

COMMUNICATION CABLE MEASUREMENT

SemaCare 20

Specific system for measuring electrical parameters of industrial cables, fieldbus, control cables...



Picture: SemaCare 432

DESCRIPTION

Industrial cables such as instrumentation, control, signaling, automation, fieldbus, profibus... each have their own specificities. SemaCare has been designed to measure the RCKE parameters of such types of cables. The resistance R is measured according to the 4 point Kelvin method while the capacitance C and the unbalanced KE are measured at low frequency. Additionally, SemaCare allows for the measurement of HF parameters at the very low end of the high frequency range, either by using the fixed points or sweeping methods.

Industrial cables are generally more rigid. Therefore connecting frames are compact and mobile which allows the operator to easily come into close proximity with the drum inner and outer ends.

KEY FEATURES

- **Fast and compliant**
 - The fastest measurement system on the market today
 - Compliant to all major national standards for industrial cables and Fieldbus
- **Modular**
 - Frames designed to be easily connected to the cable even with rigid wires and short extremities
 - Several table sizes available (32, 64, 96, 128 wires)
 - Accept conductor diameter up to 2.5mm
 - Can measure wire, pair, triad or quads
- **Accurate and certified**
 - Quality inspection with very high accuracy
 - Check against certified ISO 17025 standards



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TECHNICAL SPECIFICATIONS

Parameters	All standard low frequency and high frequency parameters available (Resistance, Capacitance, Insertion Loss, Impedance, NEXT, FEXT, ...)			
Diameters	Accept wire diameter from Ø 0.6 (0.5 solid) to 2.5 mm			
Standards	Performs all electrical tests on cables responding to: <ul style="list-style-type: none"> • BS 5308 • IEC 61158 			
Components	<ul style="list-style-type: none"> • Central measuring unit, containing : <ul style="list-style-type: none"> ◦ Low frequency parameters (RCKE) measuring unit ◦ Embedded Vector Network Analyser (VNA) for HF measurement up to 20MHz ◦ 1 state-of-the-art embedded computer with a 17" colour monitor and mouse ◦ Windows 10 Operating system ◦ 1 license OptiTest - AESA measurement and result management software • Near and Far end connecting frames for automatic LF/HF measurements • Power supplies, interfaces, connecting cables and measurement accessories 			
Supply Voltage	100 - 240 VAC / 50 - 60 Hz, Consumption: 600 W without printer, 1000 W with printer			
Versions	32 wires SemaCare 2032	64 wires SemaCare 2064	96 wires SemaCare 2096	128 wires SemaCare 20128
Dimensions (Width x Depth x Height)	Central unit : 84 x 85 x 146 cm (33 x 34 x 58 inches) Connecting frame : 45 x 45 x 23 (18 x 18 x 9 inches)		Central unit : 84 x 85 x 146 cm (33 x 34 x 58 inches) Connecting frame : 57 x 94 x 101 (23 x 37 x 40 inches)	
Weight	140 kg / 308 lb		290 kg / 638 lb	
Article No:	08.0032.0021.0	08.0064.0021.0	08.0096.0021.0	08.0128.0021.0

LOW FREQUENCY PARAMETERS ACCURACY

Accuracy	Pairs	Triads	Quads	Accuracy
Resistance	Conductor	Ra, Rb	Ra, Rb, Rc	± 0,1% + 10 mΩ
	Loop	R	R1, R2	
	Unbalance	DR	DR1, DR2, DR3	Computed (in % or Ω)
Capacitance	Mutual	C	C1, C2, C3	± 0,25% ± 10pF at 800/1000 Hz ± 0,25% ± 10pF at 125 Hz ± 0,25% ± 50pF at 12,5Hz
	Unbalance	K	K1	± 1% ± 6pF at 800 / 1000 Hz ± 1% ± 3pF at 125 Hz ± 1% ± 30pF at 12,5 Hz
	Unbalance to ground	Ei Ea E	Ei1-Ei3 Ea1-Ea3 E1-E3	
Inductance	Inductance	L	L1, L2	Computed, in mH
	Inductance/Resistance	L/R	L1/R1, L2/R2	Computed, in mH/Ω

