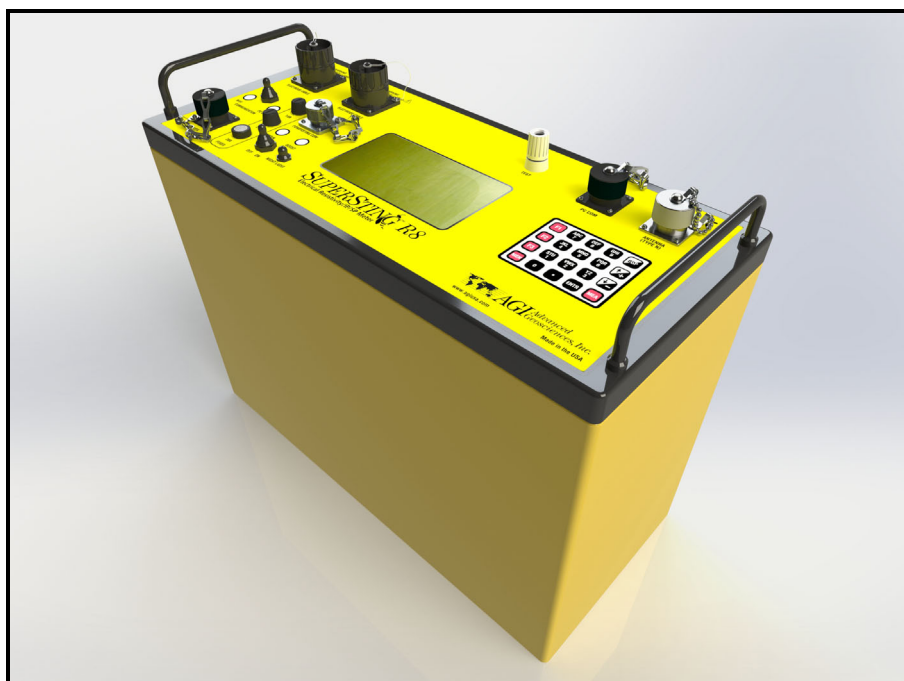




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SuperSting™ Earth Resistivity, IP & SP System With Wi-Fi®

Instruction Manual



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Welcome

All of us at Advanced Geosciences Inc. (AGI) thank you for purchasing our SuperSting™ Earth Resistivity, IP & SP System with Wi-Fi® for electrical surveys.

1 Safety and Best Practices

Every AGI instrument is designed to be safe to operate. However, they are high-power electrical devices with inherent dangers if not used properly. Even the best designed instruments require the user to employ safety precautions when using the instrument. Review the following safety precautions **to avoid injury or even death**, and to prevent damage to the equipment. To avoid potential hazard, use this product only as specified.

- **It is imperative that the users constantly monitor the survey line, ground electrodes and connections throughout the survey.**

The SuperSting emits a potentially hazardous and possibly fatal current with a voltage up to 400 V. The optional external PowerSting transmitter emits a hazardous and potentially fatal current with a voltage up to 3000 V through the connections, lines, and energized metal electrodes.

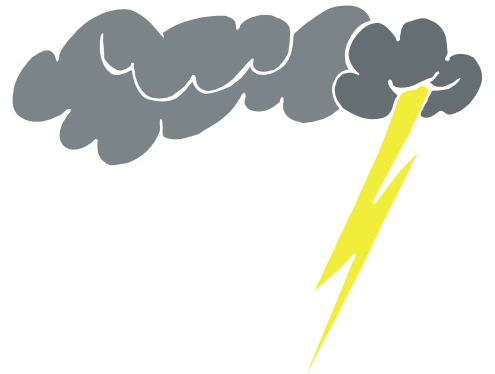
- **Disconnect the cables from the instrument and do not operate the SuperSting during an approaching thunder or lightning storm.**

Thunder & Lightning storms are dangerous both for you and the equipment. The instrumentation contains sensitive CMOS circuitry and can be destroyed by nearby lightning. For your own safety, do not touch or stand near an electrode or a cable connector during a thunder or lightning storm.

- Check the weather forecast prior to setting up the SuperSting for a survey. If you detect any signs of oncoming wet or rainy weather when preparing a survey, pack up the SuperSting, coil the cables, and gather any auxiliary equipment. Place all equipment in a dry, covered area.

Operating the SuperSting during thunder & lightning storms voids the warranty (see Warranty on page 9 for warranty information).

- Do not power the SuperSting from a vehicle (car, truck, van, etc.) 12V battery while the battery is still connected to the vehicle. The equipment can suffer extensive and costly damage should someone attempt to use the SuperSting in this configuration. Knowingly using a vehicle battery that is still connected to the vehicle (or simply in the chassis of the vehicle) with the SuperSting voids the warranty (see Warranty on page 9 for warranty information).
- Do not operate in an atmosphere with any risk of explosion.
- Before each use, inspect the electrode cables and any other connecting cables for insulation damage or exposed wiring. Damaged cables should immediately be replaced.
- Never work alone.
- Place any metal electrodes (stakes, aluminum foil or any sheet metal) into the ground before connecting them to an instrument.



- Use safe practices when setting up the survey line by following this sequence:
 1. Place any metal electrodes (stakes, aluminum foil or any sheet metal) into the ground before laying out the electrode cable.
 2. Place the electrode switch/take-out on the stake, without touching any metal.
 3. Once the switch/take-out is in contact with the stake, attach the switch/take-out with the stainless steel spring.

This procedure ensures that the electrode take-out is grounded as you attach the take-out to the stake.

- Always use a “Danger High Voltage” warning cover, available from AGI (part # 920077), on each electrode. Note that the warning covers are an alert indicator, and they do not protect from the high voltage, especially when wet. The message “Danger high voltage” in English, Spanish and Chinese is accompanied by a self-explanatory picture on the cover.
- Never attach the electrode cables to the instrument **until you are ready to start the survey**.
- Before starting the instrument, make sure that the survey line is clear of people or animals touching or near the cable or electrode stakes.
- Use only the fuse type and rating specified for this product.
- Do not touch exposed connections and components when the system is energized.
- Do not operate the instrument if you suspect it is damaged or may be subject to failure. If you suspect damage or malfunction, have it inspected by qualified service personnel.



Figure 0: Use the electrode warning covers

2 Preface and Equipment

2.1 Warranty

Advanced Geosciences, Inc. is not liable to Buyer or to any third party for consequential or incidental damages under any circumstances, whether due to defect in the product, delay or failure of delivery, failure of the product to perform as specified, or for any other reason or cause. Buyer and Advanced Geosciences, Inc. agree that Buyer's sole remedy and Advanced Geosciences, Inc.'s sole liability to Buyer is limited to repair, replacement, or refund of the purchase price. Damage due to corrosion, customer alterations, excessive dust, extreme environmental or electrical conditions, and/or misuse will be evaluated upon inspection. If inspection reveals that the cause of damage is not due to materials or workmanship, repair of the product will be treated on a non-warranty basis.

Each instrument manufactured by AGI is warranted to be free from defects in materials and workmanship. This warranty covers the servicing and adjusting of any defective parts (except for fuses, batteries, cables, and other consumables). The warranty is effective for 12 months after the date on which the instrument was shipped from the factory as set forth on the air way bill, provided that the instrument is returned freight prepaid to AGI. If the fault has been caused by misuse or abnormal conditions, AGI will submit a cost proposal to the user prior to undertaking any repair work.

This warranty does not cover freight charges to or from AGI.

This warranty does not cover the costs of any steps that the purchaser takes or fails to take as the result of measurements made using our instrument or as the result of calculations carried out by the instrument or software.

If a fault occurs, contact AGI for instructions. Lethal voltages may be present inside the instrumentation even when the input voltage is disconnected. Only properly trained and qualified personnel should remove covers and access the inside of the power supply. Installation and service must be performed only by properly trained and qualified personnel who are aware of dealing with electrical hazards.

Advanced Geosciences, Inc. or any of the associated sales organizations cannot accept responsibility for personal injury, consequential injury, loss, or damage that result from improper use of the equipment and accessories.

Using a 12 V automobile battery installed in a vehicle as an instrument power source will void the warranty. Using an automobile battery installed in a vehicle may damage the instrument beyond repair (and ruin the quality of the data). Therefore when using a 12 V battery as external instrument power source, it has to be disconnected from the vehicle and placed on the ground on some insulating material like dry wood or plastic.

2.2 Warranty Registration

Thank you for purchasing products from Advanced Geosciences, Inc. or our subsidiary Advanced Geosciences Europe S.L.

PRODUCT WARRANTY REGISTRATION CARD:	
END USER'S NAME_____	
COMPANY/ORGANIZATION_____	
ADDRESS_____	

CITY_____	STATE_____
COUNTRY_____	
POSTAL CODE_____	PHONE_____
FAX_____	E-MAIL_____
NAME & SERIAL # OF INSTRUMENT_____	
DATE OF PURCHASE_____	
THIS WARRANTY REGISTRATION INFORMATION WILL HELP US TO KEEP OUR CUSTOMERS INFORMED OF UPDATES, CHANGES, AND NEW IMPLEMENTATIONS.	
PLEASE FAX THIS REGISTRATION CARD TO +1 512 258-9958 OR SEND IT VIA E-MAIL TO sales@agiusa.com .	

Please, keep a copy of this registration form for your records.

For additional information about our products, contact our local representative at AGI (Advanced Geosciences, Inc.) or AGE (Advanced Geosciences Europe S.L.)

AGI — 2121 Geoscience Drive, Austin, TX 78626, USA
Phone) +1 512 335-3338, Fax) +1 512 258-9958

AGE — Calle del Aire, 85, 28042 Madrid, Spain
Phone) +34 913 056 477, Fax) +34 911 311 783

E-mail: sales@agiusa.com Web: <http://www.agiusa.com>

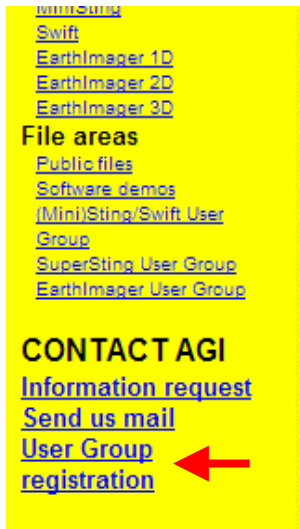


Figure 0: SuperSting User Group screen

2.3 Registration to the AGI SuperSting User Group

By registering with the SuperSting User Group on our web site, you get access to free software/instrument firmware updates, helpful hints regarding the use of the SuperSting and latest news regarding the system.

Any SuperSting owner is eligible to join our SuperSting User Group. Go to <https://www.agiusa.com> and click **User Group registration** in the yellow left side bar.

After filling in the registration information, you will receive your registration password.

2.4 About the Manual

This manual covers the following instruments:

- SuperSting R8/IP with Wi-Fi
- SuperSting R1/IP with Wi-Fi
- SuperSting Marine with Wi-Fi
- AGI R8 external or internal (built-in) switch boxes for AGI Passive multi-electrode cable systems (See **SuperSting Electrode Switch Box** on page 123)
- AGI R1 external or internal (built-in) switch boxes for AGI Passive multi-electrode cable systems (See **SuperSting Electrode Switch Box** on page 123)
- AGI Manual cables and AGI Active or Passive multi-electrode cables and accessories.

The manual uses the following menu conventions:

- **M6**—Go to menu 6 by pressing the number 6 key.
- **M7/1/4**—Go to menu 7 by pressing the number 7 key. Then, choose the first menu option, and on the following menu, choose the fourth option.

2.5 Where to Get Help

This instruction manual is the primary resource for information about the SuperSting. A PDF file of this manual can be downloaded and is also delivered with the software.

Tech Support

Email: support@agiusa.com

Phone: +1 512 335-3338

AGI directory is listed here:

<https://www.agiusa.com/directory.shtml>

Advanced Geosciences, Inc.
2121 Geoscience Dr.
Austin, Texas 78726
USA

Website: <https://www.agiusa.com>

2.6 Unpacking the Instrument

The following items are enclosed in a standard SuperSting R8/IP shipment:

Item	Qty	Code	Description
1	1	950098	SuperSting R8/IP, memory earth resistivity/IP/SP meter, comprises items 1.1-1.18
1.1	1	950101	SuperSting R8/ IP with Wi-Fi instrument console
1.2	1	951001	Power supply for office use only
1.3	1	911501	AC power cable
1.4	1	920009	Cable for communication SuperSting/Windows based computer
1.5	1	951016	Cable for loading firmware into the SuperSting
1.6	1	951010	Resistance test box for SuperSting R8
1.7	1	951005	Main battery cable with boost battery take-out
1.8	1	938202	12 V power adapter cable for boost battery
1.9	1	933040S	SSR8 Jumper cable, 2 meter, used to connect an active (dual-mode) cable, a switch box or a test box to the SuperSting
1.10	1	955002	Box for SP measurement, including grounding cable
1.11	1	953015	SuperSting R8 ABMN adapter cable
1.12	1	1000668	Antenna 2.4 GHz, 3 dB omni directional
1.13	1	951018	Kit of fuses comprising: one 20 Amp, 1x1/4", one 1 Amp 250V 5x20 mm and one 2.5 Amp 250 V 5x20 mm fuses
1.14	1	955007	Graphical display and control device
1.15	1	955006	SuperSting Manager App
1.16	1	951003	SuperSting Administrator, utility software

1.17	1	951004	SuperSting with Wi-Fi instruction manual
1.18	1	951063	USB-Serial adapter — Keyspan USA-19HS

The following items are included in a standard SuperSting R1/IP shipment:

Item	Qty	Code	Description
1	1	970001	SuperSting R1/IP, memory earth resistivity/IP/SP meter, comprises items 1.1 – 1.16
1.1	1	970002	SuperSting R1/IP instrument console
1.2	1	951001	Power supply for office use
1.3	1	911501	AC power cable
1.4	1	920009	Cable for communication SuperSting/Windows based computer
1.5	1	951016	Cable for loading firmware into the SuperSting
1.6	1	870010	Resistance test box for SuperSting R1
1.7	1	951005	Main battery cable with boost battery take-out
1.8	1	938202	12 V power adapter cable for boost battery
1.9	1	870030	SSR1 Jumper cable, 2 meter, used to connect an active (dual-mode) cable, a switch box or a test box to the SuperSting
1.10	1	973015	SuperSting R1 ABMN adapter cable
1.11	1	1000668	Antenna 2.4 GHz, 3 dB omni directional
1.12	1	851018	Kit of fuses comprising: one 20 Amp, 1x1/4", one 1 Amp 250V 5x20 mm and one 2 Amp 250 V 5x20 mm fuses
1.13	1	955007	Graphical display and control device
1.14	1	955006	SuperSting Manager App
1.15	1	951003	SuperSting Administrator, utility software
1.16	1	951004	SuperSting instruction manual
1.17	1	951063	USB-Serial adapter — Keyspan USA-19HS

The following items are enclosed in a standard SuperSting Marine shipment:

Item	Qty	Code	Description
1	1	953001	SuperSting R8 IP SP Marine meter with Wi-Fi, comprises items 1.1 – 1.21
1.1	1	953008	SuperSting Marine
1.2	1	951001	Power supply for office use
1.3	1	911501	AC power cable
1.4	1	920009	Cable for communication SuperSting/Windows based computer
1.5	1	951016	Cable for loading firmware into the SuperSting
1.6	1	951010	Test box
1.7	1	951005	Main battery cable with boost battery take-out
1.8	1	938202	12 V power adapter cable for boost battery

1.9	1	933040S	SSR8 Jumper cable, 2 meter, used to connect an active (dual-mode) cable, a switch box or a test box to the SuperSting
1.10	1	955002	Box for SP measurement
1.11	1	953015	SuperSting R8 ABMN adapter cable
1.12	1	1000668	Antenna 2.4 GHz, 3dB omni-directional
1.13	1	951018	Kit of fuses comprises: one 20 Amp, 1x1/4", one 1 Amp 250V 5x20 mm and one 2.5 Amp 250 V 5x20 mm fuses
1.14	1	951003	SuperSting Administrator, utility software
1.15	1	951004	Instruction manual
1.16	1	951063	USB-Serial adapter — Keyspan USA-19HS
1.17	1	953013	GPS
1.18	1	953011	GPS serial communications cable
1.19	1	953009	SuperSting Marine Wi-Fi repeater box
1.20	1	953012	SuperSting/GPS adapter cable
1.21	1	953114	Marine Log Manager software including the Administrator utility software and hardware key (dongle).

Depending on your order, the following accessories may be included in your shipment:

Item	Qty	Code	Description
2	1	911903	Heavy duty carrying case for the SuperSting, protects the SuperSting during transportation
3	1	920034	Carry harness for the SuperSting, protects the instrument against dirt and scratches during measurement
4	1	951080	Complete Main & Boost 220V Power Supply for gas powered AC Generator, replaces battery
5		Custom	Active (dual-mode) multi-electrode imaging cables with a number of patented "dual-mode" electrodes for SuperSting for land surveying.
5.1	1	SWITCH SERIAL#	Electrode switch serial number list
6	Varied	Custom	AGI multi-electrode cable Switch box, available for 28, 48, 56, 64, 84, 96, or 112 electrodes (if passive imaging cables are purchased)
7	Varied	Custom	AGI passive multi-electrode imaging cables for land surveying
8	Varied	Custom	AGI passive multi-electrode imaging cables for borehole ERT surveying
9	Varied	Custom	Marine Electrode Tow Streamer for use with SuperSting Marine
10	Varied	Custom	AGI Manual Cable set consisting of 4 electrode cable reels for 1D, or VES acquisition
11	Varied	920027	AGI infinity electrode cable reels for pole-pole or pole-dipole acquisition

12	Varied	920014	A number of stainless steel electrode stakes, length 18" by 3/8" diameter
13	Varied	920077	Electrode High Voltage Warning covers
14	Varied	920023	A number of non-polarizable electrodes
15	Varied	920219	NP electrode jumper cables to connect non-polarizable electrodes to the multi-electrode cables
16	1	951031	Kit for programming addresses into the programmable Active (Dual-mode) electrodes
17	1	951209	SuperSting Remote, for remote monitoring and scheduling of resistivity surveys over the internet.
18	1	944023	AGI EarthImager 1D, resistivity/IP 2D inversion software.
19	1	944004	AGI EarthImager 2D, resistivity/IP 2D inversion software.
20	1	944004	AGI EarthImager 3D, resistivity/IP 3D inversion software.
21	1	944030	AGI EarthImager 3DCL resistivity/IP 3D inversion software. Command line version of EI3D for computers with 64-bit processing capability running Windows 2003x64, Windows Vista 64-bit, Windows XP Pro 64-bit, Windows7.
22	1	1000274	AGI SP Analyzer software for SP data processing
23	1	944007	AGI CRP module for EarthImager 2D for datasets with more than 200 electrode locations (either land roll-along, or marine tow surveys)
24	1	945000	AGI Time-lapse (4D) for EarthImager 2D
25	1	945002	AGI Time-lapse (4D) for EarthImager 3D

3 SuperSting Resistivity/IP/SP Meter

The following SuperSting models are available:

SuperSting R8/IP/SP	Our basic 8-channel instrument
SuperSting R1/IP/SP	Our basic single-channel instrument
SuperSting Marine	Our 8-channel instrument specially adapted for continuous resistivity profiling (CRP) in water. This model can also be used on land like the SuperSting R8/IP.

3.1 SuperSting R8/IP/SP and R1/IP/SP

The SuperSting R8/IP and R1/IP models come with Wi-Fi capability, and can be controlled by an Android™ device like a phone or a tablet.

The single-channel SuperSting has one receiver. Therefore, for each current injection, the electric potential can only be measured between two electrodes. So, only four electrodes are used for each measurement (two for current and two for potential).

The eight-channel SuperSting has eight receivers. Therefore, for each current injection the electric potential between nine electrodes can be measured simultaneously, thus speeding up the total survey time.

Both land instruments can record manual (four electrodes connected to the instrument by four single conductor cables on four reels) or multi-electrode cable systems with a large number of electrodes, typically 28–224. There is no practical upper limit on how many electrodes can be laid out and connected to the instrument in an “automatic multi-electrode cable” setup.

There are two types of electrode switching systems:

- Distributed switching system (active or dual-mode)
- Central (passive) switching system.

In the distributed switching system, also referred to as active or dual-mode, the actual switching happens at each electrode. The instrument assigns which electrode is the current and which is the potential. The advantage is that the cable connecting all the electrodes only needs to have two leads for signaling to the electrodes: two for the current electrodes, and one for each potential electrode. In the distributed system, the electronic detection and switching circuit is molded into special take-outs along the cable.

In the central switching system, also referred to as a passive electrode system, the electrode switching typically happens at the instrument. For this method, there is one lead for each electrode connected to the central switching unit (switch box). Central switching systems use cables that are similar to seismic type cables, but with different electrical specifications.

The SuperSting can use both distributed and central switching systems separately or simultaneously.

The SuperSting instruments are mainly designed for resistivity imaging, using an active electrode cable with the automatic dual-mode electrodes or using a switch box and passive electrode cable for resistivity imaging. The SuperSting can also be used as a standard resistivity/IP/SP instrument for profiling and sounding (VES) using four “manual” cable reels and four electrode stakes.

3.2 SuperSting Marine

The SuperSting Marine instrument (part # 953001), in conjunction with the Marine Log Manager module of the SuperSting Administrator software, is used for fresh or salt water aquatic surveys, but can also perform land surveys and borehole surveys. See **SuperSting R8 Marine Instrument** on page 150.

3.3 SuperSting With Wi-Fi

All models come with Wi-Fi capability and can be controlled by an Android device like a phone or a tablet.

This new mobility frees you from monitoring imaging surveys at the instrument in the field and makes it possible to send data immediately to your processing center.

You will no longer be tied down to your instrument during electrical surveys and can work from the comfort of your vehicle up to 100 meters away (depending on terrain and atmospheric conditions).

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, review data in real time, and display pseudo sections in stunning colors on Android tablets and phones with AMOLED screens.

NOTE: The SuperSting is not currently compatible with iOS.

It also enables you to upload command files from your App to the SuperSting and download data from the instrument and email data files directly from the App to your office or processing center.

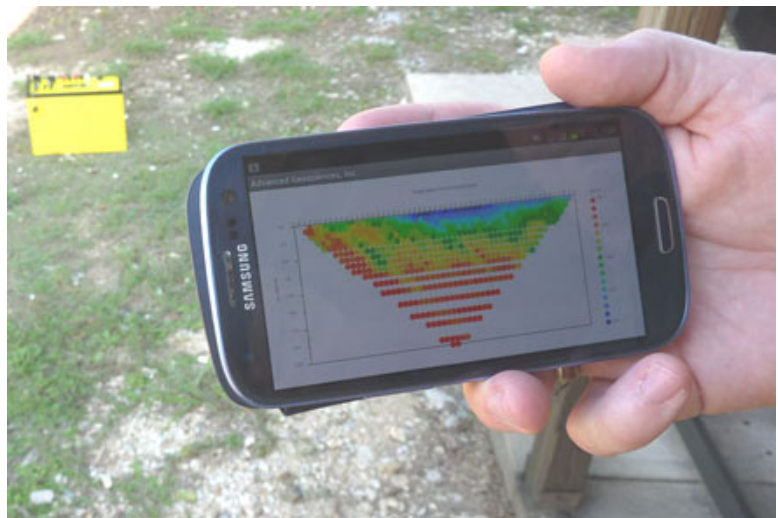


Figure 0: Display pseudo sections on your Android device.

3.4 Active or Dual-Mode Automatic Electrode Cable Systems

Active or dual-mode (patent 6,404,203) electrode cable system (formerly Swift Electrode Cable System) for SuperSting is an automatic distributed switching, multi-electrode cable system, which is comprises a number of electrode switches molded on to a special cable. The cable plugs directly into the SuperSting and no external switch box is needed.

This cable system is available in two models: the R1 cable for the single-channel instrument, and the R8 cable for the 8-channel instrument. The cable sections, available in various electrode takeout intervals, connect to form a longer cable with the specified intervals. For example, by connecting two 2.25-meter electrode takeout interval sections, the total length will be 18 meters, with 8 electrodes at 2.25-meter spacing (1.125 lead-in + 2.25x7 + 1.125 tail).

Electrode takeout interval	Number of electrodes	Lead-in and tail	R1 Part number	R8 Part number
50.25 meters	1	25.125	933917	933919
20.25 meters	1	10.125	933916	933918
12.25 meters	2	6.125	933915	933666
6.25 meters	4	3.125	933914	933667
2.25 meters	4	1.125	933913	934000S

The two systems look similar, but the R8 cable has a somewhat larger diameter cable, different internal switching and a different connector since it contains more leads. The cables are not interchangeable for dual-mode recording.

Cable	Instrument	Mode
R1	R1	Single-channel
R8	R8	Eight-channel
R1	R8	Single-channel
R8	R1	Not valid

The number of automatic electrodes that can be used with the SuperSting is virtually unlimited. Theoretically, over 65000 electrodes can be addressed.

In active electrode cable systems, the actual switching of the electrodes happens at the electrode itself. Each electrode in the system has a unique number, or electrode address, that the SuperSting uses to control the operations of the electrodes. Therefore, the SuperSting can set a certain electrode to be the A current electrode, for example, by addressing the switch by its number.

The unique advantages with the active or dual-mode electrode cable system are:

- Active or dual-mode capability makes it possible to directly connect non-polarizable electrodes to the electrode cable and measure voltage potential on those electrodes, while injecting current on the stainless steel electrode stakes for automatic measurements. This is especially valuable for IP or SP measurements. Since this feature is patented (patent 6,404,203), it is only available with AGI equipment.

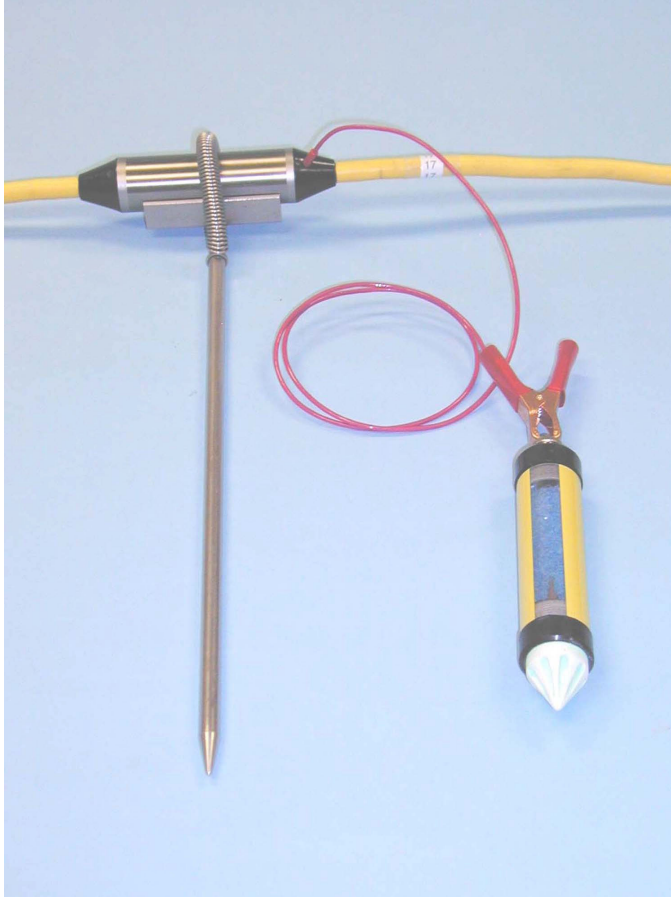


Figure 1: Dual-mode (non-polarizable) electrode connection

- All active or dual-mode electrode addresses can be re-programmed without having to open the electrodes, using an active or dual-mode electrode Reprogramming Kit (part #951031 for R8, or part #951133 for R1). This feature is important when using an active or dual-mode multi-electrode cable set from another user, for example. The electrode addresses can then be re-programmed so they are in consecutive order. Alternatively, if an electrode needs to be replaced by a spare electrode, the spare electrode is then quickly re-programmed and replaces the faulty electrode.

3.5 Passive Multi-Electrode Cables and Switch Box Systems

The SuperSting can also be used with passive multi-electrode cables and electrode relay switch boxes.

The Switch Box is a centralized switching system, because the actual switching of the electrodes happens at a central location. Each electrode in the system has a specific conductor in the cable that attaches it to the switch box. The leads assign a particular relay switch that represents specific electrode addresses for each electrode. The switch box can switch any electrode to any function, A, B, M or N. With the SuperSting R8, the switch box can switch any electrode to any function, A, B, P1, P2, P3, P4, P5, P6, P7, P8, and P9.

The switch boxes currently are available in the following electrode switching capability; 28, 48, 56, 64, 84, 96, and 112 electrodes. Several switch boxes can be daisy chained together for virtually infinite electrode switching capacity, or to create a large electrode grid for 3D measurements. See **SuperSting Electrode Switch Box** on page 123 for more information.

NOTE: Switch boxes for SuperSting R8 and R1 are different. If you use an R1 switch box with a SuperSting R8 instrument, the measurements can only be performed in single-channel mode, and are therefore slower. An R8 switch box cannot be used with a SuperSting R1 instrument.

Switch box	Instrument	Mode
R1	R1	Single-channel
R8	R8	Eight-channel
R1	R8	Single-channel
R8	R1	Not valid

4 Your SuperSting, Memory Earth Resistivity and IP Instrument

The SuperSting with Wi-Fi is a rugged resistivity, IP (induced polarization) and SP (spontaneous potential, self-potential, and streaming potential) portable instrument with memory storage and user-defined measure cycles. One or two external 12 V DC batteries power the SuperSting (see **About the Battery** on page 43). The SuperSting R8/IP features a built-in 8-channel receiver and a transmitter.

With the optional automatic multi-electrode system, the swift, automatic measurement of any array type can be performed.

4.1 Getting to Know the SuperSting

The SuperSting is a memory earth resistivity instrument. The controls, the display and the connectors are all located on the front panel.



Figure 2: SuperSting R8/IP front panel

Item	Feature
1	Power connector.
2	Three fuse holders: SuperSting R8 is 20 A, 2.5 A and 1.0 A. SuperSting R1 is 20 A, 2.0 A, and 1.0 A.
3	Power O/I (OFF/ON).
4	Night light, used to illuminate the display during poor light conditions.
5	Switch to toggle between Wi-Fi and PC communication modes (connector #12). Wi-Fi is used for communication between the

	SuperSting and an Android device. PC communication is used to make communication between the SuperSting and a PC. Wi-Fi and PC communication cannot be used simultaneously.
6	Indicator light for main and booster mode.
7	Connector for firmware upload or wired communication with the PowerSting external transmitter. The instrument recognizes if a firmware cable or a PowerSting communication cable is connected.
8	Liquid crystal display (LCD) window with 16 text lines of 30 characters each.
9	Keyboard
10	Connectors for dual-mode cable 1 and 2, or to connect one or two switch boxes. SuperSting R1 uses different connectors than SuperSting R8.
11	Test terminal for use with banana connector or stripped wire (only on SuperSting R8/IP)
12	Connector used for serial communication with a PC for data download and command file upload
13	Antenna connector for Wi-Fi or wireless antenna

4.1.1 Power Connector

One or two external 12 V DC batteries power the instrument (see **About the Battery** on page 43). The batteries are connected to the instrument front panel connector by the special power cable delivered with the instrument. The power cable has a pig-tail connector for the boost battery.

Main mode: The instrument is powered by one 12 V battery and operates in the range 0-100 Watt. The Main indicator light is on.

Boost mode: The instrument is powered by two 12 V batteries and operates in the range 0-200 Watt. The Main and Boost indicator lights are on.

Office mode: When the instrument is used in an office environment, it is powered by a power supply (Part # 951001) delivered with the instrument. The power supply is connected to the power outlet (100-250 V AC at 50-60 Hz input power) and the front panel connector marked **Power**. The instrument automatically turns on when the power is connected.



Figure 2: Office power supply

NOTE: The front panel ON/OFF switch will not work when the instrument is powered by the Power Supply.

In this mode, the processor is working but the transmitter is unable to transmit any current. The instrument therefore cannot take any readings. Downloading data, uploading command files, and instrument firmware upload all work in this mode.

4.1.2 Fuse Holders

The fuse holders are located on the front panel of the instrument. The fuses for SuperSting R1 are 20 Amp/32 V, 1 ¼"x ¼", 1 Amp 250 V 5x20 mm, and 2 Amp 250 V 5x20 mm fuses (Part # 851018). For SuperSting R8, the fuses are 20 Amp/32 V, 1 ¼"x ¼" fuse, 2.5 Amp and 1.0 Amp (Part # 951018).

4.1.3 ON/OFF

When the battery is attached, turn the instrument on, by turning the I/O (On/Off) switch to the I (On) position. The following message is displayed:

```
Advanced Geosciences, Inc.  
SuperSting  
  
Hardware initializing
```

After a short moment, the main menu replaces the text.

If the instrument is powered by the office power supply, the following message appears:

```
Advanced Geosciences, Inc.  
SuperSting  
  
Hardware initializing  
  
TRANSMITTER OFFLINE!!!  
Press any key to continue.
```

The instrument can be turned off at any time and will keep its current settings until it is turned on again. Data in the memory will not be lost when the instrument is shut off or disconnected from the battery.

To save battery power, the instrument automatically shuts off if no keyboard action has been detected for 5 minutes. The automatic shut off function will cause no loss of data or instrument setting. The automatic shut off function can be disabled, or the time setting can be changed, on menu 6/4/1. The shut off time can be set for any time between 1-60 minutes.



Figure 2: SuperSting keyboard

4.1.4 Keyboard

The **Alphanumeric keys** are used to enter letters and numbers and to select options on the different menus. To enter letters, select the first, second or third letter on the key by first pressing **F1**, **F2** or **F3**. For example, to enter the word STING, press **F1 1**, **F2 1**, **F3 9**, **F2 5** and **F1 9**.

The menu key (**MEN**) is used to go up one step in the menu system.

The keyboard has 20 tactile keys.

The function keys (**F1**, **F2** and **F3**) are used to select certain functions.

The measure key (**MEA**) is used to start the measurements.

The combination contrast adjustment key and back space key (**BSP**) is located in the top right corner of the keyboard. The LCD is sensitive to temperature and may turn pale or too dark with change of ambient temperature. To adjust the contrast to a suitable level, press the contrast key repeatedly.

The enter key (**ENTR**) is used to enter or select data.

4.1.5 Power Supply

The power supply is necessary when the SuperSting is used in an office environment, for example if it is connected to a PC for data download, command file upload or flash memory upload. The power supply, delivered with the instrument, can handle 100-250 V AC at 50-60 Hz input power.

The power supply does not have an ON/OFF switch. The SuperSting turns on automatically when connected to the power supply.

NOTE: The ON/OFF switch on the SuperSting front panel does not work when the instrument is powered with the power supply.

4.2 SuperSting Files

There are six types of files associated with the SuperSting:

- Firmware software with extension .agi
- Command files with extension .cmd
- Data files with extension .stg
- Calibration file with extension .cal
- Contact resistance file with extension .crs
- Binary file with extension .bin

5 Quick Start

This chapter presents information to help you get started quickly if you are already somewhat familiar with earth resistivity meters and methods.

The SuperSting can be used in two basic modes:

- **Automatic mode** with active (dual-mode) or passive multi-electrode cables. In this mode, the SuperSting R8/IP can take up to 8 simultaneous readings for each current injection (1 reading/current injection for the SuperSting R1).
- **Manual mode** with four cable reels* and electrode stakes (part # 920014) attached to the ABMN adapter (R1 part # 973015, R8 part # 953015). The adapter is attached to one of the electrode cable connectors (#10) on the front panel. In this mode, the SuperSting R8/IP and R1/IP can take one reading for each current injection.

*Long cable set (2x750 and 2x250 m) part # 911906; medium cable set (2x400 and 2x100 m) part # 911904; short cable set (2x150 and 2x50 m) part # 911905

5.1 Automatic Mode for Multi-Electrode Resistivity/IP/SP Profiling and Imaging

The automatic mode is used to automatically record resistivity, IP or SP data using a preprogrammed command file and the active or passive automatic multi-electrode cables. The SuperSting system is used to collect large amounts of field resistivity/IP or SP data. A complete step-by-step guide on how to collect and present resistivity/IP or SP data is outlined below.

5.1.1 Setting up the SuperSting System for an Automatic Field Survey

The complete field system consists of:

- The SuperSting R8 or SuperSting R1.
- A command file that defines a specific array or multiple array type and is uploaded to the SuperSting.
- Multi-electrode cables with a number of addressable active (dual-mode) switches or a single (or multiple) addressable electrode switch box(es) with passive multi-electrode cables (standard sizes include 5.25 or 6.25 m cables, to be used with 28 or 56 electrode switch boxes).
- Stainless steel electrode stakes with connection spring (part # 920035).
- Electrode High Voltage Warning Covers (part # 920077).

The SuperSting uses one (normal power mode, 100 Watt) or two (boost power mode, 200 Watt) 12 V DC batteries. Deep cycle marine type batteries are recommended. Make sure that the batteries are fully charged at the start of the day. Alternatively, the SuperSting can be powered by small gas-powered AC generators (such as the Honda 1000EUi) through the AGI SuperSting power supplies for AC generators (part # 951080).

IMPORTANT

You must be connected to a battery or generator power supplies when you perform measurements. Office power supplies are not powerful enough to power the SuperSting transmitter, and they introduce data noise. Do not try taking measurements with the office power supply (the wall office power supply) or a generator power supply through wall power. The 15W office power supply (part # 951001) will be damaged if the SuperSting tries to draw 100W from it, and there are grounding issues with trying to use wall power (120V or 240V) with a generator power supply. Using an improper power supply results in noisy data, unusable during data processing.

5.1.2 Creating a 2D Command File With the SSADMIN software

A command file must be created prior to going into the field. Command files are simple text files that tell the instrument how to perform the measurements. 2D Command files can be manually user-made, using a regular text editor, or automatically made using the “Command creator module” of the SuperSting Administrator (SSADMIN) or EarthImager 2D. Similarly, 3D Command files can only be created by the EarthImager 3D software.

IMPORTANT

Using the SSADMIN software, the command file must always have the electrode unit spacing (physical distance between the electrode stakes) equal 1. The actual electrode spacing is achieved in the field when entering the “Scaling factor,” simply a multiplier that gives the correct electrode spacing.

At other special surveys, the electrode spacing is not the same along the line. In such cases, the command file can be edited, using a regular text editor, to enter the correct electrode coordinates. It is important in these cases to enter scaling factor =1 in the field so the entered coordinates do not get multiplied with some scaling factor other than 1.

To create a 2D command file using the SSADMIN:

1. Click the button for the **SuperSting Command Creator** module at the top right corner of the SuperSting Administrator screen.
2. Make sure to check the box for **SuperSting R1/IP** if the command file is for a SuperSting R1/IP, and to un-check the same box if the command file is for a SuperSting R8/IP.

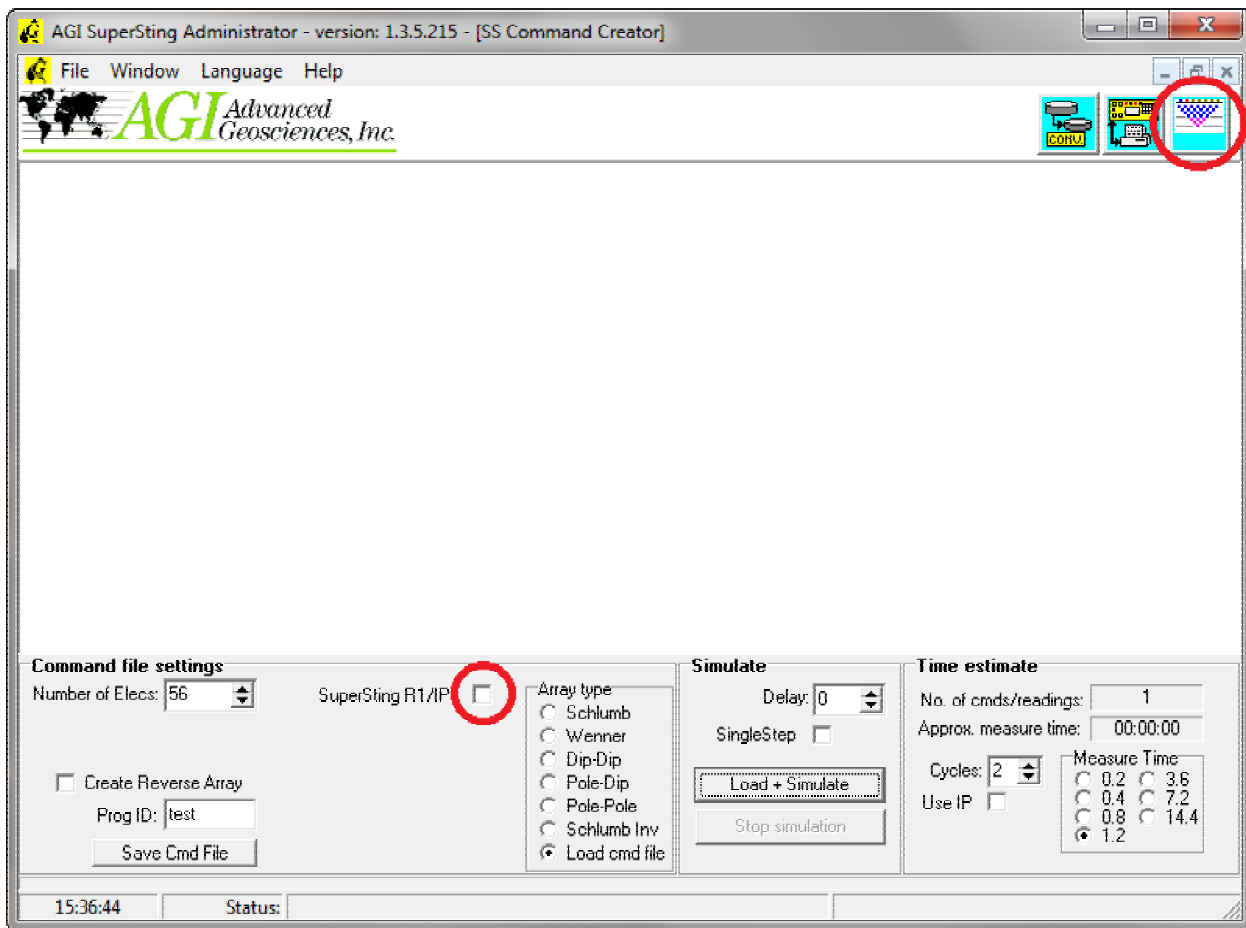


Figure 3: SuperSting Administrator software

3. If the command file is for a SuperSting R8/IP, we recommend you check the **Create Reverse Array** box. This will in many cases speed up roll-along surveys when using the SuperSting R8/IP. For SuperSting R1/IP, you do not need to check the box.
4. Enter the number of electrodes you are using.
5. The depth scale is estimated based on an electrode spacing of one unit. To get an estimate of the depth penetration for your survey, multiply the planned electrode spacing by the appropriate scalar shown on the left in Figure 4 (For example, 3 ES means 3 times the planned electrode spacing).

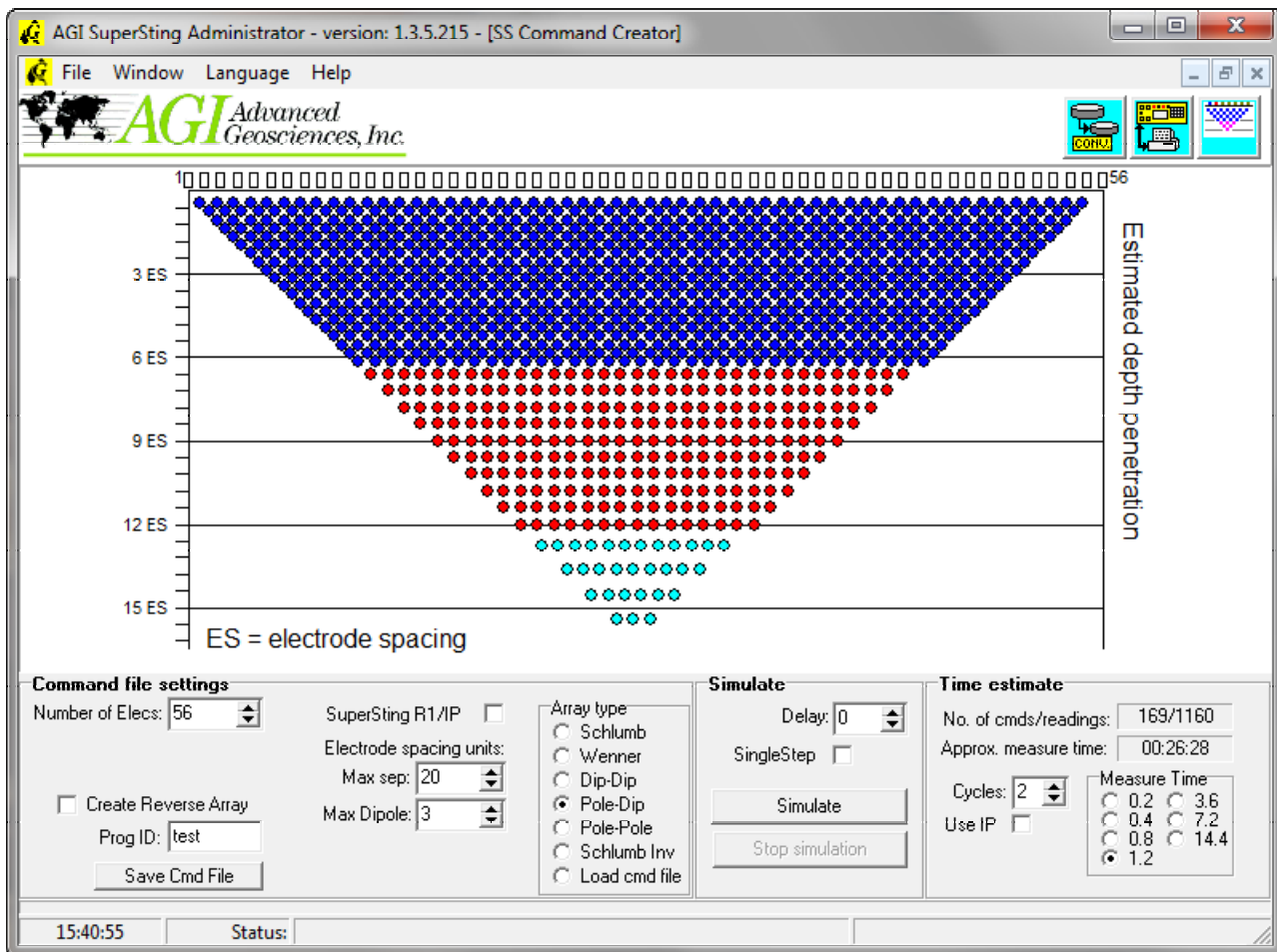


Figure 4: Creating a command file using the Administrator software

6. Enter a program ID name in the **Prog ID** window. This is the ID you will see on the SuperSting display when you select the **Command file** for a survey. If you forget to enter a name, you will not be able to select this file in the SuperSting, since you cannot see the file.

NOTE: Failing to enter a name may be the cause of “lost command file.” It exists, but you cannot see it. The ID name is also the default name for the command file name when you save the command file.

7. Select the array type of your choice.
8. The following table gives recommended settings for the “Electrode Spacing Units.” Numbers are entered in terms of “electrode spacing.”

