

Oil and Gas Division

Mark F. Bohrer - Assistant Director

North Dakota Industrial Commission

Department of Mineral Resources

www.dmr.nd.gov/oilgas/

August 14, 2024

Trevor Richards

Assistant Director for Geophysics

UND-Energy & Environmental Research Center

15 N. 23rd Street, Stop 9018

Grand Forks, ND 58202-9018

RE: BASIN ELECTRIC RESEARCH PROJECT – EM METHODS
GEOPHYSICAL EXPLORATION PERMIT #97-0331
MERCER COUNTY
NON-EXPLOSIVE METHODS

Dear Mr. Richards:

Be advised that your Geophysical Exploration permit is conditionally approved; effective for one year from August 14, 2024.

PERMIT STIPULATIONS:

- **UND-EERC must contact seismic inspector Tom Torstenson at (701) 290-1546 72 hours prior, to arrange a start-up meeting. Also, a copy of the entire permit is required for all contractors at the start up meeting.**
- **UND-EERC must contact Tom Torstenson at (701) 290-1546 24 hours prior to conducting any geophysical activities.**
- **Pursuant to NDAC 43-02-12-05 (DISTANCE RESTRICTION) Non-explosive exploration methods may not be conducted less than 300 feet from water wells, buildings, underground cisterns, pipelines, and flowing springs.**
- **In addition, pursuant to NDAC 43-02-12-06 (NOTIFICATION OF WORK PERFORMED), “The director is authorized to suspend operations of the entire geophysical project, or any portion thereof, if further activity will cause excessive damage to the surface of the land”.**

Review the following conditions for your permit:

1. All variances for distance restrictions are to be furnished, and a pre-plot map displaying any source points that do not comply with the distance restriction rule must be supplied to the inspector.
2. The following information must be submitted within 30 days of the completion of the project by the Geophysical Company:
 - a. Completion Report,

- b. Completion Affidavit,
 - c. Post Plot Map. It must show all water wells, buildings, underground cisterns, pipelines, and flowing springs that fall within the program area and within one half mile of the perimeter of the program.
 - d. Must provide a GIS layer using NAD83 in an Esri shape file format and an Image file (.img) on a Flash Drive or email: ttorstenson@nd.gov with all source and receiver points,
3. The permit agent shall notify the operator of the land at least seven days before commencement of any geophysical exploration activity, unless waived by mutual agreement of both parties. The notice must include the approximate time schedule and the location of the planned activity.
 4. Information regarding the location of water wells, springs, etc.; refer to the following ND State Water Commission Mapservice website, at: <http://mapservice.swc.state.nd.us/>
 5. The entire permit can be viewed, as well as the status of various seismic projects in the state, at: <https://www.dmr.nd.gov/oilgas/seismic/seismicstats.asp>

Should you have any questions regarding this matter, feel free to contact our office.

Sincerely,



Todd L. Holweger
Permit Manager/Geophysical Supervisor



GEOPHYSICAL EXPLORATION PERMIT - FORM GE 1

INDUSTRIAL COMMISSION OF NORTH DAKOTA
OIL AND GAS DIVISION
600 EAST BOULEVARD DEPT 405
BISMARCK, ND 58505-0840
SFN 51459 (03-2011)

Received

AUG - 8 2024

ND Oil & Gas
Division

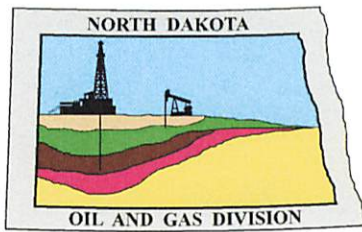
1) a. Company UND EERC		Address 15 N 23rd St, Stop 9018, Grand Forks, ND 58202-9018			
Contact Trevor Richards		Telephone (701) 777-5052		Fax	
Surety Company Bank of North Dakota		Bond Amount \$25,000		Bond Number GEO 308	
2) a. Subcontractor(s)		Address		Telephone	
b. Subcontractor(s)		Address		Telephone	
3) Party Manager Kris MacLennan		Address (local) Same as EERC above		Telephone (local) (701) 777-5174	
4) Project Name or Line Numbers Basin Electric Research Project - EM Methods					
5) Exploration Method (Shot Hole, Non-Explosive, 2D, 3D, Other) Magnetotelluric, Electrical Resistivity Tomography					
6) Distance Restrictions (Must check all that apply)					
<input checked="" type="checkbox"/> 300 feet - NonExplosive - Distance setbacks apply to water wells, buildings, underground cisterns, pipelines, and flowing springs.					
<input type="checkbox"/> 660 feet - Shot Hole - Distance setbacks apply to water wells, buildings, underground cisterns, pipelines, and flowing springs.					
7) Size of Hole	Amt of Charge	Depth	Source points per sq. mi.	No. of sq. mi.	
3-D n/a	n/a	n/a	n/a	n/a	
Size of Hole	Amt of Charge	Depth	Source points per ln. mi.	No. of ln. mi.	
2-D n/a	n/a	n/a	3.2	2.5	
8) Approximate Start Date August 17, 2024			Approximate Completion Date August 27, 2024		

