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## SOIL SALINITY / CONDUCTIVITY METERS

In irrigation areas, one is often confronted with salinization problems. In order to acquire the necessary understanding regarding these issues, it is very important to check the salinity of the soil regularly. Also in examining ecosystems that are influenced by salt water (lagoons, etc), it is necessary that we know the salinity of the soil. In some countries, salinization problems can occur in road shoulders, as a consequence of salt sprinkling in the winter.

resistivity of the soil is measured, and this reading is subsequently converted into electrical conductivity. This conductivity depends on the structure and texture of the soil, the moisture content and the salinity of the ground water.

The method is less accurate than a soil sample analysis in a laboratory set-up, but for an estimate of the salinity this method is highly satisfactory. When one has sufficient reference samples, the EC-probe can be used to perform many comparative measurements in a certain area in a short period of time.

### 14.01 EC-probe for salinity measurements, standard set for reading to a depth of 1 m

Determination of the soil salinity is possible by taking soil samples and having these examined in a laboratory. However, this method is labour-intensive and requires transport as well as the availability of a laboratory.

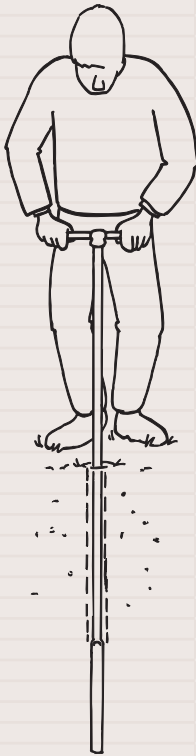
Eijkelkamp Agrisearch equipment has developed a probe which enables its user to determine the salinity of a soil electrically. This probe is called the EC-probe (Electrical Conductivity).

In combination with an earth resistivity meter, the

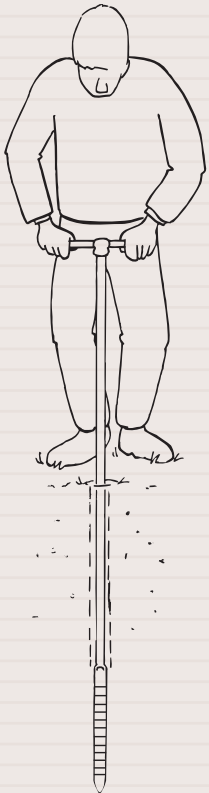
The EC-probe consist of a stainless steel bar, provided with a detachable handle. The bar is provided with a 10 cm graduation. Inside the actual probe, at the bottom of the bar, there are four electrodes, separated by a sealing ring and a insulation ring.

To facilitate measurements with the EC-probe, proper contact (= low contact resistance) with the surrounding soil is necessary.

The gouge auger is used to pre-drill a hole.



The probe is pushed into the hole.



## BENEFITS

### 14.01 Soil salinity meter

- Fastest localization of salt accumulations
- Easy layer per layer measurement
- Instrument for reference measurements
- Can be calibrated by user
- Clearly shows need for leaching
- Simple operation, no sample preparation



EC-probe for soil salinity measurements, standard set

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To establish proper contact, first the gouge auger is used to make a pilot hole to the desired depth. The drilled out soil can be used as a reference sample to determine the calibration curve.

In every EC-measurement, the temperature of the soil stratum that is to be read must also be measured.

For this purpose, the tip of the probe is provided with a temperature sensor. Having measured the earth resistivity, the temperature correction factor is determined. The temperature coefficient can be read before the electrical conductivity is calculated.

The standard set includes: the EC-probe, an earth-resistivity meter, the single gouge auger, a spatula and a strong transport bag.

