

# Electric Vehicle High Voltage Performance Test System

## Datasheet



### In compliance with

- > LV 123
- > VW 80300\_EN\_2021
- > ISO 21498-2-2021
- > Mercedes MBN 11123

### Introduction

The high voltage piezoelectric performance test system for electric vehicles is suitable for the high voltage parts test of new energy vehicles in the voltage class DC 60 V ~ 1500 V. The electrical parameters and safety of high voltage components such as high voltage battery systems(HV battery system), DC/DC high and low voltage converters(DC / DC converter HV / LV), vehicle chargers(On-board charger), air conditioning compressors(Air conditioning compressor) can be verified through a series of electrical characteristic tests

EVTS 150C10 electric vehicle high voltage integrated measuring instrument supports DC 0 V ~ 1500 V voltage output, voltage slope control is greater than 250 V/ms, can complete the ISO 21498-2-2021 test project, but also can meet the LV 123 and VW 80300-2021 related test requirements. The system expansibility is strong.

### Features

- > Voltage slope control greater than 250 V/ms;
- > As per ISO 21498-2-2021、VW 80300\_EN\_2021 and LV 123;
- > simulate various complex electrical environments of high-voltage components of new energy vehicles in practical application scenarios;
- > Support DC 0 V ~ 1000 V / 1500 V voltage output, can edit waveform output, two-way power supply
- > strong expansibility, and the power supply can be extended to 1 main N slave, so that the output current can achieve 60 A, 120 A, 240 A or more.

### Application Areas

- > Electric power
- > Wind power

| Electric vehicle high voltage performance test system equipment composition |  |                 |  |
|---|--|-----------------|--|
| Serial  | Name   | Instrument type | summarize  |
| 1   | High voltage integrated performance tester for electric vehicles | EVTS 150C10     | Output voltage:0 ~ 1500 Vdc;Current:120 A;<br>Power:60 kW(single power supply:30 kW / 60 A);<br>Power/Current spreading : one master and N slave;<br>Note: Select the parallel power module according to the actual power/current requirements;  |
| 2   | DC Decoupling Capacitor  | C150C30         | >10 mF , MAX input voltage:1500 Vdc ;<br>Current:120 A;  |
| 3   | High Voltage Manual Network                                      | AN 1501N        | Impedance:10 mΩ、 25 mΩ、 100 mΩ;<br>Built-in capacitor: >10 mF;<br>Output MAX voltage:1500 Vdc ; Current:100 A;<br>Note: Select a network model based on actual requirements;<br>AN 150C30:300 A/1500 Vdc , no 10 mF capacitor;<br>AN 150C70:700 A/1500 Vdc , no 10 mF capacitor;<br>As per ISO 21498-2-2021; |
| 4   | High Voltage Test Device   | HTS 1501        | Impedance: 10 mΩ、 25 mΩ、 100 mΩ;<br>Built-in capacitor: 10 mF;<br>HTS 150C30:300 A/1500 Vdc , no 10 mF capacitor;<br>As per VW 80300_EN_2021;  |
| 5   | Ripple Signal Generator  | RSG 40C20       | Frequency:10 Hz ~ 300kHz; Power:800 W;<br>Note: Select the corresponding generator model according to the actual power/current requirements;<br>RSG 80C50: power 5 kW;<br>RSG 80C100: power 10 kW;   |
| 6   | Coupling Transformer   | TPT-7637-4C100B | Frequency: 10 Hz ~ 300kHz;Current:100 A;<br>Note: Select the corresponding generator model according to the actual power/current requirements;<br>TPT-7637-4C300B:current 300 A / 300 Hz ~ 300kHz<br>TPT-7637-4C1000B:current 1000A /300 Hz ~ 300kHz   |
| 7   | Pulse Interference Generator for Electric Vehicle                | EVPG 20         | As per VW 80300_EN_2021:EHV-10-02/EHV-16;<br>Pulse amplitude:10 V ~ 200 V;<br>DUT load capacity:1000 Vdc / 100 A;  |

|    |                                   |          |   |
|----|-----------------------------------|----------|---|
| 8  | Automotive Immunity Test Software | Autolab  | Automotive immunity test software                                       |
| 9  | Oscilloscope                      | MDO 32   | Bandwidth 1 GHz , sampling rate 5 GSa/s , 2 analog channels             |
| 10 | High Voltage Differential Probe   | THDP0200 | Attenuation:50 X/500 X , bandwidth: 200 MHz;<br>MAX voltage: 1500 Vdc ; |
| 11 | Current Probe                     | PT-722   | Frequency: DC ~ 200 kHz ;<br>Current: 0.5 ~ 1000 A (4000 Ap -p)         |

