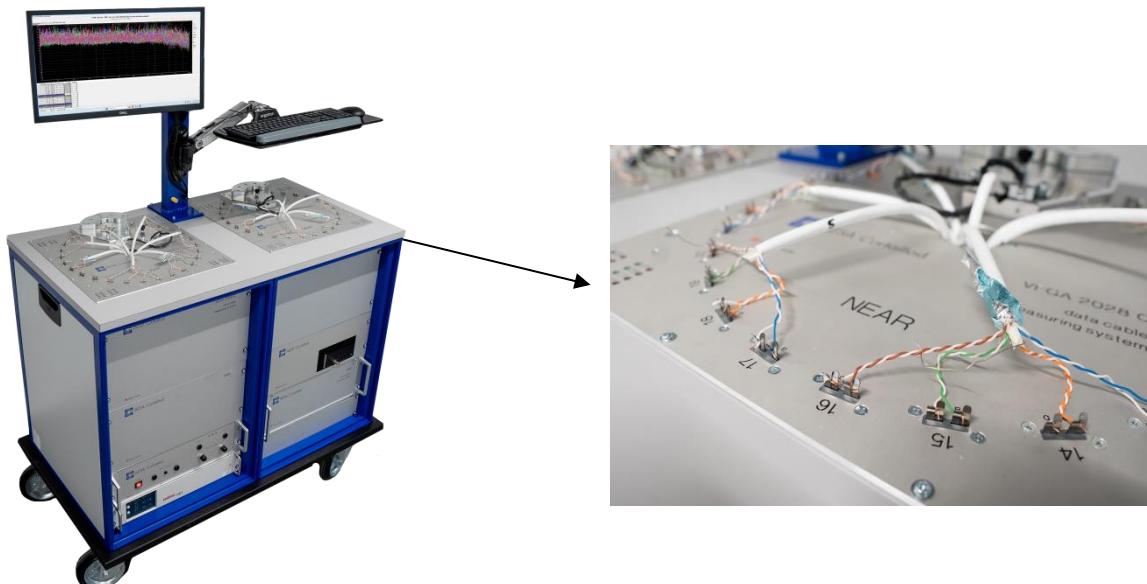


# COPPER COMMUNICATION CABLE MEASUREMENT

## Vega AXT L 28 pairs

*to measure the high frequency parameters including Alien crosstalk of bundled cables Cat 5 to Cat 8*



### DESCRIPTION

When several cables run in bundle, they interfere with each other. This is the so-called Alien crosstalk (AXT). Basically, measuring the Alien crosstalk consists in successively measuring the impact of the 4 pairs of each disturbing cable against those of the victim cable (usually 6 +1 cables of 4 pairs).

This testing equipment has been developed to quickly and accurately test bundled Cat 5 to Cat 8 LAN and/or DATA cables. It allows for the automatic measurement of high frequency parameters up to 2.0 GHz (on positions 1-4) including the Alien crosstalk. AESA software makes work and data management (analysis, traceability, statistical information,..) straight forward.

Different options such as low frequency (RCKE) parameters or EMC disturbances (AC, AS, TI) offer considerable flexibility in terms of testing, thus allowing for the full characterization of your cable.

### KEY FEATURES

- **Fast and compliant**
  - Possibility of connecting up to 7 cables of 4 pairs at the same time
  - The fastest measurement system on the market (<10 min for 7 bundles of 4 pairs)
  - Compliant to all major international standards for LAN and DATA cables
- **High-Tech**
  - Executive RF switches using MIL standardized relays (min 10'000'000 cycles with superior repeatability)
- **Accurate and certified**
  - Quality inspection, with very high accuracy
  - Check against certified ISO 17025 standards
- **Add-on**
  - Mode conversion parameters (TCL, ELTCTL, etc...)
  - EMC parameters (TI, AS, AC)



