TEMcompany

# sTEMprofiler
# Product Description

TEMcompany
Value groundwater assets

# Contents

# 1. INTRODUCTION

The sTEMprofiler system maps subsurface geological layers, making it ideal for the location of new groundwater wells and estimating the extent of aquifer layers and groundwater recharge conditions. The sTEMprofiler produces close to continuous data, which is well suited to locating fractures and provides an estimate of the thickness of a weathered overburden. Another application is mapping surface layers to identify the best sites for rapid artificial infiltration of excess surface water into subsurface aquifers.

The system is designed to be easy to use, and very little training is necessary for the field crew. The sTEMprofiler is operated from an iOS or Android App, and data is processed on a Windows PC. The sTEMprofiler instrument can be used both with the profiler rig and with a standard sTEM 40 x 40 m transmitter loop.

A sTEMprofiler station is done by putting the rigs on the ground and stretching out the setup. Then, 15 – 30 sec of data is measured, the rigs are lifted up, moved 10 – 20 m, and the measurements are repeated. A well-trained crew of 2 or 3 people can easily make a station in 2 minutes. This corresponds to 30 stations per hour, or, with 15 m between the stations, 450 m of densely sampled profile.

The investigation depth depends on the geological layers' overall resistivity, but it can be as much as 150 m. To put this in perspective, in a similar profile collected with ERT (Earth Resistivity Tomography) with 5 – 7 people taking almost a day, the depth of investigation would only be around 100 m at most in the center of the section.

The system transmits a 5 Amp or 10 Amp current. Small, lightweight batteries deliver the power for a day of operation. Data is processed using dedicated software and presented along cross-sections or on maps. Combining the information from the sTEM measurements with topography data, typical resistivities of the aquifer layers, etc., an excellent hydrological image can be created, and well sites can be pinpointed.

A sTEMprofiler system is designed to be lightweight and portable. The instrument, transmitter, and receiver rig weigh only around 20 kg. It can easily be transported in a shipping box, making checking in as luggage on airplanes or putting on the back of a truck hassle-free. Figure 1 shows a picture of the system.

At TEMcompany, we are committed to providing comprehensive support to our customers. We engage in close dialogue to assist with survey planning, help with data quality control, and even aid in interpreting results. Our team of experts is always available to offer guidance and expertise, ensuring that the sTEMprofiler geoscanner provides maximum value.

The price of the sTEMprofiler starts at just over 22,000 EUR for the 5 Amp version. The instrument can easily be upgraded to 10 Amp. Please ask us about the exact costs for any combination of power and rig.

Figure 1: The sTEMprofiler in operation. The system is operated from an Android or IOS app. The transmitter and receiver rigs are engineered to be very stiff.

## 2. STEMPROFILER

The sTEMprofiler is a very lightweight and mobile configuration used for rapid measurements with shallow to intermediate investigation depth. The sTEMprofiler is fully compatible with the sTEM and sTEM+ units. The measurement configuration is illustrated in Figure 3. The coils are carried in a rigid, lightweight rig.

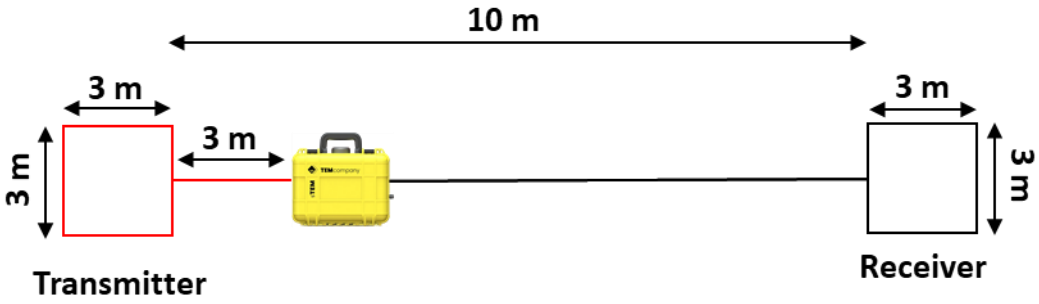


Figure 2: sTEMprofiler system, with the instrument located between the receiver and transmitter coils.

