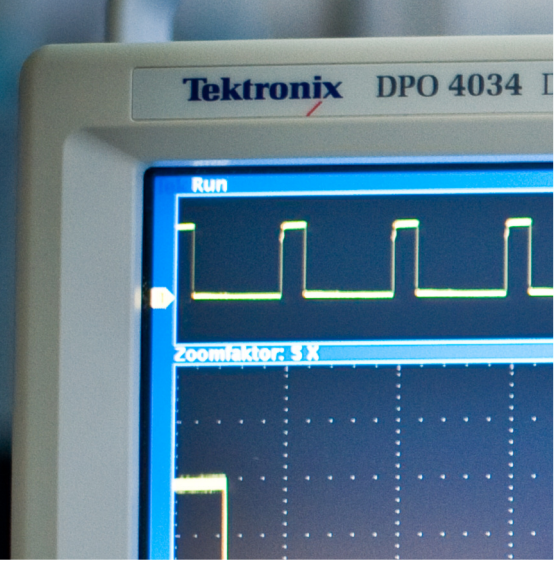


IMS RÖNTGENSYSTEME

HVA 75-225
HVD 75-225

High-voltage adapters
High-voltage measuring dividers

IMS RÖNTGENSYSTEME

Components

High-voltage adapters and high-voltage measuring dividers are devices for checking, testing, and simplifying the installation of an X-ray system. Their use can be particularly helpful in the fields of testing and development.

High-voltage adapters

A high-voltage adapter creates a connection between two high-voltage terminals. This allows to connect different types of connectors as well as connectors of the same type. An adaption of different high-voltage connector types can make replacement of a high-voltage cable unnecessary, hence making an X-ray system more flexible and universally functional. The installation of the high-voltage adapter can be performed quickly, thus saving installation time when connecting an X-ray system. In addition to the adaption of two high-voltage connectors, the installation of a dummy plug in a high-voltage terminal allows the use of the high-voltage adapter for high-voltage termination. If one of the connectors of the adapter is connected to a X-ray generator by a high-voltage cable, and the other connector is terminated using a dummy plug, the X-ray generator and the high-voltage cable can be switched on at maximum high voltage without imposing a load on the system. Thus, the generator and the high-voltage cable can be tested. The dummy plug can also be attached directly to the X-ray generator, hence only testing the X-ray generator for its high-voltage resistance. Standard adapters are available. It is also possible, however, to manufacture special adapters to customer specifications.

High-voltage measuring dividers

In contrast to high-voltage adapters, high-voltage measuring dividers also contain a resistor measuring divider. This measuring divider allows the high voltage to be back-measured independently of other measurement systems. The accuracy of the high voltage can be tested. The back-measurement is achieved using high-voltage resistors and a base resistor. The division ratio of the high voltage can be adjusted via the resistance ratio. In addition to the measurement of direct-current voltages, which are typically required by X-ray systems, the measurement of alternating-current voltage signals is also possible. Switch ON and OFF times can be monitored, as can rapid fluctuations in the high voltage. The measuring dividers are equipped with frequency compensation system which facilitates the measurement of rapidly changing signals. A high-voltage measuring divider can be used as a high-voltage adapter. In contrast to high-voltage adapters, measuring dividers have two connectors of the same type. Therefore, not every type of adaption is possible. Special high-voltage measuring dividers can be manufactured to customer specifications.

