HIGH VOLT
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HIGH VOLTAGE MODULE TEST SYSTEM

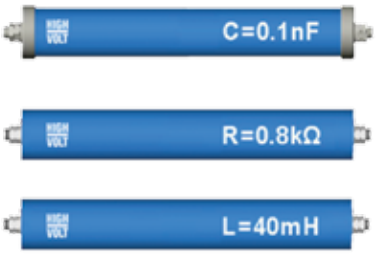
- AC, DC, and impulse testing
- Factory testing
- R&D
- Education / training

MODULES FOR VOLTAGE GENERATION



Test transformers for 100 and 200 kV

The oil-insulated transformer T 100 is built in an insulating, fibre-glass reinforced tube with steel covers. Two transformers T 100 can be switched in series to the cascade type T 200 for 200 kV. The transformer is designed for continuous power of 6.6 kVA and 11 kVA for one hour per day.



HV capacitors for 100 kV AC/135 kV DC

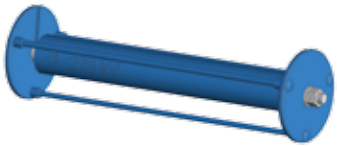
The capacitors C 01 to C 10 (0.1 to 10 nF) of liquid-impregnated foil-paper insulation are used for voltage measurement, PD coupling, DC and impulse voltage generation.

HV resistors for 140 kV

The resistors R 025 to R 5000 (0.25 to 5000 kΩ) are used for impulse generation, current limitation, protection or discharging.

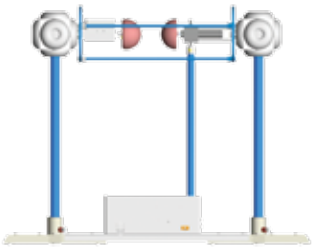
HV blocking impedance for 150 kV

The HV impedance is used for sensitive PD-measurements.



HV rectifier for 135 kV DC

The rectifier G 270 is designed for a reverse voltage of 270 kV which is necessary for the generation of 135 kV DC voltage. For quick and convenient polarity reversal, the rectifier element can be simply turned within a casing.



Spark gaps for 100 kV AC/135 kV DC

The two spheres of the spark gap are arranged in an insulating frame. The spark gap is available as a motor driven type TF and alternatively as a manually adjusted type VF. Both units are used as a trigger spark gap for impulse voltage generation. They are equipped with a trigger generator. The drive (Type TF) and the trigger generator are controlled via fibre-optic links.



Compressed-gas capacitor for 100 kV AC

A standard capacitor MCP 100 with a capacitance of 100 pF is applied for precise voltage and dielectric loss measurements. It is filled with SF_6 of a pressure of 4 bar.

Divider resistor for 135 kV DC

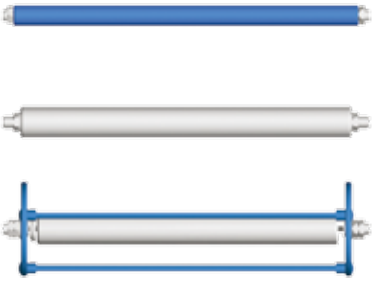
The resistor MR 250 (250 MΩ) is designed for resistive voltage dividers for 135 kV, 270 kV (two in series) and 350 kV (three in series). The dividers MRT 250, MRT 500 und MRT 750 are completed by the LV measuring branch, a base element FE 1 and the junction element KE.

MECHANICAL MODULES



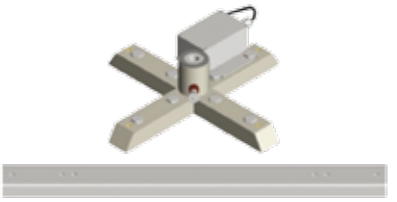
Junction element

The junction element KE is a PD-free polygon electrode of six plates that are screwed into an internal cross. The KE 1 with plates of 125 mm diameter can be used up to 240 kV peak. For higher voltages up to 350 kV peak, the KE 2 with 250 mm plates are available. The components are connected to the junction elements by bolted connections.



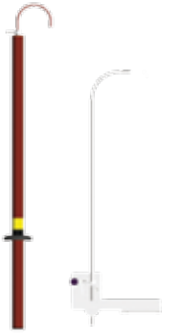
Insulating and connecting elements

The insulating element IE serves as a support insulator (up to 140 kV peak) or a spacer (up to 270 kV peak). The connecting element VE is an electrical connection. Both functions can be performed by the combined insulating/connecting element VES, which is installed on an insulating frame where a connecting element can be plugged in or removed.