AESA Cortaillod

## TECHNICAL SPECIFICATIONS

|  |  |  |  |
|--|--|--|--|
| Parameters                             | All standard low frequency and high frequency parameters available (Resistance, Capacitance, Insertion Loss, Impedance, NEXT, FEXT, Alien NEXT, Alien FEXT... )  |  |  |
| Standards                              | Performs electrical tests on cables responding to: <ul style="list-style-type: none"> <li>ANSI/TIA-568.2-D for Category 5, 5e, 6, 6a and 8</li> <li>IEC 61156-5/-10 for Category 5e to 8.2</li> <li>YD/T 1019/2013</li> </ul>  |  |  |
| Components                             | <ul style="list-style-type: none"> <li>Connecting frame with 2 x 28 pairs each (Near &amp; Far End) for HF measurements.</li> <li>Positions 1-4 with Wago connectors, positions 5-28 with self-cutting knives</li> <li>Microsoft Windows PC with a 17" colour monitor</li> <li>1 AESA measurement and result management software</li> <li>Power supplies, connecting interfaces and cables, measurement accessories</li> </ul> |  |  |
| Supply Voltage                         | 100 - 240 VAC / 50 - 60 Hz, Consumption: 600 W without printer, 1000 W with printer  |  |  |
| Dimensions<br>(Width x Depth x Height) | 1180 x 670 x 1050 (trolley only) / 1700 (including screen) mm, weight ~200kg   |  |  |
| Versions                               | Vega 2004 + Lyra 7524<br>Positions 1-4 to 2GHz LF + HF<br>Positions 5-28 up to 750MHz high frequency only  | Vega 2004 + Lyra 624 LF HF<br>Positions 1-4 to 2GHz LF + HF<br>Positions 5-28 up to 600MHz LF + HF   |  |
| Article No:                            | 00.2004.0009.0   | 00.2004.0008.0   |  |
| Versions                               | Vega 1204 + Lyra 7524<br>Positions 1-4 to 1.2GHz LF + HF<br>Positions 5-28 up to 750MHz high frequency only  | Vega 1204 + Lyra 624 LF HF<br>Positions 1-4 to 1.2GHz LF + HF<br>Positions 5-28 up to 600MHz LF + HF |  |
| Article No:                            | 00.1204.0009.0   | 00.1204.0008.0   |  |

## HIGH FREQUENCY ACCURACY

|   | Vega AXT L<br>Pair 5-28         |                                 | Vega AXT L<br>Pair 1-4       |                              |
|---|---------------------------------|---------------------------------|------------------------------|------------------------------|
| <b>0.772 MHz -<br/>100 MHz</b>                            | <b>100 MHz -<br/>600/750MHz</b> | <b>600/750MHz -<br/>1.5 GHz</b> | <b>1.5 GHz -<br/>2.2 GHz</b> |                              |
| <b>Attenuation (corrected to 20°C)</b>                    |                                 |                                 |                              |                              |
| -80 dB to -50 dB*   | ± 1.5 dB                        | ± 3 dB                          | ± 4 dB                       | ± 6 dB                       |
| -50 dB to -25 dB  | ± 0.5 dB                        | ± 0.9 dB                        | ± 1.5 dB                     | ± 2 dB                       |
| -25 dB to 0 dB  | ± 0.2 dB                        | ± 0.8 dB                        | ± 1.3 dB                     | ± 1.7 dB                     |
| <b>Near-End &amp; Far-End Crosstalk (NEXT &amp; FEXT)</b> |                                 |                                 |                              |                              |
| -90 dB to -60 dB*   | ± 2 dB                          | ± 4 dB                          | ± 6 dB                       | ± 8 dB                       |
| -60 dB to -30 dB  | ± 1.4 dB                        | ± 1.8 dB                        | ± 4 dB                       | ± 6 dB                       |
| -30 dB to -10 dB  | ± 0.8 dB                        | ± 1.5 dB                        | ± 2 dB                       | ± 3 dB                       |
|   | <b>0.772 MHz -<br/>100 MHz</b>  | <b>100 MHz -<br/>750 MHz</b>    | <b>750 MHz -<br/>1.5 GHz</b> | <b>1.5 GHz -<br/>2.2 GHz</b> |
| <b>Impedance</b>  |                                 |                                 |                              |                              |
| 90Ω - 110Ω  | ± 1.5Ω                          | ± 3Ω                            | ± 4Ω                         | ± 5Ω                         |
| 70Ω - 90Ω &<br>110Ω - 130Ω                                | ± 1.5Ω                          | ± 3.5Ω                          | ± 4.5Ω                       | ± 6Ω                         |

