SIP COMPACT S

• Stand-alone long-term impedance measurements on sediments and rocks.

Spectral Induced Polarization

Geophysics

SIP COMPACT S

The instrument measures the complex electrical impedance of rocks and loose sediments over a wide frequency range (0.1 mHz - 40 kHz). After being programmed using a laptop computer via WiFi (WLAN), it measures the changes in impedance over time by repeating measurements. The internal battery is sufficient for a total measurement time of at least 10 hours. This measurement period can be spread over one year. Between measurements, the instrument enters a sleep mode that places almost no load on the battery. The data is stored on a CD-card in a fail-safe manner. They can be called up via WiFi at any time if required. An extended version (SIP COMPACT E) additionally allows GPS synchronized measurements together with other measuring devices of the same design, as well as the independent sending of data emails via the mobile phone network.

SIP COMPACT S features:

- WiFi interface for programming and data retrieval.
- Autonomous measurements over a period of up to one year.
- Measures the complex electrical impedance of rocks and soils.
- One channel for current measurements and three channels for voltage measurements.
- PC operating software to calculate complex resistivity, export data, display and store time series.

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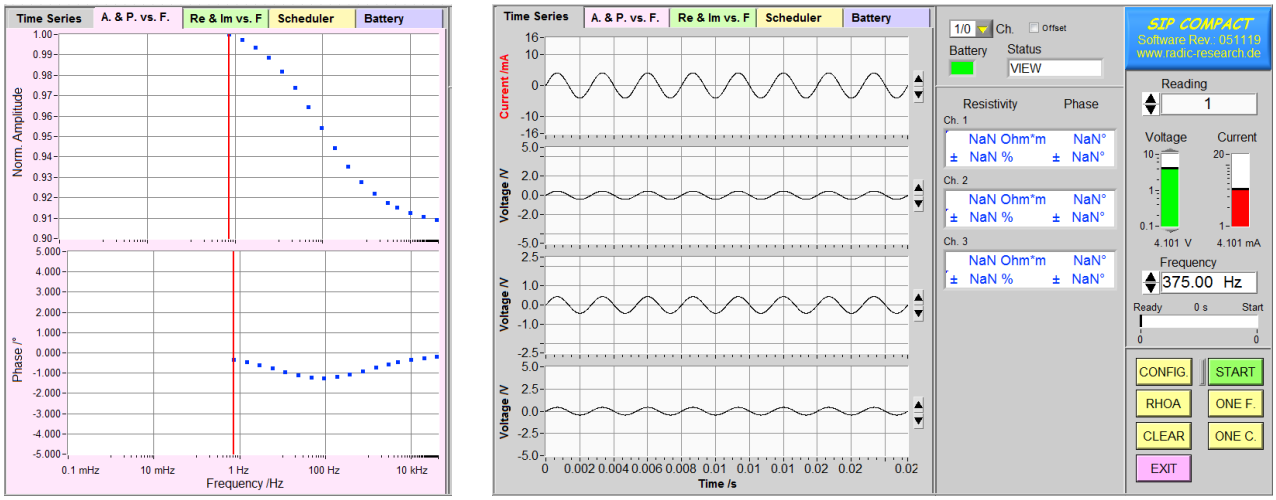


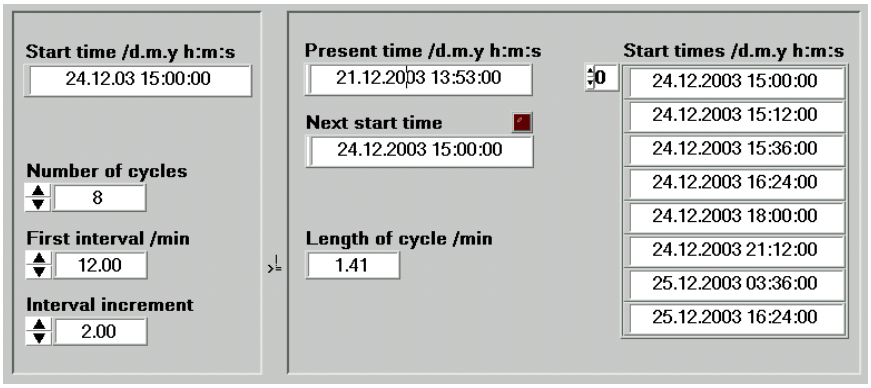
Main screen of PC operating software, left: recorded time series, right: measured impedance spectrum

▲ OPERATING SOFTWARE

The main menu of the PC operating software displays (real time) the recorded time series of current and voltages during the measurement. This makes a first data quality check very easy. Recording starts at highest frequency. The recording time increases therefore from a few milliseconds up to tens of minutes per frequency. Depending on the lowest measured frequency, the acquisition of a complete spectrum takes from a few minutes (f_{min}=1 Hz) up to one hour (f_{min}=1 mHz). A second quality check permits the observation of the confidence limits of amplitude and phase. Moreover, the current intensity and whether the measured impedances fulfil a smoothness criterion is checked.

SCHEDULER ▶

The scheduler menu supports auto repetitions of measurements. Time intervals between cycles of measurements can be set as constant as well as exponential in- or decreasing.
Left: Settings for start time, number of repetitions, first time interval length and exponent.
Right: Resulting start times of individual cycles.