**As per ISO 21498-2 -2021**

| Test Item  | Test Type                   | Match the Situation   | Required equipment   |
|--|-----------------------------|-----------------------|--|
| 6.2 DC supply voltage variation within operational range | Immunity –voltage variation | Complete satisfaction | 1.MDO 32<br>2.PT-722<br>3.Autolab<br>4.THDP0200<br>5.AN 1501N<br>6.RSG 40C20<br>7.EVTS 150C10<br>8.TPT-7637-4C100B |
| 6.3 Generated voltage slope                              | Generation                  | Complete satisfaction |  |
| 6.4 Immunity to voltage slope                            | Immunity –voltage variation | Complete satisfaction |  |
| 6.5 Generated voltage ripple                             | Generation                  | Complete satisfaction |  |
| 6.6 Immunity to voltage ripple                           | Immunity –DC ripple         | Complete satisfaction |  |
| 6.7 Overvoltage  | Immunity –voltage variation | Complete satisfaction |  |
| 6.8 Under voltage  | Immunity –voltage variation | Complete satisfaction |  |
| 6.9 Voltage offset                                       | Immunity –voltage variation | Complete satisfaction |  |
| 6.10 Generated load dump voltage                         | Generation                  | Complete satisfaction |  |
| 6.11 Immunity to load dump voltage                       | Immunity –voltage variation | Complete satisfaction |  |

Note : System scheme selection configuration is divided into three categories , 100A system , 300 A system , and 700 A system. Large current can be compatible with small current test. All equipments are at the same current range . AN 1501N built-in 10 mF capacitor , so C150C10 is not needed.

| As per ISO LV 123  |                             |                       |  |
|--|-----------------------------|-----------------------|--|
| Test Item  | Test Type                   | Match the Situation   | Required equipment   |
| 10.4.1 Range of unlimited operating capability                     | Immunity –voltage variation | Complete satisfaction | 1.MDO 32<br>2.PT-722<br>3.Autolab<br>4.THDP0200<br>5.AN 1501N<br>6.RSG 40C20<br>7.EVTS 150C10<br>8.TPT-7637-4C100B |
| 10.4.2 Range of upper limited operating capability                 | Immunity –voltage variation | Complete satisfaction |  |
| 10.4.3 Range of lower limited operating capability                 | Immunity –voltage variation | Complete satisfaction |  |
| 10.4.4 Range of highly limited operating capability                | Immunity –voltage variation | Complete satisfaction |  |
| 10.4.5 Generated voltage ripple                                    | Immunity –voltage variation | Complete satisfaction |  |
| 10.4.6 Immunity to voltage ripple                                  | Immunity –DC ripple         | Complete satisfaction |  |
| 10.4.7 Overvoltage   | Immunity –voltage variation | Complete satisfaction |  |
| 10.4.8 Undervoltage  | Immunity –voltage variation | Complete satisfaction |  |
| 10.4.9 Load dump   | Immunity –voltage variation | Complete satisfaction |  |
| 10.4.10 Voltage offset   | Immunity –voltage variation | Complete satisfaction |  |
| 10.4.11 Interaction between low-pressure and high-pressure systems | Function test               | Power supply only     |  |
| Note: LV 123 is benchmarking ISO 21498-2-2021.                     |                             |                       |  |