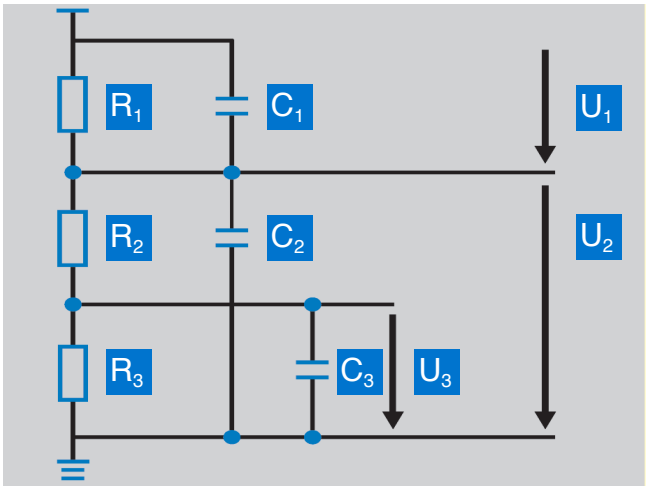
Stability

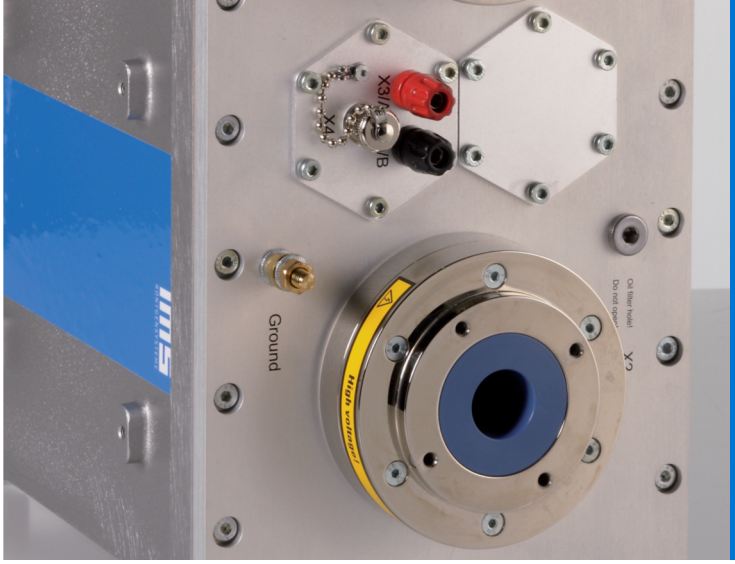
The stability of the measurement results from a high-voltage measuring divider depends principally on the quality of the high-voltage resistors. The more stable the resistors are in respect to temperature, the more stable and accurate are the measurement results. High-voltage measurement resistors are available in very good qualities, meaning that even the highest customer requirements can be complied with.

Measurement principle

The high-voltage measurement is effected by means of a frequency-compensated resistor divider. The high-voltage resistor R_1, together with two base resistors, forms the measurement chain. Each resistor is connected in parallel to a capacitor. The value of the high-voltage resistor is selected such that the measurement speed is fast enough while ensuring that the losses at the high-voltage resistor are kept small. Otherwise the temperature of the measuring divider would rise too high during continuous operation.

Two base resistors are selected in order to reduce the influence of different measurement devices on the accuracy of the measurements. The resistance value R_2 is ten times higher than resistance value R_3.





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Losses and leakage current in the measuring divider

If a measuring divider is installed in the high-voltage connection between the X-ray generator and the X-ray tube, the resistance results in additional leakage current. This leakage current varies depending on the type of measuring divider. If the resistance value is known, the leakage current can be calculated very simply using Ohm's Law. The greater the high voltage, the greater the leakage current. This effect of the measuring divider on the overall current must be taken into account.

The losses and the leakage current can be calculated using the following formulae. As the voltage U_1 and the resistance R_1 are the independent variables, the other values can be neglected.

$$\frac{U_1}{U_2} = \frac{R_1}{R_2+R_3}$$

$$P_{losses} = \frac{U_1^2}{R_1}$$

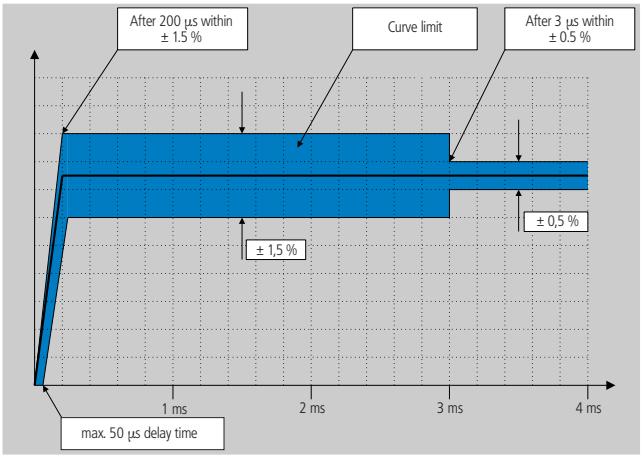
$$I_{leakage\ current} = \frac{U_1}{R_1}$$

Measurement accuracy

The measurement accuracy is affected by the measurement devices connected. The resulting measurement errors must be included in the calculations for precise testing. The input impedances constitute a parallel circuit to the base resistors and have an effect on the accuracy. The voltage U_2 can be measured using a multimeter. Faster signals are measured using U_3 and an oscilloscope.

