with several sensors and long-term measurements such as soil hydrological measurement stations or lysimeters.



Technical data

- Measurement frequency for water content: 60 MHz (other frequencies on request)
- Antenna length: 100 mm (other lengths on request)
- Antenna diameter: 3 mm

Advantages

- Inexpensive
- Data loggers at hand can be used
- Data are stored in one data set with all other data from the same plot

UMP-1 BT

The UMP-1 BT sensor is the wireless version of the UMP-1 sensors and opens up the market to smartphone-based measurement technology. Measurement data are transmitted by Bluetooth directly to and stored on an Android smartphone. The necessary app can be downloaded from the Google Play Store and installed by the user on any Android smart-

phone. Up to 7 probes can be managed simultaneously using the app, and measurement data can be stored and visualised. During measurement, the data can be depicted as graph or as table of readings. Further it is possible to link the measurement data to the location of the measurement site if the smartphone features GPS.



Technical data

- Measurement frequency for water content: 60 MHz (other frequencies on request)
- Antenna length: 100 mm (other lengths on request)
- Antenna diameter: 3 mm

Advantages

- Smartphone instead of handheld device
- Mobile probe for fast and easy measurement

UMP-1 BTim

The UMP-1 BTim is the compact version of the UMP-1 BT sensor. It consists of a shaft with the integrated UMP-1 BT sensor, a height-adjustable handgrip, a smartphone holder and a spring guide for inserting the measuring rods. This device has all possible advantages to fast and easy carry out measuring campaigns with lots of single measurements, distributed over large areas. The rods are more stable with a bigger diameter compared to the standard version.

The rods are inserted into the soil

with pressure. They are protected by a spiral spring and a guide at the bottom of the shaft. The shaft together with the hand grip and the smartphone holder facilitate the handling, enabling many point measurements in a shorter time.

The UMP-1 BTim sensor has an integrated battery. It is switched on for each measurement and switched off again. The supply voltage is recorded additionally. Thus, it is possible to charge the battery in time preventing data loss.



Technical data

- Dimensions (H x B x \varnothing): 970 x 405 x 40 mm
- Measurement frequency for water content: 40 MHz
- Antenna length: 150 mm
- Antenna diameter: 5 mm

Advantages

- mobile sensor for campaigns with lots of point measurements
- integrated smartphone
- clear display of the measurement values in real time

UMP-1 BT Plus

The UMP-1 BT Plus is the advanced version of the UMP-1 BT sensor. Data are transmitted via Bluetooth to any windows-PC and can be visualized and managed with the application software. Additionally this sensor features an integrated data logger and can therefore be used autonomously. The PC or laptop is only needed to read

data and to start, stop and manage a measurement. They are therefore also suitable for longer-term deployments, especially as stand-alone sensors independent of complete measurement stations. Since the sensor can be completely buried the UMP-1 BT Plus is also very easy to protect from vandalism.



Technical data

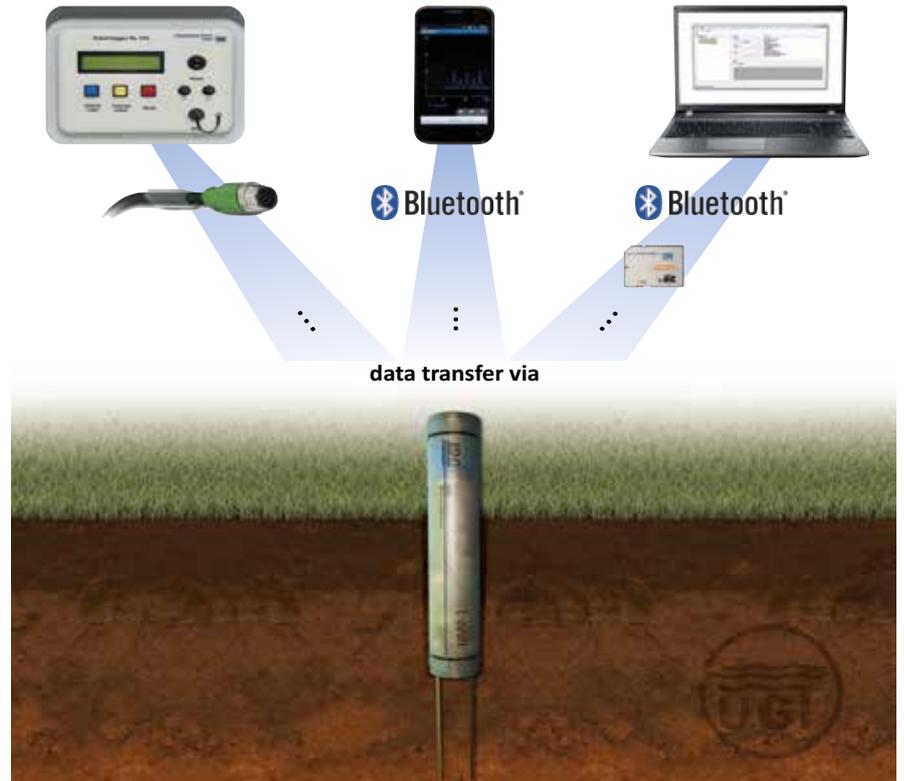
- measurement frequency for water content: 60 MHz (other frequencies on request)
- Antenna length / diameter: 100 mm / 3 mm

Advantages

- Internal data logger
- Small stand-alone system

UMP-1 / UMP-1 BT / UMP-1 BTim / UMP-1 BT Plus

The three models of the UMP-1 are sealed to make them waterproof, and can also be completely buried. An installation depth of 50 cm should not be exceeded for the two wireless types of sensor so as to guarantee data transmission via Bluetooth. The energy supply to the wired UMP-1 sensor is provided via the electricity supply cable on the data logger. Wireless sensors have an integrated storage battery whose charge lasts for 6 to 24 months depending on the measurement intervals and the frequency of reading out data. The sensor reads out the water content of the soil in % volumetric water content. However the ϵ_r value can be retrieved for independent water content calculations according to other models. The soil temperature in °C and electrical conductivity of the soil in mS/cm are also read out. The additional recording of battery voltage enables empty batteries to be recognised at an early stage and so prevents data losses.



Advantages

- High accuracy
- Independent conductivity measurements
- Wireless use possible
- Compatible with all Android smartphones

Technical data

- Water content measurement range: 0 ... 100 % Vol. water content
- Water content accuracy: ±2%
- Dielectric coefficient ϵ measurement range: 0 ... 80
- Electrical conductivity measurement range: 0,001 ... 5mS/cm (optional data extension to 40mS/cm possible)
- Electrical conductivity accuracy: ±1%
- Soil temperature measurement range: -20 ... +60°C
- Soil temperature accuracy: ±0.2°C
- Measurement volume: 1000 ml
- Working temperature range: -20 ... +60°C

SMT-100

Measuring the volumetric water content

The SMT-100 combines the advantages of the low cost FDR sensor systems with the accuracy of a TDR system. Like a TDR, it measures the travel time of a signal to determine the relative permittivity of the soil. And like a FDR, it converts this relative permittivity into an easy to measure frequency. But unlike an FDR it isn't based on a capacitor, but utilizes a ring oscillator to transform the signal's travel time into the measure frequency. The resulting frequency (>100 MHz) is high enough to operate well in clayey soils.

Compact, functional and robust: the PCB board based design allows for an economic design, and the blade shape facilitates installation. The casing and cable is water sealed. Different communication protocols are available, as well as analogue output. Output: volumetric water content and temperature.

The SMT-100 has a broad measurement range. It is maintenance free and frost resistant.



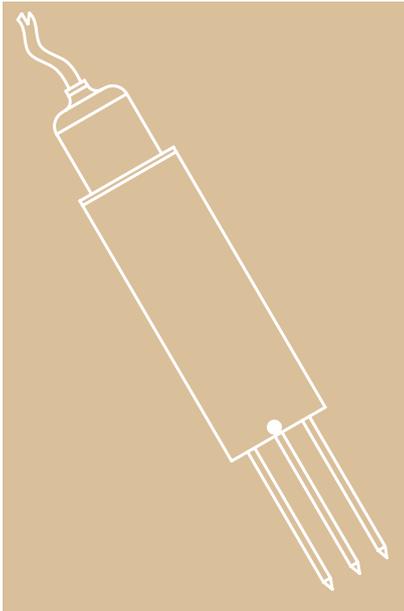
With short response times and low disturbance by salinity it is designed for a long term observation.

Advantages

- Frost resistant
- Reliable measurement
- Maintenance free
- Long lifetime
- Fast response
- Low influence of salinity and pH
- Cost efficient

**Technical data**

• Signal output	digital: RS485 with UGT-protocol, with SDI-12 protocol analog: \emptyset 2x 0 - 1 V (other voltage on request)
• Cable length	10 m
• Power supply	digital 4 - 24 (V DC), analog 12 - 24 (V DC)
• Dimensions	182 x 30 x 12 mm
Moisture	
• Measurement range	0-60 % (0-100 % with limited accuracy)
• Accuracy	± 3 %
• Accuracy after specific calibration	± 1 %
• Resolution	digital ± 0.1 %, analog ± 0.2 %
Temperature	
• Range	-40 ... +80 °C (analog -40 ... +60 °C, extended temperature range on request)
• Accuracy	± 0.2 °C (analog ± 0.8 °C)
• Resolution	0.01 °C (analog 0.2 °C)



FDR - FREQUENCY-DOMAIN-REFLECTOMETRY

As for the TDR measurement, the water content is indirectly determined via the relative permittivity ϵ_r in this method. Unlike the TDR method in which the term of the reflected signal is measured, in the FDR method the differences between the sent and reflected electromagnetic waves are determined and the water content of the soil calculated from this.

The resistance of the soil, in accordance with its relative permittivity, influences the reflection of the sent sinus waves causing a slightly altered wave compared to the initial signal. The relative permittivity is then calculated from the difference between the two waves at two points and then the water content calculated.

SM150T

Soil moisture sensor

The SM150T is a capacitive measuring device for the determination of soil moisture with an integrated temperature sensor. It has a low salinity sensitivity and low temperature response. Due to its design the soil disturbance is minimal.

Besides the generic calibration (mineral and organic soils) it can also be calibrated for specific soils improving the measurement accuracy. The sensor is powered by a logger, but can also be ob-

tained as portable kit comprising the SMT150, the HH150 Moisture Meter (displaying the volumetric water content in % volume) and a carry case.

Advantages

- Soil moisture and temperature
- Soil specific calibration
- Low salinity sensitivity
- Choice of cabling system options

Technical data

Volumetric Water Content

- Accuracy $\pm 3\%$ vol (over 0 ... 70 % vol and 0 ... 60 °C)
- Measuring range 0 ... 100 % vol (over 60 ... 100 % vol with reduced accuracy)
- Conductivity 100 ... 1000 mS/m (Inaccuracy: $\pm 5\%$ vol over 0 ... 60 % vol)
- Output signal 0 ... 1 V differential (≈ 0 ... 60 % vol)

Temperature

- Accuracy $\pm 0,5\text{ °C}$ (over 0 ... 40 °C)
- Output signal 5.8 ... 28 k Ω
- Operating range -20 ... +60 °C
- Sample volume 55 x 70 mm diameter
- Dimension 143 x 40 mm diameter
- Power supply 5 ... 14 V DC, 1.8 mA (for 0.5 ... 1 s)
- Cable length 5 ... 25 m (100 m maximum)



Moisture Meter HH150 displaying the volumetric water content in % volume (no temperature display possible).

Moisture Meter - HH2

The Moisture Meter is a versatile device for Delta-T moisture sensors ThetaProbe, SM150T and WET Sensor (no temperature display possible).

The HH2 offers high functionality in a compact handheld device which has been specially developed for field use. The measured values are listed directly on the LCD and may be saved for later use on the PC. The device can be operated with one hand for practical use in the field. For every measured value the measurement time and a unique sample

number, a measurement point number and a sensor identification number are stored.

The data is transmitted to the PC using the supplied RS-232 cable. The HH2 software for Windows PCs offers a Wizard for data import. The data can also be read out directly in Excel or other spreadsheet programs or in programs for irrigation control. Alternatively, the data can also be downloaded as ASCII data.



Advantages

- Compact practical design
- Saves up to 1500 data
- Time, as well as corresponding identification numbers are saved for all data

Theta Probe ML3

The ML3 Theta Probe is a capacitive measuring device for the determination of soil moisture with an integrated temperature sensor. Its sealed plastic body is attached to four sensing rods which insert directly into the soil for taking readings. A waterproof plug connects to a choice of signal cables. Both extension cables and extension tubes can be used. The sensor can be installed horizontally as well as vertical, at the surface and at depth.

The ML3 is powered by a data logger, which stores the measured values. Additionally, it can be used as mobile measuring device together with the HH2 Moisture Meter (obtainable as portable Theta Kit).

The ML3 is a stable working measurement instrument with a low salinity sensitivity and temperature response. With specific calibration it can be operated in soils with a salinity up to 2000 mS/m. Typical applications are irrigation control, hydrology, agriculture, forestry, monitoring of contamination and civil engineering.

Advantages

- High Accuracy
- Soil specific calibration
- low salinity sensitivity
- Choice of cabling system options



Technical data

Volumetric Water Content

- Accuracy ± 1 % vol with soil specific calibration (over 0 ... 50 % vol and 0 ... 40 °C)
- Measuring range 0 ... 100 % vol (over 50 ... 100 % vol with reduced accuracy)
- Conductivity 50 ... 500 mS/m (Inaccuracy: ± 3.5 % vol over 0 ... 50 % vol)
50 ... 2000 mS/m (with soil specific calibration)
- Output signal 0 ... 1 V differential (≈ 0 ... 60 % vol)

Temperature

- Accuracy $\pm 0,5$ °C (over 0 ... 40 °C)
- Output signal 5.8 ... 28 k Ω
- Operating range -20 ... +60 °C
- Sample volume 60 x 40 mm diameter
- Dimension 170.5 x 40 mm diameter
- Power supply 5 ... 14 V DC, 1.8 mA (for 0.5 ... 1 s)
- Cable length 5 ... 25 m (100 m maximum)

EnviroSCAN

Tubular probe

EnviroScan probes continuously record the water content in the soil profile. Depending on equipment with soil moisture or TriSCAN sensors, the salt and fertilizer content (quantity of dissolved ions in the soil water) can be measured in addition to soil moisture. The soil moisture is measured using FDR (Frequency Domain Reflectometry).

Usually, 16 sensors may be placed on a probe in flexible depth (at intervals of 10 cm). This system is suitable both for measurements near the surface (starting from 10 cm) and for depth measurement (> 40 m).

The use of different interfaces (e.g. RS232, RS485, SDI-12, Voltage, Modbus) means that the probes can be connected not only to Sentek systems such as Sentek PLUS and Sentek SOLO but also to a large number of other data loggers.

The data can be read out using GPRS via the Internet or in situ using the connection cable.

The sensors are located in the installation tube. This therefore avoids direct contact with the soil and means that the probes are easier to maintain if required. If installed correctly, the soil structure is not disturbed so that the actual water movement in the surrounding soil can be recorded.

Advantages

- Flexible positioning of the sensors
- Flexible options for a large number of data transmission possibilities
- Flexible time intervals for measurement adjustable
- Simple maintenance without removing the probe

Technical data

• Measurement range for water content:	0 ... 100% volumetric water content
• Measurement accuracy of water content:	±0.003 %
• Resolution:	0.008 %
• Working temperature range:	-30 ... +85 °C



EnviroScan probe equipped with TriSCAN salinity and soil water sensors



EnviroScan probe equipped with soil moisture sensors

Sentek Plus „All-in-one“

The Sentek Plus system transmits data from EnviroScan and EasyAG tubular probes wirelessly using mobile communications to an Internet server. The data are retrieved from the office and displayed in the software Irrimax.

The Sentek Plus „All in one“ System provides all the advantages of the established Sentek Plus system built into a compact head that can be attached to EnviroScan or EasyAG tubular probes. This way all components necessary for operation and data transfer are integrated into the housing - a Modem, a lithium battery with a minimum lifetime of 12 months under normal use and an antenna. Furthermore the system features a bluetooth interface for diagnosis and configuration. There is no need for solar panels, external Data loggers or modems and hence there are no cables that are prone to damages caused by game animals or agricultural machinery. Therefore the „All in one“ system is especially suitable for agricultural land still to be processed.

Advantages

- A complete, self-contained unit
- No cables
- No hindrance for field processing



Standard (undisturbed) installation



Slurry installation



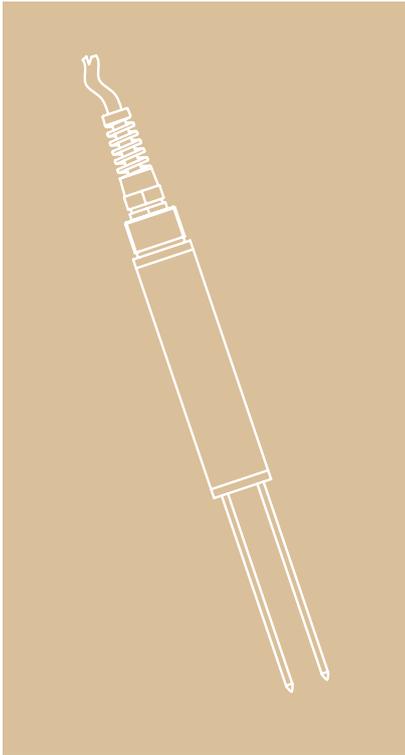
Diviner 2000

The Diviner 2000 is a mobile portable device for the exact determination of soil moisture. The system consists of a measurement probe and graphics display. Probes with a measurement depth of 0.7 m, 1 m and 1.6 m area available. The measurement is very simple and user friendly. The measurement probe is inserted into a

tube or pulled out again in one go, whereby the instrument measures and saves the depth-dependent moisture values (at intervals of 10 cm).

Up to 99 measurement points can be monitored with the Diviner 2000 which is primarily reflected in the costs per measurement point.





TDR - TIME DOMAIN REFLECTOMETRY

Soil moisture measurements using the TDR principle are based on the fact that the relative dielectric constant of water ($\epsilon_0 = 81$) is far greater than the other elements of the soil (min particle: $\epsilon_0 = 2-5$ and air $\epsilon_0 = 1$) and the moisture in the soil therefore decisively influences its dielectric constant. The TDR probe initially only measures the dielectric constant of the considered soil body.

The soil moisture is then determined from this. The measurement of the dielectric constant ϵ is based on a speed and runtime measurement of an electromagnetic wave in the soil body. Parallel rods of the same length are introduced to the soil through which highly frequent electromagnetic pulses are conducted. The dielectric constant is obtained from the term of the pulse within the rods and the length of the wave guide.

Easy Test FOM/mts

FOM/mts is a portable battery-driven and microprocessor-controlled TDR meter designed for the simultaneous in situ measurement of the volumetric water content, of the electrical conductivity and of the temperature in the soil. Using this instrument both continuous and periodical measurements can be made and

therefore also the distribution of the soil moisture, conductivity and temperature in different soil horizons recorded. The instrument is equipped with a keypad and a matrix graphics display for menu navigation and measured value display. As an option, the instrument can be equipped with a GPS module to record the geogra-

phical coordinates of the measurement points. Using a USB interface, the measurement data can be transferred to a PC.

Advantages

- High mobility
- Soil moisture, soil temperature and conductivity in one measurement

Technical data

• Measurement range for water content:	0.0 .. 100.0 % volumetric water content
• Measurement accuracy of water content:	< ± 2 %
• Conductivity range:	0.000 ... 100.000 mS/cm
• Measurement accuracy of conductivity:	<± 10 %
• Working temperature range:	-20 ... +50°C
• Weight:	0.35 kg with battery
• Measurement range for soil temperature:	-20.0 ... +50.0 °C
• Measurement accuracy of soil temperature:	< ±0.5 °C
• Measurement volume:	85 ml



TRIME-PICO

TRIME-PICO64 - sensor with integrated TDR electronics

The intelligent TRIME rod probe PICO64 offers ultra-modern electronics using the moisture measurement method specially for field use. The integration of probe and TDR analysis electronics in one sensor is unique. A temperature sensor has been additionally integrated. This probe guarantees an exact measurement even at high temperatures and conductivities. The large measurement volume of some 1250 ml guarantees good representativity also for hetero-

geneous soils. The robust housing and the Bluetooth gateway make it a good choice for field use.

Advantages

- Large measurement volume
- Good suitability for heterogeneous, stony soils
- Precise measurement also at high temperatures / conductivities



TRIME-PICO32 - sensor with integrated TDR electronics

The intelligent TRIME rod probe PICO32 is ideally suited for in situ monitoring systems to record the moisture in soils and in other porous materials. The integration of probe and TDR analysis electronics in one sensor is unique. Compared to other measurement methods, an exact measurement even at high temperatures and conductivities is guaranteed with the TRIME-PICO32. An integrated temperature sensor provides additional valuable information. With the small housing of 32 mm

in diameter, the TRIME-PICO32 can be installed without problem in relatively homogeneous soils and with its 11 cm rod length provides best possible representativity. In view of its mechanical toughness, the TRIME-PICO32 may be used in a mobile environment with the Bluetooth module PICO-BT.

Advantages

- Small and tough design, ideal for mobile use



Thanks to a protective housing in accordance with IP68, both sensors are suitable for long term use.

Technical data	TRIME-PICO64			TRIME-PICO32		
• Measurement range for water content:	0 ... 100 % volumetric water content			0 ... 100 % volumetric water content		
• Measurement range for conductivity:	0 ... 6 mS/cm for probes P2/P3			0 ... 6 mS/cm for probes P2/P3		
• Resolution [vol% water content] for conductivity range [dS/m]:	0 ... 6	6 ... 12	12 ... 50	0 ... 6	6 ... 12	12 ... 50
Water content 0 ... 40%	±1 %	±2 %	with soil specific calibration possible	±1 %	±2 %	with soil specific calibration possible
Water content 40 ... 70%	±2 %	±3 %		±2 %	±3 %	
• Measurement range for soil temperature:	-40 ... +70 °C			-40 ... +70 °C		
• Measurement accuracy of soil temperature:	±0.2 °C			±0.2 °C		
• Working temperature range:	-15 °C ... 50 °C (extended temperature range on request)			-15 °C ... 50 °C (extended temperature range on request)		
• Measuring volume:	1250 ml			250 ml		

Trime-T3

Tubular probe

Using the Trime-T3 tubular probe, it is possible to record moisture profiles up to a depth of 3 m in combination with the probe head Trime-T3/IPH54 with integrated TDR electronics even up to a depth of 50 m. Profile measurements are possible in increments of 18 cm (T3) or 11 cm (T3C), whereby the measurement volume of the T3C is smaller than that of the T3. The Trime-T3 is therefore particularly suitable for heterogeneous soils whilst the T3C is designed for homogeneous and saline soils. The

moisture measurement is made in accordance with the TDR principle. The measurements are conducted in plastic tubes from particularly tough and impact-resistant TECANAT plastic. The tubes are inserted into the soil before the measurement and remain there during the measurement series. Probes with Trime-T3/IPH54 can be inserted without plastic tubes directly into the borehole and sealed completely with sealing mass, thereby guaranteeing the long term operation of the probe

for years even under harsh ambient conditions. The data may be read out directly by the Trime-HD or a data logger.

Advantages

- Recording of moisture profiles
- Maintenance without influencing the measurement point



Technical data

	Trime - T3	Trime - T3C
• Measurement range for water content:	0 ... 60 % volumetric water content	0 ... 70 % volumetric water content
• Measurement accuracy water content:	2% at 0 ... 40 % 3% at 40 ... 60 %	2% at 0 ... 40 % 3% at 40 ... 70 %
• Measurement volume:	3.0 l	3.0 l

Soil Salinity Sensor

The salinity sensor that measures subsurface pore water salinity content in place.

If you need to monitor the progression of salt build up in soil profiles, or need to see the effects of „leaching“ sequences, the 5000L Series can do that at specific points in the profile. Only the 5000L sensors give discrete point evaluations of in-situ total dissolved salt contents in the pore waters. Fabricated from proprietary 15 bar porous ceramics the pore water is measured through the full range of plant growth. The sensor remains „saturated“ with ambient pore waters from saturated 0 to 1500kPa matric suction. Constructed of durable acrylic housing and made for years of subsurface use the spring loaded head provides

assurances that the sensor is in contact with the soil when deployed. It comes in various lengths, and is used with the 5500 Salinity Bridge. The 5500 Salinity Bridge is covered by an aluminum case, with precision readout dials and associated potentiometers assure accurate salinity readings either in ohms or in mmho values. The data are reads out directly in mmho/cm corrected to 25° C (77 F) using 1KHz AC signal. Provides measurement of conductivity in the range of 2-40 mmho/cm. 3 Ohm scale ranges available 0-1 K, 0-1 OK and 0-100K. It is battery powered by 4ea. 9V batteries that will take 1000's of readings.



UMP-1

118000	UMP-1 standard version
118100	UMP-1 BT wireless version
118300	UMP-1 BTim wireless version handle including
118400	UMP-1 BT Plus advanced version

SMT-100

118600	SMT-100 (analog 0 - 1 V)
118601	SMT-100 (analog 0 - 10 V)
118610	SMT-100 (digital)

SM150T**Soil moisture sensor**

113520	SM150T
113525	SM150T Kit (Moisture Meter HH150 including)

Moisture Meter-HH2

113510	Handheld device to read out data for Theta Probe ML3 and SM150T
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Theta Probe ML3

115000	FDR soil moisture measurement system with plug
115001	FDR soil moisture measurement system without plug

EnviroSCAN**Tubular probe**

112060	EnviroSCAN Tubular probe Profile moisture measurement with salt / fertilizer content
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Sentek Plus „All-in-one“

112068	Sentek Plus „All-in-one“ System
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Diviner 2000

112070	Diviner 2000
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ORDERING DETAILS

Easy-Test FOM/mts

112200	Easy Test FOM TDR soil moisture measurement system alternatively with temperature and / or conductivity / salinity
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112202	Easy Test FOM with GPS
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TRIME-PICO

TRIME-PICO64

111810	Trime Pico 64 TDR soil moisture measurement system
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TRIME-PICO32

111820	Trime Pico 32 TDR soil moisture measurement system
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Trime-T3

Tubular probe

111201	Trime-T3 tubular probe TDR profile moisture measurement
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Soil Salinity Sensor

112600	The salinity sensor that measures subsurface pore water salinity content in place
--------	--

Related Products	Usable for
Insertion tool	<ul style="list-style-type: none"> • PICO64 / PICO32 • UMP-1 / UMP-1 BT / UMP-1 BT Plus
Replacement antennas	<ul style="list-style-type: none"> • PICO64 / PICO32 • UMP-1 / UMP-1 BT / UMP-1 BTim / UMP-1 BT Plus
App for Android smartphones	<ul style="list-style-type: none"> • UMP-1 BT / UMP-1 BTim
Charger	<ul style="list-style-type: none"> • UMP-1 BT / UMP-1 BTim / UMP-1 BT Plus
(Optional) Outdoor-capable Android smartphone	<ul style="list-style-type: none"> • UMP-1 BT / UMP-1 BTim
(Optional) Universal grip	<ul style="list-style-type: none"> • UMP-1 BT / UMP-1 BT Plus

ORDERING DETAILS



Umwelt-Geräte-Technik GmbH
made in Germany

Umwelt-Geräte-Technik GmbH 75374 Möckmühlweg www.ugt-technik.de	UGT	75374 Möckmühlweg 75374 Möckmühlweg www.ugt-technik.de
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SUCTION PROBE TECHNOLOGY

The constituents and composition of soil water and soil air provide important information for the analysis of substance transportation and substance spread in soils and permit insights into internal processes through to "... soil life (=Edaphone)...".

Suction probes offer the possibility to obtain samples of the soil water or of the soil air for subsequent analysis.

The suction probe itself is installed in the soil. The vacuum created by a vacuum pump draws the water or the air into sampling vessels.



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Suction probes with ceramic cup

With this suction probe the percolate is drawn from the soil to a ceramic cup (P80; 20 x 50 mm). The acrylic glass standpipe (Ø 20 mm) simultaneously serves as a collection compartment. No additional sampling vessels are therefore necessary but may be connected as required. The storage of the sample in the standpipe means that it is extensively kept at soil temperature. Transport and vacuum line are kept separately and can be individually sealed by drain taps at the hose connections. The structure of this suction probe permits a completely autonomous operation and prevents the percolate being drawn back into the soil in dry phases. Both the tubes themselves and the tube connections are made of inert PE to prevent falsification of the samples.

The suction probes with ceramic cup are also offered as an underground version. Instead of the standpipe, this design has a tube to the soil surface which is connected to a separate sampling vessel.

For the taking of larger samples the ceramic cup with integrated 100 ml collection vessel is recommended.

This suction probe can also be equipped with a glass cup instead of a ceramic cup for the detection of organic substances such as pesticides or DOC without absorption losses.

Advantages

- Can be operated autonomously
- Percolate cannot flow back
- Sample is stored at soil temperature



Technical data

• Bubble point:	0.89 bars	
• Collection volume:	Depending on standpipe length / sampling vessel	
• Dimensions of the sampling body:	Ceramic cup	Suction cup with 100 ml collection vessel
	Ø: 20 mm Length: 50 mm	Ø: 60 mm Length: 100 mm
• Working temperature range:	Frost proof in installed state	

In installed state, the suction probes are frost proof and can therefore remain in the soil throughout the year.

Suction probes with plastic cup

The suction probes with cups made of open-grained, hydrophile polyethylene structure and polyamid diaphragm (pore size 0.45 μm) have been specially developed for the detection of heavy metals in the soil water. These are absorbed at the ceramic surfaces leading to a falsification of the heavy metal concentration in the sample. PE and polyamid do not absorb heavy metals so that the heavy metal concentration in the soil is transferred into the sampling vessel cleanly. The higher permeability of the plastic cups compared to the ceramics also permits larger sample quantities to be taken in a shorter period.

The acrylic glass standpipe (\varnothing 25 mm) serves as collector. This means that the suction probe can be used completely autonomously and the soil solution is stored at the natural ambient conditions.

A separate sampling vessel can be connected without problem. By separating the feed and vacuum line, the percolate cannot be drawn back by the soil moisture tension. The suction cups are also available without standpipe for underground installation.

The PE tube is then laid underground from the suction cup to the site of sampling so as to guarantee the storage of the sample at ambient conditions which are as natural as possible.



Advantages

- Heavy metal concentration not influenced
- Can be operated autonomously
- Percolate cannot flow back
- Sample stored at soil temperature

Technical data

- | | |
|------------------------------------|---|
| • Bubble point: | ≥ 1 bars |
| • Collection volume: | Depending on standpipe length / sampling vessel |
| • Dimensions of the sampling body: | Suction cup
\varnothing : 32 resp. 20 mm
Length: 90 resp. 80 mm |
| • Working temperature range: | Frost proof in installed state |

Porous Ceramics

The ceramic products offered in this section are the most popular which have been sold for decades to customers. The unique characteristics and quality of these porous ceramics allow them to be used in a variety of applications. The natural wetting abilities of a porous ceramic, the uniform pore sizing, and inert raw materials provide an excellent finished product for research or industrial applications. A combination of these attractive features with the strength and durability capabilities of a variety of ceramic shapes leads to a limitless number of excellent possibilities.



Customised dimensions available on request!

Suction plate nylon diaphragm

Suction plates offer the advantage over suction cups of obtaining the soil solution over a larger area. The area from which the percolate is obtained is defined exactly and the sample does not originate from only a single point measurement. The plates are installed laterally from an excavation point and therefore draw the soil solution from the undisturbed soil area above.

The surface of the suction plate consists of a nylon film with a pore size of 0.45 µm. This is supported by a layer of hydrophile PE sinter beneath. The housing of the suction plate is made by standard of inert PP but can also be supplied in stainless steel.

Advantages

- Drawing of the soil solution over a larger area
- Soil solution from undisturbed soil



For lysimeters, lysimeter bases can, on request, be equipped with up to 7 suction plates depending on size.

Technical data

- Bubble point: > 1 bar
- Collection volume: Depending on sampling vessel
- Dimensions of the sampling body: Ø: 250 mm
Effective area: 490 cm²
- Working temperature range: Frost proof

Hand diaphragm pump with manometer

Easy to transport, one hand operation and independent of any power supply, the hand pump is ideal for use in the field and at the same time offers a favourably priced alternative to electronic pumps.

For applications under tough conditions we offer a robust hand pump made of aluminium which can be used both to create a vacuum and overpressure.

The lighter version made of PVC only works in the vacuum range but offers a distinctly greater

lift and therefore saves work and time.

The respective pressure is shown on the integrated manometer. The connections are designed for tubes with an inner diameter of 6 mm. It is maintenance free, self-lubricating and essentially corrosion resistant.

Advantages

- Maintenance free
- Independent of mains supply
- Favourably priced



PVC



Aluminium

Technical data

- | | | |
|-------------|-----------|-----------|
| • Material: | PVC | Aluminium |
| • Lift: | 32 ml | 16 ml |
| • Vacuum: | 850 mbars | 850 mbars |
| • Pressure: | 2 bars | 2 bars |

Mobile vacuum & feed pump MVF-120

With the lightweight and yet tough plastic housing with carry handle on the top side this pump unit has been specially designed for mobile deployment in the field. The housing is dust and jet water tight (class of protection IP65).

The pump head of the diaphragm pump is made of Hostalen and the diaphragm of Neoprene. A vacuum regulator permits the stepless

regulation of the pump.

As required the pump can be used for suction or pressing purposes depending on choice of appropriate hose connection.

The power supply for an autonomous operation in the field is provided by a position-independent storage battery with deep discharge protection. The charged status is shown on 3 LEDs.

Advantages

- Easy to transport
- Tough
- Independent of mains supply



Technical data

• Suction power:	9.0 l/min
• Vacuum:	850 mbars
• Regulator:	-0.1 ... -0.9 bars
• Voltage supply:	12 V DC / 6.5 Ah storage battery
• Operation duration:	approx 8 h (normal operation)
• Charging socket:	13.8 V DC, 600 mA
• Degree of protection:	IP65
• Own weight:	5.0 kg

Automatic vacuum pump unit AVP-100

A constant pressure test volume pressure can be guaranteed by the automatic readjustment facility of the automatic vacuum pump AVP-100. The diaphragm pump with Neoprene diaphragm and pump head made of Hostalen is activated as soon as the freely selectable set point value is not reached. On reaching the set point value, the pump switches

off again. It is installed in a dust and jet water tight ABS plastic housing (class of protection IP65). The pump can therefore be used indoors and outdoors and is very well protected from environmental influences.



Advantages

- Fully automatic
- Long term stability

Technical data

• Suction power:	0.4 l/min
• Vacuum:	650 mbars
• Voltage supply:	12 V DC
• Vacuum display:	LCD 9 mm
• Degree of protection:	IP65

Vacuum unit 19"

The 19" vacuum unit enables liquids to be extracted through the generation of a time controlled vacuum and for this liquid to be collected in a collection flask.

A drain tap is positioned on the collection flask for the samples to be drawn off.

The 19" unit has up to 5 independently programmable and controllable vacuum circuits.

As required the number of control circuits can be randomly extended by additional housing units. Every control circuit has its own

time control, its own analog manometer for vacuum display, a controller for the manual adjustment of the vacuum and its own collection flask. A time interval can be entered on the control unit during which the corresponding collection flask is evacuated to the selected pressure value. Depending on the application, the time control can be realised via a week timer, an annual timer or a count-down timer.

The pump with PTFE diaphragm permits an unfalsified transporta-

tion of the liquid to be extracted. The media is not contaminated thanks to oil free operation. The metal housing is tough and impact resistant but is not suitable for permanent outdoor use.

Advantages

- Automatic, time controlled sampling
- Up to five separate control circuits

Technical data

• Suction power:	1.8 l/min
• Vacuum:	750 mbars
• Voltage supply:	90-264 VAC / 50-60Hz
• Vacuum display:	Analog manometer
• Degree of protection:	IP 30



Time controlled suction probe systems SSA-101 / SSA-102

These pump systems with integrated timer automatically regulate the pressures in the suction probes in accordance with the preset time cycles. In agreement with the planned application, the suction probe system may be supplied with a week timer for free programming of seven day cycles, or with an annual timer for annual control cycles.

Thanks to the dust and jet water tight housing as well as the pow-

er supply via a position independent storage battery, these pump systems are also ideally suited for outdoor use. They may be attached to a wall or mast.

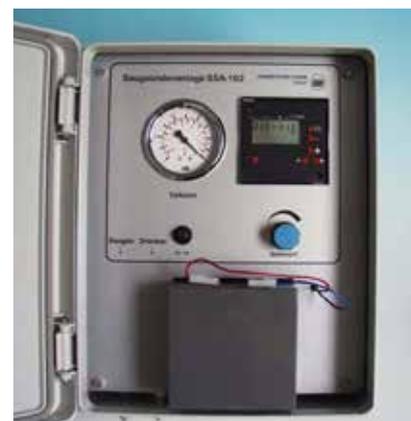
The diaphragm pump with Neoprene diaphragm and pump head of Hostalin is durable and maintenance free.

Advantages

- Automatic, time controlled triggering of the suction probes

Technical data

• Suction power:	0.4 l/min
• Vacuum:	600 mbars
• Voltage supply:	12 V DC / 10 Ah Storage battery
• Operation duration:	at least 14 d
• Degree of protection:	IP65
• Reserve power timer:	9 h
• Accuracy of the timer:	1 s/d



Time controlled suction probe system SSA-121

This suction probe system is suitable for conveying air and gases as well as for pumping liquids over vacuum and is specially designed for long-term constant pressure conditions.

Unlike other suction probe systems or pumps, the SSA-121 has a pressure reservoir with a volume of 10 l or 20 l, depending on the model. This ensures long-term stable pressure conditions in the system regardless of the ambient conditions and minimizes pressure surges during pumping.

For the safe and practical use under field conditions, the housing is dust-and jet water-proof (IP 65) and the device is equipped with a 12 V DC power supply to be independent from mains current. The stable pedestal ensures a safe stand even during operation.

Advantages

- long-term stable pressure conditions
- Minimization of pressure surges

Technical data

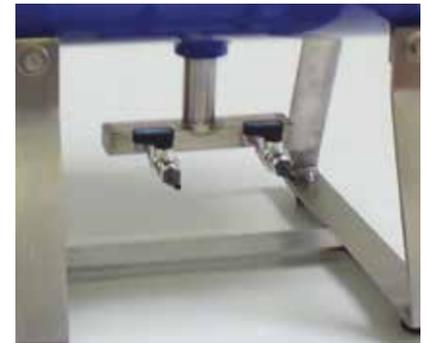
- Suction power: 9 l/min
- Vacuum: 900 mbars
- Electronic vacuum control: -0.1 ... -0.9 bar
- Power supply: 12V DC exchangeable rechargeable battery
- Degree of protection: IP 54
- Pressure reservoir: 10 l / max. 10 bar
20 l / max. 10 bar

The diaphragm gas pump with Hostalen pump head and elastic membrane is characterized by a high pneumatic performance, high gas tightness and low flow losses. Due to the closed membrane surface and the special sealing system as well as the new valve system it has a long life time (about 20,000 Operating hours) and is almost maintenance free. If necessary, diaphragms and valve plates can easily be replaced without special tools.

Due to oil-free operation unaltered transport without contamination of the media is possible.

Of the three hose connections with separate cut-off cocks two are available for suction and one is available for pressure. The desired pressure can be set via the vacuum control.

The integrated weekly time switch enables the automated control in weekly cycles.



Tension controlled suction probe systems

The control of suction probes in accordance with the tension in the surrounding soil permits soil solution to be drawn from various soil moisture areas with adjusted pressure. The respective vacuum results from the prevailing tension amplified by a freely selectable amplification factor and / or a freely selectable offset. Up to four stages can be controlled separa-

tely from each other on a micro-computer basis. Every stage contains its own vacuum circuit with its own pump. Both the pressure control and the data storage is realised by the integrated logger. The standard device with a tensiometer per stage as set point generator can be extended by additional logger modules to up to 15 set point generators. For operation

independent of the mains supply, the power supply can be provided via solar panels or replaceable storage batteries.