**As per VW 80300**

| Test Item  | Test Type                   | Match the Situation   | Required equipment   |
|--|-----------------------------|-----------------------|--|
| EHV-01 Performance test within the regular HV operating voltage range            | Immunity –voltage variation | Complete satisfaction | 1.MDO 32<br>2.PT-722<br>3.Autolab<br>4.THDP0200<br>5.HTS 1501<br>6.RSG 40C20<br>7.EVTS 150C10<br>8.TPT-7637-4C100B |
| EHV-02 Operating within the HV overvoltage range                                 | Immunity –voltage variation | Complete satisfaction |  |
| EHV-03 Operation within the HV undervoltage range                                | Immunity –voltage variation | Complete satisfaction |  |
| EHV-04 Pre-charging  | Function test               | Unsatisfied           |  |
| EHV-05 Generated HV voltage dynamics   | Generation                  | Complete satisfaction |  |
| EHV-06 System HV voltage dynamics  | Immunity –voltage variation | Complete satisfaction |  |
| EHV-07 HV voltage dynamics of energy storage devices                             | Battery test                | Unsatisfied           |  |
| EHV-08 Generated HV voltage ripple   | Generation                  | Complete satisfaction |  |
| EHV-09 System HV voltage ripple  | Immunity –DC ripple         | Complete satisfaction |  |
| EHV-10 System load dump  | Immunity –pulse             | Complete satisfaction |  |
| EHV-11 HV voltage offset   | Immunity –pulse             | Complete satisfaction |  |
| EHV-12 HV overcurrent  | Current variation           | Power supply only     |  |
| EHV-13 HV service life   | Periodic test               | Power supply only     |  |
| EHV-14 On/off durability testing for HV components                               | Periodic test               | Power supply only     |  |
| EHV-15 Functionality of HV interlock, maintenance connecter, and crash signaling | Function test               | Power supply only     |  |
| EHV-16 HV pulse  | Immunity –pulse             | Complete satisfaction |  |

Note: 1. System scheme selection configuration is divided into three categories , 100A system , 300 A system , and 700 A system. Large current can be compatible with small current test. All equipments are at the same current range . HTS 1501(As per VW 80300) is different from AN 1501N(As per ISO 21498).

2. EHV-04 Pre-charging: Confirmation of functional state when components of pre-charging function work.

3. EHV-07 HV voltage dynamics of energy storage devices: The sudden change of current is realized by changing the

load.

4. EHV-12 HV overcurrent: Changing the output load of DUT to increase the current by 3 times.
5. EHV-13 HV service life: Programmable AC/DC power supply frequency to 40 KHz.
6. EHV-14 On/off durability testing for HV components: Reliability test.

## Electric vehicle high-voltage electrical performance comprehensive tester EVTS 150C10



### Technical Parameters

|   |  |
|---|--|
| MAX DC voltage  | 1500 VDC   |
| MAV current   | 120 A  |
| MAX power   | 60 kW  |
| Number of power modules   | 2 (single :30 KW / 60 A)                               |
| Overvoltage protection  | 0 ~ 1650 V   |
| Overcurrent protection  | 0 ~ 132 A  |
| Overpower protection  | 0 ~ 66 kW  |
| Output voltage range  | 0 ~ 1500 V   |
| Internal resistance   | 0/50/100/200 mΩ  |
| Pulse   | Sine, RAMP   |
| Amplitude and position change   | Static, line   |
| maximum number of supported segments  | 99   |
| count   | 1 ~ 999  |
| Expand  | Current and power are supported, 1 master and N slaves |
| Voltage load dump   |  |
| MAX current   | 100 A  |
| Size  | 22 U (more than 3 models for 35 U)                     |
| Note: 1. One master and one slave, MAX current 120 A, suitable for 100 A system, if you need higher current, please expand the number of power supply modules.<br>2. 300 A current system, internal resistance is external. |  |

## DC Decoupling Capacitor

## C150C30



### Technical Parameters

|                   |   |
|-------------------|---|
| MAX input voltage | 1500 VDC  |
| MAX current       | 300 A   |
| Capacitor         | >10 mF  |
| Working Power     | AC 110 V/220 V ( $\pm 10\%$ ), 50 Hz /60 Hz<br>(Default in mainland China: 220 V) |
| Fuse              | 6 A   |
| Max. Power        | 100 W   |
| Size              | 22 U  |
| Weight            | 70 kg   |

## High Voltage Manual Network

## AN 1501N



### Technical Parameters

|                       |                                      |
|-----------------------|--------------------------------------|
| MAX input voltage     | 1500 VDC                             |
| MAX current           | 100 A                                |
| Transient MAX current | 280 A                                |
| INPUT/OUTPUT terminal | 4 mm banana or high voltage shielded |
| Internal resistance   | 10/25/100 mΩ                         |
| Inductance            | 1 μH                                 |
| Decoupling capacitor  | >10 mF                               |
| Grounding capacitor   | 1 μF                                 |
| Frequency             | 10 Hz ~ 150kHz                       |
| Working Power         | AC 220 V (±10 %), 50 Hz              |
| Fuse                  | 6 A                                  |
| Max. Power            | 250 W                                |
| Size                  | 22 U                                 |
| Weight                | 178 kg                               |

Note: High Voltage Manual Network as per ISO 21498-2-2021, a total of three impedances, it is suitable for 100 A current system.



