TEMcompany

sTEM Instrument Family

Description and technical specifications

28-05-2025

TEMcompany
Value groundwater assets

CONTENTS

1. INTRODUCTION

The sTEM system maps subsurface geological layers, making it ideal for locating new groundwater wells, estimating extent of aquifer layers or location of fractures and the thickness of weathered overburden.

Choosing the sTEM high power option and combining it with a large transmitter and receiver loop makes the sTEM an excellent tool for mineral exploration, both in terms of mapping the extent of the mineral-bearing body as well as the depth of burial.

The system is designed to be easy to use and requires very little training for the field crew. sTEM is operated from an iOS or Android App, and data is processed on a Windows PC.

A typical sTEM measurement is achieved by rolling out a 40m x 40m long wire in a square, measuring for a few minutes, roll in the wire, and moving it to the next station. A typical day's production is 15 – 20 stations per day for a field crew of 2 persons. The distance between the stations is typically 250 m, covering more than 1 km^2 per day or about 100 hectares. The depth of investigation is dependent on the overall resistivity of the geological layers, but it can be as much as 300 m.

A sTEM high power measurement is achieved by rolling out an 80m x 80m long wire in a square, put the specially designed high sensitivity receiver coil in the center, measuring for typically 5 or 10 minutes, roll in the wire, and moving to the next station. With this system, the depth of investigation can be 600 m, and a trained field crew can do more than 10 stations a day.

The system transmits a 5, 10, or 20 Amp current. The 10 Amp can be boosted to 12 Amp to further boost the depth of investigation or shorten the measurement time. Small, lightweight batteries deliver power; only the batteries of the sTEM20 need to be changed during a full day of operation. The size of the transmitter loop also varies, starting with a very lightweight 20 m x 20 m loop, the standard 40 m x 40 m loop, and the heavier 80 m x 80 m loop. With the last-mentioned large loop investigations, a depth 600 m can be achieved in the right geological formations.

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 layers, etc., an accurate resistivity image of the subsurface can be created, and potential explorations sites located.

The sTEM system is designed to be lightweight and portable. The instrument, transmitter, easily transported in shipping boxes making checking it in as luggage on airplanes or putting it on the back of a truck hassle-free. Figure 1 shows a

picture of the system. The system also comes with the option of using a wireless receiver which is handy when working with large loops so the long lead-in cable to the receiver coil is avoided.

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 sTEM geoscanner provides maximum value.

The instrument can easily be upgraded from 5 Amp to 10/12 Amp with a firmware upgrade. To upgrade to 20 Amp, the instrument must be returned to the workshop for modification. Please ask us about the exact costs for any combination of software, power and transmitter coils.

Figure 1 The sTEM system in operation. The system is operated from an Android or IOS app.

2. STEM INSTRUMENTS

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 three different maximum currents, as shown in Table 1. The instrument can be upgraded from 5 Amp to 10 Amp with a firmware upgrade.

Property	sTEM5	sTEM10/12	sTEM20
Maximum current	5 Amp	10/12 Amp	20 Amp
Operation mode: Dual Moment LM /HM	1 Amp/ 5 Amp	1 Amp/ 10/12 Amp	1 Amp/ 20 Amp
First gate start time (LM/HM)	10 us / 25 us	10 us / 25 us	10 us / 35 us
Last center gate time (LM/HM)	0.93 ms / 12.5 ms	0.93 ms / 12.5 ms	0.93 ms / 12.5 ms
Batteries 14.4 V, Li-Ion	2	2	3
Continues operation time	~4 hr	~2 hr	~2 hr (2 extra batteries)
Number of stations with 5 min measurement time	~40	~20	~20
Weight, incl. batteries	6.1 kg	6.1 kg	6.6 kg

Table 1. The table shows the specs for the three different sTEM instruments. The sTEM20 is delivered with 3 extra batteries. The maximum current is transmitted in a loop with a maximum impedance of approximately 0.7 ohm. The First gate start time and Last center gate time can change as it is dependent on power line frequency and external VLF noise sources.

3. CENTRAL LOOP TRANSMITTER AND RECEIVER COILS

The sTEM is configured with different coil configurations, allowing the survey to be optimized according to field conditions and the target depth of investigation. The standard unit offers three transmitter coils: 80 m x 80 m, 40 m x 40 m, and 20 m x 20 m. The standard coil is 40 x 40 m, and each coil is designed to transmit maximum current with one of the sTEM systems. The receiver is placed in the center of the transmitter, as shown in Figure 2. The system is shown in Figure 3.

