

# ENERGY CONDUCTOR MEASUREMENT

MAKE SIGNIFICANT SAVINGS  
IN RAW MATERIAL QUANTITIES  
WHILE ENSURING CABLE  
PERFORMANCE  
TO THE REQUIRED STANDARDS



AESA Cortailod

THE HIGH COST OF  
RAW MATERIAL MAKES  
IMPORTANT THE USE  
OF IT AS ECONOMICALLY  
AS POSSIBLE.

THIS GOAL CAN ONLY  
BE ACHIEVED WITH AN  
EXTREMELY ACCURATE AND  
RELIABLE MEASUREMENT  
OF THE RESISTANCE OF THE  
CONDUCTOR.

## OUR SOLUTION

Performing fast measurements during manufacturing, ensuring optimal results accuracy, combining facilitated data analysis and simplicity of installation, the **ResTest** family is the perfect solution to overcome major challenges facing cables manufacturers.

ResTest family includes integrated equipment specifically designed for the cable industry.

These resistance bridges not only offer the operating comfort, but also allow mastering of all related uncertainties (temperature, length, current distribution...) to ensure full reliability of the measurement.

## OUR OFFERING

AESA provides a full range of equipment, ISO 17025 certified, to fulfil the specificities of most types of conductors - solid, stranded, flexible, insulated,... - no matter where the measurement has to be performed:

- In the incoming inspection
- On the production line
- In the shop-floor
- In the laboratory
- On the drum

There are a multitude of areas requiring the transport of energy through a metallic conductor. The conductor's resistance is always one of the determining criteria. Our equipment allow the validation of this criterion, regardless of the type of cable.

- Building
- Automotive
- LV, MV, HV conductors
- Overhead lines
- Green energies
- and more

## ROI < 6 MONTHS\*

**Significant raw material savings  
through ultra-smart inspection of  
safety margin.**

\* Considering a ResTest 813x on-the-line equipment and a reduced margin of 1% on a monthly copper consumption of 400 tons.

## 6 KEY POINTS TO BE VERIFIED FOR GETTING RELIABLE RESULTS.

### AESA SOLUTIONS

AESA delivers integrated, functional and accurate equipment/solutions.

The reliability of the measurement depends on the type of sample, uncertainties related to the connecting device and the operator skills. In our equipment, all components are integrated in a single housing to perfectly master the uncertainties. Unlike most other test equipment manufacturers, AESA specifications apply to a complete measuring system, which matches the needs of our customers.

### COMPETITORS' SOLUTIONS

Usually, most of our competitors propose non-integrated equipment, with some parts according to their main activity (e.g. micro-ohmmeter). To address the wire industry, they propose accessories such as connection ruler, temperature probe, Kelvin test leads,.... Specifications are limited to the dimensional capabilities. No clear commitment is given on the specifications for the complete system.

UNCERTAINTIES	STANDARD	AESA	COMPETITOR'S SOLUTION
	IEC 60468 Routine method		
1 Ohmmeter [ $\Omega$ ]	$\pm 0.15\%$	$\pm 0.03\%$	$\pm 0.03$ to $\geq 0.15\%$
2 Length [m]	$\pm 0.1\%$	<b>Calibrated length</b> (fix length) (deviation corrected by software)	<b>Usually not specified</b> (usually $> 0.05\%$ for adjustable systems)
3 Temperature [ $^{\circ}\text{C}$ ]	$\pm 0.4^{\circ}\text{C}$	$\pm 0.05^{\circ}\text{C}$ (integrated sensor with stabilizer)	<b>Usually not specified</b> (if ext. thermometer, accuracy $> 0.1^{\circ}\text{C}$ ) ( $1^{\circ}\text{C} \rightarrow R=0.4\%$ )
4 Method of measurement	4 points	<b>Yes</b>	<b>Yes</b>
5 Current distribution	Essential knowledge	<b>Jaws</b> (+ compacting system) (+ axial current injection)	<b>Not specified</b>
6 Risk of errors		<b>Mastered by the equipment</b> Compacting jaws Contact supervision with LEDs Fix integrated system Integrated sensor Final result displayed Print and export functions	<b>Depend on the operators skills</b> Current not correctly distributed Bad contact of voltage knives Wrong Kelvin points connections Temperature captured far from sample Wrong calculation of final result Wrong reporting
OVERALL ACCURACY $R_{lin}$ [ $\Omega/\text{m}$ at $20^{\circ}\text{C}$ ]	$\pm 0.15\%$	$\pm 0.10\%$	<b>Never specified</b> (instrument : electrical specifications) (rule : mechanical dimensions only)
CONCLUSIONS		Solution reliable for <b>CABLES &amp; WIRES</b> 	Solution reliable for <b>DISCRETE COMPONENTS</b> 

## RETEST FOR STRAND

The unique solution to measure directly on the stranding machine, without cutting samples. No other instrument available on the market today can offer such advantages!