Measurement of fast rising edges

The following diagram defines the maximum impulse and the tolerances of the measurement in the first 4 ms.



Within the first 3 ms, a transient response is specified within a tolerance range of ± 1.5 %. After 3 ms, the transient response process must be completed and the measurement value must be within a measurement accuracy of ± 0.5 %.

Calibration

The high-voltage measuring dividers are manufactured in accordance with the EN ISO 9001:2008 quality standard. Each measuring divider is subjected to a factory calibration derived from the DKD (German Calibration Service) standards. Comparison measurements are made using a DKD-calibrated reference measuring divider. This allows a traceable measurement. It is recommended that the measuring dividers should be recalibrated every two years.

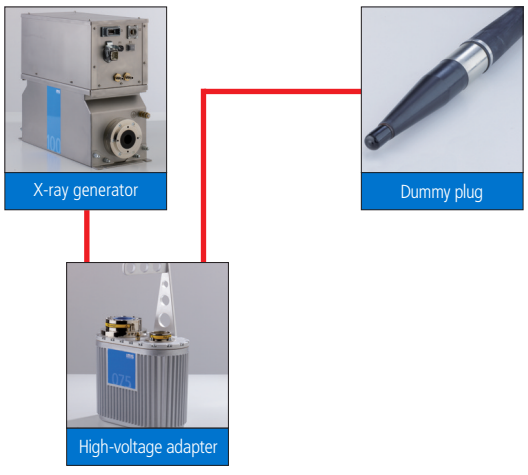
Installation

The high-voltage adapters and high-voltage measuring dividers can be installed in any position. Their components are not position-dependent. Insulating oil is used as insulation material. A compensating vessel ensures pressure compensation if the high-voltage measuring dividers heat up. The utilisation of insulating oil ensures good heat circulation and allows very easy replacement of defective high-voltage receptacles.

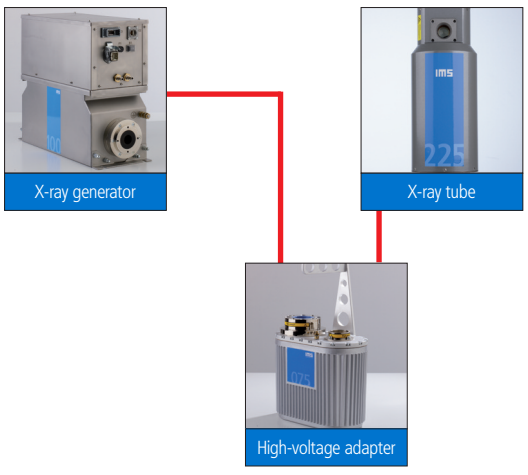
System specifications - HVA

- Voltage ranges up to 225 kV
- Flexible adaption of various high-voltage connector systems
- Ideal for service, testing and development
- Saves time thanks to quick installation instead of cable replacement
- Lower costs
- Oil-insulated design
- Compact construction
- Customer-specific adjustment possible
- Produced in compliance with DIN EN ISO 9001:2008