## High Voltage Test Device

## HTS 1501



### Technical Parameters

|   |                                    |
|---|------------------------------------|
| MAX input voltage   | 1500 VDC                           |
| MAX current   | 100 A                              |
| Decoupling capacitor  | 10 mF ( $\pm 10\%$ )               |
| Box inductance  | 2*1 $\mu$ H ( $\pm 10\%$ )         |
| Internal resistance   | 50 m $\Omega$ (-2/+6 m $\Omega$ )  |
|   | 100 m $\Omega$ ( $\pm 10\%$ )      |
|   | 200 m $\Omega$ ( $\pm 10\%$ )      |
| Cy  | 100 nF ( $\pm 10\%$ )              |
| Voltage monitoring  | Digital tube display voltage value |
| Frequency   | 10 Hz ~ 150kHz                     |
| Working Power   | AC 220 V ( $\pm 10\%$ ), 50 Hz     |
| Fuse  | 6 A                                |
| Max. Power  | 500 W                              |
| Size  | 22 U                               |
| Weight  | 75 kg                              |
| <p>Note: High Voltage Manual Network as per VW 80300_EN_2021, a total of three impedances, it is suitable for 100 A current system.</p> |                                    |

## Coupling Transformer

## TPT-7637-4C100B



### Technical Parameters

|  |   |
|--|---|
| MAX unsaturated voltage  | 15 V@10 Hz ≤ f ≤ 3 kHz<br>25 V@3 kHz ≤ f ≤ 30 kHz<br>2.5 V@30 kHz ≤ f ≤ 300 kHz |
| Primary current  | MAX 32 A  |
| EUT current  | MAX 100 A   |
| Frequency  | 10 Hz ~ 300kHz  |
| Size   | 4 U   |
| Weight   | 60 kg   |
| Note: the maximum EUT current is 100 A, suitable for 100 A current system. |   |

## Ripple Signal Generator

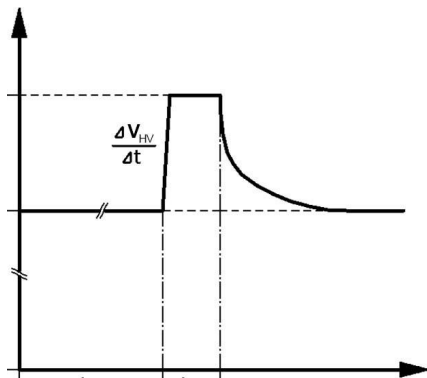
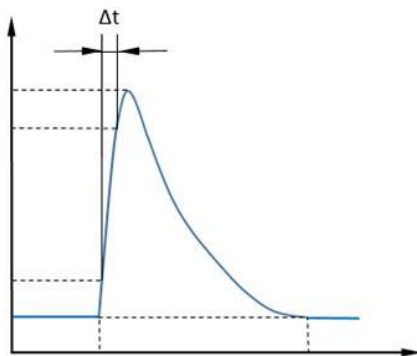
## RSG 40C20



### Technical Parameters

|   |   |
|---|---|
| Frequency   | 10 Hz ~ 300kHz  |
| Frequency step  | 3 kHz ~ 30 kHz, step: 1 kHz<br>30 kHz ~ 300 kHz, step: 10 kHz   |
| MAX voltage U <sub>pp</sub>   | f < 50 kHz, U <sub>pp</sub> ≤ 80 V<br>50 kHz ≤ f < 150 kHz, U <sub>pp</sub> ≤ 48 V<br>150 kHz ≤ f ≤ 300 kHz, U <sub>pp</sub> ≤ 24 V<br>resolution ratio 0.1 V |
| Residence time  | 1 s ~ 10 s<br>resolution ratio 0.1 s  |
| Power   | 800 W   |
| Output  | MAX 40 V <sub>p</sub> / 20 A <sub>p</sub>   |
| Working Power   | AC 220 V (±10%), 50 Hz  |
| Size  | 4 U   |
| Weight  | 25 kg   |
| Note: the power of ripple signal generator is 800 W, suitable for 100 A current system. |   |