Array type	Property	Setting	Description
Schlumb	Max AB/MN	11	-Keep the relationship AB/MN less than or equal to 11 gives a strong signal in most cases.
	Expansion Factor	#	-Equal to or greater than 0.25 x the total number of electrodes will provide all possible data points. Less than 0.25 x the total number of electrodes will act as a depth filter.
Wenner	Expansion	#	-Equal to or greater than 0.3 x the total number

	Factor		of electrodes will provide all possible data points. Less than 0.3 x the total number of electrodes will act as a depth filter.
Dip-Dip	Max n	8	How far to separate the transmitter and receiver dipoles per injection (measured in electrode separation units, 8 gives a strong enough signal in most cases. Depends on number of electrodes, for 28 set 3, for 56 set 6. To get all data just set a large number.
	Max Dipole	6	
Pole-Dip	Max sep	20	20 gives a good enough signal strength in most cases. Depends on number of electrodes, for 28 set 2, for 56 set 3. To get all data just set a large number. Make sure to set the remote electrode at “infinity” approximately in line with the electrode line.
	Max Dipole	3	
Pole-Pole	Max sep	55	Number of electrodes, less one. Make sure to set the remote electrode at “infinity” approximately in line with the electrode line.
Schlumb Inv	Max AB/MN	11	Keep the relationship AB/MN less than or equal to 11 gives a strong signal in most cases.
Load cmd file	N/A	N/A	A command file can be loaded and displayed using the CommandCreator module of the SSADMIN software.

9. Click the Simulate button to see the measurement sequence in a graphical presentation. If the Single Step window is checked, you can step through the measurement sequence one step at a time.

If you step through the sequence and are not satisfied with the electrode placement along the top line, change the Electrode Spacing Units value and single-step through the sequence again.

10. Click **Save CMD File** to save the command file.

NOTE: The “Geometry” section of a command file created with SSADMIN only increments each electrode location by 1. The real electrode spacing used in the field is entered manually during the setup of the instrument prior to starting the data acquisition. See **Setting up the Instrument for Use With Swift Dual-Mode Electrodes** on page 44 or **Setting up the Instrument for Use With Switch Box and Passive Cables** on page 46.

5.1.3 Creating a 2D Command File With the EarthImager2D software

A command file must be created prior to going into the field. Using the EarthImager 2D software, you can create a 2D command file for surface, stationary underwater, or borehole measurements with or without the specific electrode geometry included.

A detailed description of EarthImager 2D, including full functionality, is available in the *Instruction Manual for EarthImager 2D*. To create a 2D command file using the EarthImager 2D:

1. Open EarthImager 2D and proceed to the **Tools** menu.
2. Choose Command Creator 2D. Refer to the EarthImager 2D manual for additional detailed explanations of each variable.

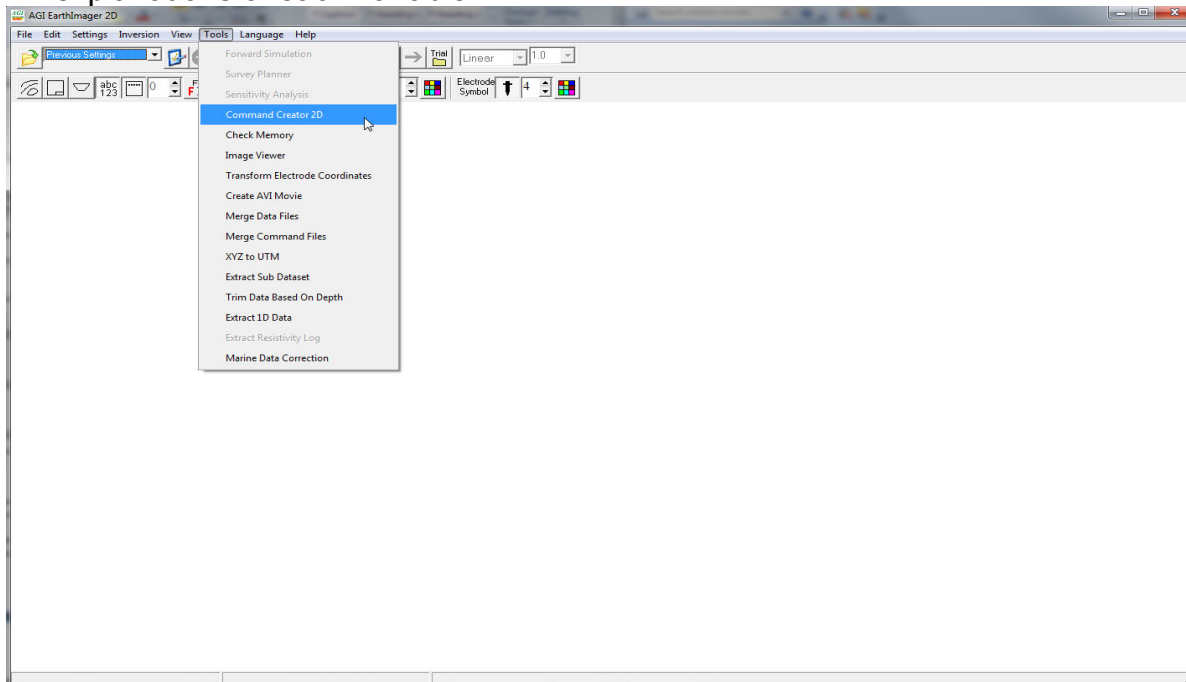


Figure 5: EarthImager2D main tool bar with Command Creator under Tools

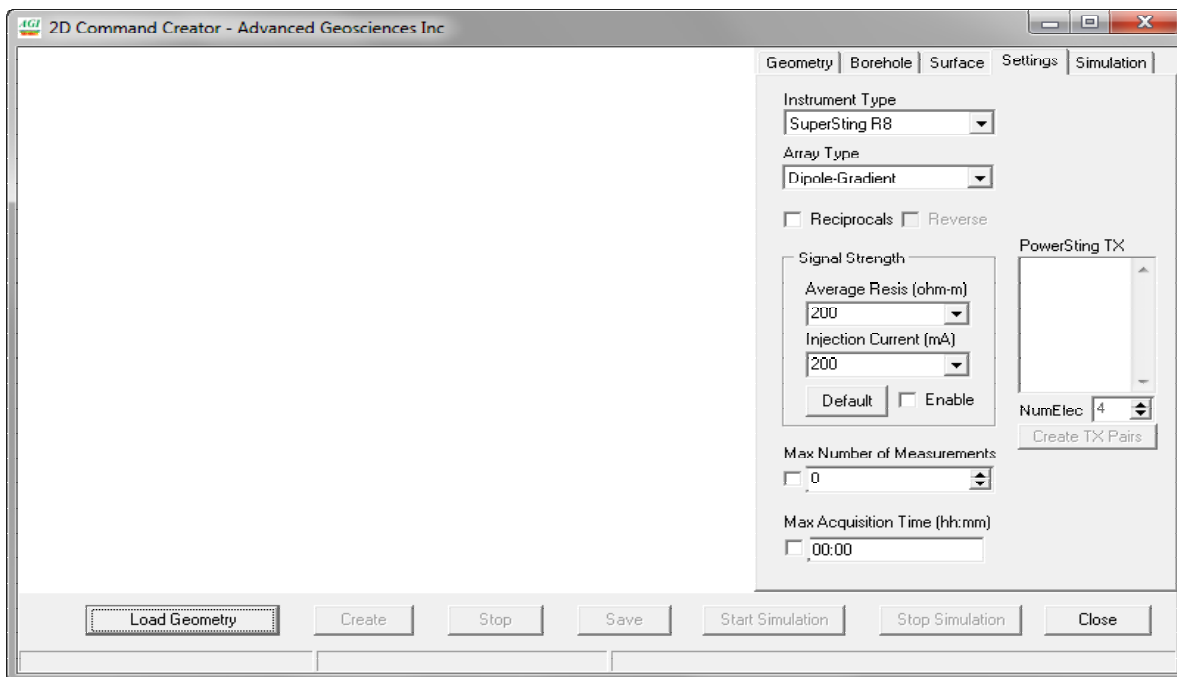


Figure 6: EarthImager2D Settings window

Under the **Geometry** tab, the electrode geometry defines the location of electrodes. The open window to the left is used to visualize the location of the electrodes, and to show the simulation of commands. Note that under the **Surface** and **Borehole** tabs, electrode intervals can only be entered as same spacing for all electrode intervals. Under the **Geometry** tab, you can edit such a file and create command files where electrode spacing reflects what you are actually planning to lay out.

3. Click the **Surface** or **Borehole** tab to define the electrode layout. Remember that you can define the “Electrode Spacing” in this tab based on your actual (or planned) field layout or with an Electrode spacing of 1.0. The **Borehole** tab allows you to use this command file with different Scaling Factors or multiple field electrode spacings during the SuperSting setup.
4. On the **Geometry** tab, you can change the distance between electrodes by entering new coordinates in the window to the right.

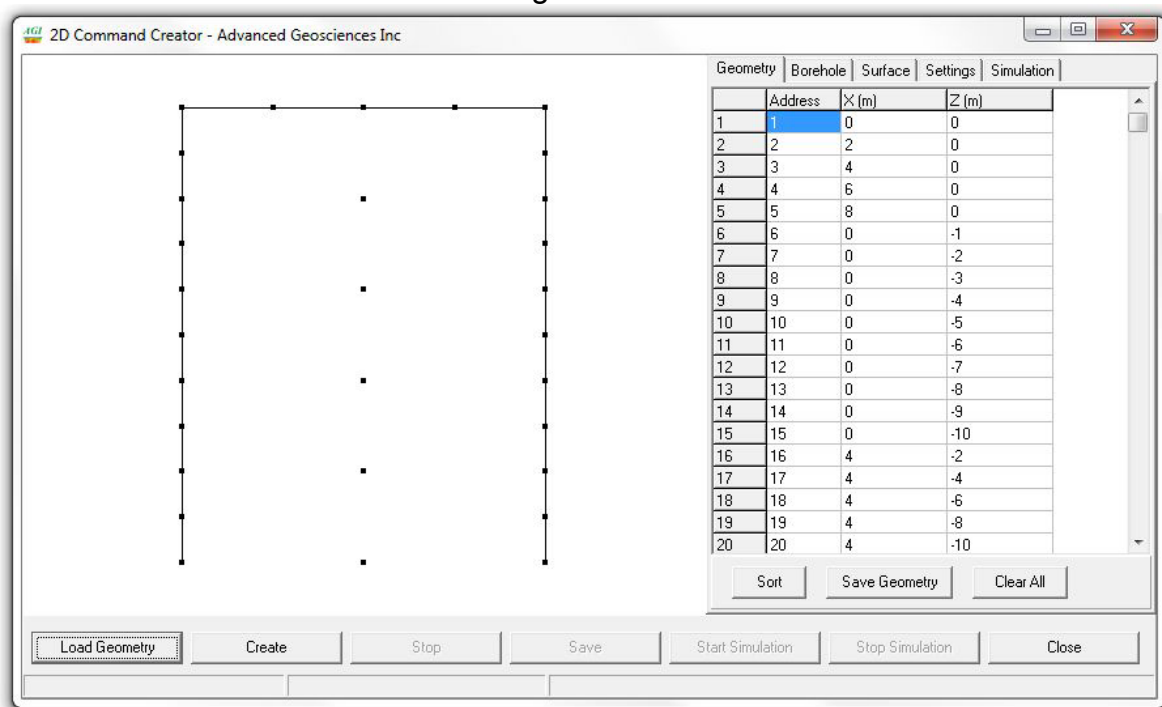


Figure 7: EarthImager2D Geometry window

5. On the **Surface** tab, enter the First Electrode X location, Address number (**Addr**), **Number of electrodes**, and the **Electrode spacing**.
6. Click **Add Surface Electrodes** to view the layout.

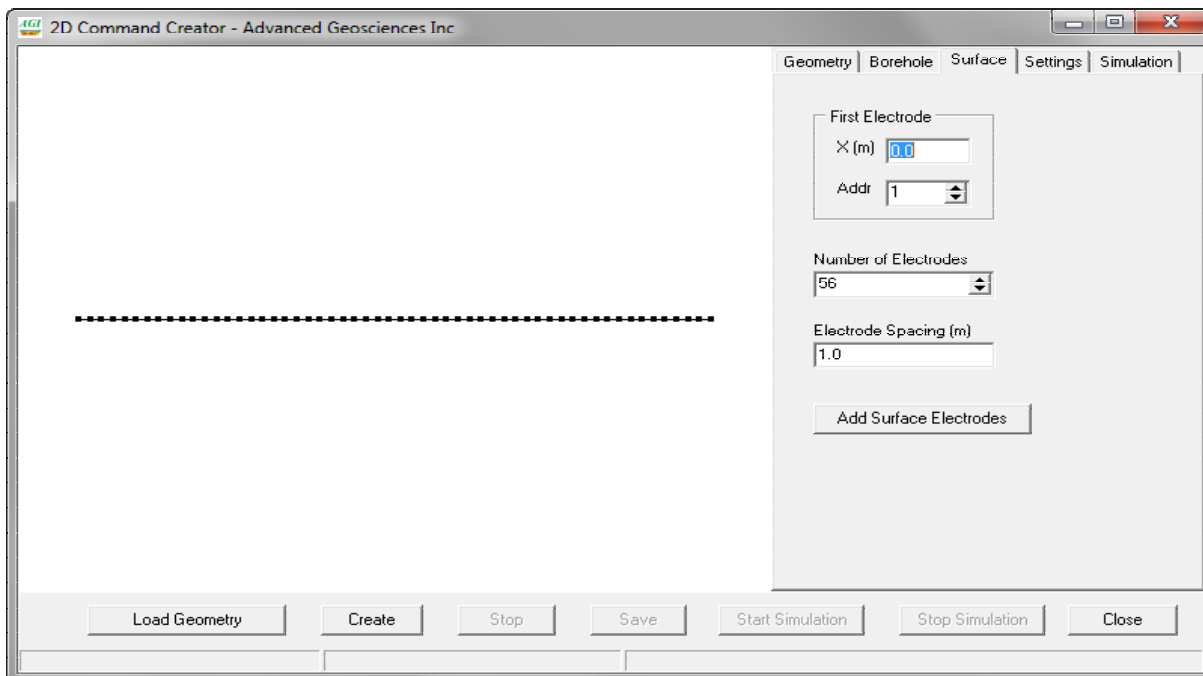


Figure 8: EarthImager2D Surface electrode surface definition window

7. Once you see the layout, access the **Settings** tab and choose the **Instrument type** and **Array type** (Figure 9). Then click **Create** to generate the command file. For more details about the settings, refer to the EarthImager2D manual. After the command file is created, click **Save**.

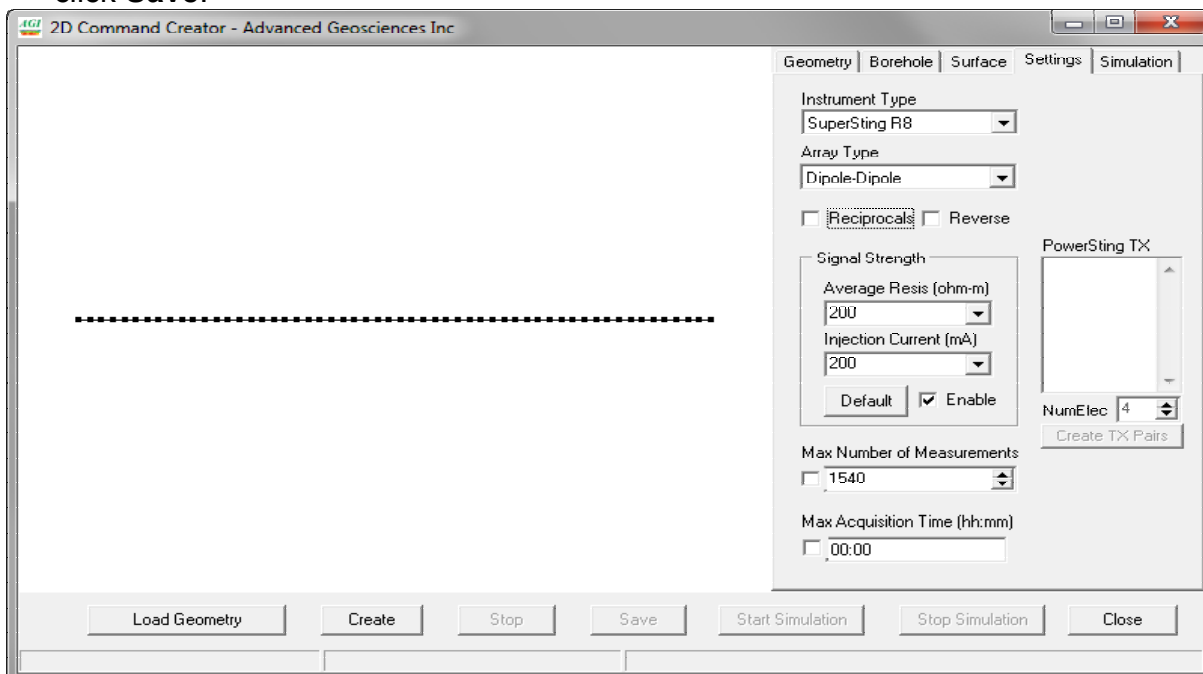


Figure 9: EarthImager2D Settings menu

8. Click the **Simulation** tab to view the execution of the command file (See Figure 11). You can see the estimated survey time based on the number of possible cycles and measurement times implemented.

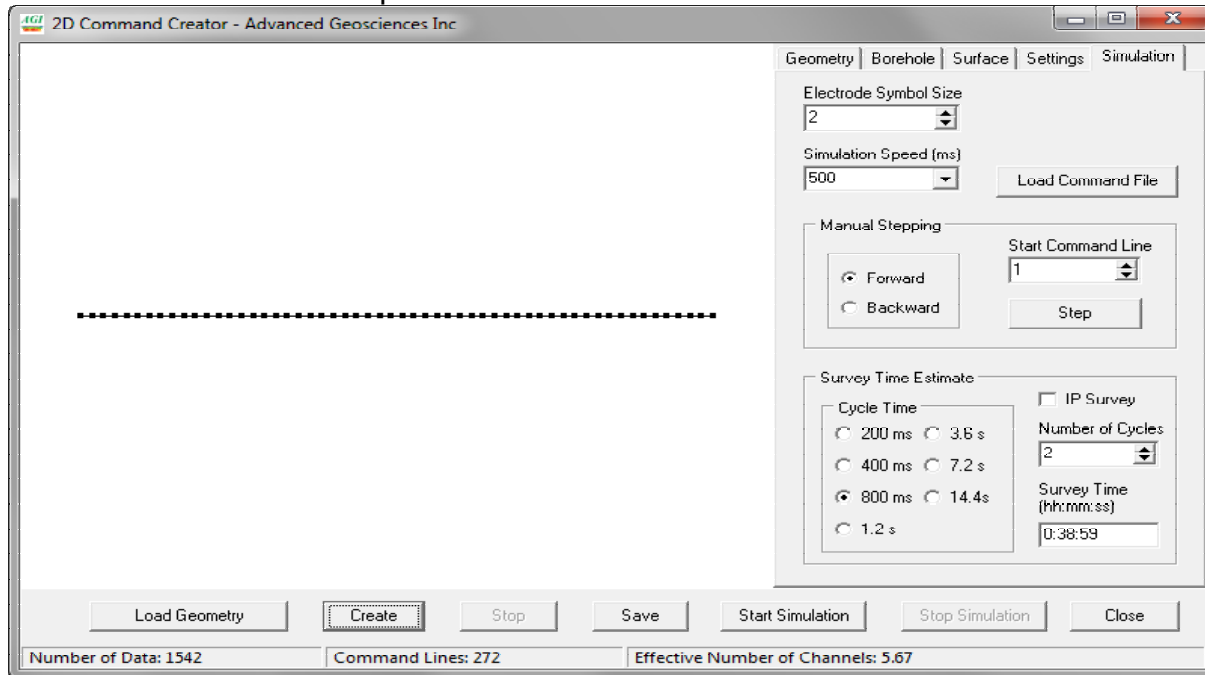


Figure 10: EarthImager2D Command Creator command file simulation window

During the simulation, you will only see which electrodes are being used for current (blue) or potentials (red), and no pseudo section will be shown. Further, this simulation is only for your information and does NOT determine or preset the measurement time or number of cycles that must be set in the SuperSting for actual field acquisition.

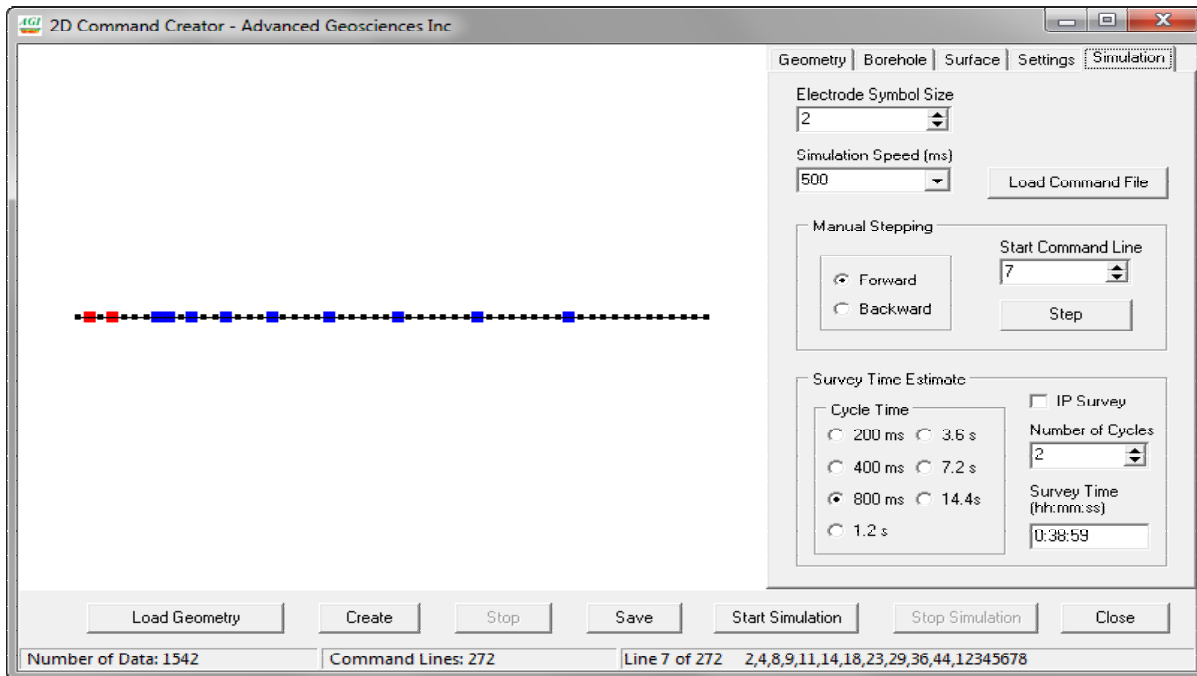


Figure 11: Simulation of the command file execution with EarthImager2D

5.1.4 Command file With EarthImager3D

To create a command file using EarthImager 3D:

1. Open EarthImager 3D and select **3D Command Creator** from the **Tools** menu.

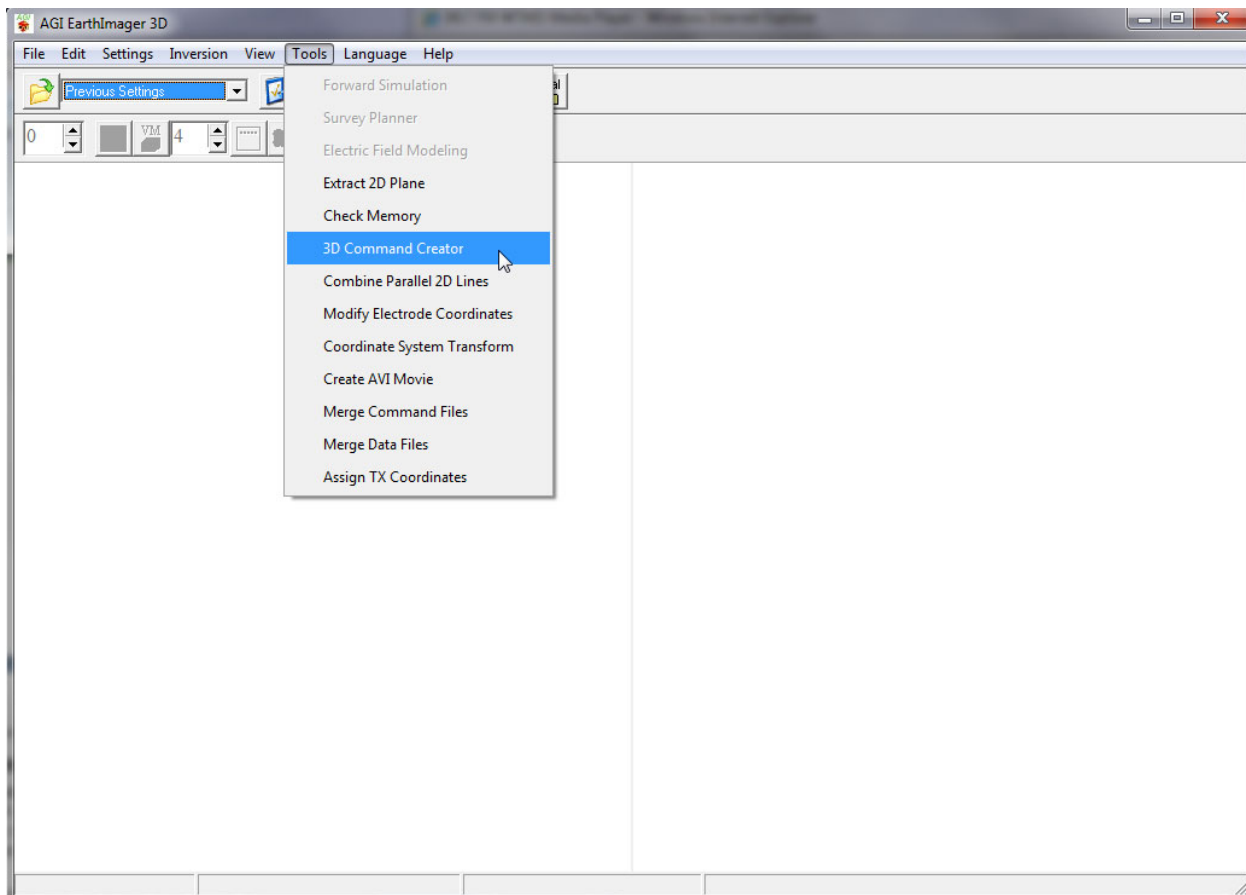


Figure 12: Opening 3D Command Creator in EarthImager 3D

2. On the **Surface** tab, enter values for the following fields:

- Total Number of Electrodes
- Number of Electrodes in X
- Number of Electrodes in Y
- Electrode Spacing in X
- Electrode Spacing in Y
- Cable Orientation

NOTE: The cable orientation for a roll-along survey must have an opposite number of even electrodes, and must be perpendicular to the roll-along direction (See Figure 19). You will get a warning if the electrodes are not equal.

3. Select **Meters** or **Feet** for the **Length Unit**.

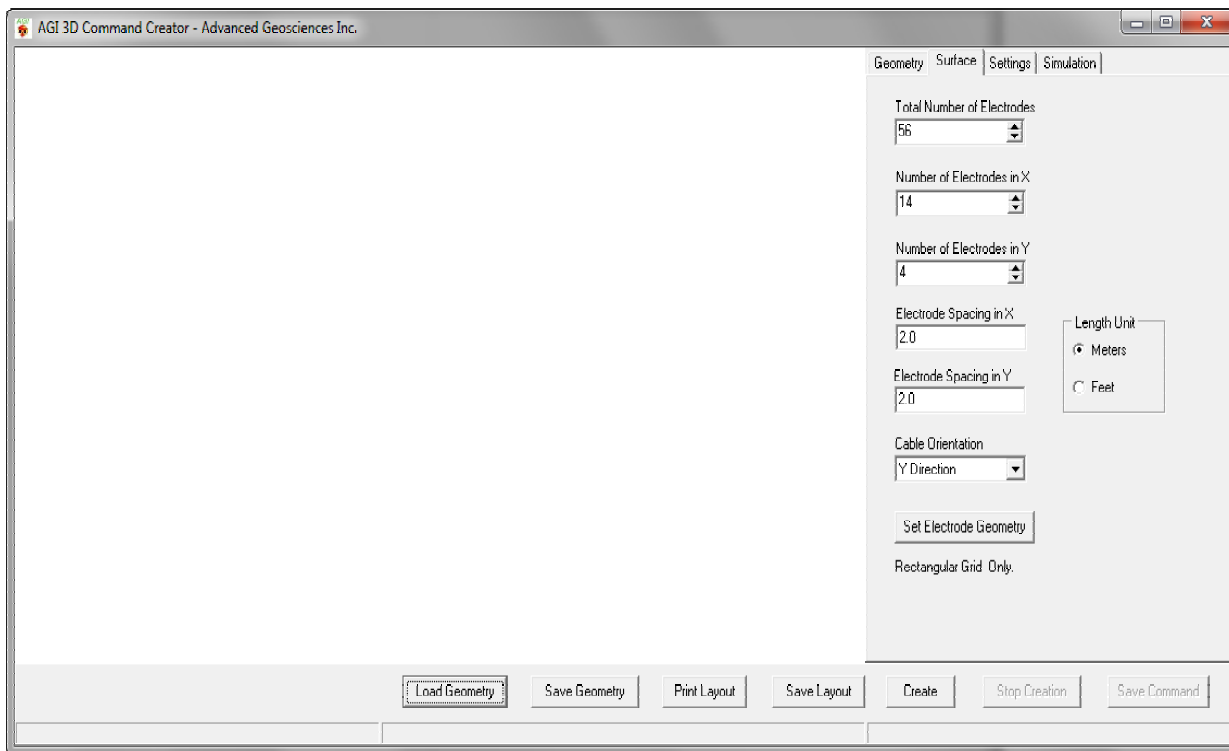


Figure 13: Command Creator in EarthImager 3D, surface screen

4. Click **Set Electrode Geometry**. A cable/electrode map with the set parameters appears in the geometry window. You can use the mouse wheel to enlarge or reduce the size of the geometry, or if you do not have a mouse wheel, you can right click and move the mouse up or down.

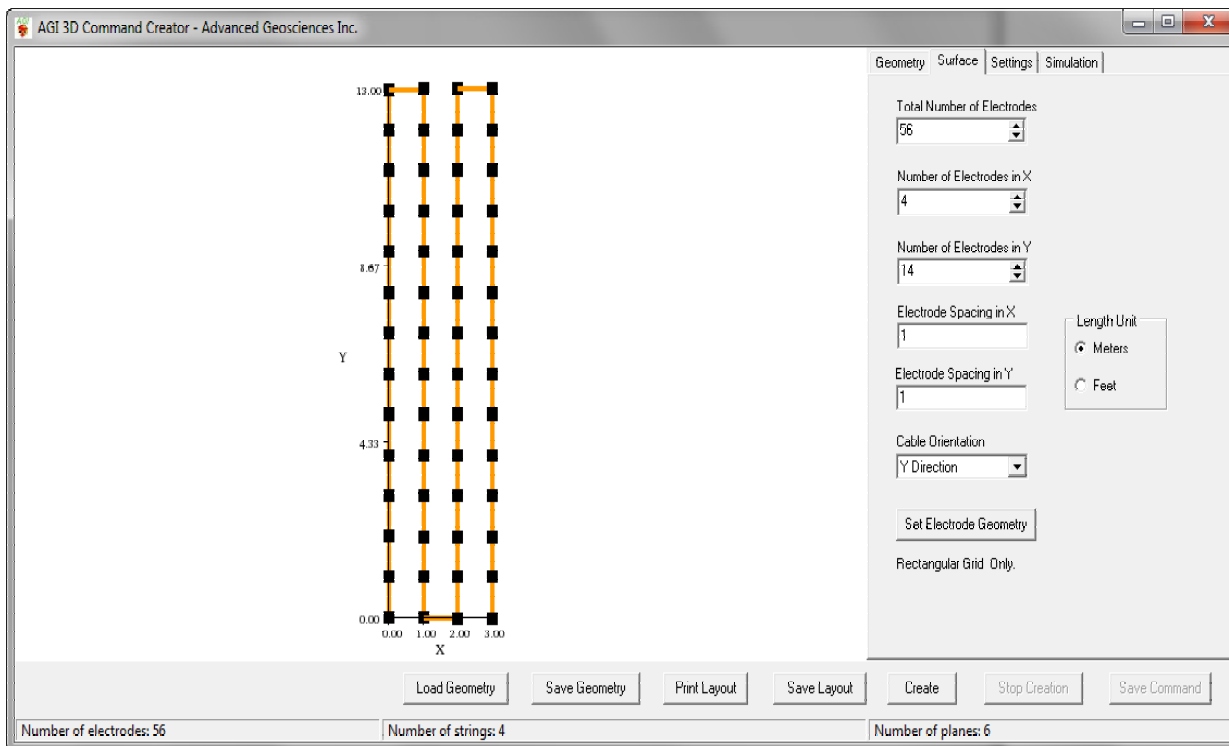


Figure 14: Command Creator in EarthImager 3D, Electrode Geometry on Surface screen

5. On the **Settings** screen, make selections for the following fields:

- Array Type
 - A-M (Pole-Pole) - This array is the same as the conventional pole-pole array, producing strong signals but a low model resolution. There is no bipole length involved in this array. The maximum number of measurements equals $N * (N - 1) / 2$ where N is the number of electrodes.
 - A-MN (Pole-Dipole) - This array is a compromise between the pole-pole array (good signal strength) and dipole-dipole array (high model resolution). The number of measurements depends on the signal strength, or average resistivity value of imaging volume. This pole-dipole array is an adapted version of the radial pole-dipole array from *Nyquist, J. and Roth, M., 2005, Improved 3D pole-dipole resistivity surveys using radial measurement pairs, Geophysical Research Letters, Vol 32, L21416.*
 - AB-MN (Dipole-Dipole) - The 3D data set collected with the dipole-dipole array often produces a large RMS error during the inversion. This 3D dipole-dipole array does not produce resolution as good as the 2D dipole-dipole array. Adequate data cannot be collected in this array in a conductive environment, so the data coverage suffers. To increase the number of measurements, either collect data at multiple Dipole-Lengths or lower the acceptable signal strength (increase the resistivity value).
 - AM-BN (Bipole-Bipole) - This array produces very strong signals due to a large AB separation, large MN separation, and small transmitter-receiver spacing. The Bipole-Bipole array is ideal for cross borehole tomography. Separating transmitting electrodes in two different boreholes would force the electric currents to penetrate the formation and reduce the current channeling effect. This array should not be used for surface data collection.
 - Gradient Array - This is a nonstandard gradient array, meaning the potential electrodes may be between two current electrodes AB or outside AB. This array generates a large number of measurements. Our gradient array has a roaming “A” electrode and a fixed “B” electrode at two ends of a diagonal line of the rectangular electrode grid. This array is not appropriate for cross borehole measurements
 - Radial Dipole-Dipole - This is a variant of the dipole-dipole array with all four A, B, M and N electrodes on a straight line in a 3D rectangular electrode grid, either on the same line or across four lines. This array is not appropriate for cross borehole data acquisition. Compared with the standard dipole-dipole array, this array should have fewer measurements but stronger signal and higher model resolution.
 - Mixed Dipole Gradient - This is a mixed radial dipole-dipole and radial gradient array. All four electrodes A, B, M and N are almost always on a straight line. This is our default and recommended 3D array.
- Dipole Length - Choose Dipole Length which corresponds to the A-spacing in the dipole-dipole array. Choose multiple A-spacings to get better data coverage at depth. This setting is applied to the dipole-dipole, radial dipole-dipole and mixed dipole-gradient arrays, but it is disabled for any other array.
- Instrument Type

- Max Number of Measurements – Helps removed measurements with small signals. Check the check box in front of this if you do not want over sampling.
 - Max Acquisition Time (hh:mm) – Check the check box in front of this if you do not want over sampling.
6. Select whether you want to include the following parameters in the command file:
- No cross-string data - Produces commands with all electrodes of each measurement on a straight line.
 - Reciprocals – Produces reciprocal commands (no forward commands) only.
 - Numerical Check – Verifies correct signal strength and spacing. Commands with incorrect readings will not be saved. A large electrode grid may take several hours.
7. If you are doing a Bipole-Bipole array, select pairs of strings. A **String Pairs** tab will appear between **Surface** and **Settings** if you have a command using electrodes on the same string. This **String Pairs** tab shows Pair ID, First String, and Second String addresses. All possible pairs are listed and selected by default. Un-check the box at the beginning of each pair list to unselect it. Unselecting some pairs is recommended, to avoid over sampling. Electrodes of selected pairs appear in different colors. The first string is red, the second string green.

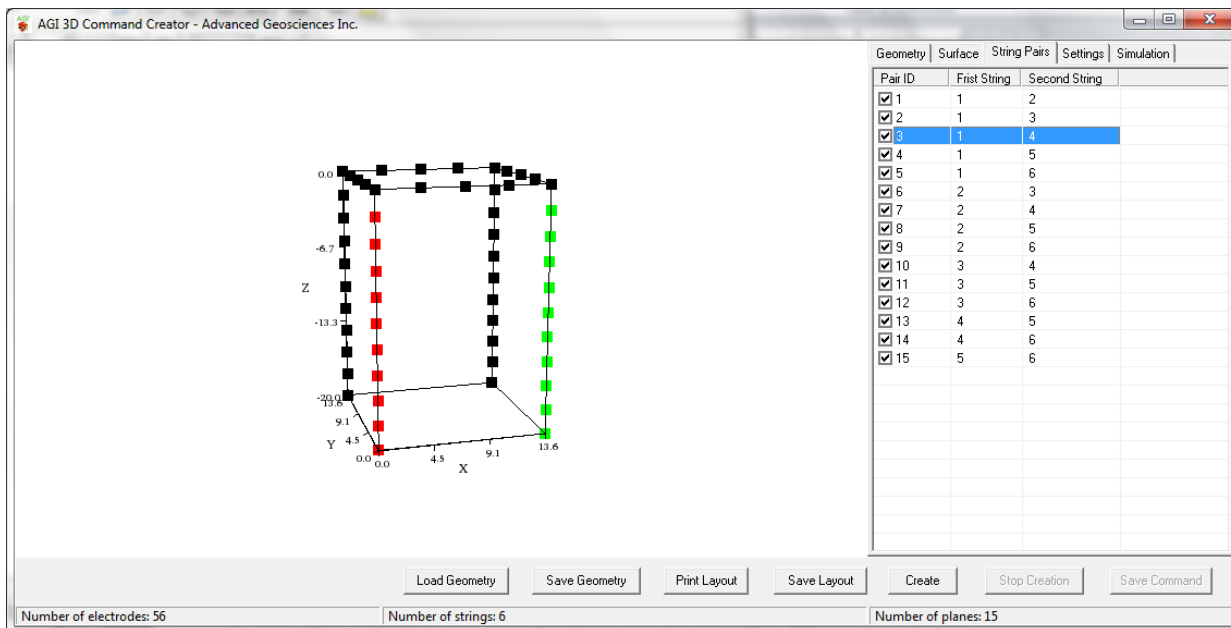


Figure 15: Command Creator in EarthImager 3D, String Pairs tab

8. Click **Create**.
9. Click **Save Command**, and when prompted, save (as a bitmap or .jpg file) to the desired location.

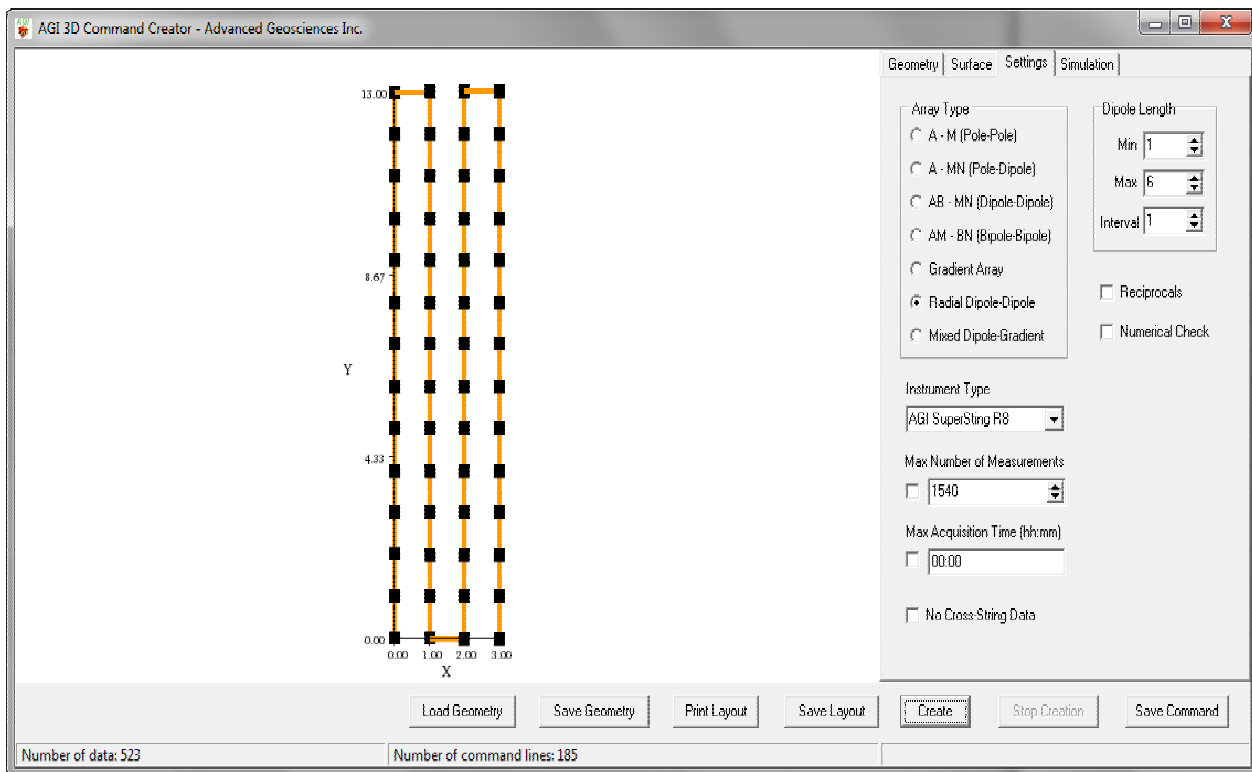


Figure 16: Command Creator in EarthImager 3D, settings screen

10. The **Simulation** tab estimates how much time is needed for the command. Make selections for the following fields:

- Electrode Symbol Size
- Time Interval(s)
- Manual Stepping – Choose the line from which you want to start, whether you want to move forward or backward, and click the **Step** button to manually frame through the simulation.
- Survey Time Estimate
 - Cycle Time
 - Number of Cycles
 - Survey Time
 - IP Survey
- Depth of Investigation – Estimation is based on simulation settings.

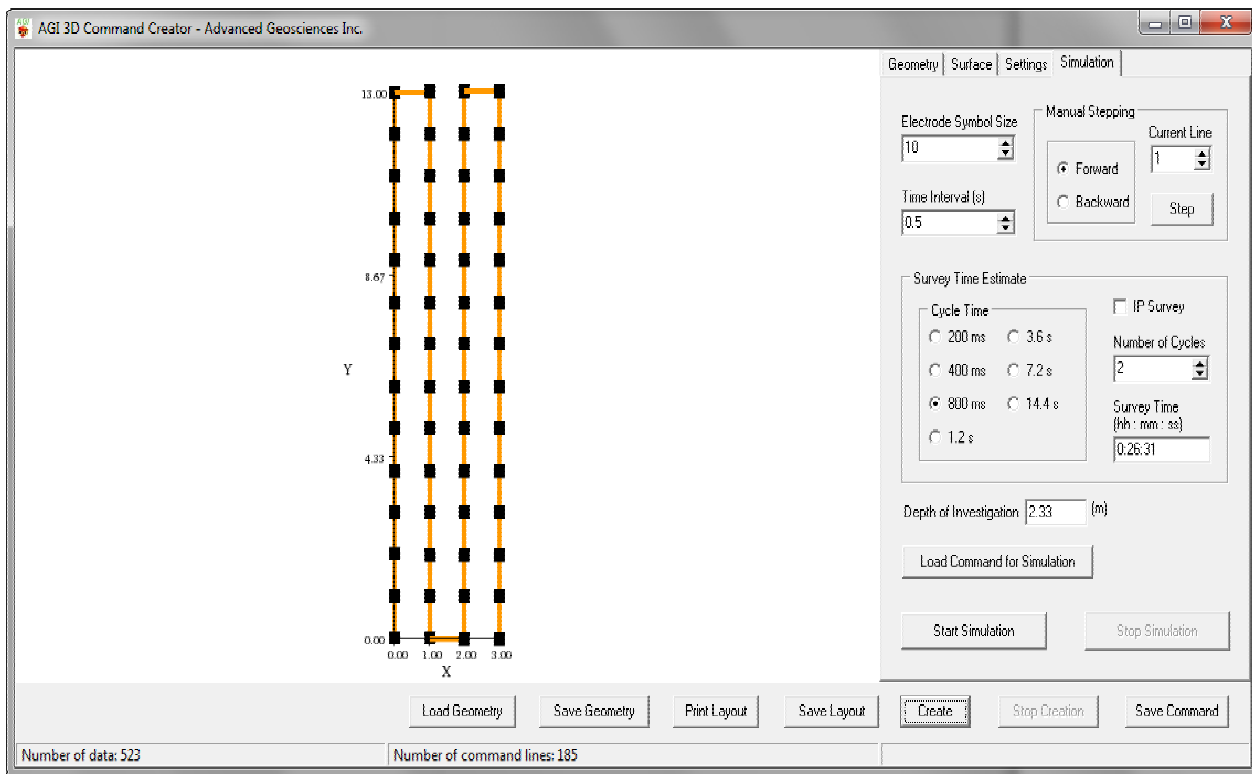


Figure 17: Command Creator simulation in EarthImager 3D

11. Click **Load Command for Simulation**.
12. Open the file you created from the **Settings** tab, or a command file created previously.
13. Click **Start Simulation**. Electrodes denoted by green (P1-P9 electrodes) and red (A, B electrodes) flow through the geometry. The command lines and electrode numbers show at the bottom of the window.

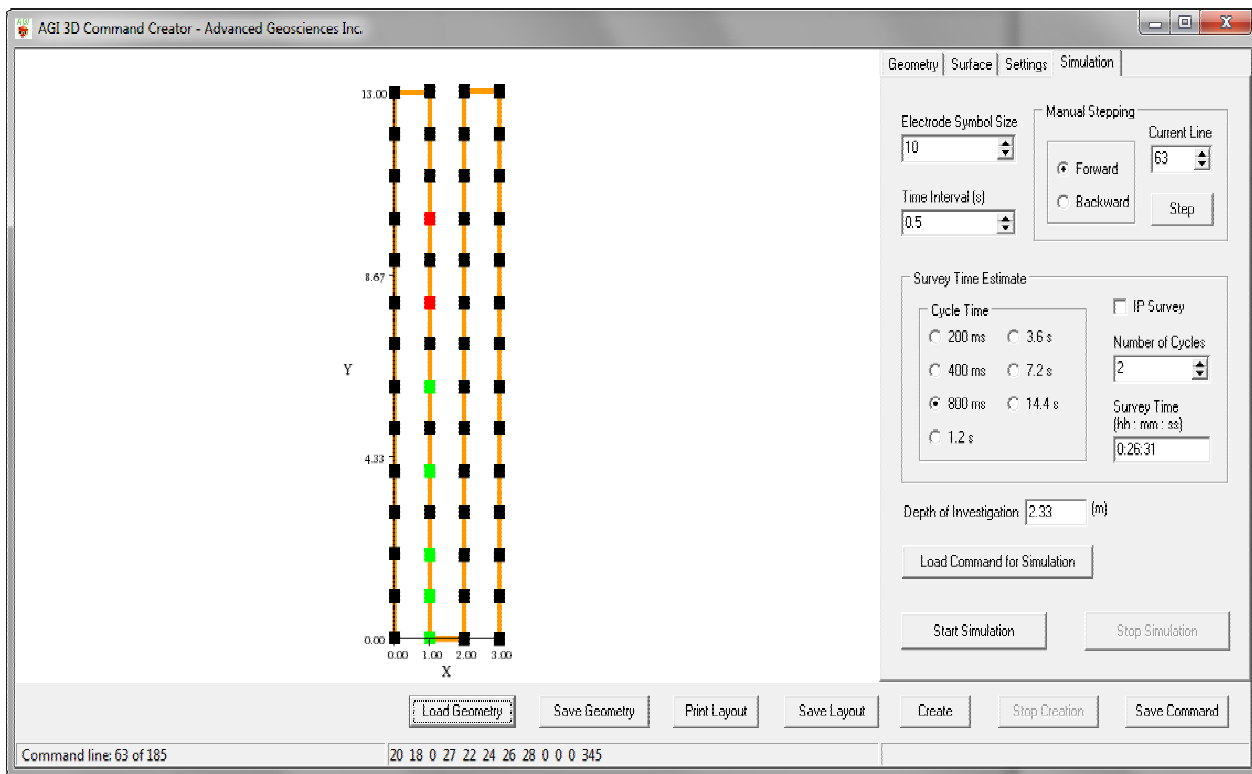


Figure 18: Command Creator running simulation in EarthImager 3D

14. Click **Stop Simulation** to make any additional changes, return to previous tabs, or exit.

The following options, at the bottom of the screen, can be clicked at any time.