HIGH FREQUENCY PARAMETERS* ACCURACY

Accuracy	5 kHz - 30 kHz	30 kHz - 100 kHz	100 kHz - 1 MHz	1 MHz - 20 MHz
Attenuation (corrected at 20°C)	-80 to -30 dB	± 0.8 dB	± 1.0 dB	± 2.0 dB
	-30 to -10 dB	± 0.6 dB	± 0.8 dB	± 1.2 dB
	-10 to 0 dB	± 0.2 dB	± 1.5 dB	± 0.5 dB
NEXT & FEXT Near-End Crosstalk Far-End Crosstalk	-100 to -70 dB	± 2.5 dB	± 3.0 dB	± 3.5 dB
	-70 to -40 dB	± 1.5 dB	± 1.8 dB	± 2.0 dB
	-40 to -10 dB	± 1.0 dB	± 1.2 dB	± 1.0 dB
Impedance	50 Ω - 180 Ω	± 2.5%	± 3%	± 2%
	180 Ω - 1000 Ω	± 5.0%	NA	NA

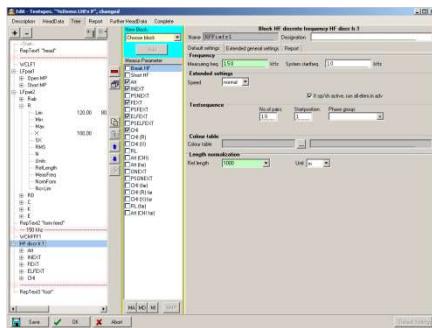
* A list of all measured and calculated parameters is available on request.

OPTIONS

- 50Ω switch for options
- EMC parameters (Transfer Impedance, Screening/Coupling Attenuation)
- Printer
- 9000 RCKE ISO 17025 certified standards
- 9800 HF ISO 17025 certified standards (50Ω SMA)
- Maintenance contract
- Spare parts

AESA proposes other specific equipment for low & high frequency measurement.

KEY BENEFITS



USER-FRIENDLY

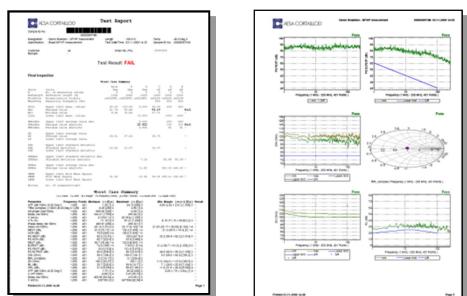
- Multilingual Optitest software
- Direct results without post calculation
- Calibration managed/saved by computer
- Library with full specifications and limits formulas

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ACCURATE

- The equipment is checked against traceable calibration standards according to ISO/IEC 17025
- The risk of human error is reduced to its strict minimum
- No movable parts for maximum measurement speed, accuracy and reliability
- Connecting frame equipped with special 124 Ohm baluns



SMART

- All data (results and conditions) are saved in the internal PC
- Reports can be printed
- Data can be exported through the LAN in an ASCII or XLS file



OVERVIEW

SYSTEM

The system consists of a central measuring unit installed in a trolley for easy movement from one reel to another. The connection tables are mobile, thus facilitating the approach and connection of the cable, which is usually rigid. Although the wires have to be stripped beforehand, the system is equipped with fast connectors for rapid and easy installation of the cable to be measured.

Robust mechanical design to facilitate maintenance and servicing operations.

LOW FREQUENCY PARAMETERS (RCKE - L)

The low frequency parameters unit is designed to measure wires, pairs, triads or quads.

The resistances R and DR are measured according to the 4 points method (Kelvin).

The capacitances CKE can be measured at different frequencies to accommodate different cable lengths.
(Please refer to our application note 'Length Restrictions in Cable Testing').

The inductances L and L/R ratio are computed from other LF parameters

The unit provides self-calibration.

Measured parameters	Pairs	Triads	Quads
Conductor Resistance	Ra, Rb	Ra, Rb, Rc	Ra, Rb, Rc, Rd
Loop Resistance	R	R1	R1, R2
Resistance unbalanced (<i>computed</i>)	DR	DR1	DR1, DR2, DR3
Capacitance	C	C1	C1, C2, C3
Capacitance unbalanced	K	K1	K1-K12
Capacitance unbalanced to ground	Ei, Ea, E	Ei1, Ea1, E1	Ei1-Ei3, Ea1-Ea3, E1-E3
Inductance (<i>computed</i>)	L	L1	C1, C2, C3
Inductance / Resistance ratio (<i>computed</i>)	L/R	L1/R1	L1/R1, L2/R2

Calculated parameters (from 100Hz to 10 kHz)

Attenuation

Characteristic Impedance

Crosstalk

Phase

Velocity of propagation (VOP)

Statistical parameters

Maximum and minimum measured values	Upper quality factor
Absolute minimum measured value	Lower quality factor
Average value	RC product
Quadratic average	Standard deviation RC
Standard deviation	Variance
and more ...	