## Pulse Interference Generator for Electric Vehicle **EVPG 20**



### Technical Parameters(EHV-10-02)

|   |   |
|---|---|
| Pulse characteristics   | Double exponential wave                   |
| Pulse voltage amplitude   | 10 V ~ 50 V ± 20 %<br>50 V ~ 200 V ± 10 % |
| Pulsewidth  | ≥ 50 μs (0 % ~ 0%)                        |
| Rise time (0 % ~ 100 %)   | 6.67 μs ± 20 % (3000 V/ms @ 20 V)         |
| Impedance   | 2 Ω                                       |
| Interval time   | 1 s ~ 99 s                                |
| Polarity  | Positive                                  |
| count   | 1 ~ 99                                    |
| Trigger   | Manual/Auto/External                      |
| Coupling method   | Capacitor                                 |
| Decoupling method   | Diode                                     |
| DUT loading capacity  | 1000 VDC/100 A                            |
| Note: The current of DUT loading capacity is 100 A, larger current system needs to be customized. |   |

### Technical Parameters(EHV-10-02)

|   |   |
|---|---|
| Pulse characteristics   | Double exponential wave                       |
| Pulse voltage amplitude   | 10 V ~ 50 V ± 20 %<br>50 V ~ 200 V ± 10 %     |
| Pulsewidth  | 10 μs ~ 20 μs ± 20 %<br>20 μs ~ 200 μs ± 10 % |
| Rise time (0 % ~ 100 %)   | ≤ 300 ns (< 5 V/ns)                           |
| Impedance   | 2 Ω   |
| Interval time   | 0.1 s ~ 10 s                                  |
| Polarity  | Positive                                      |
| count   | 1 ~ 99  |
| Trigger   | Manual/Auto/External                          |
| Coupling method   | Capacitor                                     |
| Decoupling method   | Diode   |
| DUT loading capacity  | 1000 VDC/100 A                                |
| Note: The current of DUT loading capacity is 100 A, larger current system needs to be customized. |   |

100 A , 300 A , 700 A system configuration table :

|   |   |  |                   |   |
|---|---|--|-------------------|---|
| 1 | Ripple Signal Generator                           | RSG 40C20  | RSG 80C50         | RSG 80C100  |
|   | Frequency   | DC / 10 Hz ~ 300 kHz   |                   |   |
|   | Power   | 800 W  | 5000 W            | 10000 W   |
|   | Output Max  | 80 Vpp / 40 App  | 160 Vpp / 100 App | 160 Vpp / 800 App   |
|   | Signal Generator                                  | Inside , one channel , frequency : 0 ~ 300 kHz   |                   |   |
|   | Note  | This ripple generator is mainly aimed at the test requirements of high-impedance and high voltage parts of new energy.             |                   | This ripple generator is mainly aimed at low impedance and high power generators such as new energy and high voltage battery packs to meet the test requirements. |
| 2 | High Voltage Manual Network                       | AN 1501N   | AN 150C30         | AN 150C70   |
|   | Output channel                                    | 2  |                   |   |
|   | EUT supply  | 100 A / 1500 Vdc   | 300 A / 1500 Vdc  | 700 A / 1500 Vdc  |
|   | Frequency (At EUT terminal)                       | 10 Hz ~ 150 kHz  | 10 Hz ~ 150 kHz   | 10 Hz ~ 150 kHz   |
| 3 | Coupling Transformer                              | TPT-7637-4C100B  | TPT-7637-4C300B   | TPT-7637-4C1000B  |
|   | Frequency range                                   | 10 Hz ~ 300 kHz  | 300 Hz ~ 300 kHz  |   |
|   | Coupling current                                  | 100 A  | 300 A             | 1000 A  |
|   | Turn ratio  | 1:1  | 1:1               | 2:1 & 4:1   |
| 4 | Decoupling capacitor                              | Built-in AN 1501N at 100 A system  | C150C30           |   |
|   | Load current                                      | 100A   | 300 A             |   |
|   | Value   | >10mF(Built-in instantaneous disconnection load shedding emission test function and automatic active charge and discharge circuit) |                   |   |
| 5 | High Voltage Test Device                          | HTS 1501   | HTS 150C30        |   |
|   | Load current                                      | 100 A  | 300 A             |   |
| 6 | Pulse Interference Generator for Electric Vehicle | EVPG 20  |                   |   |
|   | Load current                                      | 100 A  |                   |   |

|   |                                |  |
|---|--------------------------------|--|
| 7 | Vehicle immunity test software | Autolab  |
|   | Fouction                       | Software for remote control of ripple signal generator, including pre-programmed standard and test library, enhanced analysis and report generation. At the same time, it can be compatible with the immunity testing equipment of automobile parts. |



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