- **Load Geometry**—Load a previously created geometry file, which lists the electrodes with their address, x, y, and z coordinates, and the string to which they belong.
- **Save Geometry**—Saves the geometry you have created for future use.
- **Print Layout**—Print the cable/electrode map. Before printing, click the geometry and use the mouse wheel to enlarge the graphic. You can also right click and move the mouse up to enlarge, or down to reduce, if you do not have a mouse wheel.
- **Save Layout**—Saves the cable/electrode map as a bitmap or .jpg file.

15. Field Deployment of the 3D Array – Important Details

- When deploying the 3D command files in the field, use the exact layout as shown in the 3D Command Creator window. It is a good idea to bring a print out or image file of the grid.
- Do not use Scaling Factor in the SuperSting Automatic Mode menu when running a 3D command file. This is only used for 2D command files to scale the electrode spacing in X. You must deploy the 3D grids exactly as planned with regards to the electrode coordinates. In the 3D command file.

- The display of electrode coordinates in the Earthlamger 3D Command Creator uses meters. If feet are chosen for input of spacing, the spacing units will be converted to equivalent meters in the geometry (.geo) file and command (.cmd) files.
- If you select feet in the SuperSting Automatic Mode menu, the data file (.stg) will save in equivalent meters.

5.1.5 Downloading Command Files to the SuperSting

NOTE: An alternate, easier way to create and transfer command files is to use the SuperSting Manager App on an Android tablet. See **Upload Command Files** menu on page 67.

1. Connect the “Cable for communication *SuperSting*/PC MS Windows type computer” (part # 951002) to the serial port on the computer, and the other end to the SuperSting connector labeled PC COM.
- If the computer used does not have a serial port, connect the USB-Serial adapter -- Keyspan USA-19HS (part # 951063) in series with the cable and attach it to a USB port on the computer. The Keyspan USA-19HS was originally delivered with your SuperSting.
2. Turn the instrument on.
3. Press any key to get to the main menu. You must be in the main menu or the first level submenu when connecting to the computer.
4. Start the Administrator for SuperSting software.
5. Click the **SuperSting control center** button.



Figure 19: SuperSting control center button

6. Select the appropriate com port, found under the **Config** option on the menu bar.
7. Click the **Connect** button. The red square between the Connect and Disconnect buttons changes to green when the connection is established. Available command files and data files in the SuperSting will also be listed in the respective windows on the computer screen.
8. Under **Command files** on the Administrator menu bar, click **Send new command**.
9. Select the command file to send. The selected command file is transferred to the SuperSting RAM memory. After a short moment, the file is displayed in the **Administrators Command files** window, indicating that the file now resides in the SuperSting.
10. Click the **Disconnect** button to disconnect the SuperSting from the Administrator.

A padlock at the command file on the Administrator screen indicates that this file is used by one or more data files still residing in the SuperSting memory. Since this command file is used when any of these data files are downloaded, it is locked to prevent premature erasing. When all the corresponding data files have been downloaded and erased from the SuperSting memory, the padlock disappears and it is possible to erase the command file.

To erase command files from the SuperSting memory, right click the command file in the **Administrator** window, and then click **Erase Command**.

5.2 Field Preparation Prior to Data Recording

It is important to make sure conditions are safe and well-prepared for measurements. To prepare the area in which you will be taking measurements:

1. Stretch a tape measure along the profile line. You may need to clear a line that is wide enough to allow an adult to walk through without being forced to turn sideways.
2. Place the stainless steel electrode stakes (part # 920035) in the ground at the predetermined spacing (for example, 1m, 6m, or 10m). Pound the electrode stakes into the ground approximately 4-8 inches. Make sure the electrode stakes are planted firmly in the ground, if possible. If you are collecting data over a concrete slab (reinforced or not), asphalt pavement, or rock outcrop, please contact AGI for additional recommendations for electrode placement and preparation.
3. Lay out the active (dual-mode) or passive multi-electrode cable. Drop one switch (or take-out for passive cables) at each stake. Note that the switches (or take-outs) are numbered. The switch number is marked on the cable beside each electrode switch.



Figure 19: Attach the electrode switch to the stake by using the stainless steel spring

△ IMPORTANT If several cables are used, it is important to lay out the cables in the correct order so that the switches (take-outs for passive cables) are numbered consecutively (1, 2, 3.....27, 28, etc.).

4. Using the stainless steel springs, fasten each switch or take-out to its electrode, making sure that there is metallic connection between the switch and the electrode stake. The springs are strong and may cause hand injuries if not connected properly. See **Connecting the multi-electrode cable to the electrode stakes** on page 139.
5. Place the Electrode High Voltage Warning Covers (part # 920077) over the electrode switch and secure with the Velcro straps (if available).

5.2.1 About the Battery

Use a 12 V battery, preferably of the “deep cycle marine” type. If a deep cycle marine battery is not available, a 12 V automobile battery may be used.

The difference between the two types of batteries is that a deep cycle marine battery is designed to be discharged and charged many times without damaging the battery. An automobile battery is designed to be fully charged most of the time by the automobile’s

generator. An automobile battery will lose capacity gradually for each complete discharge-charge cycle, eventually becoming unusable.

NOTE: Using a 12 V automobile battery installed in a vehicle as an instrument power source will void the warranty.

Using an automobile battery installed in a vehicle may damage the instrument beyond repair. Therefore, when using a 12 V battery as external instrument power source, it must be disconnected from the vehicle and placed on some insulating material like dry wood or plastic on the ground.

5.2.2 Connecting the Instrument

The SuperSting is powered by either one or two 12 V DC external batteries attached to the connector marked “Power.” Note that the high-power transmitter mode is only achieved if two external 12 V batteries are used.

After you have prepared the electrodes in the field, prepare the SuperSting for measurements:

1. Make sure that the electrode line is clear and under observation so that no humans or animals can come into contact with the electrodes.
 2. Turn the SuperSting on.
 3. Attach the electrode cable end connectors to the SuperSting (to the switch box, or to the SuperSting, if using active cables), where marked with “Electrode Cable.”
- When using the dual-mode system with the SuperSting, the instrument can be connected at either end of the cable lay-out; however, it is best to connect the instrument in the middle. By connecting in the middle, the effect of voltage drop in the cables is minimized. When using the SuperSting with switch box and passive system, always place the instrument with switch box in the middle of the electrode spread, except for passive systems with 28 electrodes, in which case the instrument is connected in either end of the electrode cable.

5.2.3 Setting up the Instrument for Use With Swift Dual-Mode Electrodes

In the following scenario, we assume that an appropriate command file has been created and loaded into the SuperSting RAM memory. For information on how to load a command file into the SuperSting, see **Loading a Command File Into the SuperSting RAM Memory** on page 107. We also assume that an accurate cable section table has been entered in menu 6/2. See **Cable Addresses Set up** on page 96. This is important if a roll-along survey is performed.

To set up the instrument:

1. Select **1** from the main menu to prepare for an automatic survey.
2. On Menu 1, select **2: Create data file**.

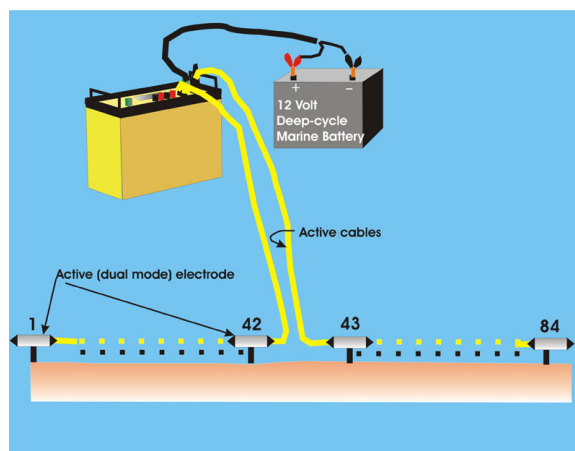


Figure 19: SuperSting set-up with active (dual-mode) electrodes

3. Press **1** to enter a name for the new file, maximum 8 characters. To enter letters, select the first, second or third letter on the key by first pressing **F1**, **F2** or **F3**. For example, to enter the word STING, press **F1 1**, **F2 1**, **F3 9**, **F2 5**, **F1 9**. Press **Enter** after the file name is spelled.
4. Select the appropriate command file for the survey. Use + or – to scroll up and down in the list of command files.
5. Select the unit used, pressing + or – to select feet or meters.
6. Enter Electrode spacing (Scaling factor).
NOTE: If you have created the command file with electrode spacing=1 (default setting if you created the command file using the Administrator software), enter the electrode spacing you are actually using.
7. Enter x-, y- and z-coordinates for the first electrode of the line.
NOTE: The z-coordinate is always 0 unless it is placed underground. Exception is for electrodes placed on the bottom of a lake, where the z-coordinate is also entered as 0. Terrain elevation and water depth is entered in a separate file during the data processing stage.
8. Enter Start command line=1. This simply means that the SuperSting will start at the first command line in the command file. If you would like to start at a point other than line 1 in the command file, you can enter that line number here.
9. Enter **Y**(es) or **N**(o) for Roll-along, using + for Yes and – for No. Roll-along is the survey technique in which you advance forward along the measurement profile by moving your electrode cable sections and its electrodes forward in a leap-frog way. This method is used when the survey line is longer than the electrode cable. When roll-along is selected, you move the cable sections as specified on menu 6/2.
NOTE: All data will end up in one continuous data file when performing roll-along surveys.
10. Sometimes a line ends up against an obstacle, like a building or a fence, etc. so that the last electrodes on the cable cannot be used. If this is the case, enter the last electrode to be used at End address=.
NOTE: If you enter erroneous x-, y-, z-coordinates, Start command line, Roll-along or End address, you can correct them later on **menu 1, option 3: Edit survey information** before you start the actual measurement.
11. Press **ENTR** to continue.
12. If pole-pole or pole-dipole array is used, enter the position of the infinite electrode at this point. If any other array, continue the setup. Again the z-coordinate is entered as 0 in all cases except when it is underground.
13. Press **ENTR** to continue setup or press **MEN** to exit setup. The following setup is most likely from one survey line to another. Therefore, if this is the second line, the following setup has already been entered and you can then exit by pressing the **MEN** key. If this is the first line, press **ENTR** to continue setup.
14. Select **2: Distributed** if you are using dual-mode electrodes (smart electrodes).
15. Choose which dual-mode cables you are using. You can use R1 dual-mode electrode cables with the SuperSting R8/IP (for single-channel recording only), but you cannot use R8 dual-mode electrode cables with the SuperSting R1/IP.
16. Enter the electrode cable sections used. For example, if you have a cable of 28 electrodes, divided into four sections with 7 electrodes each, you should enter sections 1-7, 8-14, 15-

- 21, and 22-28. This cable address table is then used by the instrument to perform roll-along. When finished, press the **MEN** key.
17. Select the measurement settings. For a good setting under most conditions, select the factory default setting by pressing the **9** key until the word FACTORY appears. Then press the **MEN** key.
 18. The contact resistance test menu appears. Enter the Start and End address of the first and last electrode to be tested.
 19. Start the test by pressing the **F1** key.
 20. The instrument is ready to start measuring. After checking again that the line is clear, press the **MEA** key to start the actual measurement.
 21. If the roll-along mode is selected, the instrument will stop when ready and display the message "ENTR to continue roll-along." When you press the **ENTR** key, the message "Shutting off power to move instrument and cables" momentarily appears, before the instrument powers down.
 22. Move the appropriate electrode section and turn on the instrument when done. Press the **1** key for Automatic mode measurement and then press the **MEA** key. The instrument displays "ENTR to continue roll-along." Press **ENTR** to confirm that you still want to continue roll-along, or press **MEN** to end the survey.
 23. The new Start coordinate for the first electrode, which is the first in line after removing the roll-along section, appears if you press **ENTR**. If this is the correct coordinate, press **ENTR**. **IMPORTANT:** The instrument re-numbers the coordinates when a section is removed. Do not change it back to the previous coordinate displayed.
 24. Enter the address of the last electrode to be used if your line ends up against an obstacle and all electrodes cannot be used. After you enter the last coordinate, the SuperSting automatically starts measuring.

5.2.4 Setting up the Instrument for Use With Switch Box and Passive Cables

When using a passive system, the instrument should always be placed in the middle of the electrode spread, with the exception of the 28 electrode passive system. When using a 28 electrode passive system, the instrument should be connected at either end of the electrode spread.

To set up the instrument:

1. Select **1: Automatic Mode** from the main menu to prepare for an automatic survey.
2. On Menu 1, select **2: Create data file**.
3. Enter a name for the new file, maximum 8 characters. To enter letters, select the first, second or third letter on the key by first pressing **F1**, **F2** or **F3**. For example, to enter the word STING, press **F1 1**, **F2 1**, **F3 9**, **F2 5**, **F1 9**. Press **Enter** after the file name is spelled out.
4. Select the appropriate command file for the

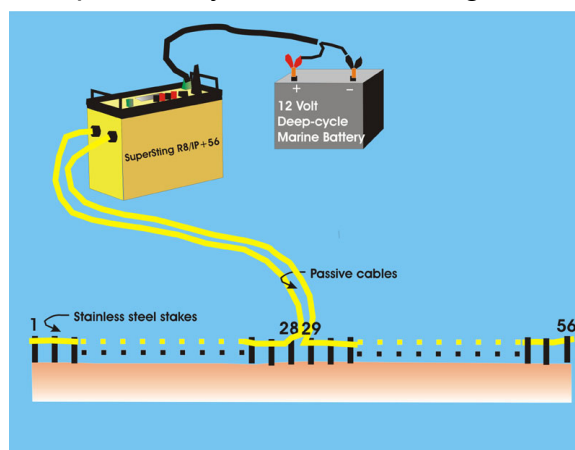


Figure 19: SuperSting set-up with built-in switch box and passive cables

- survey. Use + or – to scroll up and down in the list of command files and press **ENTR** to select the command file.
5. Select the unit used, pressing + or – keys to select feet or meters.
 6. Enter Electrode spacing (Scaling factor).
NOTE: If you have created the command file with electrode spacing=1 (default setting if you created the command file using the Administrator or the EarthImager software), enter the electrode spacing you are actually using.
 7. Enter x-, y- and z-coordinates for the first electrode of the line.
NOTE: The z-coordinate is always 0 unless it is placed underground. Exception is for electrodes placed on the bottom of a lake, where the z-coordinate is also entered as 0. Terrain elevation and water depth is entered in a separate file during the data processing stage.
 8. Enter Start command line=1. This simply means that the SuperSting starts at the first command line in the command file. If you would like to start at a point other than line 1 in the command file, you can enter that line number here. The number after the /xxx indicates the total number of command lines in the selected command file.
 9. Enter **Y**(es) or **N**(o) for Roll-along, using + for Yes and – for No.
 Roll-along is the survey technique in which you advance forward along the measurement profile by moving your electrode cable sections in a leap-frog way. This method is used when the survey line is longer than the electrode cable. When roll-along is selected, you move the cable sections as specified on menu 6/2.
NOTE: All data will end up in one continuous data file when performing roll-along surveys.
 10. Sometimes a line ends up against an obstacle, like a building or a fence, etc. making the last electrodes unusable. If this is the case, enter the last electrode to be used at End address=. The SuperSting will not use the electrodes past this address number and the electrodes can safely be put aside.
NOTE: If you enter erroneous x-, y-, z-coordinates, Start command line, Roll-along or End address, you can correct them later on **menu 1, option 3: Edit survey information** before you start the actual measurement.
 11. If pole-pole or pole-dipole array is used, enter the position of the infinite electrode at this point. If any other array, continue the setup. Again the z-coordinate is entered as 0 in all cases except when it is underground.
 12. Press **ENTR** to continue setup or press **MEN** to exit setup. The following setup is most likely the same from one survey line to another. Therefore, if this is the second line, the following setup has already been set and you can then exit by pressing the **MEN** key. If this is the first line press **ENTR** to continue setup.
 13. Select **1: Switch box** if you are using switch box/boxes or built-in switches.
 14. If you are using a SuperSting R8/IP, choose which cables/switch boxes you are using. You can use R1 switch boxes and R1 dual-mode electrodes with the SuperSting R8/IP, but you cannot use R8 switch boxes and R8 dual-mode electrodes with the SuperSting R1/IP.
 15. If you are using one or more switch boxes, enter the type of switch box/boxes you are using. Press **1** to add a switch box and use + or – keys to scroll among the different switch boxes. When done, press **MEN** to continue.
 16. Enter the electrode cable sections used. For example, if you have a cable of 56 electrodes, divided into four sections with 14 electrodes each, enter sections 1-14, 15-28,

- 29-42 and 43-56. This cable address table is then used by the instrument to perform roll-along. When finished, press the **MEN** key.
17. Select measurement settings. For a good setting under most conditions, select the factory default setting by pressing the **9** key until the word FACTORY appears. Then press the **MEN** key.
 18. The contact resistance test menu appears. Enter the Start and End address of the first and last electrode to be tested.
 19. Press the **F1** key to start the test.
 20. Press the **MEN** key when the contact resistance test is satisfactorily finished.
 21. The instrument is ready to start measuring. After checking again that the line is clear, press the **MEA** key to start the actual measurement.

5.3 Roll-Along Survey

At times, the survey line is longer than the available electrode spread (number of electrodes less one, times the electrode spacing). If the electrode cable is divided into sections and each section has connectors in each end, the surveyed line, after the original data has been recorded, can be extended by moving the first electrode cable section and electrodes to the end of the cable. Data for each “roll” is then recorded and added to the previous data into one complete data file. This type of survey is called “roll-along survey.” Using this technique can extend a survey line indefinitely.

Roll-along surveys can be performed using both passive and active electrode systems and can also be performed both in 2D and 3D surveys.

NOTE: When using active cables (dual-mode electrodes), the instrument can be placed at any location along the line, though placing it near the middle of the line is best. When placed in the middle, the signal, which decreases with distance from the instrument, will have shortest possible distance to either end electrode.

When using the passive electrode system with switch box or built-in switches, it is absolutely necessary to place the instrument in the middle of the electrode spread. This ensures an equal number of electrodes on each side of the instrument. The exception to this rule is when using a switch box for 28 electrodes: the instrument must be connected to one of the ends of the electrode cable.

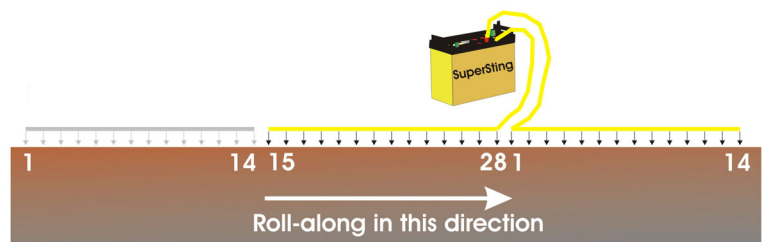


Figure 19: Data is first collected using cable section 1-14 and 15-28 to the left in the picture. After the initial data is recorded, cable section 1-14 is moved to the right and connected to the SuperSting, which also has been moved forward.

5.4 Roll-Along in 2D Surveys

The order and number of electrodes to move during a roll-along survey is specified in the “Cable Addresses Setup” table on menu 6/2 in the SuperSting.

1. If the roll-along mode is selected during setup prior to the survey, the instrument will stop when ready and display the message “ENTR to continue roll-along.” When you

press the **ENTR** key, the message: “Shutting off power to move instrument and cables” momentarily appears, before the instrument powers down.

2. Move the appropriate electrode section and turn on the instrument when done. Press the **1** key for Automatic mode measurement, and then press the **MEA** key. The instrument displays “ENTR to continue roll-along.” Press **ENTR** to confirm that you still want to continue roll-along, or press **MEN** to end the survey.
3. The new Start coordinate (physical location) of the first electrode, which is the first in line after removing the previous section, appears if you press **ENTR**. If this is the correct location, press **ENTR**.
IMPORTANT: The instrument automatically renumbers the coordinates after moving a section. Do not change it back to the previous coordinate displayed.
4. Enter the address (electrode number) of the last electrode to be used, in case your line ends up against an obstacle and all electrodes cannot be used. After you enter the last coordinate, the SuperSting automatically starts measuring.

5.5 Roll-Along Using Two Switch Boxes

When using passive cables, it is possible to perform a roll-along survey with two switch boxes, **as long as both switch boxes are entered into the SuperSting**. If you are using two 28-electrode switch boxes, see **Roll-Along Using Two 28-Electrode Switch boxes** on page 51. The 28-electrode switch box has one connector for the multi-electrode cable; all others have two, making the 28-electrode switch box roll-along procedure different.

Using two switch boxes other than the 28-electrode size, the typical start layout for 112 electrodes would be:

1---28 → **SB56A** ← 29---56 57---84 → **SB56B** ← 85---112

IMPORTANT	There is no connecting cable between electrodes 56 and 57. <u>Do not attempt to connect electrode 56 to electrodes 57, since it will cause all data from electrodes 29 to 84 to corrupt.</u>
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The SuperSting can be placed by either switch box (SB56A or SB56B) and is connected to the other switch box by a long extension cable.

The two switch boxes must be programmed with different address numbers, so that SB56A is programmed with addresses 1-56 and SB56B is programmed with addresses 57-112. It is important to program two separate switch boxes. See **Re-Programming Switch Box Electrode Addresses** on page 113 for instructions on how to program the addresses in a switch box.

IMPORTANT

Keeping track of the cable connections before performing the roll-along survey prevents erroneous data. An error connecting the cables to the low and high side of the switch box could result in unreadable, unrecoverable data. AGI recommends making a diagram of cable positions for each roll. Cover the factory labels with white electrical tape and use a marker to label the address numbers (57-112 in the example above).

In the layout example above, there is no electrical difference between cable sections 1-28 and 57-84, or between cable sections 29-56 and 85-112, making them interchangeable. However, cable section 1-28 is different from cable section 29-56, for example, so they are not interchangeable.

The multi-electrode cables have the electrode address marked by each electrode take-out. Depending on how the cables originally were ordered, the address numbers may vary. If the switch box SB56B in the example above originally was purchased as a 56-electrode system, the cable sections 57-84 and 85-112 above might be marked with addresses 1-28 and 29-56.

IMPORTANT

If you are programming two switch boxes, you must enter them separately. Entering the total number of switches will result in error. For example, if you are using two 56-electrode switch boxes, do not enter one 112-electrode switch box.

When rolling-along with a two-electrode switch box system, the switch boxes stay in the same position relative to each other, and the cable sections leap frog each other forward like a normal roll-along. For example, let's say we are using a SuperSting with two 56-electrode switch boxes. We are rolling 28 electrodes at a time. The initial setup will look like this:

1---28 → **SB56A** ← 29---56 57---84 → **SB56B** ← 85---112

Then for the first roll, electrode cable 1-28 moves to the far high end. The switch box SB56A moves and is connected to the high number end of the 29-56 cable section, and to the low end of the 57-84 cable section.

Switch box SB56B is connected to the high end of cable section 85-112, and to the low end of cable section 1-28. The new layout now looks like this:

29---56 → **SB56A** ← 57---84 85---112 → **SB56B** ← 1---28

For the next roll forward, the cable section 29-56 moves to the far end and the two cable boxes move one cable section forward so the layout now looks like this:

57---84 → **SB56A** ← 85---112 1---28 → **SB56B** ← 29-56

This pattern continues for the remainder of the survey.

5.5.1 Roll-Along Using Two 28-Electrode Switch boxes

When using two 28-electrode switch boxes, you can roll 14 or 28 electrodes at a time. Settings are different when creating a data file, depending on which measurement you choose. When rolling 50% of the line, the switch boxes leap frog, in Distributed mode; when rolling 25% or less of the line, switch boxes stay in the same position to each other, in Switch Box mode.

5.5.1.1 Rolling 14 electrodes at a time

When creating a data file, make the following selections when prompted during setup (see **Setting up the Instrument for Use With Switch Box and Passive Cables** on page 46):

1. Select **1:Switch Box**.
2. For the type of switch boxes or cable, enter two 28-electrode switch boxes.
3. When setting up the address table (cable sections used), enter four sections with 14 electrodes in each section.

When rolling the cables using these settings, the switch boxes stay in the same position. They do not need to be renumbered due to leap frogging. The initial layout looks like this:

1-14+15-28 → **SB1** + **SB2** ← 29-42+ 43-56

After the first roll of 14 electrodes, the layout looks like this:

15-28+29-42 → **SB1** + **SB2** ← 43-56+1-14

Switch box 1 is always connected to the lowest 28 electrodes in the line.

5.5.1.2 Rolling with 28 electrodes at a time

When creating a data file, make the following selections when prompted during the setup (see **Setting up the Instrument for Use With Swift Dual-Mode Electrodes** on page 44):

1. Select **2: Distributed**.
2. When setting up the address table (cable sections used), enter two sections with 28 electrodes in each section.

When rolling the cables using these settings, the switch boxes leap frog each other. The initial layout looks like this:

1-14+15-28 → **SB1** + **SB2** ← 29-42+ 43-56

After the first roll of 28 electrodes, the layout looks like this:

29-42+ 43-56 → **SB2** + **SB1** ← 1-14+15-28

Switch box 1 leap frogged and stays with cables 1-28.

5.6 Roll-Along in 3D Surveys

Roll-along surveys performed in 3D surveys must be performed in the X-direction, and the cable needs to be laid out back and forth in the Y-direction (see **Error! Reference source not found.**).

NOTE: The cable must be laid out so the connectors allow roll-along with an even number of “electrode columns” at a time (2, 4 etc.).

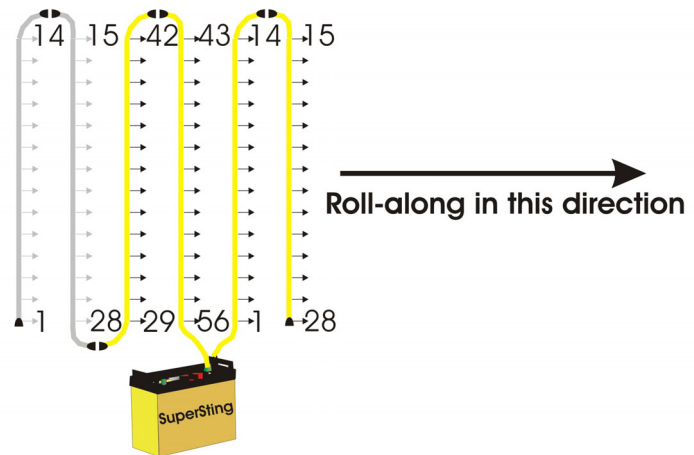


Figure 19: Data is first collected using cable section 1-28 and 29-56 in the left of the picture. After the initial data is recorded, cable section 1-28 is moved to the right and connected to the SuperSting, which also has been moved forward.

5.6.1 Downloading Data

When the survey is complete, you can safely turn off the instrument and disconnect the external battery to transport it to a place where you can download the data.

To download the data:

11. Connect the SuperSting to a Windows type computer using the “Cable for communication *SuperSting*/PC MS Windows type computer” (part # 951002).
12. Connect the cable to the serial port on the computer, and the other end to the SuperSting connector, labeled PC COM.

IMPORTANT

If your computer only has USB ports, you will need a USB/serial adapter. We recommend the use of the Keyspan model USA-19HS (part # 951063). This adapter is available from AGI and was originally delivered with your SuperSting instrument.

13. Turn the instrument on.
14. Press any key to get to the main menu. You must be in the main menu or the first level submenu when connecting to the computer.
15. Start the Administrator for SuperSting software.
16. Under **Window** on the computer menu bar, select the **SuperSting control center**.
17. Under **Config** on the computer menu bar, select the appropriate **COM port**.
18. Click the **Connect** button. The green light between the Connect and Disconnect buttons indicates that the connection is established. Available command files and data files in the SuperSting are also listed in the respective windows on the computer screen.

19. In the **Data files** window, select the data file to download by right clicking on the file name. Click **Read File** and select where to save the file.
20. When the transfer is finished, the text “Selected measure file read from instrument. File set saved as:” appears. Click **OK**.
21. Click the **Disconnect** button to disconnect the SuperSting from the Administrator.

5.7 Manual Mode for Resistivity and IP Surveying

The manual mode is used for recording data using four wire reels and four electrode stakes. The stakes are moved for each measurement.

You must be connected to a battery when you perform measurements.

The office power supply is not powerful enough to power the SuperSting transmitter, and will not support measurements.

To perform a survey in manual mode:

1. Connect the ABMN adapter (part # 953015) to one of the front panel connectors marked **Electrode cable** (older SuperSting models have A, B, M, and N terminal posts on the front panel, and do not need the ABMN adapter). Connect four ground electrode stakes to the current (A and B) and potential (M and N) terminals on the ABMN adapter.
2. With a 12 V battery connected, turn the instrument on by flipping the ON/OFF (I/O) switch to the **ON (I)** position. The main menu displays after a few seconds. Before you start measuring, you need to set a few parameters, which will stay the same for the whole survey.
3. Press the **6** key for “System settings” and then the **1** key for measurement settings.
4. Press the **F2** key until FACTORY is displayed. All factory defaults are now set. Make any desired changes to the factory defaults.
5. After you have made your changes, press the **F3** key to save your own default settings.
6. When finished, press the **MENU** key twice to get back to the “Main menu.”
7. Press the **2** key to get to the “Manual mode” menu. From the supported configurations, select the array type (electrode configuration) you are going to use. The chosen configuration remains in effect until changed.
8. Press the **2** key to create a data file in which to store the data.
9. Press the **1** key to enter the file name. Letters or numbers can be used for the file name, maximum 8 characters.

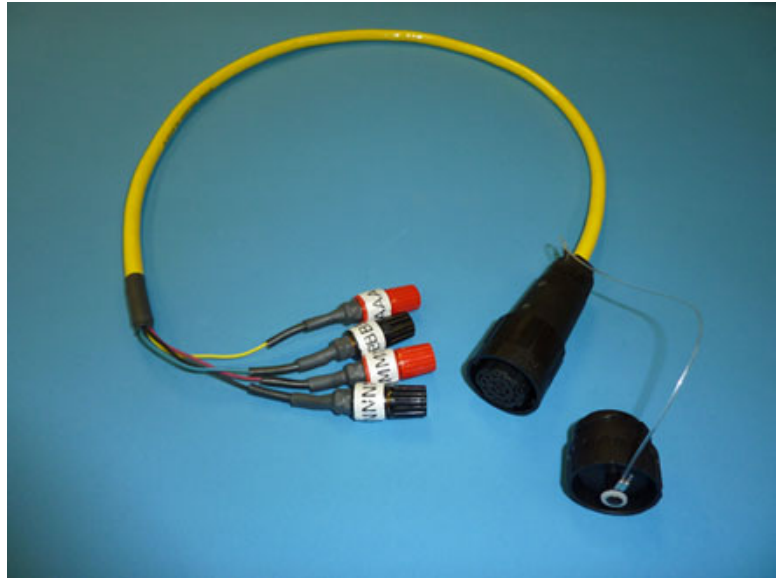


Figure 19: ABMN cable adapter.

IMPORTANT

You cannot change electrode configuration for the same data file. For example, if your data file is named Sound1, you cannot store both Schlumberger and Wenner soundings in the Sound1 data file--only one of them.

10. Enter the appropriate electrode geometry.
11. Make sure the line is clear and no one is touching the stakes before measuring.
12. Press the **MEA** key to take the reading. The measurement result is displayed on the LCD screen.
13. Measured data is automatically stored in the memory and can later be downloaded to a computer using the download module of the Administrator software. If the displayed error σ is too large, you may want to repeat the measurement or increase the output current (go to menu 6/1 to change the current) and measure again.
14. When the measurement is ready, move the stakes to a new location, enter the new geometry, check that the line is clear, and press **MEA** again.

5.8 Performing an Automatic SP Survey

To perform an automatic SP survey, you will need the following components:

- SP adapter box and grounding cable (included with the SuperSting R8)
- SuperSting R8 with firmware version 1.x3.51 or later
- Dual-mode electrodes or switch box and passive cables

IMPORTANT

Use non-polarizable electrodes (part # 920023 or 920099) when performing an SP survey.

To perform an SP survey:

1. The SP survey is only designed for single-channel measurements, so any SuperSting R1 command file will work. You will most likely edit an automatically created command file, depending on the SP measurements you are taking. The SuperSting can do two types of SP measurements, each recording only one channel at a time:
 - Gradient SP measurements: Measure between two electrodes, moving them forward along the line while keeping their distance equal.
 - SP measurements with a fixed reference: Keep one electrode in the same place, while the other moves along the line and takes measurements. These readings show the difference in potential field and the roving electrode.Keep in mind that the command file header contains information to specify which array is being used. See **Command File Examples** on page 56 for command file examples for both array types.
2. Set up the equipment for a field survey. See **Field Preparation Prior to Data Recording** on page 43 for details.



Figure 20: SP survey components

3. Add the SP adapter box to the system:

- a. The SP adapter box (part # 955002) has one 17-pin R8 connector on each side (two total). Using a 2-meter SuperSting R8 jumper cable (part # 933040S), connect the SP adapter box to the SuperSting electrode cable connector.
- b. Using another 2-meter SuperSting R8 jumper cable, connect the SP adapter box (using the “ELECTRODE CABLE” connector) to one of the two plastic switch box connectors, marked “Connect to SuperSting and additional switch box.”

NOTE: The cables have different connectors on each end. Use the appropriate end of the cable for the connection type on the instrument.

- c. Using a grounding cable (included with the SuperSting R8), connect the SP adapter box to the SuperSting firmware connector:
 - i. Connect the banana plug end of the SP grounding cable to the black “reference” post on the front of the SP adapter box.
 - ii. Connect the 6-pin connector of the SP grounding cable to the 6-pin connector used for firmware updates on the SuperSting (the connector is labeled either EXT TX COM FIRMWARE or POWERSTING COM, depending on the SuperSting model).

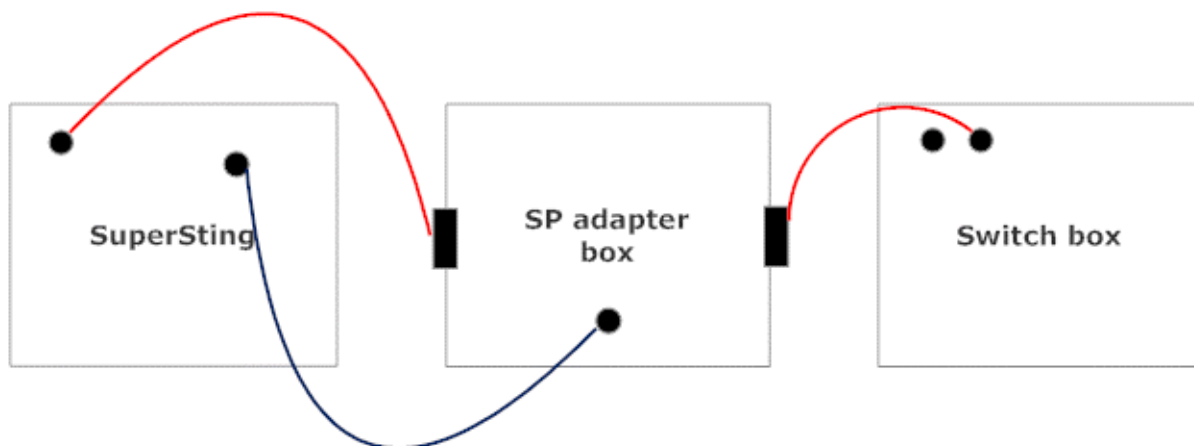


Figure 21: The SP adapter box connects to the SuperSting and the switch box. Red represents the 2-meter jumper cables; blue represents the grounding cable.

4. Access SuperSting menu 6/1: **Measurement Settings**. Change option 7 to **SP**. Continue with all other options as you would for a normal field survey, including the cable address table in menu 6/2.
5. Access menu 1: **Automatic Mode**, and create a new data file using the SP command file you loaded earlier.
6. Verify the remainder of the SuperSting menu settings.
7. Begin taking measurements. The SP voltages are displayed on the screen.
8. When measurements are complete, download the .stg file from the SuperSting using SuperSting Administrator software. See **Downloading SuperSting Data to Your PC** on page 108 for details, or to use the SuperSting Manager App, see **Download Files** menu on page 66.
9. When viewing the stg file, note that the column for the current output of the transmitter is set to 100mA. The column for raw V/I value in the stg file now represents the value for V of the SP measurement.

5.8.1 Command File Examples

When creating the SP command file, it is best to start by creating a SuperSting R1 command file with the appropriate array type and number of electrodes. Only the command lines will need to be edited.

IMPORTANT

The header information for the command file must indicate whether you use the wire connected to the N post or an addressed electrode as the reference. The SuperSting needs the appropriate header to configure correctly, or the data will be inaccurate.

The following examples show the necessary headings for proper configuration. Comments on the settings are in **bold** and are not actually part of the header file.

5.8.1.1 Example 1: Header for fixed reference using N connector on SuperSting ABMN adapter

There are two different ways to approach this type of array:

- Create a pole-pole SuperSting R1 command file, and connect a wire from the reference stake to the N post on the SuperSting faceplate. This will mean that all P2 addresses in the command line section will be 0.
— Or —
- Use an actual electrode on the survey line. In this case, the P2 address in the command line will be an actual electrode address from the cable.

Automatically created command file

```
:header  
progID=SPfixed  
type=R  
arraytype=5  
Binf=1  
Ninf=1  
MUX=2
```

Array type is not critical, but to be consistent it should be set to 5.
Should be a 1. This line and the two below are the critical settings.
Must be set to 1 to reference to the N post on the SuperSting.
Must be set to 2 so the SuperSting configures itself correctly.

5.8.1.2 Example 2: Header for fixed reference using an addressed electrode on the survey line

Automatically created command file

```
:header  
progID=SPfixed  
type=R  
arraytype=3  
Binf=0  
Ninf=0  
MUX=1
```

This is not critical, but should be set to 3.
Binf and Ninf will be 0.
Must be 1 to use an addressed electrode for the reference

Geometry Section

The geometry section of an SP command file will be the same as the geometry section for any Res or Res/IP command file.

5.8.1.3 Example 3: Commands sections for fixed reference using N connector on SuperSting ABMN adapter

```
:commands  
A,B,P1,P2,P3,P4,P5,P6,P7,P8,P9,channels  
0,0,1,0,0,0,0,0,0,0,0,1  
0,0,2,0,0,0,0,0,0,0,0,1
```

There are two command lines shown, using electrodes 1 and 2 to take measurements. Notice that A, B, and P2-P9 are all zeroes. The 1 at the end indicates that channel 1 is taking the measurement.

5.8.1.4 Example 4: Commands sections for fixed reference using an addressed electrode on the survey line

```
:commands
A,B,P1,P2,P3,P4,P5,P6,P7,P8,P9,channels
0,0,1,28,0,0,0,0,0,0,0,1
0,0,2,28,0,0,0,0,0,0,0,1
```

Here we are using electrode 28 as the reference electrode. So A, B, and P3-P9 are still zero, but P2 now indicates that electrode 28 is the reference.

The next example will show a gradient array command file. This command file will be very similar to the command file that uses an addressed electrode as the fixed reference.

5.8.1.5 Example 5: Header for gradient SP

Automatically created command file

```
:header
progID=SPgrad
type=R
arraytype=3          This is not critical, but should be set to 3.
Binf=0               Binf and Ninf will be 0
Ninf=0
MUX=1                This must be 1 for gradient measurements
```

Geometry Section

The geometry section of an SP command file will be the same as the geometry section for any Res or Res/IP command file.

5.8.1.6 Example 6: Commands section for gradient SP

```
:commands
A,B,P1,P2,P3,P4,P5,P6,P7,P8,P9,channels
0,0,1,2,0,0,0,0,0,0,0,1
0,0,2,3,0,0,0,0,0,0,0,1
```

Here the gradient measurements are being taken between adjacent electrodes using P1 and P2 electrodes. Any combination of electrodes will work, so depending on what is needed, the measurement could be between electrodes 1 and 14, or 2 and 6, etc.

6 The SuperSting Manager App

The SuperSting Manager App is used to remotely control the SuperSting from mobile 7-inch or 10-inch tablets or phones. Some of the advantages of using the SuperSting Manager App are:

- All functions performed using the SuperSting keypad can be performed remotely using the App's GUI, with the exception of baud rate setting.
- Using the SuperSting Manager App, color pseudo section plots, transmitter/receiver pair plots, IP curve plots, contact resistance test results, real time data review; all assures real time quality control (QC) in the field.
- Data storage on Android devices is typically in Gigabyte range, meaning essentially unlimited storage space is available.
- Data transfer by email or by file transfer from the Android device USB port.
- Wi-Fi range is up to 100 m, depending on terrain & atmospheric conditions.

6.1 Installing the SuperSting Manager App

The *AGI SuperSting Manager License*, which can be found in the front of this document, contains important information about your license code and update code. Locate these codes and take the following important steps prior to installing the SuperSting Manager App:

1. Make sure you have a Wi-Fi connection to the Internet.
2. Make sure your Android device operating system is Version 9 (Gingerbread) or later.
3. Configure your Android device to accept installation of apps from sites outside of Google Play. To modify your device's security setting, go to:
Settings=>Security=>Device Administration=>Unknown sources=>Allow. This sequence may be slightly different with different software versions.
4. Make sure your Android device's permissions are as follows:
 - Storage—modify/delete SD card contents
 - Network communication—full internet access
 - Personal information—read contact data
 - System tools—Change Wi-Fi state, prevent tablet from sleeping, control vibrator
 - Hardware controls—control vibrator
5. Install the free Mozilla® Firefox® browser. Go to the "Google Play Store" and search for Firefox Browser for Mozilla.

Observe the following guidelines for using the SuperSting Manager App with the SuperSting:

- The number of files that can be saved to the Android device's internal storage depends on a number of factors, including but not limited to the device's storage size, the downloaded file size, and the number and size of other applications and data.

- To communicate with the SuperSting, the baud rate of the SuperSting instrument must match the baud rate of the serial to Wi-Fi module. The serial to Wi-Fi module has a default baud rate of 38400 at power up. The SuperSting baud rate is set on the SuperSting menu 6/4/8.
- Once the device is connected to the SuperSting access point, the SuperSting must be on the main menu before a connection is made. If a connection attempt fails, check the settings of the SuperSting.
- Communication over the SuperSting Wi-Fi network is SECURED with WPA PSK security. Use of the Wi-Fi SuperSting may be disrupted or not possible in high network traffic areas. It is recommended that all computers and devices within range of the SuperSting Wi-Fi access point that are not communicating with the SuperSting have their Wi-Fi capabilities disabled.
- Currently, the SuperSting Wi-Fi access point is configured to allow a total of five client connections. Only one connected client may communicate with the SuperSting instrument at a given time.

6.1.1 To Install the SuperSting Manager App

IMPORTANT

Make sure that your Android device has an internet Wi-Fi connection. Also make sure that your SuperSting is turned off at this time, so the SuperSting Wi-Fi connection does not compete with your internet connection.

Access the *AGI SuperSting Manager License*, which includes the following information to allow you to access the AGI SuperSting Wi-Fi App website:

- Company:
- Contact:
- Email:
- Usergroup login:
- Usergroup password:
- Usergroup URL:
- AGI Purchase Reference:
- Registration Date:
- License code (not case-sensitive)
- Subscription code (not case-sensitive)



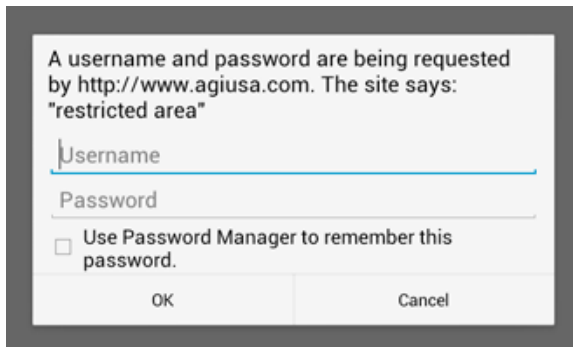
Store this information in safe place for future use so that you may stay up to date with the latest developments.

Before beginning installation, make sure that your Android device has an internet Wi-Fi connection (if it does not, see **To Install the SuperSting Manager App Without Internet Access on the Android Device** on page 62). Also make sure that your SuperSting is turned off at this time, so the SuperSting Wi-Fi connection does not compete with your internet connection.

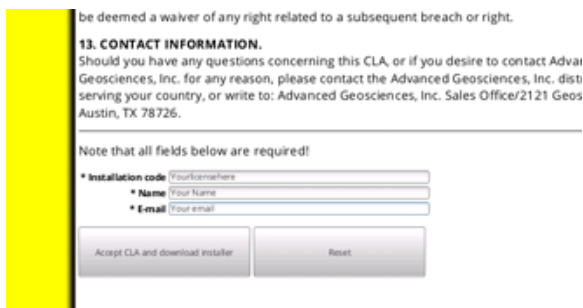
1. Access the SuperSting Manager App download page in one of two ways:
 - Use your Android device's QR code reader on the image at the left
 - If you do not have a QR enabled camera on your device, type in the following URL:
https://www.agiusa.com/files/mobile/SSM_CLA.shtml

The QR code, a link that can be tapped to get to the license agreement page, is also displayed on this page.

1. Enter the user name and password you received in the hardcopy of the *AGI SuperSting Manager License*.

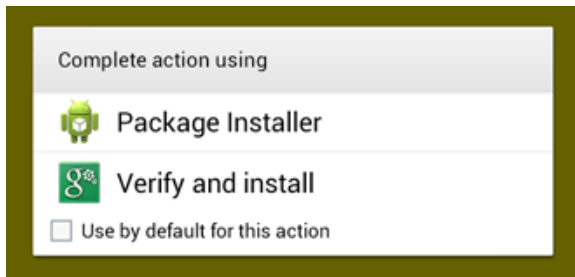


2. The Customer License Agreement page appears after you enter the user name and password. At the bottom of the page, enter your license code (not case-sensitive) from the hardcopy of the *AGI SuperSting Manager License*.
3. Enter your name and email address.
4. Tap **Accept CLA and download installer**.



The App installer will be downloaded to your device. After a short moment, the application installation may prompt you to select the Firefox browser again, or the Android Package Installer.

