

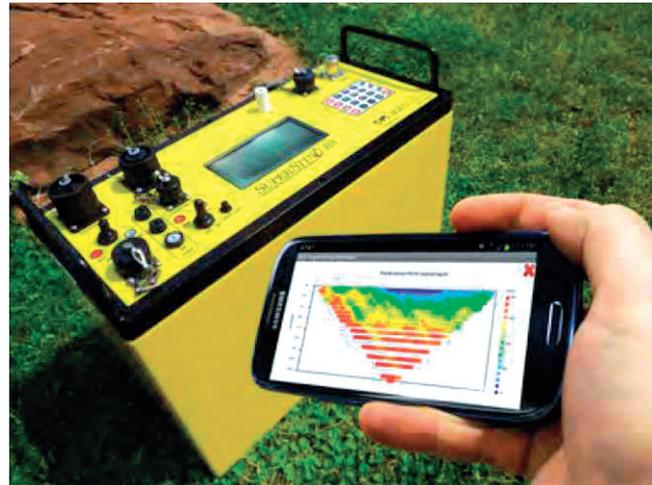
MEASURING EQUIPMENT

SuperSting™ Wi-Fi® - Geo-electrical Imaging System

Document No.: 11-320-R1

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German Cathodic Protection



Super Sting™ Wi-Fi® - Geo-electrical Imaging System

The SuperSting™ with Wi-Fi® is a portable resistivity, induced polarization (IP), and self-potential (SP) instrument with memory storage and user-defined measure cycles. It provides the highest accuracy and lowest noise levels in the industry. The instrument comes in two versions: the single-channel version R1 and the eight-channel version R8. The R8 measures up to 8 channels simultaneously for each current injection, making it up to 8 times faster than the R1 model. Both models exhibit the accuracy, reliability and ruggedness that all Advanced Geosciences instruments are known for.

The instrument uses a built-in power transmitter and can be used for traditional vertical electrical sounding (VES), mise-a-la-masse measurements, or multi-electrode electrical tomography in 2D, 3D and 4D (time lapse). Other applications include borehole-to-borehole tomography and underwater measurements in rivers, lakes, dams and the sea to investigate bottom conditions.

Geo-electrical Imaging with Android™ App & Wi-Fi®

New mobility allows you to send data immediately to your processing center from the comfort of your vehicle up to 100 meters away (depending on terrain and atmospheric conditions). You no longer need to monitor imaging surveys from the instrument in the field. Using Android™ mobile 7-inch or 10-inch tablets or phones, you can check the electrodes for contact resistance and at the same time control the SuperSting™ while reviewing data in real time in both numerical and color plots.

Accessories

- The SuperSting™ comes with a built-in 200 W transmitter. A series of external high-power, 5-15 kW, transmitters are available for deep IP surveys.
- AGI's **EarthImager™** inversion software for 1D, 2D and 3D data processing.
- **SuperSting™ Remote** for resistivity, IP and SP time monitoring in remote & hard-to-access areas.
- Cables for land, borehole and underwater surveys.
- Electrode streamers for towed marine surveys.
- Stainless steel electrodes, non-polarizable electrodes and patented graphite electrodes.
- Manual single conductor cables on reel.

Features

- The 8-channel instrument (R8) is designed for large surveys when time is of the essence.
- The single-channel unit (R1) is designed for smaller surveys when speed of survey is less important.
- Used for resistivity and IP imaging in 2D, 3D and 4D.
- Borehole-to-borehole, and borehole-to-surface measurements.
- Underwater measurements in fresh and salt water.
- Deep IP mineral exploration using the external power transmitter PowerSting™ (5 - 15 kW).
- Ground water exploration.
- Geotechnical investigation for depth to bedrock, cavity detection, stratigraphy and more.

Android™ is a trademark of Google Inc. The term Wi-Fi® is a registered trademark of the Wi-Fi Alliance® SuperSting™ is a trademark of Advanced Geosciences, Inc.

SuperSting™ with Android™ App SuperSting™ with Android™ App Geo-electrical Instrument for Resistivity/IP/SP Tomography

- Gives you freedom in the field to move away from the instrument and still be in contact to control and monitor the data acquisition.
- Data quality analysis in real time.
- Review the data as a pseudo section or cross-plot of transmitter and receiver pairs.
- Review IP curves in real time.
- Android™ devices can serve as easily replaceable, upgradable display and control devices.
- Data can be emailed and backed up to cloud servers in real time for enhanced data security and faster reporting.

