SYSCAL TERRA

IRIS INSTRUMENTS

RESISTIVITY & IP

SURVEYING SYSTEM OF
NEW GENERATION

The combination of recent electronics with 30 years of know-how

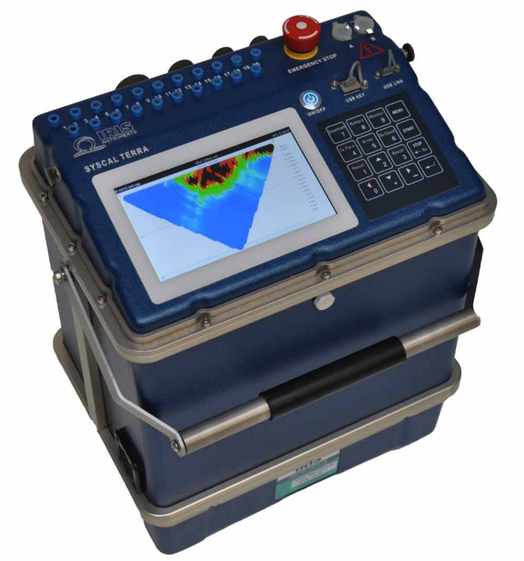
· Rugged system made for the field: This new generation resistivity & IP surveying system mixes recent electronics advances with the standards of resistivitymeters designed by IRIS Instruments for more than 30 years such as robustness, compactness, light weight and large temperature range (-20°C to +70°C). The transmitter part has been redisigned for a better cooling and improved performed in hot context.

· Exceptional data quality: The Syscal Terra features 20 channels measured with a 24 bits converter giving 30 bits of dynamic range (at 100 Hz). This new generation of resistivity & IP meter allows to measure accurately resistivity and IP signal with few mV of reception.

· Color touch screen: The graphic color screen allows the user to clearly visualize the 20 IP decay curves at the same time and the pseudo-section of resistivity and chargeability during and after the measurement. For a better experience of navigation in the menus and of text writing, the screen can be set as touchable.

· Automatic recording of full waveform data: The Syscal Terra automatically records the 20 channel voltage timeseries in background. It allows if necessary to visualize and to reprocess your dataset a posteriori on a laptop with a free dedicated software (FullWave Viewer 2).

· Scalability: The Syscal Terra exists both in standard or switch mode (48 to 120 electrodes in a single box). A Syscal Terra standard can also be connected to one or several Switch Terra unit(s) (48 to 240 electrodes in a unique box) to be used in switch configuration. Connect 2 Syscal Terra Switch in master-slave mode to increase your total number of electrodes (2 Syscal Terra Switch 48 become 1 Syscal Terra Switch 96)

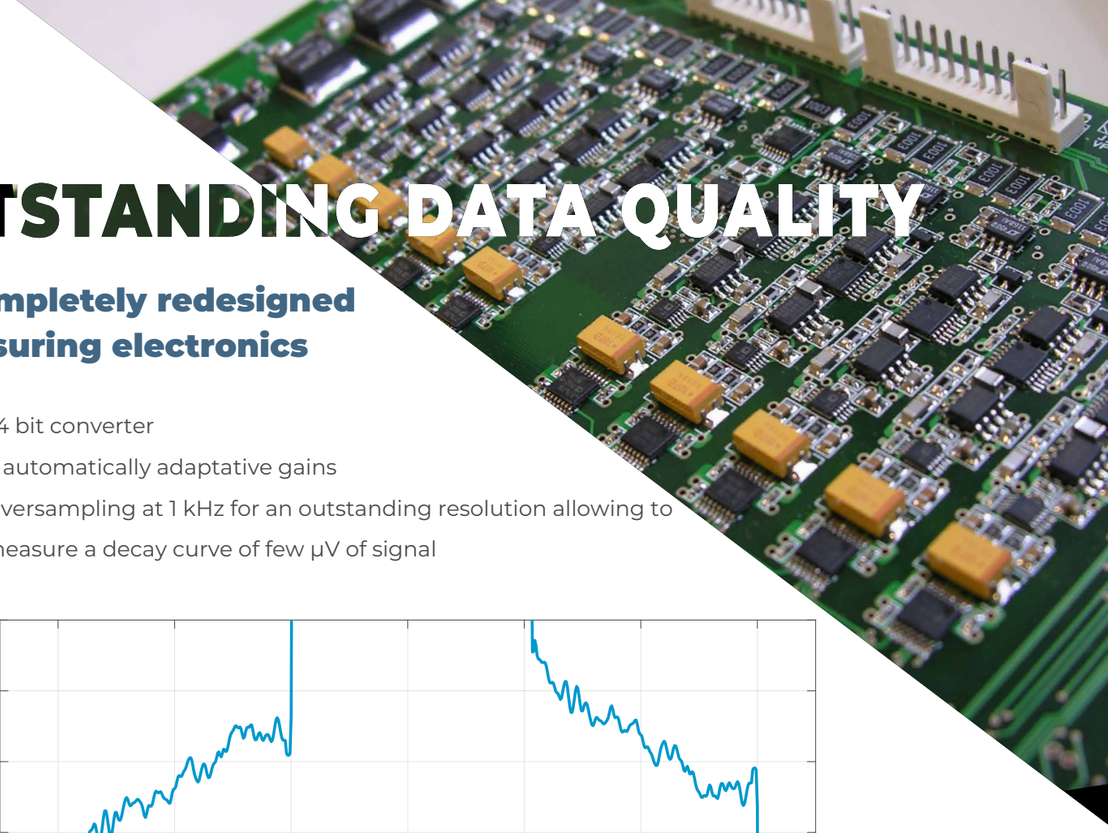


· Update and test the Syscal by yourself: Realize self-test by yourself (calibration, switch board and external battery capacity testing) using specific tools provided with the system. Update the Syscal firmware by yourself for free during the entire lifetime of the system to benefit from new developments.