5. Tap the Android **Package Installer**.



6. When the AGI SuperSting Manager page appears, tap **Install**. This may take a short moment. Then, tap **Done**.

7. The AGI SuperSting icon  is now visible among the icons on your device. Tap the **AGI SuperSting** icon.

6.1.2 To Install the SuperSting Manager App Without Internet Access on the Android Device

1. If your Android device does not have internet access, use a PC with internet access to download the file named AGI.apk from the following website (requires user name and password): http://www.agiusa.com/files/mobile/AGI_AndroidApps.shtml
2. Click the **AGI SuperSting Wi-Fi remote control app** hyperlink to download the file directly to the PC.
3. Transfer the file to the Android device through a USB cable.
4. Locate the file on your Android device, and tap to install it.

6.2 App Registration

To register your SuperSting:

1. On the first screen, enter the License code, the Subscription code, your name, and your email address, and then tap **Register**.
Note: The License and Subscription codes are **not** case-sensitive.
2. You will see "Registration Complete." Tap **OK**.

The SuperSting Manager main page appears and the App is ready to be used.

NOTE: Once the App is registered, the registration screen will not be shown again.

Figure 21: SuperSting Manager App registration

6.3 App Update

1. To update the app, tap **About AGI**.
2. Tap **Check for App Update**.

3. If a more recent version is available, the update dialog appears. Tap **Start Update** to continue.
4. The subscription code should be visible. If not, type it (not case-sensitive) into the empty field. Then, tap **Start Download**. The installer will download and be applied as it was when the App was first installed.

The next time you start the App update, no registration page will be shown since you have already registered.

6.4 Connecting to the SuperSting

For communication to occur between the SuperSting and the Android device, the SuperSting must be set to communicate at 38400 baud. To access control of the SuperSting from the Android device:

1. Turn the SuperSting on.
2. Ensure the following:
 - a. Wi-Fi is turned on and Wi-Fi antennae is installed and raised
 - b. Communication switch is pointing toward the Wi-Fi position
 - c. Red indicator light shows Wi-Fi is operating
3. Go to menu M6/4 to make sure that the SuperSting is set to communicate at 38400 baud. If it is not, change it to 38400.
4. Back out to the main menu by pressing the **MEN** key twice. You must be in the **main menu** for the SuperSting Manager App to connect.

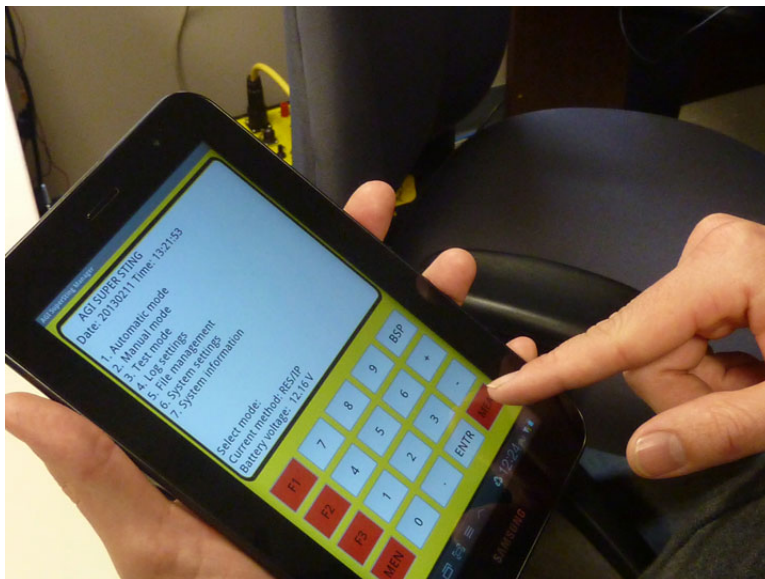


Figure 22: SuperSting Manager App on an Android device

5. On the Android device, go to Settings=>Wi-Fi, and select SuperSting.
6. Enter the Security code for SuperSting Wi-Fi: **SuperSting01** (Note that it is case-sensitive). Tap **Connect**.

7. On the device, tap the **AGI** icon, and then tap **Remote Control** to gain control of the SuperSting.

The SuperSting Manager App utilizes the Android Notification Service and Alarm Service. While operating the SuperSting in Remote Control Mode or Data Transfer Mode, a notification appears in the Notifications Bar when the measurement is completed. An audible alarm (device's default alarm) sounds for 30 seconds and a haptic feedback alert executes at the same time.

If the Wi-Fi connection is lost, the notification, audible alarm, and haptic feedback alert remain active. The SuperSting must be power cycled in order to reestablish a Wi-Fi connection. If a measurement is in progress when the Wi-Fi connection is lost, the measurement will proceed until the end.

6.4.1 SuperSting Wi-Fi access point settings

IP Address — IP address=1.2.3.4

Pass phrase — Passphrase= SuperSting01

Web server URL — 1.2.3.4/iChip

Web server pass phrase — Passphrase=SuperSting01

6.5 Using the SuperSting Manager App

To start the SuperSting Manager App, tap the AGI icon  on your device. When the App has started, you will see the main menu.

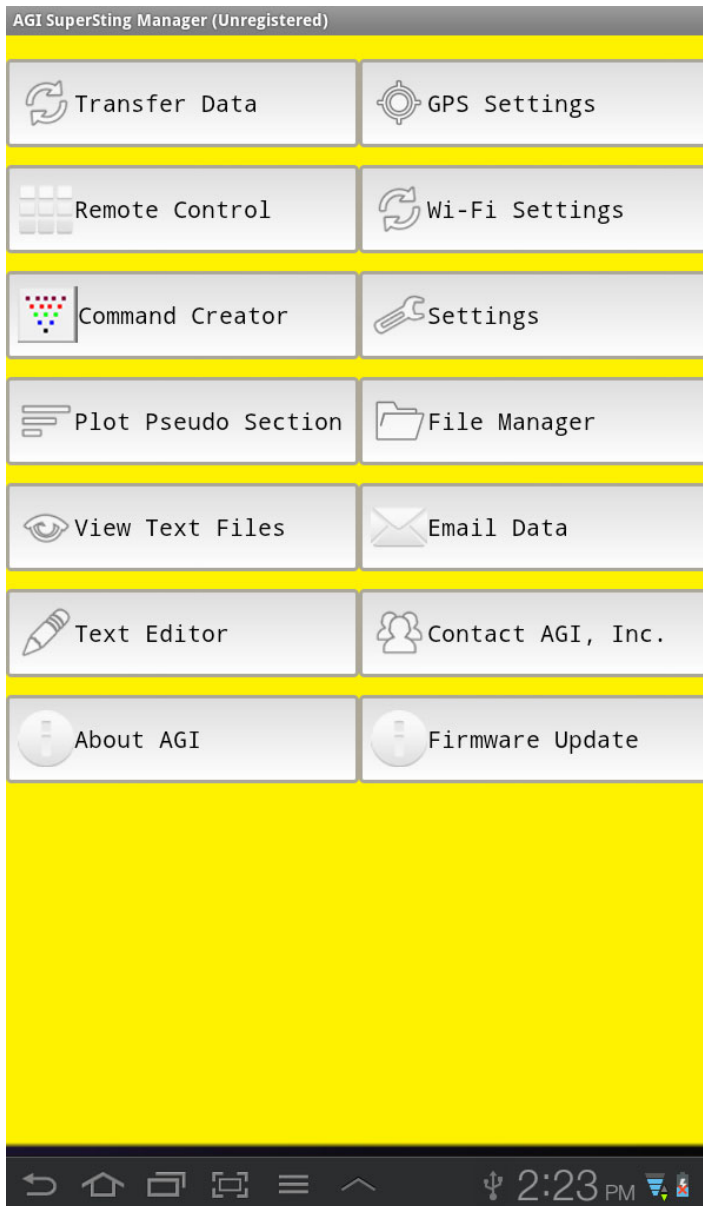


Figure 23: SuperSting Manager App main menu

6.5.1 Transfer Data Menu

This menu provides several options for data transfer between the device and the SuperSting. The downloaded files are saved in the AGI folder on the device's internal storage. The following actions can be performed from this menu:

- Upload to the SuperSting cmd.bin and .cmd files that have the following path:
/mnt/sdcard/AGI/filename
- Erase SuperSting memory files
- Download a Data zip file, which contains the following files: Calib.bin, CmdDir.bin, FileDir.bin, cmd.bin, datafile.bin., datafile.crs, datafile.stg. The zip file will have the

name XX.zip where XX is the Datafile name. You can choose to automatically download this file through the Settings/Preferences menu. (See **Preferences** on page 75.)



Figure 24: Transfer data menu

When downloading the Data zip file, the files listed above are saved both externally (/mnt/sdcard/AGI/ilenames) and internally (/mnt/sdcard/AGI/ZipFileName) to the zip file.

6.5.1.1 Download Files menu

Touch **Download Files** to download command files, stg files or contact resistance files from the SuperSting to the tablet.

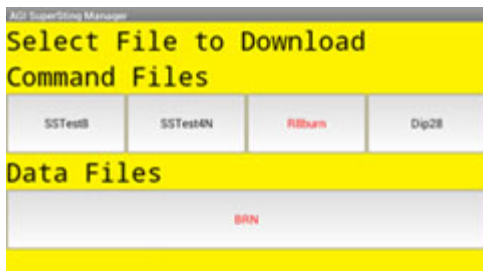


Figure 25: Download files menu

Choose from a list of available command files or data files. Note that files displayed in red have not been downloaded and can therefore not be erased from the SuperSting memory.

Touch the file button to start the data download. The actual download may take 1-2 minutes, depending on file size.

6.5.1.2 Erase SuperSting Memory Files menu

Use the **Erase SuperSting Memory Files** button to erase command files or data from the SuperSting memory.

6.5.1.3 Upload Command Files menu

Command files are created in one of the following ways:

- Using the SuperSting Administrator software
- Using EarthImager software in a PC
- Using a regular text editor
- Using the Command Creator feature of the App

Once the command files are transferred to your Android device, they can be uploaded to the SuperSting memory by touching the **Upload Command Files** button.

6.5.2 Remote Control Menu

The SuperSting is operated in Remote Control Mode with the SuperSting GUI.

All functions performed using the instrument's keypad can be performed using the app's GUI, with the exception of changing the SuperSting serial port baud rate in SuperSting menu M64.

NOTE: Changing the baud rate of the SuperSting serial port from the App will cause the SuperSting to become unresponsive.

This menu also provides new Real-Time Data Quality and Analysis Tools (Data Q&A) that are only available with the app. The Data Q&A Tools include:

- Real-Time Pseudo Section Plotter (pseudo section

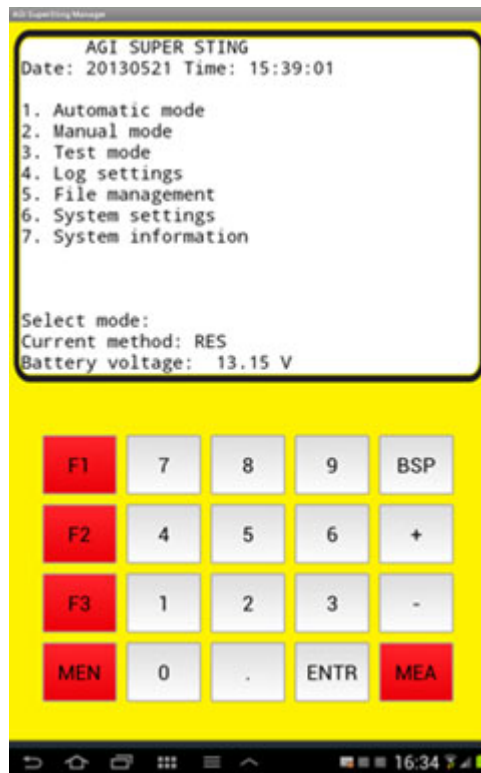


Figure 25: Remote control allows full control of the SuperSting.

Plot)

- Real-Time Transmitter and Receiver Pair Plot (TxRx Plot)
- Real-Time Induced Polarization Curves Plot (IP Curves Plot)
- Contact Resistance Test Results Log (CRS Test Results)

6.5.3 Command Creator

In the SuperSting Manager App, you can create command files for the following arrays:

- Wenner
- Schlumberger
- Dipole-Dipole
- Pole-Dipole
- Pole-Pole
- Inverse Schlumberger

You can also display TxRx or Pseudo Section plots on your device in the field, eliminating the need to wait until you return to an office.

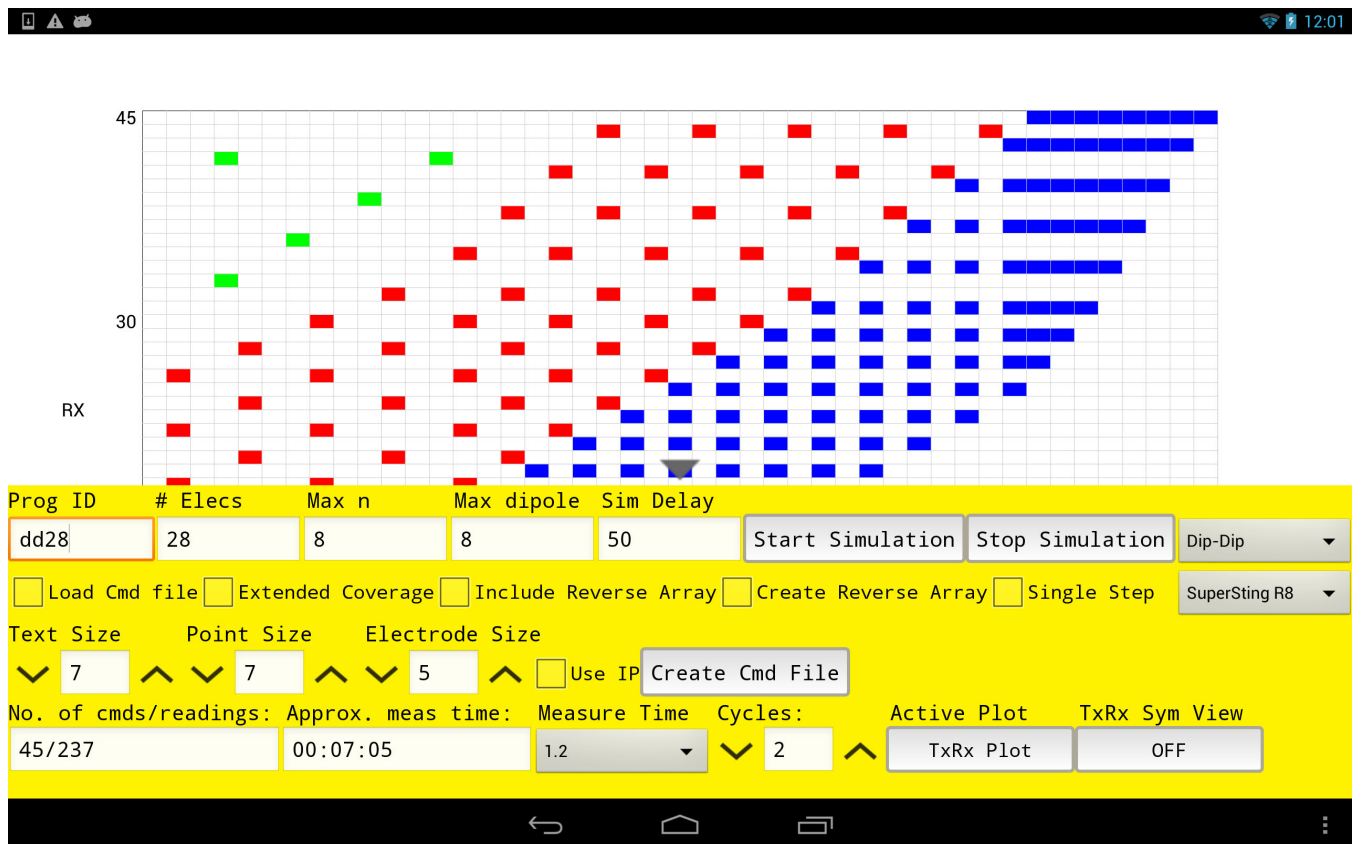


Figure 26: SuperSting Manager App Command Creator, TxRx image

To create a command file:

1. Select the type of array.
2. Select **Command Creator** from the main menu.
3. Enter the Prog ID.
4. Enter the total number of electrodes in **# Elecs**.
5. Enter the distance between the transmitter and receiver in **Max n**.
6. Enter a value for **Max dipole**. The default is 9.
7. Enter a value (in milliseconds) for **Sim Delay**.
8. Select the instrument you are using.
9. Enter a value for **Text Size**, **Point Size**, and **Electrode Size**, based on how you want the plot to display.
10. Check **Use IP** to change the measurement times for an IP measurement.
11. **Extended Coverage** is available to check only for dipole-dipole arrays. Checking this box maximizes the number of data points collected in the survey.
12. **Include Reverse Array** is available to check only for dipole-dipole arrays. When selected, a reverse array is automatically created during the survey.
13. If the command file is for a SuperSting R8/IP, we recommend you check the **Create Reverse Array** box. This will in many cases speed up roll-along surveys when using the SuperSting R8/IP. For SuperSting R1/IP, you do not need to check the box.
14. Select **Single Step** to manually step through the plot.
15. **Measure Time** defaults to the survey time you selected when entering measurement settings. You can choose a time from the drop-down menu.
16. You can increase the **Cycles** to increase survey time. 2 is the most common.
No. of cmds/readings and **Approx. meas time** are determined by other parameters, and are not user-defined.
17. Click **Create Cmd File**. In the verification window, click either **Save** or **Cancel**.

To plot an image using command file specifications:

1. Load or create a command file.
2. In the **Active Plot** box, you can toggle between **Pseudo Section** or **TxRx Plot**.
3. If you choose **TxRx Plot** in the **Active Plot** box, you can turn the **TxRx Sym View** on or off to view symmetrical TxRx simulation. If you change this after starting a simulation, you will need to click **Start Simulation** again for it to take effect.
4. Click **Start Simulation** to view command file execution, and **Start Simulation** to stop. During the simulation, current electrodes are denoted by blue (A electrodes) and red (B electrodes), while receiver electrodes are denoted by green.

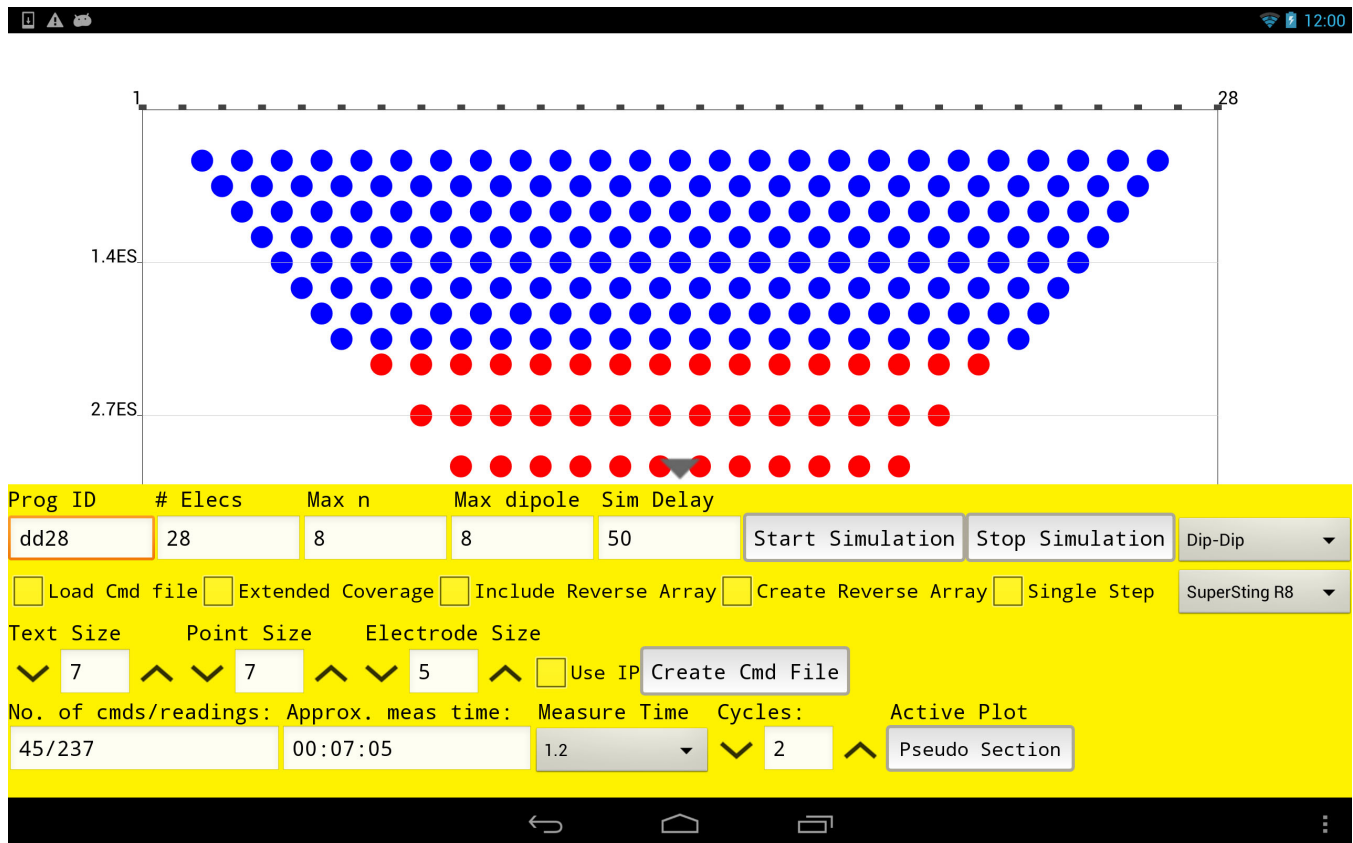


Figure 27: SuperSting Manager App Command Creator, pseudo section image

You can transfer a newly created command file to the SuperSting (see **Upload Command Files** menu on page 67) or load and view previously created command files. To load a command file:

1. Select **Command Creator** from the main menu.
2. Check **Load Cmd file** on the Command Creator menu.
3. When prompted, select the command file from the available files on your device.
4. Click **Start Simulation** to view.

6.5.4 Plot Pseudo Section Menu

With this option, you can select a .stg file from a list of available files saved to the device and plot the corresponding pseudo section provided by the selected file.

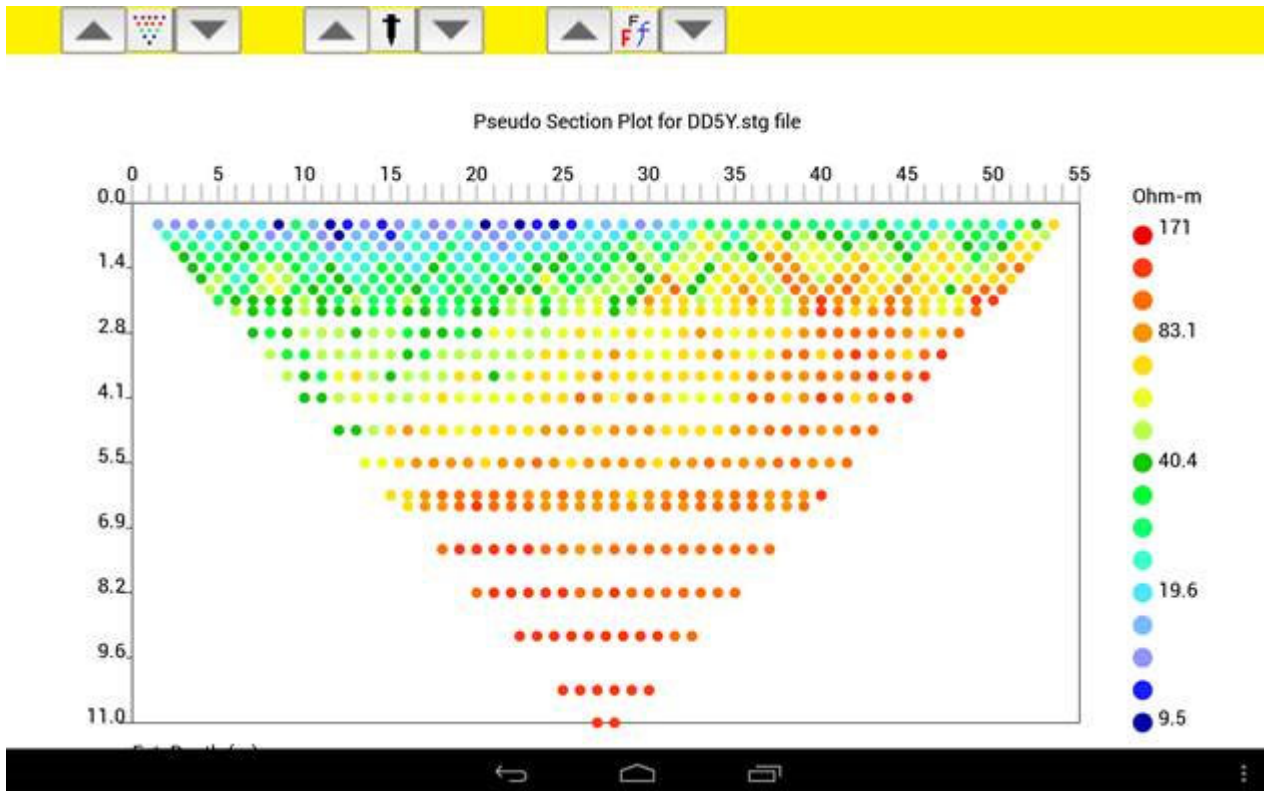


Figure 28: SuperSting Manager App, Plot pseudo section

The plot is full screen, and controls are accessed by pressing the device **Menu** button.

The **Settings** button on the device brings up the control bar to adjust certain plot characteristics (point size, electrode size, text size). If no adjustments are made within five seconds of pressing the Settings button, the bar disappears. This plot has pinch-to-zoom capabilities.

6.5.4.1 Real time pseudo section plots

The pseudo section plot is initialized with an unfilled pseudo section at start of the measurement and the data points are rendered with respect to the recorded measurement data. If a measurement is started and then paused, the pseudo section Plot will retain its state upon resuming the measurement. The pseudo section Plot Tool is only available when using a command file that contains only one of the following arrays:

1. Dipole-Dipole
2. Schlumberger
3. Inverse Schlumberger
4. Pole-Dipole
5. Pole-Pole
6. Wenner

If the command file contains a Mixed array, the pseudo section plot tool will be disabled. This tool has pinch-to-zoom capabilities.

NOTE: Only files saved in the AGI folder on the device's internal storage will be available for plotting. To put the current selected command file in the AGI folder, use the app's data transfer capabilities in the Transfer Data menu. The option to show Apparent Resistivity in SuperSting menu M64 must also be enabled for the real-time data to properly render. The **Settings** button enables the option to adjust certain plot characteristics.

6.5.4.2 Real time TxRx plots

The TxRx Plot Tool plots ordered transmitter and receiver pairs on a Tx/Rx plane using the data provided by the current selected command file as shown in SuperSting menu M1. The TxRx Plot is initialized with unfilled data points at start of the measurement and the data points are rendered with respect to the recorded measurement data. If a measurement is started and then paused, the TxRx Plot will retain its state upon resuming the measurement. The pseudo section plot tool is available when using a command file that contains any of the following arrays:

1. Dipole-Dipole
2. Schlumberger
3. Inverse Schlumberger
4. Pole-Dipole
5. Pole-Pole
6. Wenner
7. Mixed

This tool has pinch-to-zoom capabilities.

NOTE: Only files saved in the AGI folder on the device's internal storage will be available for plotting. To put the current selected command file in the AGI folder, use the app's data transfer capabilities in the Transfer Data menu. The option to show Apparent Resistivity in SuperSting menu M64 must also be enabled for the real-time data to properly render. The **Settings** button enables the option to adjust certain plot characteristics.

6.5.4.3 Real time IP curves plots

The IP Curves Plot Tool plots IP curves on an Apparent Chargeability/IP Windows plane.

The SuperSting records six IP windows per channel when used in Res/IP mode as selected in SuperSting menu M64. The IP curve is generated with respect to the six IP window measurements.

The IP curves are plotted using a color scale to aid in visualizing the most recently recorded IP windows. The most recent IP curve corresponds to the color RED while the first recorded IP curves correspond to the color BLACK. There are eight colors spanning RED, ORANGE,

YELLOW, GREEN, BLUE, and BLACK. The IP curves will stack for the duration of the measurement. If a measurement is started and then paused, the IP Curves Plot retains its state upon resuming the measurement.

NOTE: The IP Curves Plot Tool is only available when the SuperSting is in Res/IP Mode. Once a measurement is started, the Data Q&A Tools will retain their state if the measurement is paused and then subsequently resumed. However, the data for the Data Q&A Tools will be cleared if a new data file is created in Menu M21 or a data file is selected in Menu M51.

6.5.4.4 Contact Resistance test result log

The contact resistance test log displays the results of a Contact Resistance Test executed from SuperSting menu M31.

The CRS test results can be used to identify potential problems that may affect the recorded data before a measurement is started. The CRS test results are logged in real-time and contain a date/time stamp. A CRS test is recommended before starting all measurements.

6.5.5 View Text Files Menu

Select and view .crs, .cmd, and .stg files from a list of available files saved to the device. Corresponding text files can also be viewed. Only files saved in the AGI folder on the device's internal storage will be available for viewing. There is an option in this menu to delete the file from the device.

6.5.6 Text Editor Menu

Select, view, and edit .crs, .cmd, and .stg files from a list of available files saved to the device. Corresponding text files can also be viewed. Only files saved in the AGI folder on the device's internal storage will be available for viewing. There is an option in this menu to save the file with a new name and delete the file from the device.

6.5.7 About AGI

This feature provides a brief overview of Advanced Geosciences Inc. and what our systems may be used for. The App version number will be found at the bottom of the page. There is also a **Check for Update** that, upon selecting, will check the AGI server for an updated version of the app. A notification will appear in the notification section indicating whether or not a notification is available for download.

6.5.8 GPS Settings

This feature takes you to the Android device's GPS settings.

6.5.9 Wi-Fi Settings

This feature takes you to the Android device's Wi-Fi settings.

6.5.10 Settings Menu

Through the Settings menu, you can change SuperSting, language, Wi-Fi, and various App preferences.

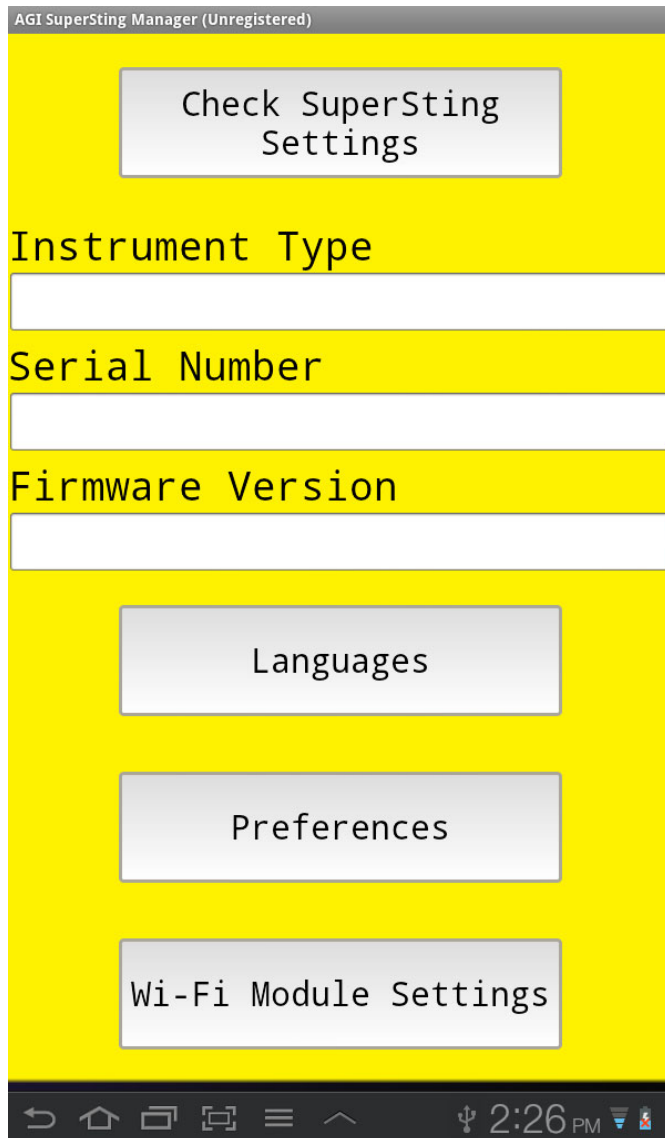


Figure 29: SuperSting Manager App Settings menu

6.5.10.1 Check SuperSting settings

This option downloads the calibration file (Calib.bin) from the SuperSting and displays the Instrument Type, Instrument Serial Number, and the loaded Firmware Version Number. The firmware version should be **.60E** for the App to work properly with the SuperSting.

6.5.10.2 Languages

This option provides a list of languages that will change the default language setting of the app. The default language is set to English. Changing the language of the App does not

change the device's set language. Currently only English and Swedish are available, but other language options will be made available once the respective translation is complete.

NOTE: Changing the Language setting of the device will override the language setting of the app. If the device language setting is changed, the app's language will need to be reset to the desired language.

6.5.10.3 Preferences

Use this menu to enable or disable the available preferences. Checked preferences are enabled.

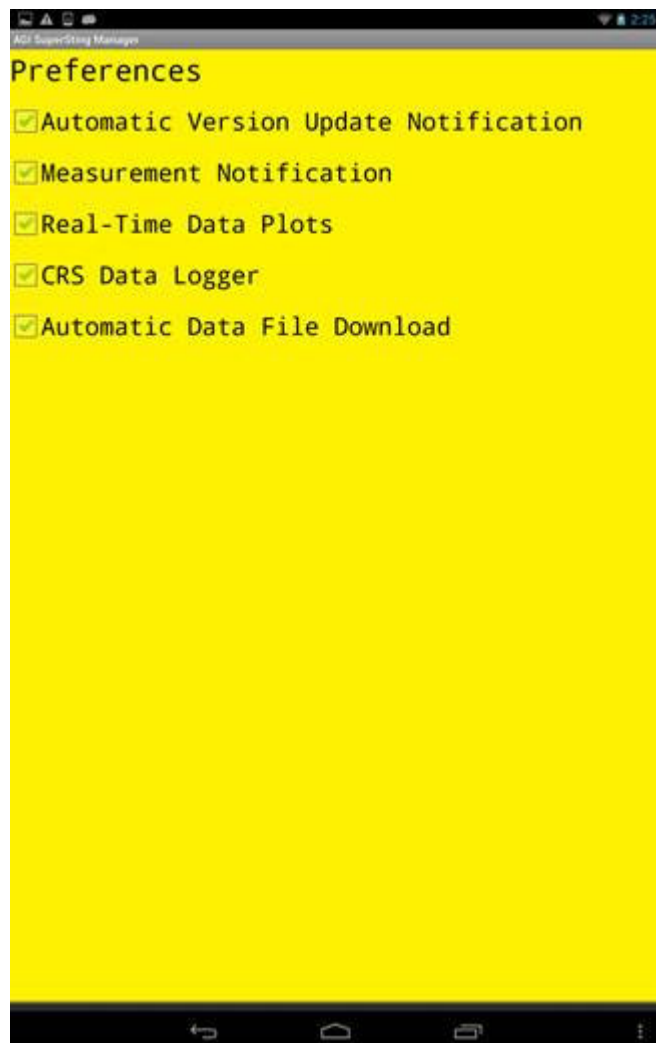


Figure 30: SuperSting Manager App Preferences menu

Automatic Version Update Notification — Checks once every two weeks for a new App version. If a new version is available, the notifications section indicates it, and clicking the notification starts the update process.

Measurement Notification — Notifies when a survey is near completion. The notification is launched based on “EST TIME TO FINISH,” and is designed to signal the approximate (not exact) end.

Real-Time Data Plots — Choosing this preference enables the real-time Data Q&A, launched at the measurement start. Disable this feature if you prefer not to use Data Q&A.

CRS Data Logger — Enables the CRS test data log that is launched when a CRS test is executed from SuperSting menu M31.

Automatic Data File Download — Enables data zip file to automatically download when a survey is completed.

6.5.10.4 Wi-Fi Module Settings

This option directs you to the SuperSting Wi-Fi module, where you can change the SSID and IP addresses.

6.5.11 File Manager

With the file manager utility, you can:

- Create a new file
- Delete a file
- Rename a file
- Copy a file
- Move a file
- View supported file types

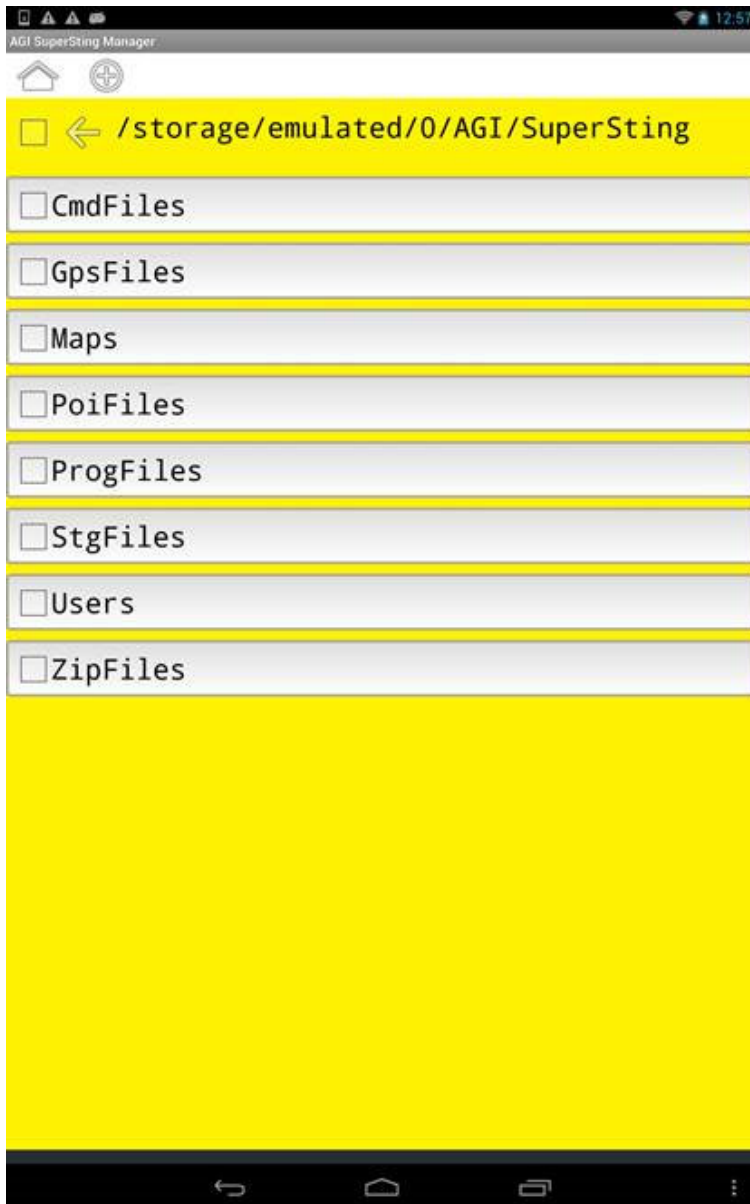


Figure 31: SuperSting Manager App File Manager

The following buttons at the top of the File Manager home directory allow for quick functions:

- Home—Return to the root directory of the device.
- New—Create a new file.

In the File Manager root directory and subsequent directories, the checkbox beneath the function buttons selects all folders listed. The arrow next to the checkbox navigates up one directory level.

The following folders contain all the project-related files:

- **CmdFiles**—Command files either created in the Command Creator or saved and downloaded from the SuperSting are saved and listed here. Command file extensions can be changed from .cmd to .txt so the file can be emailed.

Within the **CmdFiles** directory, the following buttons at the top allow for quick functions:

- Home—Return to the root directory of the device.

- New—Create a new file.
- Edit—Edit a file name. A “Rename File” box appears. Type the new file name, and if you want to change the file extension, select it from the drop-down menu AND check the **Use new extension** box.

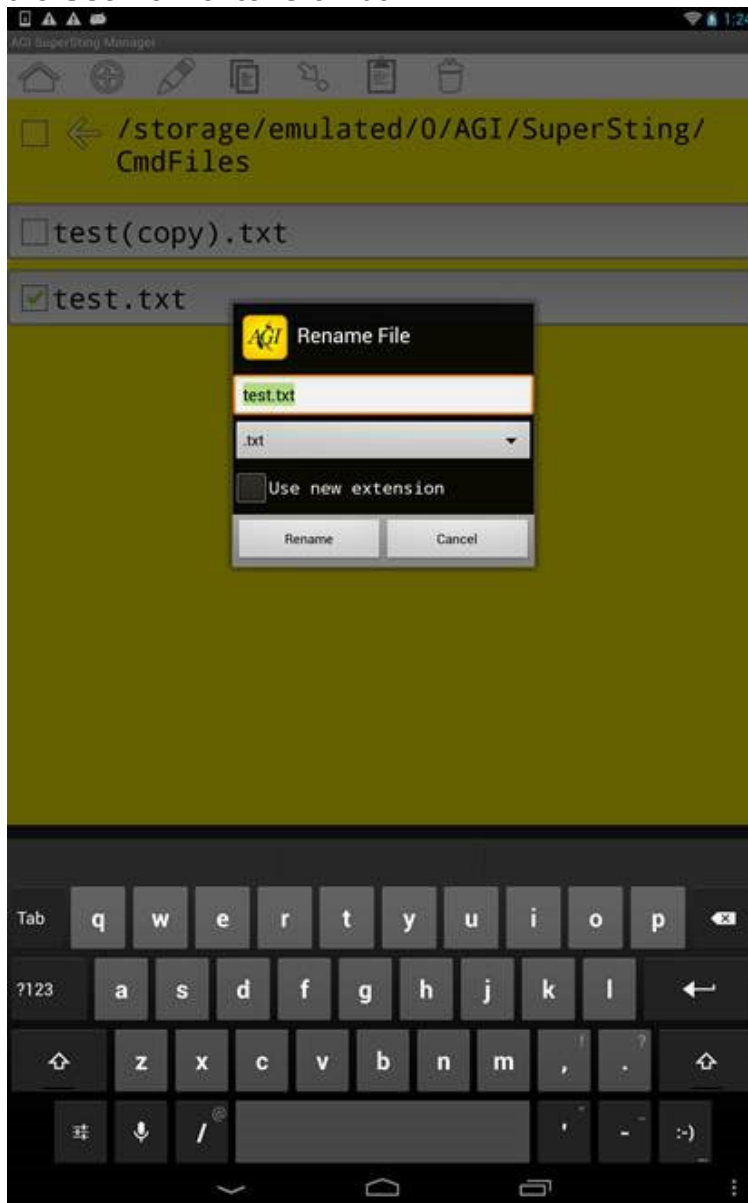


Figure 32: SuperSting Manager App cmd files>edit (rename file)

- Copy—Copy a file. If the name of a file is test.txt, copying that file automatically names it text(copy).txt.
- Move—Move a file. Check the checkbox and then press the **move** button. You will be prompted to navigate to the directory to which the file will be moved.
- Paste—Paste the file you are moving into the current directory.
- Delete —Delete a file.
- **GpsFiles**—.gps files that contain NMEA sentence data received from an externally connected gps are stored here. This option is only available with the Marine Module.

- **Maps**—Images in .jpg, .jpeg, .png format are saved here. This option is only available with the Marine Module.
- **PoiFiles**—Poi (point of interest) text files are saved here. This option is only available with the Marine Module.
- **ProgFiles**—FileDir.bin, CmdDir.bin, and Calib.bin binary files, which are downloaded from the SuperSting when a data file is downloaded, are stored here.
- **StgFiles**—The .stg file, created when a data file is downloaded from the SuperSting, is stored here.
- **Users**—Project files created when a data file is downloaded from the SuperSting are stored here.
Example scenario: Select **Transfer Data** from the main menu. Upon successfully connecting to the SuperSting, there are options to Download Files, Erase SuperSting Memory Files, and Upload Command Files. Select **Download Files**, and select a data file (test, for example) from the list of Command Files and Data Files currently on the SuperSting. When this test data file is downloaded in the Users directory, a file called “text” is created. The file contains the following files: test.cmd, test.cmd.bin, test.stg, test.stg.bin, test.crs.
- **ZipFiles**—When a data file is downloaded from the SuperSting, all of the files associated with the project are put into a zip file and named project_name.zip.

6.5.12 Email Data Menu

Select from a list of available files saved in the AGI folder on the device’s internal storage and send an email with the attached file using a previously initialized email client (Gmail, Yahoo, Outlook accts have been verified).

NOTE: This feature requires previous initialization of an email client. The email will not be sent if no internet connection is available. Depending on the email client being used, the email will sit in the Outbox until an internet connection is available. at which point the email will be sent. If the device has a mobile data plan, additional data charges may apply if email is sent using the mobile network.

6.5.13 Contact AGI, Inc

Connect to the AGI Contact Directory at <http://www.agiusa.com/directory.shtml>. If no internet connection is available, a non-interactive version of the AGI Contact Directory will be displayed.

NOTE: Additional data charges may apply if connecting to the AGI Contact Directory via a mobile data network.

6.5.14 Firmware Update

You can update the SuperSting firmware using this option on the main menu. Using the SuperSting Manager App eliminates the need for a serial cable or a USB-serial adapter. To update the firmware:

1. Tap Firmware Update from the main menu.

NOTE: Firmware update should not be performed with a low Wi-Fi signal strength. If the signal strength is below 2 on a scale of 1-5, you will get a warning when asked to confirm the update, and should attempt the update when the signal is stronger. When updating the firmware, it is best to keep the Android device near the SuperSting, and not use it for any other function. Firmware update is a relatively short process, but should use full bandwidth.

2. The next screen lists the available firmware files in the directory AGI/SuperSting/FirmwareFiles.

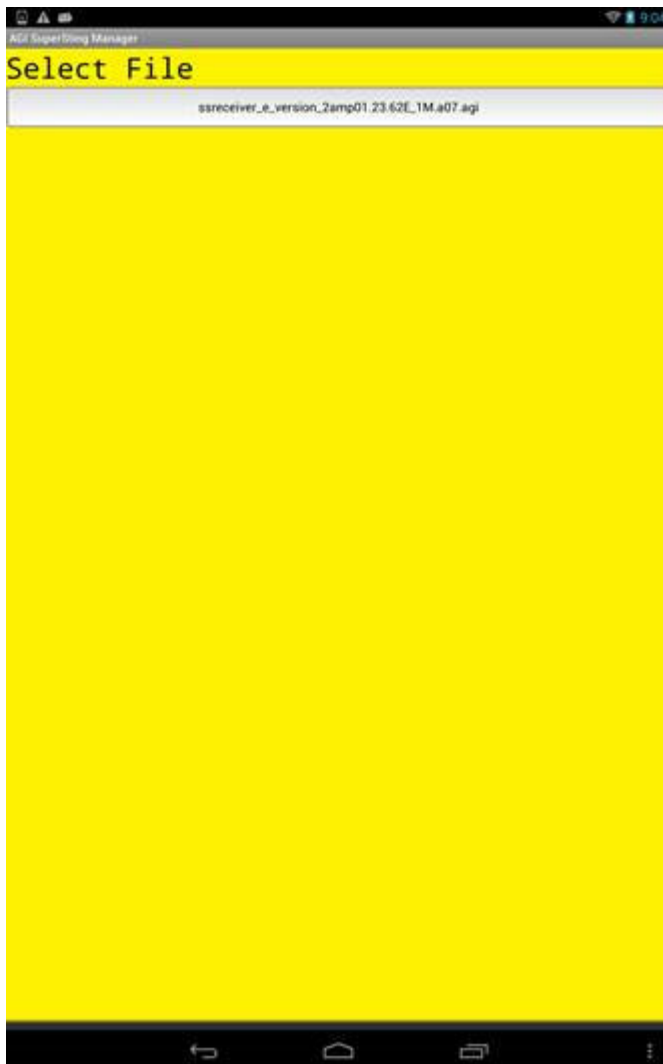


Figure 33: SuperSting Manager App firmware files

3. On the confirmation screen, click **Yes** to proceed with updating the firmware.
4. Click **Yes** to confirm whether the firmware update is compatible with the SuperSting.