THE COMMISSION MUST BE NOTIFIED AT LEAST 24 HOURS IN ADVANCE OF COMMENCEMENT OF GEOPHYSICAL OPERATIONS

9) Location of Proposed Project - County Mercer County					
Section(s), Township(s) & Range(s)	Section	T.	R.		
	1, 2, 11, 12	145N	88W		
	Section	T.	R.		
	Section	T.	R.		
	Section	T.	R.		
	Section	T.	R.		

I hereby swear or affirm that the information provided is true, complete and correct as determined from all available records.			Date July 30, 2024
Signature 	Printed Name Trevor Richards	Title Assistant Director - Geophysics	
Email Address(es) trichards@undeerc.org			

(This space for State office use)		Permit Conditions
Permit No. 97-0331	Approval Date 8/14/24	
Approved by 		
Title Mineral Resources Permit Manager		* Permit in hand required at pre-program meeting with field inspector and be aware of all NDIC Rules and Regulations (i.e. distance restrictions).
		* See attached letter.



Oil and Gas Division

Mark F. Bohrer - Assistant Director

North Dakota Industrial Commission

Department of Mineral Resources

www.dmr.nd.gov/oilgas/

August 14, 2024

The Honorable Carmen Reed
Mercer County Auditor
P.O. Box 39
Stanton, ND 58571-0039

RE: Geophysical Exploration
Permit Number 97-0331

Dear Ms. Reed:

Pursuant to Section 38-08.1-04.2 of the North Dakota Century Code, please be advised that the University of North Dakota Energy & Environmental Research Center was issued the above captioned permit on August 14, 2024, and will remain in effect for a period of one year. The entire permit can be viewed on our website at: <https://www.dmr.nd.gov/oilgas/seismic/seismicstats.asp>

Should you have any questions, please contact our office.

Sincerely,

Todd L. Holweger

Permit Manager/Geophysical Supervisor



August 13, 2024

Mr. Todd Holweger
Industrial Commission of North Dakota
Oil and Gas Division
600 East Boulevard Ave, Dept 405
Bismarck, North Dakota 58505-0840

Dear Mr. Holweger

Subject: University of North Dakota Energy & Environmental Research Center – Permit Application Supplement

I am writing to provide supplemental information in support of the seismic permit request that was previously submitted on August 8, 2024. The details provided herein are intended to clarify and expand upon the information in the original application, ensuring that all requirements and concerns are fully addressed.

Project Summary & Timeline

The magnetotelluric (MT) and electrical resistivity tomography (ERT) operations will occur more or less simultaneously over the course of the fieldwork, and work will vary little from day to day. MT stations are planned to be deployed in the mornings and ERT lines are planned to be deployed in the afternoon, with ERT transmits occurring as segments of the profiles are deployed. The MT stations will begin recording in the afternoon and continue through the night, until they are picked up and redeployed the following morning.

The MT operations will utilize the Zonge Zen receivers.

Attached hereto please find the official pre-plot map to support the permit application.

Should you have any questions or require further information, please do not hesitate to contact me at trichards@undeerc.org or 701-777-5052.

Thank you for your attention to this matter.