· A multitude of interesting features: such as removable Li-ion batteries for easy shipping and replacement, external battery powering possibility, removable/adaptable signal filters, decay curves stored with one sample every 10 ms (full decay curve), datafiles download on a USB key or by Wi-Fi from laptop and any smartphone or tablet, internal GPS included and automatic handle of local and global coordinates to visualize your profiles on Google Earth, and a lot of other options to discover

· On-time IP acquisition mode: Reduce by two the total measurement time of your survey and multiply by two the IP signal strength.

· Free IP: The Syscal Terra allows to get an estimate of IP data while measuring resistivity at 500ms injection time.



OUTSTANDING DATA QUALITY

A completely redesigned measuring electronics

- 24 bit converter
- 4 automatically adaptative gains
- Oversampling at 1 kHz for an outstanding resolution allowing to measure a decay curve of few µV of signal

With the standards of IRIS Instruments resistivity meters

- Max. Voltage: 1000 V (2000 Vpp) in VES mode, 800 V (1600 Vpp) in ERT mode
- Max. Power: 250 W
- Max. Current: 2.5 Amp
- Light weight
- Large temperature range (-20°C to +60° C/+70° C on external battery)
- Up to 120 electrodes in a single casing
- Large autonomy

A higher accuracy, increased depth of investigation and improved productivity on the field

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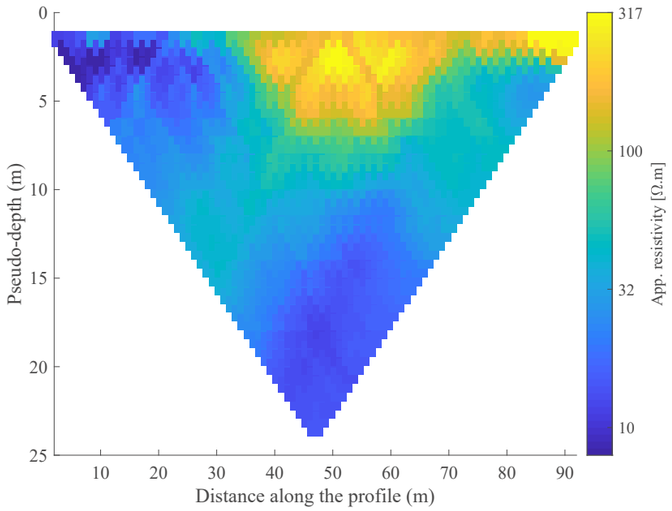
THE HIGHEST PRODUCTIVITY ON THE MARKET

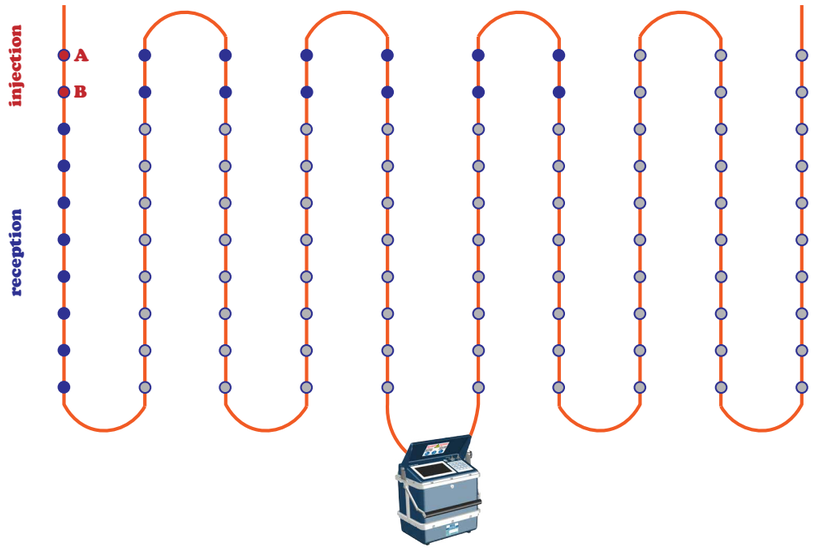
20 channels for 20 simultaneous measurement in a single injection

dipole-dipole: 2034 measurements in 6 min



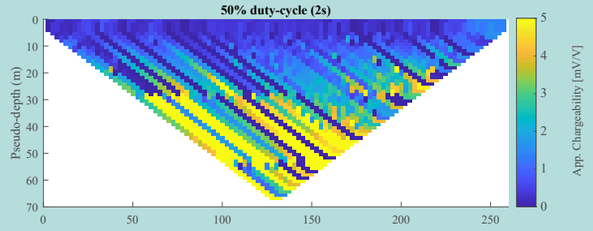
- For 2D surveys, the 20 channels of the Syscal Terra allow a fast acquisition with adapted configurations such as :
  - Multiple gradient
  - Wenner-Schlumberger reciprocal
  - Dipole-Dipole
  - Full gradient
- Useful for small electrode spacing in 2D configuration
- Up to 500 measurements per minute

For 3D survey, the gain of productivity is even more obvious.