\*: Measured with lower bandwidth to reduce VNA noise

## REQUIRED COMPONENTS

The system must be completed with:

- Vector Network Analyzer (VNA).  
Provided either by AESA or by customer

## LOW FREQUENCY ACCURACY (OPTION)

| <b>Resistance R (corrected to 20°C)</b> |                          |
|---|--------------------------|
| R                                       | ± 0,1% + 10 mΩ           |
| DR                                      | Computed                 |
| <b>Capacitance C</b>                    |                          |
| C                                       | ± 0,25% ± 10pF at 800 Hz |
| K                                       | ± 0,25% ± 10pF at 125 Hz |
|   | ± 0,25% ± 50pF at 12,5Hz |
|   |                          |
| K                                       | ± 1% ± 6pF at 800 Hz     |
|   | ± 1% ± 3pF at 125 Hz     |
| E                                       | ± 1% ± 30pF at 12,5 Hz   |

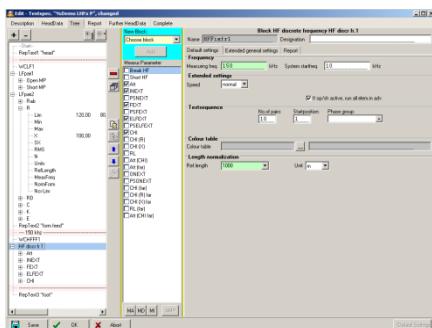
## AVAILABLE OPTIONS

The equipment can be completed with:

- Coaxial cable measurement (50Ω or 50+75Ω)
- Switch for a 50Ω external connection
- Mode conversion parameters (TCL, ELTCTL,...)
- EMC parameters  
(Transfer Impedance, Screening/Coupling Attenuation)
- 9000 Low Frequency standards
- 9800 High Frequency standards
- Spare parts

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

## KEY BENEFITS



### USER-FRIENDLY

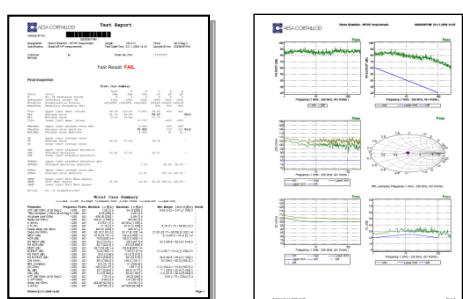
- Fast measurements
- No special HF or LF knowledge required
- Multilingual software
- Direct results without post calculation
- Test order library

### ISO 17025 ACCREDITED



### ACCURATE AND REPEATABLE

- The equipment is checked against traceable calibration standards according to ISO/IEC 17025
- Perfect reproducibility
- The risk of human error is reduced to its strict minimum
- Calibration managed/saved by computer



### SMART

- All data (results & conditions) are saved in the PC
- Reports and evaluations can be printed
- Data can be exported (PDF, TXT or XLS files)

# Overview

## SYSTEM

Accept wire diameters up to 1.2mm.

Wago connectors on positions 1 to 4 and self-cutting knives on positions 5 to 28.

Full two ports calibration (Thru-Open-Short-Load) for high accuracy measurement.

No movable parts for maximum measurement speed and reliability.

Robust mechanical design studied to facilitate maintenance and servicing operations.

## LOW FREQUENCY PARAMETERS (OPTION)

The low frequency parameters feature is designed to measure pairs or quads.

The resistance is measured at 4 points (Kelvin bridge).

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

The feature provides self-calibration.

### Measured parameters

|                                  | <u>Pairs</u> | <u>Quads</u>            |
|----------------------------------|--------------|-------------------------|
| Conductor Resistance             | Ra, Rb       | Ra, Rb, Rc, Rd          |
| Loop Resistance                  | R            | R1, R2                  |
| Resistance unbalanced            | DR           | DR1, DR2, DR3           |
| Capacitance                      | C            | C1, C2, C3              |
| Capacitance unbalanced           | K            | K1-K12                  |
| Capacitance unbalanced to ground | Ei, Ea, E    | Ei1-Ei3, Ea1-Ea3, E1-E3 |

### Calculated parameters (100 to 10kHz)

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.

