

SIP Fuchs III

- For wide frequency range investigations on complex resistivity of sediments and rocks

Spectral Induced Polarization System

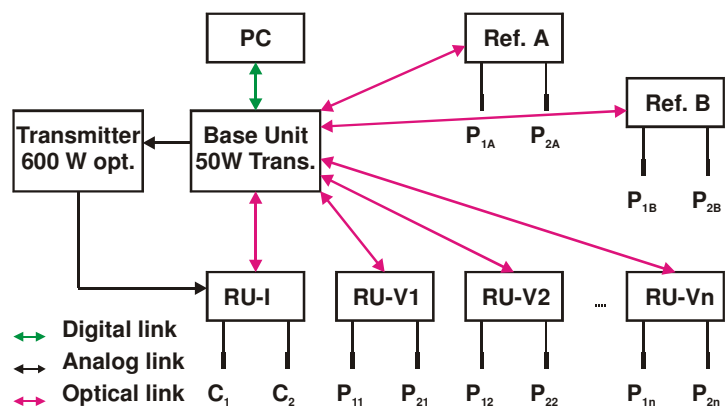


Geophysics

The **SIP Fuchs III** system measures the frequency dependence of resistivity (amplitude and phase) of rocks and sediments over 7 decades. At non-mineralized sediments the frequency dependence is controlled by the pore space structure. This delivers additional information for an improved characterization and discrimination of the materials. The **SIP Fuchs III** instrument is also suitable for large exploration depths, for investigations of low conductive materials and for measurements with unconventional electrode configurations. SIP measurements are also possible in noisy environments often found in laboratories as well as in densely populated areas.

SIP Fuchs III equipment consists of:

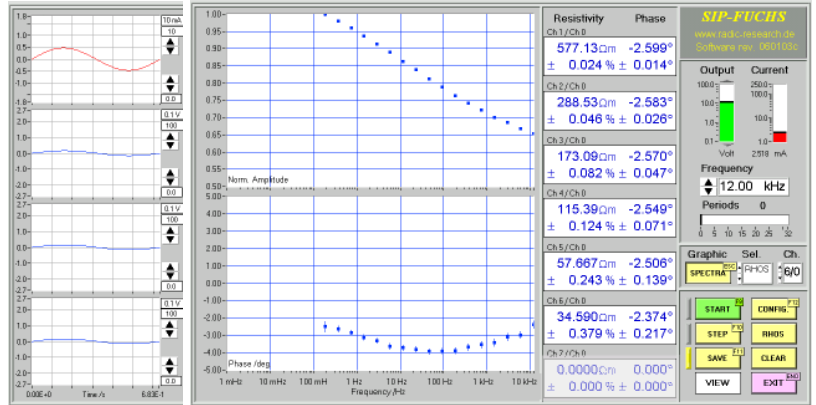
- a base unit with build-in 50 W transmitter, signal generation, data management & synchronism
- 2 - 8 remote units for true parallel current and voltages recording
- 2 remote reference units for telluric noise recording
- PC software to control the whole system
- an optional external 600 W transmitter



SIP Fuchs III schematic diagram

DATA ACQUISITION SOFTWARE

During the measurement the main menu of the PC (Notebook) displays (real time) the recorded time series of current and voltage(s). This makes a first data quality check very easy. The measurement starts at the highest frequency. Thereby the recording time increases from a few milliseconds up to tens of minutes per frequency. Depending on the lowest measured frequency the acquisition of a complete spectrum takes 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.



Main screen of PC operating software.

FIBER OPTICAL DATA TRANSMISSION

For data transmission and system synchronization optical fibre are used. This eliminates uncontrolled cross coupling between transmitter and receivers and increases measuring accuracy because potential cables can be shortened to the distance between the electrodes.

EM EFFECTS

Unavoidable electromagnetic coupling between current and potential cables causes EM effects. Coupling produces a signal that overlies the wanted signal. The **SIP Fuchs III** instrument operates up to frequencies of 20 kHz. At these high frequencies, EM effects superimpose IP effects already at medium conductivities and configuration factors. Two strategies help to minimize EM coupling effects:

1. Voltage and current cables will be separated from each other as wide as possible
2. EM effects are taken into account from special inversion programs: Radic et al. (1998): 4th EEGS meeting.