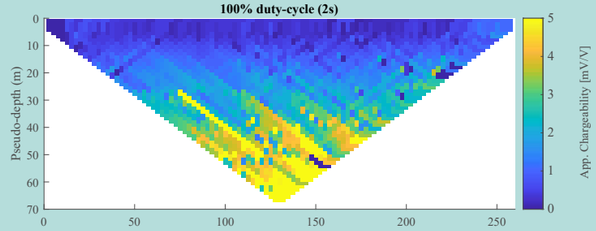


WITH ON-TIME IP SAVE TIME & INCREASE SIGNAL

STANDARD OFF-TIME IP
50% duty-cycle
2s pulse - 8 stacks
Acquisition time: **75 min**

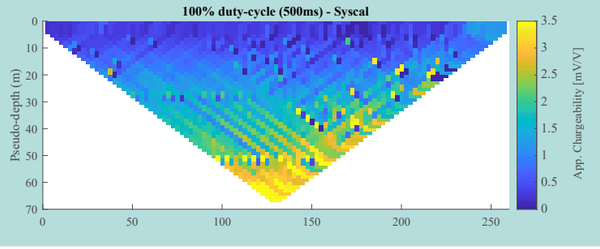


ON-TIME IP
100% duty-cycle
2s pulse - 4 stacks
Acquisition time: **21 min**



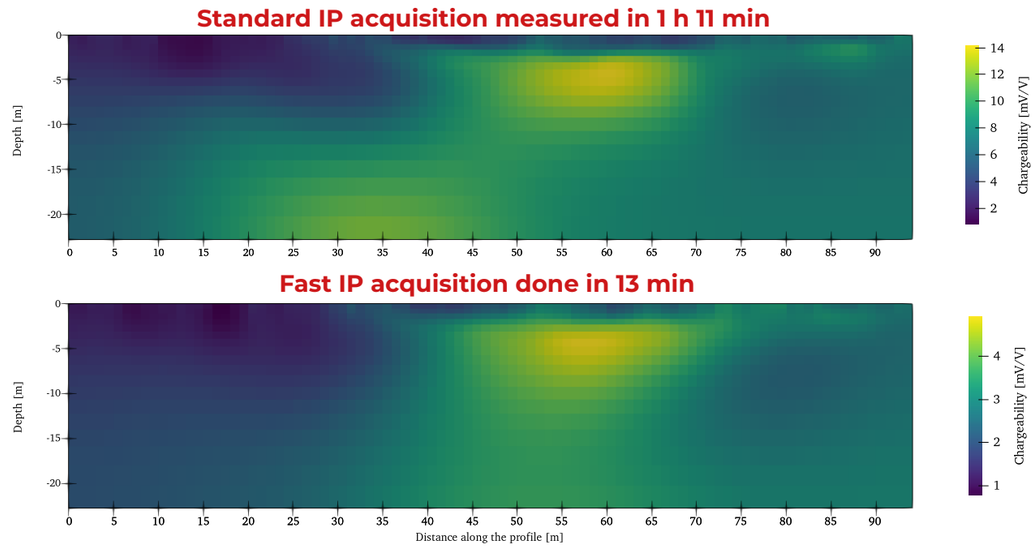
FAST IP - (on-time)
100% duty-cycle
500ms - 4 stacks
Acquisition time: **7 min**

Fast IP gives a «free» estimate of the IP while measuring resistivity



Conductive site = low reception

FOR SIMILAR SHAPE OF IP ANOMALY



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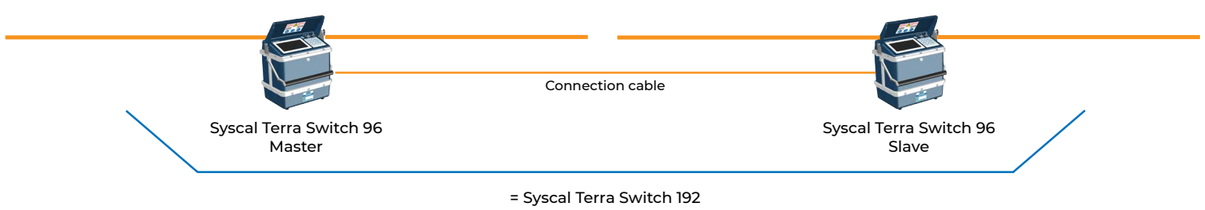
AN EXTREME FLEXIBILITY

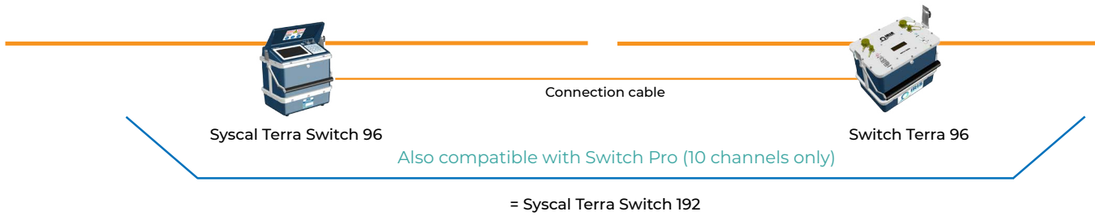
WITH THE MASTER-SLAVE MODE

The Master-Slave use allows to combine several Syscal Terra Switch for a new system with a higher number of electrodes. Eg. Two Syscal Terra Switch 96 can be connected to operate with 192 electrodes. The Syscal Terra slave acts as a simple Switch Terra 96.