Sincerely,

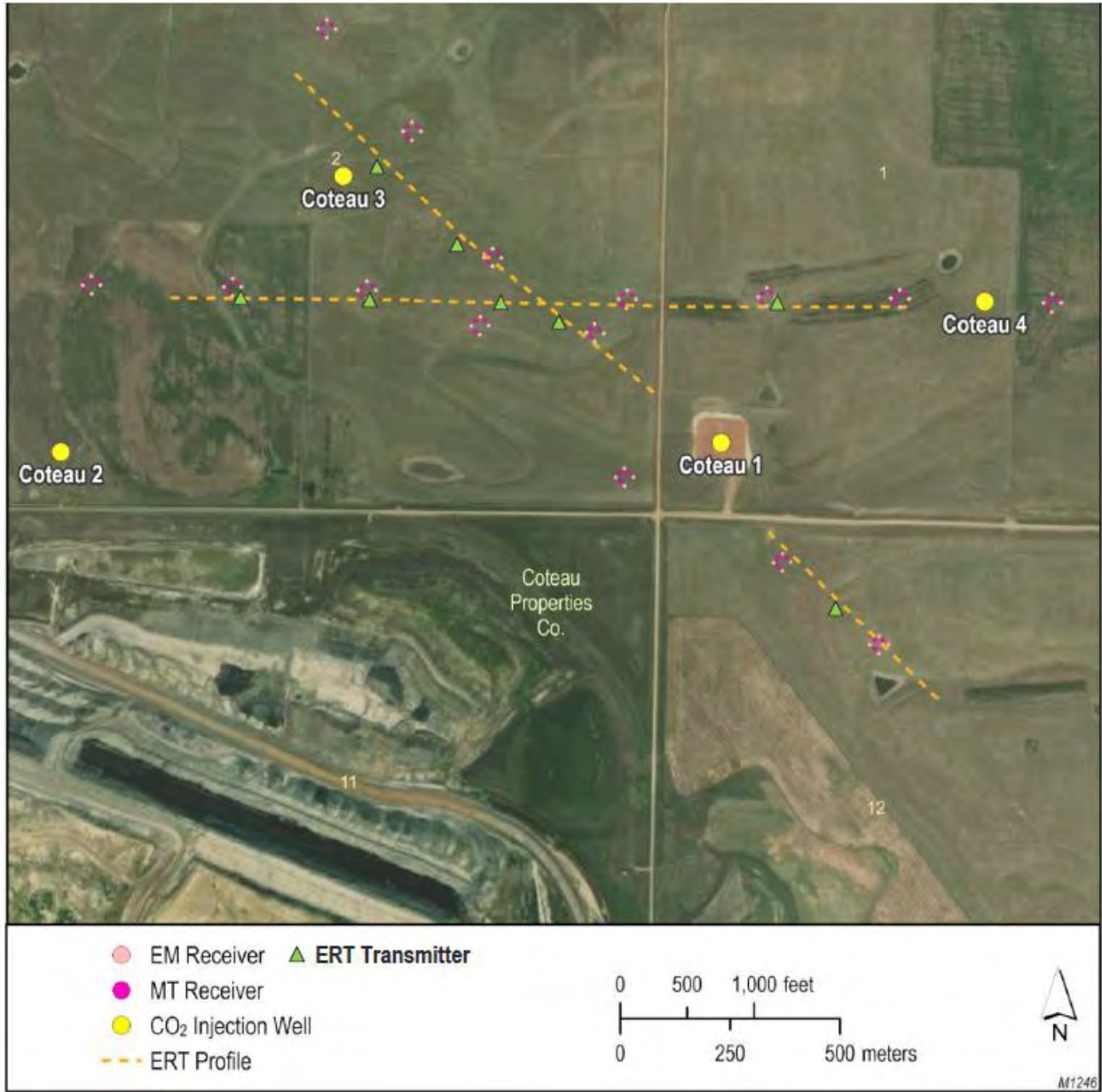
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Trevor Richards

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Trevor Richards

Assistant Director for Geophysics





Energy & Environmental Research Center (EERC)