Advantages

- Sampling pressure adjusted to the existing soil moisture tension



Technical data

- | | |
|-------------------------|---|
| • Suction power: | 0.4 l/min per level |
| • Vacuum: | 600 mbars |
| • Voltage supply: | 12V DC replaceable storage battery, solar power or storage battery supported mains supply |
| • Degree of protection: | IP 65 |

Bottle magazine and storage container for suction probe systems

The bottle magazines for suction probe systems facilitate easy handling and safe storage of several sampling vessels, even underfloor. The soil solution is filled separately into a Duranglas bottle for each suction cup or suction cup level.

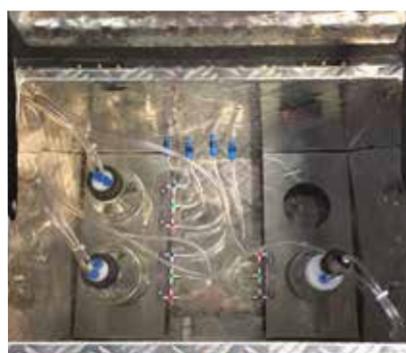
Plastic container

The container protects the sample glasses against flooding, moisture and other external influences and destruction (e.g. animals). All bottles can be switched optionally via a valved manifold. To protect the suction system from soil solution it is possible to install water stop valves. The plastic container can be installed underneath and can hold up to 6 bottles of 500 ml.



Aluminium box

This box has a load capacity of up to 8 Duran glasses with a content of 1000 ml. It protects all sample glasses against destruction and moisture and can be installed below ground. The insulation ensures a moderate temperature while stored. Via the valved manifold the underpressure is evenly distributed. Water stop valves



Advantages

- safe storage of the sample glasses
- tempered storage due to the insulation of the aluminium box
- one large collection volume together for all vessels -> operation of all suction probes via one central system

may be installed as an additional protection of the suction system.



Suction probe with ceramic cup

121100	Standpipe length up to 50 cm
121200	Standpipe length up to 100 cm
121300	Standpipe length up to 150 cm
121400	Standpipe length up to 200 cm
121420	Standpipe length up to 300 cm

for underground installation

122100	Tube lengths up to 100 cm
122200	Standpipe length up to 200 cm
122300	Standpipe length up to 300 cm
125400	Ceramic suction cup with integrated 100 ml collection vessel

Suction probe with plastic sintered cup

123100	Standpipe length up to 100 cm
123200	Standpipe length up to 200 cm
123300	Standpipe length up to 300 cm

for underground installation

124100	Tube length up to 100 cm
124200	Standpipe length up to 200 cm
124300	Standpipe length up to 300 cm

Suction plate nylon diaphragm

120000	Suction plate nylon diaphragm V2A
120010	Suction plate nylon diaphragm PP

Manual diaphragm pump with manometer

241002	PVC 32 ml lift
241009	Aluminium 16 ml lift

Mobile vacuum and conveyer pump MVF-120

124000	Mobile vacuum and feed pump MVF-120
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Automatic vacuum pump unit

125000	AVP-100	0 - 650 mbars
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Vacuum unit 19"

126120	Vacuum unit 19"
--------	-----------------

Time controlled suction probe system

126004	with weekly timer	SSA-101
--------	-------------------	---------

126002	with weekly timer	SSA-121
--------	-------------------	---------

126100	with annual timer	SSA-102
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Tension controlled suction probe system

126200	on microcomputer base	one phase; SSA-201
--------	-----------------------	--------------------

126300	on microcomputer base	two phases; SSA-202
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126400	on microcomputer base	three phases; SSA-203
--------	-----------------------	-----------------------

126500	on microcomputer base	four phases ; SSA-204
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Bottle magazine for suction probe system

127100	with water stop valve
--------	-----------------------

127200	with electronic valve control
--------	-------------------------------

Related Products	Usable for
Insertion tool Gentle and simple installation of the suction probes, optimum connection to pore system of the soil	<ul style="list-style-type: none"> Suction probes with ceramic cup
Installation assistance Selective placement of the suction probes for underground installation for optimum connection to the pore system of the soil	<ul style="list-style-type: none"> Suction probes with ceramic cup for underground installation

ORDERING DETAILS





SOIL RESPIRATION AND SOIL GASES

The exchange of soil air between the soil, vegetation, and the atmosphere is an important subject in many ecological research questions. With respect to climate forecasts, greenhouse gases are important parameters for models and assessments.

The gas exchange between the soil and the atmosphere results from numerous complex and non-linear relationships, such as physiological, biochemical, chemical, ecological and meteorological conditions.

It is possible to sample soil-borne gases by means of accumulation in closed hoods, flows through open hoods or the use of special soil gas lances.

The analysis of soil gases is carried out using gas analyzers.



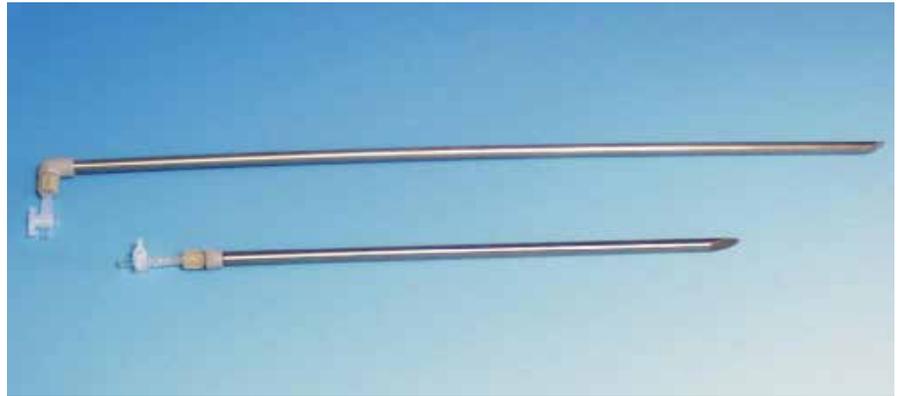
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Soil air sampler

The soil air sampler offers a simple to use and favourably priced option to obtain soil air samples. The sampler tube made of V2A stainless steel may be easily inserted into the soil due to the diagonal tip.

A stainless steel filter prevents the tube becoming blocked. The tube connection with tap at the upper end of the sampler is made of inert PE and facilitates simple sampling.



Advantages

- Favourably priced
- Fast and simple measurements

Technical data

- | | |
|---|---|
| • Material: | V2A stainless steel and PE |
| • Available lengths: | Standard: up to 3 m
special lengths on request |
| • Mesh width of the stainless steel filter: | 0.2 mm |

Substrate sampler

The substrate sampler has been developed for in-depth field measurement of air permeability and pore gas composition in the loose substrate in particular in loose piles. With the assistance of this measurement instrument, statements on the air-filled pore volume and its content of oxygen, carbon dioxide and methane may be made at increments of 0.1 m in a depth of 4 m. As a result of the combined measurement of air permeability and soil gas composition, up to 5 minutes per individual measurement is saved compared to sole gas measurement.

The sampler consists of four connectable 1 m pipe pieces so as to obtain a sampler length which is always adapted to the local conditions.

The entire measurement instrument can be dismantled and is optional packed read for transport in a tough aluminium case with the dimensions 1100 x 507 x 260 mm.

The sampler may be inserted manually and also by hammer. The air contact surface to the substrate is around 200 cm² and is sealed by a cone over the measurement area against the permeation of outside air.

The vacuum to obtain the pore gas is generated by vessels filled with water whose average height difference is set to 0.3 m. The vacuum generating unit is secured on a 4-foot stand which can be equipped optionally with ground pins to increase stability on a loose base. The gas composition is determined directly in situ using a connected digital gas meter.

Advantages

- Time saving of up to 5 minutes per measurement compared to traditional individual measurements
- Sampling from defined air compartment due to self sealing of the sampler tip
- Optional practical and safe transportation in aluminium case



SOM - soil oxygen meter

The soil oxygen meter (SOM) is used to measure root respiration and detects the oxygen content of the soil in %. An auger drill is used to prepare a hole in the soil into which the sensor is placed.

The oxygen meters are generally placed at vertical intervals of 20 to 50 cm to establish a vertical profile of the oxygen content of the soil.

Technical data

- Measurement principle: Galvanic battery + porous membrane sheet
- Dimensions: Diameter 35 mm, length 65 mm (cable connector length 50 mm)
- Output signal: 45 ... 65 mV at 20.9 % O₂
- Weight: 220 grammes (incl. 3 m cable)
- Cable length: 3 m
- Temperature influence: At relative humidity 100 % and O₂ 20.9 %
Sensor output: 20.8 % at 5 °C, 19.4 % at 40 °C
At relative humidity 0 % and O₂ 20.9 %
Sensor output not influenced by temperature
- Temperature range: 0 ... 40 °C in operation

Advantages

- Simple set-up
- Automatic temperature compensation
- No influence of rain/water
- Simple calibration by user
- No zero point calibration required

eosFDCO₂Standalone Soil CO₂ Flux Sensor

The eosFD is a revolutionary device that uses patented Forced Diffusion technology to measure soil CO₂ flux directly. Featuring built-in data logging and

impressively low power consumption, its standalone design delivers spatial freedom at any scale.

Technical data

- Dimensions (∅ x L): 10.2 x 25 cm / 4 x 9.8 in
- Mass (approx): 1600 g / 3.5 lb
- Operating temperature: -20 to 50 C / -4 to 122 F
- Operating power: - avg < 1.6 W
- Operating voltage: 12 V DC
- Outputs (analog): 0 - 5 V DC
- Data capacity (# meas.): 65,000
- Flux range: 0 to 20 μmol/m²/s
- Flux resolution: < 0.2 μmol/m²/s



Advantages

- Zero spatial Constraints
- Truly portable
- High temporal resolution
- Weather proof

eosGPCO₂

Waterproof CO₂ Sensor for Continuous In-Situ Monitoring

The eosGP gas probe offers continuous in-situ monitoring of CO₂ concentrations. Its robust design is ideal for harsh deploy-

ments—buried in soil, submerged in a stream or lake, or covered in snow.

Low power requirements, out-of-the-box submersibility, small size, and compatibility with standard



dataloggers make the eosGP an easy addition to your field kit.

Technical data

• Dimensions (∅ x L)	5.1 x 10.7 cm / 2 x 4.2 in
• Operating temperature	-20 to 50 C / -4 to 122 F
• Operating power	- avg / peak < 0.5 / < 1 W
• Operating voltage	5 to 24 V DC
• Time to equilibrium	< 90 s (in air)
• Mass (approx)	200 g / 0.44 lb
• Output voltage	0 to 5 V DC
• Concentration accuracy	1% range + 1% reading
• Calibration ranges (ppm)	0-5,000, 0-20,000, custom

Advantages

- Accurate
- Durable
- Compatible
- Waterproof
- Compact

Picarro G2201-i CRDS Analyzer

δ¹³C for methane (CH₄) and carbon dioxide (CO₂)

Isotope analyzer for determining sources of carbon dioxide. Soils as sources and sinks in the carbon dioxide and methane cycle represent an important variable when examining the global climate balance. The various components of the soil/atmosphere system contribute to the situation in a complex manner. Isotope studies are an indispensable tool for an accurate knowledge of the conversion processes.

The examination is made considerably simpler by the G2201-i. It is ready to use in minutes, and is small and robust for simple use in the field. The device can be operated for months without interaction on the part of the user.

The concentrations of CO₂, H₂O and CH₄ are recorded accurately, thereby compensating for the mutual interactions of the various species. There is consequently no need for gas drying.

Various systems are available for collecting samples, enabling diverse measurements:

- Dissolved inorganic carbon (DIC)
- Dissolved organic carbon (DOC)
- Carbonates
- Solids
- Small volumes of gas
- Highly concentrated gas samples
- Closed chambers



Further analysis systems available on request:

- **G2131** (δ¹³C in CO₂, ¹²CO₂ + ¹³CO₂)
- **G2132** (δ¹³C in CH₄, ¹²CH₄ + ¹³CH₄)
- **G2201-i** (δ¹³C in CO₂ and CH₄, ¹²CO₂ + ¹³CO₂ + ¹²CH₄ + ¹³CH₄)
- **G5101-i** (δ¹⁵N in N₂O, ¹⁴N¹⁴NO + ¹⁴N¹⁵NO + ¹⁵N¹⁴NO)

Gas measurement hoods

For measuring gas flows in the field

Gas flows can be recorded in various ways. Gas measurement hoods which either create a controlled gradient (open systems) or which interrupt the exchange for a set time (dynamic, closed systems) or prevent it completely (fixed, closed systems) have become established as the reference method.

Open systems permit the exchange across the top edge and provide a measurement path beneath it that can be used to determine flow rates according to the gradient. The top opening ensures that the plants are affected as little as possible, and that the temperature and gas composition do not differ significantly from that of the environment.

Closed systems can either deter-



mine the accumulation or decrease of gas fractions as a fixed installation for a specific period of time, or by means of mobile installation can conduct temporary measurements to precisely determine variable flows over time.

UGT offers a wide range of customised solutions, adapted to the vegetation and the subject of the examination. Contact us about your specific project. Accurate and customised solutions are available, especially in combination with the Picarro Gas Analyzers (as open path or closed path application).

Advantages

- Flexible and perfectly adapted solution for every project
- Measurement under field conditions
- Open systems: Little influence on vegetation, mobile
- Closed systems: clearly defined measurement, high degree of accuracy
- Can be combined with existing measuring equipment



eosAC

Weatherproof, Dependable Autochamber for GHG Analyzers

The eosAC is a robust autochamber for measuring multispecies soil gas flux with Los Gatos Research (LGR) and Picarro gas ana-

lyzers. Up to twelve chambers can be connected to the analyzer via the eosMX or eosMX-P multiplexers. The eosAnalyze software enables processing of gas flux data on any Windows-based computer.



Technical data

• Chamber volume	1969 cm ³ / 120 in ³
• Chamber surface area	182 cm ² / 28 in ²
• Operating voltage	12 V DC
• Operating power - in motion	< 8 W
• Operating power - idle	< 1 W
• Mass (approx)	5 kg / 11 lb
• Reach (analyzer to chamber)	30 m / 100 ft (Picarro) 15 m / 50 ft (LGR)
• Auxiliary sensor ports	3
• Post-processing & visualization software	eosAnalyze-AC

Advantages

- Long term, continuous measurement
- LGR & PICARRO compatible
- Flux analysis software
- Compact
- Robust construction

Picarro G2508 CRDS Analyzer

For the precise measurement of the concentration of nitrous oxide (N₂O), methane (CH₄), carbon dioxide (CO₂), ammoniac (NH₃) and water (H₂O).

Measurement of all gases using cavity ring-down spectroscopy, which permits excellent quantification of the rates of increase.

Robust platform tested in the field measures flows in situ, no transportation to the lab is necessary (which simplifies the design of the experiment and eliminates additional sources of error).

Measurement accuracy with measurement period of 5 minutes:

- N₂O: < 5 ppb
- CH₄: < 5 ppb
- CO₂: < 200 ppb
- NH₃: < 1 ppb
- H₂O: < 100 ppm



G2508 with soil chamber

Advantages

- Measurement at remote sites with minimum maintenance and calibration
- Ideal for atmospheric measurements on all scales, from global networks to regional and local flows up to in-flight measurements



Analyzer and suitcase stacked

Further analysis systems available on request:

- **G2301** (CO₂ + CH₄ + H₂O)
- **G2401** (CO₂ + CH₄ + CO + H₂O)
- **G2401-m** (CO₂ + CH₄ + CO + H₂O in-flight)
- **G2508** (N₂O + CO₂ + CH₄ + NH₃ + H₂O)

Soil air sampler

128000	Standpipe length up to 1 m
128100	Standpipe length up to 2 m
128200	Standpipe length up to 3 m

Substrate sampler

128800	Substrate sampler
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SOM soil oxygen meter

115008	Soil oxygen meter
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eosFDCO₂

115080	Standalone Soil CO ₂ Flux Sensor
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eosGPCO₂

115081	Waterproof CO ₂ Sensor for Continuous In-Situ Monitoring
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Picarro G2201-*i* CRDS Analyzer

196284	$\delta^{13}\text{C}$ for methane (CH ₄) and carbondioxide (CO ₂)
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Gas measurement hoods

128900	Gasmeasurement hoods (customized)
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eosAC

128910	Weatherproof, Dependable Autochamber for GHG Analyzers
--------	--

Picarro G2508 CRDS Analyzer

196290	For the precise measurement of the concentration of nitrous oxide (N ₂ O), methane (CH ₄), carbon dioxide (CO ₂), ammoniac (NH ₃) and water (H ₂ O)
--------	---

Related Products	Nutzbar für
eosMX - 12-Kanal eosAC Probenkammer Multiplexer	<ul style="list-style-type: none"> • eosAC • LGR und Picarro Analysatoren
eosMX-P - 12-Kanal eosAC Probenkammer Multiplexer (kompakte Feldvariante)	<ul style="list-style-type: none"> • eosAC • LGR und Picarro Analysatoren

ORDERING DETAILS





PENETROMETER

The penetrometer measurement is a simple and yet very sensitive method of determining the penetration resistance in the soil. This value is of great importance both for agriculture and for the assessment of building ground.

The soil compaction, for example in the driving tracks of agricultural equipment, but also the success of processing technologies can be assessed. For construction projects the penetration resistance is a sign of stability and the load bearing capacity of the soil.



Type of soil, density, soil moisture, humus content and coarse soil content are factors influencing the penetration resistance. In view of this bandwidth of influencing parameters and the simple handling, penetrometers are very well suited to make statements about the homogeneity of soil areas.



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Mobile field penetrometer

This electronic penetrometer was specially developed on behalf of the Humboldt University in Berlin to determine penetration resistance with high spatial resolution for large test areas in a short time and with minimum physical effort. The penetrometer structure, in terms of the electronic penetrometer with rods and pressure sensor, is mounted on a sampling vehicle. The conducting of the penetrometer measurement is automatically controlled by a track system. To prevent springing movements by the shock absorbers, the vehicle is lifted out with hydraulics and two supports for the duration of the measurement. The corresponding software runs on a connected laptop; in addition to controlling the test, it is also used to record data, for data processing and to display graphics. The visualisation can be used on site as basis for further measurements.

Installation on a sampling vehicle makes it possible to change locations quickly. The penetrometer is activated at the desired measurement station by the controller and automatically inserted in the ground.

The resistance created is registered by a pressure sensor and saved on the connected laptop. The automated penetration using the track system ensures the same penetration conditions at all times. The penetration resistance is dependent on the penetration speed. This remains constant throughout the entire test run when using the mobile field penetrometer. The crucial penetration angle of 90° for measurement is also always maintained consistently by this system. Compared to manual measurement, this produces greater accuracy and improved repeatability of measurements.

What is more, the physical force and size of the person conducting the test are no longer decisive for the quality of data obtained or the measuring conditions required. The stability of the penetrometer rod alone limits the application range of the penetrometer. Dry and hard soils where physical force alone is insufficient to insert the penetrometer in the soil can thus also be sampled. To protect the measuring device from damage, e.g. from stones or hard layers of soil, a maximum pressure can be set as stop criterion during



sampling. The probe rods and probe cones can be replaced easily if measurement conditions change or the control template indicates excessive cone wear for the cone test.

Uses

The mobile field penetrometer can be used in the agricultural and civil engineering area:

- General soil examinations
- Examination into the suitability of the soil for agricultural and civil engineering purposes
- Recognition of compacted (possibly impermeable) layers of soil/horizons
- Examination of artificial compaction

Advantages

- High repeatability
- High mobility
- Minimised expenditure of time and physical strength

Manual penetrometer

The penetrometer basically consists of a measuring instrument, a probe rod and a probe cone. The instrument is pressed at a right angle into the soil by exercising pressure on both handles. Uneven pressing does not produce representative measured values which are exaggerated for specific soils. The resistance measured by the probe cone can be read off on the black pointer of the manometer. The maximum resistance recorded during the measurement is shown by the red pointer.

The penetration resistance of the soil (kPa/cm^2) can be determined by dividing the displayed value by the surface area of the probe cone. The value to be expected for the penetration resistance determines the surface of the probe cone to be used. For higher values, a smaller cone is used.

General principle: the larger the probe cone, the more precisely the penetration resistance may be determined.



Uses

In view of its depth of use, the instrument may be used for the following tasks:

- general soil investigation
- simple foundation appraisal
- examination of the artificial compaction of the soil
- examination of the growth conditions for plants to be expected
- determination of compacted horizons

Penetrometers are used to determine the penetration resistance (load bearing capacity) of the soil. The Eijkelkamp penetrometer can be supplied in two different sets:

- Set for a depth of up to one metre
- Set for a depth of 3 metres

Technical data

- Measurement depth (depending on set): Up to 100 cm
Up to 300 cm
- Measurement range: 10000 kN/m^2
- Accuracy: $\pm 8\%$



Penetrologger

The penetration resistance shows the load bearing capacity of the soil and is a measurement of how easily roots may penetrate it. This is particularly important in agriculture and for rural and urban civil engineering projects. The penetration resistance is a mechanical parameter which depends on changing parameters such as the degree of moisture, the density and the strength of connection between mineral particles. The penetration resistance is measured in many measurement

steps using an electronic penetrometer in combination with a data logger, whereby the data will be stored directly and analysed in the data logger.

For this purpose the Eijkelkamp Penetrologger has been developed:

An electronic penetrometer with integrated data logger to store and process a large number of measurement data (1500 measurements).



Penetrologger, standard set for measurement in a depth of up to 80 cm

The Penetrologger is a flexible instrument for measurements of the penetration resistance in the field.

Uses

The Penetrologger can be used in the area of agriculture and civil engineering:

- general soil examinations
- foundation appraisal
- examination into whether the soil is suitable for agricultural purposes
- examination of the growth conditions for plants
- recognition of compacted (possibly impermeable) soil layers / horizons
- examination of core growth conditions, for example, of trees in the city or in parks
- examination of artificial compaction

Technical Data

- Measurement depth: up to 80 cm
- Measurement range: 0 ... 10 MPa
- Resolution: 0.1 kPa
- Measurement interval: 1 cm

Mobile field penetrometer

131000	Mobile field penetrometer
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Manual penetrometer

130001	Up to a depth of 1 m
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130002	Up to a depth of 3 m
--------	----------------------

Penetrologger

130000	Penetrologger Eijkelkamp with GPS
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Related Products	Usable for
Probe cone 1 cm² surface, cone end 60 Gr.	<ul style="list-style-type: none"> • Manual penetrometer • Penetrologger • Mobile field penetrometer
Probe cone 2 cm² surface, cone end 60 Gr.	<ul style="list-style-type: none"> • Manual penetrometer • Penetrologger • Mobile field penetrometer
Probe cone 3 1/3 cm² surface, cone end 60 Gr.	<ul style="list-style-type: none"> • Manual penetrometer • Penetrologger • Mobile field penetrometer
Probe cone 5 cm² surface, cone end 60 Gr.	<ul style="list-style-type: none"> • Manual penetrometer • Penetrologger • Mobile field penetrometer
Probe cone 1 cm² surface, cone end 30 Gr.	<ul style="list-style-type: none"> • Manual penetrometer • Mobile field penetrometer
Probe cone 2 cm² surface, cone end 30 Gr.	<ul style="list-style-type: none"> • Manual penetrometer • Mobile field penetrometer
Probe cone 3 1/3 cm² surface, cone end 30 Gr.	<ul style="list-style-type: none"> • Manual penetrometer • Mobile field penetrometer
Probe cone 5 cm² surface, cone end 30 Gr.	<ul style="list-style-type: none"> • Manual penetrometer • Mobile field penetrometer
Probe cone 7,5 cm² surface, cone end 30 Gr.	<ul style="list-style-type: none"> • Manual penetrometer • Mobile field penetrometer
Probe cone 10 cm² surface, cone end 30 Gr.	<ul style="list-style-type: none"> • Manual penetrometer • Mobile field penetrometer
Probe rod Ø 8 mm (for cone 1 cm²)	<ul style="list-style-type: none"> • Manual penetrometer • Mobile field penetrometer
Probe rod Ø 10 mm (for cone 2 cm²)	<ul style="list-style-type: none"> • Manual penetrometer • Mobile field penetrometer
Probe rod Ø 15 mm (for cone 3 1/3 cm² up to 10 cm²)	<ul style="list-style-type: none"> • Manual penetrometer • Mobile field penetrometer
Control template for probe cones	<ul style="list-style-type: none"> • Manual penetrometer • Mobile field penetrometer • Penetrologger

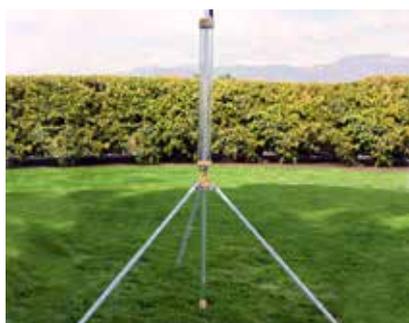
ORDERING DETAILS





FIELD INSTRUMENTS

Direct field measurements are necessary in order to characterize a specific location, taking into account real boundary conditions and heterogeneity such as those of the soil. Key parameters in soil and soil hydrology include the (field) saturated hydraulic conductivity or the infiltration rate. The determination of the pneumatic conductivity is important for the description of the gas transport in soils. This may also be used for deriving the hydraulic conductivity.

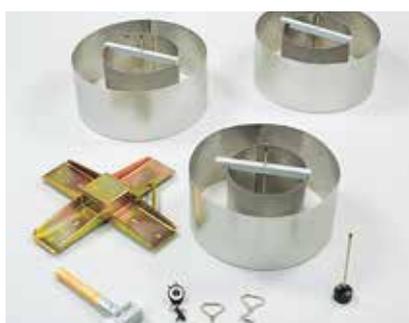


With innovative measurement techniques, it is now also possible to determine chemical parameters such as, the carbonate content, the electrical conductivity, and the pH-value simply under real boundary conditions, which were previously determined only in laboratory tests.



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Hood infiltrometer / IL-2700

The hood infiltrometer is used to measure the hydraulic conductivity of soils in virtually saturated areas as field tests. The infiltration is made from a sealed hood placed on the soil and filled with water. The circular soil surface covered by water beneath the hood forms the source area for the infiltration flux. No additional contact layer and no preparation of the soil surface is necessary on the measurement area. This not only saves working time but also makes it possible to measure the infiltration and conductivity under completely natural conditions in a destruction-free manner.

The pressure beneath the hood is controlled using a Mariott's water supply. The effective increase in pressure on the soil surface can be freely selected between zero and a vacuum up to the bubble point of the soil. This pressure level is shown exactly on a U-tube manometer.

The hydraulic conductivity is calculated from the stationary flux rates determined in the test run according to WOODING (1968). With the IL-2700 the measurement data for the flux rate is electronically recorded with a pressure sensor combined with a handheld instrument IL-2700. With the corresponding software they are transferred to the PC and analysed.

The hood infiltrometer is also available without electronic data recording as a favourably priced alternative which is tough enough to withstand adverse measurement conditions.

In order to guarantee an optimum adjustment of the experiment to the prevailing infiltration conditions, two hoods are available with a ratio to infiltration areas of around 1:2. The tension chamber, which is an available option, creates a tension infiltrometer together with the Mariott's water supply which permits infiltration experiments up to a water tension of around 60 hPa irrespective of the bubble point of the soil.

For maximum protection and simple handling during transportation and storage, the complete system is packed in an aluminium framed case with carry grip and foam inlays.

Advantages

- No contact layer necessary
- Simple adjustment to different conductivity areas
- Simple conversion to produce the tension infiltrometer



Set without electronic data acquisition consisting of:

- 1 Infiltration vessel with scale for manual level recording
- 1 U-tube manometer with field tripod
- 2 infiltration hoods
- 1 restriction ring for sand compaction
- 1 funnel
- 1 pipette ball
- 1 transport case
- Optional: tension chamber

Set with electronic data acquisition consisting of:

- 1 Infiltration vessel with pressure sensor for electronic level recording
- 1 handheld instrument IL-2700
- 1 U-tube manometer with field tripod
- 2 infiltration hoods
- 1 restriction ring for sand compaction
- 1 funnel
- 1 pipette ball
- 1 read out software IL-2700
- 1 transport case

Technical data

• Tension area:	0 ... bubble point with hood 0 ... 60 hPa with tension chamber
• Tension measurement:	U-tube manometer Resolution 0.1 hPa
• Infiltration measurement:	Differential pressure sensor 0 - 70 mba Resolution 1 mm water column
• Conductivity range of the soil:	10 ⁻³ m/s bis 10 ⁻⁷ m/s

GUELPH PERMEAMETER KIT

The Guelph Permeameter is an easy to use instrument to quickly and accurately measure in-situ hydraulic conductivity. Accurate evaluation of soil hydraulic conductivity, soil sorptivity, and matrix flux potential can be made in all types of soils. The equipment can be transported, assembled, and operated easily by one person. Measurements can be made in 1/2 to 2 hours, depending on soil type, and requires only about 2.5 liters of water. Measurements can be made in the range of 15 to 75 cm below the soil surface. The Guelph Permeameter is a complete kit consisting of the permeameter, field tripod, well auger, well preparation and cleanup tools, collapsible water container, and vacuum test hand pump, all packaged in a durable carrying case. Accessory attachments are available for ex-

tending the measurement capability of the permeameter. Depth attachments increase the depth of operation by 80 cm. The maximum practical operating depth is 315 cm. Ring attachments allow ring infiltrometer measurements from 10 cm and 20 cm diameter rings.

A tension adapter allows measurements to be made under tensional and very low head conditions.

Ring and tension infiltrometers are also available as stand-alone units, rather than attachments to a Guelph Permeameter unit. The stand-alone units come as kits which include carrying cases and all items necessary to make measurements.



Technical data

- | | |
|--------------------|--|
| • Operating Range: | 10^{-2} cm/s to 10^{-6} cm/s |
| • Operating Depth: | 15 - 38 cm (standard) or
15 - 610 cm (extended) |
| • Volume: | 3.5 liter |
| • Water container: | 11 liter |
| • Dimensions: | 132.1 x 44.4 x 15.2 cm |
| • Weight: | 19.9 kg |

Advantages

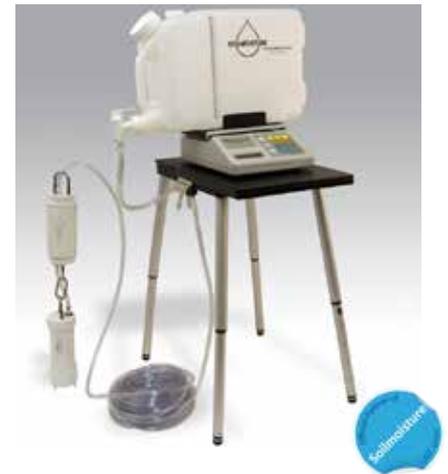
- Field measurements can be done by one person
- Quick installation and removal of the measuring installation
- Measurements can be done on nearly all soils
- Measurement up to a depth of 315 cm possible
- Low water consumption

Aardvark Permeameter

Knowing soil hydraulic characteristics is essential for many agronomic applications such as irrigation scheduling and application rates, watershed and runoff predictions, and drainage system capacities.

The Aardvark Permeameter is the very first battery-operated automated Constant Head Borehole Permeameter. The Aardvark sets up in minutes and automatically

records reading for water consumption rate. In minutes it will automatically determine Steady State, calculate Steady State Water Consumption Rate and then give you the Saturated Hydraulic Conductivity (K value). The permeameter is available for use with a laptop/tablet and for use with a (flash) logger.



Technical data

- | | |
|----------------------------------|----------------------------|
| • Reading Accuracy: | 0.2 ml |
| • Max Nominal Measurement Depth: | 15 m |
| • Measurement Range (Ksat): | 10^{-4} to 10^{-9} m/s |
| • Min. Head Height: | 10 cm |

Advantages

- automatic measurements and calculations
- stand-alone operation
- vast range of operation
- accurate

Double ring infiltrometer

The measurement of water infiltration in the soil is an important indicator of the efficiency of irrigation and drainage, optimisation of water availability for plants, improvement in the harvest yield and erosion reduction.

The double ring infiltrometer is a simple instrument used to determine the infiltration rate of water into the soil. The infiltration rate is determined as the quantity of water which penetrates the soil per surface area and time unit. This rate can be calculated using the measurement results and the law of DARCY. The standard set of the double ring infiltrometer consists of a few sets of stainless steel rings with different diameters (for transport reasons). Several measurements may be conducted simultaneously which leads to an extremely reliable and precise average result. If vertically infiltrated water flows off naturally, the outer ring serves as separation protection. The measurements take place exclusively in the inside ring through which

the water flows virtually vertically. In order to achieve good measurement results, it is important to consider the different factors influencing the measurements: the surface vegetation, the degree of soil compactness, the soil moisture content and the soil properties such as horizontalisation (strata). The best results are achieved with the "field capacity" of the soil. The ring infiltrometer may be used for the following purposes amongst others: irrigation and drainage projects, run-off investigations, determination of the intensity of precipitation and of the effects of soil working measures.

Advantages

- Favourably priced
- Simple to use



Set consisting of:

- 6 Infiltration rings, for 3 parallel measurements
- 1 impact plate to drive the rings into the soil
- 3 measurement bridges
- 4 floaters
- 2 hooks
- 1 digital stopwatch
- 1 hammer with nylon head (dead blow)

PL-300

The PL-300 is a field measurement instrument to determine the pneumatic conductivity of soils. This value describes the water-free pore space of the soil and is a function of water content.

A defined air flow is generated using a measurement chamber in the soil volume investigated. The rate of flow is determined from the drop in pressure through a calibrated two stage measurement throttle in the PL instrument. The pressure difference above the soil volume is recorded by a further pressure sensor and supplies the pressure gradient of this flow.



PL measurement chamber



PL surface chamber



PL soil sample ring adapter

The pneumatic conductivity is calculated from these test parameters using the DARCY equation and shown in the instrument display.

The PL-300 also has connections for an electronic soil tensiometer and a moisture probe so that soil moisture tension and/or soil moisture may be recorded parallel to each other. For this purpose UGT provides a specially adjusted Tensio 150 tensiometer and a TDR moisture probe each with the suitable plug. The data of all connected sensors as well as the calibration data of the measurement chambers and a marking of the measurement point are saved and managed by a microcomputer within the instrument. Its compact and tough design

make the PL-300 a practical and portable field measurement instrument.

In accordance with the requirements of the location, different measurement chambers are available:

- PL-300 measurement chamber for homogenous flow according to DARCY with integrated pressure probe
- PL-300 surface measurement chamber for inhomogeneous flow in undisturbed soil volume
- PL-300 soil sample ring adapter for the measurement of soil sample rings
- PL-300 sampler probe for the measurement in deeper soil horizons

Technical data

• Measurement range for pneumatic conductivity:	0.03 ... 30 cm/s
• Measurement pressure:	1 ... 3 hPa
• Settling time:	approx 2 s
• Diameter of the measurement chamber:	72 mm

FOG// Plus Digital Soil Calcimeter™ with UMP-1

The FOG// Calcimeter provides the measurement of carbonate content. It has a rugged design and is easy to use so that it is suitable for field campaigns.

Based on the Scheibler method it measures the temperature compensated pressure rise after application of hydrochloric acid. As such it replaces the lab Scheibler apparatus, and gives access to the on-site determination of the carbonate content. The Plus version comes with an integrated UMP-1, which allows the in-field measurement of the water content and the dry soil correction of the readings. This eliminates the obligatory drying step.



Advantages

- digital
- portable
- low cost
- accurate, precise
- automatic
- rapid and reliable results
- ease of use



Technical Data

<ul style="list-style-type: none"> • User Interface • Power Supply • Units • Working Range • Accuracy • Resolution • Linearity (r2) • Temperature • Reaction Vessel • Sample Volume • Sample Analysis Time • Memory • Protection • Dimensions (L×W×H) • Weight 	<p>Keyboard membrane, back-lighted LCD</p> <p>3×AA alkaline or rechargeable batteries</p> <p>% CaCO₃, Vol% water content</p> <p>0-100%</p> <p>0.5% CaCO₃</p> <p>0.1%</p> <p>0.999</p> <p>Automatic compensation with built-in temperature sensor 5-50°C</p> <p>Glass bottle</p> <p>0.5 ... 5g</p> <p>Approx. 30 sec.</p> <p>The last 50 measurements can be stored internally</p> <p>IP65</p> <p>200 × 94 × 39 mm</p> <p>350 g</p>
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Set consisting of:

- cuvettes
- bottle 100ml
- batteries
- tubing
- pocket balance 0.01g
- batteries & operating instructions
- soil moisture probe UMP-1 for humidity
- powersupply 6V - 24V
- hard plastic carry case complete for field analysis

Other measurement instruments on request:

- Fog// Basis,
- Fog// mobiles Calcimeter

COMBI 5000 - Multifunction device with case

Multifunction device for measuring pH + EC + activity + moisture + temperature.

With the COMBI 5000 in the hand, you have the most important parameters to determine the nutritional status of your plant stock professionally and quickly:

- pH measurement
- EC measurement
- Measurement of activity
- Moisture and temperature measurement

The COMBI 5000 uses the latest microprocessor technology and has an automatic sensor recognition.



When a sensor is attached, the unit changes automatically to the corresponding measuring mode. The automatic buffer recognition during calibration also ensures a high operating comfort. The handy, splash-proof device has menu languages German and English (optional: French, Italian, Spanish, Russian).

Set consisting of:

- COMBI 5000 basic unit
- High quality pH probe, gel-field
- Buffer solutions pH 4 and pH 7, 100 ml each
- High quality EC probe with platinum sensor
- Calibration solutions 1.4 mS and 111.8 mS, 50 ml each
- Stainless steel AM electrode, 25 cm
- Digital SMT soil moisture + temp. sensor
- Piercing pin
- Spray bottle with snorkel, 250 ml
- Volume measuring cup, 100 ml
- Manual
- Aluminium and storage case

Hood infiltrometer

142000	with manual data acquisition
142100	IL-2700 with electronic data acquisition

GUELPH PERMEAMETER KIT

142400	(Complete set)
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Aardvark Permeameter

142800	Constant Head Borehole Permeameter
--------	------------------------------------

Double ring infiltrometer

141100	(Complete set)
--------	----------------

PL-300

147000	PL-300
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FOG// Plus Digital Soil Calcimeter™

141240	FOG// Plus Digital Soil Calcimeter™ with UMP-1
141210	FOG// Basic Digital Soil Calcimeter™
141200	FOG// Field Kit Digital Soil Calcimeter™

COMBI 5000 - Multifunction device with case

115200	for measuring pH + EC + activity + moisture + temperature
--------	---

Related Products	Usable for
Tension chamber - for infiltration measurements below the bubble point	<ul style="list-style-type: none"> • Hood infiltrometer • Hood infiltrometer IL-2700
Dome Ø 8 or 12 cm - for adaption of the infiltration measurement to soils with higher permeability	<ul style="list-style-type: none"> • Hood infiltrometer • Hood infiltrometer IL-2700
PL-300 TDR moisture probe - for the parallel measurement of the soil moisture and pL	<ul style="list-style-type: none"> • PL-300
PL-300 Tensio 150 pressure transducer tensiometer - for the parrallel measurement of soil moisture tension and pL	<ul style="list-style-type: none"> • PL-300
PL-300 calibration valve - for the calibration of the PL-300	<ul style="list-style-type: none"> • PL-300
PL-300 soil sample ring adapter - pL measurement of the soil sample ring samples	<ul style="list-style-type: none"> • PL-300
PL-300 surface chamber - pL measurement of undisturbed soil volume	<ul style="list-style-type: none"> • PL-300
PL-300 measurement chamber according to DARCY - pL measurement with homogenous flow	<ul style="list-style-type: none"> • PL-300
PL-300 sampler probe	<ul style="list-style-type: none"> • PL-300



LABORATORY MEASURING INSTRUMENTS

Some important parameters for the hydraulic characterization of a site / soil material can only be derived from laboratory experiments. Laboratory measurements allow the determination of various parameters under defined boundary conditions, which allows a high repetition rate of the experiments and thus also a well-founded statistical evaluation of the determined parameters. One of the most important material-describing parameters are the grain size distribution and the porosity, which in addition to the determination of the soil type, also provide information about the quality of the soil, its water balance characteristic, as well as its suitability as arable land or soil. Further essential soil-hydraulic properties are the retention characteristics and the description of the conductivity of the soil as a function of the degree of saturation. Both characteristics can be determined by means of laboratory experiments.