2 connecting frames allow to connect both ends of the cable for an automatic measurement of all parameters.

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

### Measured parameters

Transmission:

Attenuation or Insertion Loss  
Near end crosstalk  
Far end crosstalk  
Alien Near end crosstalk  
Alien Far end crosstalk  
Impedance

Reflection:

### **Calculated parameters**

Fitted Impedance and RL  
Return Loss (RL) (Open/Short and Terminated 100Ω) (fully complex method)  
NEXT and ANEXT Power Sum  
FEXT and AFEXT Power Sum  
Individual ACR, ACR Worst Case, Power Sum ACR  
AACR, AACR Power Sum  
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 ...                        |                         |

## **SOFTWARE**

The measuring system is equipped with software which allows to prepare a measurement, to control the ATE 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.

### **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.

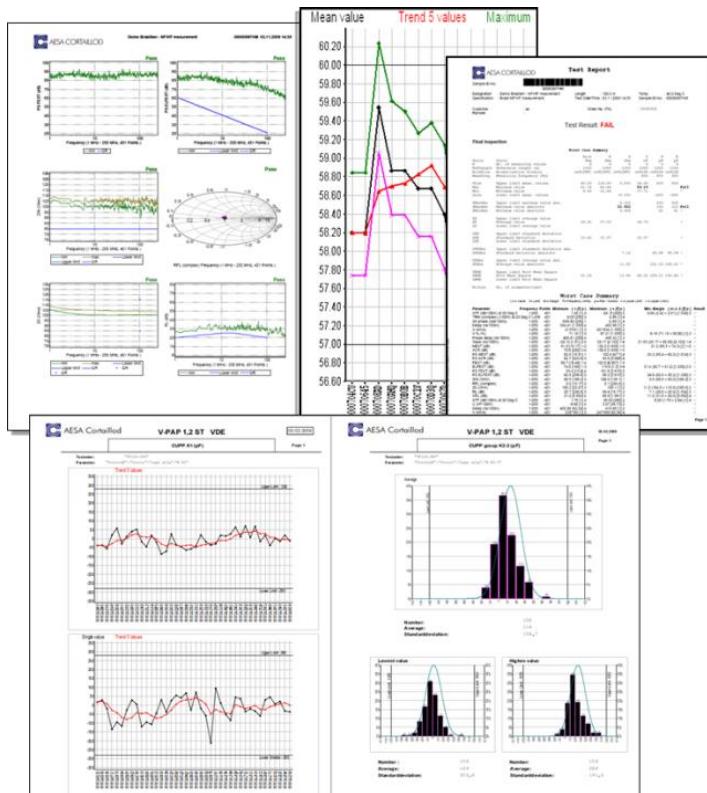
Filters and search criteria normally generate sample lists which facilitate multiple further actions such as:

- 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 analyzed 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



# Options

## 1. Vector Network Analyzer (VNA)

A VNA must be integrated into the equipment. This can be provided as an option by AESA. If the customer already has a VNA, he can send it to us (if compatible). In this case, AESA will only charge the integration cost.

- Keysight E5061B 2 ports (100 kHz – 3.0 GHz)

Article No: 51.0001.0050.0

Other VNAs can be proposed upon request.

## 2. Coaxial cables measuring option

The option includes the modification of the equipment (N-connectors, switch,...) and the related software module to allow the measurement of coaxial cables with Vega.