This feature will bring more flexibility for your survey. Depending on your need, you can:

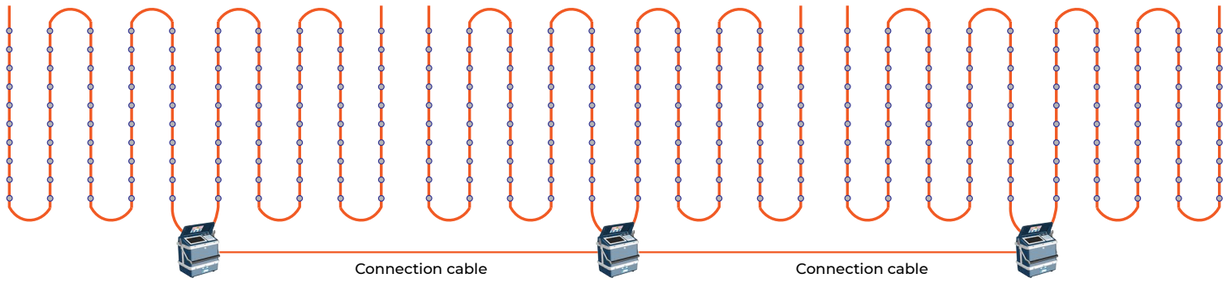
- Buy several systems with a lower number of electrode and to combine them for occasional deeper surveys.
- Rent a second system occasionnaly for deeper survey
- Borrow additional system(s) to other agency, or to other universities
- Combine multiple systems from partners in the frame of research project





Go more easily for 3D surveys with hundreds or electrodes

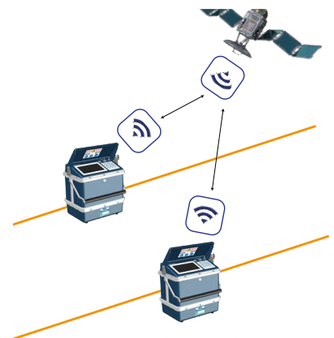
Rarely operated before due to the need of several Switch system



AND WITH THE MULTI-SYSCAL AND MULTI-TX MODE

The **Multi-Syscal** mode consists in a single acquisition performed with different Syscal Terra Switch (not connected together) synchronized to the GPS-PPS clock. The **Multi-Tx** mode refers to a survey for which several Syscal are injecting at the same time.

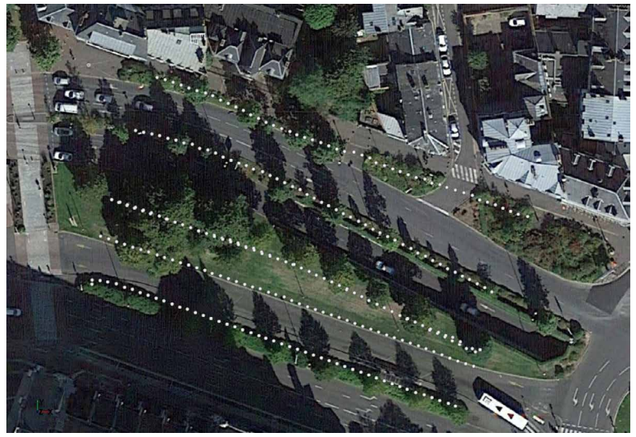
- Useful for complex 3D survey in urbanized area, around roads, highways or rivers
- Speed up acquisition (4 Syscal Terra = up to 80 measurements for a single injection)
- Can be used inside building or cave to better image under building, using synchronization on the internal clock



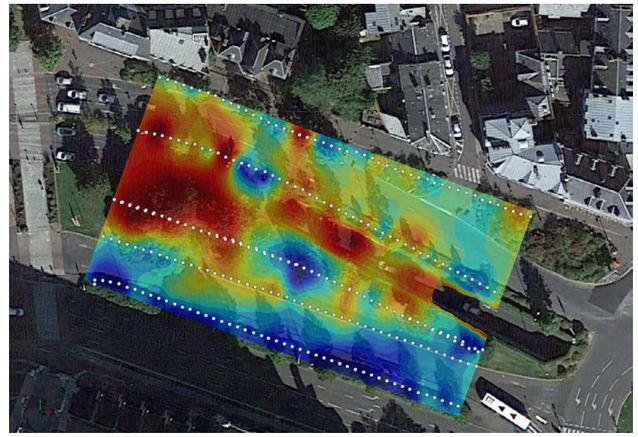
The **Multi-Syscal** principle

Example of a Multi-Tx survey in Orléans city (France). The objective was to image in 3D the ground under this place crossed by several roads (7 lanes in total) without any possibility of stopping traffic. So far this was inconceivable, but now possible thanks to the new **Multi-Syscal** & **Multi-Tx** capability.