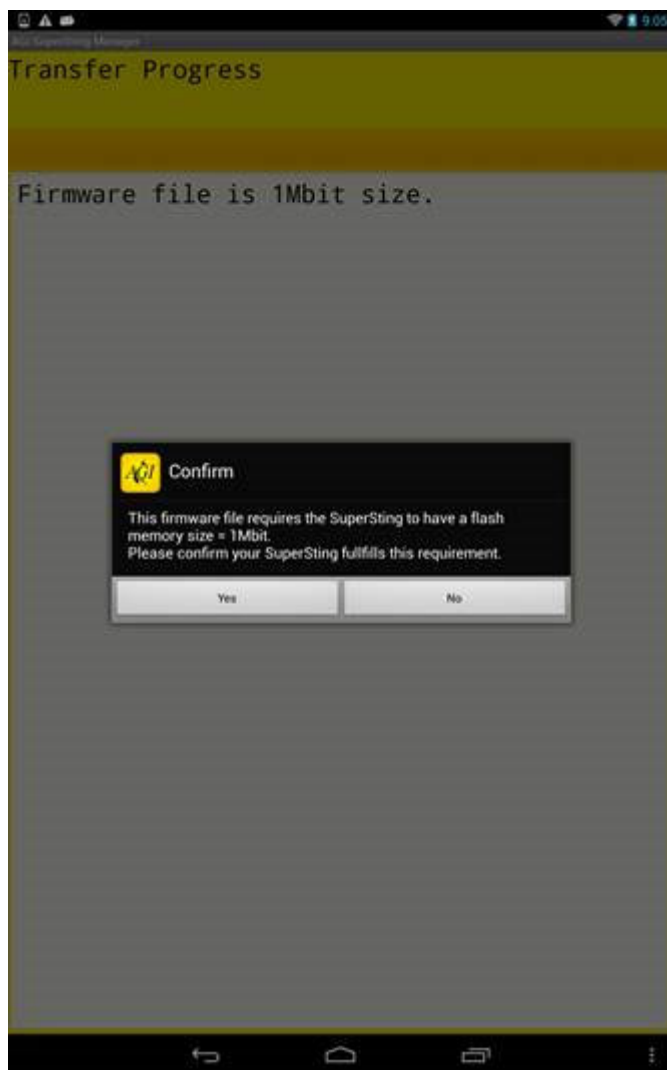


Figure 34: SuperSting Manager App firmware compatibility confirmation

The file transfer begins.

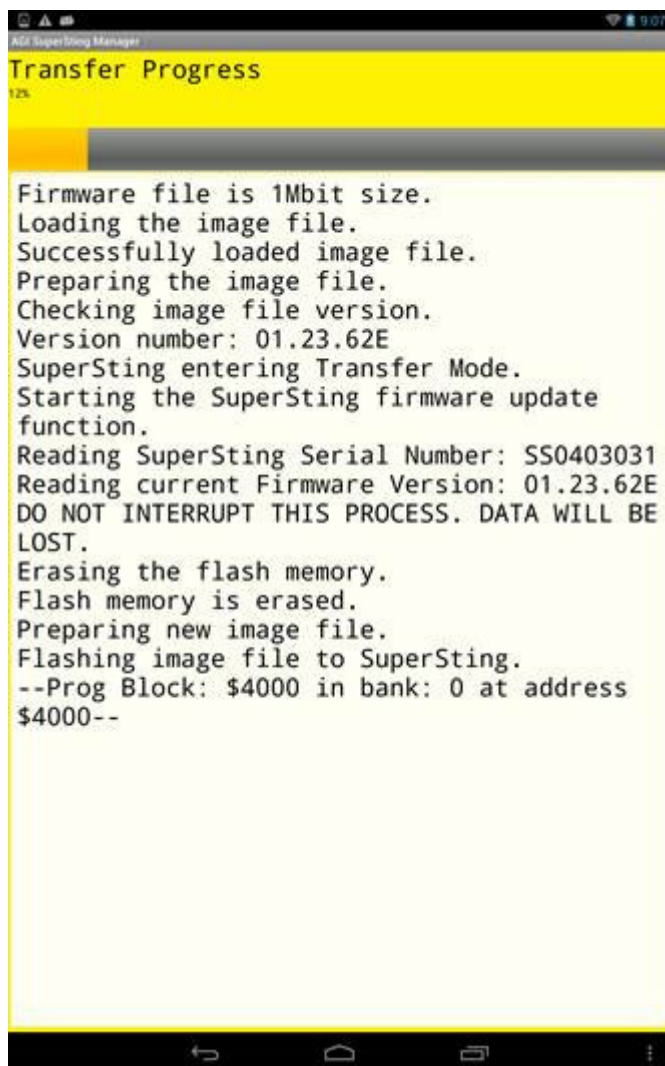


Figure 35: SuperSting Manager App firmware file transfer

A confirmation will indicate completion, verifying that the firmware has been updated.

7 Menu System and Operational Settings

When the instrument is powered up using the office power supply, it will display the following message:

```
ADVANCED GEOSCIENCES
Super Sting
Hardware Initializing
TRANSMITTER OFFLINE!!!
Press any key to continue
```

To navigate the menu:

1. Press any key to display the main menu.
2. Press **1** on the main menu to perform an automatic resistivity survey.
or
3. Enter a number from **1** to **7** in the “Select mode:” field to go to any of the seven submenus.
4. To return back to the main menu from any submenu, press the **MEN** key.

```
AGI SUPER STING
Date: 20140529 Time: 21:13:15
```

1. Automatic mode
2. Manual mode
3. Test mode
4. Log settings
5. File management
6. System settings
7. System information

```
Select mode: █
Current method: RES
Battery voltage: 13.15 V
```

NOTE: All submenus have the menu number in the upper left hand corner. For example M54, means submenu 4 of submenu 5.

7.1 Automatic Mode Menu

7.1.1 Select Data File

Press **1** to select data file. Then, move the cursor, using the + and – key, among the available data files, and press **ENTR** to make your selection.

If no data file is created, the message “No data files available!!” is displayed.

7.1.2 Create Data File

At least one command file must be available when a new data file is created.

To create a new data file:

```
M 1    AUTOMATIC MODE
```

1. Select data file
2. Create data file
3. Edit survey information

```
Command file: DipDip28
Data file: Projekt1
Scaling factor: 1.0m
x= 0.0m y= 0.0m z= 0.0m
Command line #:1 /53
Roll-along: N
```

```
MEA: Start measurement
```

```
MEN: Up level
```

- On menu 1, press **2. Create data file**.
- Type in a unique data file name, with no more than 8 alphanumeric characters. To enter letters, select the first, second or third letter on the key by first pressing F1, F2 or F3. For example, to enter the word STING, press **F1 1, F2 1, F3 9, F2 5** and **F1 9**.
- Press **ENTR**.

NOTE: If you press **2. Create data file**, you cannot back out of the menu. You must create a data file before continuing.

For instructions on how to load command files, see **Loading a Command File Into the SuperSting RAM Memory** on page 107.

7.1.3 Edit Survey Information

After entering the file name, select and enter the command file to be used.

This menu enables you to edit the survey information after it has been entered.

7.2 Manual Mode Menu

The SuperSting currently supports the following manual electrode arrays: Resistance, Schlumberger, Wenner, Dipole-dipole, Pole-dipole and Pole-pole. The SuperSting R1 also supports SP Absolute and SP Gradient.

To select an array:

1. Select **2** on the main menu, and the array types appear.
2. If you have not created a data file, use menu 1, **2: Create data file** to do so. See **Create Data File** on page 83. You must create a data file before proceeding, and you need separate data files for each array. You cannot, for example, store both Schlumberger and Wenner soundings in the same data file.

3. Press any of the keys 1-6 (1-8 on SuperSting R1) to select the appropriate array.

NOTE: You must be connected to a battery when you perform measurements. The office power supply is not powerful enough to power the SuperSting transmitter, and measurements will not work if using it.

M 1 3 EDIT SURVEY INFORMATION

```
1. Start X=0.00      m
2. Start Y=0.00      m
3. Start Z=0.00      m
4. Start command line # :
   1                /53

5. Roll-along=N
6. End address= OFF
7. Advance roll-along:
```

MEN: Up level

M 2 MANUAL MODE

```
1. Resistance
2. Schlumberger
3. Wenner
4. Dipole-dipole
5. Pole-dipole
6. Pole-pole
```

Select array:

MEN: Up level

Settings such as number of cycles, max current, and measure time are set in the System Settings menu prior to starting the manual survey. See **System Settings** Menu on page 93.

7.2.1 Resistance

To select the Resistance array, choose 1: Resistance. The V/I value is measured and displayed in this array. No correction for the electrode geometry is given and apparent resistivity is not calculated.

To select the data file where the data is going to be stored, choose **1. Select data file:LINE1**. Usually the same data file will be used for data from the same location, line etc.

```
M21    RESISTANCE

1. Select data file:LINE1
2. Create data file
3. X = 0.000 m
4. Y = 0.000 m

Resistance:
Standard deviation:
Cycles:
Current:

MEA: Start measurement
MEN: Up level
```

To create a new data file, choose **2: Create data file**. This is useful when the first measurement at a new location is taken.

Enter the X and Y location of the measurement. Press the **MEA** key to start the measurement.

7.2.2 Schlumberger

To configure the Schlumberger array:

1. Enter Schlumberger configuration on Menu 2 by pressing **2: Schlumberger**.
2. Select or create a data file the first time a new measurement is taken, for example at a new sounding or a new line.

The previously used AB/2 distance (half the distance between the current electrodes) and the previously used MN/2 distance (half the distance between the potential electrodes) are displayed. Perform one of the following actions:

- Type the new AB/2 value and press **ENTR**.
- To keep the existing MN/2 value, proceed to press the **MEA** key to start the measurement.
- To enter a new MN/2 distance, type the new value and press **ENTR**.

```
M22    SCHLUMBERGER

1. Select data file:LINE1
2. Create data file
3. AB/2 = 50.00 m
4. MN/2 = 5.000 m

Apparent res:
Resistance:
Standard deviation:
Cycles:
Current:

MEA: Start measurement
MEN: Up level
```

7.2.3 Wenner

To configure the Wenner array:

1. Enter Wenner configuration on menu 2 by pressing **3: Wenner**.
2. Select or create a data file the first time a new measurement is taken, for example at a new sounding or a new line.
3. The previously used Wenner spacing **a**, the distance between the electrodes, is displayed. Type the new a value and press **ENTR**.
4. Press the **MEA** key to start the measurement.

M23 WENNER

1. Select data file:LINE1
2. Create data file
3. a = 100.0 m

Apparent res:

Resistance:

Standard deviation:

Cycles:

Current:

MEA: Start measurement

MEN: Up level

7.2.4 Dipole-Dipole

To configure the Dipole-Dipole array:

1. Enter dipole-dipole configuration on menu 2 by pressing **4: Dipole-Dipole**.
2. Select or create a data file the first time a new measurement is taken, for example at a new sounding or a new profile line.
3. The previously used parameters are displayed. Enter the new **a**, **n** and/or **B_{pos}** electrode position values (**B_{pos}** is the position of the B electrode along the survey line). Enter only values you want to change. For example, if you want to keep the existing a and **B_{pos}** position values, just change the n value.
4. Press the **MEA** key to start the measurement.

M24 DIPOLE-DIPOLE

1. Select data file:LINE1
2. Create data file
3. a = 10.00 m
4. n = 1.00
5. Bpos = 0.00

Apparent res:

Resistance:

Standard deviation:

Cycles:

Current:

MEA: Start measurement

MEN: Up level

7.2.5 Pole-Dipole

To configure the Pole-Dipole array:

1. Enter Pole-Dipole configuration on menu 2 by pressing **5: Pole-Dipole**.
2. Select or create a data file the first time a new measurement is taken, for example at a new sounding or a new line.
3. The previously used parameters are displayed. Enter the new **a**, **n** and/or **AB** distance values. Enter only the values you want to change. For example, if you want to keep the existing **a** and **AB** distance, just change the **n** value.
4. Proceed to press the **MEA** key to start the measurement.

7.2.6 Pole-Pole

To configure the Pole-Pole array:

1. Enter pole-pole configuration on menu 2 by pressing **6: Pole-Pole**.
2. Select or create a data file the first time a new measurement is taken, for example at a new sounding or a new line.
3. The previously used parameters are displayed. Enter the new **a**, **AN** distance, and/or **AB** distance values. Enter only the values you want to change. For example, if you want to keep the existing **AN** and **AB** distance, just change the **a** value.
4. Proceed to press the **MEA** key to start the measurement.

7.2.7 SP Measurements

SP refers to voltage changes in the ground, caused by either background noise, ore bodies, or streaming water. SP, when

M25 POLE-DIPOLE

1. Select data file:LINE1
2. Create data file
3. $a = 10.00$ m
4. $n = 1.00$
5. $AB = 100.0$

Apparent res:

Resistance:

Standard deviation:

Cycles:

Current:

MEA: Start measurement

MEN: Up level

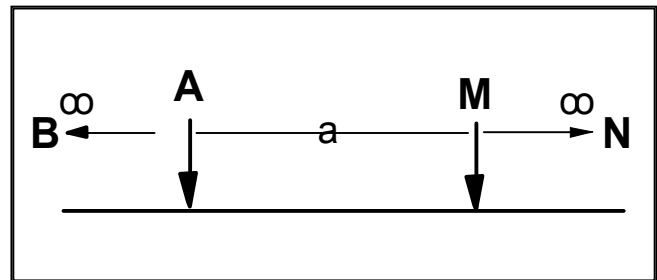


Figure 35: Pole-pole electrode array

M26 POLE-POLE

1. Select data file:LINE1
2. Create data file
3. $a = 10.00$ m
4. $AN = 100.0$
5. $AB = 100.0$

Apparent res:

Resistance:

Standard deviation:

Cycles:

Current:

MEA: Start measurement

MEN: Up level

referring to Spontaneous Potential, indicates general changes in voltage in the ground. These changes happen because of different physical properties in the ground and the background potentials vary between a few millivolts to a few tens of millivolt.

SP, referring to Self-Potential, detects negative potential at the top of ore bodies. It was first used by people who were looking for ore bodies that came up close to the surface but were covered with dirt. Rainwater seeped down into the ground to bring oxygen from the atmosphere, influencing the ore and thereby setting up the ore body as one huge but very weak battery. The top of the ore body always becomes negatively charged. This negative potential is typically detected at 100-200 mV, if very careful voltage measurements are performed on the ground above the ore body.

When water flows through the ground, a Streaming Potential (SP) voltage is created. Underground streaming water is detected when carefully measuring the voltage on the top of the ground. Streaming potential can typically produce up to 100-200 mV.

The SuperSting R1/IP instrument model can measure SP without any external equipment. For SP measurements using the SuperSting R8/IP, use the Box for SP measurement delivered with instrument. See **Performing an Automatic SP** Survey on page 54.

It is important to use non-polarizable electrodes (part # 920023 or 920099) when measuring SP.

7.2.8 SP Absolute

The SP Absolute option is used when SP (self-potential) is measured with one fixed base electrode. For each measurement, enter the x- and y-coordinate for the moving non-polarizable electrode. This option is only available in the SuperSting R1/IP instrument.

7.2.9 SP Gradient

Use the SP Gradient option when the SP gradient (two moving non-polarizable electrodes) is measured. Enter a=electrode spacing when starting the survey and the x- and y-coordinate for the moving non-polarizable electrode array. This option is only available in the SuperSting R1/IP instrument.

M 3 T E S T M O D E

1. Contact resistance test

2. Cable test

3. Receiver test

4. Relay test

5. Program address

MEN: Up level

7.3 Test Mode Menu

The contact resistance test is used when performing automatic multi electrode surveys. It is always performed after the system is set up for survey and before the actual survey starts. It is performed to ensure that all electrodes are connected properly and the contact resistance reasonably low and even from electrode pair to electrode pair.

The other tests are used to test specific parts of the system and are recommended to be used for example before and after a resistivity or IP project is started.

7.3.1 Contact Resistance Test

This test measures the contact resistance along the complete electrode cable layout. Enter the “Start address” (first electrode) and “End address” (last electrode) before starting the test by pressing **F1**.

When the test is started, the instrument will send out a current between the first two electrodes and simultaneously measure the voltage between the same electrode stakes. Therefore, a value will be measured comprising of the following:

- Contact resistance between the first stake and the ground
- Resistance in the ground
- Contact resistance between the ground and the second stake

This value is displayed on the instrument display and the test will continue between electrodes 2 and 3 and so on. If the electrode spacing is equidistant along the profile and near surface conditions are the same, one can expect similar ground/contact resistance along the profile. If near surface conditions change, for example from loose sand to moist clay, one can expect a change in contact resistance from higher values (loose sand) to lower values (moist clay), but values should stay similar within each unit.

Use this test to measure the contact resistance along the profile. If any of the measurements should show a significantly larger value, check that electrode pair to make sure it makes good contact to the ground and that the switch makes proper contact with the electrode stake. If the contact resistance is high because of local soil conditions, it usually helps to push the stake deeper into the ground and/or to pour some salt water on the ground where the electrode is planted. Be careful to avoid spilling water on the electrode switch or cable.

If the instrument stops and displays an error code it typically means that the electrode switch is not connected to the stake (error code HVOVL) or that the stake is too loosely planted in the ground (error codes INOVL and TXOVL). In such cases the stake may seem to be properly planted but minute vibrations from traffic or wind may change the stake/ground contact resistance so that the error codes are issued.

After the electrode stakes have been inspected and corrected, continue the contact resistance test from where it was interrupted by pressing the **F1** key. This will re-test the problem electrode pair; pressing **F2** will skip the problem pair and continue.

7.3.2 Cable Test

This test is only available for the SuperSting R8/IP instrument. Use it to test the dual-mode cable functionality. The dual-mode electrode switches are comprised of two parts. There is the large stainless steel take-out used for current and potential measurement, and the small banana jack take-out used for potential measurement (a small stainless steel cylinder take-out on the old style dual-mode electrodes).

To test the large take-out on the cable:

1. Connect the dual-mode cable to be tested to one of the two “ELECTRODE CABLE” connectors on the SuperSting front panel.
2. Set the “Separate potential:” to OFF, ensuring that both current and potential are measured through the large take-out.
3. Attach the test cable (part # 951019, available from AGI) between the white banana connector on the SuperSting R8 front panel and clip the large test clamp over the large take-out of the first dual-mode electrode to be tested. Do not connect the small banana plug (small test clamp for old type dual-mode electrodes) and make sure to keep it away from any electrode switch.

NOTE: There are two test cables, used only for testing dual-mode electrodes, available. The cable for dual-mode switches (with the micro banana plug) is part # 951019; the cable for older dual-modes, with two Mueller clips, is part # 951017. Neither is included in a standard shipment. Contact AGI at sales@agiusa.com, with the part number and type of dual-mode switch, to order a test cable.

4. Press **F1** to test the electrode.
5. The SuperSting will issue a PASS or FAIL for each of the eight channels.
6. Move the clamp to the next dual-mode electrode and press **F1** and so on.

To test the small take-out on the cable:

1. Set the “Separate potential:” to ON, ensuring that current is injected through the large take-out and potential is measured through the small take-out.
2. Attach the test cable between the white banana connector on the SuperSting front panel and clip the large test clamp over the large take-out of the first dual-mode electrode to be tested. Do not connect the small banana plug (small test clamp) and make sure to keep it away from any electrode switch.
3. Press **F1** to test the electrode.
4. The SuperSting should now issue a FAIL for each of the eight channels. This indicates that the potential lines are not connected to the large take-out when the “Separate potential” option is set to ON.
5. Disconnect the large test clamp and make sure to keep it away from any electrode switch.
6. Connect the small banana plug (small test clamp) to the small take-out.
7. Press **F1** to test the electrode.
8. The SuperSting should now issue a PASS for each of the eight channels. This indicates that the potential lines are connected to the small take-out when the “Separate potential” option is set to ON.
9. Disconnect the small test clamp and repeat the test on the next dual-mode electrode.

7.3.3 Receiver Test

This test is only available for the SuperSting R8/IP instrument. For this test, using the 2 meter jumper cable, connect the Test box, delivered with the instrument, to the left (male) connector of the two electrode cable connectors on the SuperSting front panel. **Do not connect the dual-mode cable.** Press the **MEA** key to start measuring. When the receivers work properly, the readings should be approximately 0.5 Ω .

To test the receiver in the SuperSting R1/IP, connect the test box as described above and perform a resistance measurement in manual mode (Menu2/1). The reading should be approximately 0.5 Ω .

7.3.4 Relay Test

This test tests the function of the relays in the dual-mode cable. Connect the dual-mode cable to be tested to one of the two “ELECTRODE CABLE” connectors on the SuperSting front panel. During the test, the A and B relays (SuperSting R8/IP) are tested for each electrode switch along the cable. For SuperSting R1/IP the A, B, M and N relays are tested with this test.

7.3.5 Program Address

This function is used to reprogram the addresses of the dual-mode electrode switches. To reprogram a switch, the serial number of the switch must be known. A list of electrode switches and their serial number was supplied when the equipment was delivered. If the list of serial numbers has been lost, there is an Address Re-programming Kit available. See **Address Re-Programming Kit** on page 128.

To reprogram an electrode switch:

1. Connect the electrode string with the dual-mode switch to be re-addressed to the SuperSting R8/IP or SuperSting R1/IP.
2. Power up and go to **3. Test mode**.
3. For SuperSting R1, select **4. Program address**. For SuperSting R8, select **5. Program address**.
4. Select **1** to enter the new address.
5. Select **2** to enter the serial number of the electrode switch to be reprogrammed.
6. For SuperSting R1, press **F1** to re-program the electrode switch. For SuperSting R8, press **F3** to re-program the electrode switch.
7. The electrode switch now has the address specified above.

7.4 Log Settings Menu

Select option 4 on the main menu to get to the Log settings menu. Set time increment in seconds to start the SuperSting to take 8 simultaneous readings. This function is used when the SuperSting is used to monitor a set of electrodes over a certain time period. Measurement cycle starts at the given interval. Enter 0 seconds to turn this function off.

M 4 LOG SETTINGS

1. Log mode

MEN: Up Level

7.5 File Management Menu

Select option 5 on the main menu.

7.5.1 Open Data File

Select option 1 to open a new data file. Use + and – to scroll through the data files, press enter to select the file.

7.5.2 Delete Data File

Select a data file using + or – and delete by pressing enter. If the file has not been downloaded to a PC, **Warning: File not dumped to PC Press . to confirm** is displayed. By pressing the . (dot) key, the deletion is confirmed and the file deleted.

M 5 FILE MANAGEMENT

DATA FILE MANAGEMENT

1. Open data file
2. Delete data file
3. View data file
4. Format disk

COMMAND FILE MANAGEMENT

5. Delete command file
6. Delete all command files

MEN: Up Level

7.5.3 View Data File

Select option 3 to view data in the opened file.

7.5.4 Format Disk

To format the virtual disk memory, select option 4 and then press 1. The message IN PROGRESS will appear. When formatting is finished, the message **DONE** is displayed. This function should only be used after replacing the back-up battery. The format function will only erase the data memory. Settings and command files will not be changed.

7.5.5 Delete Command File

Select option 5 to delete a single command file. Select a command file using + or – and delete by pressing enter. The system will display **Press . to confirm**. By pressing the . (dot) key, the deletion is confirmed and the file deleted.

NOTE: The system will not erase a command file that has been used to record a data file that has not been downloaded to a PC.

7.5.6 Delete All Command Files

Use this option to delete all command files.

7.6 System Settings Menu

Under this menu all instrument settings are configured.

7.6.1 Measurement Settings

Use option 1 – 9 and F1 to set the instrument measurement settings. Select option number, type the new setting and press enter.

Option F1 is used to save the current settings in a “User default” setting. This setting is recalled by pressing the **9** key.

7.6.1.1 Cycles

For each measurement station, the instrument can be requested to take a number of readings. This procedure is also referred to as “stacking.” During the measurement, the instrument calculates the average and standard deviation of these readings, displaying on the screen. The maximum number of readings to take at each station is set under “cycles.” The default factory setting is 2 cycles. The number is increased by pressing the **+** key. The largest number of stack is 300.

7.6.1.2 Max error

A threshold value can be set for the standard deviation. Then, if the standard deviation for all active channels is lower than the threshold value, the stacking procedure is interrupted prior to the set cycles has been reached. The default factory setting is 2.0 %.

7.6.1.3 Max repeat

If any of the channels receive the error message INOVL (meaning that the input amplifier for this channel has been overloaded during the measurement), the measurement at this station will be repeated for the channels that have received the INOVL message.

M 6 SYSTEM SETTINGS

1. Measurement settings
2. Cable addresses set-up
3. Set time & date
4. General settings
5. Switch box settings
6. Skip electrode list set-up

MEN: Up Level

M 6 1 MEASUREMENT SETTINGS

1. Cycles: 2
2. Max error: 2.0
3. Max repeat: 1
4. Max current: 1250mA
5. Measure time: 1.2s
6. Separate potential OFF
7. Measure mode: RES
8. Single-Step CMD Lines: OFF
9. Use Address Table
10. Defaults:FACTORY
- F1. Save user defaults

MEN: Up Level

If the error message TXOVL (meaning that the transmitter amplifier has been overloaded during the measurement) is given during the measurement, the measurement will be repeated for all channels at this station.

If, after the set number of cycles has been reached, one or more channels have not reached a standard deviation that is lower than the set “Max error,” the instrument will repeat the measurement at this station for the channels with higher standard deviation than the set value. This function is only relevant in the SuperSting R8/IP instrument.

The default factory setting is 1.

7.6.1.4 Max current

To select the maximum current to be used for each measurement select # 4, scroll through the possible settings using the + and – key and then press **ENTR**. The default factory setting for the maximum current setting is 1,250 mA.

7.6.1.5 Measure time

To select the measure time to be used for each individual measurement, select number 5, scroll through the possible settings using the + and – key and then press **ENTR**. Note that the measurement time is connected to the measure mode so that in the resistivity mode (RES, only resistivity is measured) the available times are 0.4 sec, 0.8 sec, 1.2 sec, 3.6 sec, 7.2 sec and 14.4 sec. In the resistivity/IP mode (RES/IP, resistivity and IP is measured simultaneously) the available times are 0.5 sec, 1 sec, 2 sec, 4 sec and 8 sec. The default factory setting is 1.2 seconds in RES mode and 0.5 seconds in RES/IP mode).

7.6.1.6 Separate potential

This function is only useful when non-polarizable electrodes are to be used with the dual-mode electrodes.

The patented dual-mode electrode switches have two “take-outs.” In most cases it is sufficient to attach the switch to the stainless steel stake using the stainless steel spring. Current is then injected through the stainless steel stake into the ground and when the same unit is used for potential electrode the potential is measured through the stainless steel stake.

However, if the highest quality IP data is required, you can connect a non-polarizable electrode a short distance to the side of the stainless steel stake and perpendicular to the survey line. The non-polarizable electrodes are connected to the small banana jack (small take-out on the old dual-mode electrodes) at one side of the Dual-Mode Smart Electrodes by a jumper cable.

If you are using just a stainless steel stake, “Separate potential” should be set to **OFF**. If you are using a stainless steel electrode and a non-polarizable electrode, “Separate potential” should be set to **ON**. Toggle between ON and OFF by pressing **6**.

7.6.1.7 Measure mode

Press number **7** to toggle between RES or RES/IP mode. When the RES mode is selected, only resistivity is measured using the special measurement strategy developed for resistivity measurements. When the RES/IP method is selected, the special measurement strategy that has been adopted for IP measurements is used.

7.6.1.8 Single-step command lines

Single-step command lines allows you to measure one command line at a time as you step forward by pressing the **MEA** key for each step.

7.6.1.9 Use Address Table

By pressing **9**, you can toggle between Use Address Table/Use Command File Addresses.

The address table (see **Cable Addresses Set up** on page 96) is used by the instrument to calculate measuring commands when roll-along is used. The table simply shows how the cable is divided.

In some special situations, for example if your electrodes have addresses 57-84 (the first electrode does not start with 1) and you want to use a command file with the actual addresses, (57-84), you must then turn off the address table function. Note that all command files created with the Administrator software start with address 1 and therefore you do not need to turn off the address table if the command files are created with the Administrator software.

The most common setting is to always have the User Address Table active.

7.6.1.10 Defaults

There are three default modes; FACTORY, USER and <none>. Toggle between modes by pressing the **9** key.

The factory default settings are as follows:

CYCLES:

2

Max error:	2.0
Max repeat:	1
Max current:	1,250 mA
Measure time:	1.2 s in RES mode, 0.5 s in RES/IP mode
Separate potential	No default setting, the user setting will be kept at all times
Measure mode:	No default setting, the user setting will be kept at all times
Address Table:	Use Address Table

To set your own defaults, change any of the parameters 1 – 5 and 8, then press **F1**. Your default values are now stored and can be recalled by pressing the **9** key to select USER.

NOTE: If a change in settings is required, which is not covered by the FACTORY or USER defaults, the defaults option needs to be set to <none> by pressing the **F2** key. This is because, if for example the FACTORY default is chosen and some setting is changed, this setting will automatically be changed back to the FACTORY setting when measurement begins.

7.6.2 Cable Addresses Set up

This menu is used to enter information about your electrode cable. The instrument uses this information to calculate the correct position of the electrodes when performing surveys using the roll-along technique.

NOTE: The cable address table is only to be set up once before the survey starts. Do not change the table during roll-along since this will ruin the data. Never change the address table during a survey unless a new cable configuration is desired.

An electrode cable typically consists of a number of cable strings, each cable string having a number of electrode switches (smart electrodes) or take-outs (passive cables). Each electrode switch or take-out has a unique address.

NOTE: Command files created with the Administrator software always have the electrodes in number sequence, starting with the first electrode as number 1. However, in reality your electrodes may have other numbers (starting with a number other than 1). The address table on menu 6/2 is used to map your physical electrodes to the electrodes in the command file.

To start entering information, press the **1** key (to erase an existing cable table, press the **2** key).

- Enter the lowest address of the first electrode string, **1** in this example.
- Enter the highest address of the first electrode string, **14** in this case.
- Press **1** for new cable section.
- Enter the lowest address of the second electrode string, **15** in this example.
- Enter the highest address of the second electrode string, **28** in this case.
- Press **1** for new cable section.
- Continue until all cable strings and their addresses have been entered.

With this set up, the instrument will calculate coordinates and addresses based on moving 14 electrodes at a time. If you want to move another number of cables for each “roll,” for example, 7 in this scenario, you will need to clear the current table and enter a new table with four strings of 7 electrodes each.

NOTE: The number of electrodes in the command file must be the same as the number of electrodes in the cable address table.

The strings entered do not need to have the same number of electrodes. However, the total number of electrodes entered in the table must be the same number as the number of electrodes in the command file used.

M62 Cable Addresses Setup

1. New cable sections
2. Clear table

Addr Low:	High:	
Section	AddrL	AddrH
1	1	14
2	15	28
3	29	42
4	43	56

+/- SCROLL ENTR:EDIT F3:DELETE

MEN:Up level

For ease of operation in the field, the strings are entered in consecutive number order. Strings can be entered into the table in any order, but then the strings must be laid out in this very same order when the survey starts in the field.

Also note that if you are using a switch box and passive cables, you must enter the correct number of strings, even if you are not going to use roll-along. For example; if you have a switch box/56, you cannot enter just one string with start address=1 and end address=56. You must enter at least one string of 1-28 and another of 29-56.

7.6.2.1 Broken smart electrode

If a cable section is damaged, the survey can continue without the broken section, but with fewer electrodes. To continue a survey, proceeds as follows:

- Create a new command file using the Administrator software. Make sure that this new command file has the same number of electrodes as you have working electrodes on the cable.
- Load this new command file into the SuperSting.
- Change the address list not to include the addresses of the removed section. See **Cable Addresses Set up** on page 96.

7.6.3 Set Time and Date

To set time:

1. Press the **F1** key.
2. Enter time as hhmmss.
3. Press **Enter**.

To set the date:

1. Press **F2**.
2. Enter date as yymmdd.
3. Press **Enter**.

7.6.4 General Settings

M 6 4 G E N E R A L S E T T I N G S

1. Automatic shutoff: ON
2. Start firmware update
3. IP Delay: 65 ms
4. Set defaults
5. Commutate Delay: 100 ms
6. Use R1 Cable: OFF
7. HIVOLT: 400
8. Baud Rate: 38400
9. Show Apparent Res: ON
- F1: HV Delay: 2ms

MEN: Up Level

7.6.4.1 Automatic shut off

Press the number **1** key to specify how long in minutes, between 1-60, the instrument will stay on after the last key-press. When this option is activated, the instrument will automatically shut off after the keyboard has been inactive for a user-specified number of minutes. However, as long as the instrument is performing an automatic survey it will stay on. After the survey is ready, the instrument will stay on for specified time and then shuts off if the keyboard has not been used in this time. Use time=0 to deactivate this function, enabling the instrument to stay on until you shut it off.

7.6.4.2 Start firmware update

This function is used when the firmware is being updated. See **Loading New Firmware into the SuperSting Flash Memory** on page 102.

7.6.4.3 IP Delay

This is the time delay after current is shut off until the first IP window is measured. The recommended default setting is 65 ms.

7.6.4.4 Set defaults

By pressing the **4** key, the default general settings are set. They are:

- Automatic shutoff: No default setting, the user setting will be kept at all times
- Switch COM delay: 60 ms
- Commutate delay: 100 ms
- Sting/Swift cable: OFF
- HIVOLT: 400
- Baud rate: 38400

7.6.4.5 Commutate delay

The delay during which the instrument will wait before starting measuring after the current has been commutated. This value can be set between 30-3000 milliseconds. The recommended default setting is 100 ms.

7.6.4.6 Use R1 cable

Single-channel R1 dual-mode cables or single-channel switch boxes can be used with the SuperSting R8/IP when this setting is set to ON. Note that when using the single-channel R1 dual-mode cables, the SuperSting R8/IP will only measure one channel for each current injection. The SuperSting R1/IP can only work with the R1 electrode cables.

In the SuperSting R1, this function is always set to ON; in the SuperSting R8, this function default is OFF. In other words, typically 8-channel dual-mode cables or switch boxes are used with the SuperSting R8.

7.6.4.7 HIVOLT

This value specifies the maximum voltage of the transmitter. It is set between 160 – 400 V. Note that the displayed value is an integer and the increments are in 1.6 V steps, therefore the value you specify may change slightly when you press **ENTR**. Default value is 400 V.

7.6.4.8 Baud rate

The **8** key scrolls through the possible baud rate settings: 2400, 4800, 9600, 19200 and 38400. The default value is 38400 baud.

7.6.4.9 Show apparent resistivity

This function is used on the SuperSting R8 to see more information. When “Show apparent res” is set to OFF, the column for the apparent resistivity values is replaced by a column that displays the address of the first potential electrode in the command file for this channel. The idea is to be able to see approximately where the measurements are being taken along the line.

This function has no effect on the SuperSting R1, since both electrode coordinates and apparent resistivity fit on the screen.

7.6.4.10 HV delay

This is the delay for the high voltage converter when it is auto ranging. The recommended default setting is 2 ms.

7.6.5 Switch Box Settings

The SuperSting can be used with one or several switch boxes and passive cables. For the system to work properly, enter each switch box used into the system (See **SuperSting Electrode Switch Box** on page 123 for options). To enter a switch box:

1. Press the **1** key to add a switch box.

2. Use the + or – key to scroll through the list of available switch boxes to select the appropriate box. The number displayed is the electrode switching capability of each box.
3. Press the **2** key to clear the switch box list. Several boxes need to be entered if multiple boxes are daisy chained together.

7.6.6 Skip Electrode List Setup

This feature is used when an electrode position cannot be used because some obstacle, such as pavement, a building, a pond etc., is occupying the station. Press the **1** key to add the address of the electrode to be skipped. Up to 8 electrode addresses may be entered into this list. Measurements that include any of the listed electrodes will be omitted. The instrument will keep this list in memory even if the instrument is turned off.

To clear the list of skip addresses, do one of the following:

- Press the **2** key
- Select “Set defaults” on menu 6/4

Note 1 Any address entered in this list will be skipped during the survey. Therefore, it is important to remember to clear this list for the survey of the next line.

Note 2 This function is not intended to skip broken electrodes. If you have broken electrodes:

1. Remove the cable section with the broken electrode.
2. Create a new command file using the Administrator software, with the number of working electrodes (the number of electrodes on the cable, less the damaged electrode section) and load it into the SuperSting.
3. Modify the Address table not to include the address(es) of the broken electrode cable section. See **Cable Addresses Set up** on page 96.

7.7 The System Information Menu

The system information menu displays contact information to Advanced Geosciences, Inc., firmware version currently installed in the instrument, and serial number of the instrument.

M 7 S Y S T E M I N F O R M A T I O N

Advanced Geosciences, Inc.
2121 Geoscience Dr.
Austin, Texas 78726

Phone: +1-512-335-3338
E-mail: support@agiusa.com

Software version: 01.23.60E
Serial #SS000626

MEN: Up level

8 Administrator for SuperSting Software

The Administrator for SuperSting software was delivered on a CD with your instrument. The Administrator for SuperSting is used to:

- Load new firmware into the SuperSting RAM memory.
- Create new command files.
- Load command files into the RAM memory.
- Download data files from the SuperSting into your PC.
- Convert the data file so that it is formatted for other common software.
- Re-address the electrodes when using the re-addressing kit, see section 10.6.

To install the software on your computer:

1. Insert the disk in your CD drive.
2. Using Explorer, double click the file **AGISSAdmin-1.3.2.171.exe** (version will vary).

The Administrator for SuperSting software will be installed.

The files are transferred in binary format, but the resulting file in the computer is a regular text file. The SuperSting file protocol used for communication is proprietary information and of no real use for the user.

The only way to up/download data is by using the Administrator for SuperSting software, which handles all aspects of establishing connection and transferring data.

Communications details:

Baud rate: 38400
Data bits: 8
Stop bits: 1
Parity: NONE

Getting an "Access denied" message is a common problem when running the Administrator for SuperSting on your computer. It indicates that the port specified is already in use by some other application or some other function within our program. In this case, check for other software running on the laptop that actually opens the port and keeps it opened. Locate that program and shut it down.

If you are using a Palm organizer with the HotSyncManager, chances are that the HotSyncManager is running (auto-starts every time you start the computer) and uses the COM1 port (keeps it open all the time).

Check if HotSyncManager is running by looking into the system tray in the lower right corner of your screen. If it is running, there will be a small red and blue circular icon. Click the icon and select Exit to stop it, and then restart Administrator for SuperSting.

8.1 Connecting the SuperSting to a Computer That Only Has a USB Port

Many newer computers are delivered with a USB port instead of a serial port. To connect the SuperSting to a computer with USB port, you will need a USB/Serial adapter (part # 951063). Note that this adapter will install itself as COM4 if the COM1 port is occupied by other devices. If more than four ports are occupied, the USB/Serial adapter will install itself to the next higher COM port. For example, if eight ports are occupied, the adapter will install itself as COM9.

Before you can use the Keyspan USB/Serial adapter, you must install the Keyspan driver. This driver was delivered on a CD with the Keyspan USB/Serial adapter. To install the driver:

1. Make sure not to connect the USB/serial adapter to the computer.
2. Insert the CD and select the driver for your computer.
3. Double click the driver and follow the installation instructions.

To find out what COM port the adapter is installed on:

1. Go to the computer **Device Manager**. In Windows XP, go to the Control panel/System and look under the **Hardware** tab to find the Device Manager.
2. In the Device Manager, look under **Ports** to find the one labeled **Keyspan High Speed USB Serial Adapter** (previous model of adapter ATEN USB to Serial Bridge). The COM port on which the adapter installed itself is listed there.

Make sure to go to the **Config** option on the menu bar of the Administrator software and select the same COM port, prior to establishing a connection between the SuperSting and the computer.

Press **Connect** to make sure that the communication works, indicated by a green light. Press **Disconnect** and a red light appears.

8.2 Loading New Firmware into the SuperSting Flash Memory

From time to time, new firmware for the SuperSting is available at our UserGroup on our web site at <http://www.agiusa.com>. We recommend that you register as a SuperSting owner to get a password to access this site. This way you can download the new firmware and load it into the SuperSting flash memory. By doing this, your SuperSting will always be up to the latest firmware standard.

SuperSting R1 and R8 changed microprocessor type in 2003. The new microprocessor needs a different firmware update file than the original microprocessor. When updating the firmware, you must be very careful to download the correct file for your instrument. The new SuperSting instruments use a CPU Model E and the corresponding firmware has been marked with an "E" identifier (for example, version 1.3.41E).

IMPORTANT

You must use version 1.3.3.180 or later of the SuperSting Administrator to send firmware of “E” type into your instrument if the instrument is of the new “E” model. Earlier Administrator versions are not able to load firmware of “E” type into the SuperSting.

To find out which model you have, look at the current firmware version number on the SuperSting menu 7. If it ends with a letter “E” then you have the Model E type and you need to make sure only to load firmware of “E” type.

To load new firmware into the SuperSting:

1. Make sure to use version 1.3.3.180 or later of the Administrator software if you install firmware of “E” type. Earlier versions of the Administrator cannot install firmware of “E” type.
2. Using the special cable for loading firmware (part # 951016) into the SuperSting, connect the SuperSting to the serial port of your computer. Do not confuse this cable with the data download cable (part # 920009). Connect the cable to the 6-pin COM connector marked “POWERSTING COM,” or “Ext. TX. COM,” for earlier models, on the SuperSting R8/IP front panel (PC SERIAL COM2 on the SuperSting R1/IP).

NOTE: For firmware uploading, only use a computer with serial port. Communication with a USB/Serial adapter is not working properly for this purpose. The best way to load firmware into the SuperSting with WiFi is through the SuperSting Manager App. See **Firmware Update** on page 79.

3. Turn on the SuperSting and go to the main menu.
4. Start the Administrator for SuperSting software.
5. Select the AGI SuperSting Firmware Updater under the Window option on the Administrator for SuperSting menu bar.
6. Make sure to select the correct com port.
7. Click the “Load firmware” button and select the firmware update file (xxxxx.agi) you want to load.
8. The Administrator Transfer progress window displays “Successfully loaded image file version x.x.x. Transferring start program to SuperSting. Start SuperSting in boot mode.”
9. At this point, on the SuperSting, go to Menu 6 and select **4. General settings**.
10. Press **2. Start firmware update**.
11. The software is being transferred to the SuperSting. This is a sensitive process, so make sure to leave the instrument and computer alone until the process is finished. This will take about 15 minutes.

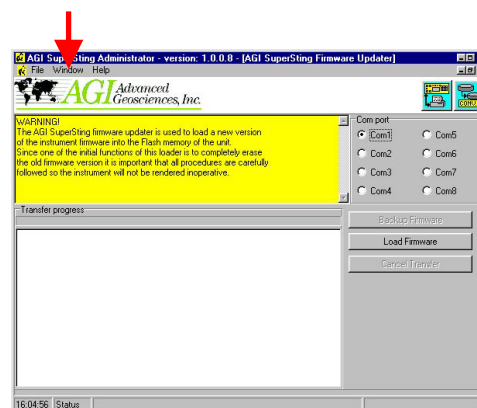


Figure 35: The SuperSting firmware update window

12. When the uploading process is finished, the progress window displays “Firmware transfer complete, restart SuperSting!”
13. Restart the SuperSting.

8.3 Creating a Command File

When measuring, the SuperSting is controlled by command files stored in the instrument RAM memory. Command files are simple text files that tell the instrument how to perform the measurements. Command files can be manually made by the user, using a regular text editor, or automatically made using the “Command creator module” of the SuperSting Administrator.

To create a command file using the Administrator, proceed as follows:

1. Click the button for the SuperSting Command Creator module (top right corner of the Administrator).
2. Make sure to check the box for SuperSting R1/IP if the command file is for a SuperSting R1/IP and to un-check the same box if the command file is for a SuperSting R8/IP.

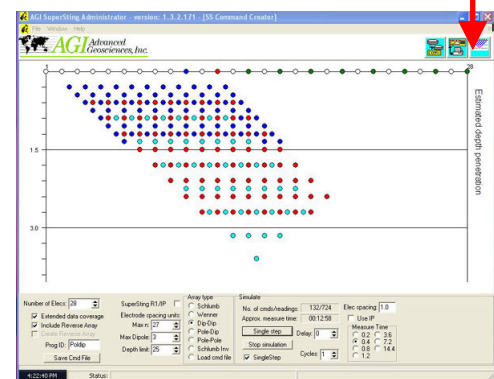


Figure 35: Use the command creator window to create a command file

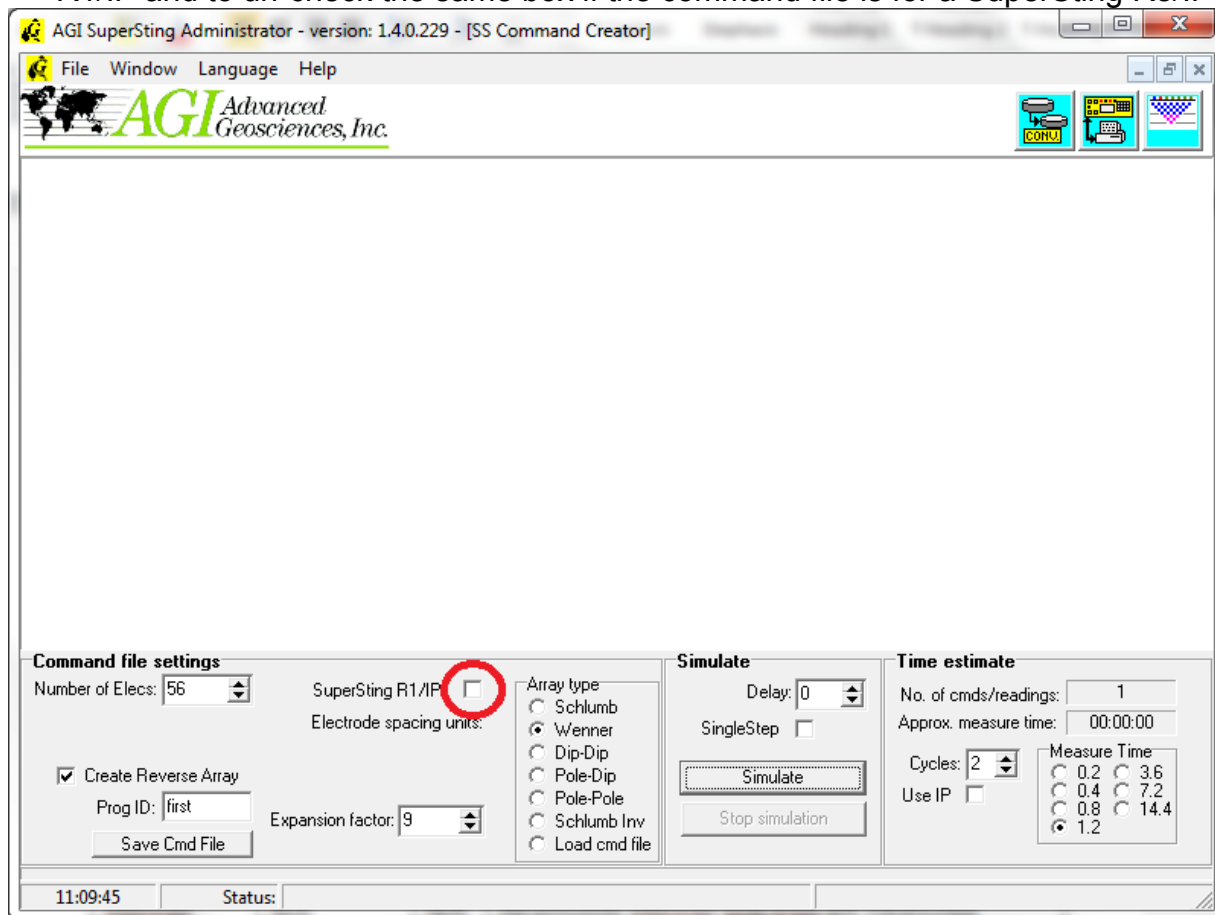


Figure 36: SuperSting Administrator command creator, SuperSting R1/IP box

3. If the command file is for a SuperSting R8/IP, we recommend you check the **Create Reverse Array** box. This will in many cases speed up roll-along surveys when using the SuperSting R8/IP. For SuperSting R1/IP you do not need to check the box.