Base and base connecting elements

Base elements (FE 1) and base connecting elements (FV 1) ensure the stable assembly of the modules and the reliable earthing of the HV circuit. An additional LV measuring branch MC including cable connection can be fixed on the base element.



Elements for earthing and discharge

Earthing rods ES are available for voltages up to 200 kV AC. For discharging capacitors the rods ERS are completed by a resistor applicable up to 350 kV DC.

For automatic or damped earthing up to 150 kV peak, magnetic-driven earthing devices (EE 150, ERE 150) are available. They are equipped with an electric magnet that is actuated by the control. The magnet is switched on for de-earthing, but for earthing it is switched off and the rod moves into the correct position by the gravity.



Storage trolley

The trolley LW is intended to store up to six HV modules that are not in use in the HV test circuit.

HIGH VOLTAGE MODULE TEST SYSTEM



Fig. 1 **Combined AC, DC, and impulse test system, type WGSBS 5.8/100-135-135, 100 kV AC, 135 kV DC, 135 kV impulse voltage**

FACTS IN BRIEF

The high voltage module test system is able to generate AC, DC, and impulse test voltages up to 200 kV AC, 350 kV DC, 110 kV LI, and 100 kV SI.

The test system has a modular design. Its main component is a 100 kV AC test system. It can effortlessly be extended by additional components for higher AC voltages or even different voltage shapes such as DC or impulse.

The rearrangement of the test system, for example from AC testing to impulse testing, requires only minimal adjustments without special training.

Due to its modular design and high flexibility it is not only widely used for factory and on-site testing of components in distribution networks, but also for research, development, training, and education.

The core of the control of the HV module test system is the industrially proven SIMATIC S7. Even the basic control enables operators to flexibly operate the test system manually and it allows a simple automatic operation of the test system. It can be improved by a computer control that allows automatic testing, easy data handling, and reporting. Furthermore, additional measuring devices such as for PD measurement can easily be implemented in this control.

BENEFITS

- EASY HANDLING
- WIDE RANGE OF APPLICATIONS FROM FACTORY TESTING TO R&D
- MANY TEST ARRANGEMENTS AS FOR AC, DC, AND IMPULSE VOLTAGES
- FAST REARRANGEMENT WITHOUT SPECIAL SKILLS