On-the-line measurement avoids cutting samples for the laboratory. It allows rapid measurement, even at high temperature, of extremely compact and warm strands. Contrary to other solutions, ResTest 813x doesn't require the need of insulating a part of the production line (dangerous and unlawful).

## OUR OFFERING

Temporary stop the production line, position and adjust the equipment towards the rope (height and slope). Tighten the jaws and close the cover. Set the basic data and start the measurement.

The equipment induces a regulated alternative current in the conductor and measures the difference of potential over a predetermined length. The resistance is calculated from the voltage to current ratio. The built-in probe measures the temperature of the conductor under test

in order to display the corrected resistance value as function of the chosen nominal temperature.

The equipment measures the rope temperature and the heating elements enable the whole area surrounding the measurement setup to quickly be brought up to the temperature of the conductor. All the heating elements are electronically regulated and controlled by microprocessor. After a few minutes only, the temperature is stabilized.

A signal notifies the operator when the displayed measuring value is valid. The value can be read or printed. At the end of the measurement, the operator may remove the equipment to continue the production.

Of course, ResTest 813x can also measure samples (use of a tensioner is recommended).



ResTest 8134

		CLASS 1 SOLID CONDUCTOR		CLASS 2 STRANDED CONDUCTOR		SECTOR CONDUCTOR	
		<div> <div></div> ResTest 8134                     <div></div> ResTest 8135                     <div></div> ResTest 8136                 </div>					
		Cu	Al	Cu	Al	Cu	Al
12 AWG	2.5 mm <sup>2</sup>						
2 AWG	35 mm <sup>2</sup>						
3/0 AWG	95 mm <sup>2</sup>						
450 MCM	240 mm <sup>2</sup>						
1250 MCM	630 mm <sup>2</sup>						
2000 MCM	1000 mm <sup>2</sup>						
3600 MCM	1800 mm <sup>2</sup>						
4000 MCM	2000 mm <sup>2</sup>						



## KEY FEATURES

- Substantial time saving as cables can be directly measured while still at high temperature, without cutting a sample
- Significant raw material savings through ultra-smart definition of the security margin of the production machinery
- Intermediate measurements during the production are possible.
- Material savings since the measurement is done directly on the rope in production (no sample to be scrapped)
- Facilitated data analysis as the display of the measured resistance values takes in consideration all parameters (nominal temperature, length, material...) related to the measurement
- Cost-effective solution provided by a robust trolley allowing to move and use the device on several lines
- The system is ISO 17025 certified



### RESTEST 8134

The standard version



**ResTest 8134** is designed to measure copper and aluminium conductors of classes 1, 2 and sector-shaped conductors.

### RESTEST 8135

The aluminium version



This model can of course measure copper conductors, but is equipped with hydraulic jaws to extend the measuring range of aluminium conductors.

### RESTEST 8136

The compact version



This model is specially designed to allow measurement when space is limited on the production line. It is shorter with a 50 cm ruler length.

# IN TEST STATION/LABORATORY

## RETEST FOR SAMPLES

The unique integrated solution to measure samples. In order to be reliable, measurement of the linear resistance of samples requires perfect mastery of important parameters such as temperature, length, input current, etc. This is the reason why this measurement is generally performed in the laboratory.

## OUR OFFERING

ResTest offers a unique combination of ultra-high precision measurement with extreme simplicity of operation.

All critical components are integrated (temperature sensor, calibrated measuring ruler, micro-ohmmeter, specific jaws for all cable types etc.) which allows to manage and integrate measuring uncertainties.

Its two-button measuring system allows its use directly in production while its touch screen allows for advanced functionalities in the laboratory.

The displayed values can be used directly (all relevant corrections are already made), printed (label or report) or exported (LAN/USB).