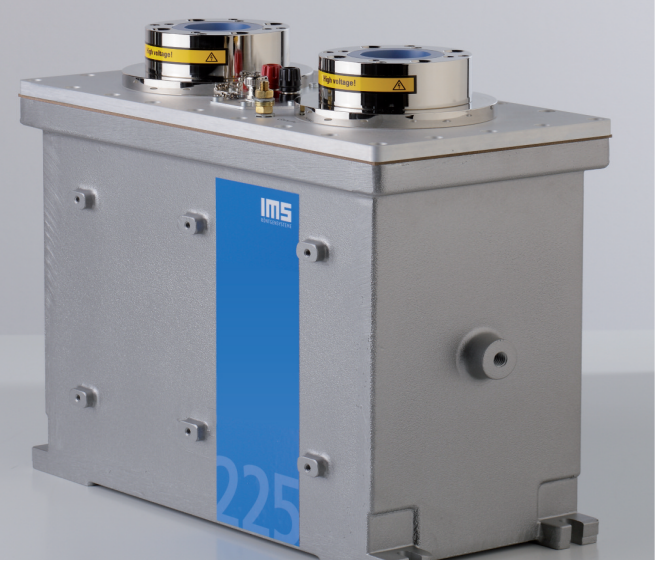
High-voltage adapter



Wiring diagram with dummy plug



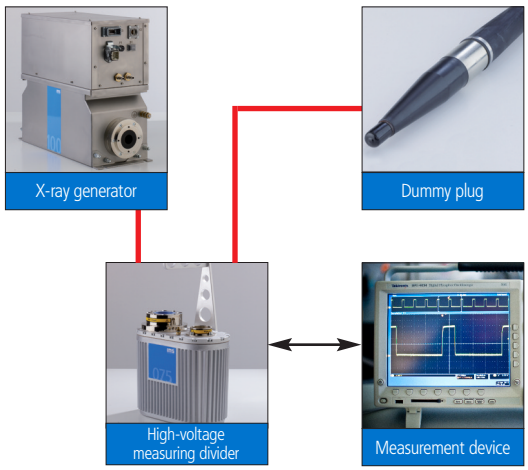
Wiring diagram tube and generator



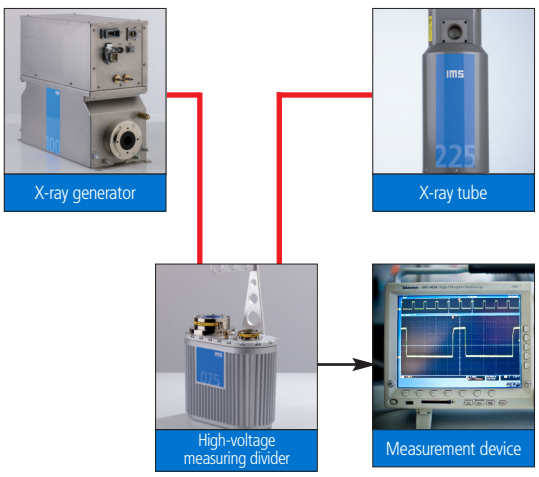
System specifications - HVD

- Voltage ranges up to 225 kV
- Two measurement outputs for DC and AC measurement
- High DC accuracy rates
- Low temperature drift
- Measurement of fast rising edges possible
- Oil-insulated design
- Compact construction
- Customer-specific adjustment possible
- Produced in compliance with DIN EN ISO 9001:2008

High-voltage measuring divider



Wiring diagram with dummy plug



Wiring diagram with tube and generator

Technical data

	HVA 75/CA1/R24
Application range	0-75 kV
High-voltage receptacle X1	CA1 (Federal Standard)
High-voltage receptacle X2	R24
Operating temperature	0 °C to 40 °C
Storage temperature	-10 °C to +60 °C
Humidity	20 % to 80 % relative humidity, non-condensing
Dimensions	255 x 163 x 443 mm
Weight	11 kg

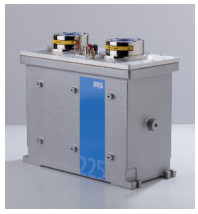
	HVA 75/CA11/R10
Application range	0-75 kV
High-voltage receptacle X1	CA11
High-voltage receptacle X2	R10
Operating temperature	0 °C to 40 °C
Storage temperature	-10 °C to +60 °C
Humidity	20 % to 80 % relative humidity, non-condensing
Dimensions	255 x 163 x 443 mm
Weight	11 kg

	HVA 75/CA11/R24
Application range	0-75 kV
High-voltage receptacle X1	CA11
High-voltage receptacle X2	R24
Operating temperature	0 °C to 40 °C
Storage temperature	-10 °C to +60 °C
Humidity	20 % to 80 % relative humidity, non-condensing
Dimensions	255 x 163 x 443 mm
Weight	11 kg

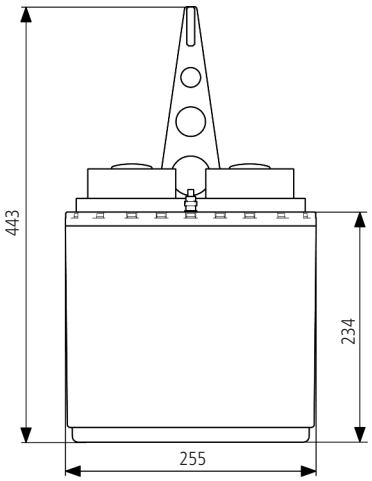
	HVA 100/R10/R24
Application range	0-100 kV
High-voltage receptacle X1	R10
High-voltage receptacle X2	R24
Operating temperature	0 °C to 40 °C
Storage temperature	-10 °C to +60 °C
Humidity	20 % to 80 % relative humidity, non-condensing
Dimensions	255 x 163 x 443 mm
Weight	11 kg

