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Data Sheet 5.18/6

Reference Voltage Measuring System

Description

A Voltage Measuring System consisting of a converting device (voltage divider) plus an instrument and applied for HV quality testing of electrical insulations shall comply with the requirements of the IEC 60060-2:2010. This means successive performance checks and tests must be executed. IEC 60060-2 recommends annual performance tests, but requires in minimum one in five years.

The very important performance tests include the determination of the scale factor and - especially at impulse voltages - the dynamic performance of the system under test. The reference method of determining the scale factor is the comparison with a **Reference Voltage Measuring System**. The comparison may be made at voltages not lower than 20 % of the rated measuring voltage of the system under test. Therefore Reference Voltage Measuring Systems (RMS) are characterized by a higher accuracy and stability, but a lower rated voltage than usual voltage measuring systems. When it is confirmed, that the measuring system complies with the requirements of IEC 60060 it is called an „approved measuring system“ (AMS).

The AMS-RMS comparison (Fig. 1) can be executed by a calibration service, but the user of the AMS may do it himself. Especially for bigger test fields it is recommended to own a RMS for all the necessary recalibrations and performance tests. HIGHVOLT supplies components (voltage dividers and instruments) for voltage measuring systems, from which also RMS's can be composed. The measurement uncertainty fulfils at least the limits given in Table 1.

In the case of the delivery of a RMS the voltage divider and the instrument are carefully adjusted and calibrated by the HIGHVOLT Calibration Laboratory, accredited by the Germany's National Accreditation Body DAkkS under registration no. D-K-19153-01-00. This calibration is directly traceable to the Standards of the German National Institute (PTB). The calibration is documented by a DAkkS-calibration certificate. This calibration certificate documents the traceability to national standards, which realize the units of measurements according to the International System of Units (SI).

The DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates.

If the application task demands a calibration at a National Institute for Metrology or if the limits of uncertainty for the demanded RMS are lower than 0.7 % for voltage or lower than 5 % for the time parameters of impulse voltages, on request the RMS would be calibrated at the Physikalisch-Technische Bundesanstalt (PTB).

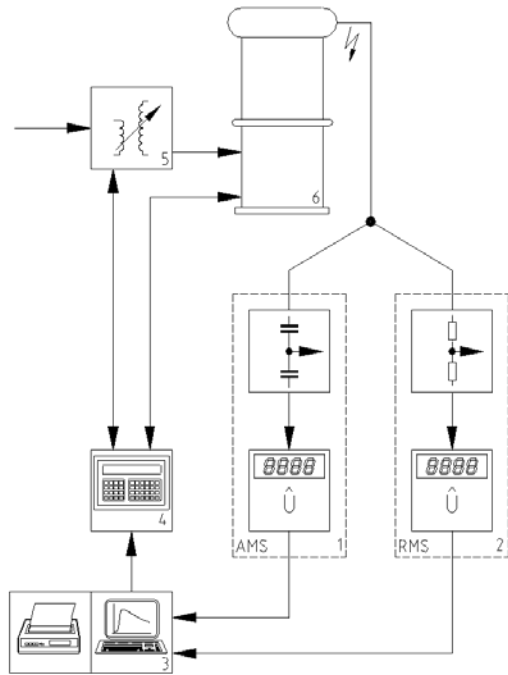


Figure 1: Comparison of a voltage measuring system (AMS) with a reference measuring system (RMS)

Table 1: Limits of uncertainties of Reference Voltage Measuring Systems (IEC 60060-2:2010)

parameter	uncertainty (%) of measured voltage for a probability level of 95 %				
	DC	AC	SI	LI	front chopped LI
voltage value (scale factor)	1	1	1	1	3
ripple factor	3	-	-	-	-
time parameters	-	-	5	5	5



Figure 2: Arrangement for comparison measurement for the calibration of RMS



Figure 3: Arrangement of the measuring instruments

Table 2: Components for Reference Measuring Systems

RMS components	Rated voltage in kV					Type	Data Sheet no.
	DC ¹⁾	AC ²⁾	SI	LI	front chopped LI		
universal resistive / capacitive ref. voltage divider	40 ⋮ 400	40 ⋮ 400	100 ⋮ 700	100 ⋮ 800	-	MCR ... ref.	5.24
damped capacitive ref. measuring divider	-	40 ⋮ 400	200 ⋮ 700	100 ⋮ 800	-	SMC ... ref.	5.25
compressed gas standard capacitors	-	100 ⋮ 800	100 ⋮ 800	-	-	MCP	5.31
controlled resistive LI ref. voltage divider	-	-	-	200 ⋮ 1200	200 ⋮ 1200	SMR ... ref.	5.21
high-ohmic resistive ref. voltage divider	135 ⋮ 400	-	-	-	-	GMR ... ref.	5.23
peak voltmeter MU 17	x	x	-	-	-	MU 17	5.56
transient recorder HiRES	(x)	(x)	x	x	x	HiRES ... ref	5.50

¹⁾ Duration 30 min

²⁾ 50/60 Hz duration 30 min

Table 2 gives an overview of the HIGHVOLT components for reference measuring systems depending on the shape of the voltage and their rated voltages:

- **Universal RMS** (for DC, AC, SI, LI) are based on damped capacitors in parallel with high-ohmic resistors (**types MCR ... ref.**).
- **Multi-purpose RMS** (for AC, SI, LI) can be composed with dividers based on damped capacitors (**types SMC ... ref.**).
- Optimum adapted **RMS for AC and switching impulse voltages** are based on compressed gas capacitors (**types MCP**).
- Optimum adapted **RMS for lightning impulse voltages** are based on controlled resistors (**types SMR ... ref.**).
- **RMS for DC voltage** (mean value) are based on resistors with a very high resistance (**types GMR ... ref.**).
- The optimum instrument for an impulse voltage RMS is a transient recorder, because voltage and time parameters must be recorded (**type HiRES**).
For AC and DC voltage RMS the device of the **type MU 17** is applicable.

For all mentioned RMS components separate Data Sheets are available (Table 2).