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Sedimat 4-12

Laboratory apparatus to determine the particle size distribution in mineral soils in accordance with DIN ISO 11277 using 12 samples with 4 fractions (optionally 2 fractions according to the US nomenclature) Patent-No.: DE 10 2012 207 898

The Sedimat 4-12 works on the basis of the KÖHN analysis to DIN ISO 11277, which is so far the only rational measurement method to provide identical results for the sedimentation analysis with same dependence on the particle shape. In this method the sedimentation rate of the soil particles at 25 °C is examined using a soil sample which has been previously homogenised and separated from carbonates and organic substance so as to create the particle total curve, for example, which provides the foundation for many soil examinations.

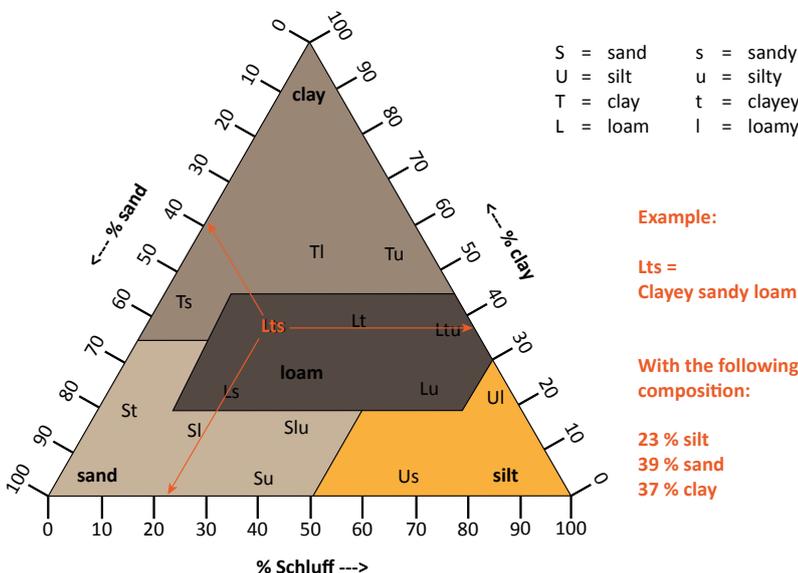
The fine soil is composed of the fraction's coarse silt (gU), medium silt (mU), fine silt (fU) and clay (T). The diagram below shows this composition. As a result of the different particle sizes (< 2.0 µm - < 63 µm) and shapes, the individual fractions have different sedimentation rates. A controlled sedimentation of the homogenised soil suspension can be used for separation due to the different sedimentation properties and therefore to quantify the individual parts.

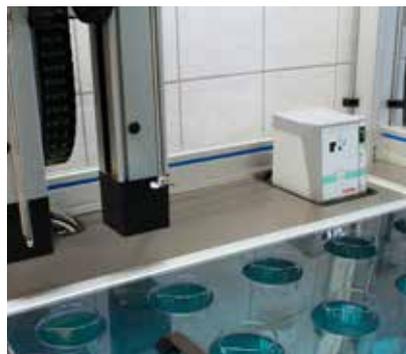


The separation of the fractions is made using a pipette analysis. During the sedimentation process, defined volumes are taken in a defined height from the suspension at defined times and their solid content then determined. The manual conducting of the test contains many sources of error due to the high requirements placed on accuracy, such as deviations

in the depth of submersion of the pipette or the time of taking the sample and is very laborious due to the long sedimentation rate of fine soil particles.

The work is considerably reduced and accuracy improved by automating this measurement method. Subjective measurement errors are ruled out. Temperature fluctuations, vibrations and turbulence which have a great influence on the measurement accuracy are minimised. Since the work is restricted to preparing samples and their analysis, a complete KÖHN analysis on 12 samples for all four fractions can be made using the Sedimat 4-12. Exactly observing the test parameters during homogenisation, temperature control and pipetting leads to a statistically reliable result. The measure of variation on repeating the test with the same samples is < 1 % (with respect to the weighed samples) using the Sedimat.





Advantages

- Reduction in workload
- Complete analysis for 12 samples in 4 fractions per day possible
- Exact realisation of the prescribed measurement conditions
- High repeat accuracy

Automisation:

The sample preparation (sieving, weighing, destruction of carbonate and organic substance) and an initial homogenisation by shaking or upturning is done by hand before installation of the soil samples in the Sedimat.

The automated test run covers the following steps:

- Temperature control
- Homogenisation
- Pipetting

Pipetting:

The suspension is taken using a piston operated pipette with lateral suction opening. The prescribed submersion depth of the pipette is controlled using an optical surface sensor so that this is always exactly identical irrespective of the level of fill of the sample vessel. For the fraction 1 (gU) the sample is taken at 20 cm depth, for fractions 2-4 (mU, fU, T) at a depth of 10 cm below the water level. The suspension is taken out 3 s after reaching the prescribed submersion depth. The pipetted quantity of the suspension of 10 ml is defined by the piston operation.

Table 1

*Submersion depth at sedimentation time at 25 °C to DIN ISO 11277:

- | | |
|--------------------|-----------------------------|
| • Fraction 1 (gU): | 20 cm ... 49 s |
| • Fraction 2 (mU): | 10 cm ... 4 min, 7 s |
| • Fraction 3 (fU): | 10 cm ... 45 min, 52 s |
| • Fraction 4 (T): | 10 cm ... 6 h, 52 min, 50 s |

Temperature control:

During the entire test run, the samples are placed in a temperature controlled water bath to guarantee constancy of temperature. After adjusting the samples and starting the program, this water bath is heated to 25 °C. The samples must then remain in the water bath for at least 30 minutes before the test can start. The exact observance of temperature is important and also prescribed according to KÖHN because this has a very great influence on the sedimentation rate of the particles.

Homogenisation:

The soil samples are stirred using a propeller agitator with variable speed and submersion depth. The specially developed stirring routines guarantee complete homogenisation of the sample. In order to prevent falsification between the samples, the agitator is cleaned in a bath before changing the sample and dried at very high speeds.

After stopping the agitator the time window for the sedimentation time to DIN ISO 11277 is open (see Tab. 1).

After withdrawal, pipette and sensor are transported to a cleaning station whereby any drops of suspension are removed with a sponge.

The pipette content is then emptied into a weighing jar at a defined position in the sample magazine. The inside and outside of the pipette are rinsed with water separately whereby the inner rinsing solution is similarly passed to the weighing jar so as to capture any fine soil particles.

...

Training Sedimat 4-12

Our team of scientists and technicians provide training and induction for practical use under field and laboratory conditions for all products of UGT GmbH.

Training events range from service, calibration and measurement instruction through to plausibility checks and the interpretation of the data records obtained.

For the Sedimat 4-12, we offer the following training courses:



Training Sample Preparation

Training content:

- sampling in the field for SEDI-MAT 4-12 and PL-300
- preparation documentation and sampling instruments
- soil sampling in the field
- sample transport
- preparation (sieving, drying, storage)

The training takes place in our house. We would be pleased to offer you a training course.



Training SEDIMAT 4-12

Training content:

- sample pretreatment for analysis: sample weight, humus destruction
- removal of soluble salts, homogenization, wet screening
- sample analysis with laboratory equipment SEDIMAT 4-12
- analysis values
- compilation of results
- soil type determination (digital)

The training takes place in our house. We would be pleased to offer you a training course.



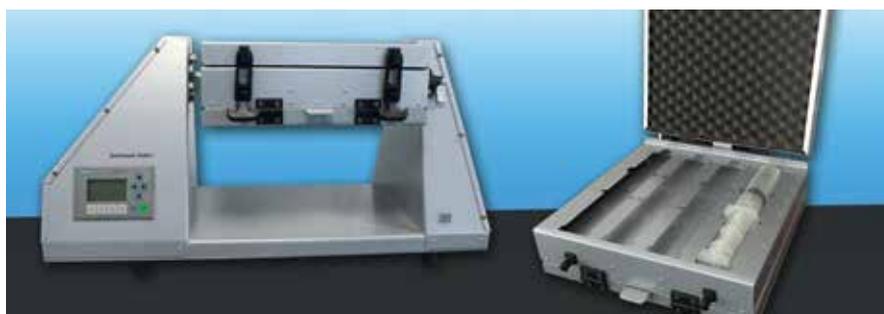
Overhead shaker

The overhead shaker is used to homogenise soil samples. Several sample vessels may be fixed between two metal mesh baskets which rotate at a steplessly controllable speed of up to 50 revolutions per minute around a rigid rotational axis. The current speed is shown in a digital display.

The constant movement causes the content of the sample to be homogenised in preparation for the use of the samples for KÖHN analysis and also serving as a starting point of many chemical analyses. The UGT overhead shaker has a high number of sample places. In the standard version 120 sample flasks of 100 ml or 72 sample flasks of 250 ml are fitted to a magazine.

Advantages

- Large number of samples compared to other commercially available devices
- Speed steplessly controllable



On request, we also custom design with more sample positions or magazines with customized sample retainers such as Laboratory syringes.

Technical data

- Speed range: 0 ... 50 rpm Steplessly controllable
- Number of samples: 120 x 100 ml, 72 x 250 ml, customisation on request

Sieve set for sieve analysis

Determination of particle size distribution



Test set for granular composition

The particle size distribution of soil samples may be determined with the assistance of this set to classify the soil based on international standards. The granular composition of the representative sample obtained in this way can be determined applying an electromagnetic sieve shaker. The sieve shaker keeps the sample continuously in motion in order to obtain the best possible sieving results. The sieve shaker and the stainless steel mesh sieves are suitable for wet and dry sieving.



Mini hand sieves set ("pocket model")

The mini hand sieves set is used for the determination of the particle size distribution of small quantities of soil in the laboratory and in the field. The set contains sieves, lids and receiver, brush and a storage bag.

Specifications:

Height 40 mm, with 6 replaceable sieves to DIN 4188 and international standards;
 Ø 100 mm, mesh width: 2.0; 1.0; 0.500; 0.250; 0.125 and 0.063 mm

ku-pF apparatus

The ku-pF MP10 is a laboratory instrument for the automatic determination of any saturated hydraulic conductivity k_u and the pf curve (water tension curve) in accordance with the condensation method on up to 10 soil ring samples simultaneously.

The apparatus is designed for the use of the UGT soil sample rings with 250 cm³ inner volume and 41 cm² cross sectional area. These soil sample rings have bore holes arranged exactly at height intervals of 3 cm for the insertion of the tensiometers. However, they may also be used for obtaining samples separately from the ku-pf apparatus.

The filled soil sample rings are set onto filter plates, saturated and sealed basally in the carrier basket for the test run. The gradient resulting from the condensation on the free ground surface is recorded by two tensiometers which record the corresponding water content and the flow rate by periodical weighing respectively.



The Tensio 130 tensiometers with particularly small ceramic cup ($\varnothing = 6,5 \text{ mm} / L = 20 \text{ mm}$) provide exact measurements with a minimum destruction of the soil.

Air bubbles are easy to recognise and eliminate through the acrylic head with bleed screw.

The arrangement of the samples on the star shaped carrier which rotates at the set test interval permits the examination of 10 samples simultaneously. The sample on the weighing position is lifted from the carrier by lifting the scales so that it is standing free. The weighing data and the tensions here are stored on the internal data logger. Automatic measuring produces continuous measurement series with a minimum of monitoring. The scales are automatically balanced between weighings. Drift effects or any foreign bodies on the scales do not therefore cause any interference.

The ku-pf apparatus works independently of a PC due to the integrated data logger and a micro-computer. A connection must be created to the PC only for maintenance, test start and reading out of the data.

Advantages

- Testing of up to 10 samples simultaneously
- Continuous data acquisition with a minimum of monitoring
- Balancing of the scales between weighings

Technical data

• Soil sample ring volume:	250 cm ³
• Cross section of the soil sample rings:	41 cm ²
• Number of samples:	1 - 10
• Cycle time of data acquisition:	10 - 40 min
• Resolution of weighing:	0.01 g
• Measurement range for k_u value:	< 10 cm/d
• Measurement range for tensiometer:	+100 ... -85 kPa
• Accuracy of tensiometer:	±0.1 kPa



Set consisting of:

- 1 ku-pF apparatus with internal data logger
- 1 laboratory scale
- 10 carrier baskets
- 10 tensiometer pairs Tensio 130
- Drill holes for tensiometer installation including 3 augers and guide device
- 10 soil sample rings $V = 250 \text{ cm}^3 / \varnothing = 41 \text{ cm}^2$
- 20 lids for soil sample rings
- 10 filter plates
- 1 software kuLog
- Perforated sheets
- Filter paper

The ku-pF apparatus is available as a single measurement station:



ku-pF SP

pF laboratory station

Convenient creation of pF-WG curves in the range of pF (10 hPa) to pF 2.9 (approx 750 hPa) with precisely regulated vacuum.

Tabletop instrument with integrated pump and vacuum control technology functions with a porous suction plate with hydrophilic plastic diaphragm and extremely high water conductivity in 230V mode. This permits very rapid drainage of soil samples compared to other methods. Dry suction plates are ready for use immediately after simply moistening them and may be used in the entire vacuum area. The vacuum control is microprocessor-based using an electronic pressure sensor and integrated diaphragm pump. Limit values can be set with a resolution of 1 hPa precisely and indepen-

dently of each other. The vacuum control is entirely operated using four keypad buttons. During operation both the system pressure and the upper and lower limit value are shown. The soil samples (up to 40 soil sample rings with D=53 mm) are protected against evaporation by a transparent cover plate. This pF laboratory station from EcoTech also has possibilities to connect four pF pressure step modules and/or additional pF suction plate modules via a tap bank.



Advantages

- Rapid drainage of the soil samples
- Connection of additional pF pressure step modules and/or pF suction plate modules possible

Technical data

- | | |
|--------------------------------|--|
| • Active filter area: | 480 x 280 mm |
| • Bubble point: | min 1000 hPa |
| • Vacuum control: | micro processor with electric pressure sensor |
| • Display: | 3 separate displays for system pressure, upper and lower limit value |
| • Number of soil sample rings: | approx 40 with D = 53 mm
approx 30 with D = 60 mm |
| • Connection possibilities: | 4 pressure step modules or suction plate modules |
| • Vacuum buffer volume: | approx 14 l |
| • Operating voltage: | 230 V AC |
| • Pump performance: | 120 W, 33 l min ⁻¹ against atmosphere |
| • Dimensions (B x H x T): | 760 x 580 x 605 mm |

Set for the pF determination in accordance with the sand box method

An extensive set has been put together for the pF determination of the entire range from pF0 to pF 4.2. The set consists of the following:

- sand box for pF determination from 0-2.0 for a maximum of 40 soil sample rings
- Sand / kaolin box for pF determination 2.0-2.7 for a max of 40 soil sample rings
- Diaphragm apparatus for pF determination 3.0-4.2 for a max of 15 soil sample rings including compressor and accessories
- Soil sample ring kit (with conical screw thread connection) for taking undisturbed samples from a depth of up to 2 metres
- Cases with soil sample rings
- Aluminium soil sample boxes for drying the soil samples in a drying oven

The set can be supplied with soil sample rings and ring holders with a diameter of 53 mm and 60 mm.



Advantage

- Testing of the complete plant-relevant pF range

Low Tension System

For precision readings in a range of 0 to 0.15 Bar.

The Low tension System is a 3-unit complete system approach to measurement of low tension conditions. The adjustable hanging columns mimics variable drainage and saturation conditions in the field.

For determining moisture retention levels for highly saturated soils, a hanging water column assembly

is the only method for obtaining precise and accurate data. For this reason. Soil moisture Equipment Corp. offers the Low Tension System. With a hanging water column adjustable from 0-150 cm, this system offers vacuum precision of <1%. With minimal components and easy assembly/disassembly, the Low Tension System is the most simple and affordable low tension system available.



Technical data

- Hanging Column Range: 5 to 150 cm
Resolution: 0.1 cm
- Plate Diameter: 273 mm
- Saturation Pan Diameter: 305 mm
- Sand: ca. 0,04 mn
- Weight: 40.8 kg
- All items come in a canvas bag, Shelving sold separately.

Advantages

- Easy and quick assembly/disassembly
- High tension resolution

Basic Vacuum Extractor

For radings in the range of 0.15 to 1 Bar.

Not much is needed for moisture retention analyses of soils in the 0.15 to 1 Bar range, which covers

the water availability of interest for most agricultural and agronomic applications.



Set for the pF determination with ceramic plates

The equipment is suitable for the determination of pF curves in the range of pF 2.0-4.2 (0.1-15 bars of soil moisture tension). Furthermore, the sets are suitable for the calibration of soil moisture blocks or other soil moisture measurement equipment. The standard set contains inter alia: two extractors with ceramic plates (0.1 MPa, 0.3 MPa and 1.5 MPa and 1.3 and 15 bars) and accessories, soil sample rings, a pressure control panel and a compressor.

Principle

Moisture is removed from the soil samples by raising the air pressure in an extractor. A porous ceramic plate serves as a hydraulic link for water to move from the soil to the exterior of the extractor. The high pressure air will not flow through the pores in the plate because these are filled with water. The smaller the pore size, the higher the pressure can be before air will pass through. During the test run at any set pressure in the extractor, soil moisture will flow around each of the soil par-

Several ceramic plates with soil samples can be placed in the extractor at the same time. The pressure control panel is standard equipped with two manometers 0-2 MPa and 0-0.4 MPa (and 0-20 bars and 0-4 bars). The supplied compressor (220V / 50 Hz) is specifically designed for this purpose: maximum pressure 2.0 MPa (20 bars), built in safety precautions, completely guarded and quiet.

ticles and out through the ceramic plate and outflow tube. Equilibrium is reached when water flow from the outflow tube ceases. At equilibrium, there is an exact relationship between the air pressure in the extractor and the water tension in the samples (and hence the moisture content). Accuracy of equilibrium values will not be above that of the regulation of air supply. Therefore, the pressure control panel has independent double regulators.



Advantages

Compared to other methods, such as compaction, centrifugation, molecular absorption etc, the advantages are as follows:

- Relatively simple method
- Reliable way of removing soil moisture from soil samples under controlled conditions without disturbing the soil structure.
- The method may be used on prepared samples or undisturbed samples. The soil structure is not disturbed. The characteristic pF curves may be developed for each soil type. These curves relate the moisture tension at which the moisture is held in soil to its moisture content. Studies of soil moisture movement and of quantity and availability of soil moisture have shown this relationship to be important for plant growth.

Use

If the properties of the moist soil sample are known, the following values may be determined:

- The pore volume of the soil.
- The pore size distribution of the soil.
- The capillary rise capacity.
- The air and moisture contents of the soil with a given ground water level.
- Determination of the field capacity and available soil moisture.
- Water tension with respect to the germination time of seeds.

Pressure Membrane Extractor

Pressure Membrane Extractor (0 - 15bar) Model 1000 for water retention curves from shrink / swell soils to 15 Bars

A common problem in soils research is determining water retention curves for various soil types. This applies to non soil experiments where the material under study „curls“ as it dries. The model 1000 is a pressure / membrane type extractor. It is designed to contain shrink-swell soils during extraction. A special EDPM rubber “hold down“ diaphragm is inflated, with 1.81kg of force holding the soil in hydraulic contact with the cellulose membrane surface. The cellulose membrane material is a pure cellulose and has a pore size of 2.4 nanometers. The cellulose membrane can withstand over 10,000 kPa bubbling pressure. The standard model 1000 (100261) can test up to 12, 5.5 x 1 cm high samples and operates in the 0 to 1500 kPa (0 to

15 bar) soil suction range. Choose an optional PM cylinder height, to handle undisturbed cores up to 3 inch high.

The Pressure Membrane Extractor includes the following components:

Top and bottom plates, 5/8“ (1.6 cm) high by 11“ (28 cm) inside diameter cylinder and clamping bolts, cylinder seal O-rings, screen drain plate, compressing diaphragm, and eccentric clamping screw assembly. Connecting hoses (2 required), cut cellulose membrane discs, PM Hinge, and torque wrench with socket are ordered separately. Soil sample retaining rings and cylinders of various heights are available separately.



Specially designed cellulose membrane for best hydraulic contact

Technical data

- Dimensions: 45.72 x 45.72 x 35.56 cm
- Weight: 32.65 kg

Advantages

- wide measuring range
- designed for shrink-swell soils

Hood permeameter by HARTGE

Natural water movement occurs predominantly with very small pressure gradients.

Currently, the water movement is described almost exclusively as a laminar flow with DARCY equation whereby the flux speed is proportionate to the effective pressure gradients. The usual k_f measurements in soil science are conducted with comparatively high gradients which are rarely to be found in the natural water movement in soils. HARTGE therefore advocated the measurement with very small gradients. The Hood permeameter by HARTGE meets these requirements. It serves to determine the k_f value of the soil ring samples in the laboratory from the flux rate and the corresponding pressure difference whilst keeping the pressure gradients as small as possible.

The saturated sample in the manual soil sample ring is placed in a tub on a filter plate and covered completely with water. A dome filled with water is placed over the soil sample ring beneath which a pressure gradient is generated over the sample height. This dome is suitable for the manual soil sample rings offered by UGT so that the soil sample can be inserted directly.

In the test run, the water volume flowing through the sample during a specific measurement time is determined for the stationary flow. The area and length of the flow path are determined by the geometry of the soil sample ring. Depending on version, the pressure gradient is shown as height difference in the standpipes or recorded by a pressure sensor.



Advantages

- Flux rate is recorded with very small gradients near to natural water movement
- Flux rate may be adjusted to the respective soil sample
- Testing of 10 manual soil sample rings with an inner volume 250 cm³

Technical data

- | | |
|---|----------------------|
| • Resolution pressure difference with standpipe: | 1 mm water column |
| • Resolution pressure difference pressure sensor: | 0.1 mm water column |
| • Dimensions (B x H x T): | 1270 x 1000 x 420 mm |

Set consisting of:

- 1 sample tub with U-tube manometer and weighing table
- 1 permeameter hood with seal and tube connections

Chameleon Kit

The Chameleon Laboratory, an accurate, versatile, and fully automated laboratory system for measuring saturated hydraulic conductivity (Ksat). Chameleon is capable of performing Ksat measurements according to both the Falling-Head Method and Constant-Head Method. Thanks to the Monitor® Precision Pressure Transducer, and the Chameleon Software Application, both measurement methods are fully automated. The Chameleon Permeability Laboratory System allows for automated Ksat calculation in just a few minutes to a couple of hours. The user simply needs to collect samples and connect them into the system. The software will record the data, notify the user of steady state, calculate Ksat, and provide reports including charts and graphs. With both constant head and falling head calculation capabilities, this is the most complete permeability system.

The Chameleon Permeability Laboratory System is the ideal configuration for calculating Ksat quickly and effectively. Soil cores are directly inserted into the system assuring minimal disturbance for maximum accuracy. The automated software, compatible exclusively with Soilmoisture’s new Monitor Transducer, allows the user to get results limited labor and error. Constant head and falling head methodology makes this a diverse educational tool and the perfect system for a wide range of research. Furthermore, the components used in Chameleon can be reconfigured to create other types of laboratory systems, such as Soilmoisture’s Tempe Cell system, with little or no additional parts. The system includes the complete Monitor Precision Pressure Transducer software package so that the transducers can also be used for other applications.



Optional:

- Soil samplers with cores to fit directly for undisturbed analyses
- Additional cells, cylinders, and transducers to easily grow the scale of your lab
- Tempe Cell ceramics and pressure/vacuum regulating setups to test soil water retention in addition to permeability with your Chameleon Lab

Technical data

• Minimum Head-height:	1 cm
• Maximum Head-height:	100 cm
• Reservoir Inside Diameter:	5.13 cm
• Reservoir Height:	48.26 cm
• Reservoir Volume:	1 liter
• Soil Core Inside Diameter:	5.38 cm
• Soil Core Height:	6.0 cm
• Monitor Precision Transducer:	-15 to +15 psi

Advantages

- Components are easy to assemble and use
- Automated using a dedicated software application
- Measures Ksat using both the constant and falling head methods
- Components can be used in other types of lab studies

Air pycnometer

The air pycnometer is an innovative measurement instrument to determine the pore volume of a substrate sample in the laboratory. It is suitable both for undisturbed soil samples as well as for bulk goods such as sands, gravels or plant granulate. The measurement chamber is permanently connected to the basic body and is sealed by a lid which is held in place by a bar. A soil sample ring is not essential to conduct the measurement. Due to the large measurement chamber with a volume of 2120 cm³, appropriately large samples may also be examined which increases the accuracy of the measurement and makes a few of the investigations at all possible.

The design of this instrument is based on the guidelines of the FLL (Forschungsgesellschaft Landschaftsentwicklung und Landschaftsbau).

The measurement principle is based on the isothermal gas expansion experiment according to BOYLE-MARIOTTE. An additional volume of a known size is filled with compressed air, connected to the measurement chamber of known size with substrate sample and a pressure equilibrium achieved. The compensating pressure is a measurement of the air filled pore volume because only the solids volume within the measurement chamber serves to push out gas.



The pressure values are displayed by a digital manometer in a freely selectable pressure unit. The integrated compressor renders additional devices or gas flasks superfluous as long as air is used as measurement gas. As an option, a different measurement gas may be used via a separate feed line.

Technical data

- | | |
|--|--|
| • Measurement chamber: | V ≈ 2120 cm ³
h = 12 cm
Ø = 15 cm |
| • Measurement range for digital manometer: | -1 ... 3 bars |
| • Resolution of digital manometer: | 1 mbars |

Advantages

- Investigation of large samples possible due to large measurement chamber
- No soil sample ring necessary
- No additional devices necessary

Tempe Cells 1400D

Application for Hydrology of Undisturbed Soil Samples 0-2 Bar, Lab or Field

The 1400 Tempe Pressure Cell is used to determine the water-holding characteristics of a soil sample. The cell accepts an undisturbed soil sample contained in a 8.89 cm outside diameter x 6 cm tall cylinder. The cell comes with a Ceramic Plate. It's based on undisturbed soil cores obtained in the field, easily prepared from precision brass retaining rings in either 5.72 cm outside diameter or the larger 8.89 cm outside diameter

rings. The rings for undisturbed soil samples come in 3 cm or 6 cm heights, other materials and longer lengths available for soil columns.

Made from strong clear acrylic with O-ring seals on both top and bottom surfaces for all sealing. Comes complete with a selection of ceramics 0-2 Bars (0-200 kPa) base plates with various flow rates. Cylinders and hold downs sold separately, different length



and diameters are available.

SPECIFICATIONS

Please specify cylinder type (length and type) when ordering.

2.25 in (5.72 cm) Ø Tempe Cell, weight 0.57 kg

- 1400D2.25-B0.5M2 Tempe, 0.5 bar, HF-plate
- 1400D2.25-B01M1 Tempe, 1 bar, STD-plate
- 1400D2.25-B01M3 Tempe, 1 bar, HF-plate
- 1400D2.25-B02M1 Tempe, 2 bar, STD-plate

3.50 in (8.89 cm) Ø Tempe Cell, weight 1.03 kg

- 1400D3.50-B0.5M2 Tempe, 0.5 bar, HF-plate
- 1400D3.50-B01M1 Tempe, 1 bar, STD-plate
- 1400D3.50-B01M3 Tempe, 1 bar, HF-plate
- 1400D3.50-B02M1 Tempe, 2 bar, STD-plate

Advantages

- Easy setup
- Long-lasting proven

Calcimeter

The calcimeter by Eijkelkamp is suitable for the simultaneous determination of the carbonate content in 5 samples. Where possible the vulnerable glass was replaced by synthetic materials. Because hydrochloric acid is used a stable and ergonomic design was chosen. The calcimeter is delivered complete with reaction vessels and test tubes (without reagents).

Per reaction approximately one hour is required. Carbonates that are hard to dissolve, such as sea shells, take more reaction time.

The quantity of sample needed is determined beforehand by treating a part of the sample with hydrochloric acid on a watch glass. The carbonate content is estima-

ted on the basis of the extend and the period of bubbling. Based on this estimate the quantity of sample for the analysis is determined.

With this calcimeter no balloon is used to keep the CO_2 separate from the water (to prevent any gas from dissolving in the water). This results in much more accurate measuring results.

As a consequence of the repeatability and the accuracy, a series of measurements should be executed in a room in which there are no differences in temperature exceeding 4°C . In addition the reagents used must meet the standards for analysis. It should also be considered that other gasses (for instance in polluted soils) may be released.



The gas will then have to be purified first and the CO_2 will have to be determined otherwise.

Technical Data

- | | |
|------------------------|----------------|
| • Measurement range | 0 - > 200 g/kg |
| • Reading accuracy | 1 g/kg |
| • Sample specification | disturbed |

Advantages

- Accurate measurements the easiest way
- 5 flasks allow batchwise working
- Rapid results

Sedimat 4-12

150000	Sedimat 4-12
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Overhead shaker

156000	60 x 100 ml
--------	-------------

156010	72 x 250 ml
--------	-------------

Sieve set for sieve analysis

152000	Test set for granular composition
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153000	Mini hand sieves set ("pocket model")
--------	---------------------------------------

ku-pF apparatus

143500	ku-pF MP10	(10 measurement station, complete set)
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143400	ku-pF SP	(Single measurement station, complete set)
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pF laboratory station

144000	pF laboratory station
--------	-----------------------

Sand box method

145000	Set for pF determination using the sand box method
--------	--

Low Tension Systems

142250	For precision readings in a range of 0 to 0.15 Bar
--------	--

Basic Vacuum Extractor

142251	For readings in the range of 0.15 to 1 Bar
--------	--

Ceramic plate method

146000	Set for pF determination using the ceramic plate method
--------	---

Pressure Membrane Extractor

142450	Water retention curves from shrink / swell soils – 15 bar
--------	---

Hood permeameter according to HARTGE

142500	(Complete set)
--------	----------------

Chameleon Kit

142350	Single Unit
--------	-------------

142351	Five independent Units
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Air pycnometer

148000	Air pycnometer
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Tempe Cells 1400D

142550	Equipment for Hydrology of Undisturbed Soil Samples 0-2 bar
--------	--

Calcimeter

141230	Calcimeter for the determination of the carbonate content
--------	---

ORDERING DETAILS

Related Products	Usable for
Magazine	• Sedimat
Duran weighing jars	• Sedimat
Sample rings	• Sedimat
Pipette	• Sedimat
Aqua-Stabil Protective agent, 100 ml	• Sedimat
Tensio 130 Laboratory tensiometer pair For the tension measurement in soil sample rings	• ku-pF
Soil sample rings set of 10 with 20 lids	• ku-pF • sampling in general
Filter plates For the saturation of soils sample in the soil sample ring	• ku-pF • sampling in general

ORDERING DETAILS

Related Products	Usable for
Auger for tensiometer installation incl 3 augers and 1 guide device for the exactly horizontal and undisturbed installation of the tensiometers	<ul style="list-style-type: none"> • Tensio 130 • Tensio 131
Filter paper Insert for the filter plates	<ul style="list-style-type: none"> • ku-pF
Perforated foil To regulate the evaporation at the soil surface	<ul style="list-style-type: none"> • ku-pF
Laboratory scales with serial interface	<ul style="list-style-type: none"> • Hood permeameter according to HARTGE
10 soil sample rings	<ul style="list-style-type: none"> • Hood permeameter according to HARTGE
Zylinder, standard (1.58 cm, 1.3 kg)	<ul style="list-style-type: none"> • Pressure Membrane Extractor (0 – 15bar) Model 1000
Zylinder, tall (3.2 cm, 3 kg)	<ul style="list-style-type: none"> • Pressure Membrane Extractor (0 – 15bar) Model 1000
Zylinder, extra tall (4.75 cm, 4.8 kg)	<ul style="list-style-type: none"> • Pressure Membrane Extractor (0 – 15bar) Model 1000
Zylinder, super tall (8.8 cm, 9.0 kg)	<ul style="list-style-type: none"> • Pressure Membrane Extractor (0 – 15bar) Model 1000



EROSION MEASUREMENT TECHNOLOGY

In these times in which buzzwords such as soil overuse and sealing, extreme flow-off and desertification are no longer simply issues for science, soil erosion is assuming an ever greater importance.

Water and wind erode the soil and move it to other places. The incorrect management of the soil, such as over-grazing, leads to the protective layer being destroyed and intensifies the natural erosion process to create a man-made problem. This is because the excessive overuse of the soil leads to an impairment in its productivity and even to its complete destruction.



The first step to counter this development is to obtain a comprehensive picture of the erosion process. For this purpose, the erosion material in air and water must be determined as dependent on the meteorological and hydrological conditions.



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Run off measurement instrument

The measurement system serves to record and examine surface run off and the erosion materials contained therein. The surface run off water is collected in a collection channel and quantified by a tipping counter before being filled into sample vessels. The start and intensity of the run off event is registered by an internal data logger.

The final filling of the samples of the surface run off into up to 24 brown glass flasks is performed fully automatically and solely via water pumps. There are no bottlenecks which could clog, cause a congestion or lead to the reduction of the flow speed. The erosion material can thus be transported in the flowing water without impediment. Coarse dirt is already retained by a stainless steel sieve. In order to be able to ideally record the different run off events, the sampling frequency is adjusted by a microcomputer to the run off intensity.

With low run off quantities the entire surface run off recorded by the collection channel is taken as sample in order to obtain a sample quantity which is as large as possible. By contrast with a considerable run off event, sample water is only taken at adjusted time intervals. The remaining water is discharged after having been quantified. This prevents the sample flasks filling too quickly and guarantees that the samples are distributed via the entire run off event.



With upstream connected run off dividers, both test parcels and also small capture areas up to 3 ha in size can be investigated.

Combined with meteorological and hydrological measurement points a comprehensive picture of the run off and erosion processes can be obtained in this way.

The entire system is made of rust free stainless steel which is inert to the samples. It is installed underground so as to generate the flow solely as the result of the height difference and not to be dependent on pumps and therefore to generate a free flow and minimise energy consumption.

Advantages

- Fully automatic sampling
- Sampling adjusted to the run off intensity
- Water distribution solely via water points



Technical data

- Number of samples: 24
- Sample volume: 1000 ml
- Energy supply: Replaceable storage battery 12 V/10 Ah
Also solar panels on request

Wind erosion sediment trap

The wind erosion sediment trap automatically records the aeolically transported sediment material. This is weighed directly in the system and then remains in the weighing dish for the subsequent investigations. The body of the system is made completely of rust free stainless steel and consists of a base, logger, accumulator and scales as well as rotatable head section with wind vane for the actual sample. The base of the system is usually installed underground in order to guarantee that the wind flow is influenced as little as possible and the apparatus is steady.

The wind vane means that the head section with the inlet opening is always facing the wind direction so that the wind flows directly into the measurement system. It hits a baffle plate from which the sediment particles carried in the air fall onto the scales. The air flows out through the outlet opening located above the baffle plate. The scales weigh the cumulative sediment and this result is recorded in the internal data logger. The recorded data therefore shows both the start and intensity of an event.

Combined with a weather station, the aeolic sediment material in connection with the meteorological parameters, particularly the wind conditions, may be obtained. This provides a comprehensive picture of the wind related erosion. Using measurement points such as this, the weighing



data may be recorded via the data logger of the weather station so that two loggers are not required. The energy supply is then assumed by the weather station.

Usually both the wind erosion sediment trap and the weather station are supplied with power by a replacement storage battery.

However, the power supply may also be provided by solar panels for autonomous operation.

Advantages

- Fully automatic recording of the aeolic sediment material
- Samples of the sediment material for laboratory analysis

Technical data

• Resolution of weighing:	0.1 g
• Temporal resolution:	1 min
• Energy supply:	Replaceable storage battery 12 V/10 Ah Also solar panels on request

Run off measurement apparatus

201100 Run off measurement apparatus

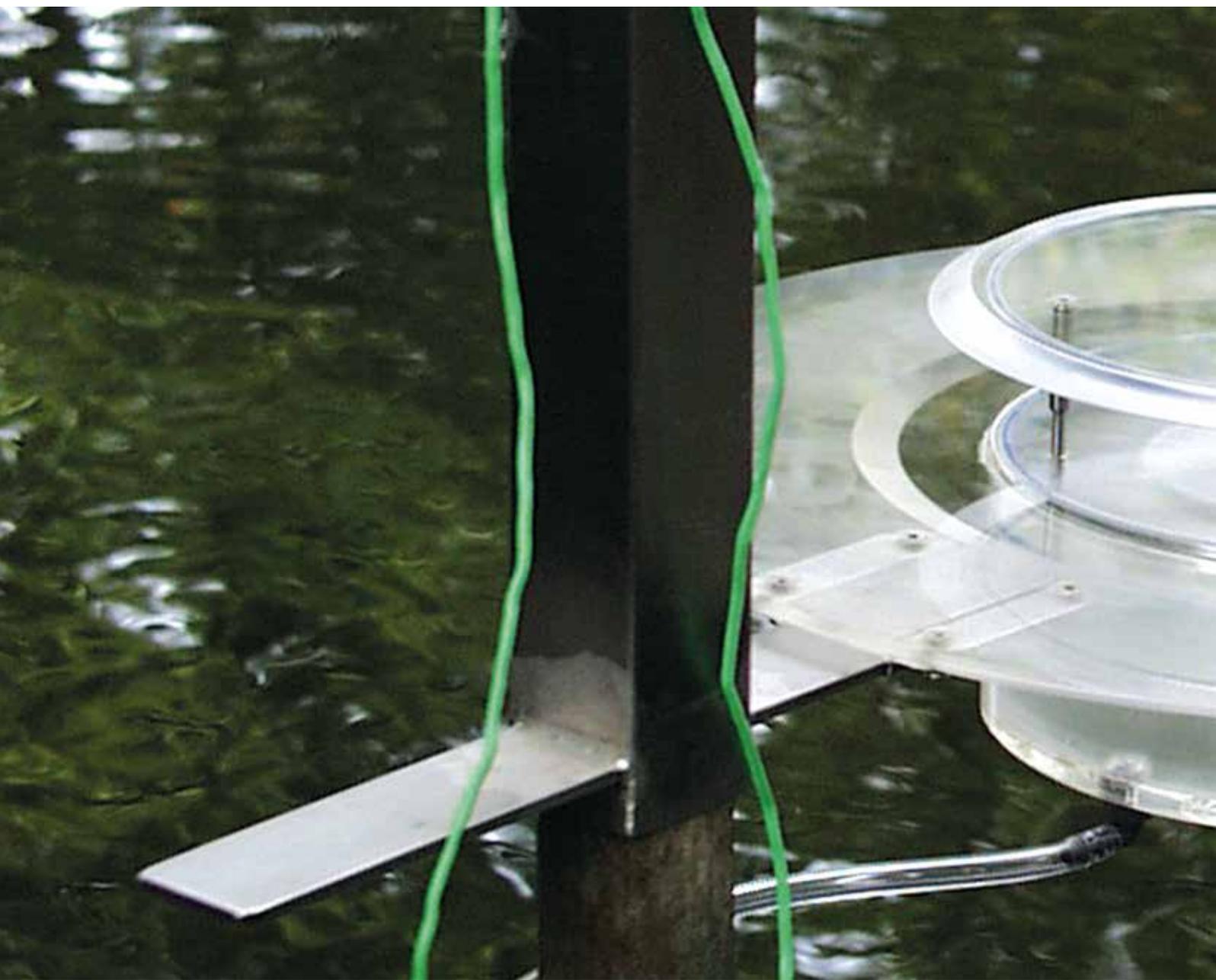
Wind erosion sediment trap

202100 Wind erosion sediment trap

ORDERING DETAILS

Related Products	Useable for
Brown glass flasks 1000 ml	<ul style="list-style-type: none">• Run off

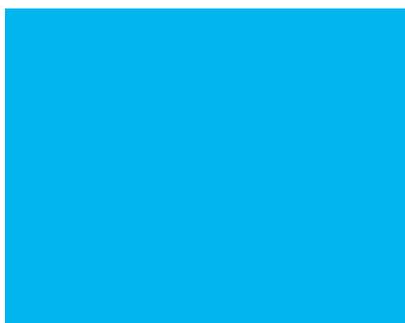
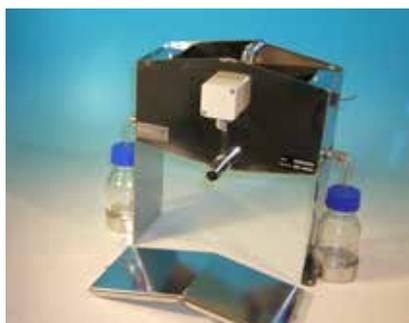




HYDROLOGY







FLOW MEASUREMENT

Reliably determining the quantities of inflowing and discharged water forms the basis of every water management consideration, as well as the consideration of many flow processes. This ranges from small lysimeters to landfill sites, sealed surfaces and through to entire river basins. Various measurement methods have emerged to adapt to different flow rates and application areas.