HIGH FREQUENCY PARAMETERS

The high frequency parameters are measured as pairs only (1 quad = 2 pairs).

The measurement can be done according to a configurable curve or predefined fixed points.

The high frequency parameters are measured using an embedded Vector Network Analyser (VNA).

SemaCare allows measuring these parameters at the very low end of the high frequency range.

A complete calibration is saved in the system allowing changing the specifications without having to perform a new calibration.

Measured parameters

Transmission:	Attenuation or Insertion Loss Near end crosstalk Far end crosstalk Impedance
Reflection:	

Calculated parameters

Fitted Impedance
Return Loss (RL) (Open/Short and Terminated 100Ω) (fully complex method)
NEXT Power Sum
FEXT Power Sum
Individual ACR, ACR Worst Case, Power Sum ACR
ELFEXT Pair to Pair
Phase Delay
Velocity of Propagation (VOP)
and more ...

Statistical parameters

Maximum and minimum measured values
Worst case
Pair of worst case
Frequency of worst case
and more ...

CONTROL SOFTWARE

The measuring system is equipped with a control software allowing to prepare a measurement, to control the test device to automatically acquire all the values of the defined parameters, to evaluate the results, to provide the measurement reports in the desired format and finally to save or export the measured values.
The software has been developed in the Microsoft® Windows™ environment and complies with the Windows features.

Creation and administration of test specification

The early creation of "Test Plan" file allows to define:

- the successive measuring sequences (Line test, LF, HF, EMC, ...)
- the appropriated limits and conditions (including complex limit curves)
- the scales (logarithmic or linear)
- the HF measuring method (sweep or frequency table; start/stop frequencies; number of points,...)
- the configuration of reports

The test plan is created only once per cable type and can be saved and re-used accordingly.

Possibility to create an unlimited number of cable specifications and test sequences.

These "test specifications" will be stored with an individual customised name and are easily retrievable.

Most of the limits and formulas recommended by the international standards are already integrated.

Their variables are programmable to enable the preparation of special specifications

Measurement

The operator only needs to connect the cable on the frame, set the right test plan, fulfil the specific data (order number, operator name,...) and start the full automatic measurement.

- Fully automatic calibration management including automated calibration procedure
- Preliminary line test to verify the cable connection (short cut, crossover,...)
- Switching sequences indicated by LEDs
- In case of problem, the operator can repeat the measurement or continue in accepting the wrong value.

Reporting

Report generation is set in the test plan and is automatically generated.

The results may be displayed, printed, stored as PDF files, exported (e.g. Excel) or sent by email.

Different highly comprehensive reports can be generated containing a limit case compilation with graphics and for each measuring block a separate summary with related graphics.

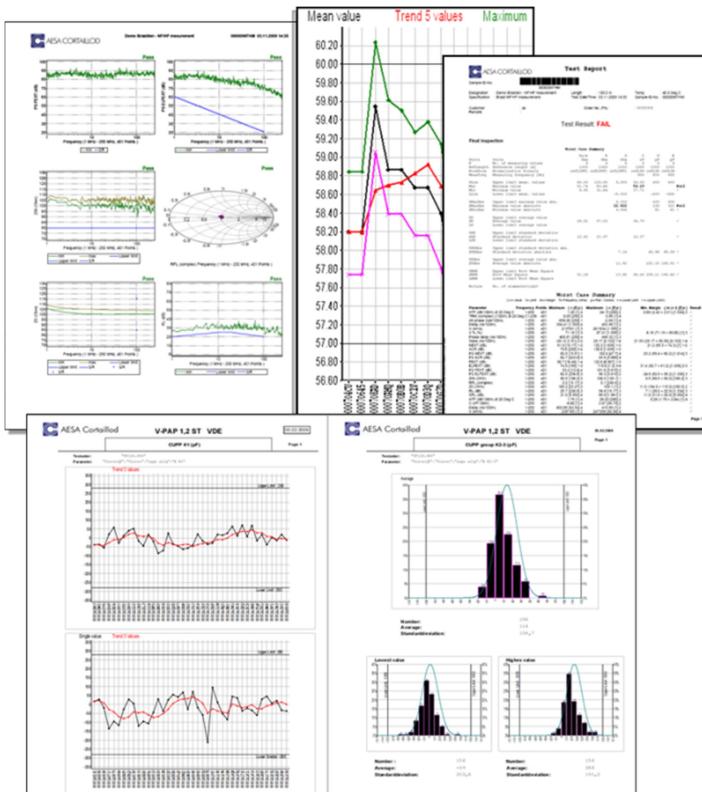
Filters and search criteria normally generate sample lists which facilitate multiple further actions such as:

