

TDR SOIL MOISTURE METERS

The moisture content determines different characteristics of various materials (energy balance, condition, composition).

The moisture present in the soil particularly determines the transport and storage of solid and dissolved nutrients and pollutants.

Various techniques allow the determination of the moisture content:

- Drying and weighing of samples: very time consuming work and cost intensive and above all destructive.
- The neutron method: expensive equipment, severe restrictions imposed by radiation law.
- Conductivity method: results less reliable due to dependence on type of material and salinity.

A very accurate method that can be easily applied to determine the moisture content is the Time Domain Reflectometry (TDR). The TDR-method allows accurate measuring results that are immediately available (non-destructive).

The principle of the TDR-technique is based on measuring the propagation time of an electromagnetic pulse along measuring pins in the sample. The propagation time depends on the humidity content of the medium to be measured.

14.60 Trime FM-2 soil moisture measuring system

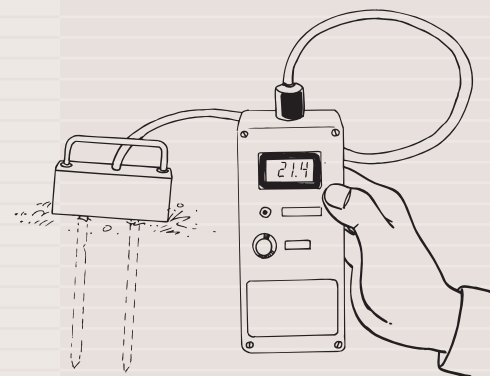
The Trime-system is a specially designed TDR-technique for measuring the moisture content in various materials. The Trime FM-2 system consists of a read-out unit and various two-pin probes. The probes have a measuring range of 0 - 95 volume percentage moisture.

The compact, portable read-out unit is fitted in a robust IP65 housing with an LCD read-out screen. The display shows the measuring result, the TDR-level, the battery capacity and the status. The meter has a very low power consumption; using rechargeable batteries approximately 300 measurements can be executed. The meter has been fitted with an analog output 0 - 1 V

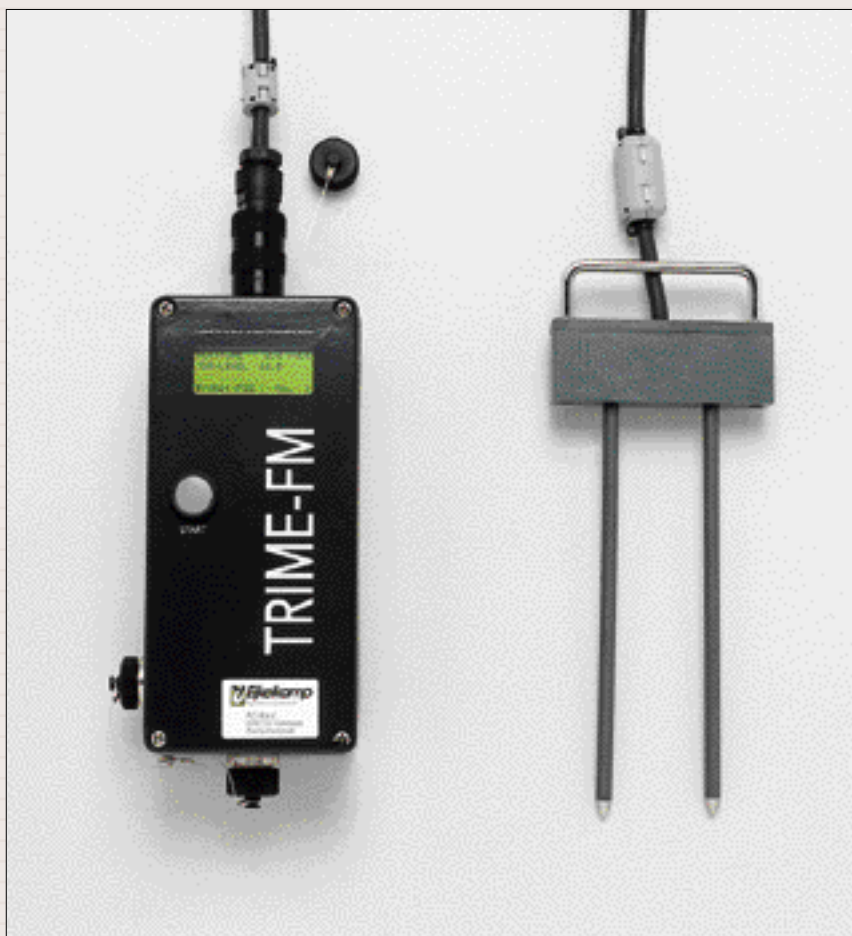
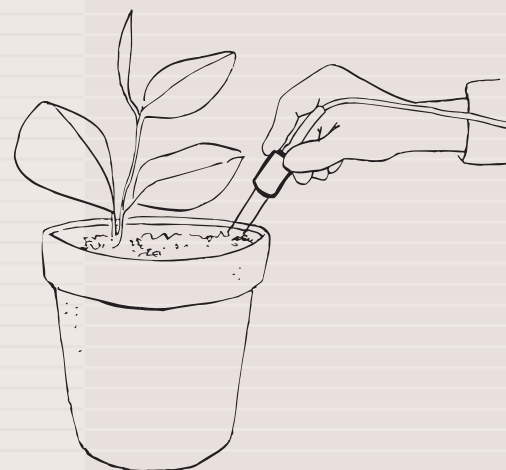