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Polycarbonate tipping counters

These polycarbonate tipping counters with a tipping tray volume of 0.1 l are particularly suitable for determining small flow rates and can be used up to a maximum discharge of 5 l/min. They offer an inexpensive alternative to the V2A tipping counters but are equally weather-resistant. In addition, unlike V2A tipping counters, they are food safe, and can therefore also be deployed in drinking water.

A 1% sample of the volume can be filled into the 250 ml PE collecting flask per tipping. The number of tipping actions is recorded by a REED sensor which can be connected to a data logger. In the case of individual devices a 1-channel data logger (e.g. Easylog) is advisable. On request the polycarbonate tipping counters can be supplied with wall bracket or base support.



Technical data

- Flow: max 5 l/min
- Volume of tipping tray: 0.1 l
- Measurement accuracy: ± 1 g set to 100 g

Advantages

- Inexpensive
- Light
- Food safe

V2A tipping counters

Tipping counters made from V2A steel are extremely strong and inert to water. The stability of this material means that significantly larger models are possible than with plastic tipping counters. In order to cater for all flow rates, these tipping counters are availa-

ble with a large selection of tipping tray sizes ranging from 0.1 l to 20 l. Up to a tipping tray volume of 3 l the tipping counters can also be equipped with a connection to the sampling device.



1 L - Tipping counter

We supply the following models of V2A tipping counters:

Tipping tray volume		Version with sampling possible	
0.1 l	closed	Yes	
0.5 l	closed	Yes	
1.0 l	closed	Yes	
2.0 l	closed	Yes	
3.0 l	closed	Yes	
5.0 l	open	No	
10.0 l	open	No	
20.0 l	open	No	



3 L - Tipping counter



20 L - Tipping counter

H-flumes

H-type flumes were developed to determine widely fluctuating flow rates, from very low to extremely high volumes. For example it is possible to measure seasonally changing discharges or discharges resulting from heavy rainfall events. Furthermore H-flumes are also deployed to record agricultural and industrial discharge processes. On condition that there is an open flume with free discharge on the outlet, they deliver outstanding accuracy even in the case of contaminated water. An upstream stilling channel ensures even distribution of the flow over the entire measurement range.

The H-flumes are manufactured from strong, stainless V2A steel. The water level is gauged in a contactless procedure using ultrasonic transducers or capacitive sensors installed in a V2A protective housing. In combination with UGT data loggers, the temperature and wind compensation of ultrasonic transducers takes place in the data logger.



1 Ft-H-flume

Advantages

- Suitable for widely varying flow rates
- Suitable for contaminated water



2 Ft-H-flume

We supply H-flumes in three sizes to facilitate optimal alignment to the prevailing flow rate range:

Type	Outer dimensions H-flume (LxWxH)	Outer dimensions approach channel (LxWxH)	max. Level	Flow rate
1 Ft-H-flume	42 x 64 x 41 cm	101* x 64 x 35 cm	30,5 cm	0,02 ... 55 l/s
2 Ft-H-flume	83 x 126 x 74 cm	101* x 126 x 68 cm	61 cm	0,04 ... 315 l/s
3 Ft-H-flume	124 x 184 x 105 cm	101* x 184 x 99,5 cm	91,5 cm	0,06 ... 870 l/s

* Standart length approach channel 101 cm, custom lengths on request

RBC flumes

RBC flumes are used to measure quantities of water. Compared to familiar flumes such as the WSC or Parshall flumes, RBC flumes give the most accurate results. The RPC flume has been especially designed for use in small streams (irrigation, inflows and discharges, furrows etc.). It is a simple and reliable instrument for measuring water volume that flows onto a field as irrigation. The standard range includes flumes with different measurement ranges of between 0.1–8.7 l/s and 2.0–145 l/s.



Larger measurement ranges can also be covered on request. The essential condition for obtaining precise measurement results is that the flume be erected absolutely horizontally and that water can flow onto the flume and out of the flume without obstruction. The value of the increased water level can be read off on the measurement equipment (measuring cylinder) at the end of the measurement flume. The flow rate (discharge rate) is calculated using standard formulae.

A pressure sensor can also be installed and connected to a data logger instead of reading measurements off the measuring cylinders.

This enables automatic measurement (and activation), storing and reading. In the case of an automated flume, the threshold value of the water level is recorded using an extremely accurate pressure sensor connected to a data logger.



Type	Height	Width	Length	Flow rate range
V 1	240 mm	510 mm	700 mm	0.1 ... 8.7 l/s
V 2	480 mm	1010 mm	1490 mm	0.9 ... 49 l/s
V 3	600 mm	1260 mm	1750 mm	1.6 ... 86 l/s
V 4	700 mm	1500 mm	2100 mm	2.0 ... 145 l/s

Flow rate measurement system with data logger

A compact, easy to handle device to determine the flow rate in hoses, such as for pump trials in the groundwater.

The impeller wheel flow meter for 2 to 48 l/min is combined with a 1-channel data logger to record the flow rate at selected measurement intervals. The recording of data begins automatically as soon as a flow is registered. The value of the preceding measurement interval can be seen in the data logger display.



The miniature data logger is supplied with Windows software for configuration and data retrieval, as well as a 1 m connection cable for the PC. Measurement system and hoses are connected using quick couplings.

As a result the measurement equipment is easy to install and can be used without difficulty on various hoses. Due to its small size it can be easily transported and with protection type IP 65 it is suitable for outdoor use.

Advantages

- Easy to use and install
- Transportable
- Also suitable for outdoor use

Flow meter

Measurement range 2.0 ... 48 l/min

Accuracy $\pm 2.5 \%$

Operating voltage 24 V DC

Type of protection IP 65

Connection size DN 25

Miniature data logger

Recording of analog signals 0 - 10 V

Resolution 1 digit

Accuracy $\pm 0.5 \%$

Recording rate 2 s ... 5 h,
freely programmable

Measurement storage 48.000 measurements

Recording duration 500 days

KATflow 210

Portable, Watertight and Powerful Clamp-On Ultrasonic Flowmeter

The KATflow 210 is a portable ultrasonic flowmeter designed for situations that require a reliable flow measurement regardless of the conditions in which it needs to be operated.

With its advanced battery technology and durable waterproof housing the instrument is ideally suited to use in the water, leak detection and environmental markets as it is intended for use in harsh outdoor conditions and in areas where long-term measurements are required without access to a power supply.

The clamp-on flowmeter KATflow 210 is built into its own robust IP 67 transport case allowing it to continue functioning even in the case of temporary immersion in water. In addition to a sizeable data logger the KATflow 210 can provide a variety of process output options including the possibility of wireless data transfer. The flowmeter is programmed with three different operating modes to maximise the battery life which allow the user to vary the measurement frequency or send the meter into hibernation.

This device has been further enhanced by the inclusion of a specially manufactured IP 68 version of the K1N stainless steel transducers which increases shock protection and ensures this ruggedised



package provides the perfect balance of reliability, robustness and autonomy.

Set consisting of:

- Robust transport case with integrated flowmeter with data logger
- Digital Open-Collector
- Digital Relay
- 2 IP 68 clamp-on ultrasonic transducers with ODU/LEMO connector

optionally available:

- Wall thickness gauge

Other versions available on request.



Flowmeter and transport case in one compact device



Robust IP 68 clamp-on ultrasonic transducers with ODU/LEMO connector.



Technical data

• Pipe diameter range	25 ... 2,500 mm
• Temperature range for sensors	-30 ... +130 °C (-22 ... +266 °F)
• Degree of protection of enclosure	IP 67
• Degree of protection of clamp-on sensors	IP 68
• Operating time	Up to 100 days
• Current output	0/4 ... 20 mA

Advantages

- Portable and robust
- Flowmeter and transport case in one compact device
- Optional wireless data transmission
- Innovative installation wizard for quick and intuitive programming

Polycarbonate tipping counter

191100	0.1 l	With sampling
--------	-------	---------------

V2A steel tipping counter

191200	0.1 l	With sampling
192000	0.1 l	Without sampling
192110	0.5 l	With sampling
192100	0.5 l	Without sampling
192210	1.0 l	With sampling
192200	1.0 l	Without sampling
192310	2.0 l	With sampling
192300	2.0 l	Without sampling
192410	3.0 l	With sampling
192400	3.0 l	Without sampling
192500	5.0 l	Without sampling
192600	10.0 l	Without sampling
192510	20.0 l	Without sampling

H-flumes

196000	1 Ft H-flume
196010	2 Ft H-flume
196020	3 Ft H-flume
194100	Level measurement device with ultrasonic scanning

RBC flumes

197000	V1
197010	V2
197020	V3
197030	V4
195110	Capacitive pressure transmitter for level measurement

Flow rate measurement system with data logger

193000	Flow rate measurement system with data logger
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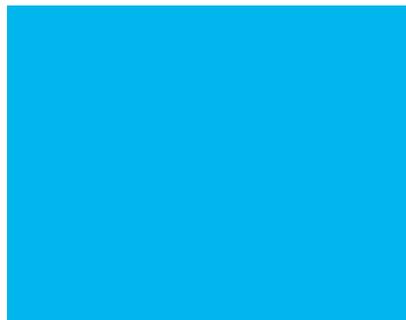
KATflow 210

199600	Portable clamp-on system for ultrasonic measurement with data transmission
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Related Products	Usable for
Base support	<ul style="list-style-type: none"> • Polycarbonate tipping counter
Wall bracket	<ul style="list-style-type: none"> • Polycarbonate tipping counter

ORDERING DETAILS





LEVELS

The precise recording of series of water levels that are as complete as possible forms the basis for the hydrological description of the situation surrounding a body of water, the processes occurring within it as well as the conduct to be expected and therefore also the water balance. In addition to the purely hydrological significance, this information also has practical use, for example for flood water warning, for the planning and management of water management and hydraulic installations and for shipping.



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Level measurement equipment with ultrasonic scanning

The water level is measured from the distance of the water surface to the top of the attached ultrasonic sensor. The level measurement equipment is installed in a soundproofed stilling pipe. Disturbances, particularly from waves, are minimised in this way. The measurement range is between 100 mm and 600 mm.

In combination with a UGT data logger it is possible for data recording and power management to be controlled by micro computer. On site calibration means that measurement values can be directly read out as actual water level. The data are exported via an RS-232 interface on the data logger.



Technical data

- | | |
|-----------------------------------|----------------|
| • Measurement range: | 100 ... 600 mm |
| • Operating voltage: | 12 V |
| • Linearity faults: | < 0.2% |
| • Repeat accuracy: | < 0.3% |
| • Temperature faults (0 to 50°C): | < 0.5% |

Advantages

- Contactless measurement
- Frost-resistant

Level measurement equipment with pressure transducer

Via the pressure sensor, the measurement system determines the water level from the pressure of the water column. This sensor with gold-coated ceramic membrane and stainless steel housing is compact, robust and durable. It is placed in a PVC stilling pipe below the lowest anticipated water level. When combined with a UGT data logger, the sensor can be calibrated to the installation depth and directly read out the water level from the water column resting on it.

The data are read out using an RS-232 interface on the data logger. The level measurement equipment itself exports the data via an RS-485 interface with a voltage output of 0-1 V. In order to be able to best adjust the measurement to the expected water level and the installation conditions, the pressure sensor is offered in three measurement ranges of up to 50, up to 100 and up to 200 cm water level.



Technical data

- | | |
|--------------------------|---|
| • Measurement range: | 0 ... 50 cmWS
0 ... 100 cmWS
0 ... 200 cmWS |
| • Operating voltage: | 12 V |
| • Operating temperature: | 0 ... 80 °C |

Advantages

- Precise measurement due to high resolution

Level measurement equipment with capacitive level transmitter

In the case of this level measurement equipment, the water level is determined via the change of capacity between an internal and external conductor. The capacitive level transmitter is installed in a PVC protective stilling pipe as protection from external influences, and in particular from waves. The data are exported via a voltage output with 0 to 1 V.

When combined with a UGT data logger with micro computer, the data can be recorded and after appropriate calibration the water level can be directly read out and an intelligent power management can be implemented. The reading out of the data from the logger takes place using an RS-232 interface.



Technical data

- Measurement range: 0 ... 1 m
- Operating voltage: 12 V
- Operating temperature: 0 ... 80 °C

Advantages

- Inexpensive

Lake probe PD1

The lake probe is a measurement device designed to determine the low pressure gradients associated with the typical flow processes at the bottom of lakes and rivers. For example it is possible to establish whether water flows off via the bottom of the lake or river, or whether the groundwater additionally feeds the lake or river. This information is important for hydrological, hydrogeological and geotechnical monitoring amongst other things. The measurement principle is based on the selective determination of pressure gradients between the pore water in the lake sediment and the absolute pressure from the free water level in a closed, water-filled system. In addition to the composition of the upper sedimentary layer (grain size, capillarity) and the consequent penetration resistance of the probe, the measurement process is above all influenced by hydraulically dynamic interactions between the current near the bottom of the water and the pore area current. The measurement equipment can be used up to a water depth of 40 m and

operates at a fixed data recording rate of 20 s. The pore water pressure is determined using a differential pressure sensor, while the current water depth is calculated at the same time using an absolute pressure sensor. The measurement position of the probe at the bottom of the water can be checked using the integrated incline sensor. Values are recorded and administered in a micro logger in a handheld format. The UGT software tools supplied with the equipment facilitate simple subsequent visualisation and processing of the data on the PC.



Advantages

- Determination of the currently effective gradients at the bottom of the water

Technical data

- Material: V2A steel
- Pore water pressure: -700 ... 700 mmWC Resolution: 1 mmWC
- Water level absolute pressure: 0 ... 6000 cmWC Resolution: 1 mmWC
- Angle of incline: 0 ... 89° Resolution: 1°

smarTROLL™ MP® Handheld

The smarTROLL MP Handheld is a multiparameter probe combining industry-leading water quality sensors with revolutionary smartphone mobility. The data is read out and stored using an Apple® app so that you can use your iPhone, iPad or iPod instead of additional handheld units. The combination of six sensors and intelligent software enables to record a complete set of up to 14 parameters with only one device.

Chemical parameters:

- Dissolved Oxygen (0 ... 50 mg/l)
- pH (0 ... 14)
- ORP (±1400 mV)
- Conductivity (actual and specific; 5 ... 10000 µS/cm)
- Salinity
- Total dissolved solids
- Resistivity
- Density

Physical parameters:

- Air temperature (-20 ... 70 °C)
- Water temperature (-5 ... 50 °C)
- Barometric pressure (300 ... 1100 mbar)
- Water level (to 76 m absolut)
- Water pressure

Therefore this system is applicable for quality spot checking in ground and surface water as well as for long term monitoring and even vertical profiling.



Advantages

- Portable
- No additional handheld unit
- Streamline Data Management
- Low maintenance

Technical data

- Operating temp.: -5 to 50 °C (23 to 122 °F)
- Dimensions: 4.7 (OD) x 26.9 cm
- Weight: 694 g
- Material: PVC, 316 stainless steel, titanium, Acetal, Viton®, PC/PMMA
- Reading rate: 1 reading every 10 seconds; data logged to smartphone
- Power: 6 VDC from battery pack
- Cable: 1.5 m, 4.6 m, 9.1 m, 30.5 m
- Interface: iPhone® 4S, iPod touch® 5, or iPad® 3, 4, mini or later; iOS 6.0 or later. BLE radio. Purchase the iSitu™ App at the Apple® App Store.

smarTROLL™ RDO® Handheld

The smarTROLL Rugged Dissolved Oxygen (RDO) is an optical dissolved oxygen probe combined with revolutionary smartphone mobility. The data is read out and stored using an Apple® app so that you can use your iPhone, iPad or iPod instead of additional handheld devices. Up to four parameters can be recorded simultaneously.

Parameters:

- Dissolved oxygen (0 ... 50 mg/l)
- Barometric pressure (300 ... 1100 mbar)
- Air temperature (-20 ... 70 °C)
- Water temperature (-5 ... 50 °C)

The system is applicable for spot checking in freshwater and saltwater, dam water sampling, effluent monitoring, stormwater management and NPDES requirements.

Advantages

- Price efficient
- Streamline Data Management
- Low maintenance



Technical data

- Operating temp.: -5 to 50 °C (23 to 122 °F)
- Dimensions: 2.8 (OD) x 16.8 cm
- Weight: 255 g
- Material: 316 stainless steel, titanium, Acetal, Viton®, PC/PMMA
- Reading rate: 1 reading every 10 seconds; data logged to smartphone
- Power: 6 VDC from battery pack
- Cable: 1.5 m, 4.6 m, 9.1 m
- Interface: iPhone® 4S, iPod touch® 5, or iPad® 3, 4, mini or later; iOS 6.0 or later. BLE radio. Purchase the iSitu™ App at the Apple® App Store.

Rugged TROLL® Instrument

Titanium Rugged TROLL 100 and 200 instruments offer durability and affordability. These instruments are designed for long- and short-term groundwater and surface-water monitoring. They record changes in water level, pressure and temperature. For programming and downloading

data the instrument can be connected to a docking station or a Rugged TROLL ComDevice, which connects either to a PC or Rugged Reader Handheld PC. The data logs can be customized switching between linear, fast linear and event mode.



Technical data

- Operating temp./measurement range: 0 to 50 °C (32 to 122 °F) / 9 to 76 m
- Dimensions / material: 2.62 (OD) x 14.43 cm / titanium
- Storage capacity: 1.0 MB
- Cable: Standard and custom lengths available
- Power: Internal battery (Lifetime 10 years or 2M readings)

Advantages

- Simplified setup and data retrieval
- Useable in harsh environments

Level TROLL® 400 / 500 / 700

The Level TROLL series offers three adapted level meters to suit your application. They are available with vented and non-vented pressure sensors for water levels up to 351 m. The body is especially

rugged and narrow enough to fit in observation wells with a diameter as narrow as 2 cm. Win-Situ®5 and Win-Situ® Mobile Software can be used for simple data collection and management.



Level TROLL® 400

- Suitable for fresh water and industrial monitoring
- Absolute instrument
- Linear, fast linear, and event logging modes; 2.0 MB
- Measurement range: to 341 m (non-vented)

Level TROLL® 500

- Ideal for groundwater and surface-water monitoring
- Gauged and absolute instruments
- Linear, fast linear, and event logging modes; 2.0 MB
- Measurement range: to 351 m (vented)

Level TROLL® 700

- Optimized for aquifer characterization
- Gauged (vented) and absolute (non-vented) instruments
- Linear, fast linear, linear average, event, step linear, and true logarithmic logging modes; 4.0 MB
- Measurement range: to 693 m (non-vented) to 351 m (vented)

Technical data

- Operating temp.: -20 to 80 °C (-4 to 176 °F)
- Dimensions: 2.08 (OD) x 22.9 cm (Level TROLL 400)
1.83 (OD) x 21.6 cm (Level TROLL 500, 700)
- Weight: 245 g (Level TROLL 400); 197 g (Level TROLL 500, 700)
- Material: Titanium
- Accuracy pressure: ±0.1% full scale
- Accuracy temperature: ±0.1 °C
- Output options: open communication protocols including, Modbus/RS485, SDI-12, and 4-20 mA
- Power: Internal battery or line power / solar panel

Advantages

- Rugged body
- Narrow design

Aqua TROLL® 100/200 Instrument

The Aqua TROLL 100 is designed to monitor and log conductivity, temperature and the Aqua TROLL 200 additional water level in harsh environments. The instrument can also calculate and record the derived parameters specific and actual conductivity, salinity, total dissolved solids, water density and resistivity. The titanium housing safeguards against corrosion. The standard logging modes include linear, linear average and event testing with logging rates as fast as 1/s. Because of the long-life cycle this product is especially suitable for long time monitoring in Aquifers, Wetlands, remediation projects or mine water management but can also be used for short-term measurements such as tracer studies. Hence to the dynamic density compensation the system delivers superior

water level accuracy also in environments where salinity values vary due to mixing, rainfall or tides.



Advantages

- Titanium housing
- Dynamic density compensation

Technical data

- Dimensions: 1.83 (OD) x 31.5 cm
- Weight / material: 500 g / titanium
- Accuracy conductivity: < 80,000 ±0,5% of reading
> 80,000 ±1% of reading
- Accuracy temperature: ±0,1°C
- Accuracy pressure: ±0,1% full scale
- Output options: open communication protocols including, Modbus/RS485, SDI-12, and 4-20 mA
- Storage capacity: 4.0 MB
- Power: Internal battery or line power / solar panel

Aqua TROLL® 400 MP Instrument

The Aqua Troll 400 Multiparameter Instrument is ideal for monitoring water quality in a variety of environmental applications. The instrument leverages In-Situ® Inc.'s patented, EPA-approved RDO® Technology. The compact instrument houses six water quality sensors and measures up to 12 parameters.

- actual and specific conductivity, salinity, total dissolved solids, resistivity, density
- Dissolved oxygen
- ORP
- pH
- Temperature
- Water level and water pressure

The narrow-diameter instrument operates in fresh, marine and process water.

Advantages

- Easy installation
- Long-lasting calibration reduce site visits
- DO readings automatically compensated for salinity



Technical data

- Operating temp.: -5 to 50 °C (23 to 122 °F)
- Dimensions: 4 (OD) x 26.9 cm
- Weight / Material: 694 g / PVC, Acetal, Titanium, stainless steel, Viton®, PC/PMMA
- Measurement range: to 76 m (non-vented)
- Accuracy conductivity: ±1%
- Accuracy dissolved oxygen: < 8 mg/L ±0,1 mg/L , <20 mg/L ±0,2 mg/L,
>20 mg/L ±10%
- Accuracy pressure: ±0.1% full scale
- Accuracy pH / ORP: ±0.1 pH unit / ±0.5 mV
- Accuracy temperature: ±0.1°C
- Output options: Modbus / RS 485 and SDI-12
- Power: 8 - 36 VDC external line power / solar panel

Aqua TROLL® 600 MP Instrument

The Aqua TROLL 600 is a customizable, powerful multiparameter sonde. It combines industry-leading water quality sensors with revolutionary smartphone mobility, allowing you the ability to collect and analyze data using the VuSitu Mobile App on your Android™ device. Rugged in groundwater and corrosion-resistant in surface water, the Aqua TROLL 600 delivers accurate data in an easy-to-use, customizable instrument. Features include a quick-read LCD status screen for visual indicators of overall readiness, battery life, internal log, and sensor status, as well as integrated Bluetooth® connection for wireless data access, and an onboard micro SD card for data backup and download.

Drift-resistant sensors, low power consumption with 9+ months of battery life and a corrosion-resistant design make it perfect for challenging environments and long-term deployments in fresh and salt water applications. The advanced active and passive antifouling systems to protect all sensors reduce cleaning requirements and extend the life of your investment. The Aqua TROLL 600 features self-compensating turbidity, optical RDO, and level, and



comes in vented and non-vented options. It is the only multiparameter sonde to have a sub-2 inch passive and active antifouling system for all sensors, including conductivity. Every detail has been engineered for maximum accuracy and minimum hassle. This flexible, data-ready sonde easily integrates with telemetry systems and our new HydroVu Data Services platform for real-time feedback on all your remote water monitoring sites. Reliable data logging and plenty of memory mean less trips to the field. For quick and easy data-sharing the sonde gives you real-time data access and instant results that can be emailed on the spot using your mobile device. The intuitive VuSitu Mobile App is an all-in-one software package that provides auto-configuration, simplified calibration, directed data analysis, and automated report creation.

Features:

- Base sensor configuration includes EPA-approved optical RDO, pH/ORP, turbidity, conductivity, temperature, and pressure
- Sub-2 inch passive and active antifouling system for all sensors, including cleanable conductivity
- Vented (gauged) or non-vented (absolute) pressure measurement
- Wireless Bluetooth® connection to the VuSitu Mobile App for Android or Win-Situ 5 for PC/laptop
- Site tagging, GPS coordinates, and auto-calibration functions through the VuSitu Mobile App
- LCD display for visual indication of overall probe functionality and battery, sensor, and log status
- Internal memory plus an integrated micro SD card for data backup and download
- RuggedCable options in poly or Tefzel® for use in harsh environments
- Field-tested design with corrosion-resistant housing
- NIST calibration report for guaranteed accuracy
- Dual-sided restrictor acts as a storage cup between deployments
- Compatible with low-flow system (sold separately)

Technical data

- Operating temp.: -5 to 50 °C
- Dimensions: Ø 4.7 cm / Length 59.2 cm (includes connector)
With bail: 72.9 cm
- Weight: 1.45 kg (includes all sensors, batteries and bail)
- Wetted materials: PC, PC alloy, Delrin™, Santoprene™, Inconel™, Viton™, Titanium, Platinum, Ceramic, Nylon
- Cable options: Vented or non-vented polyurethane or vented Tefzel®
- Output options: RS-485/MODBUS, SDI-12, Bluetooth®
- Memory: 16 MB internal memory + 8 GB micro SD card (included, user replaceable)
- Internal power supply: 2 internal user-replaceable Alkaline D batteries
>6 months typical with wiping
>9 months typical with no wiping
- External power supply: 8-36 VDC (not required for normal operation)
Sleep: 0.10 mA typical
Measurement: 15 mA typical, 45mA Max



Level measurement equipment with ultrasonic scanning

194100	Level measurement equipment with ultrasonic scanning
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Level measurement equipment with pressure transducer

194200	Level measurement equipment with pressure transducer
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Level measurement equipment with capacitive level transmitter

194300	Level measurement equipment with capacitive level transmitter
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Lake probe PD1

199000	Lake probe PD1
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smarTROLL™ Handheld

195500	smarTROLL™ MP® Handheld
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195501	smarTROLL™ RDO® Handheld
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Rugged TROLL® Instrument

195510	Rugged TROLL® 100
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195511	Rugged TROLL® 200
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Level TROLL® Instrument

195520	Level TROLL® 400
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195521	Level TROLL® 500
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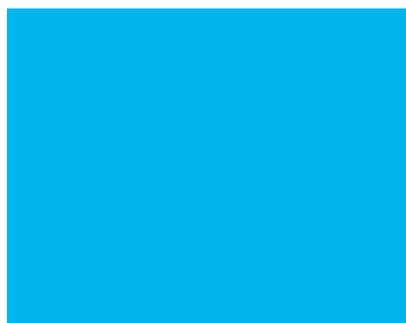
195522	Level TROLL® 700
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Aqua TROLL® Instrument

195532	Aqua TROLL® 100
195530	Aqua TROLL® 200
195531	Aqua TROLL® 400 MP - Multiparameter Instrument
195533	Aqua TROLL® 600 MP - Multiparameter Instrument

ORDERING DETAILS





SAMPLING AND ANALYTIC

It is essential to take water samples to get information on the state of the water or aquifer. This task makes very high demands both of the people processing the information and the sampling devices so that conclusive samples can actually be taken. In hydrology sampling is not, however, merely restricted to the water. Samples of sediment provide information on the current state and development of a body of water.



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Groundwater-Shuttle

Patent-No.: DE 10 2004 041 334 B3

Patent holder: GFI Grundwasserforschungsinstitut GmbH, Dresden

The shuttle guard system permits the removal of groundwater samples from an undistorted area of groundwater. Distortions even arise in regularly developed measurement points due to vertical currents in the water column (through unavoidable vertical differences in pressure, temperature and/or substance concentration). The associated substance transportation has effects on the geochemical composition of the sampled water and/or the correct assignment of the sample to the depth.

It is not possible to obtain a representative groundwater sample reliably using classic methods where there are vertical currents.

The shuttle guard system prevents vertical currents and the associated danger of substance transportation, thereby permitting long-term undistorted sampling.

The system can easily be retrofitted in existing, regularly developed groundwater measurement points and can also be dismantled again without causing damage. Unlike special measurement points and installations which are associated with considerable costs and which usually only allow sampling of a restricted depth range with removal of small sample quantities.



The system comprises two parts:

- Groundwater station (GW station) to separate the groundwater area from the affected stagnant water
- Groundwater shuttle (GW shuttle) for isobar sampling under in situ pressure

The PVC groundwater (GW) station has been designed for permanent installation in a measurement point, but can also be easily removed again for maintenance work. It has two inflatable packers which permanently seal the filter area of the groundwater area that water flows through to protect this against the stagnant water above and below it, thereby preventing substance transportation between aquifer and stagnant water or atmosphere. To do this, the GW station is positioned in the

groundwater measurement point in such a way that one packer is situated above and another below the filter.

The sample quantity per sample is 1 litre. The sampling is controlled using a laptop with Bluetooth connection.

The system shown was developed at the DGFZ Dresdner Grundwasserforschungszentrum e.V. (Dresden Groundwater Research Centre) as part of an R&D project in cooperation with UGT Müncheberg GmbH. The development has been supported by the Federal Ministry of Economics and Technology following a decision by the German Bundestag under FKZ IW072066 and MF090094.

Technical data

• Sample volume:	1000 ml
• Groundwater station material:	PVC
• Groundwater shuttle material:	V2A steel
• Sampling bag material:	PA/PE 5-layer film

Groundwater-Shuttle

To take a groundwater sample the GW shuttle is lowered into the measurement point where it docks onto the GW station. There is no need to pump water from the groundwater measurement point because the GW station separates the filter area from the stagnant water. For a perfect sample the connection path between sample location and sample bag is first rinsed with fresh groundwater after docking. Only then does sampling take place.

The water sample is conveyed at the corresponding water depth into the pressure-retaining, replaceable sample container, maintaining the ambient pressure. Even during the inflow of water there is no serious change in pressure here. Degassing and precipitation processes are avoided.

The GW shuttle is then undocked from the GW station and moved out of the measurement point. The filled sample container is removed. If necessary the sample can be taken all the way to the laboratory in the container maintaining in situ pressure. A new sample container is inserted in the GW shuttle to take another sample.

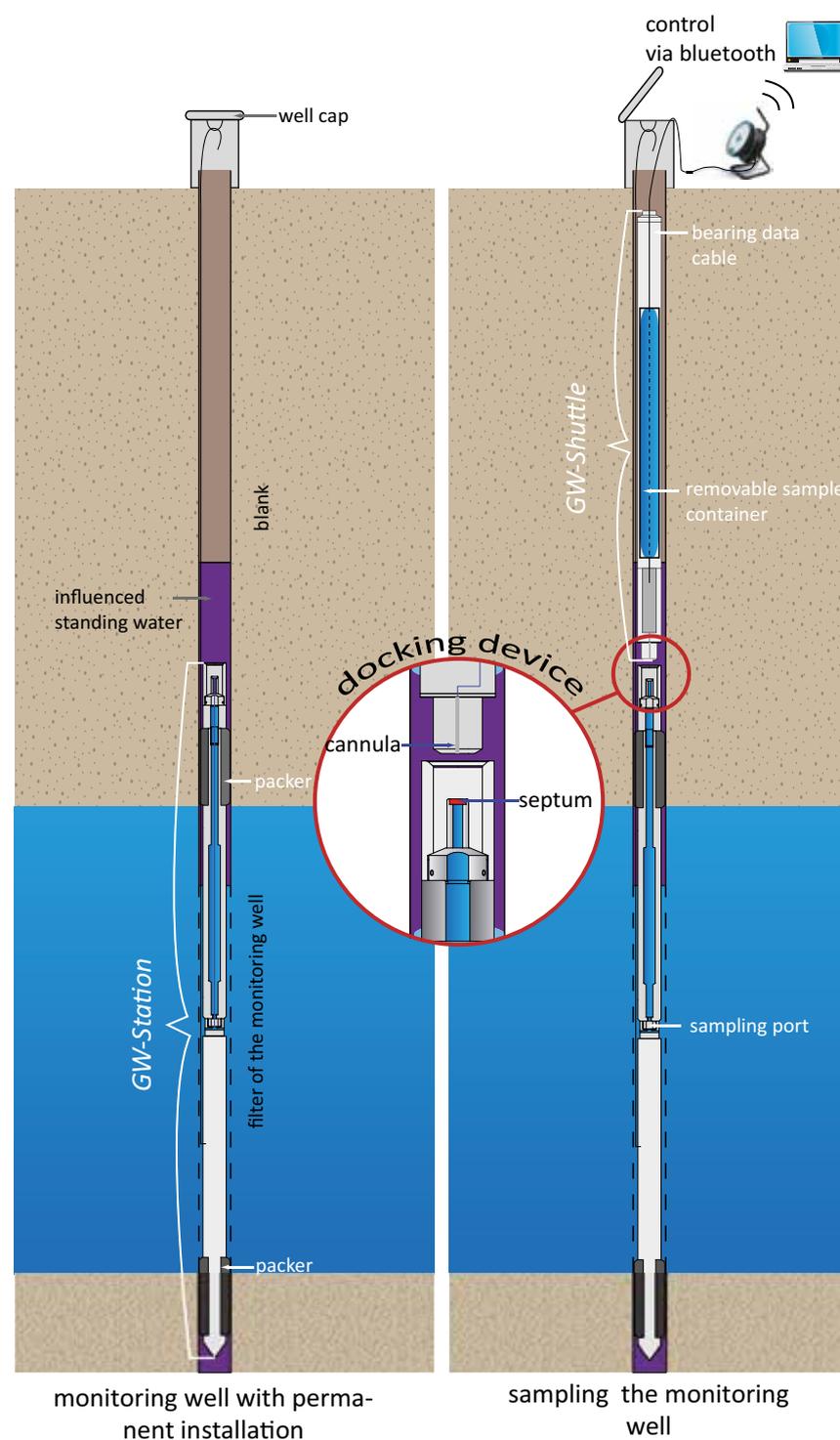
Advantages

- Taking undistorted groundwater samples under in situ pressure
- Simple retrofitting in existing measurement points
- Large sample quantity
- Protection of the aquifer
- Where applicable non-destructive, fast dismantling

Every groundwater measurement point must be equipped with its own GW station which permanently protects the aquifer and is available at all times for taking samples. The modular design of the GW station enables simple adaptation to the filter length of the groundwater measurement point.

However the filter length should not exceed 10 m.

The GW shuttle must only be procured once. It can serve all GW stations. Additional sample containers are recommended depending on the required number of samples and frequency of sampling.



Sedimentation traps

The sedimentation trap is a plate trap that has been produced by UGT GmbH under licence from IGB Berlin, and which is used to measure the sedimentation of fine organic and inorganic particles found on the beds of bodies of water. The defining hydrodynamic conditions of the beds of bodies of water are reproduced through the design and arrangement of the plate traps, and the sedimentation rates in moving water (e.g. rivers, shallow seas, seabed, canals and harbour basins) are measured under the effect of gravity and soil shearing stress.



It consists of a vertically mobile piston whose upper surface constitutes the collecting surface. When the water charged with sedimentary particles sweeps past the upstream approach rim, a boundary layer develops under the impact of shearing stress similar to that at the bottom of the water. The particles settle on the collecting surface in relation to these conditions. A rigid roof connected to the piston protects the deposited sediment from external influences.

At the end of the exposure period the deposited material is transported to the inside of the sedimentation trap by lowering the mobile piston. The roof seals the sedimentation trap in this position and prevents material getting lost when the trap is lifted out of the water. The movement of the piston is pneumatic. A hand pump is recommended for simple use in the field. The hose connection provided for this has an inner diameter of 4 mm.

The sedimentation trap can be placed directly on the bottom of the water or can be positioned at the desired height in the water using a mounting rod.



Technical data

• Material:	Acrylic glass (PMAA)	
• Plate:	Total diameter	350 mm
	Total height	120 mm
• Approach rim:	Diameter	100 mm
• Piston:	Diameter	150 mm
	Height	27 mm

Advantages

- The recording of sedimentation under realistic conditions
- Installation possible at any height

AQUA-CHECK 2

The Aqua-Check 2 is a highly sensitive and portable photometer, built for the precise determination of substances and their concentration in water. As the device was equipped to measure a broad variety of water parameters, it responds both to industrial demands, and to those of the fishery, aquaculture and koi keeping sectors.

The Aqua-Check 2 draws upon the photometric procedure, which is eminent in physics and chemistry. The photometer sends light beams of a defined wave length through a water sample, which is especially coloured for this procedure. Using the measured change in intensity of the incident light, the device can meticulously establish the concentration of the parameter under investigation. Conventional tests commonly use cuvettes. However, as they may vary in wall thickness, or may be subject to impurities, measured values are often distorted. In stark contrast, the Aqua-Check 2 determines these values without cuvettes, en-



suring precise measurements. Additionally, the photometer does not need to be calibrated. Owing to its fully extendable measuring probe, a broad measuring range is at the Aqua-Check 2's disposal. Hence, even minuscule concentrations of phosphate can be detected reliably. The Aqua-Check 2 is delivered with solutions for the titrimetric determination of total and carbonate hardness by default. Using the test kit included in its delivery items, a total of 390 individual analyses can be carried out. Although the pro equipment allows for environment-independent water analyses, it nevertheless ensures professional measurements. The Aqua-Check 2 is powered by a customary 3-Volt coin battery, which allows for up to 1'000 individual measurements.

Delivered in its sturdy hard case, the entire analysis equipment is well protected, and can be transported with ease on field trips. The photometer, all necessary indicators, testing tubules, as well as the timer and safety glasses are always ready for usage, thanks to the neat arrangement within the hard case. Preparatory time for the measurement is thus minimal.



Technical data

Parameter	Measuring Range
• Ammonium (NH ₄ ⁺)	0 – 2.0 mg/L
• Nitrite (NO ₂ ⁻)	0 – 1.0 mg/L
• Nitrate (NO ₃ ⁻)	6 – 120 mg/L
• pH-value	6.0 – 9.0
• Chlorine (Cl ₂)	0.1 – 1.6 mg/L
• Phosphate (PO ₄ ³⁻)	0.01 – 1.5 mg/L
• Silicon (Si)	0.05 – 1.0 mg/L
• Copper (Cu ²⁺)	0.02 – 3.0 mg/L
• Iron (Fe)	0.1 – 10.0 mg/L
• Fluoride (F ⁻)	0.1 – 1.0 mg/L
• Oxygen (O ₂)	2.5 – 18.0 mg/L

Advantages

- Simple operation due to a two-button control system
- Temperature-independent measuring procedure
- No calibration necessary
- Measurement without cuvettes
- Up to 1'000 measurements without battery exchange
- Laboratory-precise measuring procedure
- Portable handheld device

WaSP 12V Submersible Pumps

These simple to use 12V submersible pumps provide the flow rates and control needed to purge and sample groundwater from boreholes at depths of up to 30 metres.

The Waterra range of WaSP 12V submersible pumps are used to purge and sample groundwater from boreholes. They are simple to use, and with the addition of a WaSP-F1 Low Flow Controller, provide the groundwater professional with the ability to sample at low or high flow rates.