Key Features of the SuperSting™ Manager App

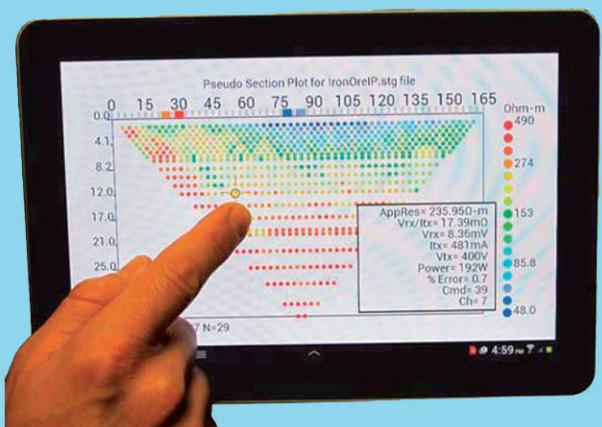
- You have all important information about each data point immediately available by touch screen.
- The electrodes for each data point are highlighted in case a survey needs to be paused and restarted to fix a loose electrode and thus save important time in the field while improving data quality.
- A floating window displays apparent resistivity, voltageRx/currentTx, voltageRx, currentTx, voltageTx, power, % error, command line number and the channels used.
- The contact resistance data is now saved in a separate file documenting this primary data quality control condition along the line.

What if my Android™ device gets lost or runs out of power?

- Your data is safe because it is saved both on the SuperSting™ instrument and on the Android™ device.
- The survey will continue locally on the SuperSting™ and can be fully controlled from the standard SuperSting™ keypad.

What happens if I get out of Wi-Fi® range?

- The Wi-Fi® max range is 100 meter depending on terrain, atmosphere etc. The SuperSting™ will continue to measure even if the Android™ device gets outside the range. As soon as the device returns within range the SuperSting™ App reconnects and continues all functions as before without losing any data.



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SuperSting with Wi-Fi

AVAILABLE AS EIGHT- OR SINGLE-CHANNEL MEMORY EARTH RESISTIVITY, SP & IP METER

TECHNICAL SPECIFICATION**SuperSting:**

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| Measurement modes | Apparent resistivity, resistance, induced polarization (IP), SP & battery voltage. |
| Measurement range | +/- 10Vp-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 | Two models are available; 8 channel & single channel. |
| Input gain ranging | Automatic, always uses full dynamic range of receiver. |
| Input impedance | >150 MΩ |
| 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. |
| Total accuracy | Better than 120 dB at power line frequencies (16 2/3, 20, 50 and 60 Hz) for measurement cycles of 1.2 s & above. 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 (m), 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 pseudosections, 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 and Schlumberger surveys 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. 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). |
| Display | Keyboard and LCD are mirrored to an Android™ device using Wi-Fi® technology for easy remote control of the SuperSting. Graphics LCD display (16 lines x 30 characters) with nightlight. 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 | -20 to +50°C when controlled by your Android device (phone or tablet). The instrument LCD screen fades out at -5°C, but the instrument continues to function normally controlled by your Android phone, kept warm in your pocket. |
| Weight | 10.9 kg (24 lb.) |
| Dimensions | Width 184 mm (7.25"); length 406 mm (16") & height 273 mm (10.75"). |

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SuperSting Manager App:

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| Device | Used with various Wi-Fi capable Android devices such as mobile phones, 7-inch & 10-inch tablets. Recommended for tablets; the App may not render properly on all handset devices. |
| Android™ version | 3.2 -4.4 |
| Functions | All functions performed using the SuperSting's keypad can be performed using the App's GUI with the exception of baud rate setting. |
| Real time quality assurance | Color pseudo-section plot, transmitter/receiver pair plot, IP curve plot, contact resistance test results, real time data review. |
| Data storage | Data storage on Android devices is typically in Gigabyte range, meaning essentially unlimited storage space is available. |
| Data transfer | Data transfer by email or by file transfer from the Android device USB port. |
| Wi-Fi range | Up to 100 m, depending on terrain & atmospheric conditions. |