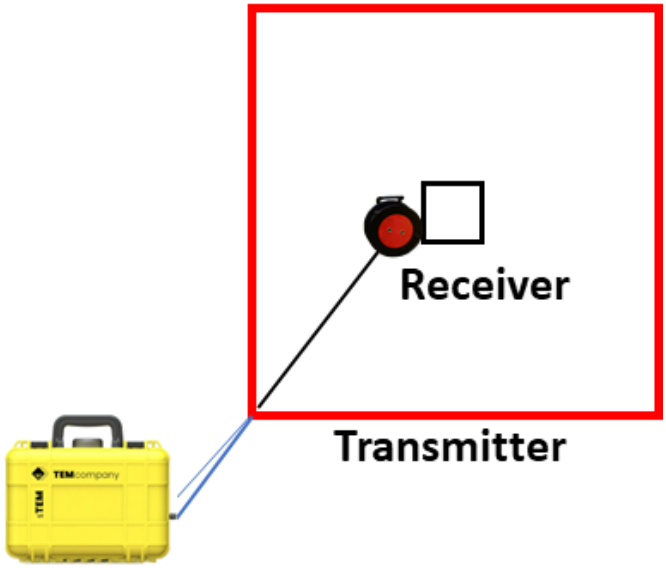

Figure 2 Central loop configuration used for 80 m x 80 m, 40 m x 40 m, and 20 m x 20 m coil configurations. The 4-turn, 3 x 3 m receiver is in the center of the transmitter and is either connected to the sTEM instrument with a lead-in cable or by using the wireless receiver that does not require a lead-in.

Figure 3 the picture shows the sTEM unit and the transmitter and receiver drums.

Property	20 m x 20 m	40 m x 40 m	80 m x 80 m
Transmitter area	400 m^2	1,600 m^2	6,400 m^2
Transmitter moment	4,000 Amp m^2 (10 Amp)	16,000 Amp m^2 (10 Amp)	128,000 Amp m^2 (20 Amp)
Transmitter total wire length	80 m	160 m	320 m
Transmitter number of drums	1	1	4
Transmitter weight incl. drum	5.2 kg	8.7 kg	7.0 kg / drum
Receiver area	36 m^2	36 m^2	100 m^2
Receiver size (4 turns)	3 m x 3 m	3 m x 3 m	5 m x 5 m
Receiver lead in	15 m	26 m	55 m
Ready for Wireless receiver	Yes	Yes	Yes
Receiver and lead-in number of drums	1	1	2
Weight receiver coil, lead-in and drum	5.3 kg	5.3 kg	8.3 kg
Used with	sTEM5 sTEM10/12 sTEM20	sTEM10/12 sTEM20	sTEM10/12 sTEM20
Depth of investigation	150 - 200 m	250 - 300 m	400 - 600 m

Table 2: The table describes the different transmitter and receiver coil configurations, as well as the wireless receiver.

Table 2 describes the properties of the transmitter and receiver coils, weight, number of drums, etc. The area of the receiver is the same for all transmitters and

is selected so the band pass properties of the coil are sufficient while maintaining the best possible suppression of noise.

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

In Aarhus SPIA, 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 layers, smooth layers, and sharp layer inversion types.

SPIA is offered on a yearly subscription basis.