The optional Waterra WaSP-F1 low flow controller is the ideal accessory for the WaSP 12V submersible pump. See separate data sheet for details.

The pumps are also characterised by their long service life of 400 hours. This is up to 100% longer than that of pumps from other suppliers.

P2, P3 and P5 have an outer diameter of 46 mm and are therefore suitable for measuring points with

a diameter of 50 mm or more. The N21 can be used for narrower measuring points. Therefore all WaSP pumps are suitable for 2" wells.

Every pump is delivered with a sufficiently long lead so that its maximum delivery height can be utilised. No cables need to be joined together.

All pumps require discharge hoses with 10 mm inner diameter for the water. Hoses and cable ties for all WaSP submersible pumps are ordered and delivered separately.

Advantages

- Easy to use
- Inexpensive
- Continuous pumping
- Smooth and controlled flow rates
- Long life expectancy



WaSP-F1 Low Flow Controller

Technical	Units	WaSP P2	WaSP P3	WaSP P5	WaSP N21
Material		PVC	PVC	PVC	PVC
Maximum Lift	m	12	18	30	21
Maximum Flow	l/min	9.5	12	14	9
Duty cycle		Continuous	Continuous	Continuous	Continuous
Pump diameter	mm	46	46	46	37
Pump body length	mm	241	381	610	406
Max. Amps	amp	7	11	15	4
Discharge tube (ID)	mm	10	10	10	10
Supplied cable	m	15	21	33	24

MP1 Submersible Pump

The MP1 submersible pump has been specially designed for sampling groundwater monitoring sites with a diameter of 2" to 4".

The pump is operated by an adjustable frequency inverter.

This provides a continuously adjustable delivery rate between 0 and 2.5 m³/h.

Pump and motor make up a complete unit which can be easily dismantled for cleaning or maintenance purposes. All components of the pump are made from materials that do not give off any foreign substances to the pumped medium. This means there can be no influencing or distortion of water samples.

The motor is a liquid filled, canned submersible motor with po-

wer supply via a Teflon cable. The cable can be changed, and is available in various lengths.

Technical data

- Delivery rate: Up to 2.5 m³/h
- Delivery height: Up to 98 m
- Media/water temperature: 0 °C to +35 °C
- Immersion depth: max. 90 m
- Voltage: 3 x 220 V, 400 Hz
- Connection thread: Rp 3/4
- Net weight: 2.5 kg



Advantages

- Compact design
- Easy cleaning and maintenance
- Fits in any measuring gauge from 2"

Picarro L2140-i Analyzer

Simultaneous measurement of oxygen and hydrogen isotopy

The analysis of the water balance is increasingly supported by isotopy over the last years. The distribution of the seasonal input as well as the shift through evapotranspiration enables the determination of retention times and the differentiation of the water components (surface run off and ground water discharge using the isotopic signature).

- Simultaneous measurement of $\delta^{18}\text{O}$, $\delta^{17}\text{O}$, δD and ^{17}O excess in liquids and vapour
- Easy use at the push of a button
- High measurement accuracy and repeatability

In combination with the UGT tipping counter different discharge depths can be sampled and analyzed.



L2130-i with Continuous Water Sampler (CWS) for continuous analysis of $\delta^{18}\text{O}$ and $\delta^2\text{H}$ in liquid water

Additionally available analyzers on request:

- **L2130-i** (δD and $\delta^{18}\text{O}$ in H_2O)
- **L2140-i** (δD , $\delta^{18}\text{O}$, $\delta^{17}\text{O}$ and ^{17}O excess in H_2O)

Groundwater-Shuttle

198500	2 m long, cable length up to 100 m
198510	With Bluetooth, cable drum, cable length up to 100 m

Sedimentation trap

198000	Sedimentation trap
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Aqua-Check 2

194700	portable photometer built for the precise determination of substances and their concentration in water
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WaSP 12V Submersible Pumps

194500	WaSP P2 12 V Submersible Pumps 9.5 l/min
194501	WaSP P3 12 V Submersible Pumps 12 l/min
194502	WaSP P5 12 V Submersible Pumps 14 l/min
194503	WaSP N21 12 V Submersible Pumps 9 l/min
194504	WaSP-F1 Flow Controller for 12 V Submersible Pumps

MP1 Submersible Pump

194600	MP1 Submersible Pump
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Picarro L2140-i Analyzer

196294	Simultaneous measurement of oxygen and hydrogen isotopy
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Related Products	Usable for
Sample container	<ul style="list-style-type: none"> • Groundwater shuttle
Sample bag PA / PE 5-layer film	<ul style="list-style-type: none"> • Groundwater shuttle
Guide pulley For lowering the groundwater shuttle in a way that is simple and protects cables	<ul style="list-style-type: none"> • Groundwater station • Groundwater shuttle
Additional volume To keep the pressure in packers constant for longer	<ul style="list-style-type: none"> • Groundwater station
Suspension To affix equipment within the sealed measurement point pipe	<ul style="list-style-type: none"> • Groundwater station • Additional volume sensor
Hand membrane pump with manometer Aluminium 18 ml stroke	<ul style="list-style-type: none"> • Sedimentation traps • Groundwater shuttle
Mounting rod V2A steel, square	<ul style="list-style-type: none"> • Sedimentation traps
Head for mounting rod	<ul style="list-style-type: none"> • Sedimentation traps
Slide to attach sedimentation trap to mounting rod V2A steel, square	<ul style="list-style-type: none"> • Sedimentation traps
PVC hose Internal diameter 4 mm	<ul style="list-style-type: none"> • Sedimentation traps
Discharge hoses Inner diameter 10 mm - LDPE 1/2x3/8 inch (~10x12 mm) - 30 m - LDPE 1/2x3/8 inch (~10x12 mm) - 100 m - 3-way valve (for hoses with 9-11 mm Inner diameter) - 1 pack of 25 cable ties, 100 mm	<ul style="list-style-type: none"> • WaSP 12V Submersible Pumps
WaSP-F1 Flow Controller	<ul style="list-style-type: none"> • WaSP 12V Submersible Pumps

ORDERING DETAILS



METEOROLOGY







WEATHER STATIONS

Weather stations are used to record large-scale dynamic processes within the atmosphere in addition to limited spatial climates such as those for woods or cities. These processes and the resultant weather dynamics have decisive influence on the water balance of a region, on the soil, on flora and fauna and thus also on land use.

The extension of a measurement station to include meteorological sensors generally generates increased information, permitting a comprehensive picture of the hydrological, geological, biological or chemical processes. The equipment on the weather station can look very different depending on the objective of the application.



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Weather station UGT

UGT offers specially customised weather stations to meet the precise requirements of the planned use of the weather station. The core element of these weather stations is the tried and tested UGT data logger DL-200. Depending on the project requirement, sensors for the following examples of parameters can be connected to these data loggers:

- Wind direction
- Wind speed
- Solar radiation
- PAR
- Air temperature
- Air humidity
- Air pressure
- Precipitation
- Soil temperature (optionally at different depths)
- Soil moisture (optionally at different depths)

In the following chapters on the subject of meteorology you will find a summary of the standard meteorological sensors offered by UGT. Other sensors are possible on request. Equipping weather stations for specific applications makes it possible to also record non-meteorological data such as soil moisture at the same time.

The measurement data can be transferred and retrieved from the data logger using remote data



transmission, by USB cable or by feeding data into a data network. The efficient energy management of the logger reduces the energy requirements of the weather station to a minimum. The energy supply can therefore be provided optionally using the mains current (230V / 50 Hz) with back-up battery to bridge failures in the mains current with solar panel or using rechargeable batteries. You can find detailed information on this in this catalogue in the section on “data acquisition and energy supply”.

UGT uses weather station masts made from high quality V2A stainless steel pipe for reliable installation and minimal influence on sensors. The ground socket specially developed for this (which

Advantages

- Always precisely adapted to the project requirements
- Comprehensive and efficient logging technology
- Compatible with all commercially available sensors

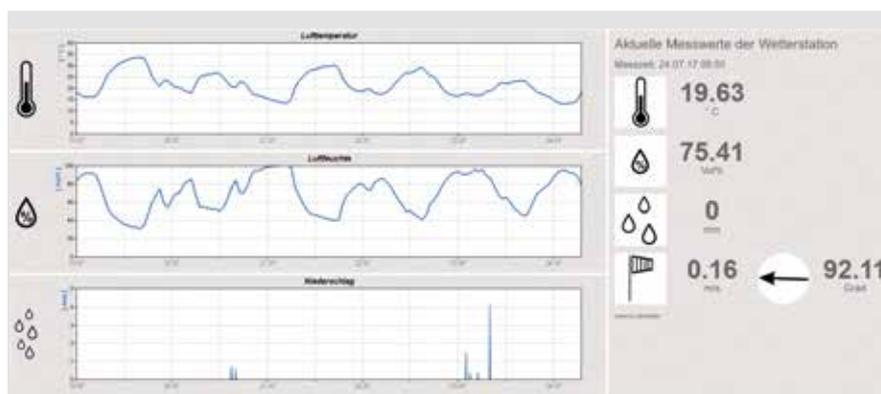
can be tilted depending on mast length and location) and the tensioning using stainless steel cables guarantee simple installation and stability for the weather station. The masts are available in any length in line with the individual character of the UGT weather stations, but are generally 2 m long in accordance with German Meteorological Service guidelines

Compact weather station UGT

The UGT compact weather station is an inexpensive alternative to the standard weather station. The UGT weather station can be used both for continuous operation and for mobile use. The data are provided via the SVADSS online portal.

UGT compact weather station consisting of the following sensors and data connection:

- wind speed
 - measuring range from 1 m / s -40 m / s
 - measurement accuracy $\pm 5\%$
- wind direction
 - measuring range 2,5° ... 357,5°
 - resolution 11.25°
 - measurement accuracy $\pm 5^\circ$
- humidity
 - measuring range 0 ... 100% RH
 - measurement accuracy $\pm 2.5\%$ RH
- air temperature
 - measuring range -40 ... 60 °C
 - measurement accuracy ± 0.5 °C
- global radiation
 - measuring range: 0 ... 2000 W/m²
 - sensitivity: 20mV per 1000 W m⁻²
 - measurement accuracy 7%
- SMT-100
 - measurement of soil moisture
- Rain gauge
 - measurement interval 10s to 4h
 - statistics compaction possible
- data logger
 - measurement interval 10s to 4h
 - statistics compaction possible
- housing IP68 / mast
- solar power supply 10W, support battery 12V / 25Ah
- SVADSS Data Integration Box (exclusive SIM card)
- SVADSS standard data service for up to 10 channels:
 - storage of data in SQL database on SVADSS own server
 - data interrogation of the measuring devices up to 4x daily, data is available immediately after the query online
 - standard visualization over any time period
 - automatic validation and flagging of minimum, maximum and delta errors during the recording of measured values
 - current sensor status
 - standard statistics: Totals & Mean, minimum and maximum over day, week, month, year
 - data download as csv file by authorized customers or employees



Advantages

- compact design
- transportable, light weight
- perfect for accompanying measurements on Bachelor's and Master's theses
- matched system
- data retrieval via Internet, secure access
- inexpensive

iMETOS® pro weather station

The iMETOS® pro weather stations can be equipped with up to 80 sensors, and can therefore deal with almost all established micro meteorological challenges. The energy supply for the entire weather station is provided using solar panels and rechargeable batteries, so that no mains connection is required on the installation site. All data measured by your iMETOS® pro are transmitted via GPRS/GSM to the uniform “field climate” user platform with password protected access. This website offers the following options: access to weather data in the most diverse forms (tabular, graphics, various averages etc.), alert programming for SMS alerts (threshold value changes, entering a telephone number etc.) and options such as automatic M2M interface for downloading to other servers.

You can change your parameters at any time, thereby adapting your requirements quickly and individually. This central internet solution requires absolutely no additional software on the part of the user, but merely an internet access with browser. It therefore has unrestricted potential for expansion. The field climate platform provides open interfaces for customised (XML EXCEL and other) solutions to configure local alert networks for cooperatives, regions, pesticide dealers etc.



Technical data

- | | |
|--|-------------------------|
| • Dimensions without sensors: | 54 cm x 18 cm x 18 cm |
| • Weight without sensors: | 2.2 kg |
| • Measurement interval/logging interval: | adjustable from 5 mins. |
| • RAM memory: | 4 MB on board |

These solutions are developed jointly with experts from Pessl Instruments and local partners.

The equipping of the weather station with sensors also takes place in agreement with the customer. When doing so the selection of sensors is not limited to purely meteorological sensors. iMETOS® pro weather stations with special soil moisture measuring station

for hydrological measurement networks can also be equipped with the EnviroScan or Ech2O EC5, Ech2O HS10 und Ech2O 5TE soil moisture sensors and with tensiometers.

Advantages

- Up to 80 sensors as required for the set task
- Compact design
- Autonomous energy supply

Clima sensor 2000 WNHTF

The Clima sensor 2000 WNHTF represents a new generation of sensors.

It logs the following parameters uniformly and reliably, and is compact:

- Wind speed
- Precipitation yes/no
- Brightness (east/south/west)
- Temperature
- Humidity
- Nightfall

The current outputs can be used to control external devices and/or record analog measurement data. The sensor perfectly combines the sensors for the most important five parameters for environmentally-related control technology (window blinds, greenhouses etc.) but thanks to standardised

outputs is, however, also extremely suitable for logging environmental measurement data. The compact design permits simple, inconspicuous assembly. The sensor is supplied complete with 10 m connecting cable and a stainless steel mounting clamp for installing on walls or masts. All external parts are corrosion-resistant, made from quality plastic. The Clima Sensor 2000 WNHTF also has a serial interface (RS 422/485), a DCF77 receiver for time and radio, as well as heating to protect against dewing. This compact sensor is also available for two, three or four of the above mentioned parameters on request.

Advantages

- One measurement instrument for five parameters
- Compact and robust design



Technical data

- Weight: 1.5 kg
- Precipitation: Measurement value signal output Yes/no
10 V / 0 V
- Brightness: Measurement range nightfall 0 ... 250 Lux
1 ... 100 Lux
Direction East, south, west
Signal output 3 x 0 – 10 V
- Wind speed: Measurement range signal output 0.5 ... 40 m/s
0 – 10 V
- Temperature: Measurement range signal output -20 ... 60 °C
0 – 10 V
- Humidity: Measurement range signal output 0 ... 100% rel. humidity
0 – 10 V

UGT weather station

161000 UGT weather station

UGT compact weather station

161005 UGT compact weather station

iMETOS® pro weather station

161037 iMETOS® pro weather station

161041 iMETOS® field climate

Clima Sensor 2000 WNHTF

162000 Clima Sensor 2000 WNHTF



WIND AND BARO TRANSMITTERS

Wind direction and wind speed, especially in the horizontal direction, are fundamental to meteorological considerations and to environmental measurement engineering. In times of alternative sources of energy, knowledge about wind conditions is also significant when planning and evaluating wind turbines. Using baro transmitters, information on the wind conditions to be expected can be obtained early on from the prevailing air pressure conditions.



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Compact wind sensor

This wind sensor is an inexpensive transmitter for measuring horizontal wind speed. The output signal is emitted as analog signal. The cup star is made of plastic while the housing is made from anodised aluminium and plastic.

The device has a PG 21 thread with 2 nuts for assembly.

Advantages

- Inexpensive

Technical data

- | | |
|----------------------|--|
| • Measurement range: | 0.5 ... 50 m/s |
| • Accuracy: | ± 3% of measured value or
± 0.5 m/s |
| • Resolution: | < 0.1 m/s |
| • Output signal: | 0 ... 2 V |



Classic wind sensor

The classic wind sensor is a transmitter for measuring the horizontal air flow irrespective of its direction using an analog output signal. The cup star speed is scanned using an opto-electronic, contactless and wear-free procedure and starts up particularly gently. There is a plug-in connection in the shaft of the device. Assembly is preferably on a mast.

All main parts are made from anodised aluminium. This wind sensor is equipped with an electronically regulated heater which can also be disconnected to save energy if wished.

Advantages

- High resolution
- Gentle start-up speed
- Contactless and wear-free speed measurement

Technical data

- | | |
|----------------------|--|
| • Measurement range: | 0.5 ... 60 m/s |
| • Accuracy: | ± 2.5% of measured value or
± 0.4 m/s |
| • Resolution: | < 0.05 wind path |
| • Output signal: | 0 ... 1 V |



Compact wind direction sensor

This wind direction sensor is an inexpensive transmitter for measuring horizontal wind direction with analog output signal. The wind vane is made of plastic, and the housing is made of anodised aluminium and plastic.

There is a PG 21 thread with 2 nuts on the underneath of the housing for mounting.

Advantages

- Inexpensive

Technical data

- | | |
|----------------------|------------|
| • Measurement range: | 0 ... 360° |
| • Accuracy: | ± 5° |
| • Resolution: | 2.5° |
| • Output signal: | 0 ... 2 V |



Classic wind direction sensor

The Classic wind direction sensor is an accurate, durable transmitter for measuring the direction of the horizontal air flow using an analog output signal. It is equipped with an opto-electronic scanner (code disc) which produces a particularly gentle start-up speed and which operates in a wear-free manner. All main parts are made from anodised aluminium.

A plug-in connector is provided in the shaft for assembly on a mast.

This transmitter has an electronically regulated heater which can also be disconnected to save energy if wished.

Advantages

- Durable
- High resolution and accuracy
- Start-up value 0.5 m/s

Technical data

- | | |
|----------------------|------------|
| • Measurement range: | 0 ... 360° |
| • Accuracy: | ± 2.5° |
| • Resolution: | 2.5° |
| • Output signal: | 0 ... 1 V |



Barometric pressure sensor

The baro transmitter is used to record the absolute barometric air pressure. The analog output signal can be evaluated for meteorological purposes or used as input signal for control systems and automatic controls. The prevailing absolute pressure is proportionally converted to a standardised electrical output value using electronics downstream of the piezo-resistive sensor.

The plastic housing is splashproof and protects the circuit from weather influences. A sinter filter connected underneath the housing permits the requisite pressure equalisation in the housing.



Technical data

- | | |
|--------------------------|--|
| • Measurement range: | 900 ... 1050 hPa |
| • Operating range: | 200 ... 1060 hPa |
| • Operating temperature: | -25 ... +70 °C |
| • Temperature faults: | max. $\pm 0.006\%$ FS/K
in the range -20 ... 40°C |
| • Output signal: | 0 ... 5 VDC
4 ... 20 mA
0 ... 20 mA |
| • Linearity: | ± 0.5 hPa |

Advantages

- Inexpensive
- Strong

Compact wind sensor

165100	Compact wind sensor
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Classic wind sensor

165130	Classic wind sensor	Heated
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Compact wind direction sensor

165140	Compact wind direction sensor
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Classic wind direction sensor

165120	Classic wind direction sensor	Heated
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Barometric pressure sensor

168100	Barometric pressure sensor
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ORDERING DETAILS





RAIN GAUGES

Rain gauges record the rain that has fallen over a specific period of time. These values are the basis for every examination of water balance and are used in meteorology for weather forecasting. Many years of rainfall statistics can, for example, be used for crop planning in agriculture or when considering flood water. Depending on the design, rain gauges can be used for snow as well as for rain.



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Automatic rain gauge with tipping bucket

This rain gauge with tipping bucket has a magnetic encoder with reed contact. The tipping bucket empties automatically each time it catches rain from 0.2 mm precipitation and triggers an electrical pulse. These pulses are added together when recording the data. The data recording can either use an electronic counter or a 1-channel data logger.

The housing is completely made of plastic (PE) and all parts are rust-proof. The surface of the tipping bucket is metallic to make it more durable. The automatic rain gauge can be used both in weather stations and as “stand alone” measurement instrument. A mounting base with adjustment screws is used to attach the rain gauge on the installation mast and also for the horizontal alignment of the device. A built-in spirit level can be used to check the horizontal alignment.

This automated rain gauge can be supplied with an electrical heater to record precipitation in the winter. The electrical connection takes place using a 12 m cable with RJ 11 socket fixed to the sensor. Extensions are possible on customer request.

Advantages

- Inexpensive
- Heated, can be used throughout the year



Technical data

- | | |
|--------------------------|--|
| • Measurement range: | 0 ... 1.6 mm/min |
| • Resolution: | 0.2 mm |
| • Collecting surface: | 200 cm ² /WMO standard |
| • Operating temperature: | 0 ... +50°C unheated
-20 ... +70°C heated |

Rain gauge with tipping bucket

Developed through experience and equipped with the properties and advantages of tried and tested predecessors, this rain sensor with weighing is the “best in class”. Its functionality is precisely geared to the needs of classic meteorology and hydrology as well as semi-professional industry meteorology. It has been awarded the best price/performance ratio of its class for the reliable weighing tipping bucket system and good quality materials. This measurement instrument can also be obtained in a heated version which can be used throughout the year.

When used together with a UGT data logger, volumes of rain are recorded automatically. The data are read out via an RS-232 interface.

Advantages

- High resolution
- Durable and precise stainless steel tipping bucket
- Heated, can be used throughout the year



Technical data

- | | |
|--------------------------|--|
| • Measurement range: | 0 ... 8 mm/min |
| • Resolution: | 0.1 mm |
| • Collecting surface: | 200 cm ² /WMO standard |
| • Operating temperature: | 0 ... +70°C unheated
-20 ... +70°C heated |

Precipitation sensor/ombrometer

This device is used to record readings of precipitation volume and intensity for digital transmission of these measurements. The measurement principle is based on the description in the »Guide to Meteorological Instruments No. 8« from the WMO. The tipping actions of the tipping bucket are recorded by a contact and read out via the electronics as a pulse for further processing using intensity-related linearisation.

This precipitation sensor is made from weather-resistant stainless steel and is also available with 49 W and reinforced 113 W housing heaters. As a result it is especially suitable for use in mountains.

Advantages

- Also suitable for very cold measurement conditions
- Digital reading out of measurement values
- Recording of precipitation intensity

Technical data

• Measurement range:	0 ... 11 mm/min
• Resolution:	0.1 mm
• Collecting surface:	200 cm ² /WMO standard
• Operating temperature:	0 ... +60°C unheated -25 ... +60°C heated -35 ... + 60°C with reinforced heater



RG 50 precipitation sensor

This precipitation sensor concerns an extremely precise rain gauge with pulse output as encoder for data collection systems and remote data transmission. The precipitation volume is detected by a plastic tipping bucket supported by ball bearings with spirit level and adjustment screw. It is also available with a collecting surface of 400 m² if required for the respective task.

The RG 50 can furthermore also be equipped with a bird protection ring and with a heater if used in areas at risk from frost. The housing made of painted aluminium is weatherproof and tough.

Advantages

- Stable for long periods
- Also available with large collecting surface

Technical data

• Measurement range:	0 ... 11 mm/min
• Resolution:	0.1 mm or 0.2 mm
• Collecting surface:	200 cm ² /WMO standard or 400 cm ² /WMO standard



Rain gauge acc. to HELLMANN

This rain gauge acc. to HELLMANN complies with the requirements of the German Meteorological Service in accordance with the WMO standard and DIN 58666 C. The collecting surface of the stainless steel collector is 200 cm² and is limited by a sharp ring. The collected precipitation passes through a funnel into a plastic can whose narrow opening minimises condensation. The volume is then measured using the corresponding graduated measurement vessel. This rain gauge is also available for use during snowfall with a set of snow crosses, covers and extra vessels in accordance with DIN 58666 D.

Set complies with DIN 58666 C and consists of:

- 1 top component
- 1 bottom component
- 1 receptacle
- 1 support
- 1 measuring cylinder

Set for use during snowfall complies with DIN 58666 D and consists of:

- 2 top components
- 2 bottom components
- 1 receptacle
- 1 support
- 1 measuring cylinder
- 2 snow crosses
- 1 cover
- 1 collecting can



Technische Daten

- | | |
|-----------------------|--|
| • Collecting surface: | 200 cm ² /WMO |
| • Material: | Stainless steel |
| • Measuring cylinder: | 200 cm ³ \triangleq 10 mm |
| • Division: | 0.1 mm precipitation |

Advantages

- Corresponds to WMO standard and DIN 58666 C/DIN 58666 D
- Simple measurement process
- Very durable
- No energy requirement

Rain and snow gauge acc. to HELLMANN

Both rain and snow can be recorded using this rain gauge. Measurement is based on the HELLMANN principle. The precipitation in this version of the HELLMANN rain gauge is directly captured in the measurement vessel so that

the corresponding value only needs to be read off. The collecting surface of 100 cm² is limited by a sharp ring.



Technical data

- | | |
|-----------------------|--|
| • Collecting surface: | 100 cm ² /WMO |
| • Material: | Stainless steel |
| • Measuring cylinder: | 250 cm ³ \triangleq 25 mm |
| • Division: | 0.1 mm precipitation |

Advantages

- Easy to use
- No siphoning is necessary for volumetric measurement of the rain

Snow lysimeter / Snow scale

With the snow lysimeter, the water equivalent of the accumulated snow cover can be exactly determined cover by using load cells without disturbing the snow. Thus in combination with SVADSS online visualization, a continuous recording of accumulation and ablation processes in the snow cover is possible. The resulting measurements

Advantages

- Easy installation without special tools
- The surrounding soil surface structure can be constructed in the measuring pan in a comparable manner, thereby reducing island effects
- Detection of the water equivalent by means of load cells with a resolution of 10 g, equivalent to a precipitation water equivalent of 0.01 mm for the 1m² version



can be used for flood protection management, avalanche risk assessment and water management.

The entire construction is made of stainless steel and has been designed for years of use under the toughest conditions. The pan with the standard dimensions of 15 cm in depth and a surface area of 1m² (customer-specific adaptation

both in depth and in size are possible) can be installed comparable to the surface of the surrounding soil. If a permanent power supply is available or a correspondingly dimensioned solar system, the melting water can be determined by means of a (heated) tipping bucket.

Snow temperature profile probe TPS

The snow-temperature profile probe is used to permanently record the temperature profile within a snow cover at up to 10 measuring points. As standard, the measuring points are placed at a distance of 10 cm from each other, resulting in a total measuring length of 1 m. Customized changes in the number of measurement points and in the distances are possible. The individual measuring points, consisting of long-term stable Pt100 resistance temperature sensors, are thermally insulated from each other. As a result, mutual interference by heat conduction within the temperature profile probe is excluded.

The snow temperature profile probe is available in 2 different versions.

The „TPSup“ is installed on the ground before the first snowfall. During the snowfall and the resultant snow cover construction, the temperature profile in the growing snow cover can thus be detected from the ground, which is the lowest measurement level. The entire construction is made of stainless steel. In order to reduce the absorption of radiation, the rod is white coated, which means that a reduction of the snow cover due to thawing around the snow-temperature profile probe is limited.

The „TPSdown“ can be inserted from above into an already existing snow cover. Customized lengths are possible at any time and are aimed among other things such as the thickness of the snow cover. In order to be able



to operate the probe at the same location over a longer period of time, it is equipped with a white and thermally insulated stabilizing plate (diameter 60 cm) on the surface of the snow cover. As a result, the probe is stabilized in its position and protected from radiation influence.

Advantages

- Easy installation on site, long-term stable materials
- Temperature profile is recorded in a vertical line without offset
- Installation in an existing snow cover is possible

Automatic rain gauge with tipping bucket

161301	Unheated
161302	Heated

Rain gauge with tipping bucket

161250	Unheated
161240	Heated

Precipitation sensor/ombrometer

166140	With reed contact	Unheated
166130	With reed contact	Heated
166150	With analog output	Unheated
166160	With analog output	Heated
166170	With DL1/N data logger	

RG 50 precipitation sensor

161100	Unheated
161200	Heated

Rain gauge acc. to HELLMANN

161021	Large version	200 cm ²
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Rain and snow gauge acc. to HELLMANN

161020	Rain gauge acc. to HELLMANN	100 cm ²
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Snow lysimeter / Snow scale

184040	Snow lysimeter / Snow scale
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Snow temperature profile probe TPS

110013	Snow temperature profile probe TPSup
110014	Snow temperature profile probe TPSdown

Related Products	Usable for
Power supply unit for heated rain sensors	<ul style="list-style-type: none"> • Rain measurement with Lambrecht tipping bucket
Bird protection ring	<ul style="list-style-type: none"> • RG 50 precipitation sensor
Snow cross for rain and snow gauge acc. to HELLMANN - 100 cm²	<ul style="list-style-type: none"> • Rain gauge acc. to HELLMANN
Snow cross for rain gauge acc. to HELLMANN - 200 cm²	<ul style="list-style-type: none"> • Rain gauge acc. to HELLMANN
Large measuring cylinder for 200 cm² rain and snow gauge	<ul style="list-style-type: none"> • Rain and snow gauge acc. to HELLMANN
Small measuring cylinder for 100 cm² rain and snow gauge	<ul style="list-style-type: none"> • Rain and snow gauge acc. to HELLMANN



TEMPERATURE AND MOISTURE SENSORS

The temperature sensors introduced in this chapter are in no way purely meteorological temperature sensors. The chapter also introduces sensors for soil temperature, because the soil temperature is of great significance to processes in the soil, to the soil life (the edaphon) and to plants. Moreover both temperatures can deliver information on the water balance. Because air temperature and air humidity are closely related to each other, measurement equipment exists with sensor combinations that can record both of these parameters together.



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WK63 resistance thermometers

This Pt100 cable resistance thermometer with protective metal sleeve is strong, compact and inexpensive. It is suitable for recording both soil and air temperature.

It is available in the following standard versions for ideal adaptation to the measurement conditions, and can be supplied with additional protective tube on request.



Technical data

- Measurement range: -40 ... 105°C and above depending on the connecting cable
- Measurement accuracy: 1/3 Class B

Advantages

- Inexpensive
- Strong
- Versatile use

Thermometer model	Sleeve \varnothing d / (d1) [mm]	Sleeve length useful length [mm] (standard lengths)	Connecting cable/maximum operation temperature
WK 63.6	6.0	50	PVC 105 °C
WK 63.9	8.0	105	Silicon 180 °C Teflon 200 °C

*Other sleeve diameters and sleeve lengths are possible on request.
Please contact us to select the sensors that are best for you.*

Soil temperature measurement

This soil temperature sensor is particularly characterised by its simplicity of use. Both in the field and in lysimeters it can be installed without screw starter and removed without causing damage because the stainless steel shaft needs simply to be pressed into the ground. There is a choice of either a PT100 or PT1000 sensor element. The cables are clamped above ground onto the terminal head. In the standard version the cable is 5 m long; special lengths are available on request.

Advantages

- Strong
- Simple installation



Technical data

- Measurement range: -40 ... +80°C
- Measurement accuracy: 1/3 Class B
- Shaft length/measurement depth: As requested by the customer

Temperature measurement on the surface of the soil

The temperature probe for measuring the temperature on the surface of the soil is installed at the desired height parallel to the soil surface using a ground spike. The ground spike also has a roof to protect the temperature sensor from direct sunshine, wind and mechanical influences. The ground spike, protective roof and sensor shaft are made from stainless steel. The system can be supplied with PT 100 or PT 1000 sensor element. The standard cable length is 5 m, but customised lengths can be produced on request.



Advantages

- Inexpensive
- Simple installation

Technical data

- Measurement range: -40 ... +80°C
- Accuracy: 1/3 Class B

Soil temperature profile measurement

The distribution of up to 8 temperature sensors at various depths facilitates an insight into the spatial development of the temperature in the soil. No elaborate installation of individual sensors is required using this probe. The sensor elements are connected to the ground via stainless steel studs for optimal temperature transmission.

The probe tube is made from PVC which minimises the influence of thermal conduction.

The soil profile temperature probe is available with PT100 or PT 1000 sensors. The depth profile can be configured individually.

Standard depths are:

5 cm, 10 cm, 20 cm, 30 cm, 40 cm, 50 cm, 80 cm and 100 cm

Advantages

- Temperature profile with up to 8 depths

Technical data

- Measurement range: -40 ... +80°C
- Measurement accuracy: 1/3 Class B
- Shaft length/measurement depth: As requested by the customer



Air temperature transmitter with weather and radiation protection

This device is used for precise measurement of outdoor air temperature. Using a specially designed weather and radiation protection made from anodised aluminium, the PT 100 temperature sensor is

protected from distortion caused by environmental influences such as direct sunshine, while ideal ventilation is simultaneously guaranteed.

Technical data

- Measurement range: -30 °C ... +50 °C
- Accuracy: 1/3 Class B (± 0.1 K)
- Dimensions: \varnothing 120 mm
L 400 mm



Advantages

- Protection from distorting environmental influences

Ventilated air temperature transmitter

This temperature transmitter is distinguished by a ventilated sensor element for precise air temperature measurement. The sensor is surrounded by double radiation protection. A built-in ventilator ensures the necessary inflow of

fresh outdoor air to the PT100 measurement element:

- Integrated ventilator
- Protection from distorting environmental influences

Technical data

- Measurement range: -30 °C ... +50 °C
- Accuracy: 1/3 Class B (± 0.1 K)
- Dimensions: \varnothing 160 mm
L 435 mm



Air humidity and temperature sensor

These combined humidity and temperature sensors are compact sensors with a rod design and with a high degree of accuracy that have been specifically developed for use in the meteorological area. These sensors are fitted with a membrane filter as stan-

dard. The version with stainless steel sintered filters is recommended for high wind speeds or in the case of a burden on the sensor due to salt spray, sand or dust (for example proximity to the sea, industrial areas etc.).

Technical data

- Measurement range for air humidity: 0 ... 100% RH
- Air humidity accuracy: $\pm 2\%$ RH
- Temperature measurement range: -30 ... +70°C
- Output signal/temperature accuracy:

0 ... 1 V	± 0.2 K
0 ... 10 V	± 0.2 K
4 ... 20 mA	± 0.3 K



Advantages

- Air humidity and temperature with one sensor
- Very good dynamics

WK63 resistance thermometers

166106 WK63 resistance thermometers

Soil temperature measurement

166100 Soil temperature measurement

Temperature measurement on the surface of the soil

167100 Temperature measurement on the surface of the soil

Soil temperature profile measurement

109600 Soil temperature profile measurement

Air temperature transmitter

169200 with weather and radiation protection

Ventilated air temperature transmitter

169300 Ventilated air temperature transmitter

Air humidity and temperature sensor

169100 Young model with protective sleeve

169105 Young model without protective sleeve

ORDERING DETAILS

Related Products	Usable for
Screw starter for soil temperature	<ul style="list-style-type: none"> • Soil temperature profile measurement
Weather and radiation protection for protruding temperature sensors	<ul style="list-style-type: none"> • For all temperature sensors





RADIATION SENSORS

The temperature of the surface of the earth as well as fundamental life processes of plants are determined by the radiation balance. This describes the overall effect of radiation, taking absorption and reflection as well as re-emission and diffusion into consideration. Depending on their design, radiation sensors can record the radiant flux density of specific irradiance parts or of all irradiance.



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CMP 3 pyranometer

This transmitter is used to measure solar irradiance. Due to the spectral range of 0.31 – 2.8 μm , the device can also be used as albedometer in the sense of a double pyranometer. The CMP 3 is smaller and lighter than other CMP pyranometers. It has a strong 4 mm glass dome which protects the thermopile from external influences. Its small size and waterproof construction make this instrument ideal for deployment in agriculture, for monitoring solar

installations, in industrial applications and for use underwater. It has a screw-on mounting rod for simple installation.

The device corresponds to “second class” in accordance with WMO and ISO 9060 and is supplied with the respective test certificate.



Technical data

- | | |
|----------------------|---|
| • Measurement range: | 0 ... 2000 W/m^2 |
| • Sensitivity: | 5 ... +20 $\mu\text{V}/\text{W}/\text{m}^2\text{V}$ |
| • Spectral range: | 0.31 ... 2.8 μm |

Advantages

- Very light (0.35 kg)
- Can also be used as albedometer

Net radiation transmitter

The net radiation transmitter consists of two completely identical thermopiles connected against each other which measure the solar and reflex radiation. The difference between the direct irradiation and reflected radiation is read out as measured value. The instrument corresponds to “first class” in accordance with WMO and is supplied with test certificate.



Technical data

- | | |
|----------------------|---|
| • Measurement range: | -500 ... +1000 W/m^2 |
| • Sensitivity: | 5 ... +15 $\mu\text{V}/\text{W}/\text{m}^2\text{V}$ |
| • Spectral range: | 0.3 ... > 30 μm |
| • Dome material: | Lupolene |

Advantages

- Inexpensive

NR Lite silicon net radiometer

The instrument is used to measure net radiation, the balance between total radiation from above (solar radiation and long wave atmospheric counter-radiation) and the total radiation from below (short wave reflection radiation and the long wave ground radiation).

The radiation values are recorded using thermopiles connected against each other. The output signal is proportional to the net radiation and can be interpreted as the radiation energy that is absorbed from the earth's surface.

The NR Lite is characterised in particular by its compact and light design which, with its 40 cm long support arm, makes it very suitable as portable measurement instrument.



Technical data

- Measurement range: -200 ... +1500 W/m²
- Sensitivity: 10µV/W/m²V
- Spectral range: 0.2 ... > 100 µm

Advantages

- Compact and light design
- Large spectral range
- Can also be used as portable measurement instrument

CNR 4 net radiometer

The CNR 4 consists of two pyrometers and two pyrgeometers whereby one instrument faces upwards and the other faces downwards. Together they all measure the energy balance between short wave and long wave (far infrared) radiation as well as the Albedo. The CNR 4 is the successor to the familiar CNR 1, and has considerably improved properties. The CNR 4 is extremely light and equipped with an integrated sunshield to reduce the impact of thermal effects on the measurement. The meniscus-shaped dome of the upper pyrgeometer ensures a significantly better measurement of long wave radiation.

The optional CNF 4 ventilation unit is unique and very efficient in preventing dirt, moisture, dew and frost accumulating on the sensors.

Advantages

- Records the total net energy between short and long wave radiation in one instrument
- Optional ventilation unit provides protection from influencing factors



Technical data

- Signal outputs: 4
 - Incoming and reflected short wave radiation
 - Downward and upward facing long wave radiation
- Sensitivity: 7 ... 20 µV/W/m²V short wave
5 ... 10 µV/W/m²V long wave
- Spectral range: 300 ... 800 nm short wave
4.5 ... 42 µm long wave

CMP 3 pyranometer

162100 CMP 3 pyranometer

Net radiation transmitter

161093 Net radiation transmitter

NR Lite silicon net radiometer

161092 NR Lite silicon net radiometer

CNR 4 net radiometer

161090 CNR 4 net radiometer



AIR ANALYSIS

Information about air constituents is vital for providing knowledgeable answers to current environmental research issues. In addition to the „classic“ greenhouse gases such as CO₂, CH₄, CO and H₂O which have been and which continue to be at the centre of attention with regard to global change, ever more constituents of the air are gaining significance in atmospheric research. Here it is apparent that real time measurements in the field detect trends more quickly from which forecasts can be derived. To guarantee this, robust but compact measuring systems are required which can detect the concentrations and isotope ratios for the most important molecules up to an accuracy of ppb. Modern equipment with a high temporal resolution in terms of measurement frequencies in the hertz range are deployed in the most diverse atmospheric „flux“ measurements. Measurements with these modern devices are, of course, not restricted to the field; they can also be used under indoor conditions at any time.

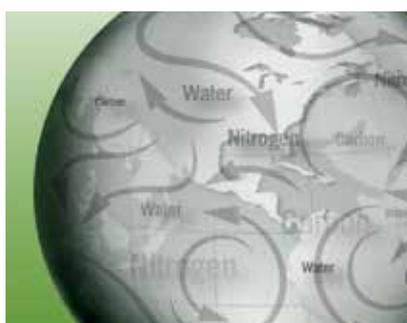


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Picarro G2301 CRDS Analyzer

For the precise measurement of CO₂, CH₄ and H₂O in Air

The measurement of greenhouse gases is an important field of research in climate research and meteorology for a long time already. For this purpose Picarro offers with the G2301 CRDS an analyzer for the analysis of the “Top 3” greenhouse gases with unrivaled precision. The high precision of the measurement, the high accuracy of the data acquisition and the portability in combination with the lowest guaranteed drift of all devices for these measurements available on the market militate in favor for the G2301. Further the integrated water correction feature automatically re-

ports the dry mol fraction. The software features an intuitive user interface and numerous customization tools.