Table 2 shows the properties of the receiver and transmitter coils. The transmitter coil is a fixed 3 m x 3 m square and has a 2-turn coil. It is carried in a fixed rig. The receiver has the same dimensions but has a 4-turn coil and is also carried in a fixed rig. The sTEM instrument is placed 3 m from the transmitter and 7 m from the receiver to avoid biased or noisy data interference.

| Property | sTEMprofiler |
|---|---|
| Transmitter size | 3 m x 3 m, 2 turns |
| Transmitter area | 18 $m^2$ |
| Receiver size | 3 m x 3 m, 4 turns |
| Transmitter area | 36 $m^2$ |
| Separation between receiver and transmitter | 10 m |
| Rig type | Rigid carrier rig for transmitter and receiver coils |
| Weight of carrier rigs and coils | 15,5 kg |
| Depth of investigation (sTEM10) | 100 m - 150 m |
| Time to make one station | 15 - 30 sec |
| Profiling speed (10 m – 30 m between stations) | 5-15 km/day |

Table 1: The table outlines the sTEMprofiler key parameters.

## 3. STEM INSTRUMENT

Several factors determine the depth of investigation, including the area of the transmitter loop, the area of the receiver loop, the stacking time, and the transmitter current.

The sTEM transmitter delivers two different maximum currents, as shown in Table 3. The instrument can be upgraded from 5 Amp to 10 Amp with a firmware upgrade.

| Property | sTEM5 | sTEM10 |
|---|---|---|
| Peak output Current | 5 Amp | 10 Amp |
| Measurement period time | ~1.6 ms | ~ 4.2 ms |
| Latest center gate time | ~0.9 ms | ~2.5 ms |
| Batteries 14.4 V, Li-Ion | 2 | 2 |
| Continues operation time | ~3 hr | ~1.5 hr |
| Stations with 30 sec measurement time | ~400 | ~200 |
| Weight, incl. batteries | 6.1 kg | 6.1 kg |

Table 3: The table shows specs for the two different sTEM instruments used with the sTEMprofiler system. The maximum current is transmitted in a loop with a maximum impedance of approximately 0.7 ohm.


Figure 3: The picture shows the sTEMprofiler system. The yellow box is the sTEM instrument, the white rods are used to build the rig and the black and read cables to the left is the receiver and transmitter coils.

# 4. EXTENDED SUPPORT AND INSTRUMENT UPDATES

## 4.1 Extended support

Access to extended support is possible. With extended support, the team offers almost unlimited support for survey design, data quality assessment, data processing, and other functions.

The extended support is based on a subscription that is renewed annually. Many customers sign up for extended support for the first year and then master the measurements and the system themselves.

## 4.2 sTEM extended functionality and realtime inversion

The sTEMprofiler is designed for future upgrades and can be customized in various ways. It always has a software package that allows basic measurements and data to be exported to a Windows PC for processing.

Extended functionality is offered on a yearly subscription basis. With the subscription, several excellent features are unlocked.

These are:

- Data is inverted in real-time, and resistivity models of the subsurface are displayed every 10 – 20 sec. while measuring. This feature makes it easy to ensure the desired depth of investigation is reached. If the measurement is not deep enough, the time can be increased, so target depth is always obtained. In addition, the data processing is most often done in real-time, and models are ready to be displayed in cross-section or on maps when the day is over.
- The accumulated station stack size is displayed, not only the individual 1 – 3 sec stacks. The accumulated stack shows the data and the data uncertainties after real-time processing.
- The individual transients are gated using non-square gates, also known as tapered gates. Using tapered gates increases the signal-to-noise ratio by up to a factor of 2. In perspective, this is the same as running, for example, the sTEM20 and 40 Amp instead of 20 Amp.
- Several features in the app, Figure 4, are unlocked. These include notes, pictures of the site, and the re-location of the GPS's position from the corner of the transmitter loop to the center.