Two Syscal Terra Switch 48 were used together in this mode to perform 4 different acquisitions of 1500 measurements realized in 8 minutes each. In this survey, the potential measured by a Syscal Terra gathers the contributions of the injections of the different lines. The cross-information between the different lines brings 3D sensitivity and the possibility to reconstruct a 3D model of the area.



Position of the different ERT profiles



3D resistivity model obtained from the Multi-Tx survey

IRIS instruments proposes this new functionality together with the ERTLab studio software containing a module specifically developed for **Multi-Tx** sequencer and data inversion.

GEOstudi Astier
STRUMENTI PER LA GEOFISICA

ERTLAB STUDIO

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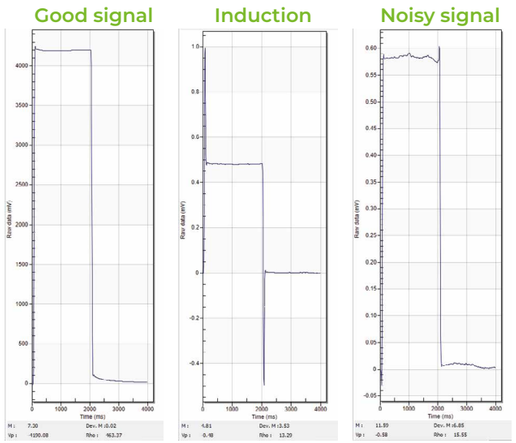
IMPROVE DATA QUALITY

EASILY QUALITY CONTROL YOUR DATA

In addition to usual readings, the Syscal Terra records now extra parameters allowing to better estimate the data quality:

Injection parameters set on the system, two different standard deviations for apparent resistivity and chargeability, but also the stacked half-period that can be very usefull to visualize a perfect signal, induction phenomenon or noise in the data



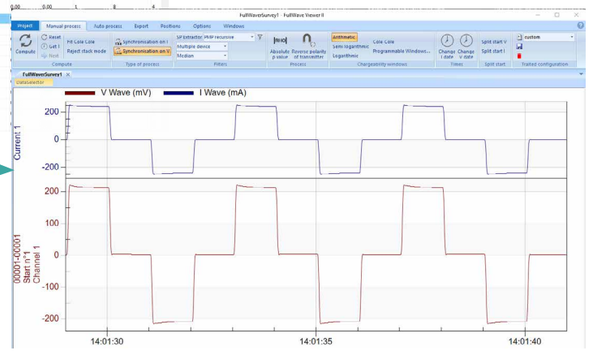
The Sycal Terra allows you to record the full waveform timeseries on 19 channels voltages together with the current. The first interest of this feature is the ability to perform a better quality control of the data

The Prosys III software has been redesigned for a better and faster quality control. It allows a straight connection between field measurement and timeseries.

PROSYS III

One click in Prosys to visualize and reprocess the raw data in FullWave Viewer 2

FULLWAVE VIEWER 2



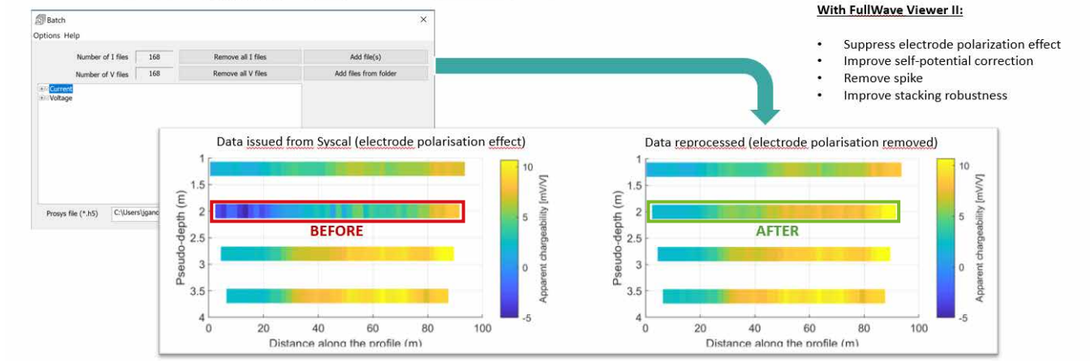
The Syscal Terra is delivered with the FullWave Viewer 2 software designed for the simple and rapid visualization of the data. Visualize and better understand your data (electrode polarization effect, spikes, single-frequency noise, signal under the noise level, etc.). This software will help you to understand the phenomenon that deteriorates the signal. This feature will help the user to quickly improve its experience and expertise in data acquisition.