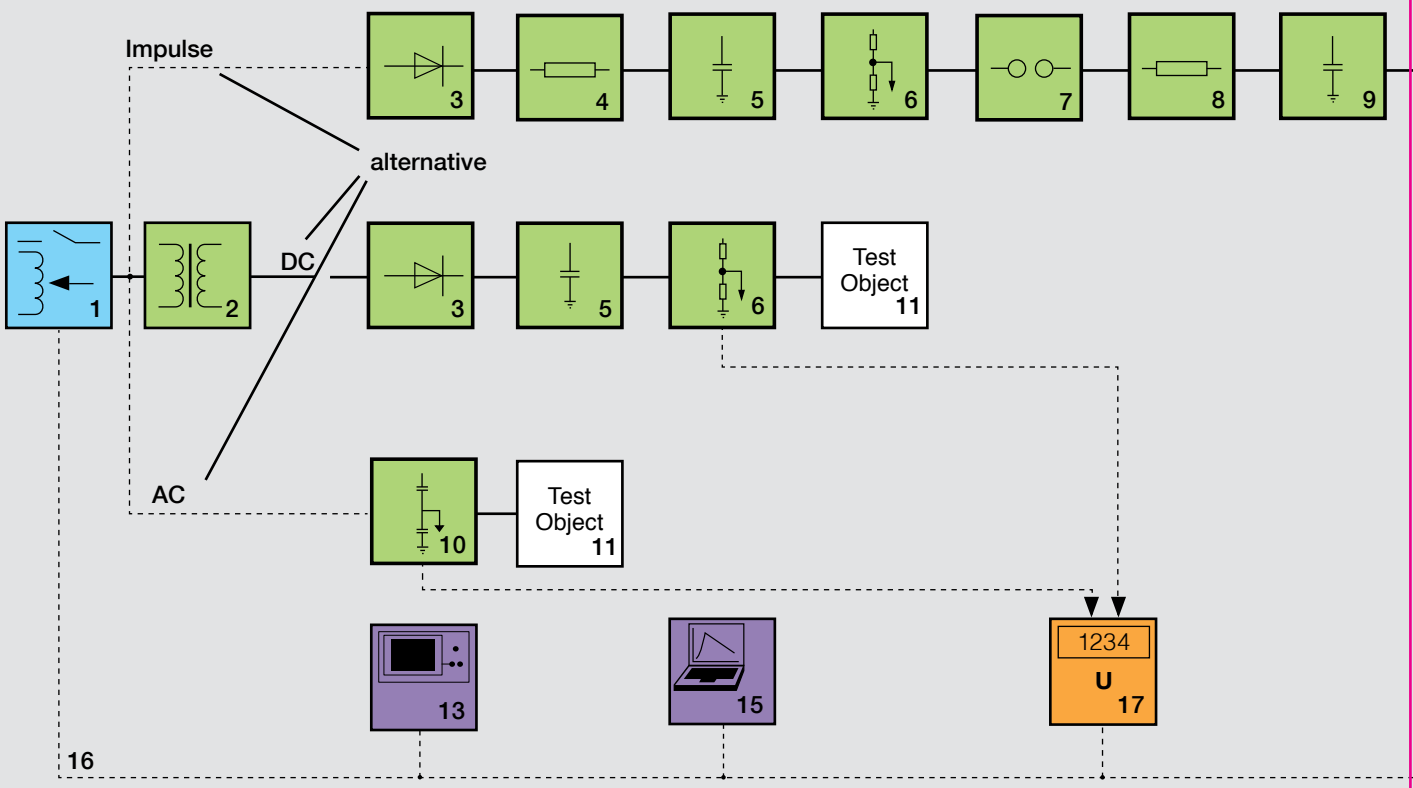


Fig. 2 **Block diagram for different test set ups as AC, DC, and impulse testing**

APPLICATION

The high voltage module test system allows a wide range of applications, e.g.:

- Training
- Education
- Diagnostic on-site testing
- Research works
- Development
- Factory testing of equipment for the distribution network

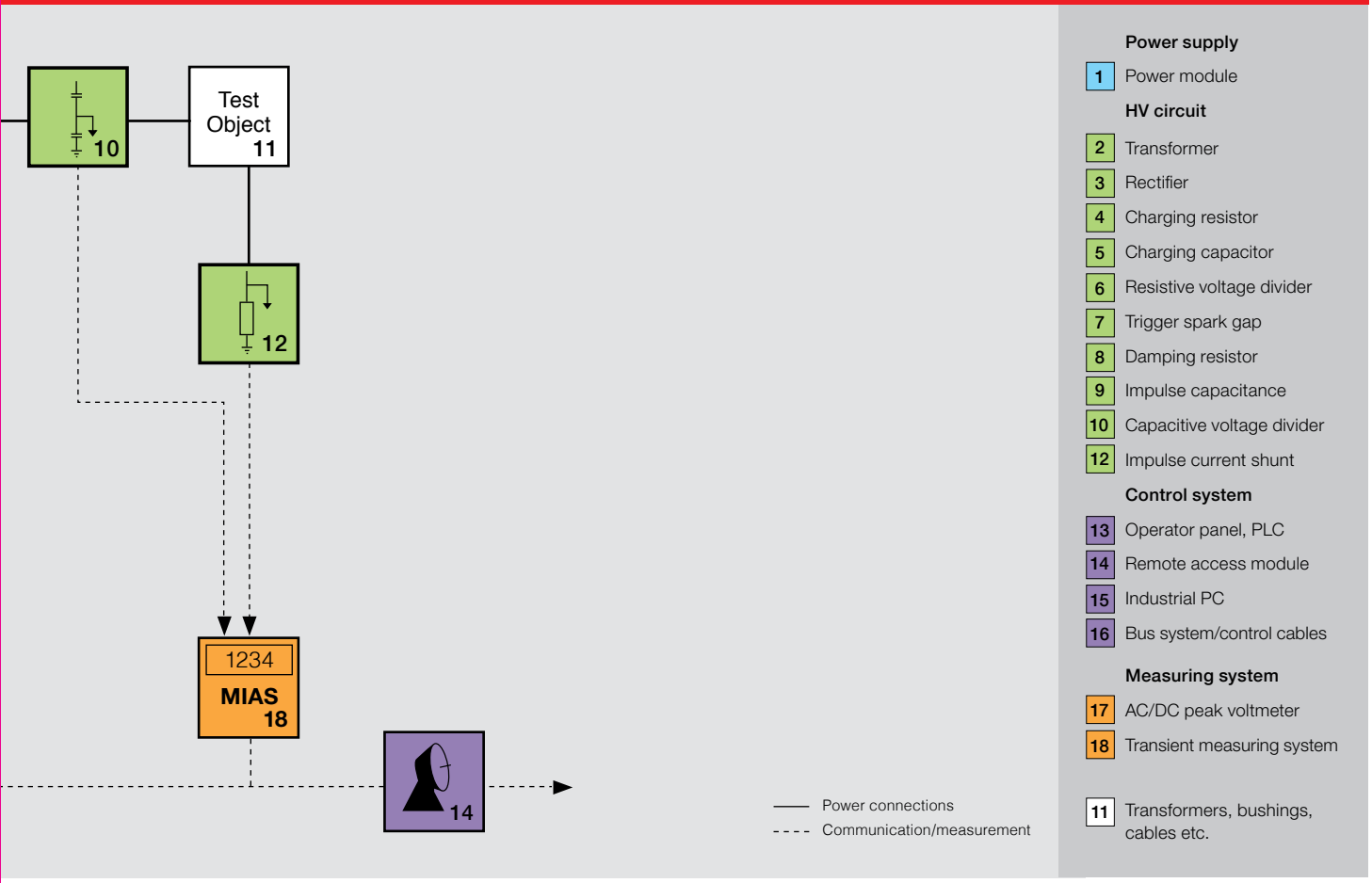
The basic control SIMATIC S7 is sufficient for simple applications as pure voltage measurement. In case of frequent measurements or combined measurements of voltage and PD, we recommend using a computer control.