AUTO SLEEP MODE

The instrument automatically switches to sleep mode between two measurement blocks. In sleep mode, the power consumption is negligible and the battery is no longer discharged. In this way, repeat measurements can be spread over a period of up to one year.

ACTIVE GUARDING TECHNIQUE

Active guarding technique minimizes the input capacity of the voltage measuring channels. Low input capacity is most important to increase the noise immunity in a laboratory environment. It also reduces systematic errors, which appear at high frequencies if the contact resistance of the potential electrodes is high. This technique improves measuring accuracy especially when unsaturated or low porous samples are investigated.

WiFi

Communication between the PC measuring computer and the SIP COMPACT S measuring instrument is wireless via WLAN. This is more convenient in the field than using a USB cable. In this way, the status of the measuring instrument can be checked and measurement data can be read out. In addition, the measuring instrument can be reprogrammed.

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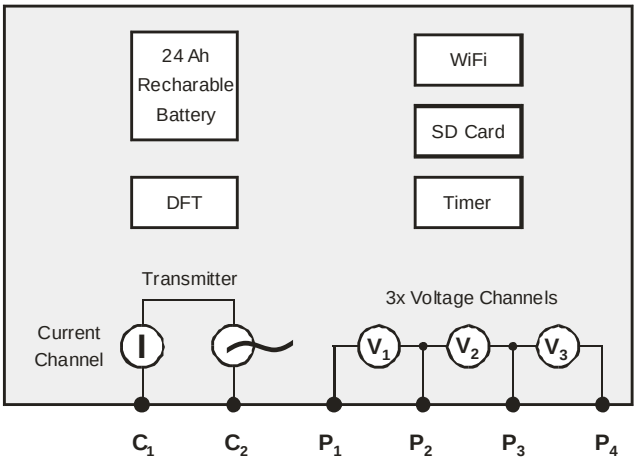


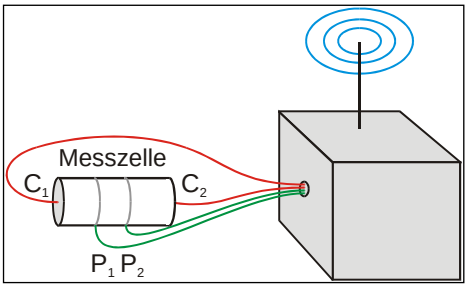
Schematic diagram of SIP COMPACT S.

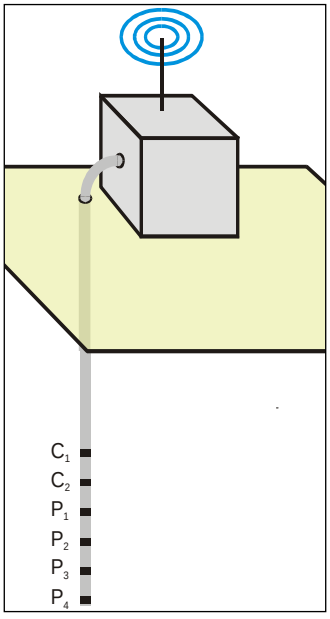
SD CARD MEMORY

In the case of long-term use in the field, for example, an empty battery could result in a device failure. To ensure that the measurement data obtained up to this point are not lost, they are continuously written to the integrated fail-safe SD card. The SD card can be read out at any time via WiFi.

LAB APPLICATION

The SIP COMPACT S is ideally suited for impedance measurements on material samples. Usually a 4-point configuration is used. The adjacent figure shows a typical measurement setup. A measuring cell is required for such a laboratory measurement. This is not part of the measuring device.





FIELD APPLICATIONS

The SIP COMPACT S is also suitable for field measurements with a fixed configuration. Typical applications are the long-term monitoring of landfills, groundwater levels or landslides. For this purpose, spectral impedance measurements are repeated at intervals of hours, days or weeks. By comparing the spectra, even the smallest changes in the pore space can be detected and characterized. In the interest of high data quality, only configurations with geometry factors K<10 m should be used. Also the measuring cable should not be longer than 10 meters. Otherwise couplings between the test leads would falsify the impedances measured at higher frequencies.

SIP COMPACT S

Technical Specifications

General

- Frequency Range:100 µHz - 40 kHz
- Voltage Source: ±10 V, ±10 mA
- Signal: mono/multi sinusoidal
- Buffer Length: 128 k samples / ch.
- Data Format: 32 Bit
- Digital Power Line Filter (50/60Hz)
- Digital Drift Filter
- PC Interface: WiFi
- Build-in Rechargeable Battery
- Weight: 1.0 kg
- Casing: Plastic
- Size: 55/175/250 mm^3

Measuring Current

- A/D Converter: 24 Bit
- Data Rate:128kHz / 2^n, n=0,1,2…18
- Input Range: ±10 mA
- Shunt: 300 Ω (default)

Measuring Voltage

- Channels: 3
- A/D Converter: 24 Bit
- Data Rate:128kHz / 2^n, n=0,1,2…18
- Input Range: ±5.0 V

PC Operating Software

- Control of the whole system
- Time series recording, displaying, storing, calculation of transfer function and confidents limits
- Data export

Minimum PC requirements

- Windows 7 - 10
- Clock: 1 GHz, RAM: 1 GB
- Display: 768 x 1024 pixel
- WiFi interface

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