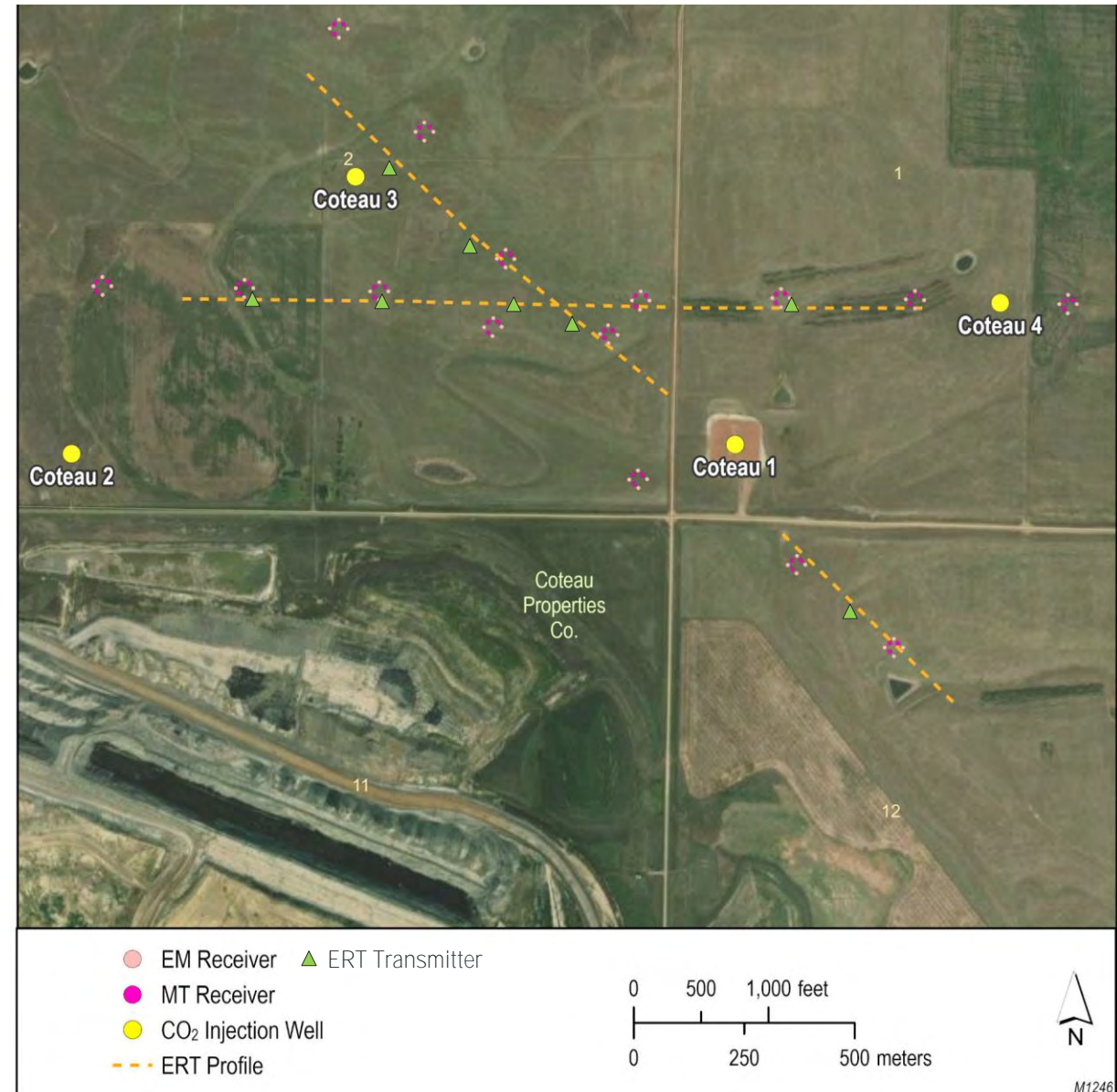
Basin Electric Research Project: Electromagnetic Methods