## Advantages

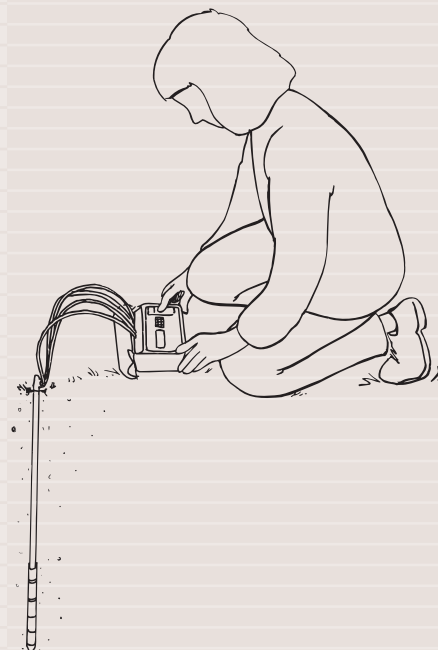
- ☐ Operates quickly and easy.
- ☐ Saves labour and laboratory research
- ☐ Is relatively inexpensive compared with laboratory research.
- ☐ Earth resistivity meter comes in splashproof, shock-resistant synthetic housing.

One limitation is that the research method is less accurate than a soil sample analysis in a laboratory set-up (however, it is much faster).



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**Having connected the EC-probe to the resistivity meter, the latter is subsequently read off.**



EC-probe



Earth resistivity meter



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# SOIL SALINITY / CONDUCTIVITY METERS

### 11.41.11.SA e+ SOIL MCT sensor/logger, standard set for surface measurements

Eijkelpoort Agrisearch Equipment has developed a Soil Moisture, Conductivity and Temperature sensor in its e+ sensor product range. Measured data are stored internally and can be transferred optically to the user via the e-SENSE® telemetry system or directly to a handheld readout or PC.

e+ SOIL MCT intelligent data logger features

- ☐ Measurement of Moisture content, electrical Conductivity and Temperature in soils or comparable substrates
- ☐ Storage of the measurements
- ☐ Comparison of actual values to preset alarm values (when using telemetry)
- ☐ Transfer of the measurements optically to the user directly or via the e-SENSE telemetry system
- ☐ Allows for user definable sampling and transfer intervals, which also can be set remotely

The measuring principle of the sensor is based on the Frequency Domain Method (FD), described by

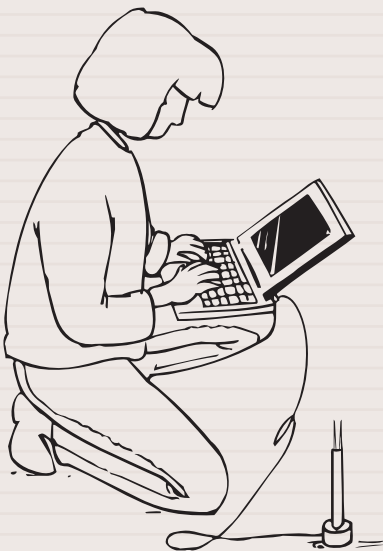
Wageningen University & Research Centre (van Balendonck and Hillhorst), at a frequency of 20 MHz, from which the system derives:

- ☐ permittivity
- ☐ conductivity
- ☐ temperature

The sensor contains a dedicated chip developed by the Institute of Agricultural and Environmental Engineering in Wageningen, the Netherlands and a microcontroller data logger with embedded software that will allow for a range of applications, e.g. the sensor can derive from its data

- ☐ volumetric water content
- ☐ bulk electrical conductivity (ECb)

The internal software can automatically compensate the conductivity for the measured temperature. From a range of different soil types the moisture content will be accurately measurable, based on general calculation models (e.g. TOPP 2001 model) and local calibration data.



## BENEFITS

### 11.41.11.SA e+SOIL MCT sensor/logger

- Follows soil moisture% behaviour and stores
- Records conductivity and temperature also
- Large memory, data can be send with modem
- In-situ field uploading possible with IR
- Different lengths available for profile research
- Perfect for trend analyses
- Standard calibration in logger



e+ SOIL MCT sensor/logger

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Soil specific calibration is possible with a 2-point calibration which can be set up by the user.