## KEY FEATURES

- Ease of use on the shop-floor, simple control with two buttons
- Extended test possibilities in the laboratory through a touchscreen
- Facilitated data analysis as the display of measured resistance values takes into consideration all parameters (nominal temperature, length, material...) related to the measurement
- High overall accuracy
- Several options available to enhance measurements of specialized samples
- Minimum risk of human errors
- Optimal traceability thanks to the saving of each measurement and related conditions
- ISO 17025 certified system



ResTest 50 with insulated cable

	CLASS 1 SOLID CONDUCTOR		CLASS 2 STRANDED CONDUCTOR		CLASS 5/6 FLEXIBLE CONDUCTOR		SECTOR CONDUCTOR		INSULATED CONDUCTOR	
	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al
ResTest 1										
ResTest 50										
ResTest 90										
ResTest 210										
axial injection										
20 AWG 0.5 mm <sup>2</sup>										
12 AWG 2.5 mm <sup>2</sup>										
2 AWG 35 mm <sup>2</sup>										
1/0 AWG 50 mm <sup>2</sup>										
3/0 AWG 95 mm <sup>2</sup>										
450 MCM 240 mm <sup>2</sup>										
1250 MCM 630 mm <sup>2</sup>										
2000 MCM 1000 mm <sup>2</sup>										
3600 MCM 1800 mm <sup>2</sup>										
5000 MCM 2500 mm <sup>2</sup>										
7800 MCM 4000 mm <sup>2</sup>										

## RETEST 50

Small section wires and cables



**ResTest 50** is a universal equipment ideally addressing the challenges experienced in the measurement of the small sections, including flexible and/or insulated wires and cables. It naturally finds its place in fields such as automotive or building for example.

## RETEST 90

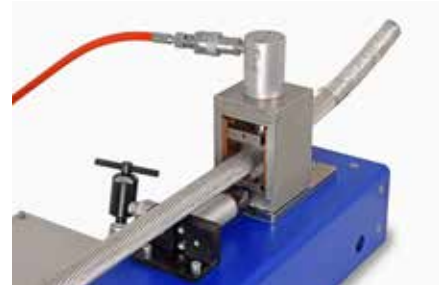
Medium section stranded conductors



**ResTest 90** is an equipment designed to measure stranded conductors. It is equipped with quick-connect jaws for user-friendly and fast operation. In addition, it can be fitted with the "axial injection" option to improve the measurement of aluminium and/or waterproof cables.

## RETEST 210

Large section conductors



**ResTest 210** is specially developed for the measurement of conductors with large cross-sections. Nevertheless, it is a universal equipment that can also be used to measure small and medium cross-sections. It also accepts options such as "axial injection", water bath or other specific jaws to cover almost all measurement needs, including insulated, sectors and waterproof conductors.

## RETEST 1

Solid conductors and rods



**ResTest 1** perfectly masters the measurement of class 1 conductors. It is specially designed to suit the needs found after a casting or drawing process.

It can also measure round or specially shaped conductors like catenary wires. It accepts a very wide range of diameters. ResTest 1 can also perform conductivity measurements (option).



Display ResTest 50



AESA MANUFACTURES  
AND SELLS HIGH-QUALITY  
PRODUCTS. BUT WHEN  
NO READILY AVAILABLE  
SOLUTION EXIST, AESA  
CAN CUSTOMIZE MARKET  
PRODUCTS THROUGH  
RELIABLE PARTNERSHIPS.

## RETEST DRUM

**ResTest Drum** was designed together with a Swiss quality partner for high degree of accuracy to measure long conductor lengths. With its specifically designed clamp for the cable industry, it allows resistance measurement directly on the production or delivery drums.

It is a high precision, fully automatic, microprocessor based system. It applies a pre-set current level, selected by the user. The measurement results are automatically displayed within few seconds only on the easy-to-read liquid crystal display and can be stored or printed out. The ResTest Drum is a lightweight system, it is battery operated, and comes complete with its own rugged waterproof field case.

## KEY FEATURES

- Lightweight and portable
- Single push button operation
- Wide measuring range
  - resistances from  $0.1\text{m}\Omega$  to  $400\text{k}\Omega$
  - cable diameter up to  $50\text{ mm} / 2''$
- Highest accuracy
  - automatic current reversal mode
- Automatic cable length and temperature corrections





## ACCESSORIES

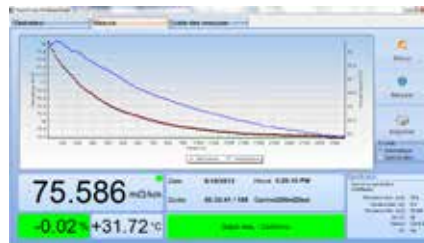
Depending on the needs and the type of equipment, AESA offers different options to extend the measuring range and the functionalities or to allow the maintenance of the equipment. Some examples among others:

- Different compacting jaws
- Tensioning system
- Axial current injection
- Conductivity
- Water bath
- Label printer
- ISO 17025 Certified calibration box
- ISO 17025 Certified standard rod

## RESSOFT



ResTest devices are delivered with a user friendly and powerful embedded software, running under Windows via a touch screen. It allows to operate the device and to manage/export the measured values and test conditions.