Dr. Kris MacLennan

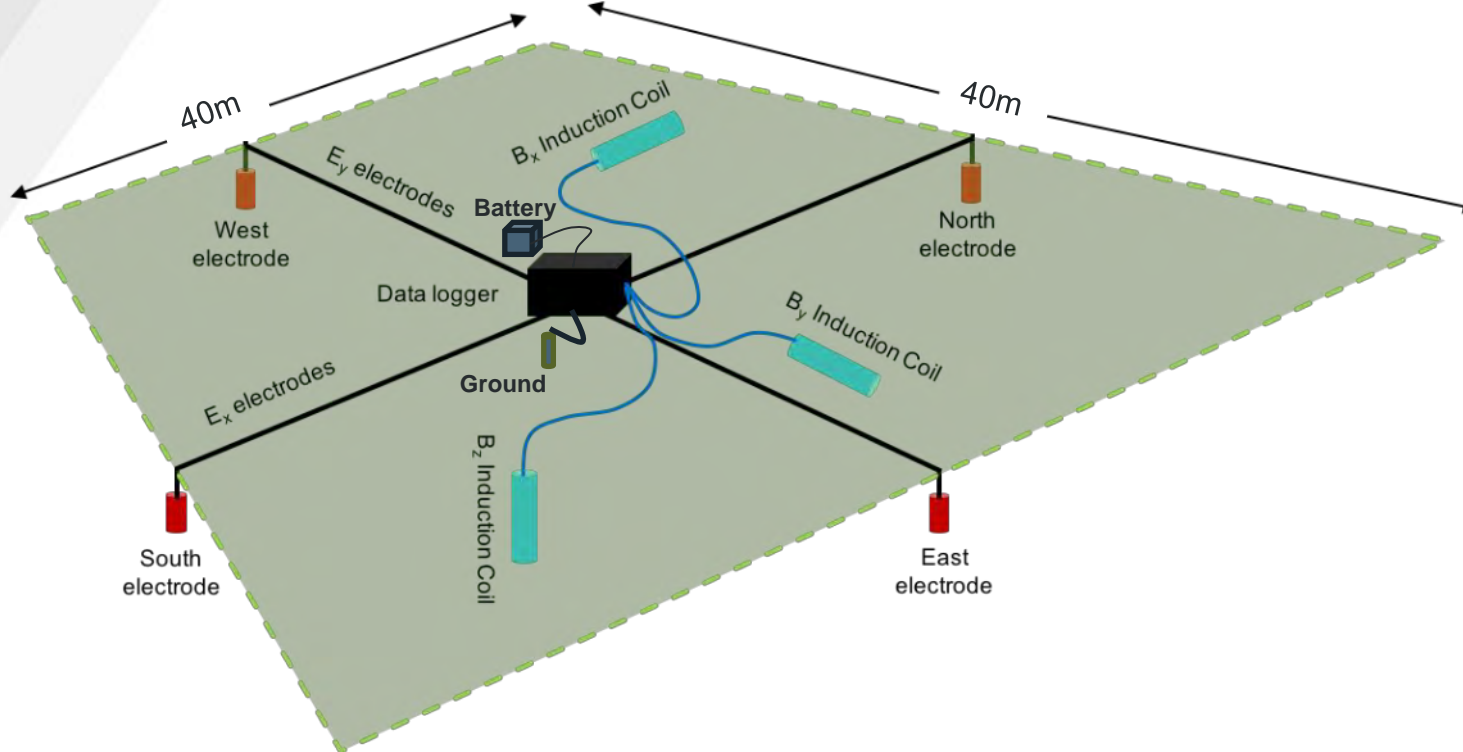
8/12/24

Basin Electric Research Project: EM Methods

- Kris and 4 EERC operations crew in field August 17-26
- Collecting magnetotelluric (passive method, no sources) and electrical resistivity tomography (active low-power sources)
- Continuation of November field work
- Mapping CO₂ plume extents and measuring CO₂ levels in the near-surface



Magnetotellurics



- Passive method, uses Earth's fields as natural sources
- 4 pot electrodes (8") buried 4-6"; 3 magnetic coils (3' long) buried in holes
- 12V car battery used to power system
- Two coils are oriented NS and EW, hole is dug 6" deep and coil is covered with backfill, one coil is oriented Z-axis, 3' deep 6" diameter hole dug with auger, coil is stabilized with backfill
- Care taken to keep soil layers in order when filling – may use tarps



Electrical Resistivity Tomography

- Two survey lines: 1.3 km and 1.7 km
- Cable is 550 m (1800') – multiple deployments
- 18" steel stake electrodes, hammered into ground at least 12"
- 12V car battery power source
- Transmits for 2-3 hours
- Cable and electrodes left deployed overnight
 - Cable has slack, walk-safe, anti-chew coating



Zonge Zen Receiver Specifications

General

Broadband, multi-channel, multi-function digital receiver

Frequency range: DC – 1024 Hz

Number of channels: 1 to 6 (user expandable)

Standard Survey capabilities: Resistivity, Frequency- and Time-Domain IP, Complex Resistivity, CSAMT (scalar, vector, tensor), Harmonic Analysis (CSAMT, Frequency- Domain EM, MMR, Magnetic IP, Magnetotellurics, Downhole Logging.