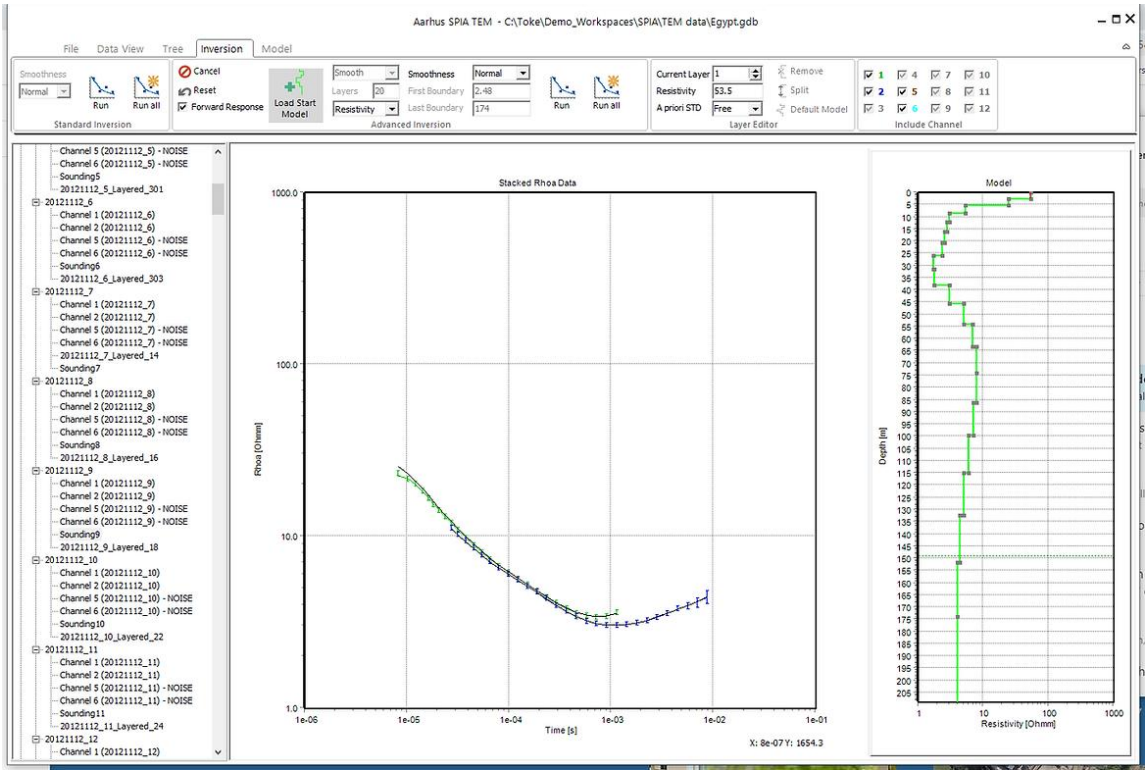

Figure 4. Aarhus SPIA processing screen.

6. DOCUMENT CHANGE LOG

25.03.2025

Detailed specifications merged into this document.

28.05.2025

Removed inconsistencies in DOI.

16.11.205 Esben Auken

Added description of the 12 Amp version of the sTEM10.

7. TECHNICAL SPECIFICATIONS

Definitions

LM Transmitter low output current

HM Transmitter high output current

Tx Transmitter

Rx Receiver

Transmitter Characteristics

	sTEM5	sTEM10	sTEM20
Dual moment	Yes	Yes	Yes
Low moment current	1 Amp	1 Amp	1 Amp
High moment current	5 Amp	10 Amp or 12 Amp	20 Amp
Number of Rx channels	1		
Real-time inversion	Ultimo 2025		
Power (14.4 V, 6.8 Ah, 99.4 Wh)	2 batteries	2 batteries	3 batteries
Tx loop options	20x20 m, 40x40 m	20x20 m, 40x40 m, 80x80 m	20 x 20 m, 40x40 m, 80x80 m
Waveform recording	Pre recorded		
Control app	iOS, Android		
Pulse on / off times	Pre-defined		
LM On-time/Off-time	46%/54%		
HM On-time/Off-time	30%/70%		
Service and upgrades	Via Internet		

Integrated Receiver in the Transmitter Unit and Independent Wireless Receiver Characteristics

Text	Value
Sample rate	4 MHz
Dynamic range	>24 bit
Onboard computer	Intel/ASUS NUC12/Single Board or newer
Internal RAM	8 GB or more
Hard disk capacity	SSD, 256 GB or more
Operating system	Windows or Linux
I/O interface	WiFi
GPS receiver	Built-in GPS with SBAS
Service and upgrades	Via internet
Bandwidth	App. 1 MHz
Max number of gates	1024
Tapered gating	Yes
Accumulated station stack	Yes
Wireless receiver: Power (14.4 V, 6.8 Ah, 99.4 Wh))	1 battery

sTEM Unit Physical Specifications

Text	Value
IP rating	ABS, IP67
Dimensions	36 x 27 x 14 cm
Weight	6.1 kg
Operating temperature	-20 ˚C to +50 ℃

sTEM Wireless Receiver Physical Specifications

Text	Value
IP rating	ABS, IP67
Dimensions	36 x 27 x 14 cm
Weight	4.1 kg
Operating temperature	-20 ˚C to +50 ℃

Transmitter Coil

Tx Coil	20x20 m	40x40 m	80x80 m
Number of drums	1	1	4

Effective area	400 m^2	1600 m^2	6400 m^2
Wire thickness	2,5 mm^2	4 mm^2	6 mm^2
Weight per drum	3.7 kg	8.8 kg	6.0 kg
Internal damping resistor	330 Ohm	330 Ohm	330 Ohm