Technical data			
	CO ₂	CH ₄	H ₂ O
Precision (1-σ of: Raw 5 sec / 5 min avg data)	< 70 ppb / 25 ppb	< 0.5 ppb / 0.22 ppb	< 80 ppm / 30 ppm
Max Drift at STP (over 24 hrs / 1 month) *(peak-to-peak, 50-minute average)	< 120 ppb / 500 ppb	< 1 ppb / 3 ppb	< 100 ppm ± 0.5% of reading
Automated calculation of dry mol fraction	Yes	Yes	No

Picarro G2401 CRDS Analyzer

For the precise measurement of CO₂, CO, CH₄ and H₂O in Air

The G2401 is a field-deployable analyzer for the parallel continuous measurement of the four atmospheric tracer gases CO₂, CO, CH₄ and H₂O. It distinguishes itself through the smallest drift of all devices available for continuous measurement of greenhouse ga-

ses. With the precise measuring method, the high accuracy and the small drift it meets the WMO Data Quality Objectives for CO, CO₂ and CH₄. The integrated water correction feature automatically reports the dry mol fraction.



Technical data				
	CO ₂	CO	CH ₄	H ₂ O
Precision (5 sec / 5 min / 60 min, 1σ)	< 50 ppb / 20 ppb / 10 ppb	< 15 ppb / 1,5 ppb / 1 ppb	< 1 ppb / 0,5 ppb / 0,3 ppb	< 30 ppm / 5 ppm / not available
Max Drift (over 24 hrs / 1 month) (peak-to-peak, 50-minute average)	100 ppb / 500 ppb	10 ppb / 50 ppb	1 ppb / 3 ppb	100 ppm ± 0.5% of reading
Automated calculation of dry mol fraction	Yes	Yes	Yes	No

Picarro G2401-*m* CRDS Analyzer

For precise in-flight measurements of CO₂, CO, CH₄ and H₂O in Air

The G2401-*m* is designed for the continuous in-flight measurement of the four atmospheric greenhouse-relevant tracer gases CO₂, CO, CH₄ and H₂O. The precision of the measuring method and the accuracy of the data acquisition and the portability set this de-

vice apart from comparable gas analyzers. Unique in the world is the applicability for continuous in-flight measurements. The G2401-*m* features an integrated water correction feature, which automatically reports the dry mol fraction, as well as a software with



an intuitive user interface and numerous customization tools.

Technical data				
	CO ₂	CO	CH ₄	H ₂ O
Precision (1-s over 30 secs, vibration @ 20 Hz, 1g)	≤ 200 ppb	≤ 30 ppb	≤ 2 ppb	≤ 150 ppm
Max Drift at STP (over 24 hrs) *(peak-to-peak, 50-minute average)	≤ 200 ppb	≤ 15 ppb	≤ 1,5 ppb	≤ 100 ppm ± 5% of reading
Drift with Changing Pressure (Peak to peak 30 sec average; < 1.4)	≤ 700 ppb	≤ 50 ppb	≤ 7,5 ppb	Not available
Automated calculation of dry mol fraction	Yes	Yes	Yes	No

Picarro G5102-*i* Analyzer

For the precise measurement of NO₂ Concentration / Isotopes

Over the past years the isotopic research has become increasingly important. With the G5102-*i* additionally to the NO₂ concentration also the isotopic composition can be continuously and precisely determined. The simultaneous measurement of δ¹⁵N including

site-specific isotopomers is possible. The device is suitable for field sites as well as for laboratory use. Additionally the measurement range can be expanded to include δ¹⁸O with the upgrade option (UH5131-*i*).



Technical data				
	Precision 1-σ 10 min avg	Precision 1-σ 100 sec avg	Concentration Range (ppb N ₂ O in Air)	Max Drift (over 24hrs, peak to peak, 1hr average)
N₂O (Concentration)	Typical: < 0.04 ppb Guaranteed: < 0.05 ppb	Typical: < 0.07ppb Guaranteed: < 0.1 ppb	300 - 1500	< 0.1 ppb Typical
δ¹⁵N, δ¹⁵Nα, δ¹⁵Nβ	Typical: 0.3 ‰ Guaranteed: < 0.5 ‰	Typical: 0.7 ‰ Guaranteed: < 1‰	300 - 1500	< 2 ‰ Typical

Picarro L2130-*i* Analyzer

For the precise measurement of δD and $\delta^{18}O$ Isotopes in Water

The L2130-*i* is Picarro's most popular isotopic water analyzer and features the simultaneous and continuous measurement of $\delta^{18}O$ and δD . Worldwide it is successfully used in field and laboratory studies and offers the possibility for analyzing water isotopes in liquids, vapor and solids with high-

est precision. It is characterized in particular by the low drift typical for Picarro. With one calibration per day it is possible to measure with an accuracy better than one per mill. For liquid analysis the guaranteed accuracy is even better 0,025 per mill for $\delta^{18}O$ and 0,1 per mill for δD .



Picarro G5131-*i* Analyzer

For the precise measurement of N_2O Concentration and Isotopes analysis for $\delta^{15}N$, $\delta^{15}N\alpha$, $\delta^{15}N\beta$, $\delta^{18}O$

With the G5131-*i* next to the N_2O concentration also the isotopic composition of N_2O ($\delta^{15}N$ including site-specific isotopomers and $\delta^{18}O$) can be measured continuously and precisely. The device is so designed that the best results are obtained at atmospheric concentrations. As almost all of the Picarro devices it is suitable for field sites as well as for the la-

boratory use as it inter alia allows for a cryogen-free continuous operation.



Technical data

	Precision 1- σ 10 min avg	Precision 1- σ 100 sec avg	Concentration Range (ppb N_2O in Air)	Max Drift (over 24hrs, peak to peak, 1hr average)
N_2O (Concentration)	Typical: < 0.04 ppb Guaranteed: < 0.05 ppb	Typical: < 0.07 ppb Guaranteed: < 0.1 ppb	300 - 1500	< 0.1 ppb Typical
$\delta^{15}N$, $\delta^{15}N\alpha$, $\delta^{15}N\beta$	Typical: 0.3 ‰ Guaranteed: < 0.5 ‰	Typical: 0.7 ‰ Guaranteed: < 1‰	300 - 1500	< 2 ‰ Typical
$\delta^{18}O$	Guaranteed: < 0.7 ‰	Guaranteed: < 1‰ (300 sec avg)	300 - 1500	< 2 ‰ Typical

Picarro G2301 CRDS Analyzer

196286 For the measurement of CO₂, CH₄ and H₂O in Air

Picarro G2401 CRDS Analyzer

196288 For the measurement of CO₂, CO, CH₄ and H₂O in Air

Picarro G2401-m CRDS Analyzer

196289 For in-flight measurements of CO₂, CO, CH₄ and H₂O in Air

Picarro G5102-i Analyzer

196383 For the measurement of NO₂ Concentration / Isotopes

Picarro L2130-i Analyzer

196293 For the measurement of δD and δ¹⁸O Isotopes in Water

Picarro G5131-i Analyzer

196382 For the measurement of N₂O Concentration and Isotopes analysis for δ¹⁵N, δ¹⁵Nα, δ¹⁵Nβ, δ¹⁸O

ORDERING DETAILS



ECOLOGY







CLIMATE INFLUENCED BY VEGETATION

Local climates are greatly influenced by the vegetation found there, just as vegetation is substantially influenced by the prevailing climate. This interaction is of great interest both to ecology and to meteorology. At the same time, however, it also represents specific challenges with respect to the monitoring of meteorological parameters. This is especially the case in the area of forestry where, due to their size, trees have an enormous influence, but one which differs in spatial and temporal terms depending on the type of tree, concentration and season. Tried and tested meteorological measurement procedures are adapted and additional parameters measured to reliably record the influence of types of vegetation on the climate.



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Litterfall trap

The litterfall trap can be used to obtain samples of fallen leaves, conifer needles, pieces of wood and seeds. Important information can be discovered about the state and process operations of the ecosystem from the mass of litter and its temporal distribution. The chemical examination of litterfall samples in the laboratory gives an insight into the nutrient balance in the ecosystem.

The UGT litterfall trap is funnel-shaped with a collecting surface of 500 mm x 500 mm and a ground surface of 100 mm x 100 mm.

It is made from weatherproof aluminium and is riveted in the corner areas. The folds are sealed with silicon rubber. This design means the litterfall trap is both very robust and resistant to falling branches.

The base frame made from square steel tubing enables simple installation and keeps the collector in the correct position. It is fixed in the ground using two ground stakes. The corrosion coating guarantees a long service life.

An optional strainer insert for easier removal of litter is available.



Technical data

- Collecting surface: 500 x 500 mm
- Material: Aluminium, riveted

Advantages

- Tough
- Simple installation

Deposition sampler

The deposition sampler is used to record precipitation to analyse the precipitation composition in the laboratory. Collecting tank and collection volume are connected to each other by screw connection. A protective filter that is overlaid with glass beads is integrated in the screw connection. This filter system prevents the entry of coarse dirt and at the same time avoids condensation from the collector volume in order to maintain the concentration of the substances dissolved in the water.

It is made of PE-HD. The aperture

is restricted by an acrylic glass ring to guarantee the collecting surface of 100 cm².

By way of standard the deposition is recorded 1 m above the surface of the soil in a PVC pipe (Ø 130 mm) that has a ring attached to its free end to prevent birds settling on it. However the tiered installation of the deposition sampler is possible on customer request.

Advantages

- Keeps substance concentration in the sample



Technical data

- Collecting surface: 100 cm²
- Collection volume: 2 l
- Material: PE-HD / acrylic glass

Rain gully under vegetation

The rain gully is used to establish the passage of rain through the tree crowns as basis for determining the throughfall. In contrast to standard rain gauges, the precipitation here is not recorded at specific points but rather integrally over a larger area to take account of the irregularity of the forest canopy. It is made from stainless steel panels. The dimensions and the resultant effective collecting surface may be freely selected by the customer. To ensure quantitative recording of the captured precipitation, it is recommended that it be used in combination with a tipping counter and where

necessary collecting vessels for sampling. The measurements can be consistently recorded using a data logger.



Advantages

- Integral capturing of precipitation over large areas
- Also available corresponding to DVWK

Mobile roof construction beneath the treetops

This individually adapted, mobile roof construction which is either manual or automatically controlled by rain sensors has been designed for targeted irrigation scenarios (e.g. drought stress trials) in forests, also where there is fully grown vegetation. The trunks of the respective “covered” trees are integrated in the roof structure; the stemflow is collected using elastomer collars (see also UGT stemflow meter) and conveyed away on the roof. The rainwater obtained in this way can be collected and examined or used for targeted spray irrigation.

Depending on the respective vegetation situation, 80-90% of the entire roof surface made from special transparent UV-resistant film across piping rails can be constructed so that it can be moved. The remaining 10-20 % is permanently closed. The special construction, which can be compared to a “pagoda roof”, enables a vertical and horizontal exchange of air even when closed.

As a result the micro climate of the crops is only slightly disturbed and problems caused by “stagnant air” such as mould are avoided. The entire roof construction has a modular structure and can be extended almost indefinitely from a minimum size of 2 m².

The materials used are aluminium, PE foil and stainless steel, as well as small quantities of diverse plastics and galvanised components. In order to be able to completely rule out the entry of zinc into the soil, special solutions without galvanised components can be offered on request. The roof construction can be expanded by a camera system for monitoring of the sample area.



Advantages

- max. 80% of the roof surface can be opened or closed as necessary
- Targeted control of the water entering the sample area
- Minimal influencing of other factors in the microclimate

Technical data

- | | |
|-----------------------|-----------------------------|
| • Roof surface: | 1 ... ∞ m ² |
| • Roof film material: | PE film, UV permeable |
| • Frame material: | Aluminium / stainless steel |

IDS-Plant

Pulse feed system for the controlled application of water, additives and CO₂

The IDS - Plant is a system for effective and resource-efficient plant care. It consists of a modular buildable application system with distribution elements and a control unit.

As required, the control unit can be designed as a portable, self-sufficient system or as a stationary control system in a control cabinet with mains supply.

The distribution elements each consist of a 200 ml reservoir with a self-opening and self-closing valve combination for inlet and outlet of the medium to be distributed. These valves have no small passages and thus don't get clogged. Therefore the system is also suitable for the distribution of ferrous or calcic groundwater, polluted surface water, biologically preclarified wastewater and fertilizer. Further also plant effective gases such as CO₂ can be applied with the distribution elements. Additional filter systems are not necessary.

The application is carried out in a pulsed manner in three clocks: Pulse = filling clock + draining clock + pause clock

During the filling clock, the medium is pumped into the reservoir by the control unit. Thereby the air in the reservoir is compacted so that an overpressure builds up in the system. When this pressure reaches the limit set on the control unit the emptying clock starts. The hose system between the reservoirs is vented so that the pressure drops. Thereby the outlet valve of the reservoir is

opened and the compressed air pushes the medium out. The reservoir is completely emptied. Through this control technology all reservoirs connected by tubes open at the same time and apply the same amount of the medium independent from their position in the overall network. With the pause clocks the time for the start of the next pulse is controlled. The pause clock can be set as a given time interval or via a given tension. This way the pulse frequency can be optimally adapted to the demand of the plants.

In adjustment to the planned application the distribution elements can be designed in different ways (e.g. as jet or distributor hose).

Leakages in the system are automatically detected by the control unit instantly since in that case the designated pressure is not reached at all or not within the set time.

The system therefore offers a high dosing accuracy and high operational reliability with minimal maintenance.



Advantages

- Parallel application of water, additives and CO₂
- Low maintenance effort
- No clogging of the distribution elements
- No filter systems necessary
- High dosing accuracy
- High operational reliability
- Instant detection of leakages
- Universal applicability

Stemflow meter

The stemflow can make up a considerable part of the entire water flow below the forest canopy. Using the stemflow meter it is possible to establish the water caused by this and the minerals entering the system.

Depending on the shape of the tree growth, an elastomer collar is placed round the trunk at a height of 0.8 to 1.2 m above the ground and sealed against the trunk using artificial bark. The collar captures the water running off and channels it into a collecting vessel. A tipping counter with electronic counter and LCD display connected between the two directly determines the flow volume.

If necessary the tipping counter can also be connected to a UGT data logger. Collecting vessel, tipping counter and counter unit are installed in a weatherproof housing next to the tree.



Technical data

- Collecting volume: 0.25 ... 5 l
- Tipping counter resolution: 4 ml
- Application range: 0 ... 200 ml/min

Advantages

- Qualitative and quantitative monitoring of the stemflow
- Autonomous system

Forest climate measurement station

This climate station has been specially designed to measure the climatic parameters influenced by vegetation. An adjustable mast enables it to be adapted to the tree height or to specific tiers. In addition to climatic sensors for temperature, pressure, wind and radiation, as an option it can be

equipped with hydrological sensors. In shaded woodland areas a rechargeable battery also enables a power supply that is independent of the mains. The data from all sensors are recorded by a data logger.

Technical data

- Precipitation sensor: 200 cm³ (WMO standard)
Resolution 0.1 mm
- Solar radiation sensor: 0 ... 1400 W/m²
Spectral range 0.3 ... 60 μm
- Wind speed transmitter: 0 ... 75 m/s
- Air humidity sensor: 0 ... 100% relative humidity +/-4%
- PT 100 temperature sensor: -30 ... +70°C
Resolution 0.1°C



Advantages

- Can be adapted to the vegetation height

PAR SunScan light incidence measurement system

The photosynthesis processes in plants and the biomass production depend heavily on solar radiation. For this reason data on the PAR (“photosynthetic active radiation”) are of great significance if the ideal light conditions for maximum yields are to be determined. The SunScan system supplies such data and is suitable for measuring and analysing the PAR in the leaf canopies of crops. The SunScan package consists of a light incidence probe, data acquisition module and software. The probe can also be supplied separately if data acquisition systems are already present. The probe is 1 m long and contains 64 PAR sensors which are read out during every measurement.

Connection to a data acquisition module uses the RS232 interface. Fast and accurate measurements can be taken using the control button on the probe handle. Using the data acquisition module the probe is programmed for automatic measurement at intervals ranging from 1 second to 24 hours. The data module reads out the readings and calculates the average light level of each individual sensor. The individual readings remain in the memory, which enables an additional, more detailed examination of the PAR. The raw data and the derived functions (light transmittance/LAI) can be collated, stored and displayed. Average values for groups of readings can be created, and vari-



1 Light incidence probe with handheld device and external PAR sensor on telescopic tripod

ous display and memory formats are available for this feature. The data acquisition module is a light, handheld computer with removable flash memory card for data storage. The 256 KG memory card supplied has room for around 2000 readings.

A laptop can be connected to the RS232 interface of the light incidence probe as an alternative to the data acquisition module. All functions and options in the data acquisition module can be used by means of the supplied SunData software for programming, display and data analysis. An external PAR sensor is likewise available for measuring the PAR above the leaf

Advantages

- Ease of use
- Sensor distribution over 1 m
- Analysis of data immediately in situ

canopy and in direct and diffuse light. The maximum reading is 2500 $\mu\text{mol}/(\text{m}^2\text{s})$. The sensor uses a number of photodiodes and a unique shaded pattern to calculate whether the sun is shining and to measure the direct and diffuse components of solar radiation. This means that no laborious shade ring settings need to be adjusted, as is the case with conventional light sensors.

A telescopic tripod is available for simple positioning of the external sensor.

Technical data

• Measurement range:	0 ... 2500 $\mu\text{mol}/(\text{m}^2\text{s})$
• Measurement accuracy:	$\pm 3 \mu\text{mol}/(\text{m}^2\text{s})$
• Measurement range (PAR):	400 ... 700 nm
• Power supply:	Alkaline battery
• Interfaces:	RS232

LINPAR - Linear PAR Sensor

For determining PAR in plants

The LINPAR was developed to measure the photosynthetic active radiation (PAR) in plants. The 33 radiation sensors are mounted in a 1-metre long anodised "U" section tube and covered with a 3 mm thick diffuser.

With the Linear PAR sensor, an integrated analysis can be conducted over 850 mm, whereby no sensors are present at the ends

of the section tube (70 mm from the start and 50 mm from the end to allow for fastening among other things). An integrated spirit level helps level the sensor in the terrain.

For complete monitoring solutions, the LINPAR can be combined with the SFM-1 Sap Flow Meter, PSY-1 psychrometer and DRL26 dendrometer.



Technical data

• Material	Anodised aluminium, acrylic, IP65
• Cable	5 m shielded 2-wire polyethylene cable 18 x 0.1 mm
• Sensors	33 GaAsP photodiodes (350 - 680 nm), Peak at 640 nm
• Sensitivity	1 mV/10 $\mu\text{mol} / \text{m}^2 / \text{s}$
• Temperature range	Accuracy $\pm 0.15\%$ °C at measurement peak, of 0 – 50 °C
• Linearity	1% from 0 - 2000 $\mu\text{mol} / \text{m}^2 / \text{s}$
• Uniformity of the sensor surface	Better than 2% over 0.85 measurement length
• Reaction time	2 μs . 10 - 90%
• Output	V version (Voltage Version): 200mV / 2,000 $\mu\text{mol} / \text{m}^2 / \text{s}$ A version (Current Version): $\sim 1.8 \mu\text{A} / 2,000 \mu\text{mol} / \text{m}^2 / \text{s}$
• Operating temperature range	-20 °C - +50 °C
• Size	1.2 cm x 1.5 cm x 1 m

Advantages

- Integrated value of 33 sensors
- Ideal for use in plant canopies

It is ideally suited to be connected to the Light Sensor Meter (LSM). One LSM can support up to 10 LINPAR sensors for complete canopy light characterisation.

Variables calculated include PAR, leaf area index, sunflecks and canopy extinction coefficient.

Litterfall trap

171100 Litterfall trap

Deposition sampler

172100 Deposition sampler

Rain gully under vegetation

161201 Rain gully under vegetation

Mobile roof construction beneath the treetops

174000 Mobile roof construction beneath the treetops

Rainmaker

178000 Flexible overhead irrigation system for use in the field
Standard measures 1m² to 3 m²
(enclosure can be customized on request)

IDS-Plant

176170 Pulse feed system for the controlled application of water,
additives and CO₂

Stemflow meter

173100 Stemflow meter

Forest climate measurement station

175100 Forest climate measurement station

PAR SunScan light incidence measurement system

176000 Set with data acquisition module and software

176010 Separate probe

LINPAR - Linear PAR Sensor

177000 Linear PAR Sensor

ORDERING DETAILS





DENDROMETER

The dendrometers presented here are used to determine the circumference, radius or diameter of plants. It has long been the case that not only trees are measured, despite the actual meaning of the word (tree measuring device). Modern dendrometers are becoming ever smaller, lighter and more accurate, which makes them suitable for an ever larger range of applications. For example special dendrometers can also be deployed for agricultural crops and fruits. Electronic dendrometers used in combination with data loggers permit the recording of entire hydrographs of the plant diameter over days, months or years so as to be able to make statements about the growth and conduct of the plants and the influence of correlating environmental factors.



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DB20 manual band dendrometer

Manual band dendrometers are frequently deployed in commercial forestry and research. They are an extremely reliable and inexpensive method of precisely measuring and monitoring tree growth rates. The tree growth rate already makes it possible to gain sufficient insight into many issues, such as those in the area of commercial forestry. In addition to this, tree growth rates can also be combined with sap flow data to correlate the respective water use or water consumption with the growth rate. The DB20 band dendrometer consists of a fixed and a sliding

scale which is held in position by a spring. By cutting the band, the DB20 band dendrometer can be individually adapted to the respective tree circumference, and is then held in place by spring tension. The tree growth in the form of increased diameter can be read off the sliding scale manually in 0.1 mm steps.

Advantages

- Inexpensive
- No upper limit to the stem diameter
- Can be reused with new band
- Precise scale due to laser printing

Technical data

- Measurement range of trunk diameter: 8 ... ∞ cm
- Resolution: 0.1 mm
- Width of the band coil: 12 mm
- Tensioning force: 5 ... 15 N



Radiusdendrometer DR

This sensor for recording the tree trunk growth is particularly distinguished by its stable installation. It is anchored in the heartwood using two screws and in this way measures the change outside the heartwood as radial growth.

This arrangement guarantees both that long-term measurements are very stable and that the fastening is secure. There is only very little counter pressure created on the measurement point its-

elf so that the radial growth is not obstructed by the sensor. Damage to the tree caused by the necessary drilling can be minimised using tree resin. The instrument is connected to an external data logger to record the data. This enables it to also be connected to an existing data logger to expand existing measurement stations. The radius dendrometer is supplied with 2 m of cable as standard. Cable extensions are available on customer request.



Advantages

- Stable fastening offers resistance to wind, snow, falling branches and fruit
- Long-term stability reduces the need for maintenance and manpower
- Little pressure on the measurement point

Technical data

- Measurement range of stem diameter: 8 ... ∞ cm
- Resolution: Infinitely small
- Sensor measurement range: 11 mm
- Accuracy: ± 2 µm (with 12 bit logger)

DRL26 logging band dendrometer

The water balance of an entire tree can now be examined more easily and more accurately. The logging band dendrometer has its own, internal data logger. The integrated lithium battery means that no external batteries or solar cells are required as energy supply for the logger. As a result the dendrometer can be fixed to a tree without any other accessories.

This individualised measurement enables the most diverse range of trees in a large study area to be sampled because there is no need for connection to a central logger. This makes it easier to conduct studies with large spatial distribution, e.g. different growth or age structures.

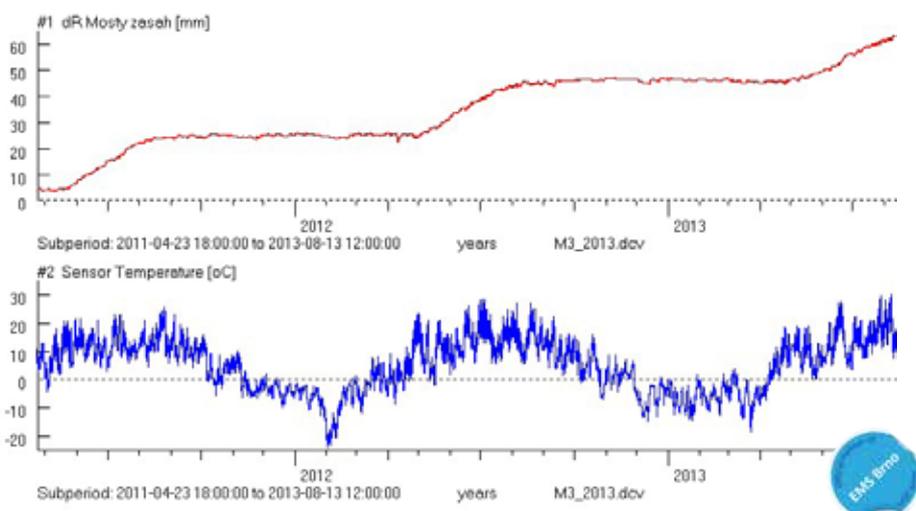
The DRL26 dendrometer is a very reliable and inexpensive method of precisely measuring and monitoring tree growth rates.

In addition to the long-term growth, the recording of changes in the stem diameter with a resolution of 0.001 mm permits observation of everyday fluctuations in the trunk tissue that are a reac-

tion to short-term (micro) climatic changes (e.g. daily variations).

The data on daily trunk tissue fluctuation can be combined with sap flow data on the same tree to improve correlation between water consumption and understanding about the functional hydrology of the tree and/or specific treatment measures.

The DRL26 is a non-invasive measurement system with a rotary position sensor for infinitely variable measurement of the trunk diameter and the growth of the tree studied. The memory card installed in the data logger has capacity for 50,000 readings. This means data storage of over 4 years with storage at hourly intervals. In this case the internal lithium battery provides an energy supply for 5 years. The logger has an environmentally friendly seal, and communication takes place via an infrared interface. A sophisticated MS Windows-based software package facilitates configuration of the logger and detailed statistical data analysis.



Technical data

- Measurement range of stem diameter: 8 ... ∞ cm
- Resolution: Infinitely variable
- Width of the band coil: 12 mm
- Tensioning force: 15 ... 20 N



Also available:

- Infrared cable to read out data
- Spare tape

Advantages

- Autonomous individual measurement instrument, no central logger is required
- Continuous data series
- No upper limit for the stem diameter
- Internal power supply
- Completely wireless

Small DD-S diameter dendrometer

The DD-S has been specially developed for agricultural plants, small trees or individual branches. It is suitable for plants with a diameter of less than 5 cm. Due to the patented fastening method, the dendrometer does not need to be supported by the plant and therefore also provides stable readings for the entire diameter of very small plants. The measurement system operates without damaging and with little pressure on the measurement point. The DD-S is supplied with 2 m cable as standard, but can also be supplied with special lengths as well as with different frame sizes for lar-

Advantages

- Suitable for very small trees and agricultural plants
- Plant does not need to support the dendrometer
- Ordering according to the size of plants is possible
- Little pressure on the measurement point

ger stem diameters on customer request. Data are recorded using an external data logger.

The measurement instrument can also be connected to existing loggers at existing measurement stations.



Technical data

- Measurement range of stem diameter: 0 ... 5 cm (can be extended on request)
- Resolution: Infinitely small
- Sensor measurement range: 11 mm
- Accuracy: ± 2 µm (with 12 bit logger)

Large DD-L diameter dendrometer

The sensor is attached to the plant using a patented fastening method. This ensures it remains securely in place at the measurement point without exerting too much pressure on the measurement point. This model is suitable for determining the changes in diameters of plants with a diameter of 3-30 cm without damaging them. The DD-L is supplied with 2 m cable as standard, but can also be supplied with special lengths

as well as with different frame sizes for larger stem diameters on customer request. Data are recorded using an external data logger.

The measurement instrument can also be connected to existing loggers at existing measurement stations.



Technical data

- Measurement range of stem diameter: 3 ... 30 cm (can be extended on request)
- Resolution: Infinitely small
- Sensor measurement range: 11 mm
- Accuracy: ± 2 µm (with 12 bit logger)

Advantages

- Stable fastening offers resistance to wind, snow, falling branches and fruit
- Ordering according to the size of the tree measured is possible
- Little pressure on the measurement point

DC1 circumference dendrometer

The DC1 circumference dendrometer is a simple, inexpensive version for measuring the changes in the circumference of trees. The sensor measures the tensile force of a metal wire which runs tightly around the trunk. Slide rings reduce the friction between the wire and tree bark and reduce the pressure on the measurement point. This means that every change in the trunk circumference is transmitted via the wire as tension to the pressure sensor. These measurement systems operate without damaging the plants, are

inexpensive, easy to install and suitable for a large range of diameters. It is generally not possible to compare values from trees with different trunk diameters, however, because the pressure of the cable on the tree depends on the tree size due to the tangential tensile force. A considerable advantage of the circumference dendrometers is that they directly determine the tree circumference. The DC1 is supplied with a 2 m cable and 1 m wire cable, but can also be supplied with special lengths of cable and wire on cus-



tomers request. Data are recorded using an external data logger. The measurement instrument can also be connected to existing loggers at existing measurement stations.

Technical data

- Measurement range of stem diameter: 5 ... 30 cm
- Resolution: Infinitely small
- Sensor measurement range: 11 mm
- Accuracy: $\pm 2 \mu\text{m}$ (with 12 bit logger)

Advantages

- Readings correspond directly to the circumference
- Stable fastening offers resistance to wind, snow, falling branches and fruit
- Simple installation

DC2 circumference dendrometer

The DC2 is the improved version of the DC1 for measuring the changes in circumference of trees without damaging them. The change in circumference is determined via the tensile force of a metal wire that is clamped round the tree being measured. Slide rings tubes reduce the friction between the wire and bark and reduce pressure on the measurement point. For trees that are predominantly round the pressure data obtained can be directly converted using the corresponding Excel program. The pressure sensor supports itself and does

not need to be held by the steel wire. Owing to the special tensioning system, the pressure on the tree is unrelated to the tree size. For this reason the data from different sizes of trees can be easily compared using the DC2. This dendrometer supplies sensitive readings even for very large trees because the tensile force of the wire is automatically adjusted.

The DC2 is supplied with a 2 m cable and 1 m wire cable, but can also be supplied with special lengths of cable and wire on customer request. Data are recorded using an external data logger. The



measurement instrument can also be connected to existing loggers at existing measurement stations.

Technical data

- Measurement range of stem diameter: 5 ... ∞ cm
- Resolution: Infinitely small
- Sensor measurement range: 15 mm
- Accuracy: $\pm 2 \mu\text{m}$ (with 12 bit logger)

Advantages

- No upper limit for the stem diameter
- Ability to compare data from different sizes of trees
- Stable fastening offers resistance to wind, snow, falling branches and fruit
- Simple installation and adjustment

DF fruit dendrometer

The fruit dendrometer is a special version of dendrometer for measuring round objects. It records changes in diameter for total diameters of up to 11 cm without damaging the fruit. Measurement frames adapted to other fruit sizes can also be produced on request. With the patented fastening method the measured object is fastened securely in the measurement frame without this affecting growth. The low amount of pressure on the measurement point does not impair growth of the fruit. The DF is only unsuitable for very soft fruit such as ripe to-

matoes. The DF is supplied with 2 m of cable as standard for connecting to the data acquisition with an external logger.

Different cable lengths are available on customer request.

Advantages

- The fruit does not support the weight of the dendrometer
- Minimum strain on the measured object
- Little pressure on the measurement point
- Ordering according to fruit size



Technical data

- Measurement range of fruit Ø: 0 ... 11 cm
- Resolution: Infinitely small
- Sensor measurement range: 15 mm
- Accuracy: ± 2 µm (with 12 bit logger)

DV vertical dendrometer

The vertical dendrometer was developed to continuously determine the vertical changes (not growth) in trees. Since the trunk length varies according to water status, wind conditions and bending, the vertical change is a useful variable when evaluating the water status, mechanical strain/stability and growth direction. As a rule the parallel measurement from 3 sides using 3 vertical dendrometers is required to be able to record the various causes separately.

The DV is supplied with 2 m of cable and 1 m of special wire to measure a 1 m trunk section. Customised cable and wire lengths can be produced on request. An external data logger is required to

record the data. The DV can also be connected to existing loggers at existing measurement stations.

Advantages

- Information about the vertical changes in the test tree
- Stable fastening offers resistance to wind, snow, falling branches and fruit



Technical data

- Suitable for stem diameter: 8 ... ∞ cm
- Resolution: Infinitely small
- Accuracy: ± 2 µm (with 12 bit logger)

DB20 manual band dendrometer

170072	DB20 manual band dendrometer
170022	Dendrometer stainless steel band

DR radius dendrometer

170017	DR radius dendrometer
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DRL26 logging band dendrometer

170073	DRL26 logging band dendrometer
205018	Infrared cable to read out data
170022	Dendrometer stainless steel band

Small DD-S diameter dendrometer

170018	Small DD-S diameter dendrometer
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Large DD-L diameter dendrometer

170019	Large DD-L diameter dendrometer
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DC1 circumference dendrometer

170015	DC1 circumference dendrometer
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DC2 circumference dendrometer

170016	DC2 circumference dendrometer
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DF fruit dendrometer

170020	DF fruit dendrometer
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DV vertical dendrometer

170021	DV vertical dendrometer
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ORDERING DETAILS





SAP FLOW AND WATER POTENTIAL

The water balance of an ecosystem is largely influenced by the water balance of the corresponding plants, while in turn this plant water balance is influenced by the ecosystem itself. An understanding of these interaction processes therefore forms the basis for water balance examinations and for studies of plant physiology.



Sensors measuring sap flow record the transportation of water in stems or branches. The aim of today's technology is to cause as little damage to the plant as possible and ideally none at all and to influence the transportation process as little as possible. The water potential of the plants can be determined both on woody parts and on leaf samples using psychrometers.



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Stem psychrometer

Stem psychrometers are used to record the plant water potential of living plants without damaging them. Compared to more commonly deployed leaf psychrometers, they offer the advantage of being considerably easier to attach. This minimises disruptions to the energy balance which in turn improves the overall measurement accuracy.

The stem psychrometer consists of two welded, series-connected chrome constantan thermocouples inside a chrome-plated brass chamber, forming a large insulating thermal mass. One thermocouple is in direct contact with the test stem, while the second simultaneously measures the air temperature in the chamber and then serves as a wet bulb thermometer. A third, soldered copper constantan thermocouple used for temperature compensation is situated inside the body of the sample chamber to determine its temperature. All temperature measurements are entered into the calculation of the plant water potential.

The stem psychrometer is attached to the stem by clamps using light pressure. These clamps are available in two sizes for stem diameters of up to 2 cm and up to

approx. 5.5 cm. The psychrometer can also be attached to thicker stems using special solutions. The measurement can be either psychrometric (wet bulb thermometer measurement) or hygrometric (measurement of dew point) and consistently permits the production of precise and reproducible measurement of the plant water potential with the help of automatic correction of the temperature gradients inside the measurement chamber. With good thermal insulation the setting half-time can be reduced to 60 seconds, making this a very fast and reliable instrument. Every stem psychrometer contains a Smart Sensor Interface which converts the microvolt measurement signal into calibrated stem water potential. The integrated microprocessor keeps the selected calibration equation and measurement frequency in the memory and provides regulated excitation voltage and the Peltier cooling current so that no complicated programming and wiring of the sensor is necessary. In conjunction with the ICT Smart Logger, use of the stem psychrometer can be flexibly adapted to various operational objectives in an accurate, user-friendly and efficient manner.



Technical data

- Resolution: 0.01 MPa
- Measurement range: -0.1 MPa ... 10 MPa
- Equilibrium half-time setting: 60 s
- Accuracy: ± 0.1 Mpa

Advantages

- Determination of water potential without damaging the plant
- Autonomously operating plug & play system

Field plant water status console

The field plant water status console is an analog system used to determine plant water potential up to 40 bar. A leaf or small branch is cut off and first exposed to atmospheric pressure in the specimen holder. The pressure is increased until the plant moisture is pressed through the section of stem. This equilibrium pressure is a measure of the negative pressure of the

water in the plant system at the time of cutting off the sample.

The set consists of:

- Standard specimen holder and accessories
- Manometer compressor which can be adjusted up to 40 bar
- Pressure tank



Technical data

- Suitable for branches/leaves: \varnothing 0 ... 6 mm
- Measurement range: 0 ... 40 bars

Advantages

- Simple, fast and reliable determination of the water potential of plants

The field plant water status console is also available as portable version for use in the field. Specimen holder, manometer and accessories for this are built into a case with handle. In place of the compressor, a portable pressure cylinder generates the required pressure in the sample container. This can be read off using a dial indicator.

The set consists of:

- Standard specimen holder and accessories in a case
- Manometer compressor up to 40 bar
- Portable pressure cylinder

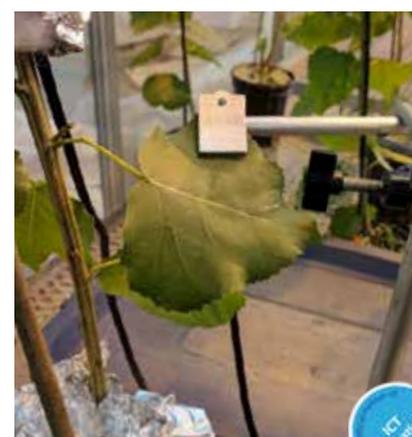


PSY1 Leaf Psychrometer

The leaf psychrometer follows the same principle of measurement as the stem psychrometer, however the body of the chamber is reduced to accommodate smaller and thinner leaf areas in several plant species. The technique used to prepare and install this instrument has also changed as it requires additional care to prepare the installation site. The leaf psychrometer measures the water potential (water status) on a leaf

of a plant. The leaf water potential is a quantified indicator of how water stressed a particular plant is based on the measurement taken from the leaf.

In terms of data logging capabilities of the PSY1, they all remain the same regardless of the application (Leaf or Stem psychrometer chambers). The difference between a leaf and stem psychrometer chamber is the size and plant preparation.



Technical data

- Dimensions: Psychrometer Chamber Diameter: 19 mm
Depths: 19 mm
Weight with cable: 120 g
- Measurement range: -0.05 MPa ... -10 MPa (1 ... 100 bars)

Advantages

- continuous, in-situ Measurements
- stand-alone data logging system
- rugged and water proof enclosure

HFD sap flow sensor (HFD8-100 / HFD8-50)

The Heat Field Deformation (HFD) technology is ideal for measuring radial sap flow profiles. This tool can therefore be used to create a hydraulic “map” of the tree architecture. High, low and negative volumes of sap flow can be determined using the HFD sensor technology. HFD measurements are an ideal supplement to SFM-1 measurements.

The HFD technology is a thermodynamic method based on measurement of the temperature gradients in axial and tangential direction inside the sap wood with reference to a linear source of heat.

The heater needle is heated at a constant level of approx. 50 mA, generating an elliptical heat field under zero sap flow conditions. This becomes more markedly deformed the more strongly defined the current sap flow is. The symmetrical temperature difference is used to measure the bidirectional flow in the case of very low flow volumes, while the average and high sap flows are determined using the asymmetrical temperature difference.

The HFD sensor consists of three measurement needles in combination with a heater needle. These are integrally connected to the Smart Interface based on a digital 24 bit microprocessor.

The sensor is exclusively compatible with an SL5 Smart Logger.



The dT symmetric (dTsym) and dT asymmetric (dTas) values are stored on a 4GB MicroSD card in °C for every radial measurement by all measurement needles.

Each HFD Sensor includes a precision voltage regulator to control the heater voltage between 0 and 12 V in 0.01 V increments. The voltage can be adjusted independently of other sensors in order to ensure complete freedom when designing experiments. The voltage can be adjusted simply via the sensor setup menu either directly using a wired connection or wirelessly using a wireless modem.