- **50 or 75 ohms coaxial option**
- **50 + 75 ohms coaxial option**

Article No: 50.0001.0031.0

Article No: 50.0001.0029.0

| Coaxial accuracy<br>(frequency range will<br>depend on the VNA) | From | To  |    | 100 kHz<br>100 MHz | 100 MHz<br>500 MHz | 500 MHz<br>1 GHz | 1 GHz<br>3 GHz | 3 GHz<br>6 GHz |
|---|------|-----|----|--------------------|--------------------|------------------|----------------|----------------|
| S21 transmission<br>(Attenuation, NEXT)<br>corrected at 20°C    | -80  | -50 | dB | ± 1.5 dB           | ± 1.7 dB           | ± 1.9 dB         | ± 2.4 dB       | ± 3.0 dB       |
|   | -50  | -25 | dB | ± 0.5 dB           | ± 0.6 dB           | ± 0.7 dB         | ± 0.9 dB       | ± 1.5 dB       |
|   | -25  | -10 | dB | ± 0.2 dB           | ± 0.3 dB           | ± 0.4 dB         | ± 0.8 dB       | ± 1.3 dB       |
|   | -10  | 0   | dB | ± 0.2 dB           | ± 0.2 dB           | ± 0.4 dB         | ± 0.8 dB       | ± 1.3 dB       |
| Impedance   | 50   | 50  | Ω  | ± 0.5 Ω            | ± 0.7 Ω            | ± 1.0 Ω          | ± 1.5 Ω        | ± 4.0 Ω        |
|   | 75   | 75  | Ω  | ± 0.75 Ω           | ± 1.2 Ω            | ± 1.5 Ω          | ± 2.0 Ω        | ± 6.0 Ω        |

## 3. Switch for an external 50Ω connection

The option includes the necessary hardware to connect specific options to the system (e.g. TCL, EMC,...).

- **Switch + 50 ohms N-connector for options**

Article No: 50.0001.0032.0

## 4. Mode conversion parameters TCL & ELTCTL\*

To perform Mode conversion parameters measurements, following accessories are required

- One hardware connecting frame with special balun or balunless
- One software package (specific measurement module)

These accessories allow measuring all Mode conversion parameters like TCL, TCTL, LCL, LCTL, EL LCTL and EL TCTL.

\* this option requires a system with a 50 ohms switch. If the system is not equipped with it, it must be ordered separately.

- **TCL & ELTCTL option 4 pairs 650MHz baluns**
- **TCL & ELTCTL option 4 pairs 1.2GHz baluns**
- **TCL & ELTCTL option 4 pairs 2.0GHz balunless**
- **TCL & ELTCTL option 25 pairs**

Article No: 51.0001.0024.0

Article No: 51.0001.0089.0

Article No: 51.0001.0104.0

On request

## 5. EMC Parameters (TI, AS, AC)\*

To perform EMC measurements (Transfer Impedance, Coupling Attenuation, Screening Attenuation) with the tri-axial method, following accessories are required

- One hardware package to prepare the sample and take care for the impedance adaptation
- One 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.

*\* this option requires a system with a 50 ohms switch. If the system is not equipped with it, it must be ordered separately.*

- Transfer Impedance Kit, Ø 2.3 - 9.8 mm

Article No: 51.0001.0072.0

- Transfer Impedance Kit, Ø 6 - 22 mm

Article No: 51.0001.0073.0



## 6. Printer

Article No: 51.0500.0021.0

LaserJet printer

## 7. 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  |



ISO 17025 ACCREDITED



## 8. Set of ISO 17025 certified HF 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).

It 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



## 9. **Warranty Extension**

Article No: 60.0900.0001.0

AESA is confident with its technology and the quality of its goods. This is why the system is supplied with a 2-years warranty period. In order to protect its customer's investment, AESA offers the possibility to extend the warranty period to 3 years.

## 10. **Maintenance contract**

Article No: 60.0100.0002.0

Even the most reliable systems require regular, planned and preventive maintenance as well as periodical calibrations. AESA proposes service packages to extend the operating life of your equipment, control of your maintenance costs and ensure optimal performances.

## 11. **Spare Parts**

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

| Vega Type   | Mini Kit       | Full Kit       |
|---|----------------|----------------|
| 1 CKE measuring bridge type KM                        |                | ✓              |
| 1 R measuring bridge type RM                          |                | ✓              |
| 1 LF relay matrix board type AZU                      |                | ✓              |
| 1 CPU Board   |                | ✓              |
| 1 test heads 9400.15B (Wago)                          | ✓              | ✓              |
| 1 test heads 9400.47B or 48A (knives)                 |                | ✓              |
| 1 HF relays 8 positions                               | ✓              | ✓              |
| 1 Control board Hecate + matrix                       | ✓              | ✓              |
| 1 Control board 9400.24B WA                           | ✓              | ✓              |
| 1 set of HF cable                                     | ✓              | ✓              |
| 1 set of different mechanical and electronic hardware | ✓              | ✓              |
| Article No  | 50.0900.0003.0 | 50.0900.0002.0 |