4. Enter the number of electrodes you are using.

5. Enter a program ID name in the Prog ID window. This is the ID you will see on the SuperSting display, when you select command file for a survey. It is also the default name for the command file name when you save the command file.

6. Choose an array type.

Electrode spacing units vary, depending on the array selected. The following table lists recommended settings for the **Electrode Spacing Units**.

Array type	Electrode spacing unit options	Electrode spacings	Description
Schlumb	Max AB/MN	11	Keeping the relationship AB/MN less than or equal to 11 gives a strong signal in most cases.
Wenner	N/A	N/A	All possible Wenner spacings are measured.

Dip-Dip	Max n	8	Distance to separate the transmitter and receiver. 8 sends a strong enough signal in most cases.
	Max Dipole	6	Setting depends on the number of electrodes. For 28 electrodes, set to 3; for 56, set to 6. Set a large number to get all data.
Pole-Dip	Max sep	20	20 sends a strong enough signal in most cases.
	Max Dipole	3	Setting depends on the number of electrodes. For 28 electrodes, set to 2; for 56, set to 3. Set a large number to get all data. Make sure to set the remote electrode at “infinity” approximately in line with the electrode line.
Pole-Pole	Max sep	55	Number of electrodes, less one. Make sure to set the remote electrode at “infinity” approximately in line with the electrode line.
Schlumb Inv	Max AB/MN	11	Keeping the relationship AB/MN less than or equal to 11 gives a strong signal in most cases.

- Click the **Simulate** button to see the measurement sequence in a graphical presentation. If the Single Step window is checked you can step through the measurement sequence one step at a time.
- Finally, click **Save CMD File** to save the command file.

Additional settings apply to dipole-dipole array.

The screenshot shows a software interface with three main panels. The left panel, titled 'Command file settings', includes a 'Number of Elecs' dropdown set to 56, checkboxes for 'Extended data coverage', 'Include Reverse Array', and 'Create Reverse Array' (which is checked), a 'Prog ID' text field with 'first', and a 'Save Cmd File' button. The middle panel, titled 'Simulate', has a 'SuperSting R1/IP' checkbox, 'Electrode spacing units' with 'Max n' (6) and 'Max Dipole' (26) dropdowns, an 'Array type' list with radio buttons (Schlumb, Wenner, Dip-Dip (selected), Pole-Dip, Pole-Pole, Schlumb Inv, Load cmd file), a 'Delay' dropdown set to 100, a 'SingleStep' checkbox, and 'Simulate' and 'Stop simulation' buttons. The right panel, titled 'Time estimate', shows 'No. of cmds/readings' as 1, 'Approx. measure time' as 00:00:00, 'Cycles' as 2, a 'Use IP' checkbox, and a 'Measure Time' section with radio buttons for 0.2, 0.4, 0.8, 1.2, 3.6, 7.2, and 14.4 (where 1.2 is selected).

Extended data coverage: The instrument will take overlapping readings in areas that are already covered by the normal measurement. This function is intended especially for the SuperSting R8, where there is not a large time difference in recording with or without extended data coverage. The additional information may help improving the data inversion process.

Include reverse array (includes reciprocal data): The instrument will first measure from left to right and then continue to measure from right to left, thereby creating a data file with two overlapping data sets. According to the rule of reciprocity, a measurement made with AB and MN replacing each other will be exactly the same as the original measurement. The

EarthImager 2D software has an option to view the reciprocal data error distribution and to manually remove data with high error or to automatically “down weight” the influence of data with high error.

Create Reverse Array: This option measures only from right to left. This is especially valuable when using the SuperSting R8 for roll-along measurements. By measuring in this way, all 8 channels of the instrument can be better utilized and the survey will be faster. This setting is always recommended with the SuperSting R8.

In the **Simulate** section, a number of entries are given to estimate the approximate time for a survey.

No. of cmds/readings: Indicates how many commands (current injections) and resistivity measurements are in the actual command file.

Approx. measure time: Indicates the approximate time for a survey with this command file, assuming the settings in the Simulate section. Note that this time is only approximate since, because of noise interference, there is no way of knowing how many repeat measurements there will be.

Use IP: Check this box if you are going to perform an IP survey. This parameter is only used to calculate the approximate time for the survey.

Cycles: Enter the number of measurement cycles (stacking) you are going to perform. This parameter is only used to calculate the approximate time for the survey.

Measure Time: Check the measure time you are going to use. This parameter is only used to calculate the approximate time for the survey.

Delay: This is the time delay between measurements when performing a simulated survey on the screen. Note that this delay time has no influence on the real measurements, but is used only to speed up or slow down the measurement plot on the computer screen.

Single step: Check this box if you want to step your way through the simulation one step at a time.

Simulate: Click this button to simulate a survey on the computer screen.

Stop simulation: Click this button to stop an ongoing simulation.

8.4 Loading a Command File Into the SuperSting RAM Memory

1. Connect the SuperSting to a PC computer using the “Cable for communication/PC MS Windows type computer” (part # 951002). Connect the cable to the serial port on the computer and to the SuperSting front panel connector marked “PC COM” (PC SERIAL COM1 on the SuperSting R1/IP).

NOTE: When using a computer without serial port, the Keyspan USB/Serial adapter (part #951063)

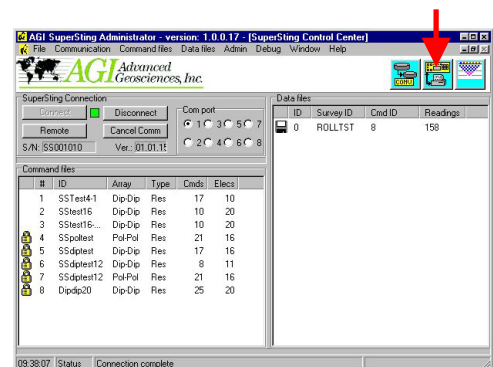


Figure 36: Use the command center window to upload command files and download data files

originally delivered with the instrument should be connected in series to one of the computer USB ports. See **Connecting the SuperSting to a Computer That Only Has a USB Port** on page 102.

2. Turn the instrument on.
3. Press any key to get to the main menu. Note that you must be in the main menu or the first level submenu when connecting to the computer.
4. Start the Administrator for SuperSting software.
5. Click the SuperSting control center module button.
6. Select the appropriate com port, found under the Config option on the menu bar.
7. Click the **Connect** button. A green light between the connect and disconnect buttons indicates that the connection is established. Available command files and data files in the SuperSting are also listed in the respective windows on the computer screen.
8. Under Command files on the Administrator menu bar, click the **Send new** command.
9. Select the command file to send. The selected command file is transferred to the SuperSting RAM memory. After a short moment, the file will be displayed in the **Administrators Command files** window, indicating that the file resides in the SuperSting.
10. Click the **Disconnect** button to disconnect the SuperSting from the Administrator.

Note that a padlock at the command file on the Administrator screen indicates that this file is used by one or more data files still residing in the SuperSting memory. Since this command file is used when any of these data files are downloaded, it is locked to prevent being prematurely erased. As soon as all the corresponding data files have been downloaded and erased from the SuperSting memory, the padlock will be removed and it is possible to erase the command file.

To erase command files from the SuperSting memory, right click the command file in the administrator window and then click **Erase Command**.

8.5 Downloading SuperSting Data to Your PC

1. Connect the SuperSting to a PC type computer using the “Cable for communication SuperSting/PC MS Windows type computer” (part # 951002). Connect the cable to the serial port on the computer and to the SuperSting front panel connector marked “PC SERIAL COM” (PC SERIAL COM1 on the SuperSting R1/IP).
2. Turn the instrument on.
3. Press any key to get to the main menu. Note that you must be in the main menu or the first level submenu when connecting to the computer.
4. Start the Administrator for SuperSting software.
5. Click the SuperSting control center module button.
6. Select the appropriate com port, found under the Config option on the menu bar.
7. Click the **Connect** button. The green light between the connect and disconnect buttons indicates that the connection is established. Available command files and data files in the SuperSting will also be listed in the respective windows on the computer screen.
8. In the “Data files” window, select the data file to download by right clicking on the file name. Click **Read File** and select a location in which to save the file.
9. When the transfer is finished, a message stating “Selected measure file read from instrument. File set saved as:” is displayed. Click **OK**.
10. Click the **Disconnect** button to disconnect the SuperSting from the Administrator.

NOTE: A red cross will mark each data file in the Administrator window, which has not been downloaded to a computer. To erase a data file, right click the data file in the Administrator window and then click **Erase File**. If the selected data file is marked by a red cross, a warning will be issued before the data file can be erased.

8.6 Converting the SuperSting Data for Use in Common Software.

The AGI EarthImager resistivity and IP inversion software directly reads the SuperSting data files (.stg format). The EarthImager software also reads the common .dat format for resistivity imaging surveys.

8.6.1 Converting Resistivity Data

For software other than the EarthImager, use the Administrator conversion module to convert the SuperSting data for use in the Res2Dinv, the Res3Dinv, the Surfer for Windows and the Resix Plus software.

NOTE: If you have EarthImager 2D or EarthImager 3D software for inversion, you do not need to convert the data. Just read the STG files into the EarthImager.

To convert for other software than EarthImager:

1. Start the Administrator for SuperSting software.
2. Under Window on the computer menu bar select the SuperSting data conversion.
3. Under **Select Output File Type**, specify what type of data you have.
4. Under **Select Output File Format**, specify to what software format you want to convert your data.
5. Select **All Datasets Into Files** if all data is going to be processed as one data set, as for example when performing a roll-along survey.
6. Make sure that the **Keep Negative Values** box is un-checked.
7. Check the **Remove Large Errors** box and specify at what % error data is omitted.
8. Select data file to convert by clicking the **Load Sting File** button.
9. Click the **Save converted file** button to specify where to save the converted data.

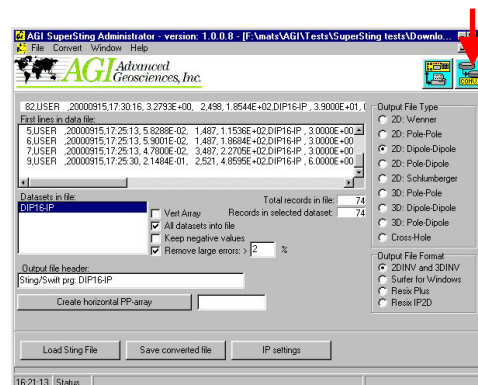


Figure 36: Use the Swift convert window to reformat data for other software

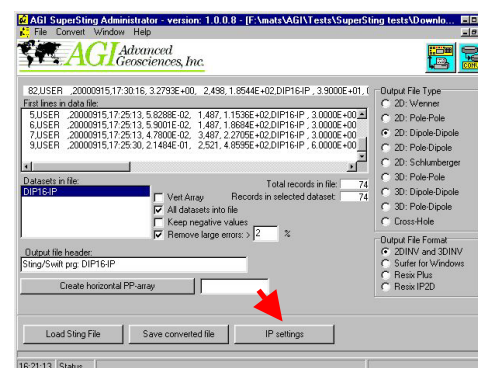


Figure 36: If IP data is present, the "IP settings" button will appear

8.6.2 Converting Resistivity/IP Data

If your data contains IP data, a new button lights up when loading the data into the software. To select the IP time windows to be included in the inversion, click this button.

A new window opens where the IP data can be graphically inspected. A single IP curve or multiple curves can be displayed.

Records to plot, selects how many IP decay curves are going to be displayed for inspection at the same time. Displaying several curves at a time speeds up the inspection of the data set.

Starting window specifies the first IP window to be displayed and saved in the converted file.

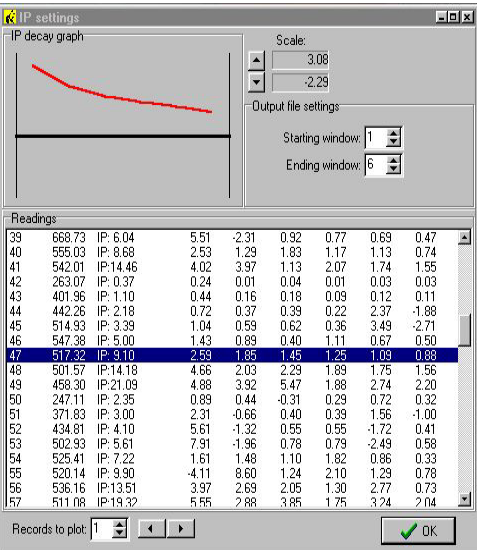


Figure 36: The IP decay curves can be inspected

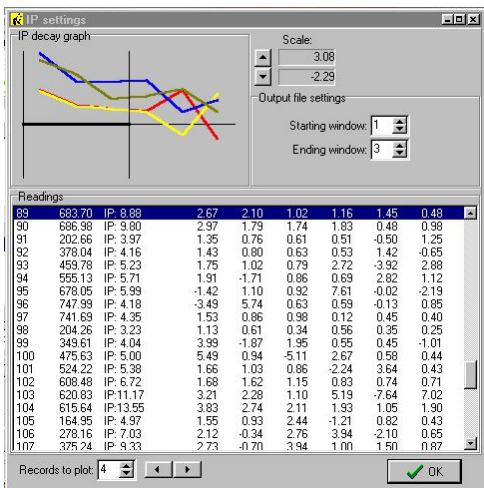


Figure 36: To speed up the inspection, several decay curves can be displayed at the same time

Ending window specifies the last IP window to be displayed and saved in the converted file.

Scale sets the scale of the display window, using the up and down arrow.

The windows with data to invert are chosen after scrolling through the data and selecting the windows that display the least amount of noise (jagged curve contour).

After your selection is made:

1. Click **OK**.
2. Click the **Save Converted File** button to specify where to save the converted data file.

The data set is converted to the selected format.

8.7 Re-Programming Electrode Addresses

Electrode addresses can be re-programmed using the re-programming kit and the Administrator software. The procedure for re-programming dual-mode electrode addresses and Switch box electrode addresses are slightly different.

The re-programming kit is only necessary for the dual-mode electrode cable, if the electrode switch serial numbers have been lost. To re-program dual-mode electrode addresses using the serial number of the dual-mode electrode, see **Cable Addresses Set up** on page 96.

The re-programming kit is not necessary for re-programming electrode addresses in the Switch box.

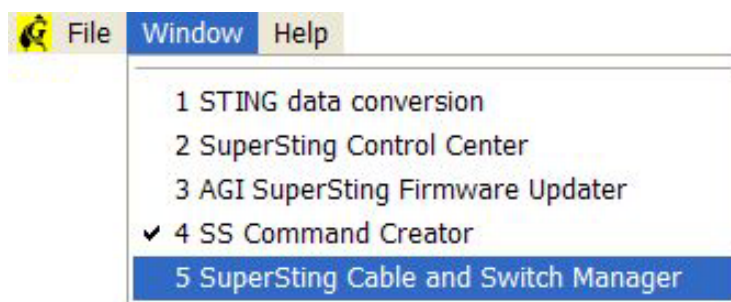
8.7.1 Re-Programming Dual-Mode Cable Electrode Addresses

If the serial numbers of the electrode switches are known, the electrode addresses can be re-programmed without the re-programming kit. The serial numbers for the electrode switches were delivered with the instrument. To re-program electrode switches when the serial number is known, see **Cable Addresses Set up** on page 96.

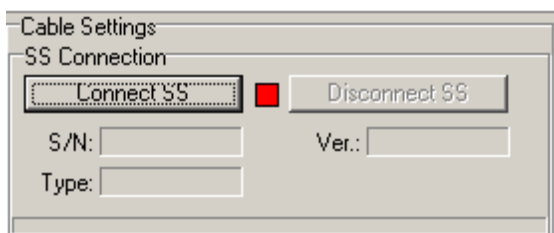
To re-program electrode addresses using the re-programming kit (R1 part # 951131; R8 part # 951031), connect the re-programming box, the SuperSting, the computer, and the cable to be re-addressed. Do not connect a complete cable, just the section of electrodes to be re-addressed.

NOTE: Connectors for the electrode cable differ, so specify the model when ordering. See Figure 38 on page 1.

1. Start the Administrator software on the computer.
2. After the Administrator software has started, open the “SuperSting Cable and Switch Manager” module by clicking the **Window** drop-down menu in the top menu bar. Select the **SuperSting Cable and Switch Manager**.



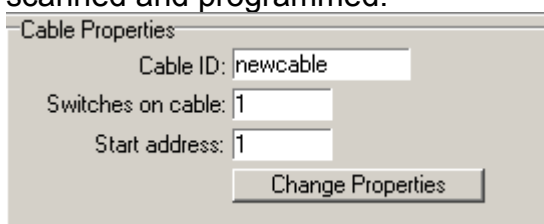
3. Turn on the SuperSting, and then click the **Connect SS** button on the computer screen to connect to the SuperSting.



After pressing the **Connect SS** button, the PC should connect to the SuperSting and all buttons and windows in the Administrator should become active.

4. If you are re-programming R1 electrode switches and are using a SuperSting R8/IP, check the **Force 1-ch cable** box.

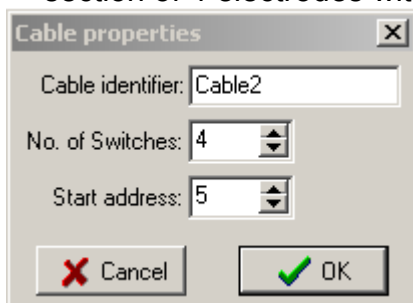
5. Press the **Change Properties** button to edit the properties of the cable section to be scanned and programmed.



7. In the “Cable Identifier” box, enter the serial number of the current cable section.

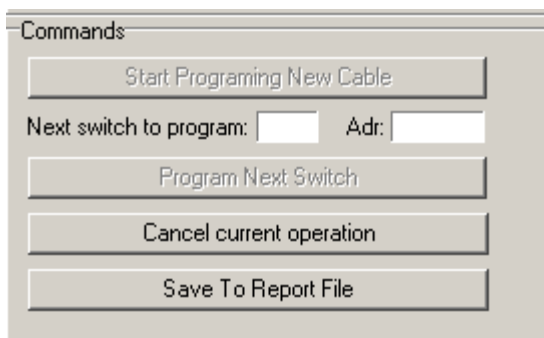
8. In the “No. of Switches” box, enter the number of switches on the cable section.

9. Finally, enter the Start address of the cable section, which is the lowest electrodes address on the cable section. The following “Cable properties” box shows the setup for a cable section of 4 electrodes with addresses 5 through 8.



Once the settings are entered, press **OK**.

1. Use the cable with banana plug in one end and a large Mueller clip in the other end to connect the reprogramming box to the electrode switch to be re-programmed (see Figure 38 on page 1). The large Mueller clip should be clipped over the stainless steel tube of the electrode switch (over the larger stainless steel tube on the old type switches).
2. Next, press the **Start Programming New Cable** button.



Once this button is pressed, the software will begin to scan the serial number of the switch and program the switch with the corresponding address. If this is successful, it will return with a program address successful message.

3. Once the first electrode has been successfully programmed with the low address, clip the Mueller clip on to the next electrode to scan and press the **Program Next Switch** button.
4. Repeat the previous step until all electrodes on the cable section have been successfully programmed with their correct addresses.

8.7.2 Re-Programming Switch Box Electrode Addresses

The re-programming kit is not necessary when re-programming the Switch box electrode addresses.

Your Switch box contains a number of printed circuit boards, varying depending on the capability of your Switch box. Each board is capable of switching 28 electrodes.

NOTE: On early Switch box models, before September 2004, each switch board could only switch 14 electrodes. The best way to find out which type of Switch box you have is to open up the Switch box by unscrewing the four Phillips screws in each corner of the box, and then count the number of circuit boards in the box. If you have a 56-electrode Switch box, for example, and there are four boards, the Switch box has the old boards for 14 electrodes ($14 \times 4 = 56$).

The boards are numbered 1, 2, 3..... etc. The number 1 board always has the lowest number addresses, for example 1-29. The number 2 board has the next 28 addresses, for example 29-56, with this number pattern continuing for all boards.

To re-program addresses in your Switch box, proceed as follows:

1. Connect the Switch box to the SuperSting using the 2-meter jumper cable originally delivered with the instrument.
NOTE: only one Switch box is allowed to be connected when re-programming addresses, therefore no daisy-chaining of Switch boxes when re-programming addresses.
2. Power up the SuperSting and go to menu **3. Test mode**.
3. For SuperSting R1, select **4. Program address**; for SuperSting R8, select **5. Program address**.
 1. Select **1** to enter the first address of the board to be programmed.
 2. Select **2** to enter the board number of the board to be re-programmed.
 3. For SuperSting R1, press **F1** to re-program the board.

4. For SuperSting R8, press **F3** to re-program the board.
5. A message appears at the bottom of the screen stating “Press . to confirm.” Press the period key (.) on the key pad. A message stating “pass” appears next to the “set address via serial.”
6. The 28 electrodes on that board have now been re-programmed.
7. Repeat for the next boards until all boards in the Switch box have been re-programmed.

IMPORTANT

If you are programming two switch boxes, you must enter them separately. Entering the total number of switches will result in error. For example, if you are using two 56-switch boxes, do not enter one 112-switch box. See **Setting up the Instrument for Use With Switch Box and Passive Cables** on page 46.

The example below shows a 56-electrode Switch box being reprogrammed from addresses 1-56 to 57-112.

Board number	Address before Re-programming	Re-programmed address
1	1-14	57-70
2	15-28	71-84
3	29-42	85-98
4	43-56	99-112

9 Data File Formats

9.1 New File Format

Starting with SuperSting firmware version 01.03.03 and the Administrator for SuperSting version 1.3.1.108, electrode position defined by x, y and z coordinates (previously only x and y) is supported. This allows more flexibility in 3D surveys where electrodes are placed both on the surface and in boreholes.

9.2 SuperSting Command Files (.cmd)

Command files, with extension .cmd, are files that tell the SuperSting how to measure. The command files are ASCII files that are prepared in a PC and uploaded to the SuperSting using the "Command Center" module of the Administrator software. See **Loading a Command File Into the SuperSting RAM Memory** on page 107.

The easiest way to make 2D command files is to use the "Command Creator" module of the Administrator software. For 3D command files, use the "Command Creator" option in the EarthImager 3D software. It is also possible, but very tedious, to manually write a command file using a regular text editor.

IMPORTANT

If running Windows 2000, the operating software considers all files with extension cmd as a program and is run by the batch processor cmd.exe. Therefore, if you would like to open a command file, right click the file name and use "Open with" or "Edit" to open the file.

When writing a command file, it is a good idea to use the unit spacing one between electrodes in the "Geometry" part of the command file. The reason is that this file can then be used for any electrode spacing by simply changing the scaling factor in the SuperSting when performing the survey. By having unit spacing one, the scaling factor simply reflects the new electrode spacing. Only one command file needs to be loaded for each electrode array type used, even if different electrode spacings will be used later on.

SuperSting also has a built-in roll-along algorithm that uses the original command file, therefore no special command files are needed for roll-along surveys.

A SuperSting R8/IP pole-pole command file for 50 electrodes is detailed below. To the right are clarifying comments in bold to each command file line.

;Automatically created command file **Bold indicates comment for your information.**

:header

Header section starts here.

progID=polpol

This name will appear on the instrument LCD.

unit=meter

Unit used; meter or feet (default meter if no unit is given)

type=R **See type below.**
 arraytype=5 **See arraytype below.**
 Binf=1 1 indicates B at infinity, otherwise use 0.
 Ninf=1 1 indicates N at infinity, otherwise use 0.
 MUX=2 **See MUX below.**

:geometry **Geometry section starts here. Each electrode address and its x and y coordinate is listed in this section.**
 1,0.00,0.00 **Use 1 as unit spacing is an advantage when loaded into the SuperSting, where a scaling factor is used to change the electrode spacing.**
 2,1.00,0.00
 3,2.00,0.00
 4,3.00,0.00
 5,4.00,0.00
 6,5.00,0.00
 7,6.00,0.00
 8,7.00,0.00

.....
 44,43.00,0.00
 45,44.00,0.00
 46,45.00,0.00
 47,46.00,0.00
 48,47.00,0.00
 49,48.00,0.00
 50,49.00,0.00

:commands Here starts the command section.

;A,B,P1,P2,P3,P4,P5,P6,P7,P8,P9,channels **This line describes the command format.**
 1,0,2,3,4,5,6,7,8,9,0,12345678 **First command= first measurement**
 1,0,10,11,12,13,14,15,16,17,0,12345678 **Second command= second measurement and so on.**

1,0,18,19,20,21,22,23,24,25,0,12345678 **A and B are the current electrode addresses specified in the first column. Since Binf=1 (B at infinity), no automatic switch is used for the B position here. Therefore write 0.**

1,0,26,27,28,29,30,31,32,33,0,12345678
 1,0,34,35,36,37,38,39,40,41,0,12345678
 1,0,42,43,44,45,46,47,48,49,0,12345678

P1 to P9 are the incoming lines. It takes 9 lines to take 8 readings since it is the difference that is measured.

1,0,50,0,0,0,0,0,0,0,0,1
 2,0,3,4,5,6,7,8,9,10,0,12345678

Each of the P-lines are separated by a comma.
At the end is a list of the receivers used. There are eight receivers, in some measurements fewer receivers are used.

2,0,11,12,13,14,15,16,17,18,0,12345678
 2,0,19,20,21,22,23,24,25,26,0,12345678

43,0,44,45,46,47,48,49,50,0,0,1234567

Here receivers 1, 2, 3, 4, 5, 6 are used for 44-45, 45-46,...49-50 and receiver 7 for 50-Ninf (N infinity)

44,0,45,46,47,48,49,50,0,0,0,123456

45,0,46,47,48,49,50,0,0,0,0,12345

46,0,47,48,49,50,0,0,0,0,0,1234

47,0,48,49,50,0,0,0,0,0,0,123

48,0,49,50,0,0,0,0,0,0,0,12

Here receiver 1 is used for 49-50 and receiver 2 is used for 50-Ninf.

An example of the corresponding command file for the SuperSting R1/IP is detailed below.

;Automatically created command file

:header

progID=Test

unit=meter

type=R

arraytype=5

Binf=1

Ninf=1

MUX=1

:geometry

1,0.00,0.00

2,1.00,0.00

.

.

49,48.00,0.00

50,49.00,0.00

:commands

;A,B,P1,P2,P3,P4,P5,P6,P7,P8,P9,channels

50,0,49,0,0,0,0,0,0,0,0,1

50,0,48,0,0,0,0,0,0,0,0,1

50,0,47,0,0,0,0,0,0,0,0,1

50,0,46,0,0,0,0,0,0,0,0,1

.

.

4,0,1,0,0,0,0,0,0,0,0,1

3,0,2,0,0,0,0,0,0,0,0,1

3,0,1,0,0,0,0,0,0,0,0,1

2,0,1,0,0,0,0,0,0,0,0,1

type=R: resistance measurement, meaning no other option is currently available.

arraytype: Six array types are available:

- 0=undefined used when an out of standard array is used
- 1=Schlumberger
- 2=Wenner
- 3=dipole-dipole
- 4=pole-dipole
- 5=pole-pole. This parameter is used to auto detect array type.

MUX: Determines from which electrodes the receiver measures voltage. There are two possible settings:

- **1** is used when the measurement is taken between P1-P2-P3-P4-P5-P6-P7-P8-P9. This would measure voltage between electrodes 1 and 2, 2 and 3, etc. Choose this setting for arrays that use two dipoles, for example.
- **2** is used to measure between a specified electrode and all the other electrodes. This would measure the voltage between P1-P9, P2-P9, P3-P9, P4-P9, P5-P9, P6-P9, P7-P9 and P8-P9. Choose this setting for arrays that reference the measurement to one potential pole (the pole-pole electrode array, for example).

9.3 SuperSting Result Files (.stg)

SuperSting result files, with extension .stg, are the result of a resistivity measurement or the result of a resistivity/IP combination measurement.

The downloaded file is a comma delimited ASCII file. The first row contains information about the instrument used. The second row informs of which software version is installed in the instrument, the survey period of the data in the file and how many records the file contains. The third row informs whether the unit used was set for meter or feet at the time of downloading. The following rows contain one data point each. The beginning of a downloaded SuperSting (stg) file is shown below:

Advanced Geosciences, Inc. SuperSting R8-IP Resistivity meter. S/N: SS001010

Software version: 01.01.15 Survey period: 20001121 Records: 450

Unit: meter

1,USER ,20001121,14:53:23, 1.8134E+00, 0,516, 6.8364E+01,ROLLTST , 2.0000E+00, 0.0000E+00, 0.0000E+00, 0.0000E+00, 4.0000E+00, 0.0000E+00, 6.0000E+00, 0.0000E+00,IP:, 130, 1000, 4.1243E-04, 2.2883E-04, 1.4102E-04, 1.0111E-04, 7.7164E-05, 6.6521E-05, 1.0271E-03

2,USER ,20001121,14:53:23, 6.4207E-01, 1,516, 9.6821E+01,ROLLTST , 2.0000E+00, 0.0000E+00, 0.0000E+00, 0.0000E+00, 6.0000E+00, 0.0000E+00, 8.0000E+00, 0.0000E+00,IP:, 130, 1000, 1.3853E-04, 6.0244E-06,-3.0113E-05,-3.6135E-05,-4.5170E-05, 3.4632E-04, 3.7946E-04

3,USER ,20001121,14:53:23, 2.8514E-01, 3,516, 1.0750E+02,ROLLTST , 2.0000E+00, 0.0000E+00, 0.0000E+00, 0.0000E+00, 8.0000E+00, 0.0000E+00, 1.0000E+01, 0.0000E+00,IP:, 130, 1000,-1.2116E-05,-4.4582E-05,-3.2622E-05,-4.1148E-05,-4.6275E-05,-3.9441E-05,-2.1618E-04

4,USER ,20001121,14:53:23, 1.7801E-01, 2,516, 1.3422E+02,ROLLTST , 2.0000E+00, 0.0000E+00, 0.0000E+00, 0.0000E+00, 1.0000E+01, 0.0000E+00, 1.2000E+01, 0.0000E+00,IP:, 130, 1000,-3.9368E-04,-7.2752E-04, 1.0765E-05,-3.2851E-04,-2.9050E-04,-2.8235E-04,-2.0118E-03

5,USER ,20001121,14:53:23, 1.2762E-01, 2,516, 1.6840E+02,ROLLTST , 2.0000E+00, 0.0000E+00, 0.0000E+00, 0.0000E+00, 1.2000E+01, 0.0000E+00, 1.4000E+01, 0.0000E+00,IP:, 130, 1000,-4.6808E-04,-3.3218E-04,-2.4534E-04,-1.9248E-04,-1.5095E-04,-1.3207E-04,-1.5211E-03

The example above shows the older data format where no z-coordinate was used.

The following data format is used:

A consecutive data record number, USER, date (YYYYMMDD), time (hh:mm:ss), V/I, error in tenths of percent, output current in mA, apparent resistivity in Ωm or Ωft , command file identifier, X-coordinate for the A-electrode, Y-coordinate for the A-electrode, Z-coordinate for the A-electrode, X-coordinate for the B-electrode, Y-coordinate for the B-electrode, Z-coordinate for the B-electrode, X-coordinate for the M-electrode, Y-coordinate for the M-electrode, Z-coordinate for the M-electrode, X-coordinate for the N-electrode, Y-coordinate for the N-electrode, Z-coordinate for the N-electrode.

If the Res/IP combination measurement has been performed, the record continues with:

IP, IP time slot in msec., IP time constant, IP reading in sec for the first time slot, IP reading in sec for the second time slot, IP reading in sec for the third time slot, IP reading in sec for the fourth time slot, IP reading in sec for the fifth time slot, IP reading in sec for the sixth time slot, total IP reading in sec.

NOTE: In the data file example above, each record wraps on two lines due to its length. It is actually one single line in the output data from SuperSting.

To avoid an unnecessary number of zeroes in the result, the values of the data fields are given in scientific notation. To read these values, simply move the decimal point to the right if the suffix is positive and to the left if the suffix is negative. For example: the value 2.5889e+02 is read 258.89 and the value 7.7424e-03 is read 0.0077424.

9.4 SuperSting Contact Resistance Files (.crs)

During the measurement, a resistance value for each pair of current electrodes used is collected and presented in the contact resistance file. This file may be a valuable piece of information in case of erroneous data. The beginning of a downloaded SuperSting contact resistance (crs) file is shown below:

Advanced Geosciences, Inc. SuperSting R8-IP Resistivity meter. S/N: SS000228

Software version: 01.01.22 Survey period: 20010121 Records: 180

Unit: meter

Contact resistance readings (approximate)

RecNo, Vcode, Curr, Res, Date, Time of reading, AddrA, AddrB, Ax, Ay, Bx, By

1, 23, 1.0320E-01, 3.5583E+02, 20010121, 17:38:27, 3, 1, 2.0000E+00, 0.0000E+00, 0.0000E+00, 0.0000E+00

2, 19, 8.1560E-02, 3.6248E+02, 20010121, 17:38:41, 3, 1, 2.0000E+00, 0.0000E+00, 0.0000E+00, 0.0000E+00

3, 29, 9.9093E-02, 4.6750E+02, 20010121, 17:38:58, 5, 3, 4.0000E+00, 0.0000E+00, 2.0000E+00, 0.0000E+00

4, 26, 1.0701E-01, 3.8801E+02, 20010121, 17:39:14, 5, 1, 4.0000E+00, 0.0000E+00, 0.0000E+00, 0.0000E+00

5, 28, 9.9097E-02, 4.5133E+02, 20010121, 17:39:31, 7, 5, 6.0000E+00, 0.0000E+00, 4.0000E+00, 0.0000E+00

6, 28, 1.0399E-01, 4.3005E+02, 20010121, 17:39:48, 7, 3, 6.0000E+00, 0.0000E+00, 2.0000E+00, 0.0000E+00

The contact resistance file is automatically downloaded with the data file. The file is a comma delimited ASCII file. The first row contains information about the instrument used. The second row informs of which software version is installed in the instrument, the survey period of the data in the file and how many records the file contains. The third row informs whether the unit used was set for meter or feet at the time of downloading. The forth row states "Contact resistance readings (approximate)" indicating that the contact resistances are approximate. The next row indicates the content of each field of the data record. The following rows contain one data point each.

A consecutive data record number, the voltage code applied to drive the current into the ground, current in Ampere, contact resistance in Ω , date (YYYYMMDD), time (hh:mm:ss), address of the A electrode, address of the B electrode, X-coordinate for the A-electrode, Y-coordinate for the A-electrode, Z-coordinate for the A-electrode, X-coordinate for the B-electrode, Y-coordinate for the B-electrode, Z-coordinate for the B-electrode.

9.5 SuperSting Binary Files (.bin) and Zip Files

When data is transferred to a computer from the SuperSting, it is transferred in binary form. After the transfer is completed, the Administrator software translates the binary file into easy to read ASCII files. The binary file is valuable as a troubleshooting tool for AGI if there has been a problem during the measurement.

When downloading the data, a zip file is also created. This file contains both the ASCII and the binary files with system information, which can help us analyze the data in case of a problem. It is named as the dataset (like PP564DF.zip).

Please e-mail the .zip file to Advanced Geosciences, Inc. (agi@agiusa.com) any time you have a question regarding the data or need our help to diagnose a problem.

9.6 SuperSting Firmware Files (.agi)

The SuperSting firmware can be updated by loading a new firmware file (.agi file) into the SuperSting using the “Firmware updater” module of the Administrator software. See **Loading New Firmware into the SuperSting Flash Memory** on page 102.

The latest version of the SuperSting firmware is posted on the SuperSting UserGroup on the AGI web site at www.agiusa.com. You must register for the SuperSting UserGroup to get your password.

10 Accessories

10.1 PowerSting Series External High Power Transmitters for the SuperSting



Figure 37: The SGS generator, SuperSting R8, and a PowerSting make up the system.

The PowerSting high power series external transmitters are designed for deep surveys and special applications. All PowerSting transmitters are equipped with wired or wireless communication to the SuperSting.

The different PowerSting transmitter models vary in specification but are operationally all the same.

Connection to the SuperSting can be either wired or wireless.

The PowerSting is a constant current source. If the load changes, the PowerSting will automatically switch to voltage mode to keep the current constant.

Two or more of same model PowerStings can be daisy chained as master/slave to increase current output by current summation.

10.1.1 PowerSting HV 10 kW 3,000 V, 3.2 A

This transmitter is designed for high contact resistance conditions where there is a demand for high voltage output. This transmitter is ideally suited for dry and rocky areas with a thin overburden. The transmitter is tuned to operate at maximum specification—3.2 A at 3,000 V—when the contact resistance is 937 Ohm.

10.1.2 PowerSting HC 10 kW 375 V, 27 A

This transmitter is designed for low contact resistance land or marine surveys where there is a demand for high current output at a relatively low voltage. This transmitter is ideally suited for marine resistivity imaging on or under seawater or when the survey is performed on land in areas with moist ground and thick overburden. The transmitter is tuned to operate at maximum specification—27 A at 375 V—when the contact resistance is 14 Ohm as is typical in a hyper-saline environment.

10.1.3 PowerSting 15 kW 1,500 V, 10 A

This transmitter is a good medium range transmitter for all around use. It is tuned to operate at maximum specification—10 A at 1,500 V—when the contact resistance is 150 Ohm.

10.1.4 PowerSting 5 kW 1,000 V, 5 A

This transmitter is used together with off-the-shelf single phase generators, greater than 7.5 kW. The transmitter is tuned to operate at maximum specification—5 A at 1,000 V—when the contact resistance is 200 Ohm.

10.2 120/220 V Field Power Supply

The field power supply box can be used instead of a battery, when connected to a small motor generator. The Honda 1000i motor generator is suggested, since it is light weight and quiet.

Because of the vents in this field power supply that are required for air circulation, it is not waterproof. It is important to keep the field power supply off the ground as much as possible, and avoid leaving it outside overnight or during any potentially wet weather.

IMPORTANT

To avoid possible water leakage inside the field power supply, do not leave the field power supply on the ground, or outside overnight. Leaving the field power supply outside overnight can cause condensation to form inside the vents. **Never use the field power supply or the SuperSting during a rain storm.**

10.3 SuperSting Electrode Switch Box

In some applications it is not feasible to use the smart (dual-mode) electrodes. In such cases, AGI has a number of electrode switch boxes available to be used with passive cables and electrodes to form a central switching system. When using the switch box any cable can be used to connect to the electrode stakes.

The switch boxes are available in 28, 56, 64, 84 and 112 electrode switching capability both for the SuperSting R8/IP and the SuperSting R1/IP.

SuperSting R8/IP is available with built-in switch box for 28 and 56 electrodes (model name SuperSting R8/IP+28 resp. SuperSting R8/IP+56).

SuperSting R1/IP is available with built-in switch box for 28, 56, 84 and 112 electrodes (model name SuperStingR1/IP+28 etc.).



Figure 37: The switch box is available in 28, 56, 64, 84, and 112 electrode capability, and for both the SuperSting R8 and the SuperSting R1

Switch box, electrode switch capability	R1 Part number	R8 Part number
28 electrodes	955128	955828
48 electrodes	955148	955848
56 electrodes	955156	955856
64 electrodes	955164	955864
84 electrodes	955184	955884
96 electrodes	955196	955896
112 electrodes	955112	958112

The switch box has two Amphenol (male and female) connectors (black plastic type) and two female MS3476L18-32S connectors (metal type). On the SuperSting models with built in switch capacity the MS3476L18-32S connectors are placed on the right side of the instrument enclosure. The Amphenol connectors are used to connect the switch box to the SuperSting instrument or daisy-chaining to other switch boxes to control more electrodes.

The MS3476L18-32S are used to connect the electrodes to the

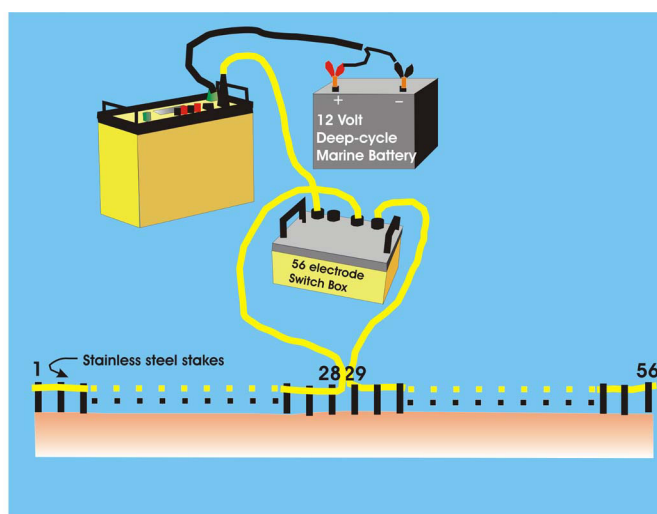


Figure 37: SuperSting/switch box

instrument, use mating connector MS3476L18-32P. The connector marked “Low address cable” is used to address electrodes 1-28. Pin 1 of the connector should be connected to electrode 1, pin 2 to electrode 2 and so on.

The connector marked “High address cable” is used to address electrodes 28-54. Pin 1 of the connector should be connected to electrode 28, pin 2 to electrode 29 and so on.

An adapter is delivered with the switch box, for connecting the female connector of a passive cable to the female connector of the switch box.

For the SuperSting to control the switch box, a regular command file can be used. For information on how to create a command file see section 8.3.

WARNING 1: The switch box contains sensitive CMOS circuitry, so make sure that the electrodes are not exposed to high voltage (over 15 V). Especially make sure that the electrodes are not touching each other so that a current electrode is not in contact with a potential electrode. Approaching thunderstorms can cause high voltage between electrodes, so you should interrupt any survey when the first thunder can be heard. Also be aware of electric fences.

10.3.1 Which Cable to Use

It is not advisable to use any unshielded cable to connect to the electrode stakes. Crosstalk between members of the cable may be a serious problem causing coherent noise in the data. Since the noise is coherent it is impossible to distinguish from real data.

It is not advisable to use “seismic cables” to connect to the electrode stakes. The reason is that a seismic cable is not designed to transmit electrical current but to transmit a small voltage signal in the millivolt range. Since the signal voltage in the seismic application is low there is no reason to protect the wires from cross talk between members. In the electrical resistivity application current are driven into the ground with up to 400 V and at the same time the response is measured on other cable members in the millivolt range.

There are several types of passive cables available from AGI. There are land cables for resistivity imaging purpose on the surface, there are special underwater cables for measurements on the bottom of ponds, lakes, rivers and in the sea. There are also special borehole cables used in resistivity tomography measurements (ERT). Contact AGI for information on cables for your special application.

10.4 Remote Monitoring System (SSRMS)

You can remotely control an unattended electrical resistivity monitoring site from anywhere in the world (with an internet connection) using the AGI Remote Monitoring System (SSRMS), part # 951209. After setting up measurement tasks in advance from the home office computer, the survey will be performed at the scheduled time. After the survey, separate emails summarizing measurement start, errors, and finish are automatically sent to the specified email address. The measurement result file is attached to the email summarizing the finish.

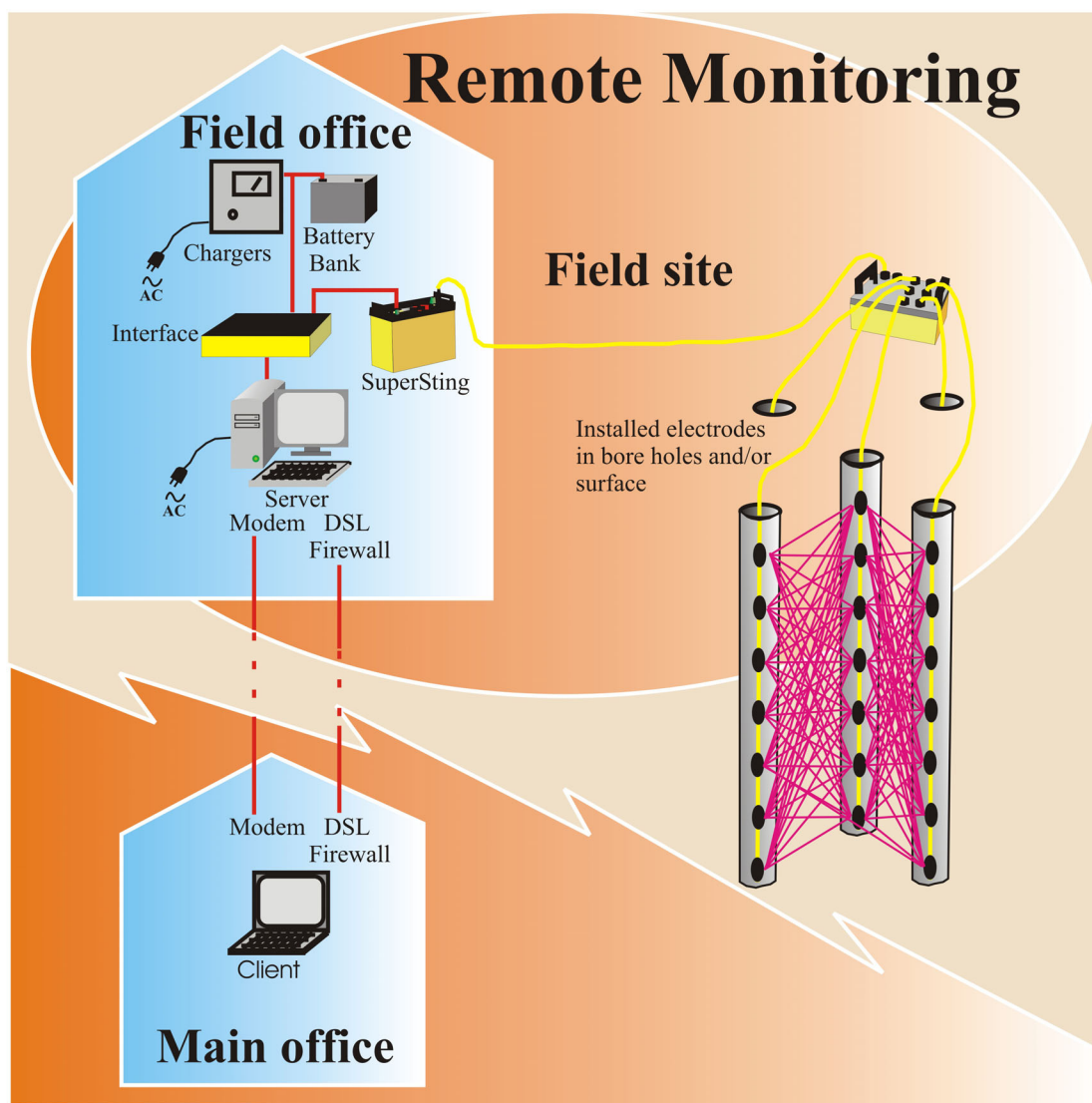


Figure 38: SSRMS diagram

SSRMS is equipped with a battery bank management system to ensure power is available for each survey. Between the task executions, the SuperSting is switched off and the batteries are charged. At the start of a task, the battery with the highest voltage is selected for use as the active battery and the other remains connected to its charger. Then the SuperSting is automatically switched on.