## Applications

- ☐ Agri- and horticulture and plant science e.g. to monitor and control irrigation parameters.
- ☐ Area's where the actual value or the actual change of water content is of importance.
- ☐ Foodstuffs before and during long term storage.
- ☐ Dike guarding
- ☐ Salinization processes

## Technical specifications

e+ SOIL MCT logger:

- ☐ Memory capacity: 3x20.000 measurements
- ☐ Measurement interval time: 10...60 sec; 1...60 minutes; 1...24 hour
- ☐ Datalogging method: Fixed interval time
- ☐ Clock accuracy: 1 sec. per day
- ☐ Alarm levels (adjustable): low and/or high alarm in the complete range of all measuring parameters
- ☐ Battery status indication: 0...100%

e+ SOIL MCT sensor:

- ☐ Measuring frequency: 20 MHz
- ☐ Measurement volume (saturation):  $\geq 1000$  ml (500 ml 98% accuracy)
- ☐ Measuring range soil moisture: 0...100% volumetric
- ☐ Accuracy soil moisture:  $\pm 2.5\%$  of the measured value (mineral soils, 0...50 °C)
- ☐ Resolution soil moisture: 0.01%
- ☐ Measuring range conductivity: 0...5 mS/cm
- ☐ Accuracy conductivity:  $\pm 5\%$  of the measured value (0...50 °C, 0...2 mS/cm)
- ☐ Resolution conductivity: 0.01 mS/cm
- ☐ Measuring range temperature: 0...80 °C
- ☐ Accuracy temperature:  $\pm 0.5$  °C
- ☐ Resolution temperature: 0.01 °C

Communication:

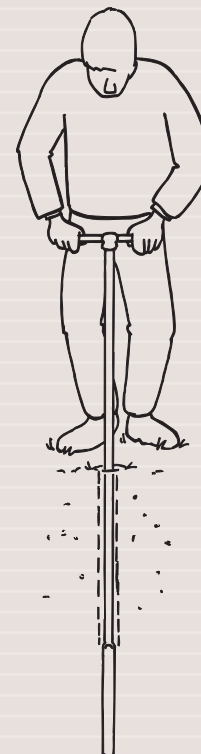
Via : e-SENSE SMS-modem

Optical read-out unit

Diver data cable

IrDa remote connection (1...2 m)

A hole is pre-drilled to install the e+ SOIL MCT sensor/logger.



The measurements can be read-out and processed on a PC.

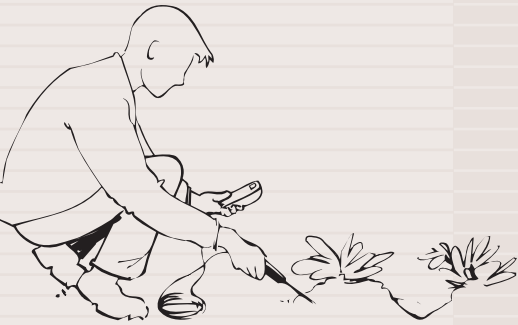


e+SOIL MCT sensors for different depths (up to 100 cm)



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The WET sensor is used to monitor the effects of irrigation with saline water.

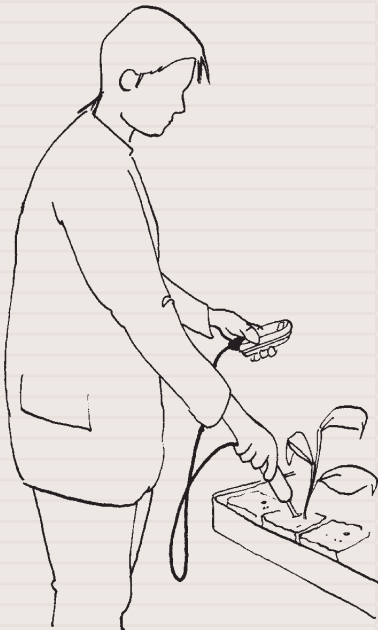


## BENEFITS

### 19.33 WET sensor kit

- Sensor can be used in field or on samples
- Readings can be stored with date and time
- Reads moisture%, bulk conductivity and T
- Push and read; no preparation
- Perfect to show changes in time or layers

Testing the substrate for nutrient availability with the WET sensor.