Figure 4 The picture shows the control app. The display to the left shows the measured decay curves, the display on the right show temperature, current and measurement time.

# 5. SPIA - PROCESSING SOFTWARE

The data collected by the sTEMprofiler is voltage decay curves, which can be processed and inverted to resistivity models. The sTEMprofiler outputs a generic data format, which can be imported into the Aarhus SPIA program by AGS/Seequent.

In Aarhus SPIA, Figure 5, the collected data can be viewed, processed, and inverted. Poor-quality data can be turned off, error bars edited, and prior information added to the starting model. The robust and fast AarhusInv inversion code is used for the inversion.

The software allows advanced options and automatic few layer, smooth layer, and sharp layer inversion types.

SPIA is offered on a yearly subscription basis.

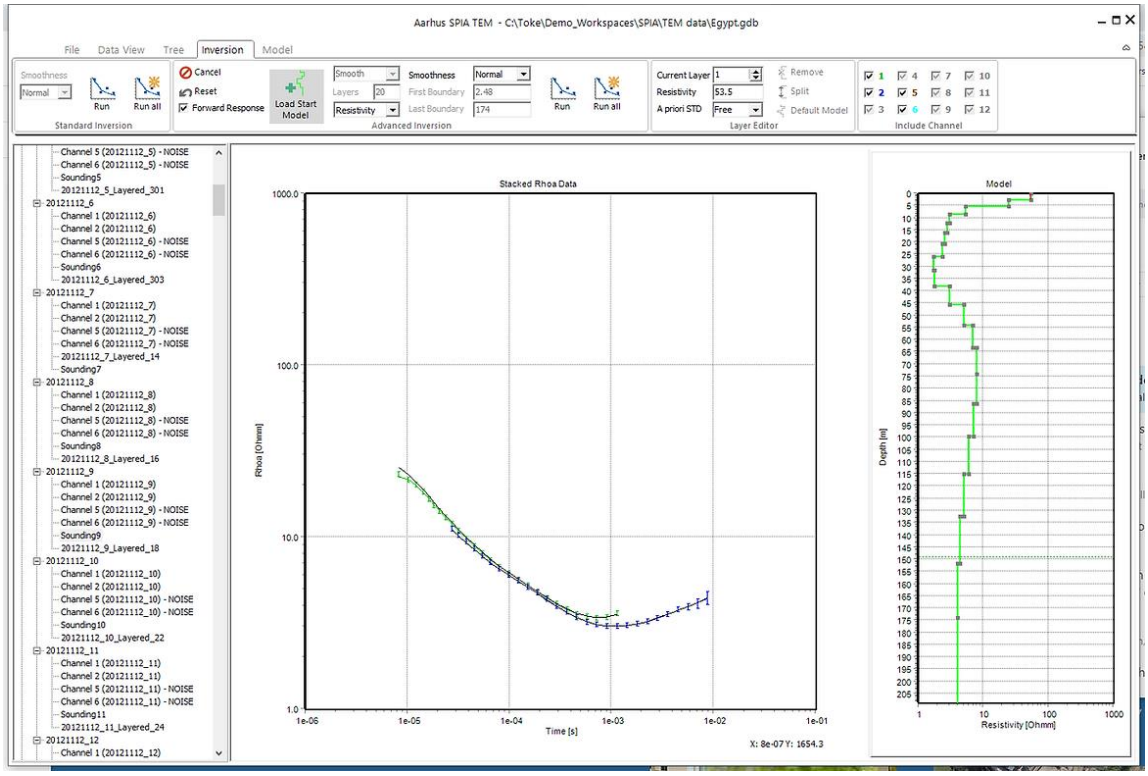


Figure 5 Aarhus SPIA processing screen.