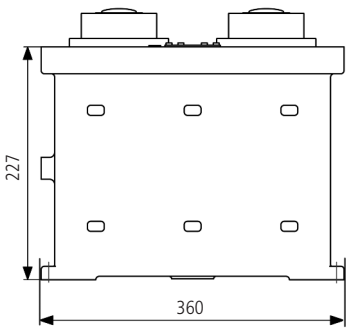
	HVA 160/R24/R24
Application range	0-160 kV
High-voltage receptacle X1	R24
High-voltage receptacle X2	R24
Operating temperature	0 °C to 40 °C
Storage temperature	-10 °C to +60 °C
Humidity	20 % to 80 % relative humidity, non-condensing
Dimensions	255 x 163 x 443 mm
Weight	11 kg

	HVA 160/R24/R28
Application range	0-160 kV
High-voltage receptacle X1	R24
High-voltage receptacle X2	R28
Operating temperature	0 °C to 40 °C
Storage temperature	-10 °C to +60 °C
Humidity	20 % to 80 % relative humidity, non-condensing
Dimensions	255 x 163 x 443 mm
Weight	11 kg



	HVA 225/R28/R28
Application range	0-225 kV
High-voltage receptacle X1	R28
High-voltage receptacle X2	R28
Operating temperature	0 °C to 40 °C
Storage temperature	-10 °C to +60 °C
Humidity	20 % to 80 % relative humidity, non-condensing
Dimensions	360 x 176 x 323 mm
Weight	23 kg





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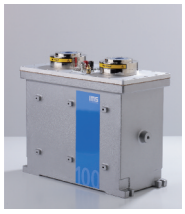
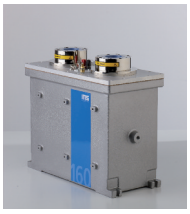
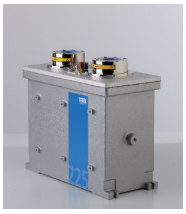
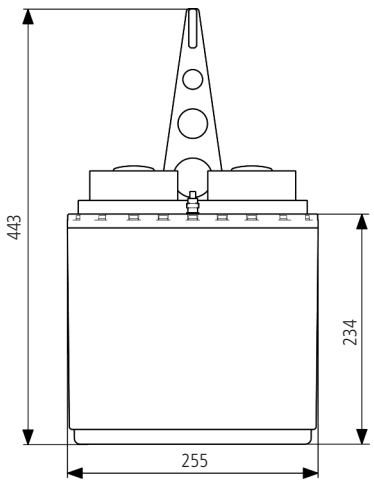
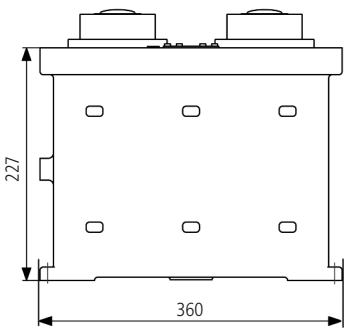