It offers a variety of advantages as semi- or fully-automatic testing even of advanced test sequences, data storage, and report generation.

In R&D, where very often a large number of tests with specific conditions and subsequent statistical evaluations have to be performed, the HV module test system is your first choice.

The advantages of the simple and modular design will stand out especially during training and education. The easy modification, which can be done without special skills, and the easy operation of the test system result in an effective training approach.

- STANDARDIZED COMPONENT GRID DIMENSIONS
- OPTIONAL COMPUTER CONTROL FOR FAST AND FULLY-AUTOMATIC TESTING
- OPTIONAL INTEGRATION OF OTHER MEASUREMENT SYSTEMS (FOR PD MEASUREMENTS)



SYSTEM AND COMPONENTS

The HV module test system is charged and controlled by a power module (1). It can be connected to a simple 230 V CE socket. The power module regulates the output voltage and is directly connected to the HV transformer (2).
Power module and HV transformer are the basic components for each set up. All other components depend on the final test configuration as AC, DC, or impulse testing (*Fig*. 2).
The HV components of the module test system have a standardized length to ensure a fast and easy rearrangement of the test set up. This fixed distance can easily be kept by the base elements which have exactly the same dimension. The HV components can be flexibly arranged in a linear as well in a rectangular shape (*Fig*.1).
Individual components of the module test system are effortlessly connected via junction elements. The junction element is designed as a polygon electrode.
The interconnection between the HV components and the junction elements is realized by union nuts fixed by hand. This results in a much more stable arrangement in comparison to other solutions such as plug-in.

The voltage is measured by individual dividers for AC (10), DC (6), and impulse voltage (10). The corresponding AC/DC peak voltmeter (17) is arranged in the power module. For impulse measurement a transient measuring system (18) is integrated.

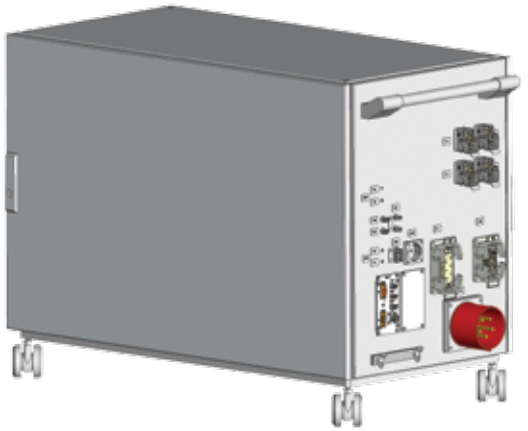
The base elements will carry the low voltage measuring branches or connection boxes for measuring cables. An interconnection of all base elements and its connection to a single earthing point will result in low inductive earthing for the complete HV module test system.

A save and easy operation of the HV module test system is ensured by the use of the basic control which is based on programmable logic controllers (PLC), type SIMATIC S7 (13). It is connected via fibre-optic cables to avoid electromagnetic interferences.
Optionally the basic control can be improved by a computer control (15). This computer control allows beside advanced testing and reporting also remote diagnosis (14).