Software language: C++

Size: 27 x 24 x 13 cm (10.5 x 9.5 x 6")

Weight: (without batteries and meter/connection panel): 3 Kg (6lb 9oz)

Enclosure: Heavy-duty, environmentally sealed aluminum

Power: 7-36V rechargeable batteries (external pack)

ZEN power consumption: 0.7 Ah

Temperature range: -40o to +50oC (-40o to +122oF)

Humidity range: 5% to 100%, internal temperature sensors

Time base: GPS Synchronization



Displays & Controls

Power On-Off

Color coded LEDs

ZigBee® or USB Control from external computer

Standard Analog

Input impedance: >10 MΩ at DC

Board dynamic range: 180 db

Minimum detectable signal: 20 ηV

Maximum input voltage: ±2.5V

Automatic gain ranging in binary steps from 1 to 64

Common-mode rejection at 1000 Hz: >100 db

Phase accuracy: ±0.1 milliradians (0.006 degree)

Adjacent channel isolation at 100 Hz: >90 db

Analog to digital converter (standard channel) Resolution: 32 bits

Conversion time: 0.25 msec

One A/D per channel for maximum speed and phase accuracy

Analog connection via Pomona or 16-pin waterproof Mil-Spec connector

Digital Section

Microprocessor: 60 MHz ARM processor per channel

Mass Storage: 8 GB per channel. Data storage device with capacities to 16 GB/channel is optional.

Serial ports: USB connection to each channel

Distributed Control: Long-range mesh network (Unlicensed 2.4 GHz)

Acquisition Software

MT, CR, RDIP graphical interfaces for Windows based computers

External Control: Serial String based interface enables easy custom development

Real-time programmable through download of BASIC scripts

SuperSting™ Wi-Fi Technical Specification

Measurement modes Apparent resistivity, resistance, induced polarization (IP), SP & battery voltage.

Measurement range +/- 5Vp-p.

Measuring resolution Max 30 nV, depends on voltage level.

Screen resolution 4 digits in engineering notation.

Transmitter 200 W internal transmitter; external 5 kW, 10 kW and 15 kW transmitters are also available (see separate brochure for specifications).

Output current 1 – 2,000 mA continuous, measured to high accuracy.

Output voltage 800 Vp-p, actual electrode voltage depends on transmitted current & ground resistivity.

Input channels Five models are available; 1 channel, 2 channel, 4 channel, 6 channel, and 8 channel.

Input gain ranging Automatic, always uses full dynamic range of receiver.

Input impedance >150 M Ω

SP compensation Automatic cancellation of SP voltages during resistivity measurement. Constant & linearly varying SP cancels completely.

Type of IP measurement Time domain chargeability (M), six time slots measured & stored in memory.

IP current transmission ON+/OFF/ON-/OFF.

IP time cycles 0.5 s/1 s/2 s/4 s/8 s.

Measure cycles Running average of measurement displayed after each cycle. Automatic cycle stop when reading errors fall below user-set limit or user-set max cycles are done.

Resistivity time cycles Basic measure time is 0.2/0.4/0.8/1.2/3.6/7.2 or 14.4 s as selected by user via keyboard. Auto-ranging & commutation adds about 1.4 s.

Signal processing Continuous averaging after each complete cycle. Noise errors calculated & displayed as percentage of reading. Reading displayed **as resistance ($\Delta V/I$) & apparent resistivity (Ωm)**. Apparent resistivity is calculated using user entered electrode array coordinates.

Noise suppression Better than 100 dB at $f > 20$ Hz. Better than 120 dB at power line frequencies (16 2/3, 20, 50 and 60 Hz) for measurement cycles of 1.2 s & above.

Total accuracy Better than 1% of reading in most cases (lab measurements). Field measurement accuracy depends on ground noise & resistivity. The instrument will calculate & display running estimate of measuring accuracy.

System calibration Calibration is done digitally by the microprocessor based on correction values stored in memory.