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Reading the meter during a soil moisture determination on the surface.



The determination of the moisture content in a plant pot.

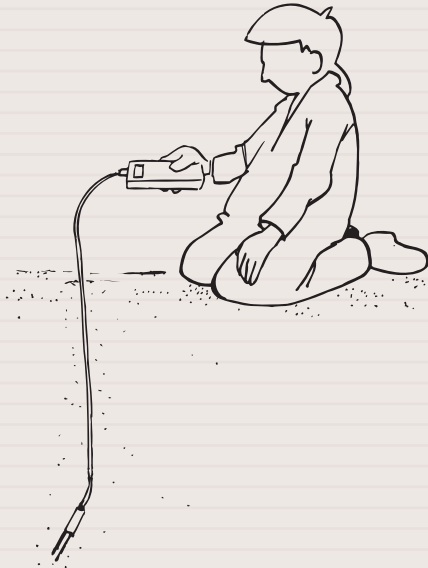


Trime FM-2 soil moisture meter with two-pin probe



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Using the dug-in probe the moisture content in a lower layer is determined.



The probe is pushed into the bottom of the pre-drilled hole.



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and a standard R232/V24 interface and therefore can be linked to a PC for programming, calibrating or reading and processing the measured values.

One meter can be used to read-out several two-pin probes, because the probes specific characteristics (cable length, probe number, type, etc.) are stored in the probe itself.

The meter is supplied in a carrying case including battery charger, cables and pens.

Depending on the application different types of two-pin probes can be connected to the Trime FM-2.

Using the special calibrating set the various probes can be calibrated with the meter.

It is also possible to execute a special calibration for deviating materials or types of soil.

The miniature probe P2M has very thin and short measuring pens (50 mm), causing only minimal disturbance in the medium to be measured. The probe

is especially suitable for measurements at the surface for instance in pot plants or in (undisturbed) soil samples.

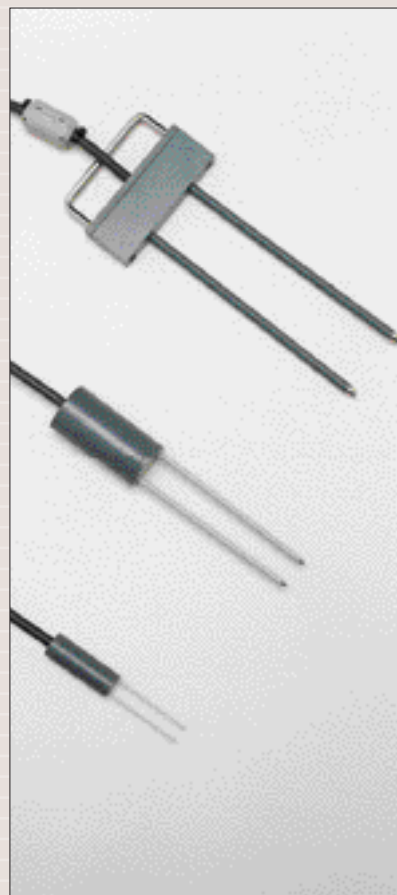
The manually operated probe P2 with a pen length of 110 mm causes only little disturbance in the medium to be measured. The waterproof probe can be dug-in allowing measurements at various depths in the soil.

The P2G-probe, with a pen length of 160 mm, is specially designed for measurements in the top layer of the soil.

The probe also is suitable for measurement in profile holes or in (undisturbed) soil samples.

For measurements in bore holes the P2Z probe was designed with measuring pens of 160 mm.

After drilling a bore hole to the desired depth the bore hole probe can be pushed into the bottom of the bore hole using extension rods and a special adapter.



Two-pin probes



Two-pin bore hole probe with adapter

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14.62 Trime FM-3 soil moisture measuring system

The Trime FM-3 system consists of a read-out unit and various probes, among which the unique tube probe.