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|--------------------------|-------------------------|--|
| AGI Earthmager 1D | Win10 Win8.1 Win7 | Use Earthmager 1D to interpret 1D vertical electrical sounding (VES) resistivity curves created with Schlumberger, Wenner and dipole-dipole electrode arrays. |
| AGI Earthmager 2D | Win10 Win8.1 Win7 | <p>The Earthmager 2D is used to interpret 2D resistivity profiles created with any electrode array, recorded with electrodes in one plane, i.e. on a line on the surface, between two or more parallel bore holes, or between bore hole and surface. Any array or mixed data from Schlumberger, pole-pole, pole-dipole, dipole-dipole or Wenner electrode arrays are possible to invert. A special „Survey Planner“ allows the user to enter a geological model and run a virtual survey and then invert the virtual data to see if the objective of the survey can be met.</p> <p>Extra modules available: The 2D time lapse module, is used when information about resistivity changes in the ground is needed. Some common situations include potential leakage from landfills, industrial sites, etc. Other monitoring situations include fracture tracing by injection of a conductive solution such as a salt solution. Other possible monitoring situations include saltwater intrusion in coastal areas, remediation progress at environmental sites, groundwater recharge, infiltration studies, to see how the ground is „wetted“ or how the ground dries up after a rain storm.</p> <p>The Continuous resistivity profiling (CRP) module, is used to invert data with large number of electrode positions, like marine CRP surveys or certain roll-along files.</p> |
| AGI Earthmager 3D | Win10 Win8.1 Win7 | <p>Earthmager 3D will automatically determine a three dimensional resistivity model for the subsurface using the data obtained from a 3D electrical imaging survey with the electrodes arranged in boreholes and/or on the surface and presents a 3D volume of inverted resistivity data with advanced volume rendering technique. The final resistivity or IP image-volume can be rotated in any orientation, zoomed in and out, and translated to anywhere inside the image window in order to see the volume of interest in detail. Colors representing areas of less interest can be made transparent so that the shape of a pollution plume, for example, can be visible. With Earthmager 3D, resistivity inversion can be as easy as two steps: Read Data and Start Inversion with only a few mouse clicks.</p> <p>Extra modules available: The 3D time lapse module, is used when information about resistivity changes in the ground is needed. Some common situations include potential leakage from landfills, industrial sites, etc. Other monitoring situations include fracture tracing by injection of a conductive solution such as a salt solution. Other possible monitoring situations include saltwater intrusion in coastal areas, remediation progress at environmental sites, groundwater recharge, infiltration studies, to see how the ground is „wetted“ or how the ground dries up after a rain storm.</p> <p>The 64-bit parallel processing module, is used to invert data with large number of electrode positions and number of data. It can access the total RAM space available on the machine as well as all cpu cores.</p> |

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SuperSting Swift Dual Mode (US Patent 6,404,203) Electrode Switches

The Swift dual mode electrode switches facilitate automatic induced polarization measurement in a multi-electrode array using stainless steel stakes for current injection and non-polarizable (porous pot) electrodes for the potential measurements. The electrode switch can operate either as a dual mode electrode with separate current injection and potential measurement or in mono mode where both current injection and potential measurement occurs through the stainless steel stake. The electrode switches have been re-designed in order to reduce the size of the electrode switch. On one side of the electrode switch is a miniature banana jack where the non-polarizable electrode is connected when the electrode is used in dual mode. When the banana jack is not in use, it is covered by a plug to prevent dirt and moisture to enter the jack.

EarthImager 2D

AGI EarthImager 2D is a Windows based computer program that interprets two-dimensional (2D) electrical resistivity and induced polarization (IP) data and produces inverted resistivity and IP sections that reveal the sought-after target and subsurface geology. EarthImager turns the complicated resistivity data inversion into a simple step wise process, i.e., reading a data file, running the inversion and plotting the figures for a report. EarthImager also presents a long list of options for advanced users.

EarthImager supports all Windows true type fonts and Windows 24-bit true color. Hardware accelerated graphics powered by OpenGL leads to fast graphics on the screen and export of report ready plots. The graphical user interface allows browsing of the processing results from one parameter to another and one iteration to another. There are multiple visualization options such as 3D volumes with variable opacity and color scale so that the viewer can see inside a subsurface volume.

Supersting wi-fi fast and easy electrical imaging