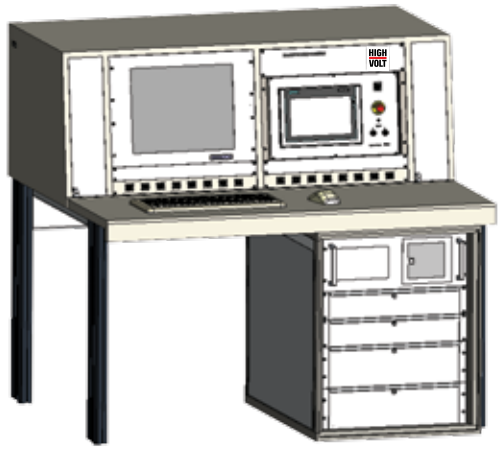
MODULES FOR CONTROL



Operator device
The operator device BG is the interface between the operator and the test system. The BG contains the operator panel that is connected by fibre-optic ETHERNET to the PLC control mainly arranged in the power module (see below). The control enables manual and simple automatic test procedures. The corresponding status messages are indicated on the display. Most operator functions, such as pre-selection of the test voltage, are implemented by soft keys. The operator device can be delivered as a single unit in a case or as plug-in device for a rack or desk.



Power module including peak voltmeter
The power module LM is available for continuous power of 5.8 and 11 kVA, corresponding to 25 and 48 A at 230 V. Both types contain a regulating transformer that is PLC-controlled. The PLCs are connected by fibre-optic ETHERNET to the operator device and controlled from there. An integral part of the power module is the AC/DC peak voltmeter MU. The measured voltages are displayed on the operator device (see above). The power module has to be completed by the extension unit LMO for impulse voltage generation. The power module (rear view in the picture) can be arranged in the control room or within the HV test area.



Computer control and measuring systems
The manual or simple automatic control by the operator device can be completed by an industrial PC to a computer control and measuring system CMS to allow fully-automatic operation. This control can be expanded by a partial discharge measuring system or for impulse voltage measurement by a digital impulse analyzer. Both control and measurement can be handled via the industrial PC. All preselected parameters and measured values are stored by the computer for further processing and test reports. The computer control can also be connected to the computer network (LAN) and for remote service, software updates, etc. via Internet to the HIGHVOLT Service Center. The computer control and measuring system can be supplied as a unit for rack or desk installation.

INSTRUCTION FOR HV EXPERIMENTS
The HV module system is very well suited for student training and is already considered an essential part of teaching HV engineering at universities, technical institutes, and professional schools. HIGHVOLT is ready to offer consultancy for the layout of laboratories and can deliver shielding systems.

HIGH VOLTAGE MODULE TEST SYSTEM

TECHNICAL PARAMETERS

The HV modules allow the construction of the following standard HV test systems:

Alternating voltages, type WBS (Data Sheet 4.01)	(1-stage)	(2-stage)
Rated AC voltage	100 kV	200 kV
Rated power continuous	5.8 kVA	5.8 kVA
Rated power short time (1 h ON/23 h OFF)	11 kVA	11 kVA

Remark: All test system versions are available with circuit for PD measurement and/or C-/tanδ measurement also.

Direct voltage, type GBS (Data Sheet 4.02)	(1-stage)	(2-stage)	(3-stage)
Rated AC voltage	135 kV	270 kV	350 kV
Rated DC current	14 mA	10 mA	8 mA

Remark: The test system version 135 kV/14 mA is available with circuit for PD measurement also.

Alternating and direct voltage, type WGBS (Data Sheet 4.03)	(1-stage)	(2-stage)	(3-stage)
Rated AC voltage	100 kV	200 kV	
Rated power continuous	5.8 kVA	5.8 kVA	
Rated power short time (1 h ON/23 h OFF)	11 kVA	11 kVA	
Rated DC voltage	135 kV	270 kV	350 kV
Rated DC current	14 mA	10 mA	8 mA

Impulse voltages, type SBS (Data Sheet 4.04)	
Rated charging voltage	135 kV
Rated energy	100 J
Output lightning impulse voltage (at no-load)	110 kV LI
Output switching impulse voltage (at no-load)	100 kV SI

Remark: This system is mainly for demonstrations in student's training. For higher voltages and energies, as necessary for real testing and research work the HIGHVOLT series L of impulse voltage test systems is recommended for both, technical and economic reasons.

AC, DC and impulse voltages, type WGSBS (Data Sheet 4.08)	(1-stage)	(2-stage)	(3-stage)
Rated AC voltage	100 kV	200 kV	
Rated power continuous	5.8 kVA	5.8 kVA	
Rated power short time (1 h ON/23 h OFF)	11 kVA	11 kVA	
Rated DC voltage	135 kV	270 kV	350 kV
Rated DC current	14 mA	10 mA	8 mA
Rated charging voltage	135 kV		
Rated energy	100 J		
Output lightning impulse voltage (at no-load)	110 kV LI		
Output switching impulse voltage (at no-load)	100 kV SI		

Remark: This universal system is especially designed for student's training and well introduced to the practice of universities and technical institutes.

For further information please contact:

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