The read-out unit or soil moisture meter has the same specifications as the FM-2 meter, it is however only possible to connect three-pin probes or tube probes.

All probes have PVC coated rods to obtain best measuring results even in saline materials (bulk soil electrical conductivity up to 2 dS/m). For very high salinities special high-conductivity-probes (C-version) are available.

The three-pin probes P3S and P3, length measuring pens respectively 110 and 160 mm, are intended for surface measurements.

For measurements in bore holes the P3Z three-pin probe is used. This probe is pushed into the bottom

of the bore hole using an adapter.

The tube probe with a measuring range of 0 - 60 volume percent moisture is used for measurements in thin-walled tubes with a length of up to 2 meter. After installation of the thin-walled tube with cutting shoe in the soil, the tube is sealed watertight using a rubber stopper.

The probe is connected to the FM-3 meter and lowered into the tube. Measurements can be executed at any desired depth in the tube. It is possible to execute measurements on several locations and different depths with only one tube probe.

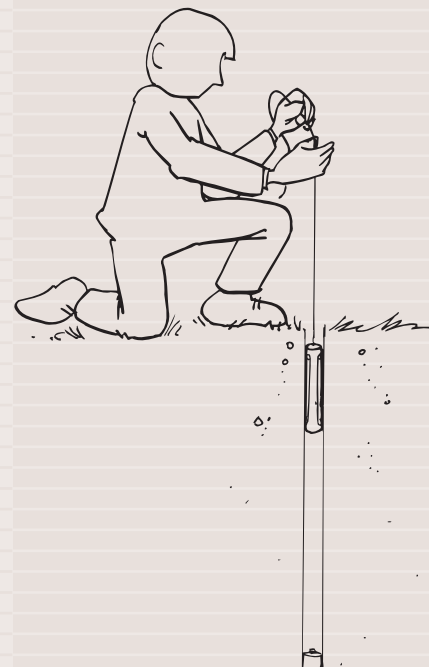
The method using the tube probe can be applied instead of the expensive neutron method. This method also is non-destructive, but suffers the disadvantages of high costs, severe restrictions imposed by radiation law and problems with the radiation released.

The different probes can, using modules, optionally be used in a network.



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The tube probe is lowered into the thin-walled tube.



Trime FM-3 with three-pin probe



Three-pin bore hole probe + adapter

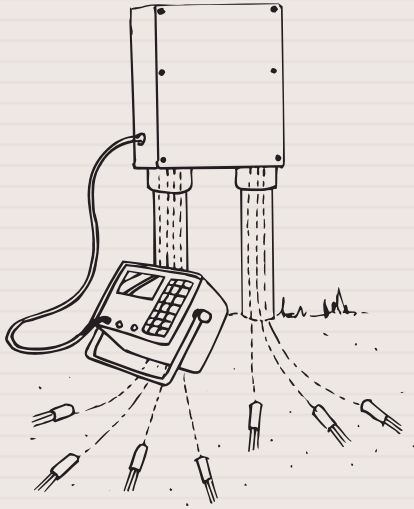


Tube probe, thin-walled tube, stopper



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Reading-out several probes connected in the multiplexer-box.



The MiniTrase can be easily transported in a backpack.



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14.63 Trase soil moisture measuring system

The Trase system is a complete (modular) measuring instrument for measuring and storing moisture data applying the TDR-technique. The open system allows for different cards to be built-in and makes the instrument suitable to meet future requirements.

The instrument can be supplied in two different designs, with or without built-in multiplexer controller card. The meter features a measuring range of 0 - 100% volume percent moisture and is supplied inclusive wave guides, connector, battery and charging equipment.

The meter is housed in a strong, aluminium, water-proof housing and is tip-key controlled. On the large, high-resolution screen it is possible to not only show the measuring values, but also the graphic image of the wave-shape during the measurements. The wave-shape yields all kinds of information regarding the qualities of the material in which the measuring takes place.

The instrument operates with various screens

(setup, autolog, help, etc.) in order to offer user-friendly control.

The meter has a memory capacity for 200 graphs or 6300 measurements. The recharge-able battery is suitable for approx. 750 manual measurements or 1500 automatic measurements. The instrument is fitted with an RS232-gate for connection to a PC, printer or modem, a connection for recharging the battery or connection to an external power source, a multiplexer connection and a BNC-plug. For different applications different wave guides are available. The standard multiplexer-protection box offers weather-resistant housing, allowing several multiplexer cards to be built-in for the connection of several probes (a maximum of 76 channels; larger boxes are optional available). The multiplexer-cards are self-configuring which makes them easy to fit in the system.

Also available is a **MiniTrase** kit (14.63.SA), which retains all of the superior capabilities of the Trase system, but also features significantly reduced weight, size and cost.



Trase soil moisture measuring system