- Display and process measured values
- Print reports and labels

Evaluation

All data is available for evaluation at any time. Thus, all test data of a cable can be collectively evaluated and printed. Some examples of how to perform evaluations are:

- Sample list sorted by test order
- Search with pre-defined or customized filters through the data pool
- Generate quality charts (statistics)
- Statistical distribution (Gauss type curve)
- Evolution and parameter survey as function of time
- Measurements repartition in a defined time period to determine the testing load



Data management

Connected to the optionally available CIQ (AESA quality data management system), all data gathered with the device can be used for further statistical evaluations and combined with other measurements gathered during the complete manufacturing process, from incoming good inspection to the dispatch of the finished product.

Options

1. **50Ω switch for options**

Article No: 50.0001.0032.0

By adding a specific input (N connectors), options such as the measurement of EMC parameters can be connected to the central unit. The solution includes the required hardware and software modules.

2. **EMC parameters*** (Transfer Impedance, Screening/Coupling Attenuation)

* this option requires a system with a 50 ohms switch.

Article No: 55.0500.0012.0

To perform EMC measurements with the tri-axial method, following accessories are required:

- the hardware package to prepare the sample and take care for the impedance adaptation
- the software package (specific measurement module)

These accessories allow measuring the transfer impedance, the screening attenuation and coupling attenuation according to IEC 62153-4-9 when knowing the impedance of the internal coaxial cable created with the sample under test.



- Transfer Impedance Kit, Ø 2.3 - 9.8 mm
- Transfer Impedance Kit, Ø 6 - 22 mm

Article No: 50.0001.0072.0

Article No: 50.0001.0073.0

3. **Laserjet printer**

Article No: 51.0500.0021.0

The trolley housing the central measuring unit can be equipped with a printer for local printing of a measurement report.

4. **Set of ISO 17025 certified LF standards type AESA 9000**

Article No: 45.9000.0001.0

This set of "Low Frequency" standards, certified ISO 17025, allows the periodic calibration, thus proving the accuracy of the complete measurement system. The kit is composed of:

- Standard type 9001	C1,2	19,20 nF	± 0,1 %	± 30 ppM/°C
- Standard type 9002	C1,2	192,0 nF	± 0,1 %	± 30 ppM/°C
- Standard type 9003	C3	16,0 nF	± 0,1 %	± 30 ppM/°C
	K1, K2, K3	16000 pF	± 0,1 %	± 30 ppM/°C
- Standard type 9004	E1, E2, E3	12000 pF	± 0,1 %	± 30 ppM/°C
- Standard type 9005	RA, RD	192 Ω	± 0,01 %	± 2 ppM/°C
	RB, RC	1920 Ω	± 0,01 %	± 2 ppM/°C



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5. Set of ISO 17025 certifies HF calibration standards type AESA 9800

Article No: 45.9800.0001.0

This set of "coaxial" primary standards, certified ISO 17025, allows the periodic calibration, thus proving the accuracy of the complete measurement system (Vector Network Analyzer + RF multiplexer + connecting frame).

This set of "coaxial" primary standards should not be mixed up with the "symmetrical" zero correction kit, delivered with the ATE, which is used to carry out the periodical zero correction files of the equipment, required to measure LAN cables.

The set of certified HF standards is composed of:

- 2 attenuation references type 9801 – 3dB
- 2 attenuation references type 9802 – 6dB
- 2 attenuation references type 9803 – 10dB
- 2 attenuation references type 9804 – 20dB
- 2 attenuation references type 9805 – 30dB
- 2 x 50Ω terminations
- 2 special connectors for the terminations
- 4 HF connecting cables for the attenuation
- 1 set of miscellaneous HF material



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6. Maintenance contract & Warranty extension

Even the most reliable systems require regular, planned and preventive maintenance to perform at optimum levels and according to specifications. For this reason, AESA proposes service packages according to your specific needs and installed base of equipment. Our Packages include advantages such as an extended warranty period, priority remote support and discounted spare parts. Details are available on request.

7. Spare Parts

AESA recommends following set of spare parts for an operation safety of two years:

SemaCare Type	HF measurement only (Mini kit)	Including LF measurement (Full kit)
1 CKE measuring bridge type KM		✓
1 R measuring bridge type RM		✓
1 LF relay matrix board type AZU		✓
2 test heads	✓	✓
2 HF relays	✓	✓
1 control boards set	✓	✓
1 set of HF cable	✓	✓
1 set of different mechanical and electronic hardware	✓	✓
Article No	50.0900.0003.0	50.0900.0002.0