	HVD 75/CA1	HVD 75/CA11	HVD 100/R10	HVD 160/R24	HVD 225/R28
Application range	0-75 kV	0-75 kV	0-100 kV	0-160 kV	0-225 kV
High-voltage receptacle	CA1 (Federal Standard)	CA11	R10	R24	R28
Divider ratio	10 000:1	10 000:1	10 000:1	10 000:1	10 000:1
Input impedance	<= 400 MΩ	<= 400 MΩ	<= 400 MΩ	<= 1600 MΩ	<= 2400 MΩ
Input capacitance	<= 100 pF	<= 100 pF	<= 100 pF	<= 100 pF	<= 100 pF
Temperature drift	< 50 ppm/ °C	< 50 ppm/ °C	< 50 ppm/ °C	< 50 ppm/ °C	< 50 ppm/ °C
Accuracy of the DC measurement	± 0.5 %	± 0.5 %	± 0.5 %	± 0.5 %	± 0.5 %
Input pulse form	See specifications	See specifications	See specifications	See specifications	See specifications
Dissipation loss at max. kV	14 W	14 W	25 W	16 W	21 W
Leakage current at max. kV	188 µA	188 µA	255 µA	100 µA	94 µA
Maximum load at X3	Multimeter 10 M Ω, 100 pF	Multimeter 10 MΩ, 100 pF	Multimeter 10 MΩ, 100 pF	Multimeter 10 MΩ, 100 pF	Multimeter 10 MΩ, 100 pF
Scaling at X3	10 V per 100 kV	10 V per 100 kV	10 V per 100 kV	10 V per 100 kV	10 V per 100 kV
Maximum load at X4	Oscilloscope 1 MΩ, 13 pF	Oscilloscope 1 MΩ, 13 pF	Oscilloscope 1 MΩ, 13 pF	Oscilloscope 1 MΩ, 13 pF	Oscilloscope 1 MΩ, 13 pF
Scaling at X4	1 V per 100 kV	1 V per 100 kV	1 V per 100 kV	1 V per 100 kV	1 V per 100 kV
Instrument lead at X4	coaxial 50/75 Ω, 15 m	coaxial 50/75 Ω, 15 m	coaxial 50/75 Ω, 15 m	coaxial 50/75 Ω, 15 m	coaxial 50/75 Ω, 15 m
Operating temperature	0 °C to 40 °C	0 °C to 40 °C	0 °C to 40 °C	0 °C to 40 °C	0 °C to 40 °C
Storage temperature	-10 °C to +60 °C	-10 °C to +60 °C	-10 °C to +60 °C	-10 °C to +60 °C	-10 °C to +60 °C
Humidity	20 % to 80 % relative humidity, non-condensing	20 % to 80 % relative humidity, non-condensing	20 % to 80 % relative humidity, non-condensing	20 % to 80 % relative humidity, non-condensing	20 % bis 80 % relative humidity, non-condensing
Installation position	no specifications	no specifications	no specifications	no specifications	no specifications
Dimensions	255 x 163 x 443 mm	255 x 163 x 443 mm	360 x 176 x 323 mm	360 x 176 x 323 mm	360 x 176 x 323 mm
Weight	11 kg	11 kg	23 kg	23 kg	23 kg





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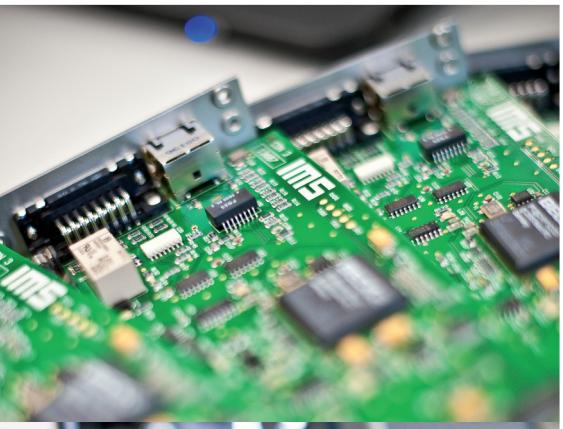

IMS Röntgensysteme offers all components required for setting up a X-ray system.

X-ray generator XRG

The XRG series is a range of compact X-ray generators featuring all the components required to supply the X-ray tube. The control and power electronics are mounted on the high-voltage generator. The modularity of the system is guaranteed in that the two components can be easily disconnected from each other by means of plugs. The latest network interface control functions are as standard as digital controls for all parameters.

Operation

The anculo operating software monitors, controls and analyses all relevant parameters and processes of an X-ray system in active operation. The ergonomically sophisticated graphic menu allows intuitive operation, both from a PC and from a mobile touchpad. The service and programming levels can be password-protected, in order to allow access to authorised persons. This allows the operator to monitor all of the system's major parameters at all time.

High-voltage measuring dividers

High-voltage measuring dividers and high-voltage adapters are reliable, high-quality and worthwhile components in the fields of testing and development. In addition to standard models, designs made to customer specifications are also available.

IMS Röntgensysteme GmbH
Dieselstraße 52
42579 Heiligenhaus
Germany

Phone +49 2056 975 600
Fax +49 2056 975 601

info@ims-roentgensysteme.de
www.ims-roentgensysteme.de

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