POST-PROCESS TIMESERIES TO IMPROVE DATA QUALITY WITH ADVANCED ALGORITHMS

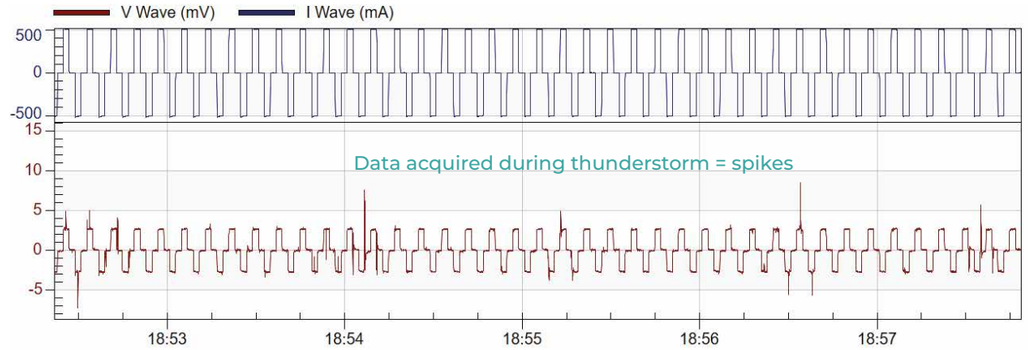
The FullWave Viewer 2 software allows you to automatically reprocess the timeseries recorded to increase the accuracy of your apparent data.

Since 30 years, the resistivity meters compute internally apparent resistivities and chargeabilities with fast, robust and simple algorithm to remain efficient on the field.

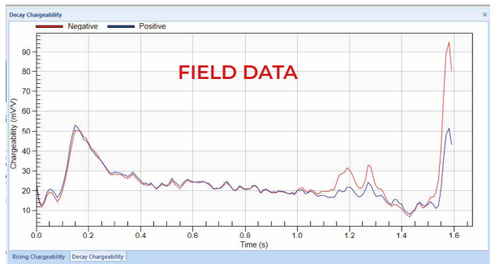
Now that the timeseries are recorded, it is possible to use the performance of your laptop to reprocess the timeseries in few minutes. Advances algorithms such as notch filters, spikes rejection or the compensation of non-linear self-potential will allow you to improve data quality.



Example of suppression of electrode polarization effect. Level 2 is polluted on the left. Our self-designed algorithm completely suppresses this effect on the re-calculated pseudo-section (right).



Syscal type processing

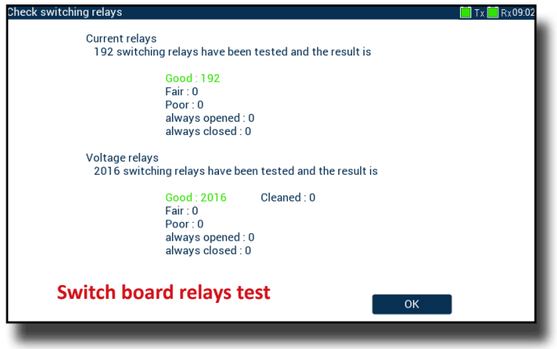


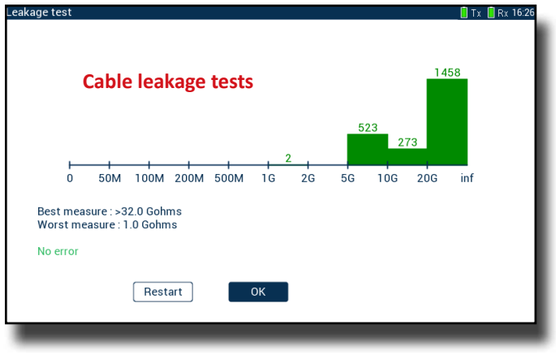
Fullwave Viewer 2 processing

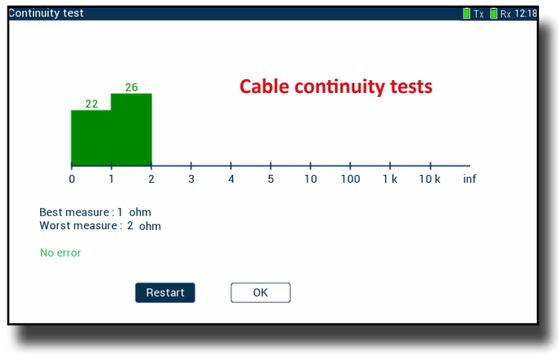
COMPLETE SELF-DIAGNOSTICS

More and more of our customers are required to provide proof of proper functionning of their systems before field surveying. In order to avoid expensive shipping to our premises, the Syscal Terra allows an almost complete self-diagnostic by allowing the test of different elements:

- External battery capacity
- Receiver board
- Transmitter board
- Switch board(s)
- Cables
- Connecting boxes







Leakage Terra Tester

For each test, a diagnostic report file is generated than can be included in the final report . A complete test of the Syscal Terra can be performed in few minutes before each contract to prove that your system is working properly.

These tests require few accessories provided with the Syscal Terra.
A leakage box, allowing to measure the current leaks between measurement channels is also proposed by IRIS Instruments allowing you to measure the internal leaks of your system but also of your cables. This box together with the Syscal Terra completely replaces the Protester device (developped for the Syscal Pro).