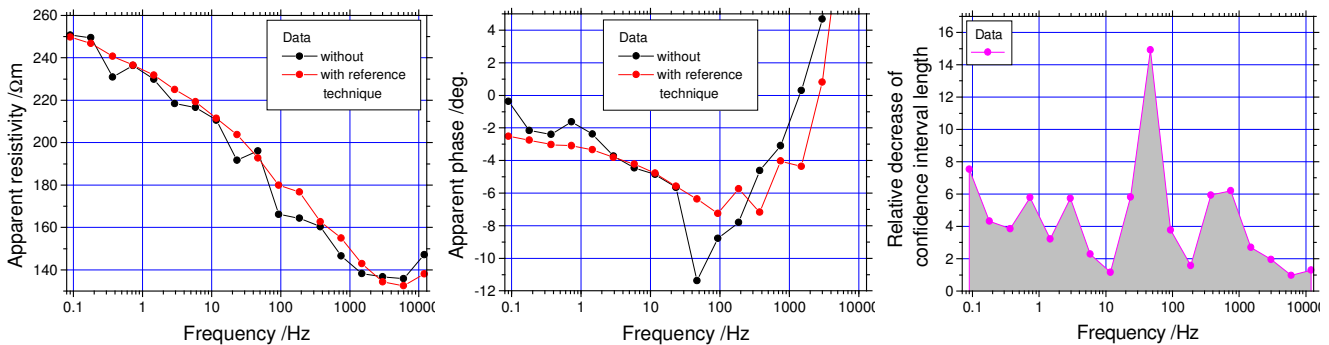
The **SIP Fuchs III** instrument is well prepared to support both strategies.

ACTIVE GUARDING TECHNIQUE

Active guarding technique lowers the input capacity of the voltage measuring remote units. 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 voltage probes is very high.

GEOELECTRICAL REFERENCE TECHNIQUE

A multi-channel coherency analysis allows an identification and cancellation of external noise voltages. Soft- and hardware support up to 2 noise monitors, which have to be placed in a distance of up to 200 m from the profile. Thus the confidence intervals of the data can be reduced up to more than factor of ten. The data set, which is shown below, was measured next to a dc powered railway line (Schönholz - Berlin). This new technique does not prolong measuring time.



Comparison between measurement with and without Geoelectrical Reference Technique (GRT). This data set was measured next to a dc powered railway line (S-Bahn station Schönholz – Berlin).

RANGE OF APPLICATIONS

- Humus
- Seashore
- Arable land
- Historical buildings
- Contaminated sites
- Archaeological sites
- Laboratory measurements
- Nuclear waste disposal sites
- Estimation of hydraulic permeability
- Groundwater exploration in arid areas
- Discrimination between clay and saline water
- Detection and characterization of electronic conductors (mineral exploration)



Base unit with or without build-in 50 W transmitter available



External 50 W & 600 W transmitter available



Remote unit (current)



Remote unit and remote reference unit (voltage)

SIP FUCHS III

Technical Specifications

Base Unit

- Frequency range: 1 mHz - 20 kHz
- Signal shape: sinusoidal
- Optical interfaces to 2 - 8 RU
- Optical interfaces to 2 RRU
- PC interface: 920 kBit/s (USB 1.2)
- 50W build-in transmitter: $\pm 400V$, $\pm 125mA$ or $\pm 200V$, $\pm 250mA$
- Interface to ext. 600 watt transmitter
- Powered by ext. 12 V car-battery
- Weight: 10 kg
- Plastic case size: 50 x 35 x 18 cm³

Remote units

- A/D converter: 24 Bit
- Data rate: 48 kHz / 2ⁿ, n=0,1,2...10
- Input range (voltage): $\pm 10 V$, $\pm 0.4 V$
- Input range (current): $\pm 2.5 A$, $\pm 0.1 mA$ (1 Ω shunt), $\pm 25 mA$, $\pm 1 mA$ (300 Ω shunt)
- Time series: max. 64k samples
- Data format: 32 Bit
- Digital power line filter
- Digital drift filter
- Optical cable length: 2-1000 m
- Battery capacity: ~20 h
- Weight: 5 kg
- Case: cable drum \varnothing 23 cm

Remote reference units

- Same data as remote unit (voltage)
- Can used also as remote unit

PC

- Windows XP, W7
- Control of the whole system
- Time series recording, storing, displaying, transfer function, confidents limits

Optional ext. 600 W transmitter

- Frequency range: DC - 20 kHz
- Maximum output: $\pm 400 V$, $\pm 1.5 A$
- Powered by: 230 VAC, 47-63 Hz
- Weight: 41 kg
- Plastic case size: 57 x 63 x 62 cm³

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