Receiver Coil

Receiver coil	**R-36**	**R-100**
Dimensions, effective area	3x3 m, 36 m^2	5x5 m, 100 m^2
Number of turns	4	4
Bandwidth	200 kHz	100 kHz
Compatible with Tx coil	20 x 20 m, 40 x 40 m	80 x 80 m

Battery Charging Suitcase

Text	**Value**
Charging capacity	6900 mAh
Time to charge battery	2-3 hours

Weight and Dimensions for a Standard System

System	**Total transport weight**	**Dimensions Length, width, height**
sTEM, 40x40 m, receiver coil, wireless receiver, battery charging suit-case, two batteries, transport case	35 kg* 6kg	80 cm x 60 cm x 45 cm 60 cm x 40 cm x 35 cm
sTEM, 40x40 m, receiver coil, battery charging suitcase, two batteries, transport case	32 kg 6kg	80 cm x 60 cm x 45 cm 60 cm x 40 cm x 35 cm

* If transporting by air the item must be below 32 kg, so e.g battery and charging suitcase must be in separate luggage.

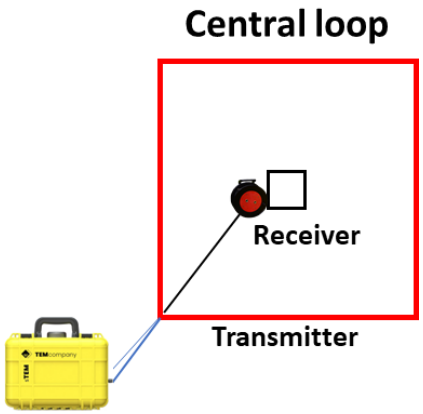

Figure 5: Sketch of the central loop sTEM coil configuration.

Transmitter Turn off

Transmitter Turn Off	
LM	7 us
HM	13 us

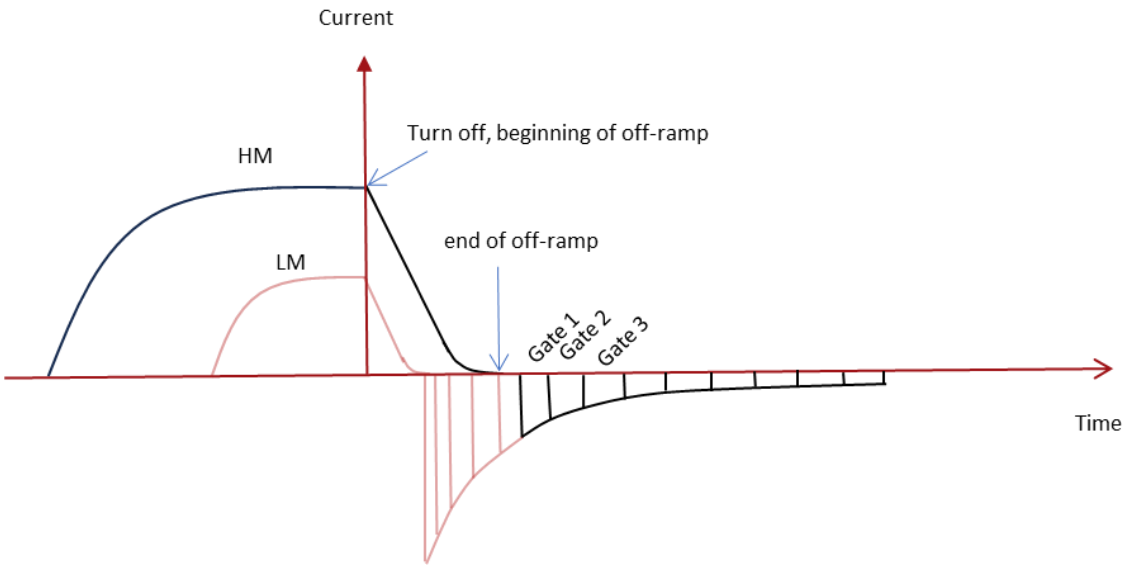

Figure 6: Idealized visualization of the waveform, turn-off ramp and gates. Not to scale.

Gate Times*

Text	Gate open	Gate center	Gate close
LM, first gate (after turn-off)	10 us	11.2 us	12.5 us

LM, first gate (after end of off-ramp)	3 us	4.2 us	5.5 us
LM, last gate	794 us	891 us	999 us
HM, first gate (after turn-off)	25.5 us	28.7 us	32 us
HM, first gate (after end of off-ramp)	12.5 us	15.7 us	19 us
HM, last gate	11050 us	12415 us	13940 us

*in 40 x 40 m loop, standard measurement script