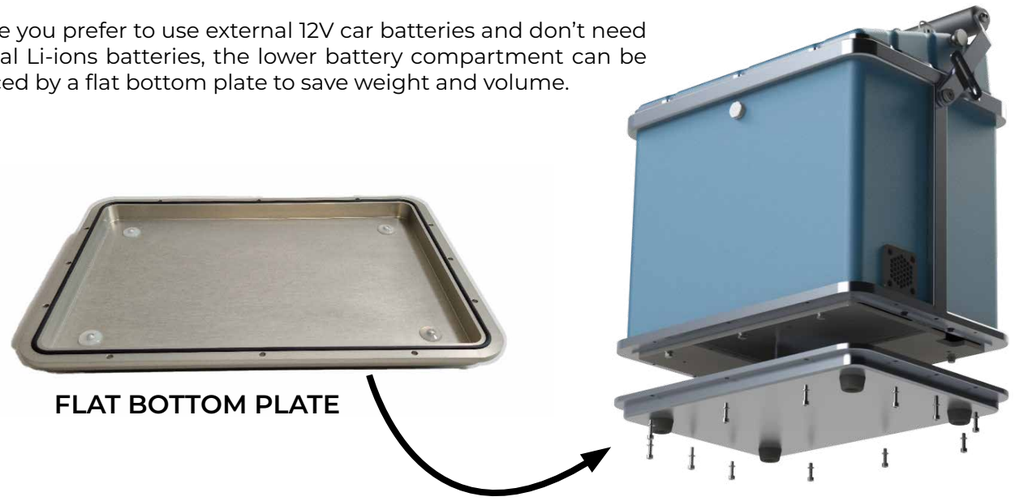
LATEST BATTERY TECHNOLOGY

The Syscal Terra box features an independant module containing 4 x 96 W.h Li-ions batteries. This part can be easily opened, allowing the user to remove easily the internal batteries to simplify shipping. The internal Li-ions batteries are totally optional as the system can operate with external batteries.

The 4 x 96 W.h batteries can travel easily with you as cabin luggages according to IATA regulation. Each battery weighs 450g and replaces a 2.6Kg standard 12V lead-acid battery of equivalent capacity

Additional spare batteries can be used to avoid the recharge of the Syscal Terra after the field. IRIS Instruments proposes charger packs for their external recharge.

In case you prefer to use external 12V car batteries and don't need internal Li-ions batteries, the lower battery compartment can be replaced by a flat bottom plate to save weight and volume.



ADDITIONAL FEATURES INCLUDED

RX-ONLY FEATURE

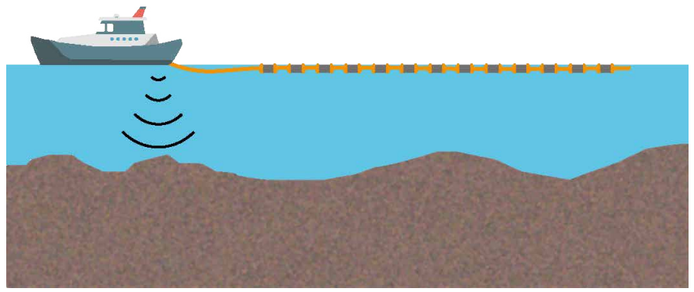
The Rx-only option allows to use the Syscal as a receiver only. The current is generally injected by a high power transmitter such as the TIP 6000.

The Rx-only option is generally used for deep resistivity and IP survey for which several amperes need to be injected in the ground to get signal.

Note that the Rx-only option can be used in standard mode (20 reception channels connected on the front panel of the Syscal) or in ERT mode (receiving electrodes are switched among 48, 72, 96 or 120 electrodes according a predefined sequence of acquisition).

DYNAMIC ACQUISITION FEATURE

- **Marine or land streamers**



The dynamic aquisition option allows the user to realize land or water (lakes, rivers, shallow sea) continuous acquisitions pulling marine or land streamer.

It requires specific cables that are continuously pulled during the survey. The measurement are automatically performed by the Syscal. The position is deduced from the position given by the internal GPS of the Syscal.

This option allows a very efficient mapping of large areas.

An echosounder may be added for the automatic measurement of the waterlevel. Our software is designed for straitghforward 2D/3D inversions with 2D or 3D representation.

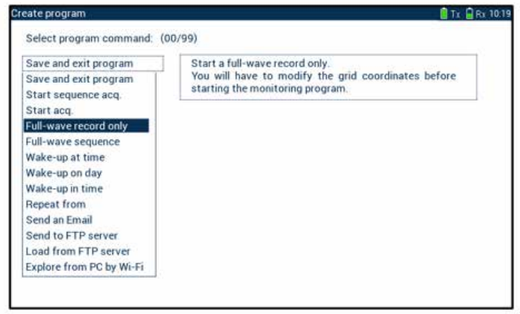
MONITORING FEATURE

The monitoring option can be used in two different manners:

- **For a single acquisition:**

The user can program its own script on the Syscal to program the automatic acquisition of a set of different sequences (eg. dipole-dipole, Wenner-Schlumberger, multiple gradient, etc...). It is now possible to program the Syscal that will run automatically the set of sequences defined. The user can work on other tasks without having to check or start manually the next sequence.

This script may be also used for the fast repetition of a measurement (eg. every 20 minutes a new acquisition is launched) during a short period.



- **For long-term monitoring (time-lapse):**

The monitoring mode also can be used for long-term monitoring. Indeed, the script generated allows the user to define a date and time of wake-up of the Syscal and to enter numerous acquisitions at different times with different sequences of measurements.

It is also possible to maintain an internet connexion thanks to the Wi-Fi module of the Syscal that can connect directly to an accessible Wi-Fi network or to a Wi-Fi 4G module. In that case, data can be pulled on a FTP server at a frequency and date defined in the script. A new script and new sequences can be sent on the FTP server. The Syscal will scan the server and replace its script by a new one automatically.