SSRMS is useful when a repeat measurement on a fixed installation of electrodes is needed. Over time, changes of resistivity conditions can occur and need to be recorded and analyzed. There are many applications for SSRMS, some of which include:

- Monitoring leakage from landfills
- Monitoring remediation progress at clean-up sites
- Monitoring progress of injected salt-solution in hydrogeological tests

- Monitoring sink hole activity in sensitive areas such as under highways and apartment buildings
- Monitoring the moisture front progress after rain or irrigation
- Monitoring permafrost annual development
- Monitoring fresh or salt water interface in tidal areas

The SSRMS system is comprised of the following components:

- SuperSting instrument
- The cable system and switch box attached to the SuperSting
- A bank of two (four if boost batteries are needed) high capacity marine quality batteries (see **About the Battery** on page 43)
- Two battery chargers: one for each battery or one for each pair of batteries if boost batteries are needed
- A Windows XP Pro PC that runs the remote monitoring server software
- A remote operations control unit (Remote Interface Box) that connects the batteries, chargers, SuperSting and PC together to form the monitoring system base.
- An Internet connection for the server PC, preferably in the form of a DSL broadband connection. If such a connection cannot be furnished, then the minimum level of connectivity that can be used is an analog telephone line and a modem configured such that the server PC can accept incoming calls from the main office. In this case, some of the SSRMS features will be disabled (such as automatic result reporting and error alarms) unless a dial-up Internet connection is also defined for server use.
- Uninterruptible power supply (UPS) to power the server PC and the control box.

For details on the SSRMS, see the *SuperSting Remote Monitoring System Instruction Manual*.

10.5 The AGI EarthImager2D and 3D Resistivity and IP Inversion Software

The EarthImager software directly reads SuperSting data files and inverts resistivity and IP data into images in color. Some of the highlights of the software are:

- Inverts both 2D and 3D data
- Inverts surface, underwater and borehole to borehole data
- Time lapse option for resistivity monitoring
- Includes a survey planner for pre-survey modeling
- Includes command file creator for borehole to borehole surveys

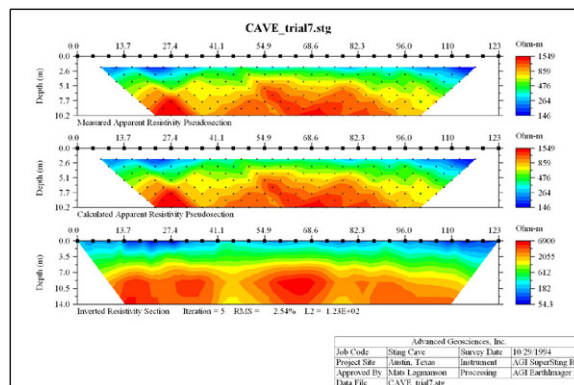


Figure 38: EarthImager report ready plat style print-out

- High definition report quality plat style print-out
- Topographic correction
- A priori information input

10.6 Address Re-Programming Kit

When purchasing active (dual-mode) electrode cables, a list of electrode switch serial numbers is included in the instruction manual. You can re-address an electrode switch in SuperSting menu 3/6, using the known serial numbers of that switch. If the list of electrode switch serial numbers has been lost, it is possible to scan the electrodes for the serial numbers, using the “Switch address re-programming kit.”

The re-programming kit comes in two versions: SuperSting R1/IP (part # 951131) and SuperSting R8/IP (part # 951031). Only the connectors for the electrode cable differ, so make sure to specify the model when ordering.

The re-programming kit comes with two cables: one to connect to the electrode switch and a serial cable to connect the re-programming box to the computer. If the computer does not have a serial connector, use the USB/Serial adapter (Keyspan USA-19HS), which was delivered with your instrument.

To connect the re-programming box to the SuperSting, use the 2-meter jumper cable (R8 part # 933040S, R1 part # 870030) that was delivered with the instrument. To connect the re-programming box communication to the SuperSting, use the download cable (part # 920009) that was delivered with the instrument.



Figure 38: Address re-programming kit

10.7 Infinity Adapters

When performing surveys like pole-dipole and pole-pole, it is necessary to place one or two electrodes at “infinity.” To make it easier to attach the infinity electrodes when using the dual-mode electrodes, there are two infinity adapters available (R8 part # 911223, R1 part # 911222). The adapters plug in at the ends of the dual-mode electrode cable, with the SuperSting connected somewhere in the middle of the cable.

The adapter for the B electrode plugs into the “low address end” of the cable, and the adapter for the N electrode plugs into the



Figure 38: The infinity adapters are available for both the SuperSting R8 and the SuperSting R1.

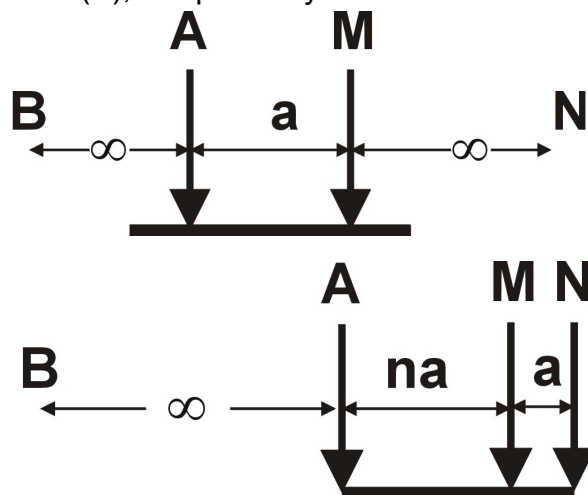
“high address end” of the cable. Each adapter has a banana jack where a single lead wire with banana plug can be connected. The single lead wire leads to the infinite electrode. The adapters are marked “Infinity Elec. (N)” and “Infinity Elec. (B),” respectively.

The infinity adapters are not possible to use with the passive electrode system. With a passive electrode system, attach the infinity current electrode to the B terminal on the instrument front panel and the potential electrode to the N terminal.

When performing pole-dipole surveys, try to place the B electrode at 10 times the largest expected ($na+a$) distance away from the survey site.

When performing pole-pole surveys, try to place the B and the N electrodes at opposite sides of the survey area and at 10 times the largest expected a away from the survey site.

There are adapters available for both the SuperSting R1/IP and the SuperSting R8/IP.



10.8 SuperSting Booster Box

When performing large surveys with many electrodes, the power supply and the signal level to the electrode switches get more attenuated the further you go from the SuperSting. At a certain distance from the SuperSting (depending on how many electrodes are used, and the electrode spacing), the electrode switches will not function correctly any longer, resulting in erratic data.

To overcome this distance problem, one or several booster boxes (R8 part # 991020, R1 part # 921004) must be installed along the line. As a rule of the thumb, place the SuperSting in the middle of the electrode cable lay-out if you have fewer than 100 electrodes.

If you are using more than 100 electrodes, place the SuperSting between electrode 50 and 51, and use a booster box for every 50 electrodes. For example, if you are using 200 electrodes place the SuperSting between electrodes 50 and 51, a booster box between 100-101 and 150-151. Of course these are not exact addresses. Place the SuperSting and the booster boxes at the nearest connector to these addresses along the line.

The booster box is placed in the line in such a way that the side marked “Towards the SuperSting” is connected to the dual-mode cable going directly towards the SuperSting.

Power the booster box with a 12 V type lawn mower battery.

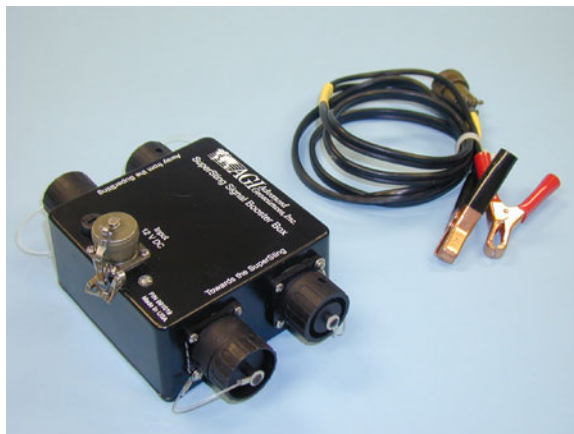


Figure 38: The booster box is available for both the SuperSting R8 and the SuperSting R1.

There is a booster box available both for the dual-mode R1 and the dual-mode R8 electrode cables.

10.9 Manual Cable Set

There are three different manual cable sets available from AGI. The short manual cable set with two current cables 150 m/each and two potential cables with 50 meter each.

The medium manual cable set with two current cables 400 m/each and two potential cables with 135 meter each.

There is also a long manual cable set with two current cables 750 m/each and two potential cables with 250 meter each.



Figure 38: Medium manual cable set

10.10 Laboratory Measurement of Soil Samples

The resistivity of any material is defined as the resistance in ohms (Ω) between opposite faces of a unit cube of that material. If R is the resistance of a block of conductive material having length (L), in a cross-sectional area (A), then the resistivity (ρ) is expressed by the formula:

$$\rho = \frac{R \times A}{L}$$

Resistivity, being a fundamental property of material, is independent of the volume. The unit for resistivity is Ohmmeter.

Resistance, however, depends upon the shape and the size of the specimen. The unit for resistance is Ohm (Ω).

Our soil resistivity test box is designed so that the readings are multiplied by a factor 101 to give result in Ωcm .

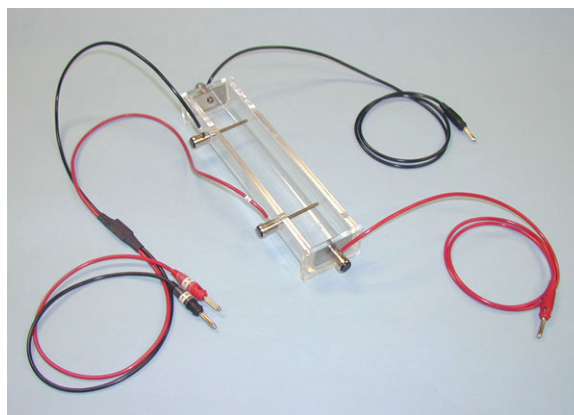


Figure 38: Test box for soil samples

10.10.1 Equipment

The equipment required for the measurement of the resistivity of soil samples in the laboratory includes:

- The SuperSting, earth resistivity meter
- A soil resistivity test box with cables and voltage divider (R8 part # 920019SS, R1 part # 920019)

- A straight edge
- Four insulated test leads
- Water (tap and distilled)

10.10.2 Sample Preparation

Soil samples should be representative of the area of interest. Where the stratum of interest contains a variety of soil types, it is recommended to sample each type separately. It is also necessary to prepare a mixed sample. The sample should be reasonably large and thoroughly mixed so that it is representative.

The resistivity of soils is to a large degree a function of moisture content. Therefore, it is important to protect the samples from drying during storage/transportation by wrapping them in a plastic sheet or putting them in plastic bags. Measurements should be taken as soon as possible after sampling, and as soon as possible after removing them from their container/wrapping.

Unscrew and remove temporarily the two potential terminals (brass pins) to facilitate filling the soil box. The soil should be well compacted in layers, with air spaces eliminated as much as possible. Fill the box and level off the top with a straight edge. Replace the two potential brass pins.

The measured resistivity is dependent on the degree of compaction, moisture content, constituent solubility and temperature. The effect of variation in compaction and moisture content can be reduced by fully saturating the sample before placing it in the box. When possible, use ground water from the sample excavation for saturation. Otherwise, use distilled water. If the soil resistivity is expected to be below 10,000 Ωcm , local tap water can be used without introducing serious error. Some soils absorb moisture slowly and contain constituents that dissolve slowly, and the resistivity may not stabilize for as much as 24 hours after saturation.

10.10.3 Measurement Procedure

The saturated measurement provides a "worst-case" resistivity and can be usefully compared with "as-received" resistivity measurements. Surplus water should not be compared with "as-received" resistivity measurements. Surplus water should not be poured off, as this will remove soluble constituents. To measure soil samples:

1. Connect the SuperSting to the terminals of the soil box, and with the voltage divider delivered with the SuperSting soil box, connect to the M and N terminals. Note that

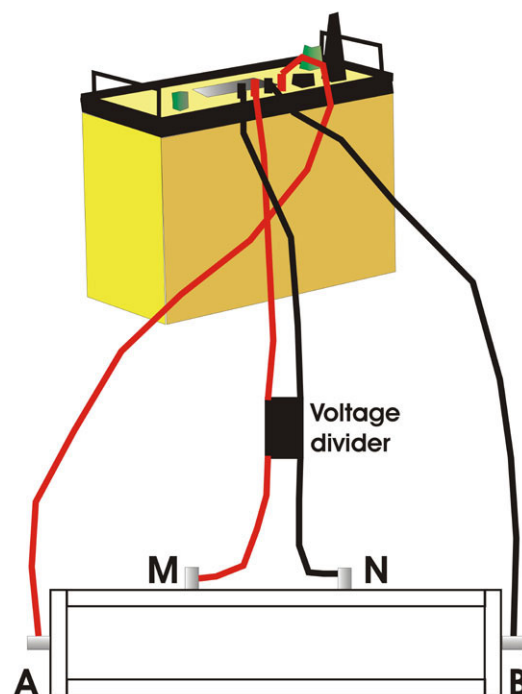


Figure 38: Connect the SuperSting to the soil box using the voltage divider for the M and N terminal

because of the voltage divider, the result has to be multiplied with the factor 101 in order to give the result in Ωcm .

2. Go to menu 6/1 and set the measurement settings to the following recommended settings:

CYCLES:

2

Max error: 2.0
 Max repeat: 1
 Max current: 1 or 2 mA
 Measure time: 1.2 s
 Separate potential: OFF
 Measure mode: RES
 Address Table: Use Address Table

3. Press **MEN** twice to get back to the main menu.
4. Go to menu 2 and select array type: **1 Resistance**.
5. Select **2** to create a data file in which to store the result.
6. X and Y are used for coordinates when performing resistance measurements in the field, but can be used to identify different soil samples in the lab situation.
7. Press the measurement key (**MEA**) and note the result on the display. This result has to be multiplied by a factor 101 to give the result in Ωcm (even though the display will not show cm). Also note the unit prefix, for example k Ω for 1000 Ωcm (kilo Ωcm).

10.10.4 Cleaning

The soil box should be thoroughly cleaned between measurements to avoid contamination by previous samples. To easily clean the box:

1. Disassemble the box.
2. Clean first with tap water.
3. Rinse thoroughly with distilled water.

10.10.5 Temperature Correction

The resistivity of soils is a function of temperature. To obtain results that best agree with field conditions, the sample should be at the same temperature as would be experienced at the test site.

Correction to 15.5°C (60°F) is recommended if the sample temperature exceeds 21°C (70°F).

$$R_{15.5} = R_T \left(\frac{24.5 + T}{40} \right)$$

where T = soil temperature, °C

R_T = resistivity at T °C

10.11 Soil Resistivity Measurements for Corrosion Control

Soil resistivity measurements are performed to be used in the control of corrosion of buried metal structures. Normally the measurements are carried out using the Wenner electrode

configuration with a number of specified Wenner-spacings. The Wenner spacing used is in most cases fairly short, most commonly not more than 5 meters (15 feet). For spacing of 1 - 5 meter (3 - 15 feet), use at least 20 mA or more to get noise-free data.

The resulting resistivity measurement represents a weighted average resistivity of a hemisphere of soil of a radius equal to the electrode spacing (Wenner spacing).

The result is reported as Ωcm . If the SuperSting has been set for meters (Ωm) in the field, then just multiply the apparent resistivity by 100 to get the value in Ωcm .

In the United States, soil tests are standardized to be measured with Wenner-spacing in feet and the result reported in Ωcm . This is achieved by setting the SuperSting in feet-mode, when collecting the field data. The SuperSting will download the data in meter-mode. In meter-mode all apparent resistivities are automatically recalculated to Ωm . Therefore, this value only has to be multiplied by 100 to give Ωcm .

11 Measurements

The SuperSting is a DC resistivity and induced polarization (IP) time domain instrument. The instrument automatically commutates the signal, but for the resistivity measurement it basically operates in the DC region of the signal.

The instrument has two modes of measurement: the resistivity (RES) mode and the resistivity/IP (RES/IP) mode.

11.1 Resistivity Mode

For each measurement in the resistivity mode, the following cycle occurs:

1. The instrument injects a current.
2. The instrument reverses polarity and injects the current again.
3. The instrument reverses polarity back to its original and injects the current again.

The time for this cycle can be selected from four different settings: 0.4, 0.8, 1.2 sec, 3.6 sec, 7.2 sec or 14.4 sec. The default setting is 3.6 seconds.

The method above has been used in the SuperSting R1 instrument and has proven to be very effective for resistivity measurements. This measurement scheme has therefore been kept in the SuperSting instrument as an option for resistivity measurement. The advantage to this method is that, if only resistivity data is required, it is faster than the resistivity/IP option.

11.2 Resistivity/IP Mode

When measuring resistivity/IP, the current injection pattern is different. The measurement cycle is:

- one period current +ON
- one period of current OFF, during which IP is measured
- one period of current -ON
- one period of current OFF, during which IP is measured again

For each time slot, the last measurement is subtracted from the first and the average is presented as the result. The SuperSting data file stores the result for each time slot and the total.

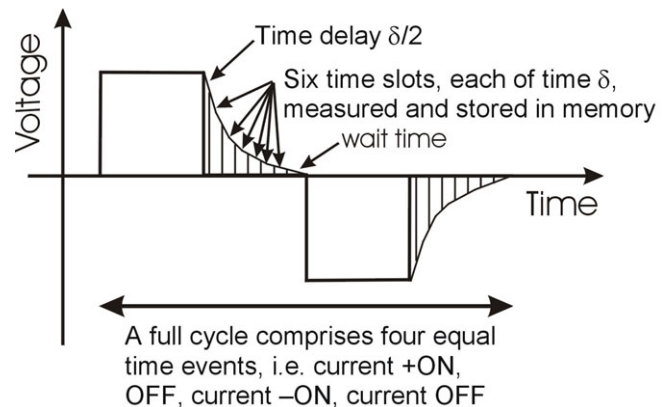


Figure 38: IP measurement parameters

The resistivity/IP mode method has become a standard for measuring time domain IP in the mineral industry. There are five user-selectable time constants in the SuperSting: 0.5, 1, 2, 4

and 8 seconds. The default setting is 0.5 seconds. The time constants and the different time events associated with each time constant are listed in the table below:

Time constant seconds	Total time cycle seconds	Time delay ($\delta/2$) mseconds	Time slot (δ) mseconds	Wait time mseconds
0.5	2.33	65	100	0
1	4	65	130	155
2	8	130	260	310
4	16	260	520	620
8	32	520	1040	1240

12 Field Procedures

12.1 Weather Conditions

12.1.1 Rain

The instrument and the dual-mode electrodes are weather proof, meaning that they can be out in the rain. However, they cannot be submerged in water. Further, any moisture on the front panel of the instrument or in the connectors increases the chance of electrical leakage between the current and potential lines, resulting in degrading data quality.

IMPORTANT

Water in the connectors may cause electrolysis and severe corrosion of the contact pins and contact receptacles. Therefore, make sure to keep the instrument and connectors clean and dry at all times. Use dust caps at all times on connectors that are not in use.

Rain will often affect your survey negatively. Although the contact resistance may be lowered, improving the signal levels, there is also an increase in noise. After a rainstorm, surface water will percolate down into the ground. When water moves through soil, streaming potentials (SP) are created. Higher levels of SP make the noise filtering less effective which can result in a “noisy” image. Therefore, it is best to wait for this active percolation to diminish before conducting surveys.

12.1.2 Cold Weather

The instrument works well below 0°C. However, around 0°C the LCD screen becomes “sticky” and changes of display happen slower and slower the colder it is. Around -10°C the LCD will stop working. Therefore, if you are planning to work in colder weather you will need to somehow keep the SuperSting warm. Android phones and tablets are much easier to keep warm in a pocket. The SuperSting WiFi remote control feature extends the cold weather operations further. The Android phone and tablet will show the same information as the LCD screen when it is too cold to view the LCD. Measurements by remote control have been run down to -20°C. The smart electrodes work well down to at least -20°C.

Snow and ice are highly resistive but do not affect the measurement in any other way. Actually, the resistivity method works well for mapping permafrost.

12.1.3 Hot Weather

When temperatures approach +40°C, the insulation performance of some plastic materials starts to break down and may cause electrical leakage problems between the current and potential lines. It is important during hot weather to keep the instrument as cool as possible by keeping it in the shade.

When the instrument works at full power (with two external batteries), it generates excess heat and may display the **TEMP WARM** overheat warning on the LCD screen. When this warning is issued, it is important to make sure the instrument temperature is lowered. By keeping the instrument in shade, out of direct sun light, the internal temperature of the instrument is lowered 10 – 15 °C. It is also a good practice to lower the current setting (M61, option 4) in case you get a **TEMP WARM** message.

If no action is taken and the instrument continues to heat up, a **TEMP OVERHEAT** warning is displayed and the instrument shuts down. It can be restarted when it has cooled down to a safe operating temperature, below 40°C.

By placing the instrument in a large camping cooler with cold camping gel packs, the instrument can be kept cool even during high ambient temperatures.

12.1.4 Blazing Sun

The LCD may darken when heated up by the sun. If this happens, it can easily be reversed by repeatedly pressing the LCD contrast key in the top right corner of the key board until the display is clear.

As described in “Hot weather” above, it is a good practice to shade the instrument during sunny days, both to eliminate overheating problems and darkening of the LCD display.

12.1.5 Thunderstorms

Thunderstorms are dangerous both for you and the equipment. The instrumentation contains sensitive CMOS circuitry and can be destroyed by nearby lightning strikes.

△WARNING It is dangerous to stand near a long, conductive cable during a thunderstorm.

Thunderstorms typically move very quickly and it takes some time to pick up the equipment. At the first sign of thunder in the distance, interrupt the survey and pick up the equipment.

12.1.6 Night Time

Do not leave cables out overnight. Many animals, like deer, rabbits, and mice, are moving around during the night time and their way of testing if something is edible is to chew on it. Therefore, it is important to keep animals off the survey line during the day and bring the equipment in during the night.



Figure 38: Typical deer chew

12.2 Batteries

The SuperSting is powered by one or two external 12 V DC batteries. When used in the main mode, the instrument is powered by one 12 V battery. In the boost mode, it is powered by two 12 V batteries.

The batteries are attached to the instrument using the power cable that was shipped with the instrument. When in main mode, the power cable is connected to the connector marked “Power” on the SuperSting front panel. The red and black Mueller clips are attached to the positive and the negative poles, respectively, of a 12 V battery.

When in boost mode, the SuperSting requires an additional 12 V battery. This battery is attached to the pig-tail connector of the main battery power cable, using the red and black Mueller clips for the positive and negative poles, respectively, of the boost battery.

When selecting the external batteries, we recommend the deep cycle marine battery type. This type of battery is used, for example, by fishermen to power their electrical trawling motors. The deep cycle marine batteries are designed to be discharged and charged repeatedly without losing their capacity. An automobile battery could also be used, but this type of battery is designed to always be fully charged and will quickly lose its capacity to be fully charged.

A 120/220 V field power supply can also be used in place of a battery. See **120/220 V Field Power** Supply on page 123.

12.3 Multi-Electrode Cables

There are two major systems for performing automatic data acquisition for resistivity and IP imaging: the distributed switching system and the central switching system.

When using a distributed switching system, the actual switching happens at each electrode. The instrument assigns which electrode is the current and which is the potential. The advantage is that the cable connecting all the electrodes only needs to have six wires (single-channel system):

- Two wires are used for signaling to the electrodes
- Two wires are used for the current electrodes
- two wires are used for the potential electrodes

In the distributed system, the electronic detection and switching circuit is molded into special take-outs along the cable. This type of cable is also referred to as an active cable and the electrodes as smart electrodes.

When using a central switching system, the electrode switching typically happens at the instrument. For this method, there is one wire, in a multi-wire cable, for each electrode connected to the central switching unit. Central switching systems use a “seismic type cable.” These types of cables are referred to as passive cables. Passive cables with central switching are used in applications not suitable for distributed switches, such as underwater measurements, borehole measurements, etc.

Observe the following terms in regard to multi-electrode cables:

Multi-electrode system—Both distributed and central switching systems are multi-electrode systems, entailing a large number of electrodes, typically 20 – 100 or more, to be laid out and connected to the instrument.

Single-channel system—The instrument has one receiver. Thus, for each current injection, the potential can only be measured between two electrodes. Therefore, when using a single-

channel instrument, only four electrodes (two for current and two for potential) are used for each measurement.

Multi-channel system—A multi-channel instrument has more than one receiver. For example, the SuperSting R8/IP has eight receivers. Therefore, for each current injection the potential between nine electrodes can be measured simultaneously, thus speeding up the measurement process.

12.3.1 Connecting the multi-electrode cable to the electrode stakes

AGI uses a simple and ingenious method for connecting the multi-electrode cable take-outs to the electrode stakes. If used correctly, this method is quick and gives a reliable connection between the electrode stake and the take-out, both mechanically and electrically.

Advantages:

- No connecting jumper cables are used. Connecting cables have a tendency to get tangled up, lost or damaged.
- The connection spring is fixed to the stake and cannot get lost.
- Mechanical and electrical connection is easily achieved by simply folding the spring over the take-out and attaching the spring to the top of the stake.
- Disconnection is achieved by simply disconnecting the spring.
- The strength of the spring is selected to give a strong mechanical connection, so the cable take-out is not pulled out of the connection at the slightest tension of the multi-electrode cable. The strength of the spring also gives a good reliable electrical connection between the stake and the take-out.
- Damaged springs can easily be replaced using a special spring mounting tool. New springs (bag of 30 stainless steel springs, part # 921012) and the mounting tool (part # 920435) are available from AGI.

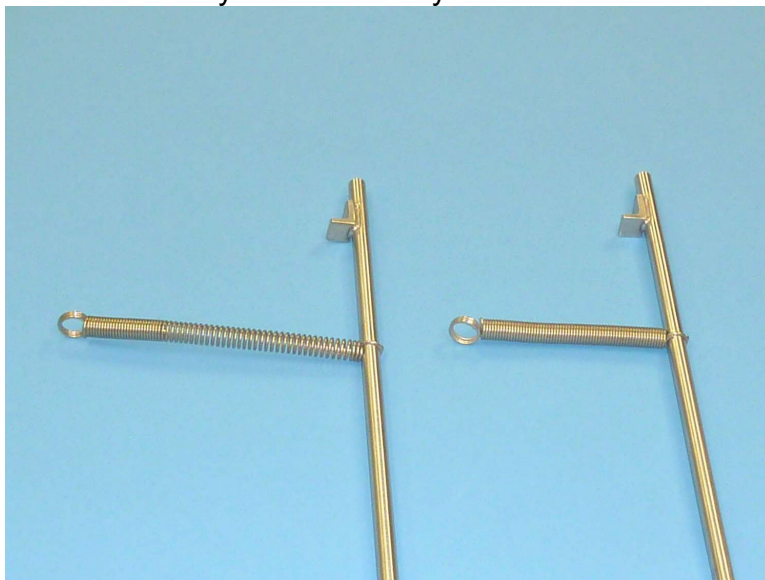


Figure 38 Damaged connection spring to the left, correct spring to the right.

There are two types of AGI multi-electrode cable take-outs: passive cable take-outs (1" diameter) and active (dual-mode) cable take-outs (1 3/8" diameter). There are two different stake/spring designs to hold the connection securely: one for the passive cable and one for the active cable. The active and passive cable stakes are not interchangeable. The correct stake/spring has to be used with the cable it is designed for.

The passive designed stake/spring also works well for third party multi-electrode cables with wire wound take outs.

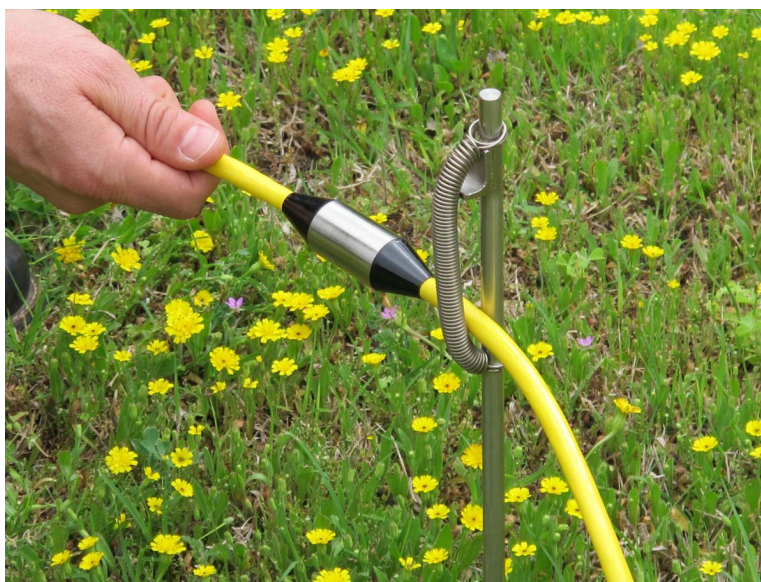
Because the wire wound design of the wire wound take-outs does not allow the plastic to flow in and completely seal the connection from any outside water, AGI does not provide multi-electrode cables with wire wound take-outs. Water contamination must be prevented at all cost, since we are injecting currents of hundreds of volts, and at the same time trying to measure a signal of a few millivolts. Moisture in the cable will cause electrical seepage between the different conductors in the cable.



Figure 38: Wire wound take-out

Wire wound connections are mainly used in the seismic industry. There, millivolt signals are measured, but no high voltage current is injected simultaneously. For this reason, wire wound take-outs work for seismic measurements, but are not good for geo-electrical measurements.

To mechanically hold the take-out firmly, the connection spring is strong. It is therefore necessary to use the following method to easily connect the cable to the stake without damaging the spring or your hands.



1. Pound the stake into the ground. Always do this before attaching the cable to protect the cable from mistaken hammer blows.
2. Place the loop of the spring over the top of the stake, making sure the cable is placed under the small shelf on the stake.

Figure 38: Place the cable under the spring and under the shelf.

3. Slide the electrode take-out in under the spring and under the shelf.



Figure 39: Slide the electrode take-out in under the spring and under the shelf.

4. With two fingers, one on each side of the spring, grab the take-out and lift it up over the shelf.



Figure 40: With two fingers, one on each side of the spring, grab the take-out and lift it up over the shelf.

The take-out is now in place, held firmly by the spring to create a good mechanical and electrical connection.



Figure 41: The take-out is in place, held firmly by the spring, creating a good mechanical and electrical connection.

To disconnect the take-out from the stake, reverse the instructions.

12.3.2 Replacing Damaged Springs

Damaged springs can be removed and replaced with new springs (bag of 30 stainless steel springs, part number 921012).



Figure 42: Spring (large loop to the left, small loop to the right), stake, and spring mounting tool

The springs have a small one-turn loop in one end and a larger three-turn loop in the other end. The smaller loop is thread onto the stake and is tight enough so that the spring will not fall off the stake. The larger loop is used to hook the spring onto the stake, over the take-out. When removing a damaged spring from the stake, turn the spring around the stake as you try to move it down the stake. Turn the spring in a direction counter to the loop winding because the loop has a tendency to open up as you slide the spring off the stake. New springs are hard to slide up on the stake. A special spring mounting tool (part # 920435) is available to make this procedure easier.

To mount a spring on the stake:

1. Place the small loop of the spring over the point of the stake, with the loop on the top side of the spring (the loop is offset to one side).

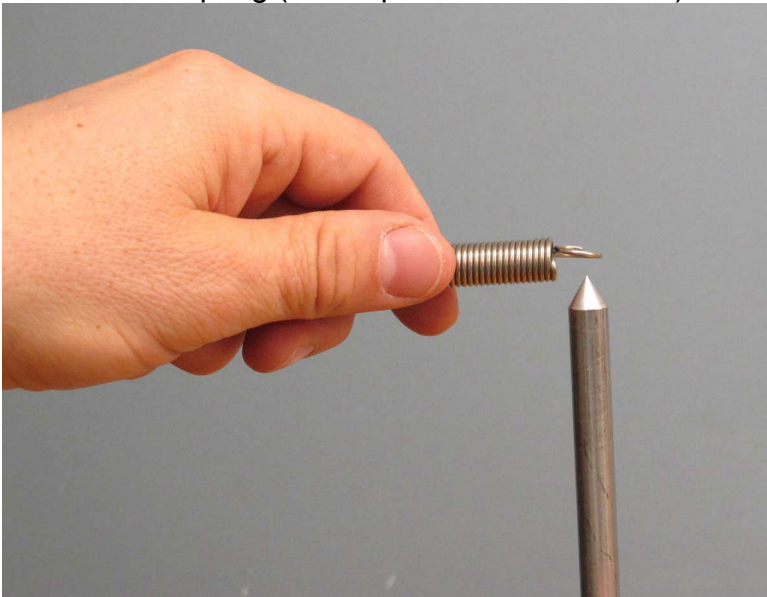


Figure 43: Place the small loop over the tip of the stake

2. Place the flange side of the mounting tool over the small spring loop and stake. Push down until the spring slips onto the stake. The flange protects the spring from being sheared off by the mounting tool.



Figure 44: The flange side of the mounting tool faces the spring

3. Push the spring down on the stake all the way to the stop knob.



Figure 45: Using the mounting tool, push the spring down on the stake

The mounting tool cannot be used to push springs all the way over old bent stakes. It can be used to get started, and then the spring has to be pushed onto the stake by other means.



Figure 46: Push the spring to the stop knob

12.3.3 Swift Cable With Dual-Mode Electrode Switches (Active Cables)

The Swift (dual-mode) cable is used for automatic resistivity or resistivity/IP surveys. The cable has a number of electrode switches (smart electrodes) mounted, most commonly at equal intervals along the cable.

The electrode switches are numbered consecutively along the cable. The number of each electrode switch is marked on the cable beside the switch. Each electrode switch also stores this number, or address, in its memory.

The cable has a 17-pin connector (SuperSting R8) or a 7-pin connector (SuperSting R1) in each end. The lower address number end of the Swift (dual-mode) cable has a female connector; the higher address end of the cable has a male connector.

The electrode switches are of the patented (patent 6,404,203) dual-mode type, meaning that they can be used in two different modes. Each switch has two take-outs: a large cylindrical stainless steel take-out and a micro banana jack (small cylinder take-out on old style switch (see Figure 46) take-out). When the switch is used in single mode, the large take-out is used both for current transmission and for potential measurement.

When the switch is used in dual-mode, the large take-out is only used for current transmission and the smaller take-out is only used for potential measurement. Dual-mode switches make it possible, if required, to use non-polarizable electrodes also during automatic IP surveys.

The micro banana jack is covered by a plastic plug. Before using the electrodes in dual-mode, remove all plastic plugs and keep in a safe place. After the survey is over, replace all plugs.

There is a Swift (dual-mode) cable system available both for the SuperSting R1/IP and the SuperSting R8/IP.

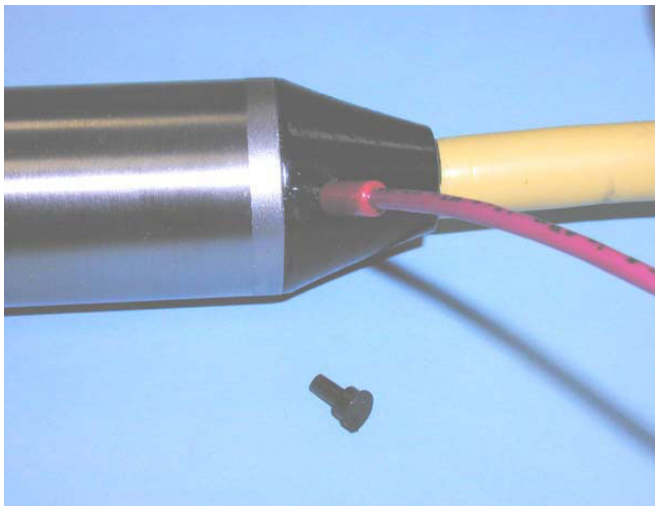


Figure 46: Remove the plastic plug using your fingernails



Figure 46: Single mode operation



Figure 46: Dual-mode operation

12.3.3.1 Dual-mode electrode cable design

Several changes in electrode cable design have occurred over time. However, all electrode cables are compatible within the SuperSting R1 and the SuperSting R8 series cables.

The dual-mode electrodes used to have two cylindrical take-outs. In dual-mode operation the large cylinder was used for current and the smaller cylinder was used for potential measurement.

The new design dual-mode electrodes have one large cylinder and a micro banana jack. In dual-mode operation, the large cylinder is used for current and the micro banana jack is used for potential.

In single mode operation, the large cylinder is used as take-out for both types of electrodes.

When ordering new parts, it is important to indicate what kind of cables and instrument you are using:

- The SuperSting R8 uses a 17-pin connector.
- The SuperSting R1 uses a 9-pin connector.
- Previous Sting/Swift (dual-mode) R1 cables used a 7-pin connector; current R1 cables have a 9-pin connector.



Figure 46: New style dual-mode electrode switch



Figure 46: Old style dual-mode electrode switch

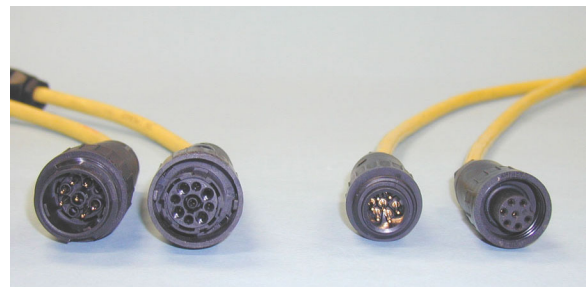


Figure 46: New style plug and socket R1 connector to the left, old style R1 connector to the right

To use R1 cables with the SuperSting R8, you will need an adapter with either the new (9-pin) or old (7-pin) R1 connector. To use R1 cables with the SuperSting R1, you will need an adapter if you have the old style R1 cables. All adapters can be ordered from AGI.

12.4 Manual Cables

Even though the SuperSting was designed primarily to be used with the Dual-mode automatic electrode system to collect large amount of data in a fast way, it can also be used for sounding and profiling using four cable reels and stakes.

The most common field problem relates to

cable problems. It is a good practice to treat the cables carefully. Observe the following tips to avoid cable problems:

- To avoid "crosstalk" between the cables, try to run the current cables and the potential cables at a safe distance of a few meters from each other wherever possible.
- Do not un-reel and reel in cable by pulling the cable. Instead "walk" the cable in and out.
- Inspect the cable frequently to detect any cut in the insulation. Remove worn sections of the cable.
- Use plastic reels to avoid "creep currents" to the ground. Do not use metal reels.

Of the cable problems, the most common has to do with the banana connectors. It is advisable to use banana connectors that are soldered on the cables, and to carry a set of spare banana connectors of the "screw on type" in case one of the soldered connectors comes off in the field.

12.5 Electrodes

For regular resistivity, stainless steel electrodes are used for both automatic surveys with the dual-mode system and manual surveys. For resistivity/IP surveys, stainless steel electrodes are often used. However, for the highest quality IP data, we recommend that you use non-polarizable electrodes (6" x 1.25" part # 920023 or 4" x 3" part # 920099) for potential electrodes when performing a manual survey. When performing an automatic IP survey using dual-mode and the highest data quality is required, use our dual-mode electrodes in dual-mode with a stainless steel stake in combination with a non-polarizable electrode.

12.5.1 Stainless Steel Electrode Stakes

For manual resistivity work using four cable reels and four stakes, the stainless steel electrode stakes are sufficient. Connect the cables to the electrodes with a solid copper Muller-clip soldered to the cable. When the electrode distance is short at shallow surveys, remember not to push the electrodes too deep into the ground, to avoid changing the geometry (the electrode is supposed to be a point source). In these cases, do not put electrodes deeper into the ground than about 5% of the distance between the electrodes.

When using smart electrodes for automatic survey, simply attach the electrode switch to the stake using the stainless steel spring. Make sure there is a good contact between the smart electrode and the stake. Make sure to get the stake deep into the ground so that the crossbar is about 5 cm (2") above the ground.

12.5.2 Non-Polarizable Electrodes

Non-polarizable electrodes (6" x 1.25" part # 920023 or 4" x 3" part # 920099) are used when high quality IP data is required. The non-polarizable electrodes are shipped dry. To prepare for use, just unscrew



Figure 46: Non-polarizable electrodes, 6" x 1.25"

the end with the porous tip, and fill with distilled water to 1 cm (1/2") below the threads. Replace the tip and shake the electrode to dissolve the copper sulfate crystals.

NOTE: Some undissolved copper sulfate crystals always remain in the electrode. The copper sulfate solution must be saturated.

For operation, connect the top copper terminal of the electrode to the potential cables (M and N) or when performing automatic survey with the Swift, connect the top terminal to the micro banana take-out with a jumper cable. Remove the vinyl protective cap from the ceramic porous tip. Place ceramic tip in contact with the moist soil and take your reading.

Always replace the vinyl cover on the electrode after each usage to prevent moisture loss in the ceramic plug.

If the solution level is getting low, remove the porous tip end of the electrode and fill with distilled water. Replace the end piece, making sure both ends are on firmly to affect proper sealing. Shake electrode to obtain proper solution saturation.

12.5.3 Graphite Electrodes

Graphite electrodes (**US patent 6,674,286**) are available for underwater use. AGI developed these electrodes because graphite is not affected by electrolysis and does not corrode under water. Regular stainless steel electrodes can be used under water for only a short time, until the electrolysis causes them to rapidly corrode. When using electrodes under water, metal stakes are unnecessary. With the graphite electrode placed on the bottom, contact with the water provides enough current to perform a survey.

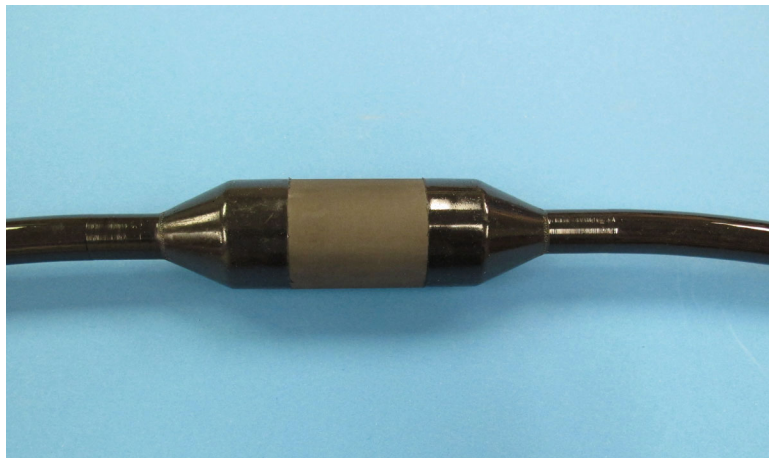


Figure 47: Underwater cable with graphite electrode, Kevlar reinforcement and water block

An underwater cable can also be used with graphite electrodes on land. However, because the graphite is soft and brittle, we do not recommend using the graphite electrodes with the connecting stainless steel springs. Use rubber bands to secure the graphite electrodes to the stakes instead, as springs will quickly damage the graphite electrodes.



Figure 48: Graphite electrode, secured to the stake with a rubber band

13 SuperSting R8 Marine Instrument

The SuperSting Marine instrument (part # 953001), in conjunction with the Marine Log Manager module of the SuperSting Administrator software, is used for fresh or salt water aquatic surveys, but can also perform land surveys and borehole surveys. It can perform the following functions for underwater measurements:

- Manage maps on which log trajectories are plotted
- Process received data from SuperSting stored in normal STG files
- Process GPS log files to retrieve survey position data
- Create depth/temperature file
- Convert from Lat/Long. to UTM coordinates
- Create data files ready for inversion in the EarthImager 2D inversion software with the Continuous Resistivity Profiling module

The marine system comprises the following parts:

- SuperSting Marine instrument
- Lowrance GPS receiver with temperature and depth finder
- Wi-Fi box programmed with client settings
- Two Wi-Fi antennas
- Marine Log Manager software
- SuperSting Manager App, including the Marine Module
- Electrode streamer

In water, the instrument can be used in dynamic mode, measuring continuously as the electrode streamer is towed along a profile, or in static mode, by placing an underwater electrode cable on the ground underwater.

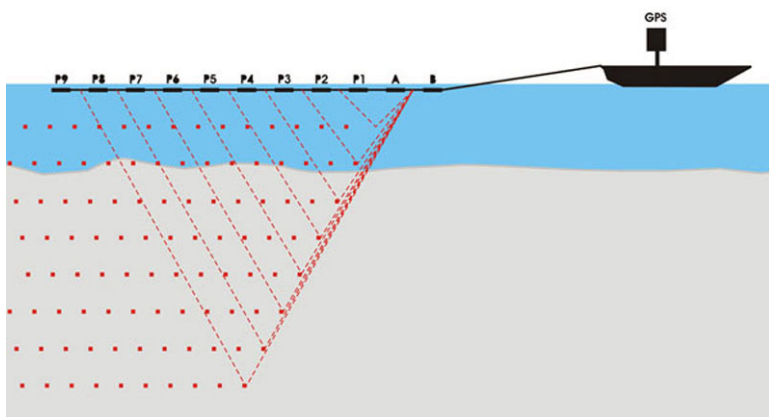


Figure 49: The electrode streamer is towed just below the surface. Current is injected into the water through electrodes A and B, simultaneously the potential is read between electrodes P1-P2, P2-P3....P8-P9.

When used in dynamic mode, the SuperSting Marine continuously records and stores data from a GPS receiver. Current is injected every 3 seconds and 8 apparent resistivity values representing 8 depth levels are simultaneously read for each current injection. Depth of penetration depends on the length of the cable and array type. Typically you will see down to approximately 20% of the electrode spread length.

The electrode streamer consists of 11 electrodes: two for current injection and nine for potential measurements. The current injection electrodes A and B are made of graphite (**US Patent 6,674,286**) to prevent corrosion through electrolysis, when a current is passed through them in water. The potential electrodes are made of stainless steel since no current is passed through them.



Figure 50: Graphite electrode molded onto a marine streamer

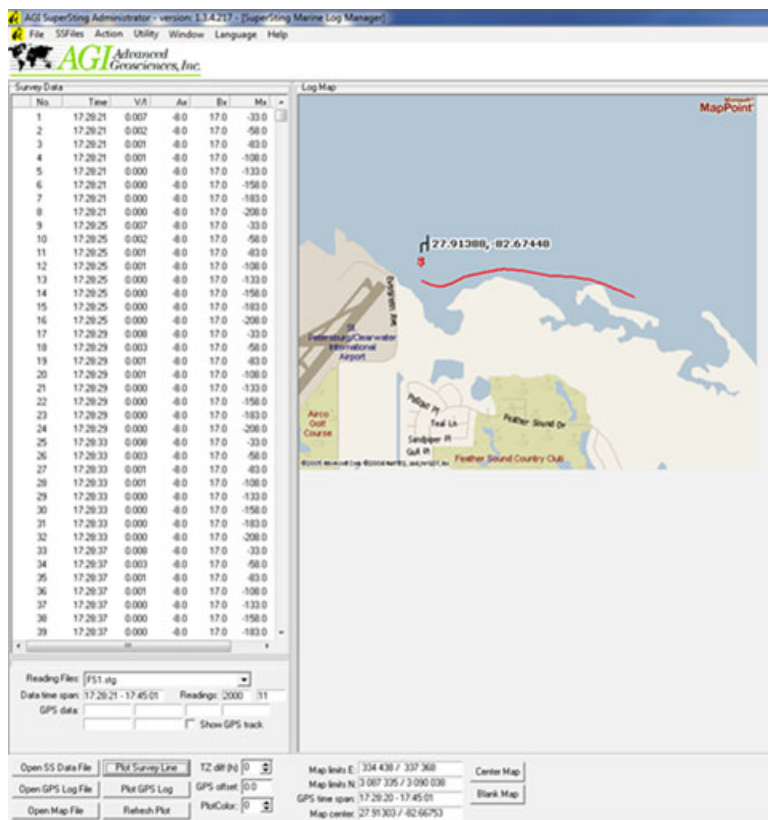


Figure 50: The Marine Log Manager software presents the data, map, and GPS information. The red line on the map indicates the boat's track.