Supported configurations In manual mode; resistance, Schlumberger, Wenner, dipole-dipole, pole-dipole, pole-pole. In automatic mode; any configuration can be programmed.

Operating system Stored in re-programmable flash memory. New version can be downloaded from the AGI web site & stored in the flash memory.

Data storage Full resolution reading average & error are stored along with user entered coordinates & time of day for each measurement. Data is automatically stored in a job oriented file system.

Data display Apparent resistivity (Ωm), current intensity (mA), & measured voltage (mV) are displayed & stored in memory for each measurement. Data can also be displayed on an Android device in real time as bright color pseudo sections, IP curves, transmitter/receiver plot, contact resistance measurements & more.

Memory capacity Virtually unlimited data storage in real time on controlling Android device. The internal SuperSting memory can store more than 79,000 measurements (resistivity mode) & more than 26,000 measurements in combined resistivity/IP mode.

Data transmission Data can be instantaneously transferred from the Android device by email or by file transfer from the Android device USB port. RS-232C channel available to dump data from the instrument to a Windows type computer on user command.

Automatic multi-electrodes The SuperSting is designed to run dipole-dipole, pole-dipole, pole-pole, gradient, Wenner, Schlumberger or any other custom array including roll-along surveys completely automatically with the patented (Pat.# 6,404,203) Dual-Mode Automatic Multi-electrode system or a passive electrode cable system with Switch Box. The SuperSting can run any other electrode array by using user programmed command files. These are ASCII files that can be created using a regular text editor. The command files are uploaded to the SuperSting RAM memory & can at any time be recalled & run as a survey.

User controls 20 key tactile | weatherproof keyboard with numeric entry keys & function keys | On/off switch | Measure button, integrated within main keyboard | LCD night light switch (push to light) | Keyboard and LCD are mirrored to an Android device using Wi-Fi technology for easy remote control of the SuperSting.

Display Graphics LCD display (16 lines x 30 characters) with nightlight. Optional Android mobile phone **screen & 7" or 10" Android tablet bright color AMOLED display.**

Power supply, field 12V or 2x12V DC external power, connector on front panel | Optional AC/DC power supply & motor generator.

Power supply, office DC power supply.

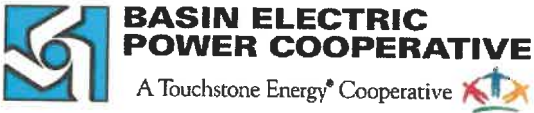
Operating time Depends on survey conditions & size of battery used. Internal circuitry in auto mode adjusts current to save energy.

Operating temperature -5 to +50°C

Weight 10.9 kg (24 lb.)

Dimensions **Width 184 mm (7.25"); length 406 mm (16") & height 273 mm (10.75").**





August 8, 2024

Mr. Todd Holweger
Permit Manager/Geophysical Supervisor
ND Industrial Commission Oil & Gas Division
600 East Boulevard Ave, Dept 405
Bismarck ND 58505

Subject: Geophysical Exploration Permits

Dear Mr. Holweger:

All landowners within one-half miles of the proposed 2024 Basin Electric Research Project area have been notified of the schedule and location of the Electromagnetic Magnetotelluric (EM MT) Surveys, Electromagnetic Charged-Well-Casing Surveys (EM CWC), and 2D Active Seismic activities estimated to take place in August and September and have been provided a written copy of the North Dakota Century Code (NDCC) Section 38-08.1-04.1 (Exploration Permit) and NDCC Chapter 38-11.1 (Oil & Gas Production Damage Compensation) as required by NDCC Section 38-08.1-04.1. There was a total of four private landowners, three industry landowners, and Mercer County that were provided the required notification. The permits for the EM MT survey will be submitted by the University of North Dakota Energy and Environmental Research Center. The EM CWC will be submitted by ESG Solutions Group, Inc. The 2D Seismic will be submitted Explor Geoscience USA Inc.

We look forward to collaborating with you further regarding this proposed geophysical project. Please contact me with any questions by phone at 701.557.5454 or by email at mmurray@bepc.com.

Sincerely,

A handwritten signature in black ink, appearing to read "Mike Murray".

Mike Murray, SR/WA, R/W-NAC
Directory of Property & Right of Way