**ResSoft** is a remote software to control the resistance bridge through an external PC. It completes the embedded software and allows, among other things, the following functions:

- Library of conductor specifications
- Measurement monitoring
- Reporting
- Maintenance

## AXIAL CURRENT INJECTION



AESA has developed a new patent filed method for measuring the linear resistance of electrical conductors by axial current injection. Rather than injecting it transversely, current is injected axially. In this way, each wire in the conductor is in direct contact with the current source, thus minimizing the contact resistance effect between wires. Using this option on a ResTest significantly improves the repeatability and reproducibility of measurements.

## CONDUCTIVITY (& RESISTIVITY)



Conductivity and Linear Resistance are intrinsically linked. Although the conductivity (inverse of resistivity) measurement is the first step of cable production monitoring, it maybe the most critical. The measurement consists of three different phases: resistance, length, and volume measurements. All the measurements are then processed by software and the result is directly computed.



Option water bath for ResTest 210

AESA MANUFACTURES AND SELLS HIGH-QUALITY PRODUCTS. BUT BESIDES THIS, AS A RELIABLE SUPPLIER, AESA CLOSELY WORKS WITH YOU BY OFFERING A FULL SET OF SERVICES TO ADDRESS YOUR MOST CHALLENGING NEEDS AND REQUESTS.

## CABLE ACADEMY

At AESA, our aim is not only to provide our clients with effective solutions. We also help you enhance your understanding and mastery of the technology related to cable metrology, as well as optimize your ability to gain the full benefits of the possibilities offered by AESA equipment.

With our long track record and extensive experience in the cable industry, AESA is proud to offer a vast array of training courses.

Our specialists can share their expertise and know-how in an advisory capacity role on topics related to the wider aspects of cable metrology, such as for instance quality assurance or measurement of low and high frequency parameters.

Equally, we offer training courses for more specific topics such as installation and handling. Thus, persons ranging from senior engineering level to technicians and installers can broaden their knowledge and increase their skills from such training opportunities.

We can tailor courses to fit your specific needs, and deliver training in different languages, either on your premises, or at our headquarters in Switzerland.



ATTEST YOUR CREDIBILITY  
THROUGH CERTIFIED  
TOOLS AND ENSURE  
EQUIPMENT RELIABILITY  
FOR TRUSTWORTHY DATA.

## WARRANTY EXTENSION

AESA is confident with its technology and the quality of its goods. This is why all new instruments are supplied with a 2-year warranty period by default.

In order to protect its customer's investment, AESA offers an exclusive contract with a smart package of services, extending the warranty period from 2 up to 3 years.



## MAINTENANCE AND SERVICE CONTRACTS

Even the most reliable systems require regular, planned and preventive maintenance to perform at optimum levels and according to specs. For this reason, AESA proposes preventive service packages.

Based on cycles of one, two or three years depending on your specific needs, the AESA service packages will help you extend the operating life of your equipment, control your maintenance costs, and ensure optimal performance. Moreover, our packages include advantages such as an extended warranty period, priority remote support, and discounted spare parts.

## ISO 17025 & SERVICE CALIBRATION

AESA is proud of its ISO quality credentials. It successfully gained accreditation for standard EN 45001 in 1994, and for ISO 17025 in 2002, for our calibration laboratory.

The AESA calibration laboratory is accredited by the Swiss Accreditation Service (SAS). The SAS is recognized by the major international accreditation bodies, such as the European Cooperation for Accreditation (EA), the International Accreditation Forum (IAF) and the International Laboratory Accreditation Cooperation (ILAC).

You can therefore rest assured that all your testing instruments are calibrated to the most stringent standards.

In addition, we offer a calibration service: not only can we re-calibrate your instruments; we can also provide certified standards for clients wishing to check instruments by themselves.



ISO 17025 ACCREDITED



## SOME USERS



### SWITZERLAND

#### AESA SA

Route de Neuchâtel 24  
CH-2022 Bevaix

T +41 32 841 5177

F +41 32 842 4865

aesa@aesa-cortailod.com

[www.aesa-cortailod.com](http://www.aesa-cortailod.com)

### GERMANY

#### AESA GmbH

TBG TechnologiePark Bergisch Gladbach  
Friedrich-Ebert-Strasse  
D-51429 Bergisch Gladbach



### CHINA

#### AESA CN

1014B Zobon Business Park  
999 Wangqiao Road, Pudong New Area  
CN-200120 Shanghai

T +86 21 50560188

aesa@aesa.com.cn

[www.aesa.com.cn](http://www.aesa.com.cn)