The streamer also features water block, a Kevlar strength member, and anchor points. The water block prevents water from entering the cable if a cut occurs in the outer jacket. The anchor points, where the streamer can be tied off to the boat or where a sea anchor can be attached, are secured to the Kevlar strength member. There is one anchor point in each end of the streamer.

For a dynamic mode survey, the Marine Log Manager software allows you to edit the recorded data, plot the boat track and the resistivity data on an imported map image, and to format the data for the inversion software. Electrode positions can also be converted to UTM coordinates.

In static mode, a special underwater cable is placed on the ground underwater and data acquisition is performed in a similar way as on land. The electrode cable can even be laid out on land, continue under a lake and come up on land on the other side. Stainless steel stakes are used to ground the cable on land, but stakes are not necessary underwater.

The underwater electrode cable features graphite electrodes (**US Patent 6,674,286**), a Kevlar strength member, and water block. The graphite electrodes do not corrode as current is passed through them. Regular metal electrodes quickly corrode in water environment, due to electrolysis processes. The water block prevents water from entering the cable if a cut occurs

in the outer jacket. For more information about graphite electrodes, see **Graphite Electrodes** on page 148.

Data from a dynamic survey or static survey are processed (inverted) by the EarthImager 2D software.

13.1 Marine Log Manager (MLM)

The Marine Log Manager module of the Administrator for SuperSting software is designed to manage the large data volume produced by the marine logging function of the SuperSting.

The main functions of the Marine Log Manager are:

- Managing maps on which log trajectories are plotted
- Processing received data from SuperSting stored in normal STG files
- Processing GPS log files to retrieve survey position data
- Creating depth/temperature file
- Conversion from Lat./Long. to UTM coordinates
- Creation of data files ready for inversion in the EarthImager inversion software with the Continuous Resistivity Profiling module.

13.1.1 Installation

The Marine Log Manager software is included as a module in the Administrator for SuperSting software. The Administrator is delivered on a CD as an accessory with the SuperSting Marine instrument, and the Marine Log Manager is protected from copying by a hardware key (dongle). To get the latest version of the Administrator, register as a SuperSting owner in our UserGroup at <http://www.agiusa.com/register.shtml>. Downloading the latest version of the Administrator is free for UserGroup members.

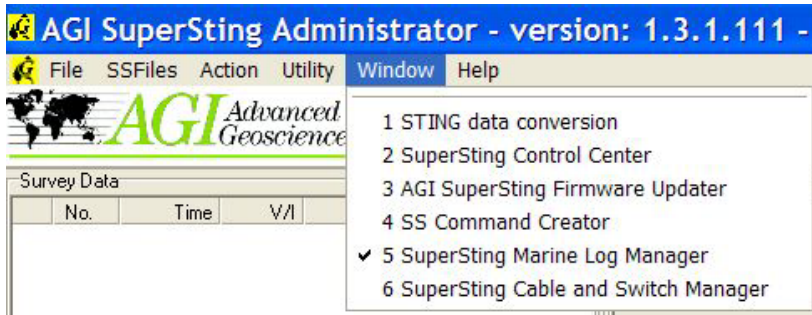
To install the software on your computer:

1. Insert the disk in your CD drive.
2. Make sure the USB key/dongle is NOT plugged in
3. Using Windows Explorer, double-click the file AGISSAdmin-MLM-1.3.2.160.exe (version number will vary).

The Administrator for SuperSting software will install, with the special settings for Marine Log Manager added.

You will need to plug in the hardware key (dongle) to run the Marine Log Manager.

With the hardware key connected, the SuperSting Marine Log Manager can be found under the Window option on the menu bar of the AGI SuperSting Administrator.



13.1.2 Operating Procedure

The following steps are needed to process marine logging data.

1. Record the data into the SuperSting Marine instrument using the Lowrance HDS-5 GPS-receiver delivered with the instrument (previously, Garmin GPS 12 XL was delivered with the system). The GPS positions and time will be saved with the readings in the SuperSting memory.
It is not possible to connect the GPS to a standard SuperSting R8/IP. It is possible to record the resistivity data in the SuperSting and the GPS positions separately as an NMEA file in a computer and later synchronize the two recordings, but it requires some care to get full accuracy. For example, it is very important that the SuperSting clock is properly synchronized before starting the measurement.
2. To aid the EarthImager inversion process, find the water depth before taking a measurement.
 - a. Use the Lowrance GPS unit with depth meter connected to the SuperSting Marine to improve the final result and make the processing easy. The Lowrance GPS records global positions, time, depth of water, and surface water temperature directly into the SuperSting Marine.
 - b. Other GPS receivers capable of outputting an NMEA file with global positions, time, depth of water and surface water temperature can also be used. If using other GPS receivers, the output must be captured as a text file in a computer and later merged with the resistivity data in the Marine Log Manager software.
3. Use the AGISSAdmin to download the data from the SuperSting memory to a PC hard drive. If you used a Lowrance GPS attached to the instrument, the download will provide the normal STG data file, in addition to an extra file containing the position, depth and temperature data. The name of this file is the same as the data file, but with a .gps extension.
4. Open the GPS file:
 - a. Start the Marine Log Manager by going to Windows, still in the AGISSAdmin, and click **SuperSting Marine Log Manager**.
 - b. Open the GPS file created when downloading the data from the SuperSting or captured as a text file in a computer by clicking the **Open GPS Log File** button. Unless there was an error, you will see the GPS position track plotted on the map.
5. If you don't yet have a map covering the survey area, use the following steps to create one. You must first load the GPS data to do this.

- a. If your survey area is in the U.S. or in Europe, use the Utility menu function "Get Map from MapPoint." This will help you download a bitmap from MapPoint and create data needed for the map calibration. Note that MapPoint does not cover the whole world so your area may not be covered.
 - b. Calibrate any "bit map" map using "Calibrate map" from the Utility menu. Use the functions to calibrate the map file you have obtained. This will show on screen where you actually did your survey. The calibration is supported by a data file created during the previous step.
 6. Load the map in the main window. Use the button or menu command "Open Map File," and map displays in the right-hand pane.
 7. If you are outside the U.S. and you do not have any "bit map" map of the survey area available, you can plot your track on a blank map.
 8. Load the data file (Open "SS Data File"). Be sure to use the same data file as the GPS log file you loaded before.
- NOTE:** The Time Zone difference (TZ diff (h)) box must have the appropriate time zone difference in hours for the resistivity data to plot.
9. Click the **Plot survey line** button to see the track of the survey line where resistivity was recorded.

13.1.2.1 Setting up the Garmin GPS 12 XL for survey

1. Push the red button to turn the Garmin on.
2. Push the **PAGE** button 5 times or until you arrive at the "Main menu."
3. Push the **Up** or **down** arrow to select the **SETUP MENU**.
4. Push the **ENTER** button.
5. Select the **SYSTEM** option and press **ENTER**.
6. Enter the following data:
 - a. Mode: Normal
 - b. Date: (today's date)
 - c. Time: (present time)
 - d. Offset: Time difference from Greenwich Mean Time, for example -06:00 central time.
 - e. Hours: 24
7. Push the **QUIT** button.
8. Select the **NAVIGATION** option and press **ENTER**.
9. Enter the following data:
 - a. Position Frmt: Select hddd°mm.mmm'
 - b. Map Datum: WGS 84
 - c. CDI: ± 0.25
 - d. Units: Metric
 - e. Heading: Auto E005°Degrees
10. Push the **QUIT** button and then select the **INTERFACE** option.
11. Make the following sections:
 - a. NMEA/NMEA
 - b. NMEA 0183 2.0

- c. 9600 baud (Note that the SuperSting also must be set up for Baud rate 9600. This is done in the SuperSting under menu 6/4/8.)

13.1.2.2 Setting up the Lowrance HDS-5 GPS for survey

Currently, the SuperSting Marine ships with the Lowrance HDS-5 GPS. Power the Lowrance GPS with a battery isolated from the SuperSting battery.

IMPORTANT

Do not use the same battery as the SuperSting Marine. Ground loops cause noise and errors if using the same battery. Power boats often have an accessible marine battery for the engine. This battery can be used for the GPS, but using the battery to power the SuperSting can damage the SuperSting.

Be sure a firm connection is made with the GPS power clips, and that the boat's wiring is not disturbed by adding the power clips.

1. Push the **PWR/LIGHT** key to turn the Lowrance on.
2. Press the **MENU** key.
3. Use the arrow buttons to highlight **System**, and press **ENT**.
4. Highlight **Network** and press **ENT**.
5. Highlight **NMEA 0183** and press **ENT**.
6. Highlight **Serial Ports** and press **ENT**.
7. Select **Protocol=NMEA0183** and **Communication Port1=9600**.
8. **Baud rate=9600** is automatically selected. (Note that the SuperSting also must be set up for Baud rate 9600. This is done in the SuperSting under menu 6/4/8.)
9. Highlight **OK** and press **ENT**.
10. Highlight **Serial Output**.
11. Highlight **GPS** and press **ENT** to expand NMEA sentence availability.
12. Check the **GLL** box and press **ENT**.
13. Check the **GGA** box and press **ENT**.
14. Check the **RMC** box.
15. Highlight **Navigation** and press **ENT**.
16. Check the **RMB** box and press **ENT**.
17. Highlight **Sonar**.
18. Check the **DBT** box and press **ENT**.
19. Check the **DPT** box and press **ENT**.
20. Check the **MTW** box and press **ENT**.
21. No other NMEA sentences are required by the SuperStingR8, and any additional boxes should be unchecked.

If logging on a laptop instead of the SuperSting, you can capture the serial output and make sure that the Lowrance outputs NMEA-data with the following parameters:

- \$GPRMC (including both time and date)
- \$SDDBT (the Lowrance depth record)
- \$SDMTW (temperature)
- \$SDDBT (the Lowrance transducer record)

To double check Marine GPS NMEA sentences directly to the SuperSting:

1. Connect the Lowrance GPS unit connector marked "GPS" to the SuperSting front panel connector marked "PC SERIAL COM."
2. Power up the instrument.
3. On the SuperSting, go to menu 4/1 and turn **1. Logging:** to **ON** by toggling the number **1** key (Note that the SuperSting must be set up for Baud rate 9600, which is done under menu 6/4/8).
4. On the same menu, make sure that **2. Log interval** is set to **00:00:00** (hh:mm:ss). This will ensure immediate next reading as soon as the previous reading is finished.
5. Still on menu 4/1, turn **3. Marine GPS Interface:** to **ON** if you have a GPS receiver connected to the SuperSting.
6. On the same menu select **4. Check GPS Com** and make sure the instrument is synchronizing with the GPS by displaying time, coordinates, depth and temperature.

Note: From this point on the instrument must be turned on. If it accidentally is turned off, you have to go back to menu 4/1 and double check the marine GPS display **Check GPS Com**.

Press and hold the **PWR/LIGHT** key to turn the Lowrance on/off as needed.

The Lowrance settings will be stored from now on, and resume sending NMEA sentences when the Lowrance is powered on (assuming good satellite signal is available).

13.1.2.3 Recording positional data to a computer when using a standard SuperSting R8/IP

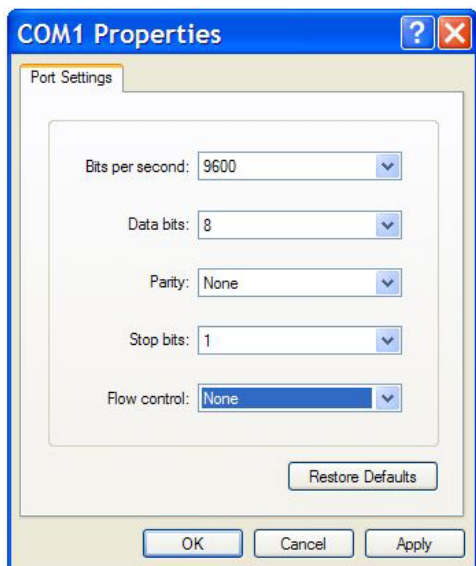
1. Connect the Garmin or Lowrance to the COM1 port of a computer using the RS232 cable.
2. Start the Hyper Terminal under Programs/Accessories/Communications/.



3. Write a name (GPS-connect, for example) and click OK.

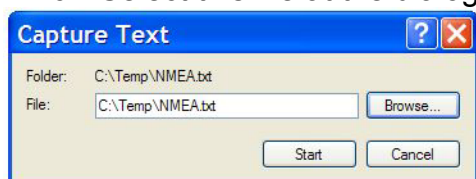


4. Set the following communication parameters. Note that baud rate must be 9600, the same as the GPS setting.



If the GPS is connected, you will see the GPS data stream over the computer screen.

5. Select **Transfer/Capture Text** at the menu bar, and select a file for the positional data using the **Browse** button.
NOTE: In some Hyper Terminals, this text file has to already exist at this point. It is best to create a text file and save it, as NMEA.txt, for example, prior to starting the Hyper Terminal.
6. Select this file at the dialog box and the following window appears:



7. Click **Start** and the positional data will be stored in NMEA.txt.

If you want to stop or pause the recording, go to **Transfer/Capture Text** and select the **Stop** or **Pause** function.

13.1.2.4 Setting up a standard SuperSting R8/IP for survey

Before surveying, load the MarineDD.cmd command file into the SuperSting memory, using the Administrator SuperSting Command Center module.

If the positional data is recorded separately in a computer, the resistivity and positional data are merged by using time synchronization. Therefore, the SuperSting clock must be time synchronized to the GPS unit. To synchronize:

1. Power up the GPS unit.
2. Make sure the GPS is set up as described in **Setting up the Garmin GPS 12 XL for survey** on page 155, and **Setting up the Lowrance HDS-5 GPS for survey** on page 156.
3. In the Garmin, push the **PAGE** button until the time is displayed at the bottom of the screen. In the Lowrance, press the **PAGES** key, and use → or ← to select Status, where the local time is displayed.
4. Power up the SuperSting and go to menu **6/3 Set date and time**.
5. Set the SuperSting time to match the GPS time exactly.

GPS NMEA file

The National Marine Electronics Association (NMEA) specifies a data format for positional and other data. The Marine Log Manager uses GPS data in the NMEA format. The following parameters are used:

```
$GPRMC Position record, example:
$GPRMC,235124,A,3025.8792,N,09752.6799,W,3.2,247.3,220403,6.0,E*6D

$SDDBT Depth record used by Lowrance GPS units, example:
$SDDBT, 8.6,0.0*59

$SDMTW Temperature record used by Lowrance GPS units, example:
$SDMTW,19.5,C*09
```

When reading in the GPS file, Marine Log Manager automatically detects the depth and temperature records and uses them in the following position reading. A depth and temperature record will be used only once in a position record.

13.1.3 Electrode Streamer

The AGI electrode streamer has a minimum of 11 electrodes. Two current electrodes and 9 potential electrodes are arranged at equal spacing along the cable. The first two electrodes are the current electrodes.

The total length of the electrode spread determines the depth penetration. Typically, a depth penetration is about 25% of the electrode spread length. For example, if a streamer with 10 meter electrode spacing is used, the total electrode spread length is 100 meters and the

expected depth penetration is approximately 25 meters. Streamers can be ordered with custom electrode spacing.

To prevent corrosion caused by electrolysis, the current electrodes are made of graphite. The potential electrodes are made of stainless steel.

The cable has at least two anchor points. The first one, placed 2 meters from the streamer connector, is used to secure the streamer to the boat before deploying the streamer. The second anchor point, positioned at the end of the cable, is used to attach a sea anchor.

The electrode streamer can also be ordered with multiple electrode spacings. For example, a streamer can be ordered with 5-meter and 10-meter spacing. In this case, the 11 electrodes at the end of the streamer are arranged at 5-meter spacing and an additional 5 electrodes are arranged at 10-meter spacing at the beginning of the streamer. By using a short adapter cable between the SuperSting and the streamer, the 5-meter or 10-meter spacing can be selected.

13.1.4 Marine Survey

To set up and perform an aquatic survey:

1. Wire tie one float in the middle of the cable, between each electrode.
2. Tie the top anchor point of the electrode cable to the boat.
3. Connect a small “sea anchor” (a small bucket with a hole in the bottom) to the bottom anchor point of the electrode cable to provide some drag to keep the cable stretched during the survey.
4. While the boat is slowly moving forward, put the electrode cable in the water by feeding it out, one electrode at a time, making sure the cable is laid out straight behind the boat. Take caution not to tangle the cable into the propeller.
5. Connect the marine cable and power to the SuperSting.
6. Connect the Lowrance GPS unit connector marked “GPS” to the SuperSting front panel connector marked “PC SERIAL COM.”
7. Power up the instrument.
8. Start the GPS recording prior to starting the resistivity survey (see **Recording positional data to a computer when using a standard SuperSting R8/IP** on page 157).



Figure 51: float tied to the cable

IMPORTANT: Turn on the GPS and start moving the boat forward before recording the resistivity data. Turn on recording with the SuperSting when the boat passes the first location on the profile to be recorded. The readings will not be usable until the last electrode passes over this start point.

9. On the SuperSting, go to menu 4/1 and turn **1. Logging:** to **ON** by toggling the number **1** key (Note that the SuperSting must be set up for Baud rate 9600, which is done under menu 6/4/8.)
10. On the same menu, make sure that **2. Log interval** is set to **00:00:00** (hh:mm:ss). This will ensure an immediate next reading as soon as the previous reading is finished.
11. Still on menu 4/1, turn **3. Marine GPS Interface:** to **ON** if you have a GPS receiver connected to the SuperSting.
12. On the same menu, select **4. Check GPS Com** and make sure the instrument is synchronizing with the GPS by displaying time and coordinates.
NOTE: From this point on the instrument must be turned on. If it accidentally is turned off, you have to go back to menu 4/1 and re-set log mode.
13. Go to the main menu and select **1 Automatic mode.**
14. Create a data file for storage of the resistivity data.
15. Select the “MarineDD” command file.
16. Enter Scaling factor = electrode spacing (spacing between electrodes on the cable).
17. Enter Start X= negative distance between the cable connection point on the boat and the first electrode (lead- in) behind the boat. For example, if the distance from the cable connection point and the first electrode is 10 meters, enter -10. The position of the GPS antenna relative to the cable connection point should be written down (positive distance if the antenna is forward of the cable connection point) and later entered in the Marine Log Manager software.
18. Press any key to access menu 6/1
Measurement Settings.

Enter the measurement settings as indicated below:

- Cycles: 1
- Max error: 2.0
- Max repeat: OFF
- Max current: 2,000 mA (set lower if you notice during measurement that the sent out current is lower)
- Measure time: 800 ms
- Measure units: meter
- Separate potential: OFF
- Measure mode: RES
- Defaults: MARINE

1. Press **MEN** to exit menu 6/1.
2. Press **MEA** to start measurement.
3. Drive the boat in a straight line to keep the electrode cable straight behind the boat.



Figure 52: Starting the marine survey with floats attached to the electrode cable

4. Maintain a speed of about 2-3 km/hour, making sure that the electrodes stay under the water surface at all times.
5. To stop the measurement, press and hold the **MEN** key.
6. Turn off the GPS recording.
7. Turn off the SuperSting.

13.1.4.1 Marine Command File

The marine command file (marineDD.cmd) controls how the instrument records data. The MarineDD.cmd file is for dipole-dipole measurements, where the current electrodes are located closest to the boat. The file is loaded into the memory of the SuperSting Marine instrument, and is also stored on the Administrator CD that was delivered with the instrument.

A hard copy of the ASCII file is shown below for reference, if the MarineDD.cmd has been lost.

```
;Automatically created command file
:header
progID=MarineDD
unit=meter
type=R
arraytype=3
Binf=0
Ninf=0
MUX=1

:geometry
1,0.00,0.00,0.00
2,-1.00,0.00,0.00
3,-2.00,0.00,0.00
4,-3.00,0.00,0.00
5,-4.00,0.00,0.00
6,-5.00,0.00,0.00
7,-6.00,0.00,0.00
8,-7.00,0.00,0.00
9,-8.00,0.00,0.00
10,-9.00,0.00,0.00
11,-10.00,0.00,0.00

:commands
;A,B,P1,P2,P3,P4,P5,P6,P7,P8,P9,channels
2,1,3,4,5,6,7,8,9,10,11,12345678
```

13.1.5 Processing

To start processing the data you have recorded:

1. Start the Administrator for SuperSting software with the hardware key connected.
2. Use the SuperSting Control Center to download the resistivity data from the SuperSting. If a GPS has been attached to the SuperSting, the GPS data will be downloaded at the same time as the resistivity data.
3. Select the SuperSting Marine Log manager from the Window option on the menu bar.

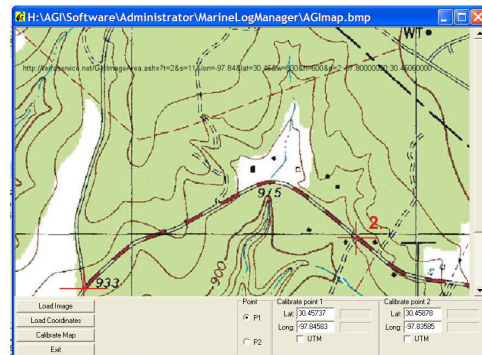
13.1.5.1 Preparing Your Own Map

1. For map background, use a map in .bmp format covering your survey area. This map can be obtained in various ways, such as by scanning a topographical map or finding and downloading an image on the Internet. You can even use scale-corrected satellite images, but the bitmap file must be scale-corrected to UTM standards.
2. Select two easy-to-recognize locations on the map where you can take positional data for map calibration. Note that the two locations should be far apart.
3. Go to each location with the GPS and write down the exact latitude and longitude.
4. Recalculate the latitude and longitude from degrees and minutes to decimal degrees. For example, if the latitude is N30°27.442', the decimal degree is $30 + 27.442/60 = 30.45737^\circ$ (carry out to five decimal places).

NOTE: Longitudes are negative in the western hemisphere. Therefore W97°50.750 translates to -97.84583.

13.1.5.2 Calibrate Map

1. Go to **Utility/Calibrate map**.
2. Click **Load Image**.
3. Select a map (in .bmp format) over your survey area.
4. Enter latitude and longitude for location 1 and 2.
5. Check Point P1 and then, using your mouse, place the cross hair over location 1 on the map and left click.
6. Check Point P2 and then, using your mouse, place the cross hair over location 3 on the map and left click.
7. Click the **Calibrate Map** button.
8. Click **Yes** to confirm and save the map calibration.
9. A map calibration file with extension .map has been created. This file, along with the original .bmp file, make up the Marine Log Manager map.



13.1.5.3 Get a Map Automatically for Surveys in the USA

Unfortunately, the Terraserver service has been discontinued and the automatic map retrieval from them is no longer available.

13.1.5.4 Getting a Map from MapPoint (USA and Europe)

If your survey was done in the U.S. or Europe, the Microsoft MapPoint service can be used to retrieve simplified non-topographical map images. The Utility menu includes helper functions for this. To retrieve the images:

1. Click **Open GPS Log File** and load the GPS file into memory.
2. Use the Utility/Get Map from MapPoint command. Click **Yes** when asked if you want the program to automatically open a connection to MapPoint.
3. When MapPoint opens, you must manually zoom in to get the best size image. Only use the size controls on the sides of the image, otherwise the center point will move and calibrations will be impossible.
4. Once you have found the largest size map that still contains the Lat/Long pin, right-click the image and select **Save Picture as** from the popup menu.
5. Set the picture format as .bmp, navigate to the survey folder, and save the image file.
6. Go back to Marine Log Manager and use the Utility/Calibrate Map function.
7. Click the **Load image** button to open the saved map image.
8. Click the **Load Coordinates** button to open the coordinate file that has been automatically created. The coordinate file is located in the same folder as the GPS log file.
9. Using the mouse, carefully locate the cross at the tip of the Lat/Long pin on the image and click the left mouse button.
10. Click the **Use Center (P2)** button to transfer the image center location to the P2 point.
11. Finally, click the **Calibrate Map** button to save the map, and then exit.

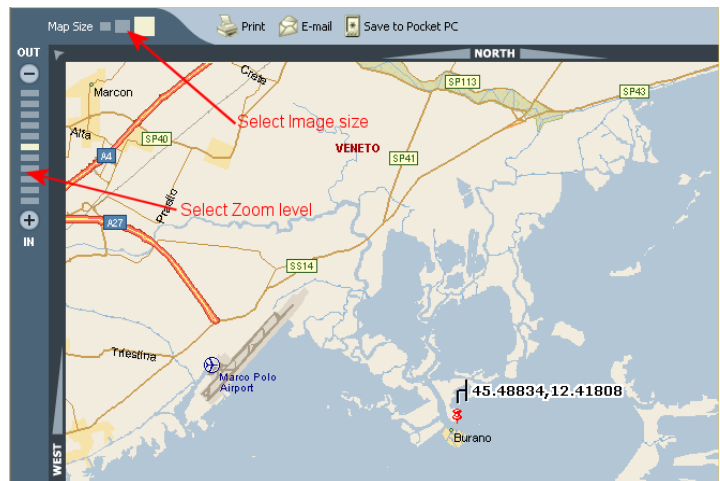


Figure 53: Microsoft MapPoint settings

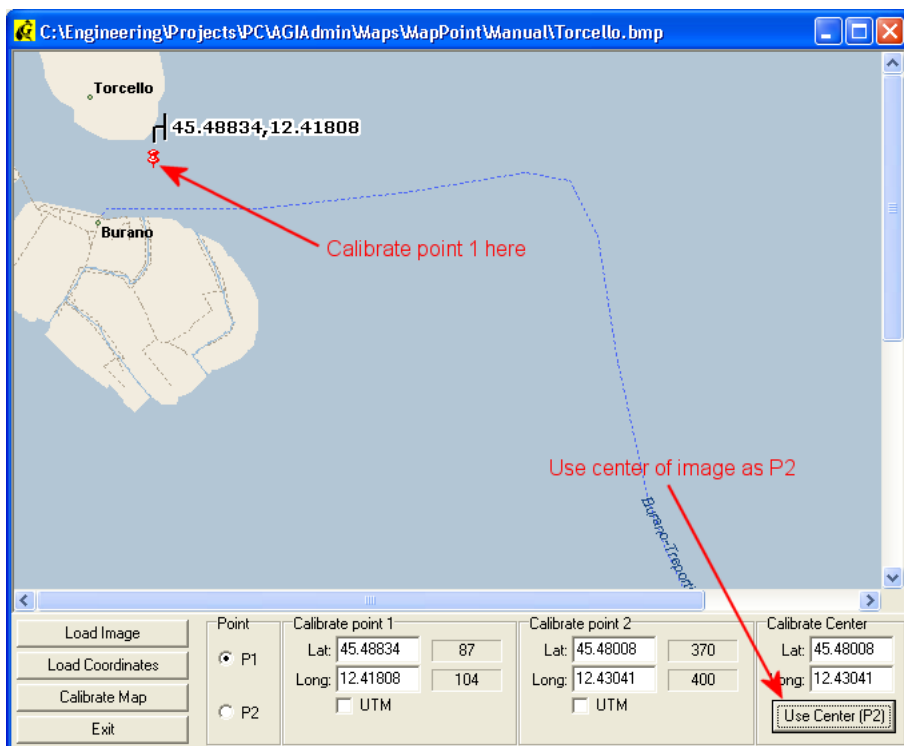


Figure 54: Calibrating a map using Marine Log Manager

12. From the main window, click the **Open Map File** button to navigate to and open the newly created Marine Log Manager map file.
13. Click the **Plot GPS Log** button to see your trajectory on the map.

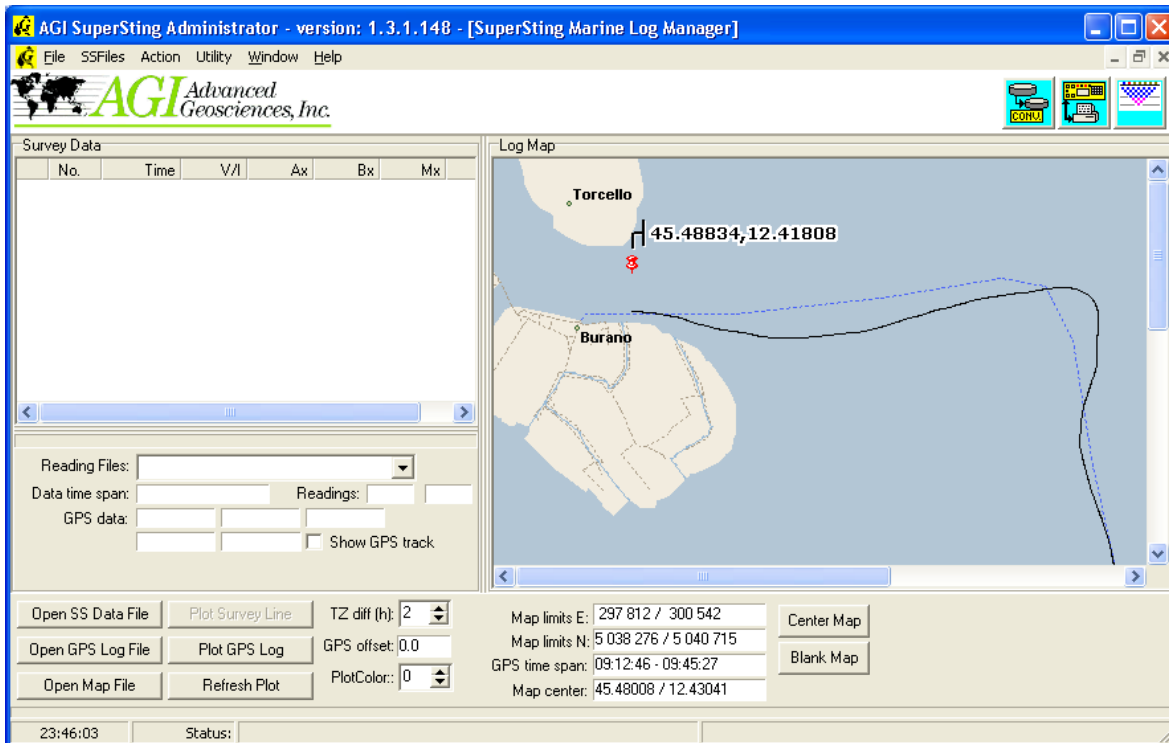


Figure 55: Viewing your map using Marine Log Manager

13.1.5.5 Using Maps from Google Earth

With the emergence of Google Earth, where close-up satellite photos can be obtained from many areas of the Earth, a new possible plotting background source is available.

Enhancements have been made to the Marine Log Manager functionality to enable the use of Google Earth images as plotting maps.

To obtain a Google Earth map image:

1. Load the GPS log file.
2. Select **Extract Google Earth coordinates** from the Utilities menu.
3. Open Google Earth.
4. Paste the location data in the **Fly To** input box.
5. Click the **fly** button and let Google Earth find your site.
6. Adjust the size of the image using the available controls. Make sure to display the coordinate grid (View/Grid).
7. Use the Google Earth menu command **File/Save/SaveImage** to save the image to a file.
8. To go **Utilities/Calibrate Map** in Marine Log Manager.
9. Open the saved image.
10. Using the image gridline as a guide, enter the top

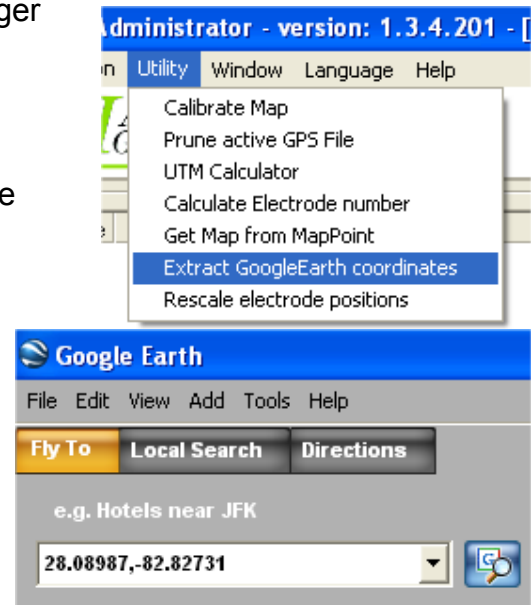


Figure 56: Google Earth "Fly To" data box

left and lower right intersection coordinate values into the Lat/Long boxes for calibrate points 1 and 2.

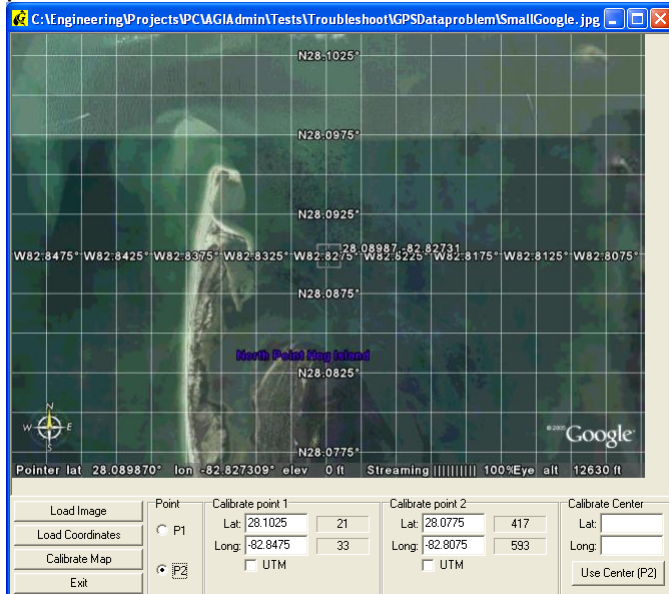


Figure 57: Viewing and calibrating image in Marine Log Manager

11. Carefully locate the crosshair on the top intersection and click the mouse button to capture that image location.
12. Select point P2 and repeat the crosshair selection for the lower right intersection.
13. Click the **Calibrate Map** button and then exit.

The map is calibrated.

13.1.5.6 Plot Survey Line on the Map

1. Click **Open Map File** and select the survey site map file with .map extension.
2. Enter the correct time difference from UTC in the **TZ** box.
3. Enter GPS offset. The offset is the distance between the cable connection point and the GPS antenna, positive if the antenna is in front of the cable connection point.
4. Click **Plot GPS Log**. The boat track is displayed on the map as a black line.
5. Click **Open SS Data File** and open a resistivity STG file.
6. Click **Plot Survey Line**. The boat track during resistivity recording changes on the map to a red line.
7. By changing the number from 0-4 in the "Plot Color" window, you can change the color of the resistivity track.
 - 0= Red
 - 1= Blue
 - 2= Green
 - 3= Teal
 - 4= Purple

This option is useful when displaying the track of several measurements on the same map.
8. The **Refresh Plot** button can be used to remove a track from the map.

13.1.5.7 Plot Survey Line on a Blank Map

If a .bmp map is not available, you can still edit your survey data by plotting the track on a blank map. To plot the track and survey data on a blank map:

1. Click **Open GPS Log File** and specify the GPS file used.
2. Click **Blank map**.
3. Proceed with survey data editing as described below.

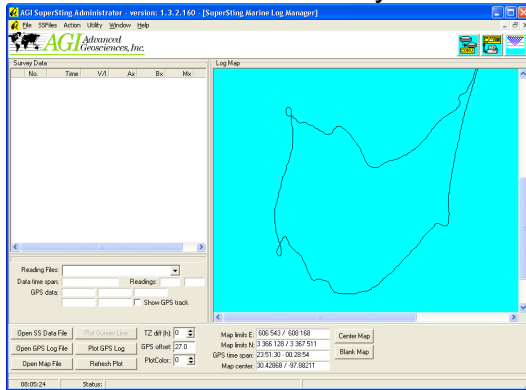


Figure 58: Plotting a survey line

13.1.5.8 Editing Resistivity Data

The resistivity data is displayed in the “Survey Data” window. During resistivity processing, it is assumed that the electrodes are in a straight line behind the boat. A complete resistivity data set may contain many sections that cannot be used, in u-turns, for example. Straight sections of data need to be extracted into sub-sets for further processing. To extract this data:

1. Click **SSFiles > Open SS Data File** to read in the appropriate STG file.
2. Click **SSFiles > Open GPS File** to read in the appropriate GPS file.
3. Click the **Blank Map Button** if not map is loaded.
4. Click **Plot survey line**.
5. Click any of the data lines. A red cross on the map indicates where this data point is located. Use this function to locate subsets of your full data set.
6. You can clear the red crosses by clicking **Refresh Plot** and then **Plot Survey Line**
7. You can also click directly on the track on the map to select the closest data point in the list to help you find the end points of the straight sections.
8. Right click any of the data points and a pop-up window will open.
9. Click **Mark First Item** to mark the first data point in a section you want to extract from the total data set (Fig. 102).

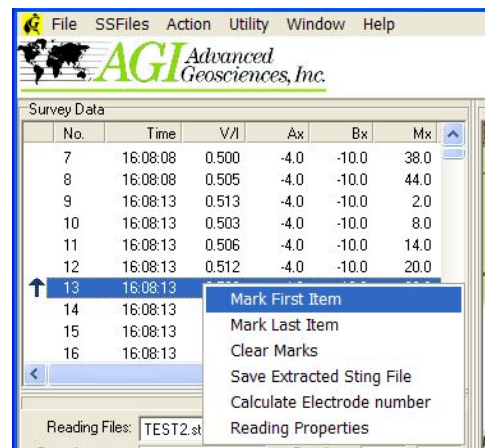


Figure 59: Data point selection

10. Go to the last data point of the data set you want to extract, right click, and then click **Mark Last Item**.
11. Right click again and click **Save Extracted Sting File** to save the extracted data file. A popup box will let you know that you are saving a non-linearized STG file with no depth file associated with it. You will need to load this new STG file and linearize it next.
12. Select a name and directory and save the file.
13. If the GPS data was recorded with water depth and temperature, a .dep file (depth file) needs to be made next by loading the STG just edited into straight line segments. Or if your files are all straight lines, then proceed to linearizing the STG without editing it.
14. Click **SSFiles > Open SS Data File** to read in the appropriate STG file.
15. Click **SSFiles > Open GPS File** to read in the appropriate GPS file.
16. Click the **Blank Map Button** if not map is loaded.
17. Click **Plot survey line**.
18. Click **Action>Convert Data File to Linear Coord**. This will create a two dimensional data set ready for inversion in the EarthImager2D with CRP. This also creates a DEP file if the GPS file contains the recommended depth data.
19. Click **SSFiles > Save SS Data File** Give the STG file a new name to signify that you have linearized the file (add "lin" at the end for example). As you save the linearized STG file, a matching depth or DEP file is saved. The DEP file allows you to add a-priori water depth and conductivity information for inversion in EarthImager2D with CRP module. All files are ASCII text and can be opened in Notepad or similar text readers.

13.1.5.9 Special Functions

Prune GPS file

The Prune GPS file function, found on the menu bar under **Utility**, is used to shorten long NMEA GPS files by removing all lines that do not begin with: \$GPRMC, \$PGRMZ, \$SDMTW or \$SDDPT. Prune will also remove erroneously formatted lines.

The original GPS file folder contains an opened file select dialog. From here, select which file name to save the pruned file under. Adding a -P to the file name, before the .gps extension, is a simple way to keep track of pruned files. For example, save the file Venice.gps as a pruned file Venice-P.gps.

UTM calculator

The UTM calculator, found on the menu bar under **Utility**, is used to calculate UTM (Universal Transverse Mercator) coordinates from latitude and longitude in decimal degrees.

Calculate Electrode number

The **Calculate electrode number** utility determines how many unique electrode positions the selected resistivity data file contains, after loading the GPS file and the STG file, linearizing the resistivity file, and selecting a section for processing.

Rescale electrode positions

This function is used to correct data in the STG file if an erroneous scaling factor has been entered during the set-up of the actual survey (see **Marine Survey** on page 160). To correct the STG file:

1. Load the STG file as usual.

2. Activate the "Utility/Rescale electrode positions."
3. Enter the scaling factor you want to apply. If you should have used a scaling factor of 3 but erroneously used 6 during data download, then enter 0.5 as the scaling factor to convert the scale from 6 to 3. The value is the multiplier you must apply to get the distances right based on the STG distances. There is no information available on the original scaling used.
4. The STG file is rescaled and then displayed again.
5. Use the "SSFiles/Save SS Data file" to save the STG file to a new name, or continue by loading the GPS file and process the STG file in memory.

IMPORTANT Only files that have not yet been linearized or UTM converted can be rescaled.

13.1.5.10 Inverting the Data Using the EarthImager Software

To invert marine data, we recommend that you use the optional CRP (Continuous Resistivity Profiling) module of the EarthImager software.

For detailed instructions on how to invert the data, read the EarthImager instruction manual. The basic procedure includes the following:

1. Start the EarthImager software.
2. Go to **File/Read data** and select the appropriate STG file.
3. Go to **File/Read Water Depth File** and select the appropriate DEP file if depth and temperature data were output by the GPS unit.
4. Go to **Settings/Initial settings** and select the Default settings for Saltwater or Freshwater survey. Click **Apply**.
5. Click the **start inversion** button (green arrow) to start the inversion.

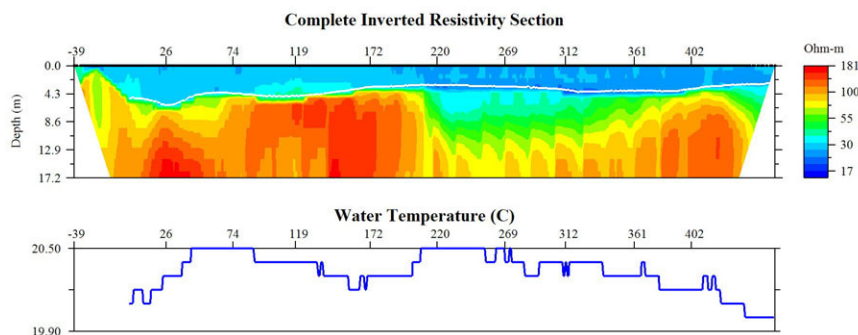


Figure 60: Inverting data with EarthImager software

14 Maintenance

14.1 Calibration

We recommend that the SuperSting instrument be calibrated once a year. For calibration, contact your nearest AGI distributor or contact AGI direct by e-mail to agi@agiusa.com or phone +1 512-335-3338 or fax +1 512-258-9958.

14.2 Fuses

There are a total of three fuses protecting the SuperSting instrument. They are all easily accessible from the front panel and marked 20A, 1.0A, and 2.5A on the R8; 20A, 1.0A, and 2.0A on the R1.

- The main fuse is for incoming power to the SuperSting. It is a 20 Amp/32 V, 1 ¼"x ¼" fuse.
 - The R8 fuse kit (part # 951018) includes one 20 Amp, 1x1/4", one 1 Amp 250V 5x20 mm and one 2.5 Amp 250 V 5x20 mm fuse
 - The R1 fuse kit (part # 851018) includes one 20 Amp, 1x1/4", one 1 Amp 250V 5x20 mm and one 2 Amp 250 V 5x20 mm fuse
- The 2.5 Amp (2.0 Amp for the SuperSting R1) fuse protects the receiver. The fuse is a 2.5 Amp/250 V, 20 mm fuse.
- The 1 Amp fuse protects the active electrode cable or any attached switch box. The fuse is a 1 Amp/250 V, 20 mm fuse.

SuperSting R8 fuse kit parts list:

- F1A250V
- F2.5A250V
- F20A250V

SuperSting R1 fuse kit parts list:

- F1A250V
- F20A250V
- F2A250V

14.3 Battery Life

The clock battery should last up to 10 years from the time the clock was manufactured. Note that the clock may have spent some time on the shelf before it was delivered to us and installed in the SuperSting. Estimate at least 5 year of operation.

The backup battery for the RAM memory depends on how often the SuperSting is used. If the SuperSting were to sit on the shelf without being used at all, the backup battery will last for about 1 year. However, this will vary depending on how often the SuperSting has been used.

For battery replacement, contact your nearest AGI distributor or contact AGI direct by e-mail to agi@agiusa.com or phone +1 512-335-3338 or fax +1 512-258-9958.

Part	AGI part number	Manufacturer part number
Clock chip	1000018	DS12C887+
Clock battery	1000165	DL2450

14.4 Electrode Cable

Small cuts and holes in the yellow polyurethane jacket of the dual-mode cable can be repaired by using a soldering iron set for not more than 200°C to melt together the insulation. Use extreme caution not to melt the insulation of the inner leads.

IMPORTANT

Always keep the connectors clean and dry to avoid current leakage between the cable members, resulting in bad readings. Always keep the dust cap on the connector, whenever it is disconnected. Never leave an open connector on the ground.

If the connectors have been contaminated or wet, try to blow them clean using dry compressed air, rinse in distilled water (careful not to get water into the connector housing), blow dry and finally dry the connector in a warm place over night. If compressed air is not available, “canned air” can be obtained from most computer stores. This product is used to blow dust of keyboards and computer components.

15 Error Codes and Messages

HVOVL Issued when the SuperSting cannot send out current. Usually caused by a discontinuity in the AB circuit. Check for disconnected cables and disconnected electrode switches or try to decrease current electrode contact resistance by wetting the soil around the electrode with water.

TXOVL Issued when there is a problem with the transmission of the current after the measurement cycle has started. The error could be caused by poor electrode contact to ground (varying resistance) or loose connections somewhere in the AB circuit. When using the automatic electrodes, the measurement is automatically restarted if Repeat (M6/1/3) is not set to **Off**. If this error persists during the last Repeat, then this measurement station is skipped.

INOVL Issued when one of the input amplifiers has been overloaded. Measurement will continue on all other receivers as normal. When the measurement is finished, the measurement is automatically restarted if Repeat (M6/1/3) is not set to **Off**. If this error persists during the last Repeat, then this measurement station is skipped.

Electrode stakes not being planted firmly in the ground typically causes both INOVL and TXOVL error messages.

NOT ENOUGH MEMORY Issued when either the data memory is full, or the command file memory is full. This message appears when trying to create a new manual mode file if there are too many manual mode data files.

TRANSMITTER OFFLINE !!! This error message is issued when the office power supply is powering the instrument, if the firmware cable is attached to the instrument, or if there is a malfunction in the transmitter/instrument communication. In case of such malfunction, contact AGI or the nearest distributor.

TEMP WARM When this warning is issued, it is important to make sure the instrument temperature is lowered. By keeping the instrument in shade and out of direct sun light, the internal temperature of the instrument is lowered 10 – 15 °C. It is also a good practice to lower the current setting in case you get a “TEMP WARM” warning.

TEMP OVERHEAT If no action is taken and the instrument continues to heat up, a “TEMP OVERHEAT” is displayed and the instrument shuts down and can only be restarted when it has cooled down.

BLANK SCREEN or DARK SCREEN The LCD is sensitive for temperature and may turn pale or too dark with change of ambient temperature. To adjust the contrast to a suitable level, press the contrast key repeatedly (see **Keyboard** on page 24.)

16 SuperSting With Wi-Fi Technical Specification

Available as eight- or single- channel memory earth resistivity, SP & IP meter

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 V _{p-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 the 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 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). 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").

SuperSting Manager App

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.
Minimum Android version	Gingerbread 2.3 or above.
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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