The HFD sensor has a maximum of 8 measurement points per needle, spaced at 10mm intervals (HFD8-100) or 5 mm intervals (HFD8-50). On the sensor setup menu the user can set the number of measurement points to be used on the needle from 1 to 8. The data are recorded in °C, then imported into the HFD software. This automatically detects the correct number of set measurement points per set of needles and calculates the



value for the K parameter from this before the sap flow rates are generated from the raw temperature data. The HFD-TOOL software has a modular design and can be individually expanded by adding further modules (e.g. the SFM-1 module). This permits processing of SFM-1 data from the same data logger in order to compare and analyse these with the HFD data at the same time.

Technical data

- Suitable for stem diameter: 10 ... ∞ cm
- Resolution: 0.002°C
- Measurement range: -10 ... 100 cm³cm²/h

Advantages

- Reliable recording of very small and even negative flow rates
- Autonomously operating plug & play system
- Measurement of radial sap flow profiles

SFM-1 sap flow sensor

The “Heat Ratio Method (SFM)” is a modification of the “Compensation Heat Pulse Method (CHPM)”. SFM represents an improvement on CHPM in that it can also be used to measure very small flow rates and even reverse flow rates. It is possible using this method to determine sap flows in trunks, stalks and roots of various types and sizes of plants under different ecological conditions, right through to drought.

A short heat pulse is the tracer for this thermometric method of measuring sap flows in xylem tissue. It is possible to calculate the quantity and direction of the sap flow from the ratio of the amount of heat transported to two symmetrically arranged temperature sensors.

The sensor consists of three 35 mm long needles connected to a 24 bit microprocessor. The top and bottom probes each have two thermistors. The third probe is positioned centrally; it is heated across its entire length and is a linear heat source, generating a constant heat pulse along the sap wood.

The integrated microprocessor is the heart of the fully automated, plug & play capable sensors. It controls all operating settings and sensor calculations, converts analog signals to calibrated values and reads these out via the serial interface. Program variables such as heat pulse interval, energy input, distances between probes and measurement frequency are stored in the memory.



Technical data

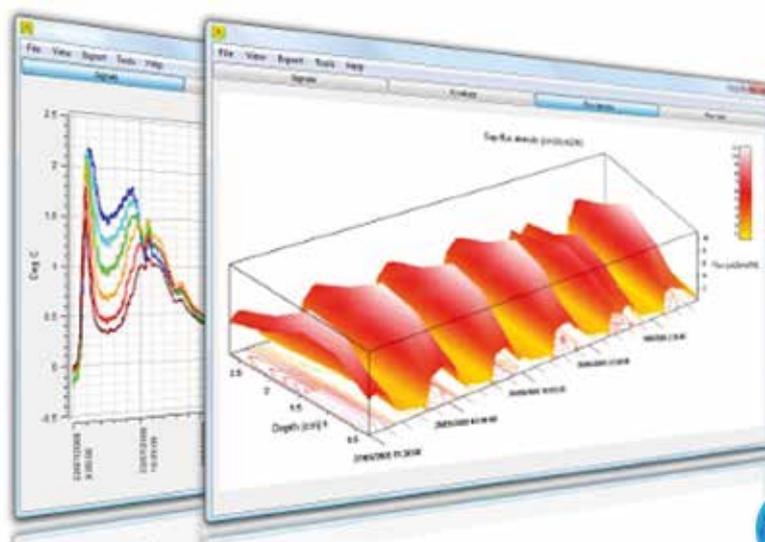
- | | |
|-------------------------------|--|
| • Suitable for stem diameter: | 1 ... ∞ cm |
| • Resolution: | 0.01 cm ³ cm ² /h |
| • Measurement range: | -10 ... +60 cm ³ cm ² /h |
| • Accuracy: | 0.5 cm ³ cm ² /h |

Advantages

- Reliable recording of very small and even reverse flow rates
- Autonomously operating plug & play system
- No additional insulation required

SFT software

Special software to optimise data evaluation is available as an optional extra. In conjunction with the Smart Logger SL5, the SFM-1 sensor provides a complete measurement report with detailed information and all variables required to calculate the velocity and volume of the sap flow.



SF sap flow sensor

This sensor for the continuous measurement of the water absorption of trees operates according to the Granier principle. This measures the temperature difference between two needles that are arranged on top of each other, whereby the top needle is heated by a constant energy supply. The temperature difference can be converted to the water flow using an empirical formula.

Two models are available depending on the degree of accuracy required:

- SF-G, classic Granier sensor with 2 needles
- SF-L, improved Granier sensor with 4 needles and a considerably greater degree of accuracy

The needles are available in 3 different lengths so they can be ideally adapted to the tree size. The energy supply for the upper needle is provided by a CCS power supply for up to 3 sensors. An external data logger is required to record the data. The sensors are supplied with 5 m of cable, weather protection cap and aluminium tubes. The cable can be extended to up to 20 m on request.



Advantages

- Can be used for trees with diameters of at least 2 cm
- Sensor can be reused

Technical data

	SF-G	SF-L
• Suitable for stem diameter:	2 ... ∞ cm	15 ... ∞ cm
• Needle dimension:	∅: 1.5 mm L: 33, 43, 63 mm	∅: 1.5 mm L: 33, 43, 63 mm

Stem psychrometer

170037 Stem psychrometer

Field plant water status console

170090 Laboratory measurement instrument

170091 Field measurement instrument

PSY1 Leaf Psychrometer

170080 for continuous in-situ logging of plant water potential in the leaf

HFD sap flow sensor

170066 HFD8-100 sap flow sensor

170062 HFD8-50 sap flow sensor

Xylemflusssensor SFM-1

170030 SFM-1 sap flow sensor 35 mm needle

SFT software

170031 Software

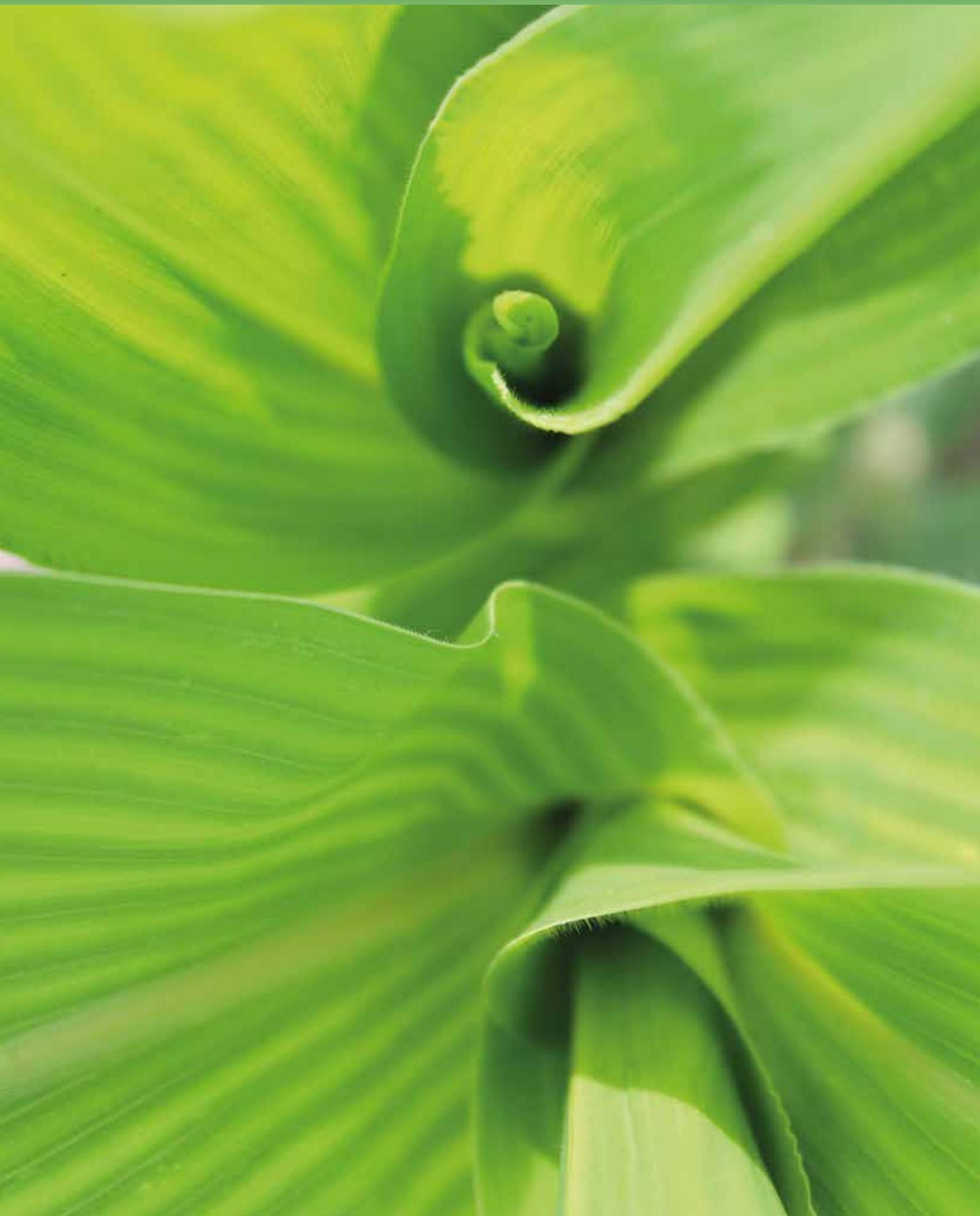
SF sap flow sensor

170050 SF-G sap flow sensor with 2 needles

170053 SF-L sap flow sensor with 4 needles

Related Products	Usable for
Installation kit	<ul style="list-style-type: none"> • Stem psychrometer
Small holder	<ul style="list-style-type: none"> • Stem psychrometer
Large holder	<ul style="list-style-type: none"> • Stem psychrometer
Special software	<ul style="list-style-type: none"> • HFD and SFM-1 sap flow sensor
Installation kit	<ul style="list-style-type: none"> • HFD sap flow sensor
Plug-in sleeves	<ul style="list-style-type: none"> • HFD sap flow sensor
Installation kit	<ul style="list-style-type: none"> • SFM-1 sap flow sensor
Radio module MCC	<ul style="list-style-type: none"> • HFD and SFM-1 sap flow sensor • Stem psychrometer

ORDERING DETAILS





LEAF PHYSIOLOGY

The state of a plant and its reaction to environmental conditions can frequently be first perceived from the leaves, although this often only becomes actually visible after a long time. Such changes can be detected quickly using parameters such as the chlorophyll content of the leaves, the stomatal conductance, CO₂ content or oxygen partial pressure. These data are not only used to determine the current state of the plant, but also serve as a basis for optimised cultivation to substantially boost the harvest.



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LCi-SD photosynthesis measurement system

The LCI is an ultra compact photosynthesis measurement system. Measurement takes place using a newly developed miniaturised analyser for infrared gas analysis (IRGA) which is housed in the plant leaf chamber. The leaf chamber permits very accurate and reliable CO₂ and water vapour measurements for various types of plants. The LCI is an open system. No large external volume is required because a new buffer application is used that compensates for fluctuations in the concentration of CO₂ in the surroundings.



There is also automatic atmospheric pressure and temperature compensation for all CO₂ measurements.

The device is operated using a control console which has a number of buttons, a large LCD display and a range of user-friendly menus with which the user can access numerous parameters. Data are stored on removable SD memory cards. Measurements can either be started from the control console or using a push button on the leaf chamber.

The recorded data can be exported via a USB interface or using direct transfer from the SD card to a computer. The data format is compatible with usual spreadsheet software. In addition to the standard leaf chamber (broad model), leaf chambers for narrow leaves, small leaves, conifers, small canopy growth (e.g. lawn), whole plants, fruits and soil respiration are also available.



The set consists of:

- 1 console
- 1 interchangeable leaf chamber (broad, narrow, conifers, soil, whole plants, fruits)
- 1 carrier bag
- 1 air probe
- 1 charger
- List of spare parts and chemicals as required

Technical data

- | | |
|---------------------------------------|---|
| • CO ₂ measurement range: | 0 ... 2000 ppm |
| • H ₂ O measurement range: | 0 ... 75 mbars |
| • PAR measurement range: | 0 – 3000 μmol/m ² s |
| • Temperature measurement range: | -5 ... 50 °C |
| • Dimensions | Console: 240 x 125 x 140 mm
Leaf chamber: 300 x 80 x 75 mm |
| • Weight: | Console: 2.4 kg
Leaf chamber: 0.6 kg |

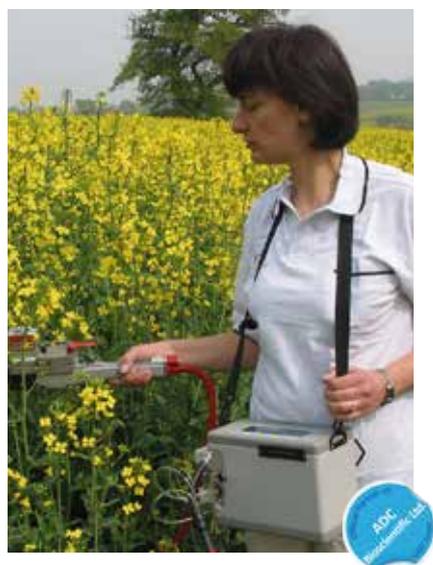
Advantages

- Light, compact and portable for field use
- Interchangeable chambers for various applications
- 10 hour battery life
- Graphical display
- Inexpensive yet effective

LCpro-SD advanced photosynthesis measurement system

The LCpro-SD is the smallest, lightest and most inexpensive system for measuring photosynthesis, permitting complete control of environmental conditions. It offers complete, automatic and independent control of the environmental conditions inside the leaf chamber. The automated control of conditions is possible both above and below ambient values.

Weighing just 4 kg, the LCpro-SD has less than half the weight and half the size of conventional systems offering microclimate control. Nevertheless the space-saving LCpro-SD console has almost unlimited storage capacity and offers flow control and full programmability.



A range of interchangeable heads is available to ensure the system can be optimally adapted to the experimental application. These can be exchanged easily, also during use in the field. Boundary layer resistance and concentration gradients are minimised irrespective of which head is used. All of the measurement chamber materials have been carefully selected to guarantee minimum interaction with H₂O and CO₂. All windows are silicon-coated to reduce scratching. The various measurement chambers (broad, narrow and the special conifer chamber) each have an individual light source with red/blue LEDs. The light source is designed to supply PAR with high intensity and an even spectrum but with little heat loss. All real-time photosynthesis data, calculations and graphs are presented clearly on a large HD LCD display. In addition to the classical photosynthesis and transpiration calculations, the LCpro-SD also provides calculations on soil respiration including NCER when the soil chamber is used. Data are stored on removable memory cards (SD cards), which can either be read out directly in the PC or via the USB interface.



Advantages

- Light, compact and portable for field use
- Completely programmable microclimate and environmental control
- Gas analyser in the handle of the leaf chamber
- 16 hour battery life
- Wide selection of chambers
- Graphical display
- Inexpensive yet effective

Technical data

- | | |
|---------------------------------------|--|
| • CO ₂ measurement range: | 0 ... 3000 ppm |
| • H ₂ O measurement range: | 0 ... 75 mbars |
| • PAR measurement range: | 0 – 3000 μmol/m ² s |
| • Temperature measurement range: | -5 ... 50°C |
| • Dimensions | Console: 230 x 110 x 1740 mm
Leaf chamber: 300 x 80 x 75 mm |
| • Weight: | Console: 4.5 kg
Leaf chamber: 0.8 kg |

AP4 porometer

The stomatal aperture is the dominant factor in the diffusion conductance of leaf surfaces; this regulates both the loss of water from leaves and the absorption of CO₂ for photosynthesis. The measurement of diffusion conductance is therefore an important indicator for the plant water balance and provides a valuable insight into plant growth and adaptation of the plant to the respective environmental conditions.

The AP4 measures the diffusion conductance by comparing the precise rate of humidification within a small cuvette to readings obtained on a calibration plate. This plate has 6 settings for diffusion conductance whose values have been accurately determined using finite element analysis.

The information cited on the accuracy of other porometers and gas analysis systems is based on time-consuming laboratory arrangements and calibration procedures which bear little comparison to operating conditions in the field. By contrast the AP4 features simple, direct calibration in the field in line with a tested physical standard. The special leaf chamber minimises leaf stress and therefore unwanted stomatal closure. The light and ergonomic sensor head, the large and clear LCD display and complete QWERTY keyboard also ensure that it is extremely user-friendly.



Advantages

- Direct readout of stomatal conductance or resistance
- Simple calibration in the field
- Minimisation of leaf stress during measurement
- Award-winning user interface

Technical data

- Conductance measurement range: 5 ... 1200 mmol/m²s
- Conductance measurement range: 0.25 ... 30 mm/s
- Resistance measurement range: 0.2 ... 40 s/cm
- RH measurement range: 0 ... 100%
- Temperature measurement range in measurement chamber: -5 ... 55°C
- Leaf temperature measurement range: 5 ... 5°C
- PAR measurement range: 0 – 2500 μmol/m²s
- Pressure measurement range: 600 ... 1200 hPa

MINI-PAM-II

The robust chlorophyll fluorometer is suited for routine analysis of photosynthesis in the lab and outdoors. An internal computer provides a multitude of options which are controlled by a field-readable b/w touchscreen. Also, operation via a Windows PC is possible. The device is specialized to measure the photochemical efficiency of photosystem II (Φ_{II}). In conjunction with a 2035-B leaf clip, the quantum flux density of photosynthetic radiation at leaf level (in units of $\mu\text{mol s}^{-1} \text{m}^{-2}$) can be measured. The latter data together with the Φ_{II} permits the calculation of photosynthetic electron transport rates.

The fluorometer is equipped with a red LED that maximally emits at 654 nm (alternatively blue, 474 nm). By means of microsecond timing, the same LED can emit weak measuring light, continuous light up to $3000 \mu\text{mol s}^{-1} \text{m}^{-2}$ or very strong light pulses up to $6000 \mu\text{mol s}^{-1} \text{m}^{-2}$. Also, the device provides a far red light source to specifically excite photosystem I. Fluorescence is detected by a photodiode.



AA Mignon batteries provide power in the absence of external electricity. An optional accessory is the 2035-B leaf clip which is equipped with sensors to measure light intensity, leaf temperature and relative humidity. Further add-ons are dark leaf clips to determine F_M and F_0 under day light, and a thermostatable cuvette with stirrer to measure suspensions.

Advantages

- Small, light and tough
- Simple use in the field



Technical data

- Ranges of leaf clip: -20 ... 60°C, 0 ... 7000 $\mu\text{mol s}^{-1} \text{m}^{-2}$, 0 ... 100% rel. humidity
- Parameters: F_v/F_M , $Y(II)$, q_L , q_P , q_N , NPQ, $Y(NPQ)$, $Y(NO)$ und ETR
- Dimensions: 172 x 112 x 76 mm
- Weight: 1.5 kg (incl. batteries)

The set consists of:

- 1 chlorophyll fluorometer with fibre optic MINI-PAM/F (optically effective diameter 5.5 mm)
- 1 WinControl-3 PC-software
- 1 Power supply
- 1 USB data cable
- 2 x 6 AA Mignon batteries and battery charger
- 1 distance leaf clip 60° (2010-A) to position a leaf in front of the fiber optics
- 1 robust aluminum transport case

JUNIOR-PAM

The JUNIOR-PAM is the chlorophyll fluorometer used in teaching. The inexpensive instrument for teaching in schools and universities can be operated using just a notebook. The device measures pulse amplitude modulated (PAM) chlorophyll fluorescence which makes it possible to examine photosynthesis under natural light conditions. Using the "saturation pulse analysis" it is easy to establish the photosystem II efficiency. The measurements permit statements to be made on the stress and damage conditions of plants. By way of standard the device is operated with the JUNIOR-B leaf clip which measures the light intensity at leaf height and the leaf temperature.

The aluminium housing has a socket for a USB cable and for the JUNIOR-B leaf clip. The control and power supply are via the USB cable type A-B.

The internal light source generates blue modulated excitation light with maximum emission at 465 nm and two modulation frequencies (5 and 100 Hz) or blue actinic light with a maximum photon flux density of 1500 $\mu\text{mol}/\text{m}^2\text{s}$; the maximum intensity of the saturation pulse is 10000 $\mu\text{mol}/\text{m}^2\text{s}$. A dark red light source is available for selective excitation of photosystem I. The fluorescence is detected using a PIN-photodiode.

Optional accessories include the "Monitoring Leaf-Clip JUNIOR-B" with micro quantum sensor for selective measurement of the photosynthetically active photon flux density and Ni-CrNi thermocouple temperature measurement.



Advantages

- Inexpensive
- Small
- Simple and clear to use
- Is directly connected to the notebook

Technical data

- Leaf temperature measurement range: -20 ... 60°C
- PAR measurement range: 0 – 25000 $\mu\text{mol}/\text{m}^2\text{s}$
- Dimensions: 115 x 65 x 30 mm
- Weight: 0.2 kg

The set consists of:

- 1 chlorophyll fluorometer with fibre optics (50 mm x 1.5 mm)
- 1 spring leaf clip and magnetic leaf clip
- 1 WinControl-3 Professional software
- Transport case

PAM-2500

The powerful chlorophyll fluorometer for field and laboratory studies.

Das PAM-2500 fluorometer is a “high end” instrument from Heinz Walz GmbH that is characterised by high time resolution, extremely strong light pulses, different light sources and complete programmability. On the basis of its features, the instrument can be used both for studies on rapid fluorescence kinetics and for saturation pulse analysis. Its compact design makes the fluorometer mobile and therefore suitable for use in the field. In conjunction with a suitable light sensor (2030-B leaf clip accessory) it is possible to estimate the linear electron transport through photosystem II.

The cast aluminium housing has connections for the fibre optics, communication cable, 2030-B leaf clip and battery charger or MINI-PAM/AK.

The PAM-2500 operates with red modulated measuring light with maximum emission at 630 nm (al-

ternatively: blue measuring light with maximum emission at 455 nm) with modulation frequencies of 10 to 200000 Hz and two photosynthetically active light sources: blue actinic light (maximum emission at 455 nm) with a maximum intensity of 800 $\mu\text{mol}/\text{m}^2\text{s}$ and red actinic light (maximum emission at 630 nm) with a maximum intensity of 4000 $\mu\text{mol}/\text{m}^2\text{s}$. The red actinic light source is also used for saturation pulse and μ -second bursts. There is additionally a far red light source with maximum emission at 740 nm. The fluorescence is measured using a photodiode.

Advantages

- High time resolution
- Extremely strong light pulse
- Various light sources
- Completely programmable

Optional accessories for the PAM-2500 also include the 2030-B leaf clip with micro quantum sensor to measure the photosynthetically active photon flux and Ni-CrNi thermocouple to determine leaf temperature, a cuvette and agitator to measure suspensions and dark leaf clips to determine F_m and F_0 in daylight. There is furthermore an ultra-mobile computer (Samsung Q1) which fits in the bag supplied with delivery of the PAM-2500.

Technical data

- Leaf temperature measurement range: -20 ... 60°C
- PAR measurement range: 0 – 20000 $\mu\text{mol}/\text{m}^2\text{s}$
- Dimensions: 230 x 1065 x 105 mm
- Weight: 2.5 kg (including battery)



The set consists of:

- 1 chlorophyll fluorometer with fibre optics (optically active diameter 6 mm)
- 1 metal leaf clip to position a sample in front of the fibre optics
- 1 power supply cable with external 12 V direct current source
- 1 MINI-PAM/L battery charger (100 to 240 V AC)
- 1 PamWin-3 software
- 1 carrier bag for tests in the field
- 1 aluminium transport chest

DUALEX SCIENTIFIC+

The DUALEX SCIENTIFIC+ is a leaf-clip used to measure the absolute value of the chlorophyll content in $\mu\text{g}/\text{cm}^2$, the index of flavonol for water stress, the nitrogen status of any crop. The anthocyanin index for temperature stress is in option. All the measurements are real time and non-destructive.

This optical sensor as an internal GPS to do mapping or localization of the plot. It is possible to have 3 levels of classification. After a measurement series, the sensor



automatically displays the average value and the standard deviation of the group. Precision is $\pm 5\%$.



Sampling area is 5 mm diameter. The system can store more than 10,000 multiparametric data.

Technical data

- Measurement area: 5 mm in diameter
- Sample thickness: max. 1 mm
- Storage capacity: 10,000 multiparametric measurements
- Dimensions: 205 mm x 65 mm x 55 mm
- Weight: 220 g (with battery)

Advantages

- Small and light
- Non-destructive measurements
- Real-time measurements
- Multiparametric fast measurements
- High-sensitivity detection thanks to the fluorescence technology

MULTIPLEX RESEARCH

The MULTIPLEX RESEARCH is a fluorometer used to measure the index of chlorophyll for chlorosis, the index of flavonol for water stress, the nitrogen status of any crop, and the anthocyanin index for temperature stress or fruit maturity. The stilbene index for disease detection is in option. All the measurements are real time and non-destructive.

This optical sensor has an internal GPS to do mapping or localization of the plot. It is possible to have 4 levels of classification. Two modes can be used: manual measurements or continuous measurements. Precision is $\pm 5\%$. Sampling area is 50 cm^2 . The system can store 1 million of multiparametric data.



Technical data

- Measurement area: 28 cm (6 cm diameter), or 12.5 cm (4 cm diameter) as an option
- Storage capacity: 1 million of multiparametric measurements (512 Mo SD card)
- Dimensions: 320 mm x 280 mm x 170 mm
- Weight: 2,5 kg (without battery)

Advantages

- Compact
- Non-destructive measurements
- Real-time measurements
- Multiparametric fast measurements
- High-sensitivity detection thanks to the fluorescence technology

SPAD-502Plus chlorophyll meter

The chlorophyll content is an indicator of the health of the plant and can be used to optimise the time and extent of additional fertilisation measures; this brings increased yields and improved quality while simultaneously causing less environmental pollution. The Konica Minolta SPAD-502Plus conducts a fast measurement of the chlorophyll content in leaves without damaging the leaf. The measurement is carried out simply by enclosing the leaf with the sensor head. Because the leaf is neither damaged nor needs to be cut off for this procedure, the same leaf can be measured again later as the plant grows. Up to 30 measurements can be stored in the memory and displayed as trend curve, indicating changes in readings over time and revealing abnormal values at a glance.



The light, splashproof structure makes the SPAD-502Plus the ideal measurement instrument for field use. It uses LEDs as light source, which means the energy consumption is extremely low. Almost 20,000 measurements can be taken using a new set of alkaline batteries.

The set consists of:

- 1 SPAD-502Plus chlorophyll meter
- 1 specimen holder
- 1 carrying strap
- 1 case
- Reference standard

Advantages

- Compact and light design
- Very low power consumption

Technical data

• Measurement area:	2 x 3 mm
• Sample thickness:	max. 1.2 mm
• Accuracy:	±1.0 SPAD value (for SPAD values between 0.0 and 50.0)
• Dimensions:	78 x 164 x 49 mm
• Weight:	200 g (excluding batteries)

LCpro-SD advanced photosynthesis measurement system

176110 LCpro+ advanced photosynthesis measurement system

LCi-SD photosynthesis measurement system

176100 LCi-SD photosynthesis measurement system

AP4 porometer

176120 AP4 porometer

MINI-PAM

176130 MINI-PAM-II

JUNIOR-PAM

176140 JUNIOR-PAM

PAM-2500

176150 PAM-2500

DUALEX SCIENTIFIC+

176151 DUALEX SCIENTIFIC+

MULTIPLEX RESEARCH

176156 MULTIPLEX RESEARCH

SPAD-502Plus chlorophyll meter

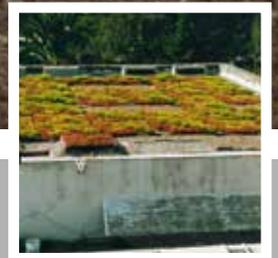
176160 SPAD-502Plus chlorophyll meter

Related Products	Usable for
LCi measurement chamber Broad leaves	<ul style="list-style-type: none"> • LCi and LCi-SD photosynthesis measurement system
LCi measurement chamber Narrow leaves	<ul style="list-style-type: none"> • LCi and LCi-SD photosynthesis measurement system
LCi measurement chamber Conifers	<ul style="list-style-type: none"> • LCi and LCi-SD photosynthesis measurement system
LCi measurement chamber Arabidopsis/small leaves	<ul style="list-style-type: none"> • LCi and LCi-SD photosynthesis measurement system
LCi measurement chamber Flat growth and soil respiration	<ul style="list-style-type: none"> • LCi and LCi-SD photosynthesis measurement system
LCi measurement chamber Whole plants (Arabidopsis)	<ul style="list-style-type: none"> • LCi and LCi-SD photosynthesis measurement system
LCi measurement chamber Fruit chamber	<ul style="list-style-type: none"> • LCi and LCi-SD photosynthesis measurement system
LCi measurement chamber attachment Fluorometer	<ul style="list-style-type: none"> • LCi and LCi-SD photosynthesis measurement system
LCi measurement chamber attachment Removable light unit	<ul style="list-style-type: none"> • LCi and LCi-SD photosynthesis measurement system
LCpro measurement chamber Broad leaves	<ul style="list-style-type: none"> • LCpro and LCpro-SD photosynthesis measurement system
LCpro measurement chamber Narrow leaves	<ul style="list-style-type: none"> • LCpro and LCpro-SD photosynthesis measurement system
LCpro measurement chamber Conifers	<ul style="list-style-type: none"> • LCpro and LCpro-SD photosynthesis measurement system
LCpro measurement chamber Arabidopsis/small leaves	<ul style="list-style-type: none"> • LCpro and LCpro-SD photosynthesis measurement system
LCpro measurement chamber Flat growth and soil respiration	<ul style="list-style-type: none"> • LCpro and LCpro-SD photosynthesis measurement system
LCpro measurement chamber Whole plants (Arabidopsis)	<ul style="list-style-type: none"> • LCpro and LCpro-SD photosynthesis measurement system
LCpro measurement chamber Fruit chamber	<ul style="list-style-type: none"> • LCpro and LCpro-SD photosynthesis measurement system
2030-B leaf clip	<ul style="list-style-type: none"> • MINI-PAM-II • PAM-2500
Cuvette	<ul style="list-style-type: none"> • MINI-PAM-II • PAM-2500
Dark leaf clip	<ul style="list-style-type: none"> • MINI-PAM-II • PAM-2500
JUNIOR-B leaf clip	<ul style="list-style-type: none"> • JUNIOR-PAM
MINI-PAM AK/Cable	<ul style="list-style-type: none"> • MINI-PAM-II • PAM-2500
Samsung Q1	<ul style="list-style-type: none"> • PAM-2500

ORDERING DETAILS



LYSIMETER TECHNOLOGY







LYSIMETER TECHNOLOGY

The knowledge of water balance and the transport processes between atmosphere, plants, soil and soil life through to ground water and the resultant interactions is the focus of ecological as well as agricultural, forestry and water-related questions time and again. Modern lysimeter technology offers the possibility to investigate all these aspects parallel to each other, always with the highest priority placed on conditions which are as natural and undisturbed as possible. UGT has a large and constantly growing repertoire of lysimeter technology along with the know-how collected over 15 years of experience in this specialised area to be able to cater to all requirements.

Only a brief overview may be provided in this catalogue. Our special brochure entitled "Novel Lysimeter Techniques" provides further detailed information on the functioning of lysimeters, the techniques of obtaining and retrieving samples, our range of standard and special lysimeters, past and current projects and we would also be happy to advise you personally.



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Lysimeters

Waterbalance:

$$\Delta W(t) = P(t) - ET(t) - S(t) - R(t)$$



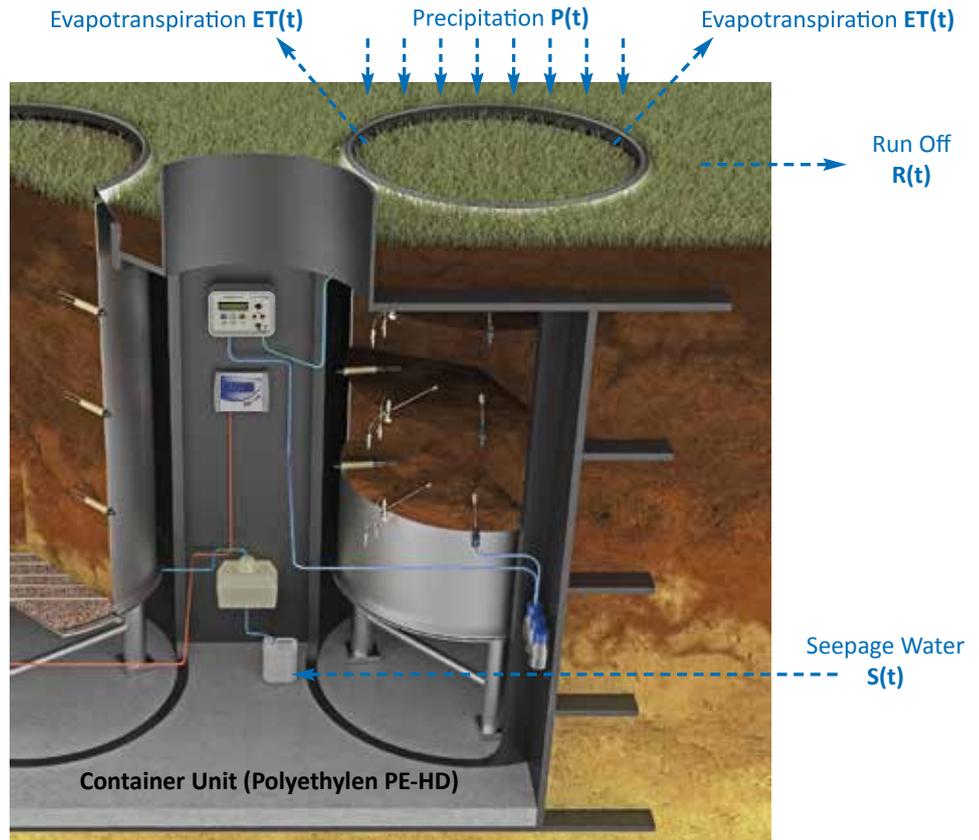
Lysimeter collar



Data logger



Weighing monitor



Lysimeters are an important way of determining the water balance for ecosystems using water balance parameters. In addition to the quantity, it is also possible to investigate the quality of seepage water. Soil monoliths of defined dimensions are taken from their natural environment and given defined boundary conditions. In combination with corresponding measurement technology, it is possible to investigate the function and mode of action of ecosystems in this way. The results can be transferred from small to large scales and are amongst other things a good method to determine the evapotranspiration of a defined area (typically 1-2 m²), of the water and solute transport in a defined volume (typically 1-5 m³) and the degradation and conversion of substances under weathering influences. Due to the possibility of long term outdoor investigations under real location

conditions, statements may be made using lysimeter tests on the water balance of certain climate scenarios, for example. Other possibilities are the comparison of several similar lysimeters in areas with different weathering conditions or the comparison of different soil types or different vegetation with the same weather over a longer time period. These investigations provide the foundation for many models to estimate the effect of climatic change, the spread of contamination in the soil or the success of re-conditioning measures. Typical areas of use for lysimeters are agricultural land locations, forest locations, landfills and post-mining landscapes as well as areas with existing waste deposits in need of re-cultivation. The combination of several lysimeters is recommended for statistically verified statements. Up to 4 lysimeters may be put to-

gether in autonomous lysimeter stations made of PE-HD. For larger test setups several stations can be combined or large lysimeter systems erected with concrete basements. In addition to the outdoor lysimeters, there is also the possibility to operate lysimeters in column experiments under laboratory conditions. These lysimeters are typically smaller and are used to investigate the behaviour of natural soils or vegetations under special environmental conditions, as well as physical/hydrological soil properties of manually imported soils or processes of (contaminant) substance distribution, relocation and leaching. The size of the soil monoliths can vary from very small dimensions (95 cm² in area, less than 1 m deep) through to large lysimeters (2 m² in area, up to 3.5 m deep).

In view of the large breadth of different lysimeters and the respective task-specific measurement method, every lysimeter is tailor-made to meet the requirements of the respective customer. In this chapter therefore, we merely intend to provide an overview of our comprehensive lysimeter technology. We would be delighted to discuss the optimum layout of a lysimeter station with you for your project and to prepare a specific quotation for you.

Number of lysimeters	Type of lysimeter station
1	PE-HD station
2	PE-HD station
3	PE-HD station
4	PE-HD station
1	Shaft of concrete rings
1 ... ∞	Lysimeter basement made of solid concrete



PE-HD lysimeter station for 2 lysimeter vessels during and after installation in Shixia/China



Large lysimeter station with concrete basement for 72 lysimeter vessels in Zürich-Reckenholz



Sampling techniques

Patent No.: 10 048 089; 10 2005 062 896; EP 07 712 322

Patent No.: 10 353 485; 10 2011 006374

for mineral soils

for organic soils and peatland

Soil columns can be sampled with a high degree of precision and undisturbed soil structure without the use of heavy duty equipment using the unique sampling technology for mineral soils developed and patented by UGT.

The sampling device guarantees a vertical passage of the lysimeter vessel down to the sampling depth of the soil monolith and cuts the contour of the soil monolith using a milling device which is guided concentrically around the lysimeter vessel. Due to the cutter on the face of the lysimeter vessel, the final contour of the soil monolith is formed. The lysimeter vessel accommodates the soil column to shape. Only low axial forces are required to cut the lysimeter due to reduction of the sheath friction. The soil monolith is not deformed during extraction and keeps its natural structure. For quality assurance purposes, the cutting process is monitored by a remote camera.

On reaching the sampling depth, the soil column is separated from the surrounding soil area by a cutting device.



After the monolith has been completely cut, it is held in place by the profile holder on the cutting device, acting as a temporary seal of the lysimeter vessel so that the monolith can be lifted safely from the sampling pit after cutting. X-ray and computer tomography examinations of the soil columns extracted using this technology have shown that no cracks or structural changes occur within the monoliths using this method.

All in all the use of lightweight technology impairs the extraction point only minimally and no special requirements are placed on the properties of the ground. Furthermore, this method of extraction is very space-efficient so that the surrounding area is influenced as little as possible when extracting the soil columns.

After extraction of the monoliths, the soil profile in the extraction pit is undisturbed and easily visible. This permits a good assessment of the soil profile in the lysimeter vessel and the taking of soil ring samples for laboratory investigations into soil properties.

Special lysimeter vessels and patented sampling technologies have been developed for the challenges presented by organic soils particularly in bog land. Large organic soil columns can be investigated using the Moor Lysimeter. For this purpose, the lysimeter vessel is trough-shaped, 4 m long,



Lysimeter vessel for Moor Lysimeter after cutting the soil monolith

1 m wide and 1.5 m deep. The length of 4 m facilitates research of the lateral flow processes which are frequently to be observed in bog lands.

This vessel is lowered into a starting pit to extract the soil monolith from where it is horizontally pushed into the peatland on a guide system.



Sampling technique

In order to minimise the destruction of the soil, the soil monolith is pre-cut by means of a cutting device on the face side of the vessel. After completion of the extraction process, the lysimeter vessel is lifted from the pit and sealed for transportation such that the soil cannot shift.

A diameter of up to 200 mm traditional column shaped monoliths can be obtained by vertical cutting using a new extraction technology. The peatland column cutter is made of an easily adjustable basic frame, a cylindrically formed, rotating cutting tube and the tubular cartridge to accommodate the cut soil body.

Ground anchors guarantee the stability of the device also on swampy soil. The cutting element on the lower side of the cutting tube cuts through the vegetation top layer and also any organic deposits such as roots, without shifting position. This maintains the



Vertical withdrawal of a soil monolith from wet peatland



natural structure of the soil body. Any outflow of aqueous substrate is prevented with an adjustable vacuum in the cartridge tube above the soil column.