IRIS Instruments proposes a monitoring box that replaces the battery box of the Syscal. This monitoring box manages the charging of the battery: charging while Syscal is off and not charging during acquisition to avoid any potential connection to the earth.
The charge of the batteries can be done through standard main power chargers, windturbines, solar panels, etc...

A 4G module can be plugged into this box and powered automatically when needed.

SPECIFICATION SHEET

General specifications	
GPS	Internal GPS for a simplified management of the global (UTM) coordinates.
Memory	2 Gb + USB ports for external memory (1 Tb).
Temperature range	-20°C - +70°C on external batteries.
Casing	Polycarbonate rugged field casing - IP66
Sequence	Can be imported from a PC (Electre Pro / Electre Terra) or created directly in the Syscal. Le Syscal Terra est doté d'un séquenceur intelligent. Il effectue automatiquement quelques mesures sur le terrain et conçoit une séquence adaptée aux conditions de terrain (espacement des électrodes, résistance de contact et résistivité du sol).
Screen	7 inches 480 x 800 color touch screen (touch screen can be disabled).
Fullwave mode recording	Possibility to record 100 Hz fullwave form timeseries of voltage in background while measuring. Possibility to record full waveform only up to 1 kHz of sampling rate.
Monitoring / time-lapse	Possibility to use the system in monitoring mode. System is controlled by scripts written by the user. The scripts can be changed remotely. Data can be sent to a FTP server automatically. An additional module integrated to the Syscal Terra box, dedicated to the management of battery charge in between measurement, can be added to the Syscal Terra.
Mode Receiver Only	Possibility to use the system in receiver mode only (to be used with external transmitter).
Mode Dynamic acquisition (terrestrial or water)	Possibility to measure continuously resistivity and IP from an adapted cable towed on the ground or in the water. This type of functioning does not require additional PC or tablet.
Mode Master-Slave	Connected to another Syscal Terra Switch, the Syscal Terra Switch behaves like a Switch Terra to make a system with 192 electrode from two 96 electrode systems for example.
Mode Multi-Syscal / Multi-Tx	Combines several Syscal Terra for complex surveys without connection between them. Two Syscal Terra can work synchronously on the same sequence, based on their GPS clock. In Multi-Tx mode, several Syscal can inject simultaneously on the same sequence , synchronized through GPS clock.
Mode diagnostic	The Syscal Terra is provided with different accessories and internal software that allow to test the receiver board, the transmitter board, the switching relays and the external battery capacity.
Rx Firmware update	Update the Syscal Terra Rx firmware by yourself when a new version is available.
Batteries	Removable internal Li-ion batteries (4 x 96 Wh). Possibility to connect external battery for the Tx and Rx. Automatic recognition of external battery.
Data downloading	From USB key, WiFi connection from a web browser or using USB cable.
Weight	Syscal Terra Switch 96: 15.5 Kg with internal batteries.
Dimensions	Syscal Terra Switch 96: 45 cm x 37 cm x 24 cm.
Quality control	Computation of the quality factor on resistivity and chargeability and storage of a stacked semi-period with 1 sample every 10ms (even when timeseries are not recorded).
Full waveform processing	Possibility to perform advanced processing of full waveform data on Fullwave Viewer II to improve the data quality.
Compatibility	Compatible with the Switch Pro (10 channels only, requires additional connectors).
Pseudo-section display	Real time display of pseudo-section on demand.
Transmitter specifications	
Maximum voltage	800 V in ERT mode / 1000 V (1) in VES mode.
Maximum power	250 W (2) / 1200 W with external AC/DC generator
Maximum Current	2.5 Amp (3).
Range of resistance	Injects on a charge from 1 Ω to open-line
Regulation	Current regulation or voltage regulation
Type of injection	Value fixed by the user or automatically calculated according to reception voltage. Injection of a regulated current or a regulated voltage
Receiver specifications	
Number of measurement channels	20 channels galvanically isolated
AD Converter / Dynamic range	24 bits / 32 bits G.B.D. (4)
Input impedance	100 MΩ G.B.D.
Max voltage	15 V on Channel 1 & 15 V on the sum of channel 2 to 20
Input protection	1000 V
Filter	Selectable filters: -low pass - 10 Hz + Notch 50 or 60 Hz, low pass 256 Hz, low pass 512 Hz
Gain	4 Automatic gains input voltage
Resolution on voltage	0.29 nV G.B.D. (4)
Accuracy on resistivity	0.05% (5)
Induced polarization windows	20 windows with possibility to export the decay curve at 1 sample every 1 ms.
Induced polarization measurement	100% or 50% duty-cycle

(1) ± 0.2% (2) ± 1% (3) ± 0.5% (4) on resistivity measurement for 8s pulses, 3 stacks (5) measured on 1 V voltage and calculated as mean accuracy on 1.5, 2.0 and 2.5 A currents.

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OUR PRINCIPAL CUSTOMERS

SERVICE WORK COMPANIES, ENGINEERING CONSULTANCIES, NATIONAL AND LOCAL AUTHORITIES, UNIVERSITIES, GEOLOGICAL SURVEYS, ENVIRONMENTAL AGENCIES

Specifications subjects to change without notice BR_SYS_TERRA_GB_V4

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