## SOIL SALINITY / CONDUCTIVITY METERS

### 19.33 W.E.T Sensor, set for direct measurement of water content, soil temperature and conductivity of soil and substrates

Also included in our product range is the WET sensor, to measure pore water conductivity and temperature in the top layer of a soil. The measurement values are shown on the display of the hand held meter and can be stored in the memory (including time and sensor location). These data can be read on a PC.

The WET sensor measures three vital soil properties directly within the soil: Water content, Electrical conductivity and Temperature. The sensor is unique in its ability to measure pore water conductivity, which is the EC of the water that is available to the plant. Traditionally this measurement has been made by the time-consuming and error-prone method of extracting pore water from the soil by suction, before measuring it with a standard conductivity meter. In contrast, the WET sensor is simply pushed into the soil (or other growing medium) and then read directly using the hand held meter.

The standard set includes: the WET sensor, a hand held meter, the software and a carrying case.

### Applications

- ❑ Salinity monitoring
- ❑ Plant nutrient status and fertigation
- ❑ Pollution and land reclamation
- ❑ Soil moisture mapping

### Specifications

- ❑ Measuring ranges: permittivity 1 - 80, bulk conductivity 0 - 200 mS.m-1, temperature - 5 to 50°C, volumetric soil moisture 0 - 1 m3.m-3.
- ❑ Accuracy: permittivity  $\pm 2.5$ , bulk conductivity  $\pm 10$  mS.m-1, temperature  $\pm 0.7$ , volumetric soil moisture  $\pm 0.03$  m3.m-3.
- ❑ Response time: ~5 seconds.
- ❑ Calibration: suitable for a variety of standard soil types.
- ❑ Environmental sealed to IP67, connector to IP65.
- ❑ Operating temperature: 0 to 50 °C.