In addition to the substrate investigation, laboratory and outdoor experiments can also be conducted on large volume undisturbed soil columns to explore substance

conversion processes and microbial changes as well as tracer tests performed depending on different degrees of drainage of the peatland.

Advantages of the lysimeter extraction technology:

- Avoidance of peripheral run off between soil monolith and lysimeter vessel using special tools adapted to different soils
- No impairment of the monolithic soil structure due to congestion or compaction (no deformation) or structural changes resulting from the insertion of the vessel
- Axial guidance of the lysimeter vessel to the extraction depth, avoidance of basic breaks in the monolith
- Light-weight, mobile extraction technology for use under difficult ground conditions
- Simple relocation of the extraction technology, e.g. if impediments are encountered which impair quality such as large stones, deposits or similar at the site
- Well visible soil profile as a result of intact extraction pits providing the possibility of soil mapping after extracting the monolith
- Minimum use of area due to the small distances between the extraction points
- Low impact on site

Sampling techniques

Soil monoliths can be obtained in the following dimensions using the extraction equipment based on this technology:

Diameter /area	Length	Type of the soil
110 mm	up to 300 mm	mineral soils
200 mm	up to 1000 mm	mineral soils
200 mm	up to 800 mm	peatland
300 mm	up to 1000 mm	mineral soils
796 mm 0.5 m ² area	up to 2000 mm	mineral soils
1128 mm 1 m ² area	up to 3000 mm	mineral soils
1596 mm 2 m ² area	up to 2500 mm	mineral soils
4 m ² square	4000 x 1000 x 1500 mm	peatland

Lysimeter station types

There are a variety of materials to house the lysimeters for the installation of a station. Firstly, it is possible to build lysimeter basements from solid concrete which are usually the choice for large installations. But the construction of concrete shafts is also possible for individual lysimeters. These are then composed of individual concrete rings. A good alternative here is hermetically sealed PE-HD container stations which have many advantages over the concrete structure. They are absolutely water proof and gas tight. PE-HD is also not only distinctly lighter but also more stable than concrete which considerably simplifies the transportation and installation. Unlike concrete, the plastic can also be used in contaminated and aggressive media. Contrary to the lysimeter shafts from concrete rings, the basement integrated in the PE-HD stations permits simple access to the lysimeters and therefore unproblematical and comprehensive maintenance.

In special cases, the possibility exists to integrate metal housing (usually stainless steel).

Lysimeters are available in different specially adjusted versions depending on the different tasks. We offer weighable and non-weighable lysimeters, Forest Lysimeters which can also be used with tree stock, Groundwater Lysimeters in which the water level can be controlled according to real conditions or scenarios, Hill-side Lysimeters adapted to the inclination of the ground, Moor Lysimeters for use in peatland and Laboratory Lysimeters for column experiments in different dimensions.

The efficacy of green roofs and railway lines has recently assumed greater importance for ecological urban planning. UGT has also developed special Roof Lysimeters and Urban Track Lysimeters for these experiments.



Greened roof with Roof Lysimeter in the front



Greened track bed with lysimeter

Lysimeter soil retrieval technology

Patent-No.: 102006010158

Following long term experiments it may be of interest in individual cases to consolidate the data obtained by examining the lysimeter soil. Year-long influences of microbial processes, the penetration of roots and substance transportation play a decisive role in the structure of the soil. Furthermore, soil changes in the lysimeter compared to the reference soil at the extraction site can be recorded. A condition for these experiments is the extraction of the soil monoliths from the lysimeter vessel which is as gentle as possible.

UGT has developed a special patented cable cutter, the “lysimeter soil retriever” (LSR) for this difficult task. A diamond cable cuts along the inside wall of the lysimeter vessel, thereby loosening the entire soil column from the lysimeter vessel. Only a maximum of 1 cm at the edge of the soil monolith is discarded as a result of precutting. A hydraulic pushing device beneath the soil plate then makes it possible to push up the released soil monolith virtually without any deformation. A second cutting device is attached to the top side of the lysimeter ves-



Lysimeter soil retriever



Soil slice after retrieval from the lysimeter

sel to cut soil slices of the required thickness, e.g. at the horizon borders from the soil column. In this form the lysimeter content is still essentially undisturbed but easy to access and can be transported even to a laboratory for further investigation.

As a result of this form of retrieval, the upper layers do not need to be destroyed to examine the lower layers. After retrieval, the lysimeter vessel can be refilled and used for further lysimeter experiments.



Advantages of the retrieval technology:

- Facilitates detailed examination of the soil inside the monoliths
- The soil column is impaired during retrieval only minimally around the edges
- Cutting of the monolith in slices facilitates transportation and storage in an essentially undisturbed condition
- The lysimeter vessel is available for further lysimeter experiments
- Soil monoliths of different thickness depending on task and findings

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 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.

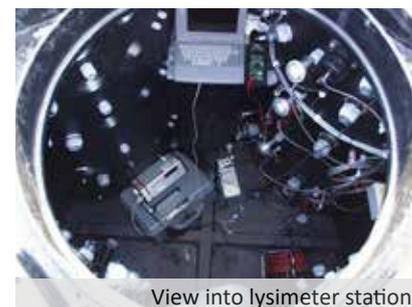
The soil moisture tension of the surrounding soil is recorded with tensiometers and then transferred to the lower edge of the soil monolith by means of a pump system via ceramic cups. Here, too, the possibility exists to conduct the control process in accordance with the scenario irrespective of the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



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.



graphic: © emc GmbH

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

Lab lysimeter

There are a number of advantages to studying soil processes under laboratory conditions: the controlled environment allows more precise experiments, the scale is adapted to several processes and permits shorter test times compared to field studies. Different materials can be integrated quickly. Laboratory lysimeters can be used to realise both monoliths and specifically filled columns.

Column experiments on laboratory lysimeters lend themselves to the examination of physical soil parameters using multistep outflow or multistep flux experiments. These can also be used for measuring conservative or reactive transport.

UGT GmbH offers laboratory lysimeters in a range of configurations. It is possible to control the boundary conditions using a suction base or overhead irrigation, as well as to configure measuring probes freely.

Every lab lysimeter system is adapted specifically customized according to the planned project.



Lysimeter vessels made from different materials and with different dimensions



SOILINSIGHT®

How are the roots growing in the earth? How fast? What is the movement strategy of worms in the soil? SOILINSIGHT® makes it possible to observe and measure root growth during the entire crop cycle. With the University of Lorraine, UGT GmbH has jointly developed a new method for observing undisturbed soil in its development. Here earth and biological elements such as plants or worms are placed in a mini cosmos.

The device can be connected to a Windows-based laptop or laboratory PC, and scans images of the physical structure and biological components (plant roots, worms etc.) of the soil.

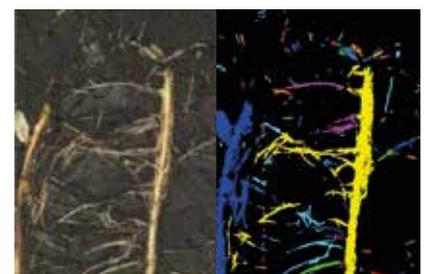
In contrast to the traditionally deployed structure stability tests and soil sampling procedures, this new device permit the continuous

observation of soil without disturbing it.

Images of the development of the soil over a specific period of time can be combined in a film, which enables better studies to be made of the dynamics of aggregation (using zooming, fast forwarding etc.).

Advantages

- Automated high resolution image collection
- Undisturbed observation
- Multi-scaling (from 21 x 30 cm to 50 µm)
- Individual image editing
- Analysis software to quantify pore size, root length, growth rate, soil porosity etc.



Rhizotron chamber

Rhizotron chambers are used for root zone observations and the investigation of the influence of different environmental factors on the growth and development of the plant root system. In addition to the root observation, several boundary conditions of the root growth can be recorded and controlled. Depending on the research aim, the effect of different stress factors such as temperature stress (in conjunction with UGT soil temperature control), water and drought stress (in conjunction with UGT IDS plant) or further chemical (e.g. pH value, content of different substances in soil), biological (e.g. age of the plants) and physical (e.g. bulk density, soil type) stress factors can be investigated. In conjunction with the UGT Soilinsight®, for certain rhizotron chambers high-resolution images of the root system can be recorded automatically over the growing period which for example then can be used for a computer-based determination of the root

density distribution. Due to the vividness of the observation system it is also perfect for school and teaching experiments.

The size of rhizotron chambers can range from a few centimeters for laboratory plants such as Arabidopsis, over large volume chambers for young trees to chambers with a height of 1.5 m for experiments with grain or crops. Depending on the requirements, the chambers can be placed together in rhizotron blocks and can be subjected to the same or varying boundary conditions. Furthermore, the rhizotron chambers can optionally be equipped with water content sensors, tensiometers, suction cups, oxygen probes, temperature sensors, and pH-foils for the monitoring of various boundary conditions and state variables. Depending on the requirements, the dimensions and instrumentation of the rhizotron chambers can be adapted. Rhizotron chambers can be placed in the laboratory or outdoors.



Exemplary sensor assembly



Rhizotron block for the reception of rhizotron chambers with a window size of approx. 30 x 42 cm



Trolley for removing and inserting the chambers

Ready-to-go Lysimeter

The Ready-to-go Lysimeter is a small lysimeter station for soil columns with an area of up to 0.5 m² and a length of up to 1 m. The Ready-to-go lysimeter is suitable both for disturbed soil (filled by hand) and for undisturbed soil monoliths when using the patented UGT excavation technology. The compact lysimeter station consists of a PE-HD lysimeter vessel with weighing system and seepage tank with tipping bucket, a weather station, a data logger and a range of soil hydrological sensors. The system operates as plug and play system, so that the entire station can be erected and put into operation without special tools or specialist personnel. The data are displayed on the internet using the SVADSS online data management system. Up to four Ready-to-go Lysimeters can be connected to one data logger.



The Ready-to-go Lysimeter is the ideal supplement to an existing weather station for directly calculating evaporation.

Advantages

- Inexpensive
- Small, and can therefore be handled and exported without large machinery
- Can be installed by the user himself



Digital weighing monitor UGT WM 100

Lysimeters are weighed at UGT with three precision weighing cells of the accuracy class C3 / C6 and the digital weighing monitor UGT WM 100 with a large graphics-capable LCD display. The stainless steel structure made of tubular steel on B15 concrete base provide a safe base for the weighing technology. This so-called load triangle guarantees a stable and exact installation of the weighing cells as the foundation for a precise measurement. The weighing cells are installed with the assistance of shock mounts which are torque and shear-force free. The use of shock mounts facilitates mechanical flexibility of the force input into the scales. Tensions between the weighing cells through temperature fluctuations, flexion and vibrations which would lead to considerable measurement errors are therefore prevented.



In addition to the centralised data acquisition the new weighing monitor facilitates direct communication with the connected lysimeter. In the lysimeter mode, measurement curves from earlier measu-

rement periods can be graphically displayed in addition to settings and measurement interval changes. Irregularities can therefore be recognised directly during inspections of the lysimeter.

Lysimeter stations

184101 Single station*

184210 Double station*

184300 Quadruple station*

**Customised height and diameter on request!
Instrumentation according to customer wishes / Project requirements!**

* Standard stations: Height: 2 m, area: 1 m²

EcoUnit

188000 We produce your EcoUnit according to your demands and project specifications.

Lab lysimeter

181232 We produce your lab lysimeter system according to your demands and project specifications.

SOILINSIGHT®

186500 Device for the continuous observation of soil development

212500 Analysis software

186540 Rhizotron block approx. 30 x 42 cm

Rhizotron chamber

186535 Rhizotron chamber approx. 150 x 46 cm

186540 Rhizotron block approx. 30 x 42 cm

Ready-to-go Lysimeter

180201 Lysimeter station for small soil columns with an area of up to 0.5 m² and a length of up to 1 m

Related Products	Usable for
Rhizotron block approx. 30 x 42 cm	<ul style="list-style-type: none"> • Soil Insight® • Rhizotron chamber

ORDERING DETAILS



DATA ACQUISITION AND POWER SUPPLY







DATA ACQUISITION AND POWER SUPPLY

Thanks to modern logger technology continuous, high resolution data series can be recorded with a minimum of manpower. Data loggers permit the common recording, storage and management of several sensor outputs of a measurement point. In addition microprocessor-based data loggers control the measurement conditions depending on the current measured values. As a result of constant improvements in power management, the data loggers are becoming increasingly independent of mains power. The data acquisition is already completely autonomous for many applications with solar power supply and remote data transmission.



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Data logger DL-200

The UGT data logger DL-200 is a modular compact device with microcontroller-assisted RAM for the recording of up to 230,000 measured values thanks to an optimised data memory. It is suitable for the use in lysimeters, hydrological soil measurement points, climate stations and many other applications requiring reliable automatic data acquisition - particularly with measurement points with a large number of different sensors because it is compatible with all commercially available physical, soil physical and meteorological sensors. It can also be programmed as process control system with or without logger function, whereby the modular concept ensures a simple, efficient and favourably priced design. If the freely adjustable measured value limits are exceeded the user can be notified by text message or email. This prevents measurement failures or even damage to the measurement technology.

The measurement cycle can be freely selected between 5 seconds and 2 h. The data can be statistically analysed directly in the logger over 15 seconds to 10 days.



The use of a 16 bit A/D transducer with real differential inputs (resolution: 15µV) permits up to 64 input channels. Up to 64 event inputs are available via the digital interface for the recording of date and time of the events precise to the second and 16 counting inputs for the time-controlled recording of numerical values (e.g. tipping counter). 4 switching outputs with up to 16 sensors per output as setpoint generator form the foundation for the use of the DL-200 for process control.

Configuration and data transfer takes place by notebook with the user-friendly software interface UGTLOG via RS232 or USB interface.

As an option the DL-200 can be equipped with GSM modem or Ethernet TCP/IP for remote data communication and remote configuration. The device can be operated in situ using the communication unit with LCD display, also without a notebook.

The intelligent power management places the data logger in a sleep mode between the measurement cycles from which it is woken up by signal inputs or at a set time as well as manually via the communication unit or by connection of a data transfer unit to the interfaces. The resultant low energy requirement permits battery operation with replaceable storage batteries as well as solar power supply for completely autonomous operation in addition to mains power supply.

Depending on place of use, different logger housings are available. Our ABS housing with class of protection IP65 provides the ideal outdoor protection for the logger

Technical data

• Number of channels:	Up to 56 analog inputs 64 event inputs 16 counter inputs 8 RS485 address inputs
• Interfaces:	RS232 / USB
• Power supply:	10.5-15.0V max. 30mV Sleep mode <0.1mA
• Data memory:	230,000 measured values
• A/D transducer:	16 bit resolution 15µV
• Time control:	Measurement cycle 15 seconds to 2 hours
• Process control:	Statistics: 15 seconds to 10 days 4 switching outputs open collector

Advantages

- Large number of inputs
- Compatible with all commercially available sensors
- Simple handling
- Can also be used for process control

... Data logger DL-200

technology from the influences of weather and mechanical damage; it can also be used indoors such as in lysimeter basements or laboratories. Alternatively, the data logger can be housed in a high quality switch cabinet. This permits simple access to the logger for the connection of sensors and protects the logger technology from mechanical destruction. This attractive and easily accessible housing has been particularly designed for use in laboratories and may only be used indoors. A favourably priced housing version

for very large loggers indoors and also for use outdoors is provided by the painted steel housing with a plastic cable flange plate, with diaphragm bushings for cables instead of PGs to minimise installation work.



Portable field data logger DL-200 Mobil

The DL-200 Mobil offers the tried and tested modular UGT logger technology in portable form as 8-channel or 16-channel version. As for the stationary DL-200, the DL-200 Mobil is compatible with all commercially available sensors. It is equipped specifically in accordance with customer requirements. Connection sockets are provided in the front plates for the sensors selected by the customer so that these may be simply inserted in the field. The 512 kByte memory holds up to 230,000 data which may be statistically analysed directly in the logger. Configuration and data transfer is realised using a notebook with the user-friendly software interface UGTLOG, via USB interface.



As an option the DL-200 can also be supplied with additional RS232 interfaces. The communication unit with LCD display permits a fast and simple review of the recording process. Energy is supplied by an internal storage battery with 3.5 Ah. The intelligent power management minimises energy requirements. The data



logger moves to sleep mode between measurement cycles from which it is woken up by signal inputs or at a set time as well as manually via series interfaces or the communication unit. The weatherproof light metal casing with handle makes the logger light and secure and can also be transported even in difficult terrain.

Technical data

- Number of channels: Up to 16 analog inputs
16 event inputs
16 counter inputs
8 RS485 address inputs
- Interfaces: USB / Optional: RS232
- Power supply: 10.5 - 15.0 V max 30 mV
Sleep mode <0.1 mA

Advantages

- Portable
- Compatible with all commercially available sensors
- Compact, weatherproof housing

Logger software UGTLOG

The accompanying software UGTLOG for logger configuration and data transfer is an ideal utilisation of the resources of the Data logger DL-200.

This extensive software is very versatile and can therefore be exactly attuned to every logger. The user interface shows all existing modules and slots. The assignment of the slots by sensors is shown by characteristic symbols so that an overview of the current structure and assignment of the logger is provided at all times. Once the connection has been created between notebook and logger the current values of all sensors can be faded in on the user interface.

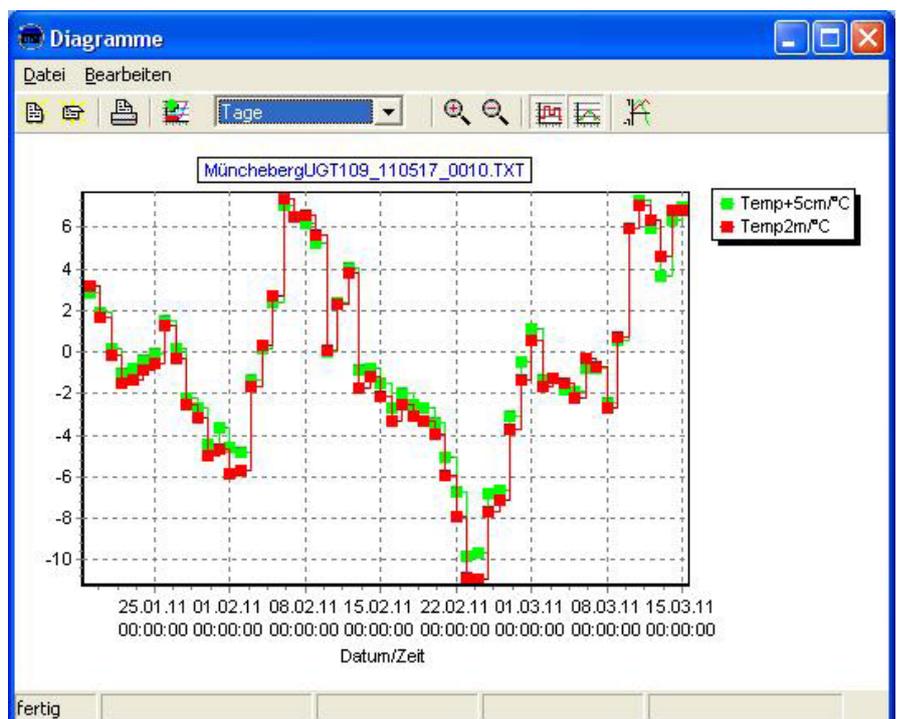
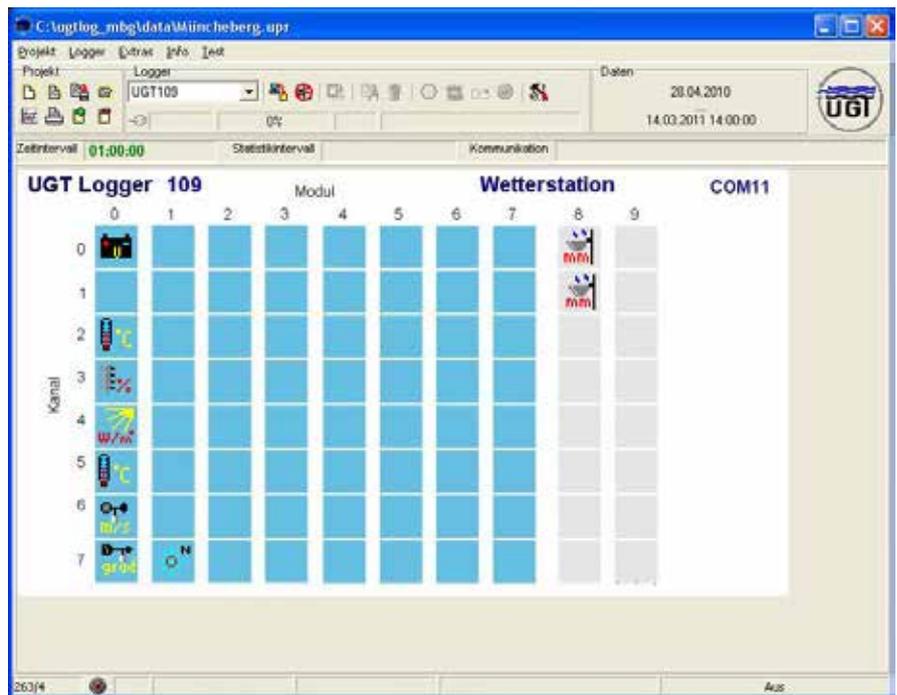
An initial analysis and graphic display can be made in UGTLOG for

Advantages

- User-friendly interface
- Easy to use
- Ideal adjustment to every logger
- Use for several loggers possible

data which have already been read out. The data in question and the scale of the display can be freely selected. Important information on the data quality and the correct function of the sensors can therefore be obtained directly in situ and action immediately taken. Any functional disturbances can be eliminated immediately.

The software is clear and kept deliberately simple. The creation or separation of the connection to the logger as well as the reading out or deletion of data is made



by clicking on the corresponding icons. The logger parameters can also be configured in the tools menu also without any preliminary knowledge of the software.

Once purchased, the software can be used for as many loggers as

required with the corresponding project files. UGT skilled personnel create the project files.

EASYlog data logger

EASYlog data loggers are available as single channel data loggers for different measurement sizes. In addition to models for temperature, moisture and temperature/moisture, a model for process signals is available which records voltages (0-2 V and 0-10 V) or currents (0-20 mA and 4-20 mA) as well as a model to record pulses and contact signals.

Depending on model, EASYlog data loggers offer a memory capacity of up to 48,000 measured values. The recording interval can be set from 2 seconds up to 1 hour. The recording can be started automatically, via a removable electronic key or also if set limit values are not reached.

The data are read out by a simple 2-wire connection which can have

a length of up to 1500 m. The digital transmission of the measurement data means that up to 120 loggers can be connected to an interface line which may be viewed at a central location independently of each other.

Windows software is available for the configuration of the data loggers and the reading out of the measured values. It provides functions for the graphic or tabular display of the measured values and for printing the stored values. For more discriminating analyses the software permits the export of the data into all popular Windows programs.

EASYlog data loggers are equipped with a battery for mains-independent operation. However, supply can also be provided via the



level converter which is used to connect the data logger to a PC. The life of the batteries is approximately 6 years. They are incorporated in a tough housing with LCD display which, with a class of protection of IP 65, is also suitable for outdoor use.

Advantages

- Inexpensive
- Compact and tough design
- Autonomous operation due to the battery power supply

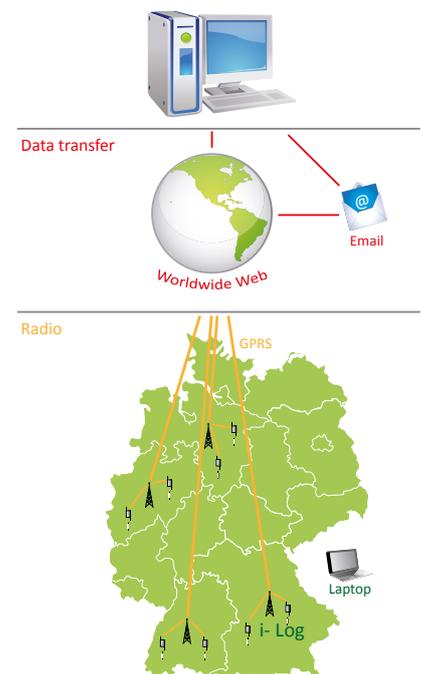
Technical data

- Number of channels: 1
- Interfaces: 2-wire connection
- Energy supply: Battery
Level converter

Remote data transmission/network connection

The optional equipping of the data logger DL-200 with a modem permits the fast and inexpensive remote transfer of data via GPRS because the data volume is very low due to the optimised memory regimen. The data can be read out at any time – in connection with UGTLOG also fully automatically – using any PC, thereby minimising the staffing requirements of a measurement point. The logger may also be configured via GPRS so that remote maintenance is also possible in the case of a fault in addition to remote diagnosis. If the device is equipped with a modem, data of other loggers can

also be used as setpoint values if the logger is used for process control. Depending on the storage conditions of the measurement point, the logger can also be incorporated in an existing network via a COM interface so as to use all these advantages without GPRS connection and the associated costs.



SVADSS - Soil Vegetation Atmosphere Data Sensor Service

More than just datasets!

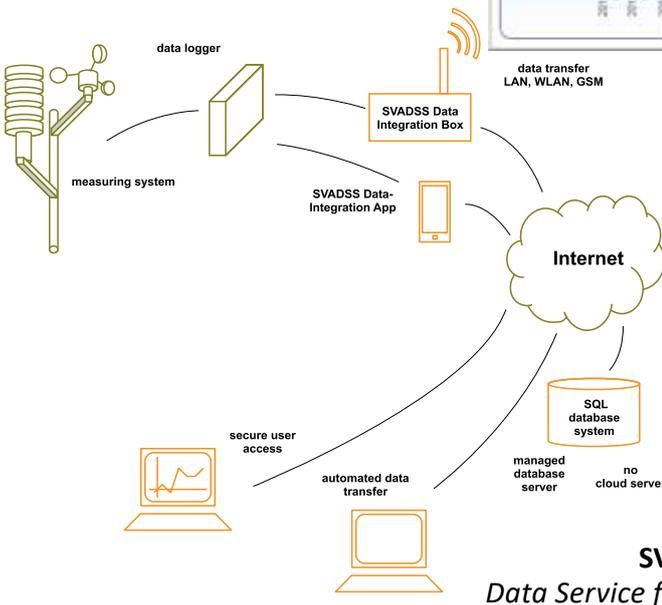
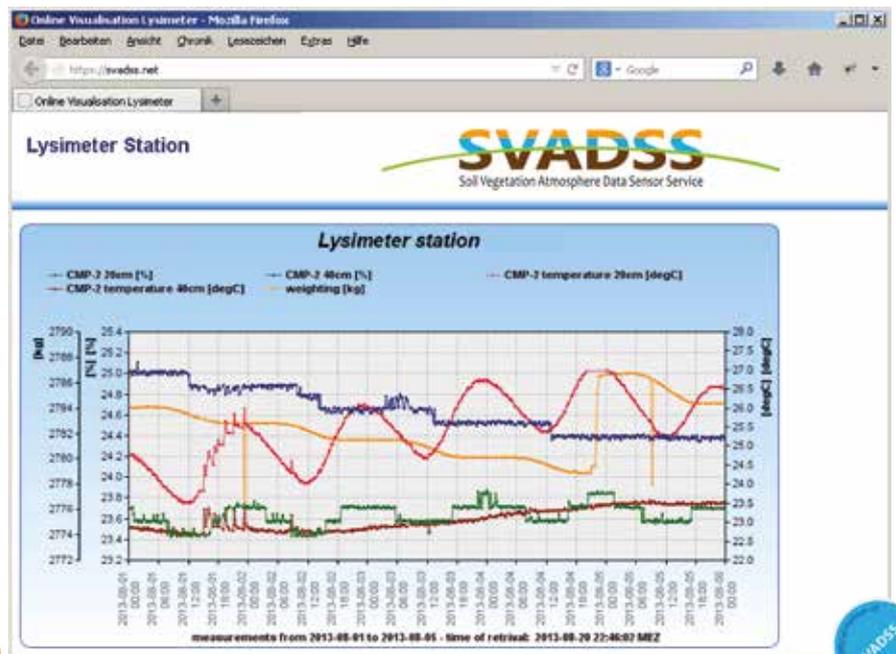
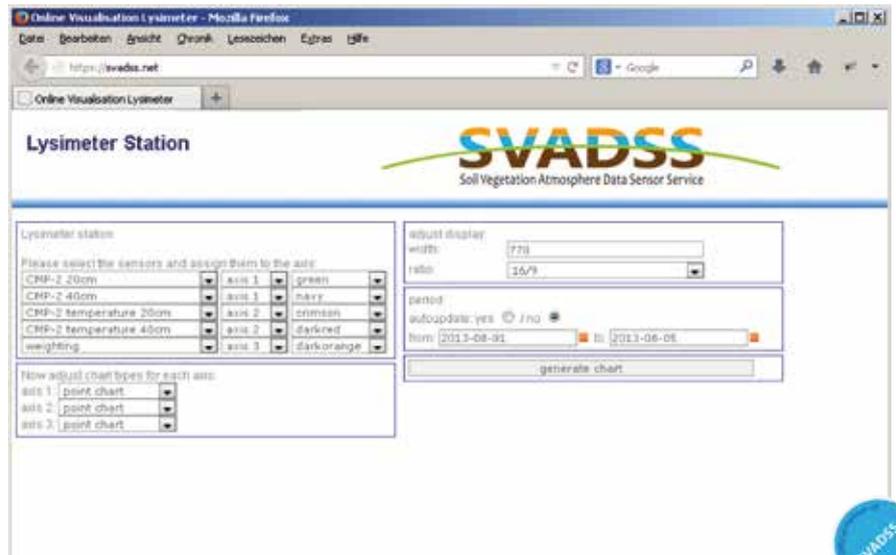
SVADSS offers a unique online data management system for your measuring systems, tailored to your needs.

SVADSS provides any technology of data acquisition from manual data upload, or automatically via LAN/WLAN to semi/full stand alone measuring stations via GSM/UMTS/LTE.

- regardless of your sensor, logger or IT environment
- standard data analysis, evaluations and charts
- extended or exclusive data services
- state-/event system for sensors and data logger

Your data repository is stored in SQL - database - servers operated by SVADSS and not in cheap and not in doubtful cloud services.

Please contact us to know the whole range of our services.



- Advantages**
- user interface for data management
 - full access to all datasets
 - individual, automated data validation
 - standard reports and charts
 - individual evaluations / data processing
 - customizable views
 - sensor management with event recording
 - special data services

LysiData

Scientific data software systems

LysiData offers an integrated software system to meet varied and complex requirements of the (scientific) recording of measurement data.

The modular structure of LysiData software systems offers an adjusted software module for virtually every technical and scientific requirement for the user friendly solving of daily tasks.

LysiData software systems offers a uniform user interface also in heterogenous measurement environments independent of measurement technology used, the number of measurement points or the database system.

It has been designed for the long term availability of measurement data, offers a clear assignment of measurement data to measurement points also after many years and can be adjusted at any time to extensions or changes in the measurement environment.

The LysiData software system is composed of two main core areas:

- A highly flexible database model to show your measurement environment and data in a persistent repository
- A systems of integrated software modules which may be used and adjusted to your measurement equipment depending on size and requirements

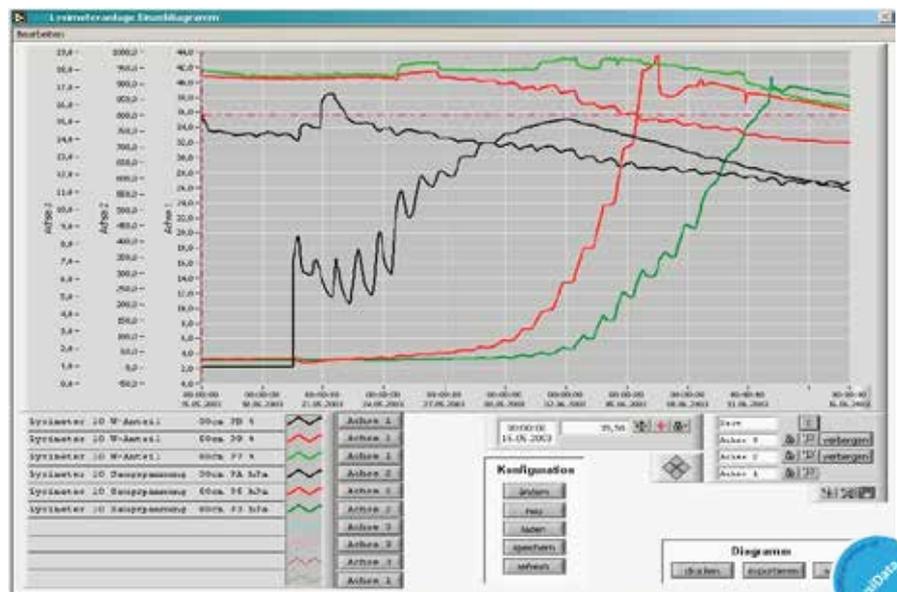
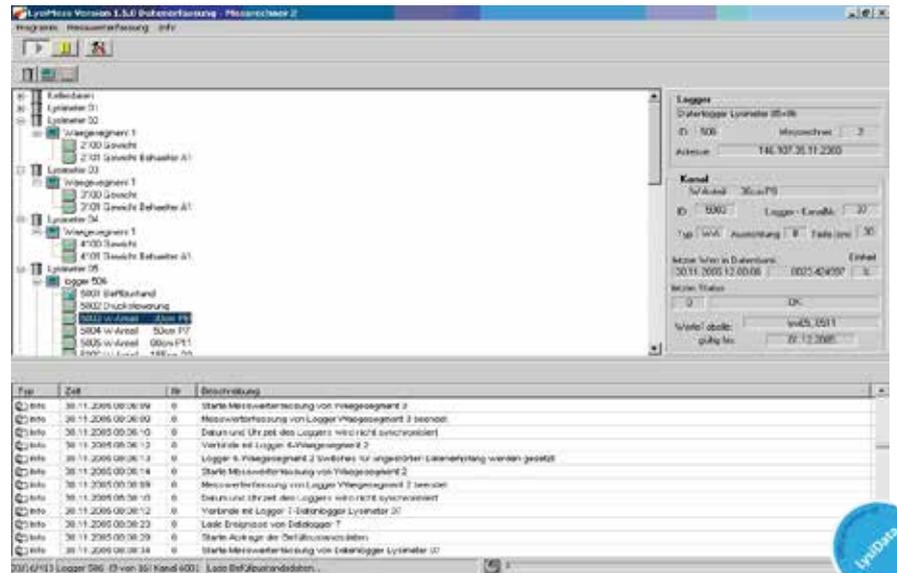
LysiData software system offers modules for the following standard requirements amongst others:

Data acquisition and evaluation, visualisation, simplified database administration, controlling, log-book, data mining, ...

There is only one system and one user interface for all tasks from data acquisition through to (scientific) pre-analysis:

LysiData

Scientific Data Software Systems



The screenshot shows the 'MicheloveControl v2.2' interface. It has a tree view on the left listing measurement points like 'Lysimeter 02', 'Lysimeter 04', and 'Lysimeter 05'. The main area shows a data table with columns for 'Daten', 'Kanal', 'Logger', 'Lysimeter', 'Ereignis/Fehler', 'Klasse', 'Status', 'gültig bis', and 'Bemerkung'. A blue 'LysiData' logo is in the bottom right corner.

Daten	Kanal	Logger	Lysimeter	Ereignis/Fehler	Klasse	Status	gültig bis	Bemerkung
18.05.2014 09:00:00	2516	205	25	2 measured value underruns minimum	Hinweis	occured		
21.05.2014 09:00:00	2516	205	25	2 measured value underruns minimum	Hinweis	terminated		
21.05.2014 15:00:00	2516	205	25	2 measured value underruns minimum	Hinweis	occured		
12.06.2014 10:00:00	2516	205	25	2 measured value underruns minimum	Hinweis	terminated		

Power supply

UGT offers three versions for the power supply of data loggers and measurement instruments: mains power supply, battery operation or solar energy systems.

If connection to the local power network is guaranteed, all loggers and measurement instruments can be supplied by the mains. In order to guarantee interruption-free power supply, this is backed up by a storage battery.

A favourably priced and economical solution for a mains-independent operation is provided by a replaceable storage battery supply. Depending on energy requirements 12 V storage batteries from 6.5 Ah to 41 Ah are available. 2 storage batteries and 1 charger are always supplied in a set which can be charged alternately. Additional storage batteries can be subsequently purchased.



A replaceable storage battery supply set consists of:

- 2 x storage batteries
- 1 charger

Optional:

- 1 housing with mast holder to accommodate the storage battery

The following storage battery types are available:

12 V	6.5 Ah
12 V	10 Ah
12 V	16 Ah
12 V	25 Ah
12 V	41 Ah

Our solar energy systems provide the possibility to operate measurement points completely autonomously. This solution may represent enormous work savings, particularly for distant measurement points. The type of solar panel is planned depending on the application. As required the solar energy system can be supplied with a 2 m high installation mast.



A solar system consists of:

- 1 panel
- 1 storage battery
- 1 charge controller
- 1 housing for storage battery
- Fittings for mast assembly \varnothing 40 mm

Optional:

- 1 installation mast \varnothing 40 mm
Length 2 m with tensioning

Solar energy systems are available in the following versions:

Panel	Storage battery		Application example	Remote data transfer with modem
2.5 W	12 V	16 Ah	Data acquisition of digital input signals	Once a week
10 W	12 V	25 Ah	Weather station	Once every day
20 W	12 V	70 Ah	Small soil hydrological measurement points	Once every day
60 W	12 V	105 Ah	Large soil hydrological measurement points	Constant modem readiness

Data logger DL-200

211100	DL-200 8-channel
211200	DL-200 16-channel
211300	DL-200 24-channel
211400	DL-200 32-channel
211500	DL-200 40-channel
211600	DL-200 48-channel
211700	DL-200 56-channel
211800	DL-200 64-channel

Portable field data logger DL-200 Mobil

214100	Portable field data logger, 8-channel
214200	Portable field data logger, 16-channel

Logger software UGTLOG

211151	UGTLOG Software
211101	Project creation for UGTLOG

EASYlog data logger

213001	Easylog40NSW 0-10 V
213000	Easylog40IMP/S

SVADSS

216000	Soil Vegetation Atmosphere Data Sensor Service
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LysiData

214500	Software modul for Single station
214510	Software modul for Double station
214520	Software modul for Quadruple station

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Energy supply supply

248028	Mains power supply with storage battery
248003	Replaceable storage battery supply 12 V / 6.5 Ah
248004	Replaceable storage battery supply 12 V / 10 Ah
248005	Replaceable storage battery supply 12 V / 16 Ah
248006	Replaceable storage battery supply 12 V / 25 Ah
248007	Replaceable storage battery supply 12 V / 41 Ah

Power supply

220010	Solar energy system 2.5 W
220014	Solar energy system 10 W
221300	Solar energy system 20 W
221400	Solar energy system 50 W
221500	Solar energy system 80 W

Related Products	Usable for
Plastic housing with protective roof For indoor and outdoor use	<ul style="list-style-type: none"> DL-200 8 to 32-channel
Plastic housing For indoor use	<ul style="list-style-type: none"> DL-200 40 to 64-channel
Switch cabinet housing For indoor use	<ul style="list-style-type: none"> DL-200 8 to 64-channel
Switch cabinet housing For indoor and outdoor use	<ul style="list-style-type: none"> DL-200 8 to 64-channel
Storage battery 12 V; 6.5 Ah	
Storage battery 12 V; 10 Ah	
Storage battery 12 V; 16 Ah	
Storage battery 12 V; 25 Ah	
Storage battery 12 V; 41 Ah	
Storage battery 12 V; 70 Ah	
Storage battery 12 V; 105 Ah	
Installation mast 1.5 m	<ul style="list-style-type: none"> Data logger with replaceable storage battery supply
Installation mast with tensioning 2 m	<ul style="list-style-type: none"> Data logger with solar energy system

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