W.E.T Sensor and hand meter

# PARTS LIST

| Art.no.                                            | Description                                                                                                                                                                                                                                                             | Qty.<br>in set | Art.no.            | Description                                                                                                                                                                                      | Qty.<br>in set |
|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <b>Soil salinity / conductivity meters (P1.62)</b> |                                                                                                                                                                                                                                                                         |                | <b>11.41.11.SA</b> | <b>e+ SOIL MCT sensor/logger set. Complete standard set for surface measurements, including e+ SOIL MCT sensor/logger, reading unit (RS232) and software.</b>                                    |                |
|                                                    | The EC-probe is used for in-situ measurement of the salt content of the soil. The set is suited for measurements to a depth of 1.0 meter.                                                                                                                               |                | **11.41.11         | e+ SOIL MCT set for surface measurements, consisting of e+ SOIL MCT sensor/logger (art. no. 11.41.11.01), 2 e+ SOIL MCT measuring pens (art. no. 11.41.11.02) and battery set (11.41.90.01).     | 1              |
| <b>14.01</b>                                       | <b>EC-probe for soil salinity measurements, standard set for measurements to 1 m depth</b>                                                                                                                                                                              |                | **11.11.10         | Reading unit for DIVER (RS232) (optical principle), is used to program and read out the DIVER, incl. cable with RS232 connection                                                                 | 1              |
| **14.01.02                                         | EC-probe with detachable handle, Ø 30 mm, total length 110 cm, with built-in temperature sensor                                                                                                                                                                         | 1              | **11.11.14         | CD-ROM with Logger Data Manager (LDM) software (for Win 95, Win 00, Win XP and Win NT4.0), USB driver software. Operating instructions included on CD-ROM for Diver, LDM and USB driver.         | 1              |
| **14.01.14                                         | Earth resistivity meter with LCD-display, measuring range 0 - 2000 Ohm, resolution 0.01 Ohm, accuracy +/- 2 % of the reading, splash waterproof, shock resistant housing, power supply 8 Penlite batteries, low-battery indicator, in carrying bag + strap, CE approved | 1              |                    | <b>Optional reading unit (USB)</b>                                                                                                                                                               |                |
| **14.01.01                                         | Single gouge auger with detachable handle, Ø 24 mm total length 130 cm, operational length 50 cm                                                                                                                                                                        | 1              | 11.11.10.01        | Reading unit for DIVER (optical principle), with USB connection, used to program and read out the Diver, with cable with USB connection. Incl. installation software and operating instructions. |                |
| **04.05.01.16                                      | Bent spatula, breadth 16 mm                                                                                                                                                                                                                                             | 1              |                    | <b>Optional MCT sensor/loggers for measuring to a depth of 1 meter. (incl. auger for installation):</b>                                                                                          |                |
| **14.01.03                                         | Transport bag for EC-probe set (excl. earth resistivity meter)                                                                                                                                                                                                          | 1              | 11.41.14           | e+ SOIL MCT set for measuring depth of 25 cm, consisting of e+ SOIL MCT sensor/logger (art. no. 11.41.14.01), 2 e+ SOIL MCT measuring pens (11.41.11.02) and battery set (11.41.90.01).          |                |
|                                                    | <b>For direct conductivity measurement in soils and substrates we also supply:</b>                                                                                                                                                                                      |                | 11.41.15           | e+ SOIL MCT set for measuring depth 50 cm, consisting of e+ SOIL MCT sensor/logger (art. no. 11.41.15.01), 2 e+ SOIL MCT measuring pens (11.41.11.02) and battery set (11.41.90.01).             |                |
| <b>19.33</b>                                       | <b>W.E.T. sensor kit. Complete set for direct measurement of water content, electrical conductivity and temperature in soil and substrates. Consisting of data collection module, W.E.T. sensor, software and carrying case.</b>                                        |                | 11.41.16           | e+ SOIL MCT set for measuring depth of 75 cm, consisting of e+ SOIL MCT sensor/logger (art. no. 11.41.16.01), 2 e+ SOIL MCT measuring pens (11.41.11.02) and battery set (11.41.90.01).          |                |
| **19.33.03                                         | W.E.T. sensor. Combined water content, electrical conductivity and temperature probe. Inclusive sensor calibration software on 3.5" disk 2 m cable and 25-way D-connector, incl. voltage regulator.                                                                     | 1              | 11.41.17           | e+ SOIL MCT set for measuring depth 100 cm, consisting of e+ SOIL MCT sensor/logger (art. no. 11.41.17.01), 2 e+ SOIL MCT measuring pens (11.41.11.02) and battery set (11.41.90.01).            |                |
| **14.26.02                                         | Soil moisture meter to read out the Thetaprobe, the W.E.T. sensor, the profile probe and the SM200 soil moisture sensor. With 25-way D socket. Incl. operating instructions, PC software and RS 232 cable.                                                              | 1              |                    | <b>Auger for installation of e + soil MCT sensors:</b>                                                                                                                                           |                |
| **19.33.04                                         | Carrying case for W.E.T. sensor with data collection module and operating instructions                                                                                                                                                                                  | 1              |                    |                                                                                                                                                                                                  |                |
|                                                    | <b>For continuous monitoring of soil moisture, conductivity and temperature in the soil we recommend the e + soil MCT sensor/logger set.</b>                                                                                                                            |                |                    |                                                                                                                                                                                                  |                |



## PARTS LIST

| Art.no.       | Description                                                                                                                                                             | Qty.<br>in set |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 11.41.91.08.C | Gouge auger, bottom part,<br>for installation of e+ SOIL MCT<br>sensors in the field, operational<br>length 100 cm, diameter 23 mm,<br>conical screw thread connection. |                |
| 01.10.11.C    | Handle, short, 10 cm, with beating<br>head, c.sc.                                                                                                                       |                |
|               | <b>Optional reading unit for<br/>IRDA communication.</b>                                                                                                                |                |
| 11.31.90      | e+ infrared communicator to<br>program and read out the<br>e+ sensor from a distance<br>(1 to 2 m)                                                                      | 1              |
|               | <b>Note: e + Soil MCT sensors can<br/>also be connected to e-SENSE SMS<br/>modems for telemetric<br/>communication (see P4.32)</b>                                      |                |



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